FIBERSTRONG™

PRODUCT INFORMATION

FPI FUTURE PIPE INDUSTRIES

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PRODUCT INFORMATION

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DISCLAIMER

All information was correct at the time of going to press. However, we reserve the right to alter, amend and update any product, information and service described in this brochure.

OVERVIEW

Future Pipe Industries is a member of Future Pipe Group a leading manufacturer of high performance, anti-corrosive pipe systems for Oil and Gas, Petrochemical, Power Generation, Desalination, Civil Industries and municipal applications. The group was founded in 1973 and since then, has evolved into the leading provider of composite thermosetting pipe systems and technologies in Europe, Africa and the Middle East.

ACCREDITATIONS

Future Pipe Group is accredited to Quality Management System (BS EN ISO 9001:2000) and Environmental Management System (BS EN ISO 14001:1996). In addition, certificates for the suitability to transmit potable water from the Water Regulation Advisory Scheme (WRAS) Great Britain and the National Sanitation Foundation (NSF) USA.

NSF
Only products bearing the NSF Mark are Certified

BSI REGISTERED FIRM
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WRAS
APPROVED MATERIAL

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FIBERGLASS REINFORCED PLASTIC PIPE
PRODUCT INFORMATION

1. DESCRIPTION

A. GENERAL

FIBERSTRONG™ non-restrained pipes and fittings are Fiberglass Reinforced Plastic (FRP) flexible pipe systems intended for underground use*. FIBERSTRONG™ consists of a Thermosetting Chemical resistant polyester resin, Fiberglass Reinforcements and fine Silica sand aggregates to BS EN 1796 / BS EN 14364 / AWWA C-950.
Large diameter pipes are available in nominal diameters ranging from DN80 to DN4000 and standard pressure classes, PN1, PN3, PN6, PN10, PN12, PN16, PN20, PN25 and PN32 and stiffness classes 2,500, 5,000 and 10,000 N/m^2.

* With special engineering procedures the pipes can also be used for above ground installation.

B. CONSTRUCTION

Fiberstrong™ pipes consist of a resin-rich reinforced liner, structural wall and resin-rich exterior layer. "C" glass is used in the internal and external pipe surfaces.

C. APPLICABLE CODES/STANDARDS

Standards	Main Applications
AS3571.1	Glass Filament Reinforced Thermoplatics (GRP) pipes systems based on unsaturated polyester (UP) resin - Pressure and non-presure drainage and sewerage applications.
AS3571.2	Glass Filament Reinforced Thermoplatics (GRP) pipes systems based on unsaturated polyester (UP) resin - Pressure and non-presure water supply.
ASTM D-3262	Standard Specification for "Fiberglass" (Fiber Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D-3517	Standard Specification for "Fiberglass" (Fiber Reinforced Thermosetting-Resin) Pressure Pipe
ASTM D-3754	Standard Specification for "Fiberglass" (Fiber Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe
AWWA C-950	Fiberglass Pressure Pipe
AWWA M-45	Fiberglass Pipe Design Manual
BS EN 1796	Plastics Piping Systems for Water Supply With or Without Pressure – Fiber-Reinforced Thermosetting Plastics (FRP) Based on Unsaturated Polyester Resin (UP).
BS EN 14364	Plastics Piping Systems for Drainage and Sewerage With or Without Pressure – Fiber-Reinforced Thermosetting Plastics (FRP) Based on Unsaturated Polyester Resin (UP) – Specifications for Pipes, Fittings and Joints.

2. FEATURES AND BENEFITS

Features	Benefits
Manufactured with corrosion resistant composite material. 	• Long, effective service life. • No need for expensive cathodic protection. • No need for costly pipe coating, wrapping, lining, painting, or use of polyethylene wraps. • Low maintenance costs. • Hydraulic characteristics essentially remain unchanged over time.
Double bell coupling joints manufactured with corrosion resistant glass fiber and sealed with elastomeric gaskets.	• Ease of jointing helps reduce installation time. Tight, efficient joints designed to eliminate infiltration and ex-filtration. • Allows for flexible alignment, accommodating changes in line direction with fewer fittings.
Light weight. Approximately 1/4 the weight of ductile iron and 1/10 concrete pipe.	- Easy to install. - Low delivery costs. No need for expensive handling equipment.
Manufactured in long sections up to 12m.	- Fewer joints reduce installation time.
Extremely smooth bore.	- Low friction loss means less pumping energy needed. - Minimum slime build up can help lower cleaning costs.
Pipe specifications meet or exceed worldwide standards.	- Assures high quality product specifications. Easy for engineers to specify **FIBERSTRONG**™ pipes and fittings with confidence.
High technology pipe manufacturing system.	- Helps ensure consistent product quality worldwide.

3. USE AND APPLICATION

FIBERSTRONG™ FRP pipe is suitable for underground use in potable water, raw water, seawater and corrosive environments including sanitary sewage, and many industrial effluents with a temperature range of -40 °C to 50°C. All industrial pipe applications must be approved by Future Pipe Industries.

4. PRESSURE AND LOADING RESTRICTIONS

A. PRESSURE RESTRICTIONS

Pipes are manufactured in the following pressure classes, regardless of pipe stiffness.

