

EXCELLENT PIPES

*Excellent Pipes
Company L.L.C*

FIBERBOND™

**Glass-Fiber Reinforced Thermosetting
Resin Pipes (GRP)**



**Product
Catalogue**



EXCELLENT PIPES CO. L.L.C.

P.O.Box: 51636, Abu Dhabi

United Arab Emirates,

Tel : +971-2-5500500

Fax: +971-2-5500600

E-mail: xellent@eim.ae

website: www.hedleyuae.com

A Member of Hedley Industrial Group

EXCELLENT 

Pioneering Excellence in Piping Systems

EXCELLENT PIPES COMPANY L.L.C

Excellent Pipes Company is part of the Hedley Industrial Group that operates state of the art manufacturing plants in United Arab Emirates. Established in 2000, Excellent Pipes Co. (EXCELLENT) is a leading manufacturer and supplier of high quality GRP, RC, uPVC, ABS and PE piping systems that are widely used in municipal, industrial and infrastructure development projects throughout the Gulf region.

EXCELLENT adopts a policy of continuous development as an integral part of its operation. We have in place advanced technology coupled with extensive research & development and assured quality. **FIBERBOND™** GRP products are used for a wide range of applications including sanitary sewerage, industrial waste water & effluents, sea water, cooling water, fire water lines and potable water.

We offer support services to our clients and assist them with their project implementation from conception to successful commissioning.

FIBERBOND™ GRP pipes are manufactured to close dimensional tolerance with an uncompromising emphasis on quality and performance. As an industrial offshoot of Hedley Industrial Group, we enjoy a unique standing in the business community, capitalizing on the group's long history of successful achievements and awards. Our group's road to success is marked with several recognitions, including the Shaikh Khalifa industrial and Excellence Awards, American Concrete Pipe Association Certificate, American Petroleum Institute Monogram, triple certification under ISO 9001, 14001 & 18001 and the highly acknowledged BSI Kitemark certification.

Our technical and operational expertise supported by technology from leaders in the pipe industry, bring EXCELLENT to the forefront of international pipe manufacturers, providing value to our customers, in line with our motto of “**PIONEERING EXCELLENCE IN PIPING SYSTEMS**”.



CONTENTS



FIBERBOND™

1	Product Description	06
	A. General	06
	B. Construction	06
	C. Applicable Codes & Standards	06
2	Features and Benefits	07
3	Use and Application	07
4	Pressure and Loading Restrictions	08
	A. Pressure Rating	08
	B. Stiffness Classes	08
	C. Burial Depth	08
	D. Maximum Allowable Deflection	09
5	Joints	09
	A. Coupler Joint	09
	B. Flanged Joint	10
	C. Laminated Joint	10
	D. Adhesive bonded Joint	10
6	Product Qualification	10
7	Quality Control	11
8	Physical / Mechanical Properties	14
	A. Spigot outside Diameter	14
	B. Dimensions	14
	C. Specific Tangential Initial Stiffness	15
	D. Mechanical Properties	15
9	Fittings	19
	A. Elbows	19
	B. Reducers	20
	C. Tees	22
	D. Wyes	30
	E. Flanges	37
10	Manholes	37
11	Visual Properties	37
	A. Exterior Visual Properties	37
	B. Visual Defects Limits	38
12	Repair Work	38
13	Marking and Identification	38
14	Packing	39
15	Handling	39
16	Customer Inspection	40
17	Installation	40
18	Limitation of Liability	41
19	Awards & Achievements	42

GLASSFIBER REINFORCED PLASTIC PIPE

PRODUCT INFORMATION

1. DESCRIPTION

A. GENERAL

FIBERBOND™ GRP non-restrained pipes and joints are intended mainly for underground use. This product range consists of Thermosetting Chemical resistant polyester resin, Fiberglass Reinforcements and fine Silica sand aggregates conforming to AWWA C-950 / BS EN 1796 / BS EN 14364 / BS 5480.

FIBERBOND™ GRP self-restrained pipes and joints used for aboveground and underground applications are manufactured in accordance to AWWA M 45.

Large diameter pipes are available in nominal diameters ranging from 300 to 2600 mm with standard pressure classes of PN1, 3, 6, 10, 12 and 16 bar and stiffness classes of 2500, 5000 and 10000 Pa.

B. CONSTRUCTION

The pipe consists of resin-rich reinforced liner, structural wall and a resin rich exterior layer. 'C' glass is used at the internal and external pipe surfaces for enhanced chemical resistance.



C. APPLICABLE CODES/STANDARDS

ASTM D 3262	Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
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 & Industrial Pressure Pipe
ASTM D 2996	Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) 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: Glass reinforced Thermosetting Plastics (GRP) based on Unsaturated Polyester Resin (UP).
BS EN 14364	Plastics Piping Systems for Drainage and Sewerage with or without Pressure: Glass-reinforced Thermosetting Plastics (GRP) based on Unsaturated Polyester Resin (UP).
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

- Manufactured with corrosion resistant composite material.
- Double bell coupling joints manufactured with corrosion resistant glass fiber & sealed with elastomer gaskets for non-restrained applications.



- Laminated and flanged joints for self-restrained applications.
- Light weight. 1/4 the weight of ductile iron & 1/10 of concrete pipe.
- Manufactured in long sections up to 12m.
- Extremely smooth bore.
- Pipe specification meets or exceeds world-wide standards.
- High technology pipe manufacturing system.

BENEFITS

- Long effective service life.
- No need for expensive cathodic protection.
- No need for costly pipe coating, wrapping, lining, painting, or use of polyethylene wraps.
- Hydraulic characteristics essentially remain unchanged overtime.
- Ease of jointing helps reduce installation time.
- Tight, efficient joints designed to eliminate infiltration and exfiltration.
- Costly joint diapers are not required.
- Allow for flexible alignment, accommodating changes in line direction with fewer fittings.
- Easy to install. No need for expensive handling equipment.
- Low delivery costs
- Fewer joints reduce installation time.
- Low friction loss means less pumping energy needed.
- Minimum slime build up can help lower cleaning cost.
- Assures high quality product specifications. Easy for engineers to specify **FIBERBOND™** pipe with confidence.
- Helps ensure consistent product quality.



3. USE AND APPLICATIONS

FIBERBOND™ non-restrained pipe is suitable for underground use in potable water, raw water, sea water 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 EXCELLENT PIPES CO.

4. PRESSURE AND LOADING RESTRICTIONS

A. PRESSURE RATING

FIBERBOND™ GRP pipes have the following pressure capabilities regardless of pipe stiffness.

Pressure Class (kPa)	PN1	PN3	PN6	PN10	PN12	PN16
Maximum operating pressure (kPa)	100	300	600	1,000	1,200	1,600
Maximum surge pressure (kPa)	140	420	840	1,400	1,680	2,240
Maximum field test pressure (kPa)	150	450	900	1,500	1,800	2,400
Maximum factory test pressure (kPa)	200	600	1,200	2,000	2,400	3,200

B. STIFFNESS CLASSES

FIBERBOND™ GRP pipes shall have the following characteristics regardless of pressure class.

Stiffness Class (N/m ²)	SN 2500	SN5000	SN10000
Minimum Specific Tangential initial Stiffness STIS = EI/D ³	2500 Pa	5000 Pa	10000 Pa

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	-100	-100
(II) Full Sand compacted to 90% Standard proctor density (@ depth shown in m)	-60 (4m)	-100 (6m)	-100

* Maximum vacuum level varies with the type of installation and burial depth

C. BURIAL DEPTH

Minimum Cover Depth ** for:

- AASHTO H-20 Loading (m)	1.0
- BS 153 HA Loading (m)	1.5
- Cooper E 80 Railroad (m)	3.0

Maximum Cover Depth *** installed in:

	SN 2500	SN5000	SN1000
-Fully compacted gravel	14 m	16 m	18 m
-Fully compacted sand to 90% Standard proctor density	8 m	10 m	15 m

** 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.

*** Maximum allowable cover depth varies with the type of installation and native soil conditions.

D. MAXIMUM ALLOWABLE DEFLECTION

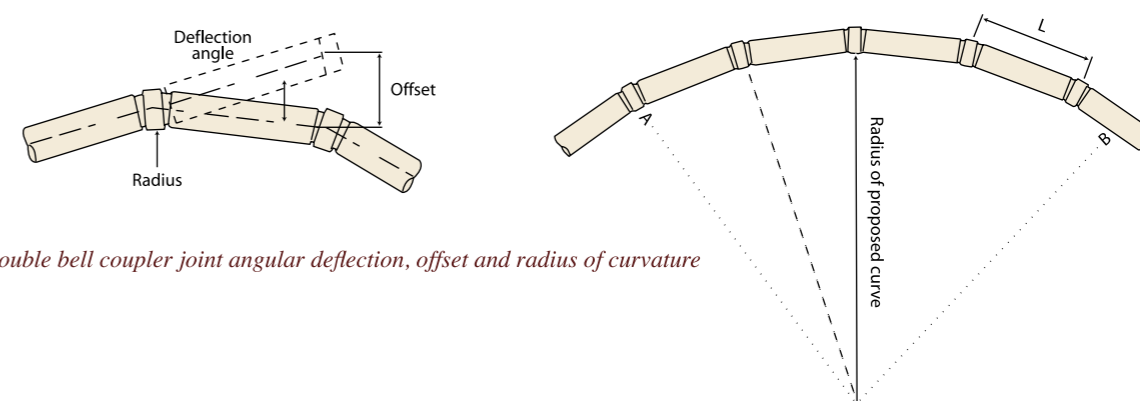
Regardless of pipe stiffness or pressure class, the following restrictions apply:

Native Soil Blow Count	> 30	16 - 30	8 - 15	4 - 7	1 - 3
Maximum available initial Vertical deflection (%)	4	3 1/2	3	2 1/2	2
Maximum available long-Term vertical deflection (%)	5	5	5	5	5

5. JOINTS

A. Coupler Joint

Flexible double bell coupling joints typically seal on the OD of pipe spigot through the use of REKA type gaskets that are placed in the groove of the coupler. These non-restrained joints allow certain angular deflection depending on the diameter range.



