شركة أميانتيت قطر للانابيب و ملحقاتها
AMIANTIT QATAR PIPES CO. LTD

GRP PIPES UN-RESTRAINED SYSTEM

for Water, Sewage and Industrial Applications

AMIANTIT PIPE SYSTEM
PRODUCT GUIDE

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1 AMIANTIT GROUP OF COMPANIES

The Amiantit Group is an internationally operating organization with a track record of growth-oriented success. Its mission is to provide customers throughout the world with pipe solutions for water, sewage, gas, oil, industrial applications, pipe technologies, water management services, and superior quality materials.

The company has a history of long-term growth, profitability, and a competitive position in the piping industry, thanks to our staff's experience, commitment, and excellent performance. Therefore, they look forward with confidence to achieving our vision of global leadership.

1.1 AMIANTIT QATAR PIPE CO.

Amiantit Qatar Pipe Company (AQAP) was established in Doha, Qatar, as a joint venture among Qatar Industrial Manufacturing Co. (QIMC), Saudi Arabian Amiantit Co. (SAAC), and Trading & Agency Services Ltd. (TRAGS). The three partners have a combined 91 yrs of experience in the pipes and industrial business.

AQAP Manufactures fiber reinforced Plastic (FRP) pipes & fittings, commonly known as GRP, in sizes up to 4000 mm in diameter.

1.2 FLOWTITE TECHNOLOGY NORWAY

Flowtite Technology Norway Flowtite fibreglass pipes and fittings are useful in many applications. They can be found in the transmission of drinking water, in fire-fighting, sea, and desalinated water, in power plants, in chemical and industrial wastes, and in sewage applications and irrigation. The use of Flowtite pipe systems is virtually unlimited. You find the products in siphon lines just as much as in sea-water outfalls, bridge dewatering, desalination projects, and as protection lines for cables. If you have an interesting application, please do not hesitate to contact us.
The Amiantit Group manufactures Flowtite GRP pipes in many factories around the world. The facilities supply pipes and fittings in various designs, lengths, and diameters, specially customized to suit your application. Flowtite products are available directly from all Amitech manufacturing sites and the APS sales offices worldwide. If you would like to receive further details, please contact us. Our address is printed on the back cover of this brochure.

1.3 OUR VISION

To emerge as the innovative leader in the piping industry by researching and developing novel products resolve pressing challenges that add value to the pipe and construction industry.

OUR MISSION

To provide quality piping products and knowledge-based solutions for the construction industry in Qatar and the entire GCC region.

To achieve this mission, our products and service procedure shall follow the under listed principles

- Achieve absolute customer satisfaction by delivering products and services beyond their expectations.
- Embrace the principle of continuous improvements in our productions and service deliveries.
- Make safety the priority in all our corporate undertakings.

1.4 INTRODUCTION

Aging infrastructure is an imminent challenge facing the nations of the world. There is an urgent need to rehabilitate and overhaul piping systems running into millions of kilometers. The few locations that are not suffering from aging infrastructure and underdeveloped areas that lack infrastructures altogether. However, these underdeveloped nations, which have emerged as hotspots for infrastructure development, are researching novel products and materials that enhance infrastructure longevity and sustainability. The goal is to avoid becoming a victim of deteriorating infrastructure like the developed nations. Corrosion is the primary cause of infrastructure decay. The presence of sulphuric acid in the sanitary saver system created by the hydrogen sulfide cycle causes the concrete sewer pipes' unprotected interiors to degenerate.

On the exterior, soil conditions and stray electrical currents deteriorate underground pipes. Metallic pipes can corrode when placed in poorly aerated, poorly drained soils with low resistivity. The presence of sulfate ñ reducing bacteria will accelerate corrosion.
This problem is simple; the challenge can be reduced significantly or eradicated by selecting corrosion-resistant piping material.

Amiantit Qatar Pipes Co (FLOWTITE) Brand of AQAP Pipe is a glass-reinforced plastic(GRP) pipe produced on the continuously advancing mandrel process that ensures consistency of production output. Features like Immune galvanic and electrolytic corrosion makes AQAP Pipe the ideal choice for water supply systems. Moreover, Its proven resistance to the acidic environment found in a sanitary sewer makes it suitable for wastewater application. AQAP pipe is known to be the most rugged in the world; for the past 20 years. It has been the preferred material for constructing sewers in the middle east.

TECHNOLOGIES YIELD HIGHER PERFORMANCE AT LOWER COST

Light weight, corrosion-resistant, and manufactured under strict quality standards, AQAP pipe is available in oversize pressure classes and three stiffness classes. Products diameters ranges from 80 mm to 4000 mm and lengths up to 18 meters. Growing awareness of the optional cost savings and superior corrosion resistance offered by glass-reinforced plastics pipe by AQAP operation has resulted in it's widespread application. Some common uses include:

- Water transmission and distribution (portable & raw water.)
- Sanitary sewerage collection systems and treated water.
- Storm sewers.
- Desalination, sea water intake, and cooling water lines.
- Circulating water, make-up and blowdown lines for power plants.
- Industrial and chemical waste.
- Irrigation and Fire fighting.

AQAP pipe option offers the most cost-efficient solution for piping projects. It also provides a long, effective service life with low operation and maintenance costs.

2 PRODUCT BENEFITS AND PERFORMANCE STANDARD

Amiantit Qatar Pipe Company has been able to bring a product to market that can provide low-cost, long-term piping solutions to customers around the world.

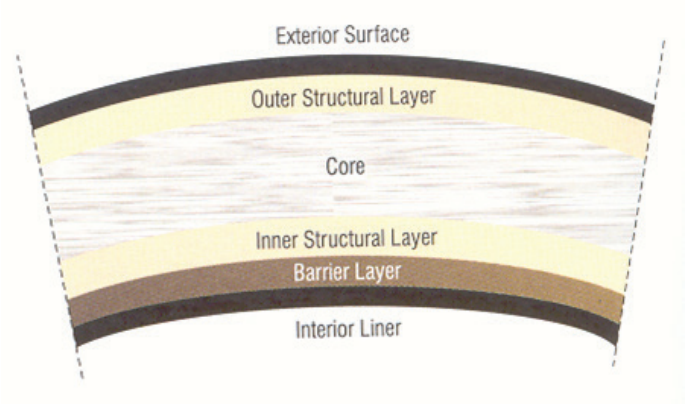
The long list of features and benefits adds up to provide the optimum installed and life cycle cost system.

