

WAVISTRONG™

Product Information





Product Information

DISCLAIMER

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OVERVIEW

Future Pipe Industries, member of Future Pipe Group, is a leading manufacturer of high performance, anti-corrosive pipe systems for Oil & Gas, Desalination & Power, Municipal & Infrastructure, Water Distribution, Industrial, Petrochemical and Marine. The group was founded in 1984, and since then, has evolved into the leading provider of composite thermosetting pipe systems and technologies in Middle East, North Africa, GCC, Europe, Russia & CIS, USA & Latin America and South East Asia.

ACCREDITATIONS

Future Pipe Group is accredited for the Quality Management System (BS EN ISO 9000: 2000) and Environmental Management System (BS EN ISO 14001:2004). In addition, certificates of the suitability to transmit potable water from the Water Regulation Advisory Scheme (WRAS) Great Britain/ the National Sanitation Foundation (NSF) USA/ KIWA.



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1. DESCRIPTION

A. General

Wavistrong™ (H₂O) non-restrained pipe, fitting and joint are Glass Reinforced Epoxy resin (GRE) flexible corrosion resistant pipe system intended for underground use. It consists of a Thermosetting Chemical resistant Epoxy resin and Fiberglass Reinforcements. It might also include fine Silica sand aggregates in the structural wall according to BS 5480 / AWWA C-950.

The pipes are available in nominal diameters ranging from 100 to 1200 mm* and stiffness classes of 5,000 and 10,000 N/m². They are pressure rated PN10*.

* For larger diameters or higher pressure rating, please contact Future Pipe Group.

B. Construction

The pipe consists of a resin-rich reinforced liner, structural wall and a resin-rich exterior layer. The resin used throughout the pipe wall is Epoxy resin. "C" glass is used at the internal pipe surface. "E" glass is used for the structural wall.

C. Applicable Codes / Standards

Standards	Main Applications
ASTM D-3517	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe
ASTM D-3754	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe
ASTM D-2310	Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
AWWA C-950	Fiberglass Pressure Pipe
AWWA M-45	Fiberglass Pipe Design Manual
BS 5480	British Standard Specification for Glass Reinforced Plastics (GRP) Pipes, joints and fittings for use for water supply or sewerage.

2. FEATURES AND BENEFITS

Features	Benefits
Manufactured with corrosion resistant composite material.	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Ease of jointing helps reduce installation time. • Tight, efficient joints designed to eliminate infiltration and exfiltration. • Costly joint diapers are not required. • Allows for flexible alignment, accommodating changes in line direction with fewer fittings.
Light weight. ¼ the weight of ductile iron and 1/10 of concrete pipe.	<ul style="list-style-type: none"> • Easy to install. No need for expensive handling equipment. • Low delivery costs.
Extremely smooth bore.	<ul style="list-style-type: none"> • Low friction loss means less pumping energy needed. • Minimum slime build up can help lower cleaning costs.
Pipe Specifications meet or exceed worldwide standards.	<ul style="list-style-type: none"> • Assures high quality product specifications. Easy for engineers to specify Wavistrong™ H₂O pipe with confidence.
High technology pipe manufacturing system.	<ul style="list-style-type: none"> • Assures high quality product specifications. Easy for engineers to specify Wavistrong™ H₂O pipe with confidence.
High technology pipe manufacturing system.	<ul style="list-style-type: none"> • Helps ensure consistent product quality worldwide.
Styrene Free Resin.	<ul style="list-style-type: none"> • Epoxy resin is used for the production of the pipes. There are no emissions of styrene gas during the production of the pipes.

3. USE AND APPLICATION

WAVISTRONG (H₂O) GRE Pipe is designed for underground use in potable water applications with a maximum temperature range of 65°C. It can also be used inside valve pits and valve chambers.

4. PRESSURE AND LOADING RESTRICTIONS

A. Pressure Restrictions

Pipe manufactured per this specification will have the following pressure capabilities regardless of pipe stiffness.

Pressure Class (KPa)	PN10
Maximum Operating Pressure (KPa)	1,000
Maximum Surge Pressure (KPa)	1,400
Maximum Field Test Pressure (KPa)	1,350
Minimum Factory Test Pressure (KPa)	1,500

B. Stiffness Classes and Allowable Vacuum

GRE Pipes shall have the following characteristics regardless of pressure class.