Double bell coupler joint angular deflection, offset and radius of curvature

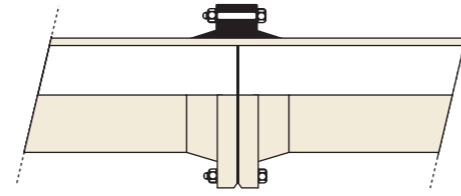
The maximum angular change of direction between pipe axis (equally distributed at both sides of the coupling) must not exceed the amount given in the following table:

Nominal Pipe Diameter (mm)	Nominal Angular Deflection (a) (degree)	Nominal Offset (mm) Section Lengths			Nominal Radius of Curvature (m) Section Lengths		
		3m	6m	12m	3m	6m	12m
80 to 0150	4.0	210	420	840	43	86	172
200 to 300	3.5	183	367	733	49	98	196
350 to 0500	3.0	157	314	629	57	115	229
600 to 900	2.0	105	210	419	86	172	344
1000 to 1200	1.5	79	157	314	114	229	458
1300 to 1800	1.0	52	105	210	172	334	687
1900 to 2600	0.5	26	52	105	344	687	1375

B. Flanged Joint

To enable connections with many types of pipes and to allow for easy assembling and disassembling of process lines. Special requirements can be met upon request.

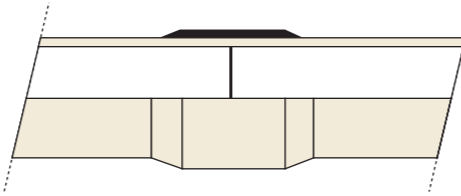
Glass fiber reinforced epoxy flanges are always flat faced and in view of this, matching flanges should also be flat faced. The flanged joint is completed by using a gasket.



C. Laminated Joint

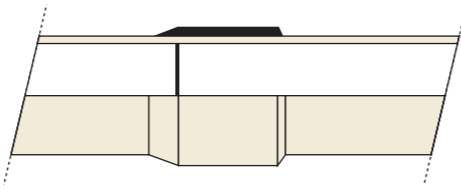
Generally these joints will only be used for diameters over 400 mm. The joint is consisting of layers of fiberglass mats and/or tapes impregnated with resin.

The preparation of this rigid joint requires good craftsmanship.



D. Adhesive Bonded Joint

The adhesive bonded joint is a rigid type of joining. The adhesive is a two component epoxy or vinyl ester resin system, packed in separate containers. The joint consists of a slightly conical socket end and a cylindrical spigot end.



6. PRODUCT QUALIFICATION

- ASTM D 2992 Standard practice for obtaining hydrostatic or pressure design basis for Glass Fiber - Reinforced Thermosetting - Resin pipe and Fittings (Hydrostatic Design Basis (HDB).
- ASTM D 3681 Chemical resistance of Glass-Fiber-Reinforced Thermosetting-Resin pipe in deflected condition (Stain corrosion performance).
- ASTM D 4161 Standard specification for Glass-Fiber-Reinforced Thermosetting-Resin pipe joint using flexible elastomeric seals.
- BS 5480 App. L British standard specification for glass reinforced plastic (GRP) 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.

7. QUALITY CONTROL

EXCELLENT is equipped with most modern Laboratory for the testing of raw materials and finished products. The Quality Control Laboratory is equipped with latest instruments and accessories to perform all the tests and measurements stipulated in the international standards and customer specifications.

Quality control inspection & testing include thorough checks for all incoming raw materials and finished products against the Excellent Pipes Co. L.L.C's strict written quality plan and data sheets.



A. RAW MATERIAL INSPECTION & TESTING



All incoming raw materials are subjected to a series of inspection and testing program to ensure compliance to the specified requirements.

Raw material testing is performed at EXCELLENT, using the latest test equipments and accessories including Digital Analytical Weighing balances, Digital Brookfield Viscometer, Electrical Muffle Furnace, Heating Ovens, Sieve shaking unit, Digital Thermocouples, etc. as stipulated in Quality Plan, standards and specifications.

B. INSPECTION AND TESTING OF PRODUCT

During in-process & final inspection stages the following physical, dimensional & mechanical checks are conducted:

Type of Test	Each Pipe	Once per Lot	Reference Standard
Visual Inspection	X		ASTM D 2563
Wall Thickness	X		ASTM D 3567
Spigot OD	X		ASTM D 3567
Length	X		ASTM D 3567
Barcol Hardness	X		ASTM D 2583
Hydrostatic Pressure*	X		AWWA C 950
Pipe Stiffness		X	ASTM D 2412 / EN 1226
Deflection to Crack		X	ASTM D 2412 / EN 1228
Axial Tensile Strength		X	ASTM D 638 / EN 1393
Hoop Tensile Strength		X	ASTM D 2290 / EN 1394
Loss on Ignition		X	ASTM D 2584

* For pressure applications.

PIPE STIFFNESS:

The stiffness testing machine is used for determining the external load bearing capacity and load-deflection characteristics of the GRP Pipes. Pipe stiffness is determined by following the parallel plate loading method.

A dedicated computer system with specially developed software is used for performing the test and handling the test data as per the relevant standards.

Reference Standards: BS EN 1226, BS EN 1228 & ASTM D 2412.



AXIAL TENSILE STRENGTH:

A Universal Testing Machine (UTM) is used for determining the axial (longitudinal) tensile strength of the GRP pipe laminates, by subjecting the specimen for extension in longitudinal direction.

A dedicated computer system with specially developed software is used for performing the test and handling the test data as per the relevant standards.

Reference Standards: BS EN 1393 & ASTM D 638.

HOOP TENSILE STRENGTH:

The Split Disc Machine is used for determining the Hoop (Circumferential) tensile strength of the GRP pipe laminates, by loading the specimen ring in circumferential direction. Software is specially developed on a dedicated system for testing and accessing the data.

Reference Standards: BS EN 1394 and ASTM D 2290.



LOSS ON IGNITION:

The muffle furnace is used to carry out Loss on Ignition test for determining the composition of the GRP pipe laminate. The test is carried out by igniting the specimens at 600 °C in the furnace followed by measurement of the weight of residual constituent materials.

Reference Standard: ASTM D 2584.

DIFFERENTIAL SCANNING CALORIMETRY (DSC):

EXCELLENT is equipped with the most advanced DSC scanning machine for determination of glass transition temperature (T_g value) of the cured thermosetting resin systems. The T_g value determined from the thermal cycle scanning data is used for establishing the degree of cure of the resin system with high precision and accuracy. Reference standard: ASTM D 3418.



REFRACTIVE INDEX:

EXCELLENT is equipped with the most modern digital ABBE Refractometer to measure the refractive index of solid and liquid substances to verify the purity as well as mixing proportions.

Reference standard: ASTM D 1045.

HYDROSTATIC PRESSURE TEST:

EXCELLENT is equipped with the latest automatic Hydrostatic Pressure Testing Machine. The computerized control panel enables to operate the machine in both Manual and Auto mode with continuous data logging system for accurate monitoring. The machine is used for conducting hydrostatic pressure test as well as vacuum test. Reference Standards: ASTM D 3517, ASTM D 3754, BS 5480, BS EN 1796, BS EN 14364, AWWA C 950.



A state of the art Coupler hydrostatic pressure test machine is used to test the soundness of the double bell couplers. Reference standards BS EN 14364, BS EN 1796 & AWWA C 950.

8. PHYSICAL/MECHANICAL PROPERTIES

A. SPIGOT OUTSIDE DIAMETER

Pipe outside diameter at spigot end: for all stiffness and pressure classes of non-restrained pipes.

Nominal Diameter (mm)	Spigot Outside Diameter (mm)	Pipe Outside Diameter (mm)
400	412.5	413
450	463.5	464
500	514.5	515
600	616.5	671
700	718.5	719
800	820.5	821
900	922.5	923
1000	1024.5	1025
1100	1126.5	1127
1200	1228.5	1229
1300	1330.5	1331
1400	1432.5	1433
1500	1534.5	1535
1600	1636.5	1637
1700	1738.5	1739
1800	1840.5	1841
1900	1942.5	1943
2000	2044.5	2045
2100	2146.5	2147
2200	2248.5	2249
2300	2350.5	2351
2400	2452.5	2453
2500	2554.5	2555
2600	2656.5	2657

B. DIMENSIONS

Dimensions	Specification	Tolerances
Standard Pipe Length (L)	Standard Length 12 m. Random Length or factory jointed lengths supplied shall not exceed 10% of the order quantity.	± 25mm
Out of Squareness	End shall be square to both axis of the pipe plane.	Not to exceed 2 + 0.005 D (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.
Wall Thickness	As per EXCELLENT PIPES CO. thickness	Single point 87.5 % of minimum average
Roundness	Pipes shall be round.	± 1%
Deviation		

C. SPECIFIC TANGENTIAL INITIAL STIFFNESS (STIS)

The minimum specific tangential initial stiffness is 2500, 5000, 10000 Pa or as per the Customer requirement determined in accordance with ASTM D 2412 / EN 1226 / BS 5480.