FEATURES	BENEFITS
CORROSION RESISTANT MATERIAL	• Long effective service life • No need for lining, coating, cathodic protection, wrap or other forms of corrosion protection. • Low maintenance costs • Hydraulics characteristics essentially constant overtime
LIGHT WEIGHT COMPARED TO (DI/ STEEL AND CONCRETE) AND LONGER PIPE LENGTHS 6, 12 M AND 18 M IS DOABLE	• Low transport cost, more pipes in trailer • Lower installation guide, lower handling cost.
EXTREMELY SMOOTH BORE	• Lower pumping cost for pressure pipes, and better hydraulic flow for gravity pipes. • Minimum scale build-up can help lower cleaning costs.
PRECISION FLOWTITE COUPLING WITH ELASTOMERIC REKA GASKETS	• Tight efficient joint designed to eliminate infiltration and exfiltration. • Ease of joining reducing installation time. • Accommodates small changes in line direction without fittings. • Flexibility solution to maintain pipe in safe condition under structure settlment.
FLEXIBLE MANUFACTURING PROCESS	• Custom diameters can be manufactured to provide maximum flow volumes with optimum design velocity.
HIGH-TECH PIPE DESIGN	• Lower wave celerity than other piping material can mean less cost when designing for surge and water hummer pressure.
HIGH TECHNOLOGY PIPE MANUFACTURING SYSTEM PRODUCT PIPES THAT COMPLIES WITH STRICT MANUFACTURING STANDARDS (AWWA, ASTM AND BS-EN, BS, ISO ... ETC)	• High and consistent product quality worldwide to • Ensure reliable product performance
VERSATILITY AND ADAPTIVITY	• Standard and non standard fittings can be fabricated based on actual site condition • GRP can be adapted to connect with other piping material (DI, Steel, Concrete, VC „ etc)

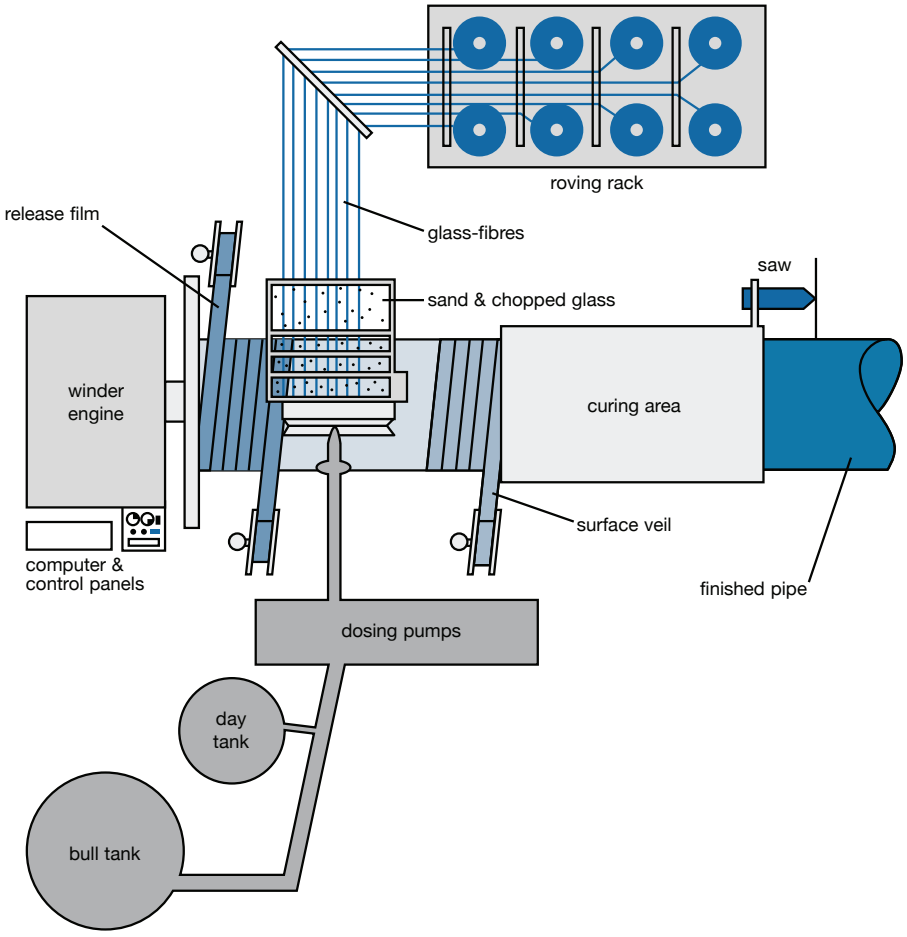
The primary raw materials used in the FLOWTITE pipe's manufacturing are resin, fibreglass, and silica sand. Usually, unsaturated polyester resins are used since they give good performance for pressure sewer applications.

FLOWTITE pipes are manufactured using the continuous advancing mandrel process, which is the state-of-the-art technology for GRP pipe production. This process allows the use of continuous glass fibre reinforcements in the circumferential direction. Thus, incorporating continuous reinforcements in this direction yields a higher-performing product at a lower cost. Using technology developed by material specialists, a very thick laminate is created that maximizes the contribution from three basic raw materials. Both continuous glass fibre rovings and choppable roving are incorporated for hoop strength enhancement and axial reinforcement. A sand fortifier is used to provide increased stiffness by pushing both structural layers away from the neural axis at the core, thereby enhancing the Ring Bending Elastic Modulus.

With the **FLOWTITE** dual resin delivery system, the equipment can apply a special inner resin liner for applications prone to severe corrosion while utilising a less costly resin for the structural and outer portion of the laminate. Taking advantage of the winding process, other materials, such as a glass veil or polyester veil, can be used to enhance the abrasion resistance and the finishing of the pipe.



The figure above shows a typical cross section of a pipe laminate. This section, as well as the way of applying and placing different raw materials, can differ depending on the pipe application.



Standards developed by ASTM and BS-EN. AWWA, BS, and ISO are applied to a variety of fiberglass pipe applications, including conveyance of sanitary sewage, water, and industrial waste. Other local approvals are also available, depending on the Qatar QCS (Qatar Construction Standard) requirements. Amiantit is participating in the development of all these standards with representatives from global organisations, thereby ensuring that standardized performance requirements will result in highly reliable products.

ASTM and BS-EN and BS-EN

Currently, there are several ASTM and BS-EN product standards that apply to a variety of fiberglass pipe with diameter ranges of 25 mm to 4000 mm. This standard demands that the flexible joint withstand hydrostatic testing in configurations (per ASTM and BS-EN D4161) that simulate exaggerated in-use conditions. These standard include many rigid qualifications and BS EN. AQAP pipe is designed to meet all ASTM and BS-EN standards.

AWWA

C950 is one of the most comprehensive product standards in existence for fiberglass pipe. This standard for pressure water application has an extensive pipe and joint requirements, concentrating on quality control and prototype qualification testing, like ASTM and BS-EN standards. This is a product performance standard. AQAP pipe is designed to meet the performance requirements of this standard. AWWA recently issued new standards manual, M-45, which includes several chapters on GRP pipe design for buried and aboveground installations.

ASTM and BS-EN	D3262	Gravity sewer
ASTM AND BS-EN	D3517	Pressure pipe(water)
ASTM and BS-EN	D3754	Pressure sewer
BS-EN	1796	Water (gravity-pressure)
BS-EN	14364	Sewer, Drainage (gravity, pressure)
ASTM	2996	Industrial Self-restrained

AWWA	C950	Fiberglass pressure pipe
AWWA	M45	Fiberglass pipe design manual

3 CONTROL TESTING & QUALIFICATION TESTING

3.1 RAW MATERIALS

Raw materials are delivered with vendor certification, demonstrating their compliance with AQAP quality requirements. Besides, samples of all raw materials are tested prior to their use. These tests ensure pipe materials compliance with the afore-mentioned specifications.

RAW MATERIALS USED IN PIPE PRODUCTION ARE:

- Glass
- Resin
- Catalyst
- Sand and
- Additives

3.2 FINISHED PIPES AND COUPLINGS

All pipes are subjected to the following control checks:

- Visual inspection
- Barcol hardness
- Wall thickness
- Section length
- Diameter
- Hydrostatic leak tightness test to 2 times rated pressure (only for pressure pipes)

3.3 PHYSICAL PROPERTIES

The manufactured pipe's hoop and axial load capacities are verified on a routine basis. In addition, pipe construction and composition are confirmed.