Stiffness Class (N/m ²)	SN 5000	SN 10000
Minimum specific tangential initial stiffness STIS = EI/D ³ (N/m ²)	5,000	10,000
Maximum Allowable vacuum level in KPa at cover with hard soil & water table at grade and pipe installed in:		
Installation Type*		
(I) Full compacted gravel @ maximum cover depth	-100	
(II) Full sand compacted to 90% standard proctor density (@ depth shown in m)	-100 (4m)	-100 (4m)

* Maximum vacuum level varies with the native soil classification, the type of installation and burial depth. Refer to Future Pipe Industries for the allowable vacuum levels for other installation types.

C. Burial Depth

Minimum Burial Depth** for:

- AASHTO H-20 Loading (m) 1.0
- BS 153 HA Loading (m) 1.5
- Cooper E80 Railroad (m) 3.0

The maximum allowable cover depth varies with the type of installation and native soil conditions. Refer to Future Pipe Industries for installation details.

** Minimum cover restrictions may be reduced with special installation such as concrete encasement, concrete cover slabs, casting, or other provisions to carry the surface load.

5. PHYSICAL/MECHANICAL PROPERTIES

A. Spigot Outside Diameter

Nominal Diameter (mm)	Spigot Outside Diameter (mm)
100	110.5
150	160.5
200	210.5
225	235
300	309.5
400	412.5
450	463.5
500	514.5
550	565.5
600	616.5
700	718.5
900	922.5
1200	1128.5

B. Minimum Material Properties

Axial Tensile Strength: (Table 11 of AWWA C950)
 Circumferential Tensile Strength: (Table 10 of AWWA C950)
 Specific Tangential Initial Stiffness (STIS): 10,000 N/m² for DN<300
 5,000 N/m² for DN300 and above.

C. Approximate Pipe and Joint Weights (for Handling Purpose)

DN	Pipe (kg/m)	Couplings (kg)
100	4	2
150	6	3
200	8	4
225	9	5
300	11	6
400	13	8
450	17	9
500	23	10
550	27	12
600	32	18
700	43	21
900	69	31
1200	122	49

6. FITTINGS

Future Pipe Industries has established a standardized line of GRE fittings. The most common fittings are (Elbows, Reducers, Tees, Wyes and Flanges).

Fittings are jointed to GRE pipes with standard double bell couplings and require thrust blocks for pressure systems.

Legend: SP = Spigot end.

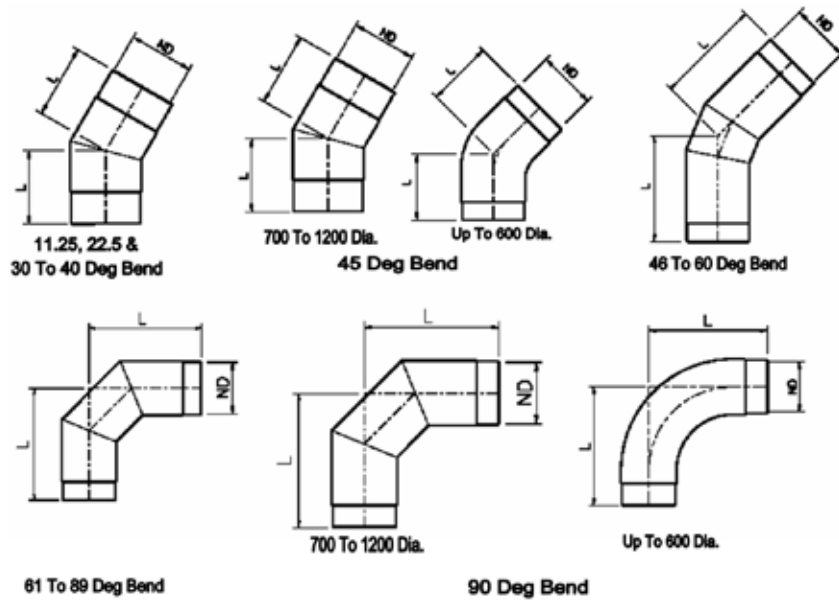
FL = Flanged end. The Standard flanges drilling pattern is BS4504-PN10.

Other drilling patterns are also available upon request.