Pressure Class		PN3	PN6	PN10	PN12	PN16	PN20	PN25	PN 32
Maximum operating pressure (kPa)		300	600	1,000	1,200	1,600	2,000	2,500	3,200
Maximum surge pressure (kPa)		420	840	1,400	1,680	2,240	2,800	3,500	4,480
Maximum field test pressure (kPa)		450	900	1,500	1,800	2,400	3,000	3,750	4,800
Maximum factory test pressure (kPa)		600	1,200	2,000	2,400	3,200	4,000	5,000	6,400

B. STIFFNESS CLASSES AND ALLOWABLE VACUUM

FRP pipes have the following characteristics regardless of pressure class.

Stiffness Class	SN 5000	SN 10000	SN 20000
Minimum Specific Tangential Initial Stiffness STIS = EI/D^3 (N/m^2)	5000 N/m/m	10000 N/m/m	20000 N/m/m
Maximum allowable vacuum level (kPa) at cover with hard soil and water table at grade and pipe installed in the following installation Types*			
(I) Full compacted gravel at maximum cover depth	-100 kPa	-100 kPa	-100 kPa
(II) Full Sand compacted to 90% Standard Proctor density at depth shown in (m)	-100 kPa(6m)	-100 KPa(13m)	-100 KPa(m)

*Maximum vacuum level varies with the type of installation and burial depth. Refer to the current Future Pipe Industries **FIBERSTRONG™** Installation Guide for Underground Pipe System for the allowable vacuum levels for other installation types.

5. JOINTS

A. DOUBLE BELL REKA COUPLINGS

FIBERSTRONG™ pipes and fittings are joined using Double Bell Reka Couplings with rubber ring seals. The pipe joints are sealed during assembly by compressing two rubber rings against the pipe spigot.

B. ALTERNATIVE JOINTING SYSTEMS

a) In certain applications Pipe sections may be laminated* together utilising an external (and internal) lay-up "butt-strap" consisting of layers of fiberglass mats and/or tapes impregnated with polyester resin. The strength of the lay-up exceeds the pipe wall strength.

b) Mechanical couplings manufactured by Straub, Teekay, Dresser, VJ or equivalent may be used for jointing to different pipe materials. Refer to section SPIGOT OUTSIDE DIAMETER for **FIBERSTRONG**™ pipe O.D's.

c) FRP flanges drilled to any standard dimensions requested by client, such as ANSI, DIN, ISO, etc...

*Laminated pipes may require different designs, if lamination is intended to avoid thrust blocks.

6. PRODUCT QUALIFICATIONS

FIBERSTRONG™ Pipes have been tested to the following Standards and Specifications

AS3571.1	Glass Filament Reinforced Thermoplastics (GRP) pipes systems based on unsaturated polyester (UP) resin - Pressure and non-presure drainage and sewerage applications.
AS3571.2	Glass Filament Reinforced Thermoplatics (GRP) pipes systems based on unsaturated polyester (UP) resin - Pressure and non-presure water supply.
ASTM D 3681:	Chemical resistance of "Fiberglass" (Fiber Reinforced Thermosetting - Resin) pipe in deflected condition (Strain corrosion performance).
BS 5480: 1990 (Appendix L):	British standard specification for fiberglass reinforced plastics (FRP) pipes, joints and fittings for use for water supply or sewerage - method for determination of long term specific ring stiffness and creep factor under ring deflection.
ASTM D 4161:	Standard specification for "Fiberglass" (Fiber Reinforced Thermosetting - Resin) pipe joint using flexible elastomeric seals.
ASTM D 1599	Short time Hydraulic failure pressure of pipes, fittings and prefabricated spools
BS 5480:1990 (Appendix J):	British standard specification for Fiberglass reinforced plastics (FRP) pipes, joints and fittings for use for water supply or sewerage - method for determination of Impact Resistance
ASTM D 2992:	Standard practice for obtaining hydrostatic or pressure design basis for "Fiberglass" (Fiber Reinforced Thermosetting - Resin) pipe and fittings. (Hydrostatic Design Basic (HDB)).
ASTM D 5365:	Standard Test Method for Long-Term Ring-Bending Strain of "Fiberglass" Pipe.

7. QUALITY CONTROL

Quality Control testing include thorough checks for all incoming raw materials and finished products against Future Pipe Industries strict written standards. The following physical and dimensional checks are made:

Type of Test	Each Pipe	Once per LOT*	Standard Reference
Visual Inspection	X		FPI / ASTM D 2563
Wall Thickness	X		FPI / AS 3571.1 / AS 3571.2
Spigot End Outside Diameter	X		FPI / AS 3571.1 / AS 3571.2
Length	X		FPI / AS 3571.1 / AS 3571.2
Squareness of Ends	X		AS 3572.4
Hydrostatic Pressure	X		FPI
Barcol Hardness	X		FPI / ASTM D 2583
Initial Specific Ring Stiffness		X	ISO 7685 / AS 3571.1 / AS 3571.2
Initial Resistance to Failure in a Deflected Condition		X	ISO 10466 / AS 3571.1 / AS 3571.2
Initial Specific Longitudinal Tensile Strength		X	ISO 8513 / AS 3571.1 / AS 3571.2
Initial Failure & Design Pressure		X	ISO 8521 / AS 3571.1 / AS 3571.2
Constituents by Weight % (LOI)		X	FPI / ASTM D 2584
Joint Performance**			ISO 8639 / AS 3571.1 / AS 3571.2
Product Marking		X	AS 3571.1 / AS 3571.2

Records of all testing on pipe sections are maintained by Future Pipe Industries and provided upon request.