On a sampling basis, the following control checks are performed:

- Pipe stiffness
- Deflection without damage or structural failure
- Axial and circumferential tensile load capacity
- Loss of Ignition (LOI)

A common element shared by all standards is the need for a pipe manufacturer to demonstrate compliance with the standard's minimum performance requirements. In the case of GRP pipe, these minimum performance requirements fall into short-term and long-term requirements. The most important of these, and generally specified at the same level of performance in all the previously defined standards, are joint, initial ring deflection, long-term ring bending, long-term pressure, and strain corrosion capability.

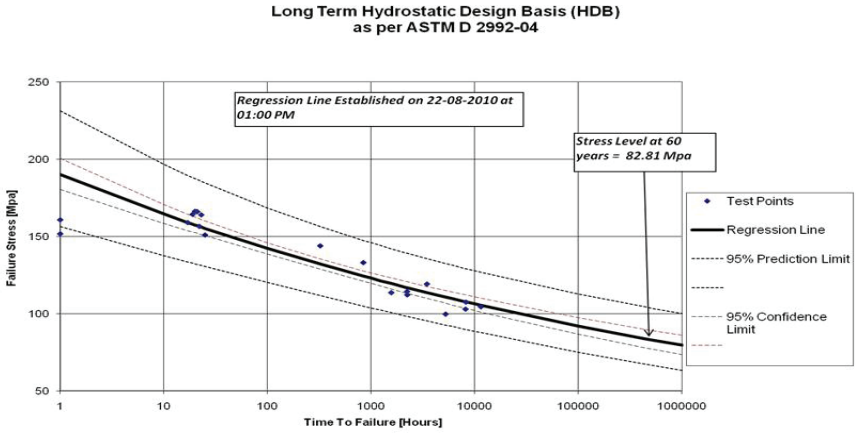
AQAP pipe has been rigorously tested to verify conformance to the ASTM and BS-EN, BSEN, ISO, and AWWA requirements.

3.4 STRAIN CORROSION TESTING

A unique and important performance requirement for GRP gravity pipe used in sewer applications is the chemical testing of the pipe deflected or strained condition. This strain corrosion testing is carried out in accordance with ASTM and BS-EN D 3681, and requires a minimum of 18 ring samples of the pipe to be deflected to various levels and held constant. These strained rings are then exposed at the invert of the interior surface to 1.0N (5% by weight) sulphuric acid (see figure 1). This is intended to simulate a buried septic sewer condition. This has been shown to be representative of the worst sewer conditions, including those found in the Middle East. The time to failure (leakage) for each test sample is measured. The minimum extrapolated failure strain at 50 years, using a least square regression analysis of the failure data, must equal the values shown for each stiffness class. The value achieved is then relatable to the pipe design to enable the prediction of safe installation limitations for the GRP pipe used for this type of service. Typically this is 5% in long-term ground deflections.

3.5 HYDROSTATIC DESIGN BASIS – HDB

Another important qualification test is the establishment of hydrostatic design basis – HDB. This test is carried out in accordance with ASTM and BS-EN D2992 procedure B and requires hydrostatic pressure testing to failure (leakage) of many pipe samples at a variety of very high constant pressure levels. As in the previously described strain corrosion test, the resulting data is evaluated on a log-log basis for strain (or hoop tensile strain) vs. Time to failure and then extrapolated to 50 years. The extrapolated failure strain at 50 years, referred to as the hydrostatic design basis (strain) for HDB, must be at least 1.8 times the rated pressure class (strain at the rated pressure) (see Figure 2).
In other words, design criteria require that the average pipe be capable of withstanding a constant pressure of 1.8 times the maximum design conditions condition for 50 years. Due to combined loading considerations, that is, the interaction of internal pressure and external soil loads, the actual long-term factor of safety against pressure failure alone is higher than 1.8. This qualification test helps assure the long-term performance of the pipe in pressure applications.



3.6 JOINT TESTING

This important qualification test is conducted on joint prototypes for elastomeric gasket sealed coupling. This is a rigorous test carried in accordance with ASTM and BS-EN D4161. It incorporates some of the most stringent join performance tests in the piping industry for pipes of any material within the pressure and size ranges of AQAP pipe. ASTM and BS-EN D4161 requires flexible joints to withstand hydrostatic testing in configurations that simulate every rigorous in-use condition. The pressure used is twice those rated mid 100 kpa (1 bar) for gravity flow pipe. Joint configurations include straight alignment, maximum angular rotation, and differential shear loading. A partial vacuum test and some cyclical pressure tests are also included.

3.7 INITIAL RING DEFIECTION:

All pipe must meet the initial ring deflection levels of no visual evidence of cracking or crazing (Level A) and no structural damage to the pipe wall (Level B) when vertically deflected between two parallel flat plates.
Other stiffness values will required to recalculate the Level A and Level B requirement as per ASTM and BS Standards

Deflection Level	Stiffness	Class	SN
	2500	5000	10000
A	15%	12%	9%
B	25%	20%	15%

3.8 LONG-TERM RING BENDING

A GRP pipe's long-term (50-year) ring deflection of ring bending (strain)capability, when exposed to an aqueous environment and under a constant load, must meet the level A deflection level specified in the initial ring deflection test.

AWWA C950 requires the test to be carried out, with the resulting 50-year predicted value used in the pipe design. AQAP pipe is tested using the guidelines of ASTM and BS-EN D5365 "long-term ring bending strain of fiberglass pipe" and meets both requirements.

3.9 LONG TERM STIFFNESS AND CREEP FACTOR

GRP Pipes in buried application is subjected to long term creep behavior due to its nature as a semi-rigid material. the long term stiffness is done be exposing two samples in to a constant load at a fully submerged in water condition, the pipe deflections is measured on timely basis up to 10000 hrs and then the data curve is extrapolated to the long term design life typically 50 years and then the long term stiffness and creep factor is calculated which is basic requirement for BS EN 14364 and a requirement for buried pipe design

4 PRODUCT SCOPE-TECHNICAL DATA

4.1 DIAMETER, PRESSURE CLASS AND STIFFNESS CLASS

AQAP pipe can be supplied in the following nominal diameters* (mm)

Diameter (mm)	Length (m)	Pressure Class (Bar)	Stiffness Class (Pa)
80, 100, 150, 200, 250, 300 (1)	6	6 , 10 , 16 , 20 , 25 , 32	20000 (6)
300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400 (2)	12 (3)	6 , 10 , 16 , 20 , 25 , 32 (4)	2500, 5000, 10000 (5) (6)
1500, 1600, 1700, 1800, 1900, 2000 (2)	12 (3)	6 , 10 , 16 (4)	2500, 5000, 10000 (5) (6)
2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000 (2)	12 (3)	6 , 10 (4)	2500, 5000, 10000 (5) (6)

(1) Pipe produced on SDP machine CW 300, maximum length 6 m.
(2) Other intermediate diameters and special diameter is doabe upon request
(3) Higher pipe length is doabel confirming special transortation and handling up to 18 m.
(4) Other intermediate pressure classes is doable upon request
(5) Higher stiffness classes like 15000 and 20000 is possible upon request.
(6) Stiffness classes is complying with BS EN 1796, BS EN 14364 classes, for Equivalent stiffness classes in ASTM standards can be provided upon request.