A. Elbows SP/SP

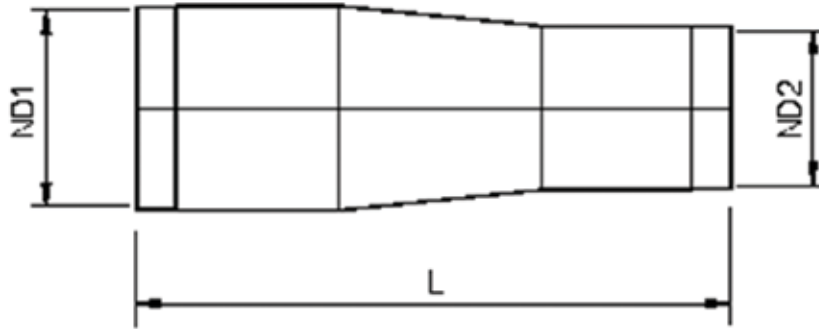
Mitered Elbows

Effective laying length (mm) = L



	11.25°, 22.5° & 30°	31° to 44°	45°	46° to 60°	61° to 89°	90°
ND (mm)	# of miters (when applicable)					
	1	1	1	2	2	2
80	200	250	185	250	300	255
100	200	250	180	250	325	270
150	200	300	215	300	375	345
200	250	325	245	350		420
225	250	325	265	350	500	470
250		350	260	425	575	480
300	300	400	305	450	650	570
450	450	600	600	700	1000	1000
500	450	600		700	1050	1050
550	500	700	700	750	1050	1050
600	500	750	750	850	1090	1090
700	500	800	800	850	1200	1200
900	550	900	900	950	1510	1510
1200	650	1000	1000	1200	1930	1930

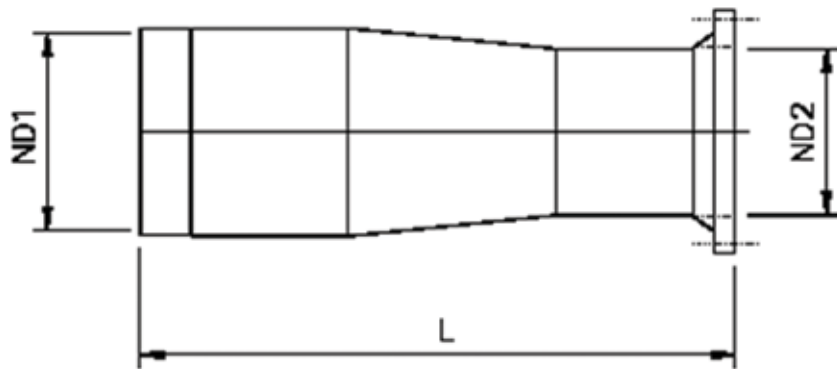
B. Concentric Reducers SP/SP



ND1 (mm)	ND2 (mm)	Laying Length L (mm)
100	80	230
150	80	430
	100	365
200	80	700
	100	650
	150	380
225	80	750
	100	700
	150	600
	200	500
250	80	825
	100	800
	150	600
	200	420
	225	500
300	80	950
	100	900
	150	825
	200	620
	225	650
	250	480
450	80	1450
	100	1410
	150	1300
	200	1190
	225	1130
	300	960
550	225	1500
	300	1300
	450	1150
	500	550
600	225	1700
	300	1500
	450	1000
	500	1250
	550	1125

ND1 (mm)	ND2 (mm)	Laying Length L (mm)
700	225	1800
	300	1850
	500	1500
	600	1150
900	225	2300
	300	2400
	500	2100
	550	1350
	600	1660
	700	1600
1200	300	2900
	500	2850
	550	2475
	600	2600
	700	2350
	900	1800

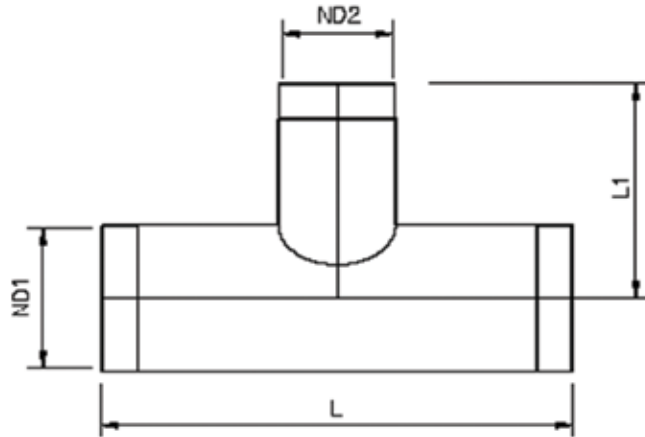
C. Concentric Reducers SP/FL



ND1 (mm)	ND2 (mm)	Laying Length L (mm)
100	50	345
	80	240
150	80	440
	100	375
200	80	610
	100	560
	150	390
225	80	800
	100	803
	150	678
	200	553
250	80	915
	100	865
	150	610
	200	430
	225	573