** Qualification Type test

8. PHYSICAL & MECHANICAL PROPERTIES

A. PIPE DIMENSIONS AND MASSES

Nominal Diameter	SN 5000																																	
	Nominal Spigot OD		PN 1 to 6			PN10			PN12			PN16			PN20			PN25			PN32		
		Nominal ID	Nominal Wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling
	mm	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m
300*	310	299.8	5.1	9	299.9	5.1	9	300.1	5.0	9	300.3	4.9	8	300.6	4.7	8	300.7	4.7	8	-	-	-
300	**345**	**333.7**	**5.6**	**11**	**333.9**	**5.5**	**11**	**334.1**	**5.5**	**11**	**334.4**	**5.3**	**10**	**334.8**	**5.1**	**10**	**334.8**	**5.1**	**10**	-	-	-
350*	361	349.2	5.9	12	349.5	5.7	12	349.8	5.6	12	349.9	5.5	11	350.4	5.3	11	350.5	5.3	11	-	-	-
375	**426**	**412.2**	**6.9**	**17**	**412.8**	**6.6**	**16**	**413.1**	**6.4**	**16**	**413.5**	**6.3**	**15**	**413.9**	**6.1**	**15**	**413.9**	**6.0**	**15**	-	-	-
400*	412	398.6	6.7	16	399.2	6.4	15	399.5	6.3	15	399.8	6.1	14	400.2	5.9	14	400.3	5.9	14	-	-	-
450*	463	448.0	7.5	21	448.8	7.1	19	449.2	6.9	19	449.5	6.7	18	450.0	6.5	17	447.8	7.6	21	-	-	-
450	**507**	**490.8**	**8.1**	**24**	**491.6**	**7.7**	**23**	**492.1**	**7.5**	**22**	**492.5**	**7.2**	**21**	**493.0**	**7.0**	**21**	**493.1**	**7.0**	**20**	-	-	-
500*	514	497.6	8.2	25	498.5	7.8	24	498.9	7.6	23	499.3	7.3	22	499.8	7.1	21	499.9	7.0	21	-	-	-
500	**560**	**542.2**	**8.9**	**30**	**543.2**	**8.4**	**28**	**543.7**	**8.2**	**27**	**544.1**	**7.9**	**26**	**544.7**	**7.6**	**25**	**544.8**	**7.6**	**25**	-	-	-
525	587	568.5	9.3	33	569.5	8.7	31	570.0	8.5	29	570.5	8.2	28	571.1	8.0	28	571.2	7.9	27	-	-	-
600*	616	596.7	9.7	36	597.7	9.1	34	598.3	8.8	32	598.9	8.6	31	599.5	8.2	30	594.0	11.0	41	-	-	-
600	**667**	**646.2**	**10.4**	**42**	**647.5**	**9.8**	**39**	**648.0**	**9.5**	**38**	**648.7**	**9.2**	**36**	**649.2**	**8.9**	**35**	**649.4**	**8.8**	**34**	-	-	-
675	747	724.0	11.5	52	725.3	10.8	49	726.0	10.5	47	726.8	10.1	45	727.3	9.8	44	727.5	9.7	43	-	-	-
700*	718	696.0	11.0	48	697.1	10.5	45	697.7	10.1	44	698.5	9.8	42	699.0	9.5	41	699.2	9.4	40	-	-	-
750	**826**	**800.8**	**12.6**	**64**	**802.2**	**11.9**	**60**	**803.0**	**11.5**	**57**	**803.8**	**11.1**	**55**	**804.5**	**10.8**	**53**	**804.7**	**10.7**	**52**	-	-	-
800*	820	795.0	12.5	63	796.4	11.8	59	797.1	11.4	57	797.9	11.0	54	798.6	10.7	52	798.9	10.6	51	-	-	-
900	924	896.2	13.9	79	897.6	13.2	74	898.4	12.8	72	899.5	12.3	68	900.2	11.9	66	900.5	11.8	64	-	-	-
1000	1026	995.5	15.3	96	996.8	14.6	91	997.9	14.1	88	999.0	13.5	83	999.8	13.1	81	1000.1	13.0	79	-	-	-
1200	1229	1193.0	18.0	136	1194.4	17.3	131	1195.6	16.7	125	1196.8	16.1	120	1197.7	15.6	116	1198.3	15.3	112	-	-	-
1400	1434	1392.4	20.8	185	1394.0	20.0	177	1395.4	19.3	170	1397.0	18.5	161	1398.0	18.0	157	1398.5	17.8	153	-	-	-
1600	1638	1591.1	23.4	238	1592.4	22.8	230	1594.2	21.9	220	1596.1	21.0	209	1597.2	20.4	203	1596.0	21.0	208	-	-	-
1800	1842	1788.8	26.6	304	1791.0	25.5	290	1792.9	24.6	279	1795.1	23.4	263	1796.4	22.8	256	1797.0	22.5	249	-	-	-
2000	2046	1987.5	29.2	372	1989.5	28.3	358	1991.7	27.1	343	1994.2	25.9	324	1995.6	25.2	314	1995.7	25.2	311	-	-	-
2,200	2,250	2,185.6	32.2	451	2,188.1	31.0	432	2,190.5	29.7	413	2,193.3	28.4	391	2,194.7	27.6	379	-	-	-	-	-	-