4.2 LENGTHS

The standard length of AQAP is 12 meters for diameters over 300 mm. Lengths of 6 and 18 meters are also available.

4.3 LOAD CAPACITY VALUES

For design purposes, the following values can be used for hoop tensile and axial tensile load capacity.

HOOP TENSILE LOAD CAPACITY

Minimum initial hoop (circumferential) load, table for hoop load capacity to be added . As shown in the table.

AXIAL TENSILE LOAD

Capacity Minimum initial axial (longitudinal) load, N per mm of the circumference. As shown in the table.

HOOP Tensile Load Capacity (N/mm)					
DN / PN	3	6	10	12	16
25	17	34	52	69	86
40	28	55	83	110	138
50	35	69	103	138	172
65	45	90	134	179	224
80	55	110	165	221	276
100	69	138	207	276	345
150	104	207	310	414	517
200	138	276	414	552	690
250	173	345	517	690	862
300	207	413	620	827	1034
350	242	482	724	965	1207
375	259	517	776	1034	1293
400	276	551	827	1103	1379
450	311	620	931	1241	1552
500	345	689	1034	1379	1724
550	380	758	1137	1517	1896
600	414	827	1241	1655	2069
700	483	965	1448	1931	2414
750	518	1034	1551	2069	2586
800	553	1103	1655	2207	2759
850	587	1171	1758	2344	2931
900	621	1240	1861	2482	3103
1000	690	1378	2068	2758	3448
1100	759	1516	2275	3034	3793
1150	794	1585	2378	3172	3965
1200	828	1654	2482	3310	4138
1300	897	1791	2688	3585	4482
1400	966	1929	2895	3861	4827
1500	1035	2067	3102	4137	5172
1600	1104	2205	3309	4413	5517
1700	1173	2343	3516	4689	5862
1800	1242	2480	3722	4964	6206
1900	1311	2618	3929	5240	6551
2000	1380	2756	4136	5516	6896
2200	1518	3032	4550	6068	7586
2300	1587	3169	4756	6343	7930
2400	1656	3307	4963	6619	8275
2500	1725	3445	5170	6895	8620
2600	1794	3583	5377	7171	8965
2700	1863	3721	5584	7447	9310
2800	1932	3858	5790	7722	9654
2900	2001	3996	5997	7998	9999
3000	2070	4134	6204	8274	10344
3400	2346	4685	7031	9377	11723
3600	2484	4961	7445	9929	12413
4000	2760	5512	8272	11032	13792

Axial Tensile Load Capacity					
DN / PN	3	6	10	12	16
25	63	63	63	63	63
40	63	63	63	63	63
50	63	63	63	63	63
65	63	63	63	63	63
80	63	63	63	63	63
100	63	63	63	63	63
150	63	63	63	63	71
200	102	102	102	102	102
250	102	102	102	102	114
300	102	102	102	109	137
350	102	102	107	127	159
375	102	102	114	137	171
400	102	102	122	146	182
450	102	102	137	164	205
500	102	102	152	182	228
550	102	107	160	191	239
600	102	122	183	219	273
700	102	137	206	246	296
750	102	152	229	273	328
800	106	160	240	287	345
850	110	168	251	301	361
900	120	183	274	315	394
1000	130	198	297	328	410
1100	140	213	320	353	441
1150	150	229	343	378	473
1200	160	244	366	403	504
1300	170	259	388	429	536
1400	180	274	411	454	567
1500	200	305	441	504	630
1600	210	320	455	518	648
1700	220	335	468	532	665
1800	240	366	511	580	725
1900	250	368	532	591	738
2000	260	369	553	601	751
2200	279	397	596	647	809
2300	299	426	638	693	867
2400	319	454	681	740	925
2500	329	468	702	763	954
2600	339	482	723	786	982
2700	349	497	745	809	1011
2800	359	511	766	832	1040
2900	379	539	809	878	1098
3000	399	567	851	925	1156
3400	439	624	936	1017	1271
3600	479	681	1021	1110	1387
4000	519	738	1106	1202	1503

4.4 FITTINGS AND ACCESSORIES

All commonly used fittings or accessories can be supplied, such as bends, tees, wyes, and reducers.

4.5 FLOW VELOCITY

Maximum recommended flow velocity is 3.0m/ sec. Velocities of up to 4m/sec can be used if the water is clean and contains no abrasive material.

4.6 UV RESISTANCE

There is no evidence to suggest that ultraviolet degradation is a factor that affects the long-term service life AQAP. The outermost surface will be affected with discoloring of the surface observed. If so desired, the installing contractor may paint the exterior surface of AQAP with a two-part urethane paint compatible with GRP. However, this will then become an item requiring future maintenance.

4.7 POISSON'S RATIO

The pipe construction influences Poisson's ratio. For AQAP, the ratio for hoop (circumferential) loads and axial response ranges from 0.22 to 0.29. For axial loading and circumferential response, Poisson's ratio will be slightly less.

4.8 THERMAL COEFFICIENT

The thermal coefficient of axial expansion and contraction for AQAP is 24 to 30 x10^-6 cm/ cmjC.

5 HYDRAULIC CHARACTERISTICS OF AQAP'S FRP PIPE

Amiantit Qatar Pipes Ltd. (AQAP) uses continuous filament winding machines and reproducible processes to manufacture FRP pipes. All these pipes are provided with resin-rich interior layers to create smooth inner surfaces. The smooth interior surfaces result in very low fluid resistance. For hydraulic analysis of every piping system, pipe roughness is an issue of concern. One of the FAQs by the Hydraulic Engineers/ Consultants/ Contractors/ Clients is related to the value of FRP pipe roughness. This roughness value is used in various equations for hydraulic analysis.

Find below the summary of the mean value based on the experimental studies. These values are based on the experimental studies carried out by Owens Corning and SINTEFF from Norway. Complete report is available upon request. In fact, AWWA C-950 recommending the usage of similar values are in agreement with the international standards. Apart from the above, the interior pipe surfaces typically remain smooth over time when exposed to most fluids. Therefore, fluid resistance will not increase with age. This fact has been demonstrated when few FRP pipes under operation over the decade were inspected and evaluated. Certificates from respective authorities confirming no deterioration are available upon request. AQAP is capable of carrying out Hydraulic Calculations using state-of-the-art commercially available software and AFT Fathom.

As a guideline to the designer, figures 1.1 and 1.2 will provide typical head losses for long diameter pipes and small diameter pipes. Please consult AQAP for any additional Hydraulic requirements and clarifications, and AQAP is happy to assist you in any way to suit your requirements.

5.1 ABRASION RESISTANCE

Abrasion resistance can be related to the effects that sand, or other similar material may have on the pipe's interior surface. While there is no widely standardized testing procedure or rating method, FLOWTITE AQAP was evaluated using the Dramastadt Rocker method.

Results are highly influenced by the type of abrasive material used in the test. Using gravel obtained from the same source used at Dramastadt University, the average abrasion loss of AQAP is 1.76 mm at 100.000 cycles.