ND1 (mm)	ND2 (mm)	Laying Length L (mm)
300	80	1040
	100	990
	150	865
	200	610
	225	600
	250	470
450	80	1430
	100	1390
	150	1280
	200	1160
	225	1110
	300	940
550	300	1325
	450	1150
	500	1025
600	500	1250
700	300	1850
	500	1500
	600	1150
900	300	2400
	500	2100
	600	1660
	700	1600
1200	500	2850
	600	2600
	800	2100
	900	1800

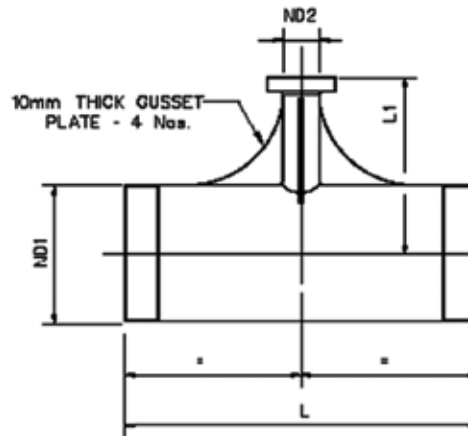
D. Tees SP/SP/SP



Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
80	80	380	190
100	80	348	190
	100	348	174
150	80	396	225
	100	396	230
	150	396	198
200	80	496	260
	100	496	265
	150	496	295
	200	496	248
225	80	600	280
	100	600	300
	150	600	305
	200	600	315
	225	600	300
250	80	600	295
	100	600	300
	150	600	310
	200	600	325
	225	600	310
	250	600	300
300	80	615	330
	100	615	335
	150	615	345
	200	615	360
	225	615	335
	250	615	370
	300	615	308

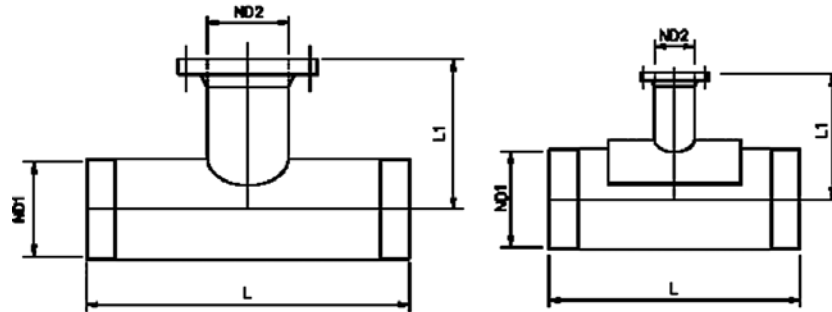
Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
450	100	750	475
	150	750	475
	225	850	500
	300	900	500
	450	1250	625
550	80	700	600
	100	750	600
	150	800	600
	200	1000	600
	225	1050	600
	250	1100	600
	300	1100	600
	550	1600	800
600	100	800	550
	150	1000	600
	200	900	600
	225	1050	600
	300	1000	600
	500	1400	650
	550	1200	600
	600	1600	800
700	100	1000	600
	150	1000	650
	200	1000	650
	225	1100	700
	250	1000	650
	300	1100	700
	500	1400	700
	550	1500	850
	600	1600	800
	700	1700	850
900	100	1000	800
	150	1000	800
	200	1100	800
	225	1100	800
	300	1100	850
	450	1200	850
	500	1400	950
	550	1600	950
	600	1600	950
	700	1700	1000
	900	2100	1050
1200	80	1000	900
	100	1000	900
	150	1000	900
	200	1100	900
	225	1100	950
	300	1100	850
	450	1400	1100
	500	1400	1100
	550	1550	1350
	600	1600	1100
	700	1700	1150
	900	2100	1250
	1200	2700	1350

E. Tees SP/SP-FL (for air valves)



Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
350	80	700	375
	100	700	375
	150	700	375
450	80	800	400
	100	800	400
	150	800	400
500	80	700	450
	100	750	450
	150	750	450
550	80	900	500
	100	900	500
	150	900	600
	200	900	650
600	80	900	500
	100	900	500
	150	900	600
	200	900	650
700	80	900	550
	100	1000	550
	150	1000	700
	200	1000	750
900	80	1000	650
	100	1000	650
	150	1000	800
	200	1000	850
1200	80	1000	800
	100	1000	800
	150	1000	900
	200	1100	900