Notes:
(1) Pipe masses are approximate only for handling and shipping purposes. *Available for Sewer applications with GRP fittings. DI fittings on application only.
(2) Highlighted sizes match DI sizes used in Australia

Nominal Diameter	SN 5000																					
	Nominal Spigot OD	PN 1 to 6			PN10			PN12			PN16			PN20			PN25			PN32		
		Nominal ID	Nominal Wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling
	mm	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m
2,400	2,453	2,383.2	34.9	534	2,385.7	33.7	513	2,388.3	32.3	490	2,391.3	30.8	463	2,392.9	30.0	450	-	-	-	-	-	-
2,600	2,658	2,582.7	37.6	625	2,585.3	36.4	601	2,588.1	34.9	575	2,591.4	33.3	543	-	-	-	-	-	-	-	-	-
2,800	2,861	2,779.7	40.6	728	2,783.0	39.0	696	2,786.0	37.5	665	2,789.5	35.8	628	-	-	-	-	-	-	-	-	-
3,000	3,066	2,979.0	43.5	836	2,982.4	41.8	800	2,985.9	40.0	763	2,989.6	38.2	720	-	-	-	-	-	-	-	-	-
3,200	3,270	3,178.1	45.9	943	3,181.1	44.4	909	3,184.8	42.6	867	-	-	-	-	-	-	-	-	-	-	-	-
3,400	3,474	3,376.4	48.8	1,065	3,379.8	47.1	1,025	3,383.4	45.3	981	-	-	-	-	-	-	-	-	-	-	-	-
3,600	3,678	3,574.7	51.6	1,195	3,578.4	49.8	1,148	3,582.3	47.8	1,098	-	-	-	-	-	-	-	-	-	-	-	-
3,800	3,882	3,773.5	54.2	1,325	3,777.1	52.5	1,278	3,781.3	50.4	1,221	-	-	-	-	-	-	-	-	-	-	-	-
4,000	4,086	3,972.2	56.9	1,465	3,975.8	55.1	1,415	3,980.1	52.9	1,352	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
(1) Pipe masses are approximate only for handling and shipping purposes. *Available for Sewer applications with GRP fittings. DI fittings on application only.
(2) Highlighted sizes match DI sizes used in Australia

Nominal Diameter	SN10000																					
	Nominal Spigot OD	PN 1 to 6			PN10			PN12			PN16			PN20			PN25			PN32		
		Nominal ID	Nominal wall Thickness	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling
	mm	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m
300*	310	297.4	6.3	11	297.4	6.3	11	297.6	6.2	11	298.1	6.0	11	298.5	5.7	10	298.7	5.7	10	298.8	5.6	10
300	**345**	**330.9**	**7.0**	**14**	**331.0**	**7.0**	**14**	**331.5**	**6.8**	**14**	**332.0**	**6.5**	**13**	**332.5**	**6.3**	**13**	**332.7**	**6.2**	**12**	**332.8**	**6.1**	**12**
350*	361	346.3	7.3	16	346.5	7.3	15	346.9	7.0	15	347.4	6.8	14	348.0	6.5	14	348.2	6.4	13	348.3	6.3	13
375	**426**	**409.0**	**8.5**	**21**	**409.2**	**8.4**	**21**	**409.7**	**8.2**	**21**	**410.4**	**7.8**	**19**	**411.0**	**7.5**	**19**	**411.2**	**7.4**	**18**	**411.4**	**7.3**	**18**
400*	412	395.5	8.3	20	395.6	8.2	20	396.2	7.9	19	396.8	7.6	18	397.4	7.3	18	397.7	7.2	17	397.8	7.1	17
450*	463	444.6	9.2	25	444.8	9.1	25	445.5	8.8	24	446.2	8.4	23	446.9	8.1	22	447.2	7.9	22	447.3	7.8	21
450	**507**	**487.0**	**10.0**	**31**	**487.2**	**9.9**	**30**	**488.0**	**9.5**	**29**	**488.8**	**9.1**	**27**	**489.5**	**8.7**	**26**	**489.9**	**8.6**	**26**	**490.0**	**8.5**	**25**
500*	514	494.0	10.0	31	494.0	10.0	31	494.7	9.6	30	495.6	9.2	28	496.3	8.8	27	496.6	8.7	26	496.9	8.6	26
500	**560**	**538.3**	**10.9**	**37**	**538.3**	**10.9**	**37**	**539.1**	**10.4**	**35**	**540.1**	**9.9**	**33**	**540.9**	**9.5**	**32**	**541.3**	**9.4**	**31**	**541.5**	**9.3**	**31**
525	587	564.4	11.3	40	564.4	11.3	40	565.2	10.9	38	566.2	10.4	36	567.0	10.0	35	567.5	9.8	34	567.7	9.6	33
600*	616	592.4	11.8	44	592.4	11.8	44	593.2	11.4	42	594.4	10.8	40	595.2	10.4	39	595.8	10.1	37	595.9	10.0	36
600	**667**	**641.7**	**12.6**	**51**	**641.7**	**12.6**	**51**	**642.5**	**12.3**	**50**	**643.7**	**11.6**	**47**	**644.7**	**11.2**	**45**	**645.1**	**11.0**	**44**	**645.4**	**10.8**	**43**
675	747	718.8	14.1	64	718.8	14.1	64	719.8	13.6	62	721.1	12.9	58	722.2	12.4	56	722.7	12.1	55	723.1	12.0	53
700*	718	691.0	13.5	59	691.0	13.5	59	691.7	13.1	57	693.0	12.5	54	694.1	11.9	52	694.6	11.7	51	694.9	11.5	49
750	**826**	**795.2**	**15.4**	**78**	**795.2**	**15.4**	**78**	**796.1**	**14.9**	**75**	**797.6**	**14.2**	**71**	**798.8**	**13.6**	**68**	**799.3**	**13.3**	**66**	**799.7**	**13.1**	**65**
800*	820	789.4	15.3	77	789.4	15.3	77	790.2	14.9	75	791.8	14.1	70	793.0	13.5	67	793.5	13.2	65	793.9	13.0	64
900	924	889.5	17.2	98	889.5	17.2	98	890.6	16.7	94	892.5	15.7	88	893.7	15.2	85	894.4	14.8	83	894.8	14.6	81
1000	1026	988.2	18.9	119	988.2	18.9	119	989.2	18.4	116	991.2	17.4	109	992.6	16.7	105	993.4	16.3	101	993.8	16.1	99
1200	1229	1183.9	22.5	171	1183.9	22.5	171	1185.1	22.0	166	1187.7	20.6	155	1189.3	19.8	149	1190.3	19.4	144	1190.9	19.1	141
1400	1434	1382.1	25.9	230	1382.1	25.9	230	1383.2	25.4	225	1386.2	23.9	210	1388.0	23.0	202	1388.9	22.5	197	1389.8	22.1	191
1600	1638	1578.9	29.5	300	1578.9	29.5	300	1580.2	28.9	293	1583.5	27.2	274	1585.8	26.1	262	1586.9	25.6	255	1587.8	25.1	248
1800	1842	1775.6	33.2	379	1775.6	33.2	379	1777.1	32.4	370	1781.0	30.5	346	1783.5	29.2	331	1784.8	28.6	321	1785.9	28.0	311
2000	2046	1972.8	36.6	466	1972.8	36.6	466	1974.2	35.9	456	1978.5	33.7	426	1980.9	32.5	410	1982.7	31.6	395	-	-	-
2,200	2,250	2,169.3	40.3	566	2,169.3	40.3	566	2,171.2	39.4	552	2,176.1	37.0	514	2,178.7	35.6	494	-	-	-	-	-	-