D. MECHANICAL PROPERTIES:

All pipes will exhibit the following properties:

Property	Nominal value
Liner coefficient of thermal expansion (mm/mm/°C)	25 - 30 x 10 ⁻⁶
Poisson's Ratio	0.17 to 0.3

Nominal Pipe Weight (kg/m)

PN (bar) DN(mm)	6			10			16		
	6	10	16	6	10	16	6	10	16
250	6.0	5.2	4.9	7.9	7.5	7.1	10.8	9.5	9.0
300	8.1	7.8	7.4	10.5	9.7	9.3	13.0	12.7	11.7
350	10.9	10.2	9.7	14.1	13.0	12.2	17.1	16.8	15.3
400	14.1	13.0	12.4	17.9	16.6	15.4	22.0	21.6	19.9
450	17.6	16.0	15.2	22.2	20.7	19.3	27.3	26.9	24.7
500	21.5	19.8	18.5	26.9	25.3	23.3	34.0	32.9	29.9
600	29.2	26.0	24.9	36.2	33.7	31.4	45.0	43.8	40.2
700	38.8	34.8	33.4	49.5	45.2	41.8	60.7	59.1	54.1
800	50.2	45.4	42.5	63.2	58.8	54.4	78.8	77.0	70.5
900	63.8	56.9	53.4	80.6	73.5	68.5	100.0	97.8	88.4
1000	78	70	66	98	90	83	123	121	109
1100	95	85	79	120	110	101	149	146	132
1200	112	100	93	143	130	119	175	171	155
1400	151	134	127	191	175	161	237	232	211
1500	174	154	145	220	201	185	273	269	242
1600	197	174	163	248	227	209	310	305	273
1800	248	221	209	313	285	289	391	388	348
2000	308	270	257	385	352	355	481	476	420
2200	373	329	312	471	434	395	588	581	510
2400	439	388	366	557	513	470	695	686	608
2600	504	446	421	643	592	580	802	790	782

Nominal pipe weight for estimating load for handling and transportation.

Minimum Tensile Strength Requirement

FIBERBOND™ GRP pipes are designed to exceed AWWA C 950 / ASTM D 3517 / ASTM D 3754 minimum Strength requirements.

Minimum Axial Tensile Strength (kN/m)

DN	PN1	PN3	PN6	PN10	PN12	PN16
80	63	63	63	63	63	63
100	63	63	63	63	63	63
150	63	63	63	63	63	66
200	102	102	102	102	102	102
250	102	102	102	102	102	115
300	102	102	102	113	118	138
350	102	102	102	132	137	160
400	102	102	102	150	157	183
450	102	102	108	160	165	192
500	102	102	118	177	183	213
600	102	102	142	213	220	256
700	102	102	156	239	247	287
800	102	102	167	250	257	296
900	122	122	200	300	308	355
1000	137	137	217	325	333	384
1100	140	140	233	350	359	413
1200	161	161	244	366	382	447
1300	171	171	259	389	406	475
1400	182	182	274	412	430	503
1500	200	200	305	457	477	559
1600	210	210	321	480	501	587
1700	220	220	336	503	525	615
1800	238	238	366	549	573	671
1900	249	249	368	551	577	678
2000	260	260	369	553	581	685
2100	270	270	383	575	603	711
2200	280	280	397	596	626	737
2300	301	301	426	638	670	790
2400	322	322	454	681	715	843
2500	331	331	468	702	737	869
2600	340	340	482	723	760	896

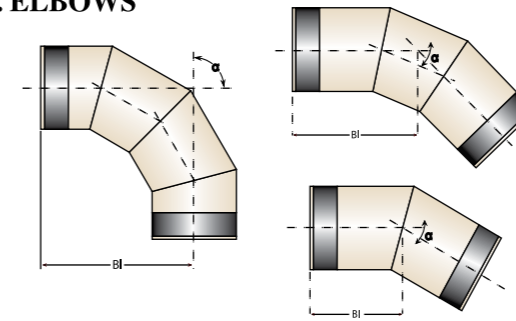


Minimum Hoop Tensile Strength (kN/m)

DN	PN1	PN3	PN6	PN10	PN12	PN16
80	53	53	105	158	184	237
100	70	70	140	210	245	315
150	105	105	210	315	368	473
200	140	140	280	420	490	630
250	175	175	350	525	613	788
300	210	210	420	630	735	945
350	245	245	490	735	858	1103
400	280	280	560	840	980	1260
450	315	315	630	945	1103	1418
500	350	350	700	1050	1225	1575
600	420	420	840	1260	1470	1890
700	473	473	945	1418	1654	2127
800	525	525	1050	1575	1838	2363
900	630	630	1260	1890	2205	2835
1000	683	683	1365	2048	2389	3072
1100	735	735	1470	2205	2573	3308
1200	840	840	1680	2520	2940	3780
1300	893	893	1785	2678	3124	4017
1400	945	945	1890	2835	3308	4253
1500	1050	1050	2100	3150	3675	4725
1600	1100	1100	2200	3300	3855	4961
1700	1155	1155	2310	3465	4043	5198
1800	1260	1260	2520	3780	4410	5670
1900	1310	1310	2625	3938	4594	5906
2000	1365	1365	2730	4095	4778	6143
2100	1415	1415	2835	4253	4961	6379
2200	1470	1470	2940	4410	5145	6615
2300	1575	1575	3150	4725	5513	7088
2400	1680	1680	3360	5040	5880	7560
2500	1730	1730	3465	5198	6064	7796
2600	1785	1785	3570	5355	6248	8033

9. FITTINGS

A. ELBOWS



Mitred Elbows.

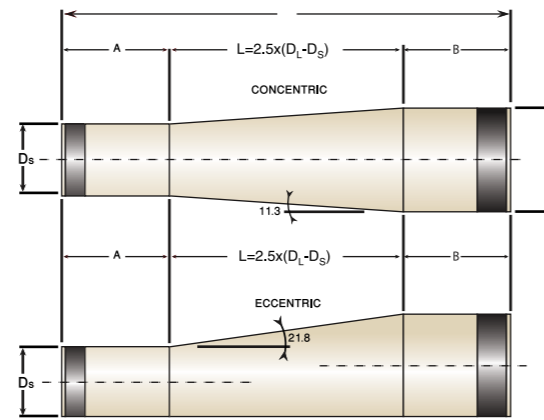
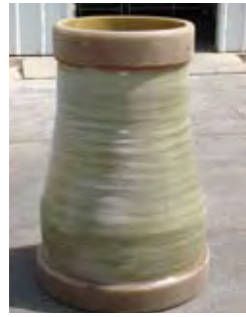
Effective Laying Length (mm) = BL

The below dimensions are valid for all pressure classes

DN (mm)	16° to 30°	46° to 60°	61° to 90°
	# of Mitres		
80	1	2	3
100	250	300	350
150	250	300	400
200	300	400	500
250	300	450	600
300	425	550	725
350	450	600	825
400	475	625	900
450	525	700	975
500	525	700	1025
600	475	700	1075
700	475	750	1200
800	525	825	1350
900	550	900	1475
1000	600	975	1625
1100	625	1050	1750
1200	650	1125	1900
1300	700	1200	2025
1400	725	1275	2175
1500	775	1375	2325
1600	800	1425	2450
1700	825	1475	2550
1800	850	1550	2675
1900	875	1600	2800
2000	900	1700	2950
2100	925	1750	3075
2200	950	1800	3200
2300	975	1875	3325
2400	1025	1950	3475
2500	1075	2050	3625
2600	1125	2125	3775

Typical dimensions based on standard product are listed above. Consult Excellent for further details.

B. REDUCERS



Concentric and Eccentric Reducers.