F. Tees SP/SP/FL

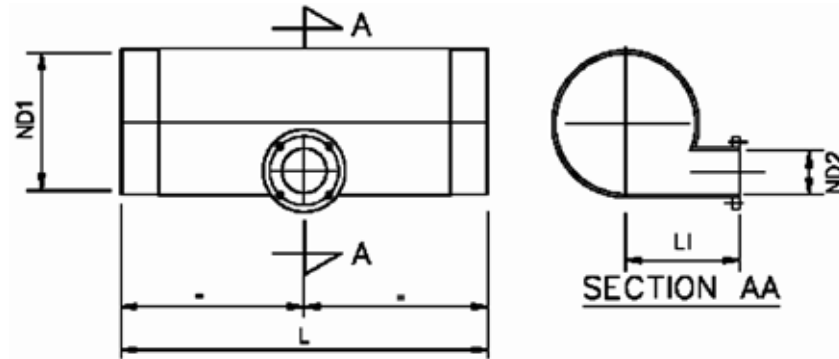


Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
80	50	360	150
	80	380	170
100	50	348	160
	80	348	180
	100	348	180
150	50	396	185
	80	396	215
	100	396	215
	150	396	235
200	50	495	210
	80	496	250
	100	496	250
	150	496	270
	200	496	270
225	50	600	230
	80	600	275
	100	600	275
	150	600	295
	200	600	295
	225	600	310
250	80	600	285
	100	600	285
	150	600	305
	200	600	305
	225	600	320
	250	600	335
300	50	615	345
	80	615	320
	100	615	320
	150	615	340
	200	615	340
	225	615	345
	250	615	360
	300	615	360

Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
450	80	750	475
	100	750	475
	150	750	475
	200	850	500
	225	850	500
	300	900	500
	450	1250	625
550	80	700	600
	100	750	600
	150	800	600
	200	1000	600
	225	1050	600
	250	1100	600
	300	1100	600
	450	1300	800
	550	1600	750
600	80	900	500
	100	800	500
	150	900	500
	200	900	500
	225	800	520
	300	1000	500
	450	1300	650
	550	1600	750
	600	1600	775
700	80	900	550
	100	1000	550
	150	1000	550
	200	1000	550
	225	1100	550
	300	1100	550
	450	1400	700
	500	1400	700
	550	1350	850
	600	1600	800
	700	1700	900
900	80	1000	650
	100	1000	700
	150	1000	700
	200	1000	700
	225	1100	650
	300	1100	700
	450	1200	850
	500	1400	950
	550	1600	950
	600	1600	950
	700	1700	1000
	900	2100	1100

Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
1200	80	1000	850
	100	1000	850
	150	1000	900
	200	1100	850
	225	1100	850
	300	1100	850
	450	1400	1100
	500	1400	1100
	550	1325	1075
	600	1600	1100
	700	1700	1150
	900	2100	1250
	1200	2700	1400

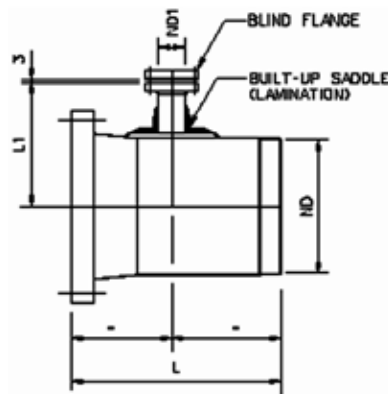
G. Invert Tees (Tangential) SP/SP/FL



Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
100	80	348	175
150	80	396	200
	100	396	225
200	80	496	225
	100	496	250
	150	496	250
225	80	600	250
	100	600	250
	150	600	275
	200	600	300
250	80	600	250
	100	600	275
	150	600	275
	200	600	325
	225	600	325
300	80	615	275
	100	615	300
	150	615	300
	200	615	350
	225	615	350
	250	615	350
450	80	700	400
	100	700	400
	150	700	450
	200	700	450
	225	700	450
500	100	800	500
	150	800	500
	200	800	500