Roughness Parameters (Men Values)			
FLOW RATE	Cole Brooke- White	Manning	Hazen - Williams
(m^3/hr)	E or K (mm)	n (s/m^3/1)	C(6 ³. ¹ ⁻10 m 6 6 6 /s)
2860-410	0.029	104	146

5.2 SURGE & WATER HAMMERS

Water hammer or pressure surge is the sudden rise or fall in pressure caused by an abrupt change in the fluid velocity within the pipe system. The usual cause of these flow changes is the rapid closing or opening of valves or sudden starting or stopping of pumps, such as during a power failure. The most important factors which influence the water hammer pressure in a pipe system are the change in velocity of the fluid, rate of change of the velocity (valve closing time), the compressibility of the fluid, hoop tensile modulus, and physical layout of the pipe system. The water hammer pressure expected for AQAP is approximately 50% of that for steel and ductile iron pipe in similar conditions. AQAP has a surge pressure allowance of 40% of the nominal pressure. An approximate relationship for the maximum pressure variation at a given point in a straight pipeline with negligible friction loss can be calculated from the formula below:

$$\Delta H = (w \Delta v)/g$$

Where:

ΔH = change in pressure (m)

W = surge wave celerity (m/s)

ΔV = change in liquid velocity (m/s)

g = acceleration due to gravity (m^2/s)

Surge Wave Celerity for AQAP Fiberglass Pipes

DIN	350-400	450-800	900-2500
SN2500		Meters/Sec	
PN6	365	350	340
PN10	435	420	405
PN16	500	490	480

SN5000		Meters/Sec	
PN6	405	380	370
PN10	435	420	410
PN16	505	495	480
PN25	575	570	560

10000		Meters/Sec	
PN6	420	415	410
PN10	435	425	415
PN16	500	495	485
PN25	580	470	460
PN32	620	615	615

DN	80	100	150	200	250
SN1000			Meters/Sec		
PN6	580	560	540	520	500
PN10	590	570	560	540	520
PN16	640	620	610	600	590

TABLE 6.1

NATIVE SOIL GROUP CLASSIFICATION						
			Non-Cohesive Soils		Cohesive Soils	
Native Soil Group	Blow Counts	E'n value (MPa)	Description	Friction Angle (degrees)	Description	Unconfined Comp Strength (kpa)
1	>15	34.5	compact	33	very stiff	192-384
2	8 - 15	20.7	slightly compact	30	stiff	76-192
3	4 - 8	10.3	loose	29	medium	48-96
4	2 - 4	4.8	very loose	28	soft	24-48
5	1 - 2	1.4	very loose	27	very soft	12-24
6	0 - 1	0.34	very, very loose	26	very, very soft	0-12

7 PIPE CLASSIFICATION SELECTION

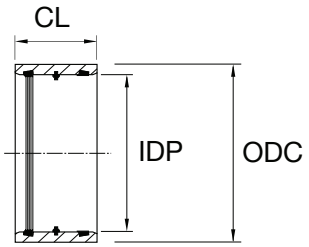
Our Flowtite pipe systems for pressure sewer applications are supplied in the standard diameter range, pressure and stiffness classes as listed below. Other diameters and pressure classes are available on request.

TABLE 7.1 SMALL DIA PIPES

SDP PIPES	DN	PIPE ID ± 0.5	SPIGOT OD	SPIGOT/ TOLERANCE	PIPE LENGTH M	PIPE WEIGHT KG/M
Series A, EN 1796	80	80	87.3	± 0.25	6	2.1
	100	100	107.3	± 0.25	6	2.6
	150	150	157.8	± 0.25	6	3.6
	200	200	209.6	± 0.4	6	6.1
	250	250	261.5	± 0.4	6	9.1
	300	300	313.3	± 0.4	6	12.5

TABLE 7.2 SMALL DIAMETERS – COUPLINGS

SN = Pipe stiffness, PN = Nominal Pressure,
ODP = Outside diameter of pipe, IDP = Inside diameter of pipe.

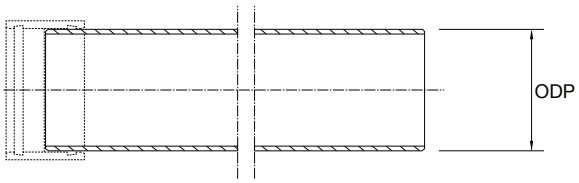


DOUBLE BELL COUPLING FPC FOR SDP

SDP PIPES	DN	COUPLING OD PN6 / PN 16	COUPLING ID	ID TOLERANCE	COUPLING LENGTH M	COUPLING WEIGHT KG/PC
Series A, EN 1796	80	108 / 110	88.3	± 0.25	150	1.1
	100	128 / 130	108.3	± 0.25	150	1.3
	150	178 / 180	158.8	± 0.25	150	1.8
	200	242 / 245	211.6	± 0.5	175	4.3
	250	294 / 297	263.5	± 0.5	175	5.2
	300	346 / 349	315.3	± 0.5	175	6.2

TABLE 7.3 LARGE DIAMETER PIPES LDP

SN = Pipe stiffness, PN = Nominal Pressure,
ODC = outside diameter of coupling,
IDC = Inside diameter of coupling, CL = Coupling length

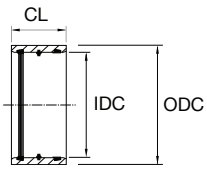


LARGE DIA PIPES (LDP)

LDP Pipes	DN	Spigot OD ± 0.5	SN 2500 PN 6		SN 5000 PN 6		SN 10000 PN 6	
			ID mm ± 1	Weight Kg/m	ID mm ± 1	Weight Kg/m	ID mm ± 1	Weight Kg/m
Series B2, EN 1796	300	324.4	316	8.1	314	10.4	312	12.6
	350	375.9	367	11	365	14.2	362	17.2
	400	426.8	417	14.4	414	18.5	411	22.3
Series B1, EN 1796	450	463.5	466	18.3	463	23.5	460	28.2
	500	514.5	517	22.8	513	29.1	510	34.8
	600	616.5	601	31.4	598	39.3	593	47.9
	700	718.5	701	42.3	697	53.2	692	65.7
	800	820.5	801	55	796	68.8	790	85.4
	900	922.5	900	69.4	895	86.8	888	107.4
	1000	1024.5	1000	85.6	994	106.4	986	132.7
	1100	1126.5	1100	103.5	1093	128.6	1085	160.6
	1200	1228.5	1199	122.3	1192	151.9	1183	190.4
	1300	1330.5	1299	143.6	1291	179.1	1281	223.3
	1400	1432.5	1399	165.9	1390	207	1380	258.4
	1500	1534.5	1498	189	1489	238	1478	295.5
	1600	1636.5	1598	215.4	1588	269.8	1576	336.6
	1700	1738.5	1697	244.8	1687	304.5	1675	378.8
	1800	1840.5	1797	273.9	1786	341.2	1773	424.7
	1900	1942.5	1897	304.1	1885	379.2	1871	472.8
	2000	2044.5	1996	336.7	1985	419.3	1970	522.5
	2100	2146.5	2096	370.8	2084	462.1	2068	576
	2200	2248.5	2196	406.5	2183	507	2166	631.8
	2300	2350.5	2295	443.8	2282	552.7	2265	689.5
	2400	2452.5	2395	482.9	2381	601.5	2363	749.7
	2500	2554.5	2495	522.3	2480	653.3	2461	814.4
	2600	2656.5	2595	565.7	2579	705.9	2560	880.6
	2700	2758.5	2694	609.7	2678	759.7	2658	948.9
	2800	2860.5	2794	654	2777	817.5	2756	1020.2
	2900	2962.5	2894	701.5	2876	877.3	2855	1092.3
	3000	3064.5	2993	751.5	2975	937.2	2953	1169.9
	3100	3166.5	3093	799.7	3074	999.8	3051	1247.6
	3200	3268.5	3193	852.6	3174	1065	3150	1329.7
	3300	3370.5	3292	907.3	3273	1132.7	3248	1414.5
	3400	3472.5	3392	961.5	3372	1202.8	3346	1498.9
	3500	3574.5	3492	1019.3	3471	1272.6		
	3600	3676.5	3591	1078.4	3570	1344.7		
	3700	3778.5	3691	1138.7	3669	1422.6		
	3800	3880.5	3791	1198.5	3768	1499.7		
	3900	3982.5	3890	1263.5				
	4000	4084.5	3990	1329.7				