Taper Length (L) = 2.5 x (DL-DS)

The below dimensions are valid for all pressure classes

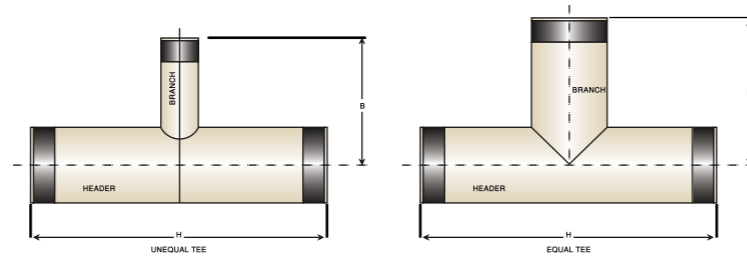
DN Large End DL (mm)	DN Small End DS (mm)	Taper Length L (mm)	Pipe Length A (mm)	Pipe Length B (mm)	Laying Length LL(mm)
100	80	50	200	200	450
150	80	175	200	200	575
	100	125	200	200	525
200	100	250	250	200	700
	150	125	250	200	575
250	150	250	250	200	750
	200	125	250	250	625
300	200	250	350	350	950
	250	125	350	350	825
350	250	250	400	350	1000
	300	125	400	350	875
400	300	250	400	350	1000
	350	125	400	400	925
450	350	250	400	400	1050
	400	125	400	400	925
500	400	250	400	400	1050
	450	125	400	400	925
600	450	375	500	400	1275
	500	250	500	400	1150
700	500	500	500	400	1400
	600	250	500	500	1250
800	600	500	500	500	1500
	700	250	500	500	1250
900	700	500	500	500	1500
	800	250	500	500	1250
1000	800	500	500	500	1500
	900	250	500	500	1250
1100	900	500	500	500	1500
	1000	250	500	500	1250
1200	1000	500	500	500	1500
	1100	250	500	500	1250

REDUCERS (Continued)

DN Large End DL (mm)	DN Small End DS (mm)	Taper Length L (mm)	Pipe Length A (mm)	Pipe Length B (mm)	Laying Length LL(mm)
1300	1100	500	500	500	1500
	1200	250	500	500	1250
1400	1000	1000	500	500	2000
	1200	500	500	500	1500
	1300	250	500	500	1250
1500	1200	750	500	500	1750
	1300	500	500	500	1500
	1400	250	500	500	1250
1600	1200	1000	600	500	2100
	1400	500	600	500	1600
	1500	250	600	500	1350
1700	1400	750	600	500	1850
	1500	500	600	500	1600
	1600	250	600	600	1450
1800	1500	750	600	500	1850
	1600	500	600	600	1700
	1700	250	600	600	1450
1900	1600	750	600	600	1950
	1700	500	600	600	1700
	1800	250	600	600	1450
2000	1400	1500	600	500	2600
	1600	1000	600	600	2200
	1800	500	600	600	1700
2100	1600	1250	750	600	2600
	1800	750	750	600	2100
	2000	250	750	600	1600
2300	1800	1250	750	600	2600
	2000	750	750	600	2100
	2200	250	750	750	1750
2400	1800	1500	750	600	2850
	2000	1000	750	600	2350
	2200	500	750	750	2000
2500	2000	1250	750	600	2600
	2200	750	750	750	2250
	2400	250	750	750	1750
2600	2000	1500	750	600	2850
	2200	1000	750	750	2500
	2400	500	750	750	2000

Typical dimensions based on standard product are listed above. Consult Excellent for further details.

C. TEES



Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10	
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)
80	80	600	300	600	300	600	300
100	100	600	300	600	300	600	300
150	100	600	300	650	350	700	400
	150	600	350	750	450	900	500
200	100	600	350	750	400	900	450
	150	600	350	750	450	900	500
	200	700	350	850	450	1000	500
250	100	600	350	700	450	800	500
	150	600	350	800	450	1000	550
	200	700	350	900	450	1100	600
	250	700	350	950	500	1200	600
300	150	800	500	900	550	1050	600
	200	850	500	1000	600	1250	700
	250	900	500	1050	600	1300	700
	300	1000	500	1150	600	1400	700
350	150	800	550	950	600	1150	700
	200	850	550	1100	650	1350	750
	250	900	550	1150	650	1450	800
	300	1000	550	1200	650	1500	800
	350	1050	550	1250	650	1550	800
400	150	800	550	950	650	1200	750
	200	850	550	1000	650	1250	750
	250	900	550	1200	700	1500	850
	300	1000	550	1250	700	1600	850
	350	1050	550	1300	700	1650	850
	400	1050	550	1350	700	1650	850
450	200	850	550	1050	650	1350	800
	250	900	550	1250	750	1650	950
	300	1000	550	1350	750	1700	950
	350	1050	550	1400	750	1750	950
	400	1050	550	1450	750	1800	950
	450	1150	600	1500	750	1850	950
500	200	850	600	1100	700	1400	900
	250	900	600	1200	750	1450	900

TEES (Continued)

Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10	
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)
500	300	1000	600	1400	800	1800	1000
	350	1050	600	1450	800	1850	1000
	400	1050	600	1450	800	1850	1000
	450	1150	600	1500	800	1900	1000
	500	1200	600	1550	800	1950	1000
600	300	950	650	1100	700	1150	700
	400	1050	650	1250	700	1350	750
	450	1100	650	1300	750	1400	800
	500	1150	650	1400	750	1500	800
	600	1300	650	1550	800	1650	850
700	300	950	700	1100	750	1200	800
	400	1050	700	1250	800	1400	850
	450	1100	700	1350	800	1450	850
	500	1200	700	1450	800	1550	850
	600	1300	700	1550	850	1700	900
	700	1400	700	1700	850	1850	950
800	300	950	750	1100	800	1200	850
	400	1050	750	1250	850	1350	850
	450	1100	750	1400	850	1500	950
	500	1200	750	1450	850	1550	950
	600	1300	750	1600	900	1750	1000
	700	1400	750	1750	950	1900	1000
	800	1550	800	1850	950	2050	1050
900	300	950	800	1100	850	1200	900
	400	1050	800	1250	900	1350	950
	450	1100	800	1350	900	1450	950
	500	1200	800	1450	950	1600	1000
	600	1300	800	1650	1000	1750	1050
	700	1450	850	1750	1000	1900	1100
	800	1550	850	1900	1000	2100	1100
	900	1700	850	2050	1050	2200	1100
1000	300	950	850	1150	950	1250	1000
	400	1050	850	1300	950	1400	1000
	450	1100	850	1350	950	1500	1000
	500	1200	850	1450	1000	1550	1050
	600	1300	850	1650	1050	1800	1100
	700	1450	900	1800	1050	1950	1150
	800	1600	900	1950	1100	2100	1200
	900	1700	900	2050	1100	2250	1200
	1000	1800	900	2200	1100	2400	1200
1100	300	950	900	1150	1000	1300	1050
	400	1050	900	1300	1000	1450	1100
	450	1100	900	1400	1050	1500	1100
	500	1200	900	1450	1050	1600	1100
	600	1350	950	1650	1100	1850	1200



TEES (Continued)

Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10	
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)
1100	700	1450	950	1850	1150	2000	1200
	800	1600	950	1950	1150	2150	1250
	900	1700	950	2100	1150	2300	1250
	1000	1800	950	2250	1200	2450	1300
	1100	1900	950	2400	1200	2600	1300
1200	300	950	950	1200	1050	1300	1100
	400	1050	950	1350	1100	1450	1150
	450	1100	950	1400	1100	1550	1150
	500	1200	950	1450	1100	1600	1150
	600	1300	950	1650	1150	1750	1200
	700	1500	1000	1850	1200	2050	1300
	800	1600	1000	2000	1200	2200	1300
	900	1700	1000	2150	1250	2350	1350
	1000	1800	1000	2300	1250	2500	1350
	1100	1950	1050	2450	1300	2650	1400
1300	1200	2050	1050	2550	1300	2800	1400
	300	950	1000	1200	1100	1300	1150
	400	1050	1000	1350	1150	1450	1200
	450	1100	1000	1400	1150	1550	1200
	500	1200	1000	1500	1150	1600	1250
	600	1300	1000	1650	1200	1800	1250
	700	1500	1050	1850	1250	2100	1350
	800	1600	1050	2050	1300	2200	1400
	900	1700	1050	2150	1300	2400	1400
	1000	1850	1100	2350	1350	2550	1450
1400	1100	1950	1100	2450	1350	2700	1450
	1200	2100	1100	2600	1350	2850	1500
	1300	2200	1100	2750	1400	3000	1500
	300	1000	1050	1200	1150	1300	1200
	400	1050	1050	1350	1200	1500	1250
	450	1150	1050	1450	1200	1550	1300
	500	1200	1050	1500	1200	1650	1300
	600	1350	1100	1650	1250	1800	1350
	700	1450	1100	1800	1250	2000	1350
	800	1600	1100	2050	1350	2300	1450
1500	900	1750	1150	2200	1350	2400	1500
	1000	1850	1150	2350	1400	2600	1500
	1100	2000	1150	2500	1400	2750	1550
	1200	2100	1150	2650	1450	2900	1550
	1300	2200	1150	2750	1450	3050	1600
	1400	2300	1150	2900	1450	3200	1600
	300	1000	1100	1200	1200	1350	1300
	400	1100	1100	1350	1250	1500	1350
	450	1150	1100	1450	1250	1600	1350

TEES (Continued)

Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10		
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	
1500	500	1200	1100	1550	1300	1700	1350	
	600	1350	1150	1700	1300	1850	2050	
	700	1450	1150	1850	1350	2000	1450	
	800	1600	1150	2100	1400	2300	1550	
	900	1750	1200	2200	1450	2450	1550	
	1000	1850	1200	2350	1450	2600	1550	
	1100	2000	1200	2500	1500	2800	1600	
	1200	2100	1200	2650	1500	2950	1650	
	1300	2200	1200	2800	1500	3100	1650	
	1400	2350	1250	2950	1550	3250	1700	
	1500	2450	1250	3050	1550	3400	1700	
	1600	300	1000	1150	1250	1300	1350	1350
		400	1100	1150	1400	1300	1500	1400
		450	1150	1150	1500	1350	1600	1400
		500	1200	1150	1550	1350	1700	1400
600		1350	1200	1700	1350	1900	1450	
700		1500	1200	1850	1400	2050	1500	
800		1600	1200	2000	1400	2200	1500	
900		1750	1250	2250	1500	2500	1650	
1000		1900	1250	2400	1500	2650	1650	
1100		2000	1250	2550	1550	2800	1650	
1200		2100	1250	2700	1550	3000	1700	
1300		2200	1250	2800	1600	3100	1700	
1400		2350	1300	2950	1600	3300	1750	
1500		2450	1300	3100	1650	3400	1750	
1600		2600	1300	3250	1650	3600	1800	
1700	300	1000	1200	1250	1350	1350	1400	
	400	1100	1200	1400	1350	1550	1450	
	450	1150	1200	1500	1400	1650	1450	
	500	1250	1250	1550	1400	1700	1500	
	600	1350	1250	1750	1450	1900	1500	
	700	1500	1250	1850	1450	2050	1550	
	800	1600	1300	2050	1500	2200	1600	
	900	1800	1300	2300	1550	2550	1700	
	1000	1900	1300	2400	1600	2700	1700	
	1100	2000	1300	2600	1600	2850	1750	
	1200	2100	1300	2700	1650	3000	1750	
	1300	2250	1350	2850	1650	3200	1800	
	1400	2350	1350	3000	1650	3300	1800	
	1500	2500	1350	3150	1700	3500	1850	
	1600	2600	1350	3300	1700	3600	1850	
1700	2700	1350	3400	1700	3800	1900		
1800	300	1000	1250	1250	1400	1400	1400	
	400	1100	1250	1450	1450	1550	1550	

TEES (Continued)

Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10	
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)
1800	450	1150	1250	1500	1450	1650	1550
	500	1250	1300	1600	1450	1750	1550
	600	1350	1300	1750	1500	1900	1600
	700	1500	1300	1900	1500	2100	1600
	800	1600	1350	2050	1550	2250	1650
	900	1700	1350	2200	1550	2400	1700
	1000	1900	1400	2450	1650	2750	1800
	1100	2000	1400	2600	1650	2900	1800
	1200	2150	1400	2750	1700	3050	1850
	1300	2250	1400	2900	1700	3200	1850
	1400	2400	1400	3000	1750	3350	1900
	1500	2500	1400	3200	1750	3500	1900
	1600	2600	1400	3300	1800	3650	1950
	1700	2700	1400	3450	1800	3800	1950
	1800	2850	1450	3600	1800	3950	2000
1900	300	1000	1300	1300	1450	1400	1500
	400	1100	1300	1450	1500	1600	1550
	450	1200	1350	1500	1500	1650	1600
	500	1250	1350	1600	1500	1750	1600
	600	1350	1350	1750	1550	1950	1650
	700	1500	1350	1900	1550	2100	1700
	800	1600	1400	2050	1600	2300	1700
	900	1750	1400	2200	1600	2450	1750
	1000	1900	1450	2500	1700	2750	1850
	1100	2000	1450	2600	1750	2950	1900
	1200	2150	1450	2800	1750	3050	1900
	1300	2300	1450	2900	1800	3250	1950
	1400	2400	1450	3050	1800	3400	1950
	1500	2500	1450	3200	1850	3550	2000
	1600	2600	1450	3350	1850	3700	2000
1700	2700	1500	3500	1850	3850	2050	
1800	2850	1500	3600	1850	4000	2050	
1900	3000	1500	3750	1900	4150	2100	
2000	300	1000	1350	1300	1500	1450	1600
	400	1100	1350	1450	1550	1600	1600
	450	1200	1400	1550	1550	1700	1650
	500	1250	1400	1600	1600	1800	1650
	600	1350	1400	1750	1600	1950	1700
	700	1500	1450	1900	1650	2150	1750
	800	1600	1450	2100	1650	2300	1800
	900	1750	1450	2200	1700	2450	1800
1000	1850	1450	2350	1700	2600	1850	
1100	2050	1500	2650	1800	2950	1950	
1200	2150	1500	2800	1850	3100	1950	

TEES (Continued)

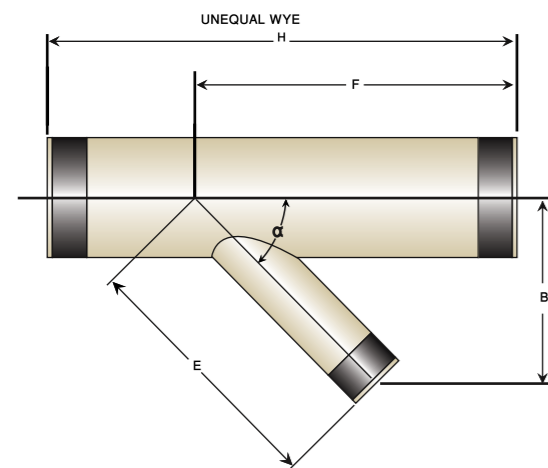
Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10		
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	
2000	1300	2300	1500	2950	1850	3250	2000	
	1400	2400	1550	3100	1850	3450	2050	
	1500	2500	1550	3250	1900	3600	2050	
	1600	2650	1550	3400	1900	3750	2100	
	1700	2750	1550	3500	1950	3900	2100	
	1800	2900	1550	3650	1950	4050	2150	
	1900	3000	1550	3800	1950	4200	2150	
	2000	3100	1550	3900	1950	4350	2200	
	2200	300	1000	1500	1300	1600	1450	1700
		400	1150	1500	1450	1650	1650	1750
450		1200	1500	1550	1650	1750	1750	
500		1250	1500	1600	1700	1800	1800	
600		1350	1500	1800	1700	2000	1850	
700		1500	1550	1950	1750	2200	1850	
800		1650	1550	2100	1800	2350	1900	
900		1750	1550	2250	1800	2500	1950	
1000		1900	1550	2400	1850	2700	1950	
1100		2000	1600	2550	1850	2850	2000	
1200		2200	1600	2850	1950	3200	2100	
1300		2300	1650	3000	2000	3350	2150	
1400		2400	1650	3150	2000	3500	2150	
1500		2550	1650	3300	2000	3650	2200	
1600		2650	1650	3450	2050	3850	2250	
1700		2800	1650	3600	2050	3950	2250	
1800	2900	1650	3700	2100	4150	2300		
1900	3000	1700	3850	2100	4300	2300		
2000	3100	1700	4000	2100	4450	2350		
2100	3250	1700	4150	2150	4550	2350		
2200	3350	1700	4300	2150	4750	2400		
2400	300	1000	1600	1350	1750	1450	1800	
	400	1150	1600	1500	1750	1700	1850	
	450	1200	1600	1550	1800	1750	1900	
	500	1250	1600	1650	1800	1850	1900	
	600	1400	1650	1800	1850	2050	1950	
	700	1550	1650	2000	1850	2200	2000	
	800	1650	1650	2150	1900	2400	2050	
	900	1800	1650	2300	1900	2600	2050	
	1000	1900	1700	2450	1950	2750	2100	
	1100	2000	1700	2600	1950	2900	2100	
	1200	2150	1700	2750	2000	3050	2150	
	1300	2300	1750	3050	2100	3450	2300	
	1400	2450	1750	3200	2150	3600	2300	
	1500	2600	1750	3350	2150	3750	2350	
	1600	2700	1750	3500	2200	3900	2350	

TEES (Continued)

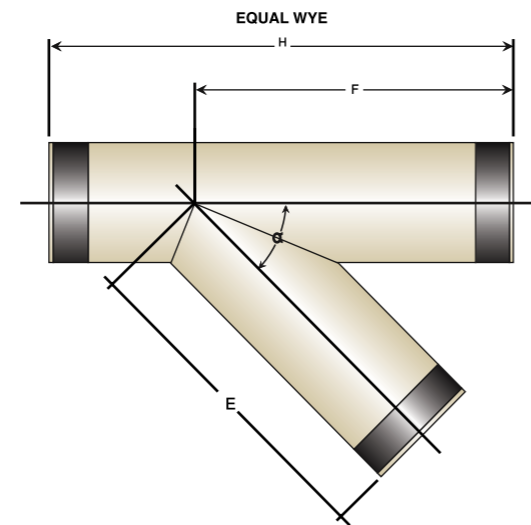
Header DN (mm)	Branch DN (mm)	PN1		PN6		PN10		
		[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	[H] Header Length (mm)	[B] Branch Length (mm)	
2400	1700	2800	1800	3650	2200	4050	2400	
	1800	2900	1800	3800	2200	4200	2400	
	1900	3050	1800	3900	2250	4350	2450	
	2000	3150	1800	4100	2250	4550	2500	
	2100	3300	1800	4200	2250	4650	2500	
	2200	3400	1800	4350	2300	4850	2550	
	2300	3500	1850	4500	2300	4950	2550	
	2400	3650	1850	4600	2300	5150	2600	
	2600	300	1000	1700	1350	1850	1500	1900
		400	1150	1700	1500	1900	1700	2000
450		1200	1700	1600	1900	1800	2000	
500		1250	1700	1700	1900	1900	2050	
600		1400	1750	1850	1950	2100	2050	
700		1550	1750	2000	2000	2300	2100	
800		1650	1750	2200	2000	2450	2150	
900		1800	1750	2350	2050	2600	2200	
1000		1900	1800	2500	2050	2750	2200	
1100		2050	1800	2650	2100	2950	2250	
1200		2150	1800	2800	2100	3100	2300	
1300		2300	1800	2900	2150	3250	2300	
1400		2500	1850	3250	2250	3650	2450	
1500		2600	1850	3400	2300	3850	2500	
1600		2700	1900	3550	2300	3950	2500	
1700		2800	1900	3700	2350	4150	2550	
1800	2950	1900	3850	2350	4300	2550		
1900	3050	1900	4000	2350	4450	2600		
2000	3200	1900	4150	2400	4600	2600		
2100	3300	1900	4300	2400	4750	2650		
2200	3400	1950	4400	2400	4900	2650		
2300	3500	1950	4550	2450	5050	2700		
2400	3650	1950	4700	2450	5200	2700		
2500	3750	1950	4850	2500	5350	2750		
2600	3900	1950	5000	2500	5500	2750		

Typical dimensions based on standard product are listed above. Consult Excellent for further details.