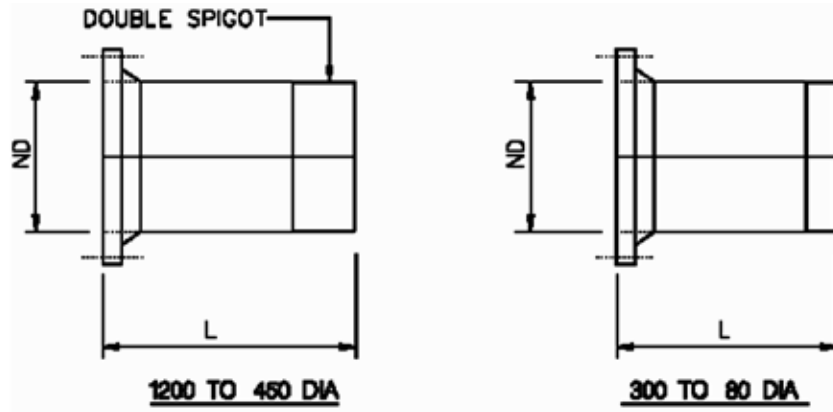
Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
550	100	900	425
	150	900	500
	200	900	650
	300	950	525
600	100	900	500
	150	900	600
	200	900	650
700	150	1000	700
	200	1000	750
	300	1100	750
900	150	1000	800
	200	1000	850
	300	1100	850
1200	150	1000	900
	200	1100	1000
	300	1300	1000

H. Special Flange Adaptor, FL/SP-FL



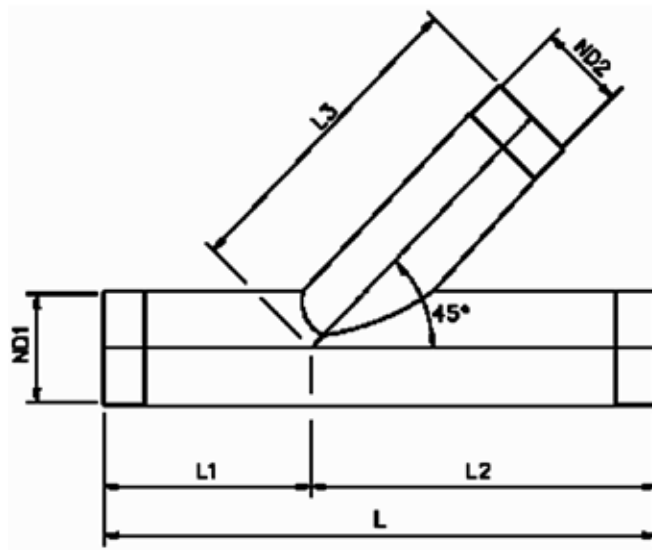
Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
150	25	600	170
200	25	600	195
300	25	600	250
450	25	600	345
500	25	600	375
550	25	600	400
600	25	600	400
700	25	600	475
900	25	600	575
1200	25	600	725

I. Special Adaptor, FL/SP



ND (mm)	L (mm)
80	250
100	250
150	250
200	250
225	250
250	250
300	250
450	500
500	500
550	600
600	600
700	600
900	600
1200	600