- Pipe Length 12 m.
- Pipe ID may vary based on liner thickness and different pressure class PN
- Pipe weight may vary for different pressure class

TABLE 7.4 LARGE DIAMETERS – DATA & WEIGHT



DOUBLE BELL COUPLING FOR LDP

LDP Couplings	DN	Coupling ID ± 0.5	Coupling Length mm	PN 6		PN 10		PN 16	
				ODC mm ± 1	Weight Kg/pc	ODC mm ± 1	Weight Kg/pc	ODC mm ± 1	Weight Kg/pc
Series B2, EN 1796	300	326.5	270	366	2.9	366	3.0	368	3.1
	350	378.4	270	417	3.4	418	3.5	420	3.6
	400	429.3	270	468	3.8	469	3.9	472	4.2
Series B1, EN 1796	450	466	270	504	4.2	506	4.4	508	4.6
	500	517	270	555	4.6	557	4.9	559	5.1
	600	619	330	664	9.5	665	9.8	667	10.3
	700	721	330	765	10.9	768	11.5	772	12.5
	800	823	330	867	12.3	871	13.5	876	14.9
	900	925	330	970	14.1	975	15.5	978	16.3
	1000	1027	330	1073	15.9	1078	17.6	1081	18.6
	1100	1129	330	1176	17.7	1181	19.7	1185	21.0
	1200	1231	330	1278	19.5	1284	21.8	1289	23.5
	1300	1333	330	1381	21.4	1387	24.0	1392	26.0
	1400	1435	330	1483	23.1	1490	26.1	1497	29.3
	1500	1537	330	1586	25.0	1592	28.3	1602	33.1
	1600	1639	330	1688	26.9	1695	30.6	1707	36.9
	1700	1741	330	1790	28.8	1798	32.9	1811	40.5
	1800	1843	330	1893	30.7	1900	35.1	1915	44.1
	1900	1945	330	1995	32.6	2004	38.0	2019	47.7
	2000	2047	330	2098	34.6	2108	41.1	2123	51.2
	2100	2149	330	2200	36.5	2211	44.2	2226	54.7
	2200	2251	330	2303	38.5	2314	47.2	2330	58.3
	2300	2353	330	2405	40.6	2418	50.2	2433	61.7
	2400	2455	330	2507	42.6	2521	53.3	2536	65.3
	2500	2557	330	2610	44.7	2624	56.4	2639	68.8
	2600	2661	360	2729	72.0	2740	83.3	2753	95.9
	2700	2763	360	2832	75.5	2843	87.2	2856	100.2
	2800	2865	360	2935	79.0	2945	91.0	2959	104.7
	2900	2967	360	3037	82.5	3048	94.9	3061	108.9
	3000	3069	360	3140	86.0	3150	98.7	3163	112.8
	3100	3171	360	3242	99.0	3253	113.8	3268	133.3
	3200	3273	360	3345	103.0	3355	118.3	3372	140.1
	3300	3375	360	3447	106.8	3458	122.7	3475	147.1
	3400	3477	360	3550	110.9	3560	127.0	3579	155.9
	3500	3579	360	3652	114.7	3663	131.4		
	3600	3681	360	3754	118.9	3765	135.9		
	3700	3783	360	3857	122.9	3867	140.3		
	3800	3885	360	3959	126.8	3970	144.7		
	3900	3987	360	4062	130.7	4072	149.2		
	4000	4089	360	4164	134.7	4175	153.7		

- Coupling OD may vary for different liner thickness

8 PIPE JOINING

8.1 DOUBLE BELL COUPLING (FPC)

FLOWTITE pipe sections are typically joined using FLOWTITE pressure couplings (FPC). Pipe and couplings may be supplied separately, or the pipe may be supplied with a coupling installed on one end. The FLOWTITE coupling utilises an elastomeric gasket for sealing. The gasket sits in a precision-machined groove in each end of the coupling and seats and seals against a spigot surface.

Note: Detailed installation instructions can be found in our separate publications for pipe installation.

8.2 JOINT ANGULAR DEFLECTION

The joint is extensively tested and qualified by ASTM and BS-EN D4161, ISO DIS8639, and EN 1119. Maximum angular deflection (turn) at each coupling joint, measured as the change in adjacent pipe centre lines, must not exceed the amounts given in Table 8.1.

The pipes must be joined in a straight alignment, but not all the way to the home line, and after that, angularly deflected as required.

Nom Pipe Diameter (mm)	Pressure (PN) in bars			
	Up to 16	20	25	32
	Max. Angular deflection (degrees)			
DN< 500	3.0	2.5	2.0	1.5
15<DN< 1800	2.0	1.5	1.3	1.0
900< DN< 1800	1.0	0.8	0.5	0.5
DN> 1800	0.5	0.4	0.3	NA

Table 8.1 Angular Deflection at Double coupling Joint

Angle of Deflection (deg)	Maximum Offset (mm) Pipe length			Radius of Cuvature (m) Pipe length		
	3m	6m	12m	3m	6m	12m
3.0	157	314	628	57	115	229
2.5	131	262	523	69	138	275
2.0	105	209	419	86	172	344
1.5	79	157	314	115	229	458
1.3	68	136	272	132	264	529
1.0	52	105	209	172	344	688
0.8	42	84	168	215	430	859
0.5	26	52	105	344	688	1375

Table 8.2 Offset and Radius of Curvature

8.3 GRP FLANGES

Flanges are produces meeting all metallic flange drilling standards like ISO, BS, ASME, ANSI and AWWA, the GRP flange face could be produced with groove face which is suitable for O-ring gasket where the matching metallic face should be flat metal.
Other option is to make the GRP flange as flat face with EPDM gasket with steel inley with special profile like (Kroll Ziller brand) where lower torque levels will be required. Flange can be produced using Filament winding process on a preassembled mold or on contact mold process.

For any special flange joining configuration please consult AQAP engineering department.