D. WYES



Standard Dimensions for 45° Wyes



Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
80	80	800	424	300	424	750	445	400	393
100	80	800	438	325	434	750	456	400	399
	100	800	448	325	448	800	474	425	410
150	80	800	473	350	459	750	485	425	413
	100	800	483	350	473	800	503	450	425
	150	900	508	375	508	850	546	475	454
200	100	800	522	375	500	800	534	475	441
	150	900	547	400	536	850	578	525	469
	200	950	575	425	575	900	625	550	501
250	100	800	561	400	528	800	566	500	456
	150	900	586	425	563	850	609	550	485
	200	950	613	450	602	900	657	575	517
	250	1050	641	475	641	950	705	625	549
300	150	900	625	450	589	850	639	575	500
	200	950	650	475	625	900	683	600	529
	250	1000	676	500	662	950	728	650	559
	300	1100	710	525	710	1050	787	700	598
350	150	900	661	475	615	850	669	600	515
	200	950	687	500	651	900	718	625	544

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
350	250	1000	713	525	688	950	758	675	574
	300	1100	747	550	736	1050	817	725	613
	350	1250	793	575	793	1100	862	750	643
400	150	900	685	500	632	850	689	600	525
	200	950	711	525	668	900	733	650	554
	250	1000	737	525	705	950	778	675	584
	300	1150	791	575	773	1050	837	725	623
	350	1250	817	600	810	1100	882	775	653
	400	1300	854	625	854	1150	931	825	693
450	200	950	747	550	694	900	762	675	569
	250	1050	793	575	750	950	807	700	598
	300	1150	827	600	798	1050	866	775	638
	350	1250	853	625	835	1150	931	825	688
	400	1300	890	650	879	1150	961	850	707
	450	1400	915	650	915	1250	1005	875	737
500	200	950	784	575	720	900	792	700	584
	250	1000	809	575	756	950	837	750	614
	300	1150	863	625	824	1050	896	800	653
	350	1250	909	650	881	1150	961	850	703
	400	1300	926	675	905	1150	991	875	722
	450	1450	972	700	961	1250	1055	925	772
	500	1500	998	725	998	1350	1100	975	802
600	300	1100	896	650	835	1000	935	825	662
	400	1250	955	675	912	1150	1026	900	728
	450	1350	1068	775	1015	1200	1129	1000	787
	500	1450	1110	800	1068	1300	1190	1050	833
	600	1600	1168	850	1147	1400	1285	1125	899
	700	1800	1235	875	1235	1550	1389	1225	974
800	300	1100	1056	750	953	1000	1053	925	721
	400	1250	1099	800	1014	1150	1143	1000	787
	450	1400	1156	825	1082	1250	1203	1050	832
	500	1450	1182	850	1119	1300	1249	1100	862
	600	1650	1256	900	1214	1450	1360	1200	944
	700	1800	1323	950	1302	1550	1448	1275	1003
	800	1950	1374	975	1374	1700	1553	1350	1078
900	300	1100	1128	800	1004	1000	1112	975	751
	400	1300	1187	850	1081	1150	1202	1050	816
	450	1350	1212	875	1117	1200	1246	1100	846
	500	1500	1270	900	1186	1300	1307	1150	892
	600	1650	1328	950	1265	1450	1419	1250	974

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
900	700	1800	1395	1000	1353	1600	1523	1325	1048
	800	2000	1462	1050	1441	1700	1611	1400	1107
	900	2150	1513	1075	1513	1850	1716	1500	1182
1000	300	1100	1200	850	1055	1000	1171	1025	780
	400	1300	1259	900	1132	1150	1261	1100	846
	450	1400	1301	925	1184	1200	1305	1150	875
	500	1450	1327	950	1221	1300	1366	1200	921
	600	1650	1417	1025	1332	1450	1478	1300	1003
	700	1850	1484	1050	1420	1600	1582	1375	1078
	800	2000	1535	1100	1492	1750	1686	1475	1153
1100	900	2150	1602	1150	1580	1850	1775	1550	1212
	1000	2350	1669	1200	1669	2000	1879	1650	1287
	300	1150	1288	925	1122	1050	1246	1100	825
	400	1300	1331	950	1183	1150	1320	1150	875
	450	1400	1373	975	1235	1250	1380	1200	921
	500	1450	1399	1000	1272	1300	1425	1250	951
	600	1650	1489	1075	1383	1450	1553	1350	1048
1200	700	1850	1556	1125	1471	1600	1657	1450	1123
	800	2000	1623	1150	1559	1750	1745	1525	1182
	900	2200	1690	1200	1647	1900	1850	1625	1257
	1000	2350	1741	1250	1720	2000	1938	1700	1316
	1100	2500	1808	1300	1808	2150	2042	1775	1391
	300	1150	1360	975	1173	1050	1304	1150	855
	400	1300	1419	1025	1250	1150	1395	1225	921
1300	450	1400	1445	1025	1286	1250	1439	1250	950
	500	1500	1487	1075	1339	1300	1484	1300	980
	600	1650	1545	1100	1418	1450	1595	1400	1062
	700	1850	1644	1175	1538	1600	1716	1500	1153
	800	2000	1695	1200	1610	1750	1820	1600	1228
	900	2200	1762	1250	1698	1900	1908	1675	1287
	1000	2350	1829	1300	1787	2050	2013	1750	1362
1400	1100	2500	1880	1350	1859	2150	2101	1825	1420
	1200	2700	1947	1400	1947	2300	2205	1925	1495
	300	1150	1433	1025	1224	1050	1363	1200	884
	400	1300	1492	1075	1301	1150	1454	1275	950
	450	1400	1533	1100	1353	1250	1498	1300	979
	500	1500	1559	1125	1390	1300	1559	1375	1025
	600	1650	1633	1175	1485	1450	1654	1450	1091
1500	700	1850	1716	1225	1589	1600	1775	1550	1182
	800	2050	1783	1275	1677	1750	1879	1650	1257
	900	2200	1850	1325	1765	1900	1983	1725	1332
	1000	2350	1901	1350	1838	2050	2072	1800	1391
	1100	2550	1968	1400	1926	2200	2176	1900	1466
	1200	2700	2035	1450	2014	2300	2264	1975	1525
	1300	2850	2086	1500	2086	2450	2369	2075	1600

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
1400	300	1150	1505	1075	1275	1050	1422	1250	914
	400	1300	1564	1125	1352	1150	1513	1325	979
	450	1400	1605	1150	1404	1250	1573	1375	1025
	500	1500	1631	1175	1441	1300	1618	1425	1055
	600	1650	1705	1225	1536	1450	1729	1500	1137
	700	1850	1772	1275	1624	1600	1818	1575	1196
	800	2050	1855	1325	1728	1750	1938	1700	1287
	900	2200	1922	1375	1816	1900	2042	1775	1361
	1000	2400	1989	1425	1905	2050	2147	1875	1436
1500	1100	2600	2056	1475	1993	2200	2235	1950	1495
	1200	2700	2107	1500	2065	2350	2339	2050	1570
	1300	2900	2174	1550	2153	2450	2428	2125	1629
	1400	3050	2225	1575	2225	2600	2532	2200	1704
	300	1200	1593	1150	1342	1050	1481	1300	943
	400	1350	1652	1175	1419	1150	1572	1375	1009
	450	1400	1677	1200	1455	1250	1632	1425	1054
	500	1500	1719	1225	1508	1300	1716	1475	1084
	600	1650	1777	1275	1587	1450	1816	1550	1166
1600	700	1850	1844	1325	1675	1600	1922	1650	1241
	800	2100	1943	1375	1795	1800	2033	1750	1332
	900	2250	2010	1425	1883	1900	2147	1825	1391
	1000	2400	2061	1475	1956	2050	2264	1925	1466
	1100	2600	2128	1525	2044	2200	2391	2025	1541
	1200	2750	2195	1575	2132	2350	2528	2100	1600
	1300	2900	2246	1600	2204	2500	2675	2175	1675
	1400	3050	2313	1650	2292	2600	2828	2250	1733
	1500	3250	2380	1700	2380	2750	2985	2350	1808
1700	300	1200	1665	11200	1393	1050	1556	1350	989
	400	1350	1724	1225	1470	1200	1646	1450	1054
	450	1400	1749	1250	1506	1250	1691	1475	1084
	500	1500	1791	1275	1559	1300	1736	1525	1114
	600	1700	1865	1325	1654	1450	1847	1600	1196
	700	1850	1932	1375	1742	1600	1951	1700	1271
	800	2000	1983	1425	1814	1750	2056	1800	1345
	900	2250	2082	1475	1934	1950	2176	1900	1436
	1000	2450	2149	1525	2023	2050	2297	1975	1495
1800	1100	2600	2216	1575	2111	2200	2428	2075	1570
	1200	2750	2267	1625	2183	2350	2573	2150	1645
	1300	2950	2334	1675	2271	2500	2728	2225	1704
	1400	3100	2401	1700	2359	2650	2883	2325	1779
	1500	3250	2452	1750	2431	2750	3038	2400	1838
	1600	3450	2519	1800	2519	2900	3193	2500	1913
	300	120	1737	1250	1444	1050	1615	1400	1018
	400	1350	1796	1275	1521	1200	1705	1500	1084
	450	1450	1838	1300	1573	1250	1750	1525	1113