Notes:
(1) Pipe masses are approximate only for handling and shipping purposes. *Available for Sewer applications with GRP fittings. DI fittings on application only.
(2) Highlighted sizes match DI sizes used in Australia

Nominal Diameter	SN10000																					
	Nominal Spigot OD	PN 1 to 6			PN10			PN12			PN16			PN20			PN25			PN32		
		Nominal ID	Nominal wall Thickness	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of Pipe with coupling
	mm	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m
2,400	2,453	2,365.6	43.7	670	2,365.6	43.7	670	2,367.5	42.7	654	2,372.7	40.1	610	2,375.6	38.7	585	-	-	-	-	-	-
2,600	2,658	2,564.0	47.0	782	2,564.0	47.0	782	2,565.5	46.2	768	2,571.3	43.4	715	-	-	-	-	-	-	-	-	-
2,800	2,861	2,759.3	50.8	912	2,759.3	50.8	912	2,761.7	49.7	889	2,767.9	46.5	827	-	-	-	-	-	-	-	-	-
3,000	3,066	2,957.9	54.0	1040	2,957.9	54.0	1040	2,959.8	53.1	1020	2,966.5	49.8	949	-	-	-	-	-	-	-	-	-
3,200	3,270	3,154.9	57.5	1182	3,154.9	57.5	1182	3,157.0	56.5	1159	-	-	-	-	-	-	-	-	-	-	-	-
3,400	3,474	3,352.0	61.0	1,333	3,352.0	61.0	1,333	3,353.9	60.0	1310	-	-	-	-	-	-	-	-	-	-	-	-
3,600	3,678	3,548.8	64.6	1,496	3,548.8	64.6	1,496	3,551.1	63.5	1,468	-	-	-	-	-	-	-	-	-	-	-	-
3,800	3,882	3,746.2	67.9	1,660	3,746.2	67.9	1,660	3,748.2	66.9	1,634	-	-	-	-	-	-	-	-	-	-	-	-
4,000	4,086	3,943.3	71.4	1,838	3,943.3	71.4	1,838	3,945.4	70.3	1,809	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
(1) Pipe masses are approximate only for handling and shipping purposes. *Available for Sewer applications with GRP fittings. DI fittings on application only.
(2) Highlighted sizes match DI sizes used in Australia

Nominal Diameter	SN 20000																						
			PN 1 to 6			PN 10			PN 12			PN 16			PN 20			PN 25			PN 32		
		Nominal Spigot OD	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling	Nominal ID	Nominal wall Thickness (Tw)	Total mass of pipe with coupling
-		mm	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m	mm	mm	Kg/m
300		345	327.5	8.7	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
350		361	342.8	9.1	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
375		426	405.3	10.4	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
400		412	391.8	10.1	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
450		507	482.6	12.2	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
525		587	559.0	14.0	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
600		667	635.7	15.7	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
675		747	712.0	17.5	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
700		718	684.2	16.9	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
750		826	787.5	19.3	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
800		820	782.2	18.9	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900		924	881.2	21.4	121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,000		1,026	978.6	23.7	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
(1) Pipe masses are approximate only for handling and shipping purposes.