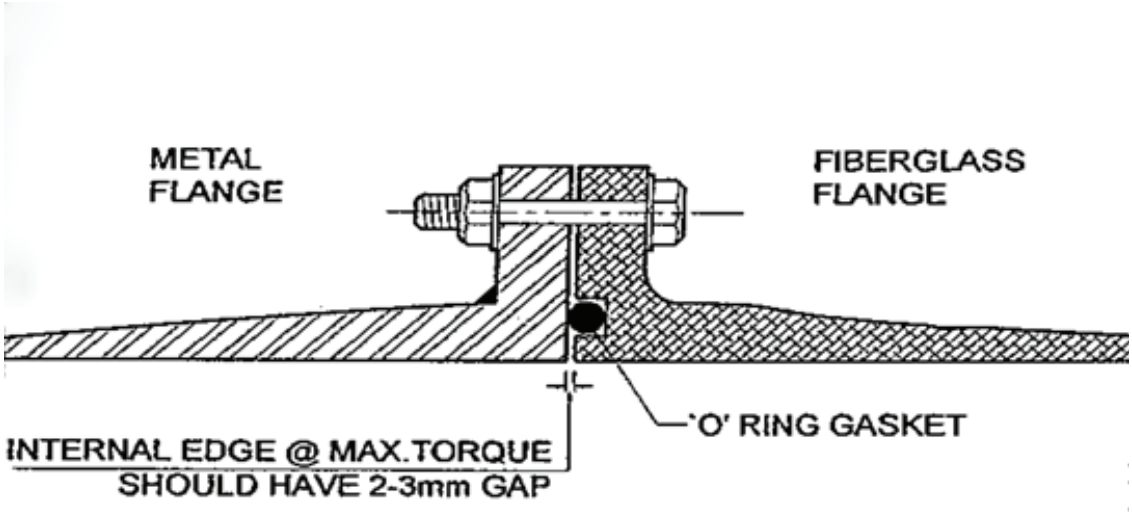


Figure 8.3 Flange Joints Grooved Face

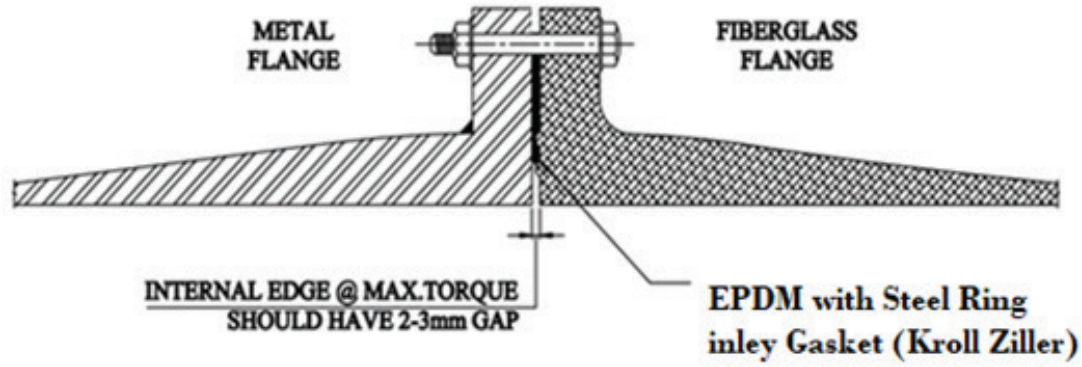


Figure 8.4 Flange Joints Flat Face

8.4 MECHANICAL STEEL COUPLINGS

When connecting FLOWTITE pipe to other materials with different exterior diameters, flexible steel couplings are one of the preferred jointing methods.

These couplings consist of a steel mantle with an interior rubber sealing sleeve. They may also be used to join FLOWTITE pipe sections together, for example, in a repair or for closure.

Three grades are commonly available:

- Coated steel mantle
- Stainless steel mantle
- Hot-dip galvanized steel mantle

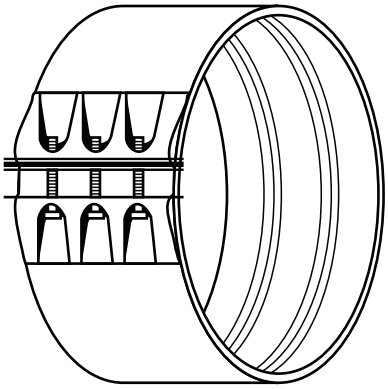


Figure 8.6 Flexible steel coupling

Mechanical couplings have been used to join pipes of different materials and diameters, and to adapt to flange outlets. FLOWTITE Technology has found a wide manufacturing variance in these couplings, including bolt size, number of bolts, and gasket design, making standardized recommendations impossible. If a mechanical joint is used to join FLOWTITE to another pipe material, a dual independent bolting system allows for the independent tightening of the FLOWTITE side, which typically requires less torque than recommended by the coupling manufacturer.

Given the facts above, we cannot recommend the general use of mechanical couplings with FLOWTITE pipe. If the installer intends to use a specific design (brand and model) of mechanical coupling, it is advisable to consult with the local FLOWTITE pipe supplier before its purchase. The pipe supplier can advise the specific conditions (if any) where the proposed design might be suitable for use with FLOWTITE.

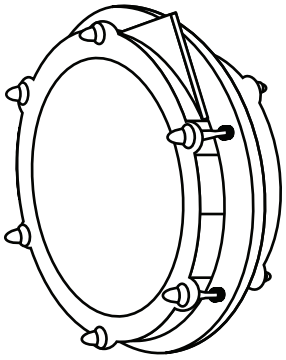


Figure 8.7 Dual bolt mechanical coupling

8.5 LAMINATED JOINTS (BUTT STRAP)

Laminated Joints are typically where the transmission of axial forces from internal pressure is required or as a repair method. The length and thickness of the lay-up depend on diameter and pressure. Detailed information about the local availability of joints and joining systems can be requested from your local supplier or found attached to this brochure.

Detailed information about the local availability of joints and joining systems can be requested from your local supplier, or is attached to this brochure.

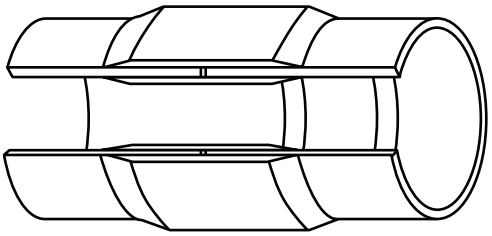
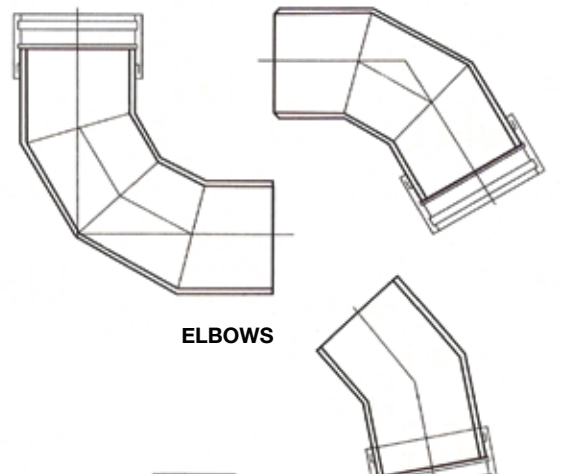


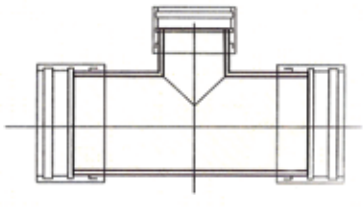
Figure 8.9 Laminated Joint

9 FITTINGS

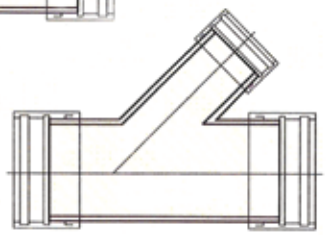
Amiantit Qatar Pipe Company has created a standardized line of GRP fittings that are moulded or fabricated using the same material used to produce AQAP pipe. One of Flowtite AQAP pipe benefits is the ability to fabricate a wide assortment of fittings, standard and non-standard. The following table shows the standard dimensions of standard fittings with different ends configuration.