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
1700	500	1500	1864	1325	1610	1350	1811	1575	
	600	1700	1938	1375	1705	14500	1906	1675	
	700	1850	2005	1425	1793	1600	2010	1750	
	800	2050	2072	1475	1881	1750	2115	1850	
	900	2300	2171	1550	2001	1950	2235	1950	
	1000	2450	2222	1575	2074	2100	2339	2050	
	1100	2600	2289	1625	2162	2250	2444	2125	
	1200	2800	2356	1675	2250	2350	2532	2200	
	1300	2950	2423	1725	2338	2500	2636	2300	
	1400	3100	2474	1750	2410	2650	2725	2375	
1500	3300	2541	1800	2498	2800	2829	2450		
1600	3450	2608	1850	2586	2900	2917	2550		
1700	3600	2659	1900	2659	3050	3022	2625		
1800	300	1200	1809	1300	1495	1050	1674	1450	
	400	1350	1868	1325	1572	1200	1764	1550	
	450	1450	1910	1375	1624	1300	1824	1600	
	500	1500	1936	1375	1661	1350	1869	1625	
	600	1700	2010	1425	1756	1500	1981	1725	
	700	1850	2077	1475	1844	1600	2069	1800	
	800	2050	2144	1525	1932	1750	2173	1900	
	900	2200	2211	1575	2020	1900	2278	1975	
	1000	2450	2310	1650	2141	2100	2398	2100	
	1100	2650	2377	1700	2229	2250	2502	2175	
1200	2800	2428	1725	2301	2400	2607	2275		
1300	2950	2495	1775	2389	2500	2695	2350		
1400	3150	2562	1825	2477	2650	2799	2425		
1500	3300	2613	1850	2549	2800	2888	2525		
1600	3450	2680	1900	2637	2950	2992	2600		
1700	3650	2747	1950	2726	3050	3080	2675		
1800	3800	2798	2000	2798	3200	3185	2775		
1900	300	1200	1881	1350	1546	1050	1733	1525	
	400	1350	1956	1400	139	1200	1823	1600	
	450	1450	1982	1425	1675	1300	1883	1650	
	500	1550	2024	1450	1728	1350	1928	1675	
	600	1750	2098	1500	1823	1500	2040	1775	
	700	1900	2165	1550	1911	1650	2144	1875	
	800	2050	2216	1575	1983	1750	2232	1950	
	900	2200	2283	1625	2071	1900	2337	2025	
	1000	2450	2382	1700	2192	2150	2473	2150	
	1100	2650	2449	1750	2280	2250	2561	2225	
1200	2800	2516	1800	2368	2400	2666	2325		
1300	3000	2583	1850	2456	2550	2770	2400		
1400	3150	2634	1875	2528	2650	2858	2500		
1500	3300	2701	1925	2616	2800	2963	2575		
1600	3500	2768	1975	2704	2950	3051	2650		

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
1900	1700	3650	2819	2000	2777	3100	3155	2750	2092
	1800	3800	2886	2050	2865	3200	3244	2825	2151
	1900	4000	2953	2100	2953	3350	3348	2900	2226
2000	300	1200	1970	1400	1613	1050	1792	1575	1106
	400	1350	2029	1450	1690	1200	1882	1650	1172
	450	1450	2054	1475	1726	1300	1942	1700	1218
	500	1550	2096	1500	1779	1350	1987	1725	1248
	600	1750	2170	1550	1874	1500	2099	1825	1329
	700	1900	2237	1600	1962	1650	2203	1925	1404
	800	2100	2304	1650	2050	1800	2307	2000	1479
	900	2250	2371	1700	2138	1900	2396	2075	1538
	1000	2400	2422	1725	2211	2050	2500	2175	1613
	1100	2650	2521	1800	2331	2300	2636	2300	1720
1200	2800	2588	1850	2419	2400	2725	2375	2375	
1300	3000	2655	1900	2507	2550	2829	2450	2450	
1400	3150	2722	1925	2595	2700	2933	2550	2550	
1500	3350	2789	1975	2683	2800	3022	2625	2625	
1600	3500	2840	2025	2755	2950	3126	2725	2725	
1700	3650	2907	2075	2844	3100	3214	2800	2800	
1800	3850	2974	2125	2932	3250	3319	2875	2875	
1900	4000	3025	2150	3004	3400	3423	2975	2975	
2000	4150	3092	2200	3092	3500	3511	3050	3050	
2200	300	1200	2114	1500	1715	1100	1925	1675	1675
	400	1350	2173	1550	1792	1250	2016	1750	1247
	450	1500	2214	1575	1844	1300	2060	100	1276
	500	1600	2256	1600	1897	1400	2121	1850	1322
	600	1750	2330	1650	1992	1550	2232	1950	1404
	700	1950	2397	1700	2080	1700	2337	2025	1479
	800	2100	2448	1750	2152	1800	2425	2125	1538
	900	2250	2515	1800	2240	1950	2529	2200	1613
	1000	2450	2582	1850	2329	2100	2634	2300	1688
	1100	2600	2649	1875	2417	2200	2722	2375	1747
1200	2850	2748	1950	2537	1450	2858	2500	1854	
1300	3050	2815	2000	2625	2600	2963	2575	1929	
1400	3200	2882	2050	2713	2750	3067	2675	2004	
1500	3400	2949	2100	2801	2850	3155	2750	2062	
1600	3500	3000	2125	2873	3000	3260	2825	2137	
1700	3700	3067	2175	2962	3100	3348	2900	2196	
1800	3850	3134	2225	3050	3250	3452	3000	2271	
1900	4000	3185	2275	3122	3400	3541	3075	2330	
2000	4200	3252	2300	3210	3550	3645	3175	2405	
2100	4350	3319	2350	3298	3700	3749	3250	2480	
2200	4500	3370	2400	3370	3800	3838	3325	2539	
2400	300	1200	2258	1600	1817	1100	2043	1775	1240
	400	1400	2333	1650	1910	1250	2134	1850	1306

WYES (Continued)

Standard Dimensions for 45° Wyes

Standard Dimensions for 60° Wyes

Header DN (mm)	Branch DN (mm)	[H] Header Length	[E] Branch Length	B(mm)	F (mm)	[H] Header Length	[E] Branch Length	B(mm)	F(mm)
2400	450	1500	2359	1675	1946	1300	2194	1900	1351
	500	1600	2401	1700	1999	1400	2239	1950	1381
	600	1750	2475	1750	2094	1550	2350	2050	1463
	700	1950	2542	1800	2182	1700	2455	2150	1538
	800	2100	2609	1850	2270	1850	2559	2225	1613
	900	2300	2676	1900	2358	2000	2663	2325	1688
	1000	2450	2743	1950	2447	2100	2752	2400	1747
	1100	2650	2810	2000	2535	2250	2856	2475	1822
	1200	2800	2861	2025	2607	2400	2960	2575	1897
	1300	3050	2976	2125	2743	2600	3097	2700	2004
	1400	3250	3043	2175	2831	2750	3185	2775	2062
	1500	3400	3110	2200	2919	2900	3289	2850	2137
	1600	3550	3161	2250	2991	3050	3394	2950	2212
	1700	3750	3228	2300	3080	3150	3482	3025	1410
	1800	3900	3295	2350	3168	3300	3586	3125	1456
	1900	4050	3346	275	3240	3400	3675	3200	1538
	2000	4250	3413	2425	3328	3550	3779	3275	1597
	2100	4400	3480	2475	3416	3700	3883	3375	1672
	2200	4550	3531	2500	3488	3850	3972	3450	1747
	2300	4700	3598	2550	3576	4000	4076	3550	1822
	2400	4900	3665	2600	3665	4100	4164	3625	1897
2600	300	1250	2418	1725	1935	1100	2161	1875	1956
	400	1400	2477	1775	2012	1250	2267	1975	2030
	450	1500	2519	1800	2064	1300	2312	2025	2137
	500	1600	2545	1800	2101	1400	2373	2075	2212
	600	1800	2635	1875	2212	1550	2484	2175	2271
	700	1950	2702	1925	2300	1700	2572	2250	2346
	800	2150	2769	1975	2388	1850	2677	2325	2421
	900	2300	2836	2025	2476	2000	2781	2425	2480
	1000	2450	2887	2050	2549	2150	2885	2500	2555
	1100	2650	2954	2100	2637	2300	2990	2600	2614
	1200	2800	3021	2150	2725	2400	3078	2675	2688
	1300	3000	3088	2200	2813	2550	3182	2775	2763
	1400	3250	3203	2275	2949	2750	3319	2875	2822
	1500	3400	3254	2325	3021	2900	3423	2975	2897
	1600	3600	3321	2350	3109	3050	3511	3050	2956
	1700	3750	3388	2400	3198	3200	3616	3150	1374
	1800	3950	3455	2450	3286	3350	3720	3225	1440
	1900	4100	3506	2500	3358	3450	3808	3300	1469
	2000	4250	3573	2550	3446	3600	3913	3400	1515
	2100	4450	3640	2575	3534	3700	4001	3475	1597
	2200	4600	3707	2625	3622	3850	4105	3575	1672
	2300	4750	3758	2675	3694	4000	4210	3650	1747
	2400	4950	3825	2725	3783	4150	4298	3725	1822
	2500	5100	3876	2750	3855	4300	4402	3825	1881

Typical dimensions based on standard product are listed above. Consult Excellent for further details.