B. TOLERENCES

Dimensions	Specifications	Tolerances
Standard Pipe Length (L)	Up to 12m, for example 3m, 6m and 12m nominal. Effective lengths may vary if containerised for exporting.	±25mm
End Squareness/ End Planeness	Ends shall be square to both axis of the pipe plane.	Not to exceed 2+0.005D (mm) where D is the nominal diameter of the pipe or 10mm, whichever is smaller.
Straightness	Pipes shall be straight.	Not to exceed 0.3% of the effective length of the pipe or 15mm, whichever is smaller.
Thickness	As per FPI design values.	Single point 87.5% of minimum average.
Roundness Deviation *	Pipes shall be round.	±1%

C. SPECIFIC TANGENTIAL INITIAL STIFFNESS (STIS)

Stiffness Class	Minimum STIS*	Minimum Pipe Stiffness (PS**)
	(EI/D^3) Pa	$F/ AY=EI/(0.149\ r^3)$ KPa
SN5000	5000	248
SN10000	10000	496
SN20000	20000	992

* Specific Tangential Initial Stiffness determined as per ASTM D-2412 or BS 5480

** As per ASTM D-2412

D. MECHANICAL PROPERTIES

All Pipes will exhibit the following properties

Linear Coefficient of thermal expansion (mm/mm/°C)	25 to 30 x 10^{-6}
Poisson's Ratio	0.25 to 0.3

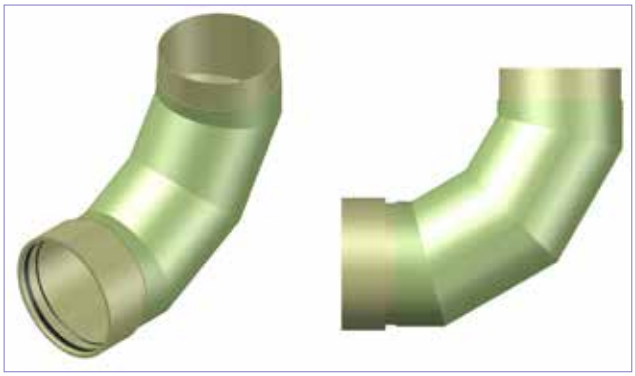
9. FITTINGS

Future Pipe Industries has established a standardized range of FRP fittings. The most common fittings are Elbows, Reducers, Tees, Wye Junctions and Flanges. Custom designed fittings can also be supplied as specified.

Fittings are fabricated from FRP pipe sections with standard double bell rubber ring jointed couplings. Fittings with RRJ couplings used for pressure applications also require thrust restraints. Refer to the "**FIBERSTRONG**™ Installation Guide for Underground Pipe System" for further details on proper construction of thrust blocks.

The method of fabrication for FRP fittings is essentially the same. Pipes are cut to the required dimensions and are laminated together. The thickness and width of the laminated joint is designed to exceed pipe performance.

A. Bends



Mitred Elbows. Effective Laying Length = BL (mm). The dimensions in the Table are valid for all pressure classes

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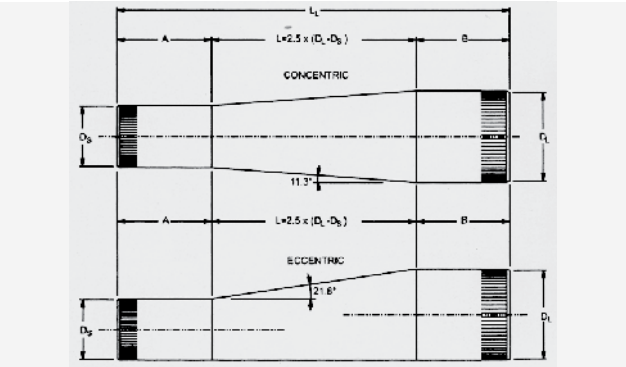
B. REDUCERS



Concentric and Eccentric Reducers. Taper Length (L) = 2.5 x (D_L - D_S)

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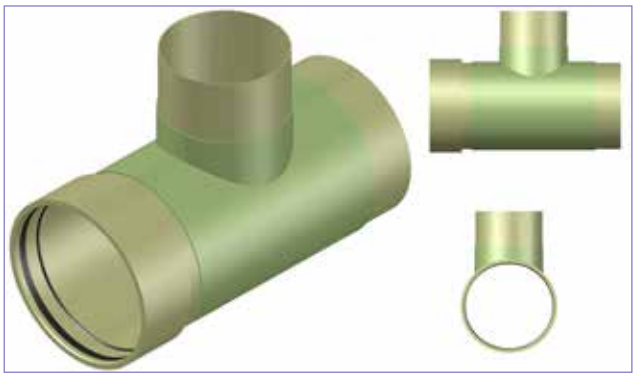
C. TEES