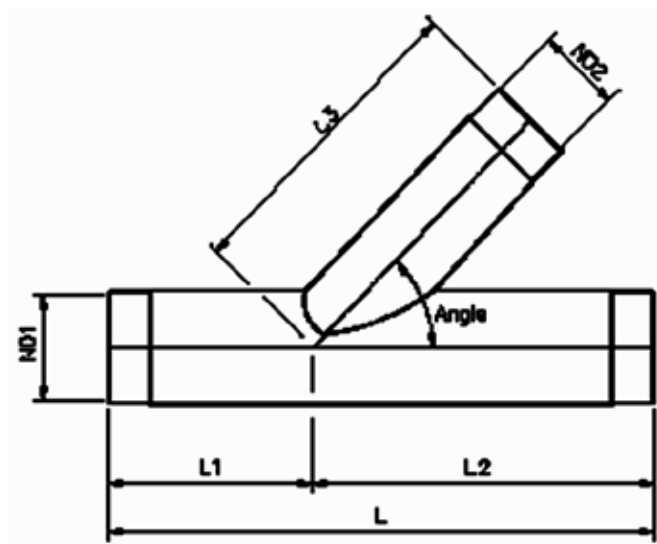
J. 45 Deg Wye Branch Tee SP/SP-SP



Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)	L2 (mm)	L3 (mm)
80	80	750	330	420	420
100	80	800	325	475	520
	100	750	330	420	420
150	80	800	325	475	520
	100	850	325	525	525
	150	850	350	500	500
200	80	880	330	550	600
	100	880	330	550	600
	150	930	330	600	600
	200	1000	400	600	600
225	100	900	350	550	550
	150	900	350	550	550
	200	1000	400	600	600
	225	1000	400	600	600
250	80	850	325	525	600
	100	850	325	525	600
	150	900	325	575	600
	200	1000	375	625	670
	225	1100	475	625	675
	250	1100	450	650	650
300	80	930	330	600	600
	100	930	330	600	600
	150	1000	350	650	670
	200	1100	400	700	670
	225	1200	450	750	740
	250	1200	450	750	740
	300	1100	450	650	650
500	300	1100	250	850	850
	500	1500	500	1000	1000

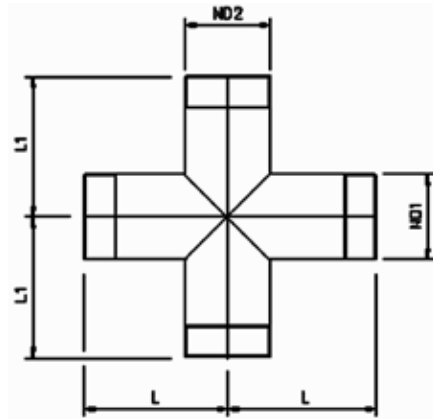
Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)	L2 (mm)	L3 (mm)
550	200	1600	500	1100	1100
	550	1600	500	1100	1100
600	500	1600	500	1100	1100
	600	1600	500	1100	1100
700	550	1500	360	1140	1140
	700	1900	630	1270	1270
900	550	1700	350	1350	1350
	900	2300	670	1630	1630
1200	1200	2900	850	2050	2050

K. Wye Branch Tee SP/SP-SP



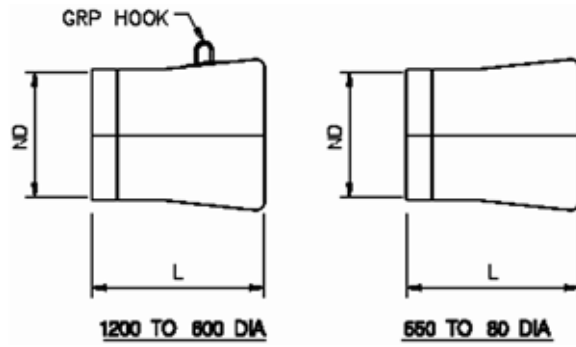
Header ND1 (mm)	Branch ND2 (mm)	Angle (Deg.)	L (mm)	L1 (mm)	L2 (mm)	L3 (mm)
1200	600	67.5	1700	600	1100	1200
900	900	62	2800	950	1850	1850

L. Cross Tee SP/SP/SP/SP



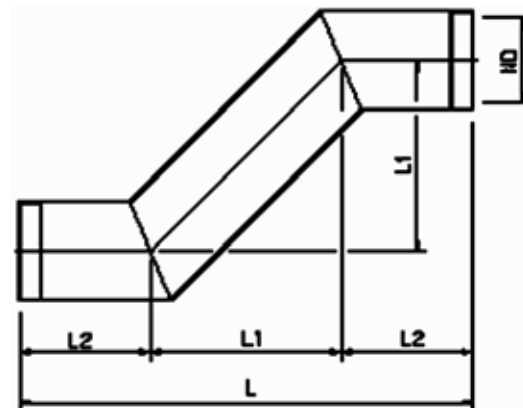
Header ND1 (mm)	Branch ND2 (mm)	L (mm)	L1 (mm)
80	80	225	225
100	80	250	225
	100	250	250
150	80	300	275
	100	300	275
	150	300	300
200	100	325	325
	150	325	325
	200	350	350
225	100	325	325
	150	375	350
	200	375	375
	225	375	375
250	200	400	400
	225	400	400
	250	400	400
300	100	275	350
	150	300	375
	225	450	450
	250	450	450
	300	450	450
500	500	750	750
550	500	800	800
	550	800	800
600	500	750	650
	550	600	600
	600	600	600
700	500	700	700
	600	800	800
	700	850	850
900	600	950	950
	900	1050	1050
1200	1200	1350	1350