E. FLANGES

Flanges and blind flanges are provided for the complete range of diameters with drilling pattern to match any international standard required such as BS, DIN, ISO, ANSI, AWWA, etc ... or to match the client requirements.

10. MANHOLE LINERS

Manhole liners are flexible composite constructed of a thermo-setting chemical resistant resin, glass reinforcement with silica sand, the manhole can be provided with cover slab and benching base, the product is suitable for use as internal protection of concrete environments including storm, water and sanitary sewers.

The liners are designed to be used inside a concrete manhole. Therefore, this type of product is not designed to be used directly as a structural manhole without concrete surround.



- 10.1 The manhole liner is manufactured by using the same process used for the standard pipe the average total wall thickness is 7.0mm. The liner is provided with GRP strip lugs, which provide additional bonding between the GRP liners and the concrete manhole.
- 10.2 The cover slabs are manufactured by hand lamination contact molding utilizing woven roving mat impregnated with vinylester or polyester resin.
- 10.3 The benching is manufactured by hand lamination contact molding utilizing woven roving mat impregnated with vinylester or polyester resin.
- 10.4 The cover slab, the benching and the cylindrical parts are manufactured separately and may be factory jointed with contact molded fiberglass joint.

11. VISUAL APPEARANCE

A. INTERIOR AND EXTERIOR SURFACES

The interior and exterior surfaces of pipes, joints and fittings shall be commercially free of the following visual irregularities:

Visual irregularities	Definitions
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
Blisters	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
Delamination	Separation in the Laminate.	None	None
Ground area	Area around lay-up which has been abraded but lay-up does not cover or has not been coated.	Permitted	None
Haystacks	Accumulations of glass, resin and sand on exterior surface.	None greater than 30mm Dia.	N/A
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. greater than 4mm deep of any dia.
Torn edges, end delamination and end gouges.	Tears and rips in the edges of cuts.	N/A	None which will effect the integrity of the joints.
Wrinkles, grooves and band depressions.	Smooth irregularities on liner surface.	N/A	None greater than 3mm deep.

12. REPAIR WORK

Repairs to the 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 repair.

13. 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.
8. Customer Name / Project Number

14. PACKING

Pipe and fittings shall be suitably cradled, wedged or braced to prevent damage during shipment.

15. HANDLING

15.1 Transportation

Depending on the transport means adopted, the transporter shall consult with Excellent Pipes Co. in order to recommend the appropriate packing system. In general, pipes are stacked on trucks through evenly spaced wooden supports or joists and kept in place by wooden wedges nailed at the sides.

In practice, the system is similar to that employed to store finished pipes in the yard. However, the number of wooden supports shall be increased by one or two units to take into consideration vehicle jolt and the diameter and stiffness of the pipe.

In cases where the pipes with different diameters are nested to reduce transport cost, great care shall be taken to avoid damage to the inner liner. P.V.C. or Polythene sleds may be used to slide in the pipes during nesting and de-nesting. The inner most pipe shall be lifted sufficiently so that it does not touch the pipe around it during de-nesting.

When lifting nested pipes, a spreader beam shall be used to ensure that the pipes are leveled to avoid sliding of the inner pipes.

For lifting and laying purposes, nylon slings, hemp ropes or belts shall be used. In no case shall steel cables or ropes be employed in transporting, lifting. Laying and overall handling of GRP pipes.

15.2 Unloading

The following procedures should be followed so as to eliminated potential damage to pipes and maintain maximum safety.

- 1) Use pliable straps, slings or ropes to lift the pipes, these can be canvas or polyester belts with a minimum width of 100 mm or nylon ropes with a minimum diameter of 30 mm.

CAUTION: DO NOT USE STEEL CABLES OR CHAINS FOR LIFTING!

- 2) Straight continues lengths of pipe can be lifted at one point. However, owing to its very smooth surface, it is usually safer for the pipe to be lifted at two points as shown I Figure (2).

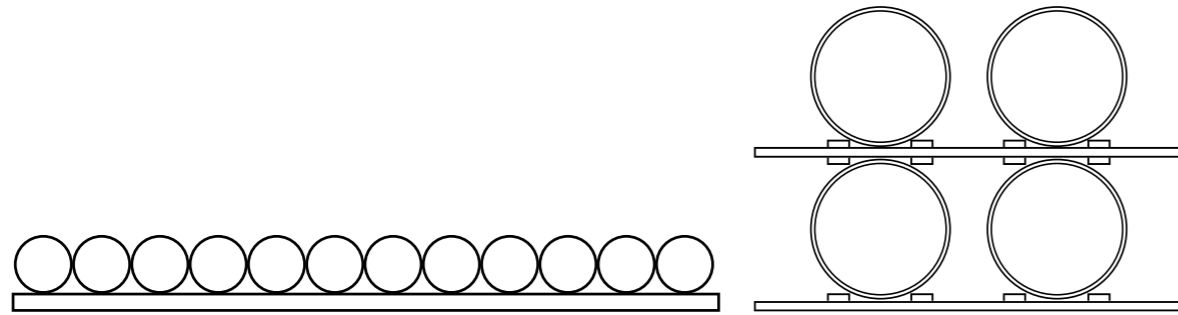
- 3) Pipe assemblies fabricated in multiple sections or special pieces may require special lifting arrangement. Consultation with EPC is recommended in this respect.

CAUTION: DO NOT DROP, IMPACT OR BUMP PIPES!

Pipes having the same diameter, class and stiffness shall be stockpiled separately. Stockpiles shall not exceed the number of layers shown in Table below.

Nominal Diameter and Stockpile Layers					
Nominal Diameter (mm)	250 - 400	450 - 600	700 - 800	900 - 1200	>1400
Stockpile Layers (No.)	5	4	3	2	1

In general, pipes shall be stacked, stored and/or stockpiled with wooden wedges placed on both sides of stack and supported on timber beams, as shown below.



15.3 Site storage

- 1) Pipes shall be stored on their delivery cradles. Narrow flat supports are not an adequate substitute.
- 2) Pipes can be stored or stacked in the open as well as alongside the trench for a period of 12 months, without any detrimental effects being caused by ultra – violet degradation. Customers are advised to consult EPC regarding longer periods of storage in the open.

CAUTION: DO NOT STORE PIPES NEAR INFLAMMABLE LIQUIDS!

- 3) When stacked, care shall be taken to ensure that the ground beneath the stockpile is leveled, firm and contains no rock or sharp objects. Standard length pipes shall be placed on timber with a maximum space of 6 meter.

16) CUSTOMER INSPECTION

- a) The customer is responsible for inspection of the pipe for shipping damage at the time delivery and must note any damage, shortage discrepancy on the delivery not at the time.
- b) The customer is responsible for visually inspecting the pipe upon delivery for adhering to the product standard set forth therein.

17) INSTALLATION

Installation specification has been developed to insure that pipe will perform as designed, therefore, must be adhered to during installation. The contractor shall ensure that the pipes are being installed according to Excellent pipes company work instructions and recommendations.

As with all piping systems, unbalanced thrust forces will be present at changes of diameter such as in elbows, reducers, tees, wyes or bulk heads.

These forces must be restrained for system stabilization. Adequate restraint can be achieved through concrete thrust blocks.

Limitation of Liability

While the information, opinions, advice and recommendations contained in this publication have prepared with proper care, they are offered only in pursuance of the objective to provide useful information and assist those interested in technical matters associated with pipeline design, selection and installation.

The information contained herein is not intended to be an exhaustive statement of all relevant data as the successful installation in each case may depend on numerous factors outside the control of Excellent Pipes Company L.L.C e.g. particular design requirements, site preparation, quality of workmanship during installation, etc. EXCELLENT accepts no responsibility for or in connection with the quality or standard of any pipeline or installation nor its suitability for any purpose when installed.

All conditions, warranties, obligations and liabilities of any kind which are or may be implied or imposed to the contrary by any statute, rule or regulations or under the general law, whether arising from the negligence of EXCELLENT, its servants or otherwise are or may be implied or imposed to the contrary by any statute, rule or regulations or under the general law, whether arising from the negligence of EXCELLENT, its servants or otherwise are hereby excluded except to the extent that EXCELLENT may be prevented by any statute, rule or regulation from doing so.

Awards & Achievements



FIBERBOND™ GRP pipes