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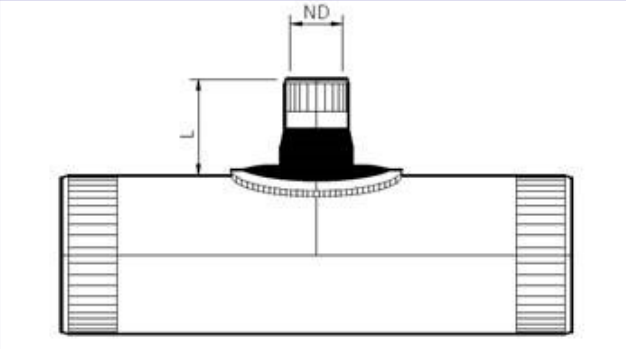
D. NOZZLES



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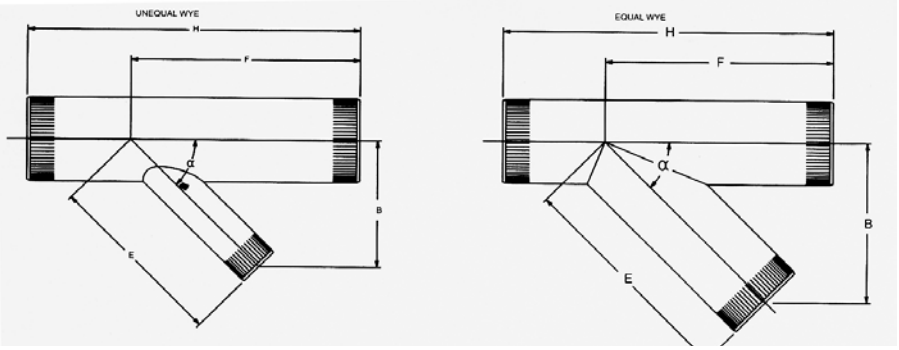
E. GRAVITY WYES



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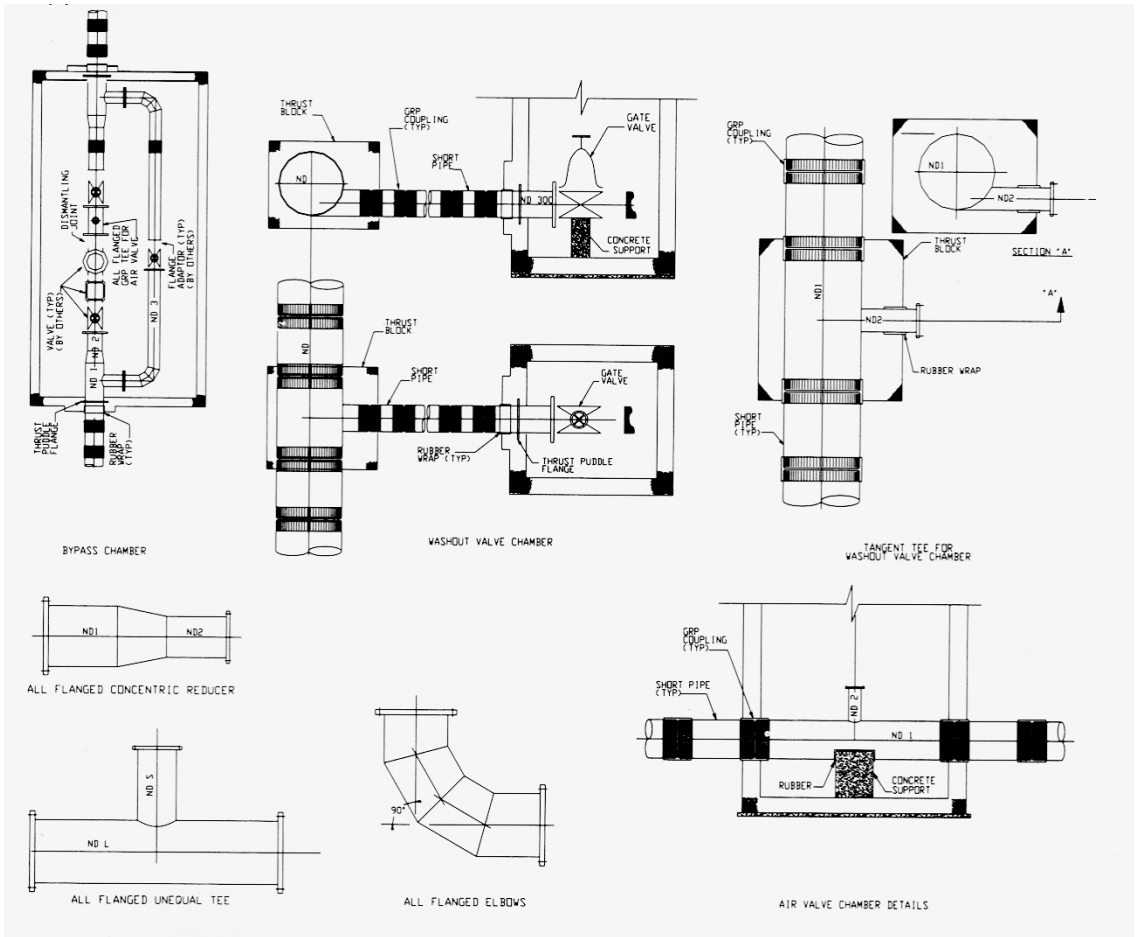
F. FLANGES

Flanges and blinds could be provided for the complete range of diameters with drilling patterns to match any international standard required such as DIN, ISO, ANSI, AWWA, JIS or to client requirements.