M. Male End-Cap SP



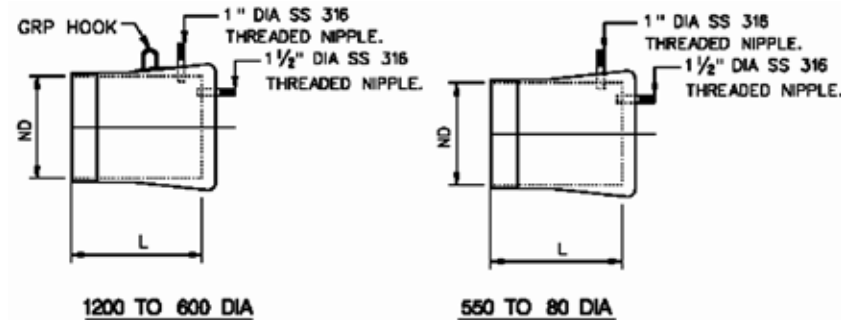
ND (mm)	L (mm)
80	250
100	250
150	250
200	250
225	250
250	250
300	250
450	400
500	400
550	400
600	400
700	400
900	450
1200	450

N. 45 deg 'S' Bend SP/SP



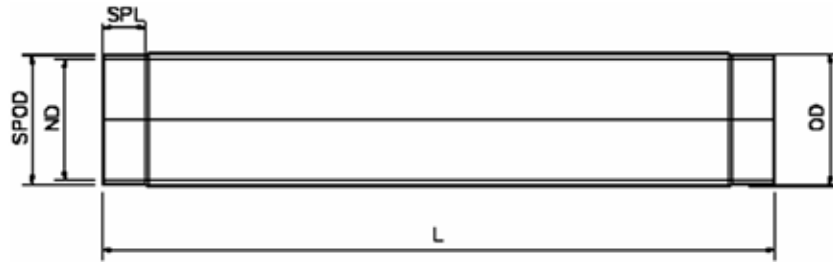
Header ND1 (mm)	L (mm)	L1 (mm)	L2 (mm)
1200	3500	1500	1000

O. Male Test End-Cap SP



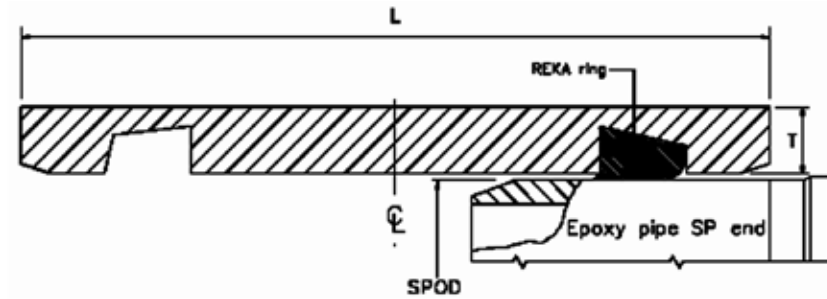
ND (mm)	L (mm)
80	250
100	250
150	250
200	250
225	250
250	250
300	250
450	400
500	400
550	400
600	400
700	400
900	450
1200	450

P. Pipe SP/SP



ND (mm)	OD (mm)	SPOD (mm)	SPL (mm)	L (mm)
80	90.6	90.5	78	5000
100	110.6	110.5	78	5000
150	160.6	160.5	78	5000
200	210.6	210.5	93	5000
225	235.6	235.0	93	5000
300	310	309.5	93	5000
400	413	412.5	118	5000
450	464	463.5	118	5000
500	515	514.5	118	5000
550	566	565.5	118	5000
600	617	616.5	138	5000
700	719	718.5	138	5000
900	923	922.5	153	5000
1200	1229	1228.5	168	5000

Q. Double Bell Coupler



ND (mm)	SPOD (mm)	T (mm)	L (mm)
80	90.5	14.3	150
100	110.5	14.3	150
150	160.5	14.3	150
200	210.5	15.3	176
225	235.0	15.3	176
300	309.5	15.3	176
400	412.5	15.8	200
450	463.5	15.8	200
500	514.5	16.0	200
550	565.5	16.2	200
600	616.5	19.4	240
700	718.5	19.8	240
900	922.5	20.7	270
1200	1228.5	22.0	300

R. 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.

7. HOT TAPPING

Wavistrong™ (H₂O) pipes intended for water distribution networks (DN450 and below) can be "Hot Tapped". "Live" pipes can be tapped while pressurized and in service to obtain service connections to consumers. Typically, ¾" or 1" service connections are made. Please refer to Future Pipe Industries for the proper tapping procedures.