G. CUSTOM DESIGNED FITTINGS

Future Pipe Industries can provide custom designed fittings for Air Valve Chambers, Wash-Out Chambers, By-Pass Chambers, in addition to all flanged fittings for specific applications.



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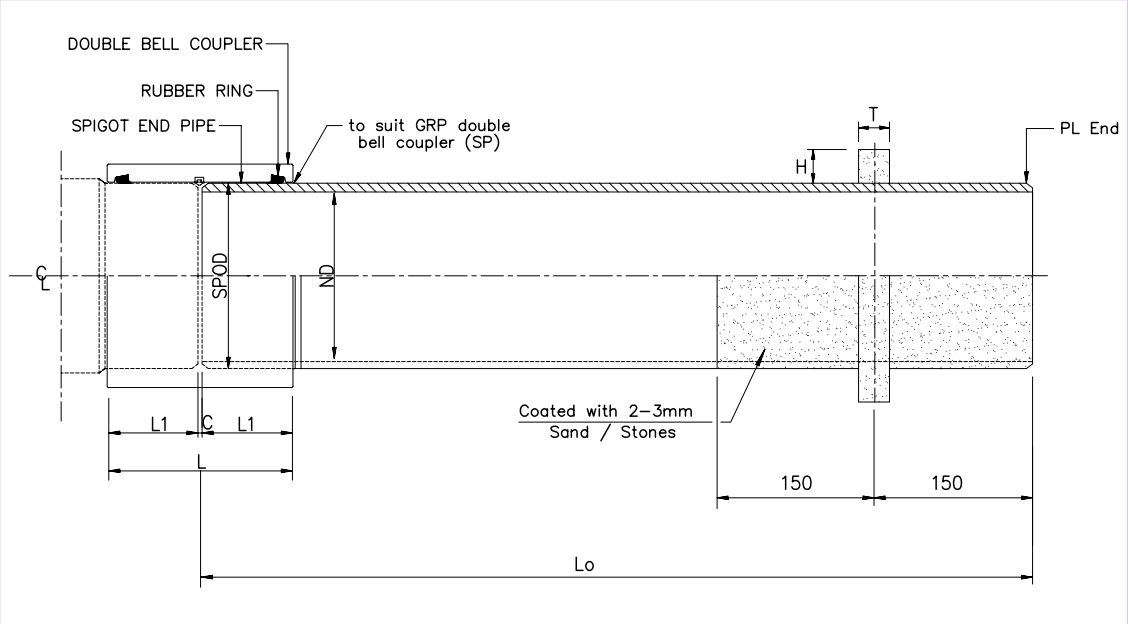
H. MANHOLE CONNECTORS



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10. VISUAL PROPERTIES

A. EXTERIOR VISUAL PROPERTIES

The exterior surface of **FIBERSTRONG™** pipe, joints and fittings shall be free of the following visual irregularities:

Fuzz	Glass fibers loosely adhering to the pipe that are not wet out with resin.
Protruding fibers	Glass fibers sticking out from face that are wet out with resin.
Resin runs	Runs of resin and sand on surface of pipe.
Dry area	Area in laminate with glass not wet out with resin.
Hand lay-up ragged edges	Ragged edges, areas at the edge of hand lay-up that are not rolled down properly or that are rough.

B. VISUAL DEFECTS LIMITS

The following visual limits apply:

Visual defect	Definition	Allowable Limits	
		External Surface	Internal Surface
Delamination Blisters	Separation in the laminate	None	None
	Light straw colored areas resulting from too hot a cure	None to exceed 13mm in Dia	None to exceed 4mm in Dia
Crazes	Cracks on inner surface usually star shaped; caused by sharp impact	N/A	None
Surface pits and voids	Small air pockets on the surface or directly beneath are solid. Surface mat can be broken by finger nail	N/A	None greater than 2mm deep and 20mm Dia. Or greater than 4mm deep of any Dia
Wrinkles, grooves and band depressions	Smooth Irregularities on liner surface	N/A	None greater than 3mm deep
Haystacks	Accumulations of glass, resin and sand on exterior surface	None greater than 30mm Dia.	N/A
Torn edges, end delamination and end gouges	Tears and rips in the edges of cuts	N/A	None that will effect the integrity of the joints
Ground area	Area around lay-up which has been abraded but lay-up does not cover or has not been coated.	Permitted	None

11. REPAIR WORK

Repairs to internal and external layers shall not exceed 5% of the total surface area. No Structural repair work is allowed.

The number of repairs will not exceed an average of one (1) per one (1) meter length of pipe in each surface.

Pipe sections may contain factory lay-up joints which shall not be considered as repairs.

12. MARKING AND IDENTIFICATION

Each pipe section and coupling shall be marked with the following information:

1) Company name
2) Manufacturing standard
3) Pipe diameter
4) Pressure class
5) Stiffness class
6) Pipe serial number
7) Manufacturing date

Specific marking requirement by customers can be arranged; Future Pipe Industries marks the product accordingly while maintaining traceability.

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