ELBOWS

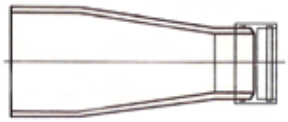


TEES

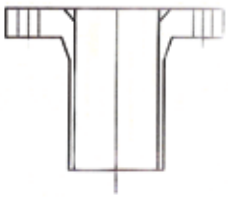


WYES

ECCENTRIC REDUCERS

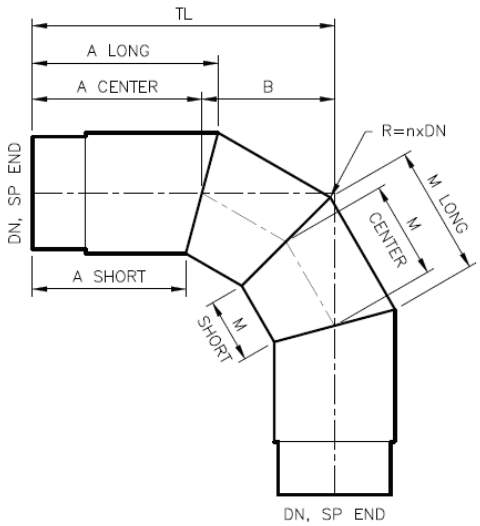


CONCENTRIC REDUCERS



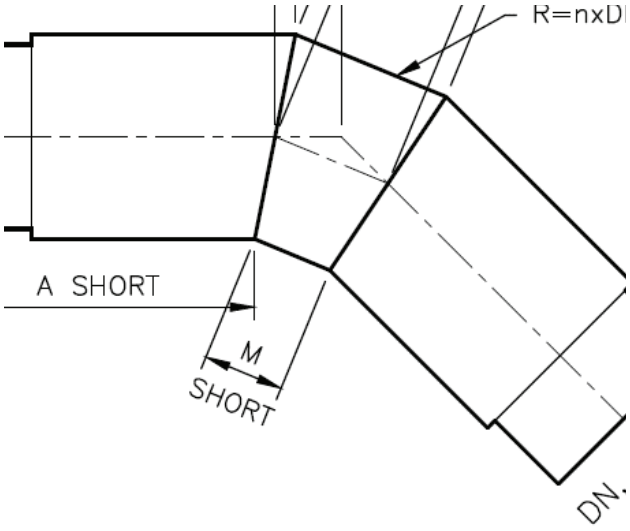
WYES

9.1 SEGMENTED BENDS



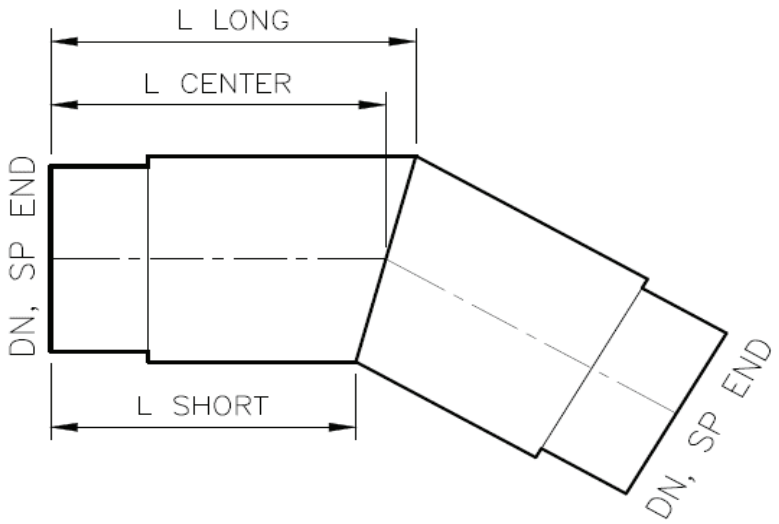
GRP 90 DEG.MITERED ELBOW-SPIGOT END
PRESSURE RATING : PN16

DN	No. of Miters	n	A LONG	A CENTER	A SHORT	M LONG	M CENTER	M SHORT	B	TL
80	3	1.5	273	262	251	86	64	42	88	350
100	3	1.5	263	250	237	106	80	54	110	360
125	3	1.5	280	263	246	134	100	66	137	400
150	3	1.5	275	255	235	161	121	81	165	420
200	3	1.5	307	280	253	215	161	107	220	500
250	3	1.5	338	305	272	267	201	135	275	580
300	3	1.5	391	351	311	321	241	161	329	680
350	3	1.5	463	416	369	375	281	187	384	800
400	3	1.5	495	441	387	430	322	214	439	880
450	3	1.5	546	486	426	482	362	242	494	980
500	3	1.5	578	511	444	536	402	268	549	1060
600	3	1.5	621	541	461	642	482	322	659	1200
700	3	1.5	575	481	387	751	563	375	769	1250
800	3	1.5	629	522	415	857	643	429	878	1400
900	3	1.5	683	562	441	965	723	481	988	1550
1000	3	1.5	736	602	468	1072	804	536	1098	1700
1100	3	1.5	739	592	445	1178	884	590	1208	1800
1200	3	1.5	843	682	521	1287	965	643	1318	2000
1300	3	1.5	947	773	599	1393	1045	697	1427	2200
1400	3	1.5	951	763	575	1501	1125	749	1537	2300
1500	3	1.5	1054	853	652	1608	1206	804	1647	2500
1600	3	1.5	1057	843	629	1714	1286	858	1757	2600
1700	3	1.5	1111	883	655	1823	1367	911	1867	2750
1800	3	1.5	1114	873	632	1929	1447	965	1977	2850
1900	3	1.5	1169	914	659	2037	1527	1017	2086	3000
2000	3	1.5	1272	1004	736	2144	1608	1072	2196	3200



GRP 45 DEG.MITERED ELBOW-SPIGOT END
PRESSURE RATING : PN16

DN	No. of Miters	n	A LONG	A CENTER	A SHORT	M LONG	M CENTER	M SHORT	B	TL
80	2	1.5	252	244	236	64	48	32	26	270
100	2	1.5	258	248	238	80	60	40	32	280
125	2	1.5	262	250	238	99	75	51	40	290
150	2	1.5	267	252	237	120	90	60	48	300
200	2	1.5	285	265	245	159	119	79	65	330
250	2	1.5	324	299	274	199	149	99	81	380
300	2	1.5	363	333	303	239	179	119	97	430
350	2	1.5	432	397	362	279	209	139	113	510
400	2	1.5	471	431	391	319	239	159	129	560
450	2	1.5	510	465	420	359	269	179	145	610
500	2	1.5	549	499	449	398	298	198	161	660
600	2	1.5	516	456	396	478	358	238	194	650
700	2	1.5	544	474	404	558	418	278	226	700
800	2	1.5	572	492	412	637	477	317	258	750
900	2	1.5	599	509	419	717	537	357	291	800
1000	2	1.5	676	577	478	795	597	399	323	900
1100	2	1.5	704	595	486	874	656	438	355	950
1200	2	1.5	781	662	543	954	716	478	388	1050
1300	2	1.5	809	680	551	1034	776	518	420	1100
1400	2	1.5	887	748	609	1113	835	557	452	1200
1500	2	1.5	865	716	567	1193	895	597	484	1200
1600	2	1.5	892	733	574	1273	955	637	517	1250
1700	2	1.5	970	801	632	1352	1014	676	549	1350
1800	2	1.5	998	819	640	1432	1074	716	581	1400
1900	2	1.5	1025	836	647	1512	1134	756	614	1450
2000	2	1.5	1103	904	705	1591	1193	795	646	1550



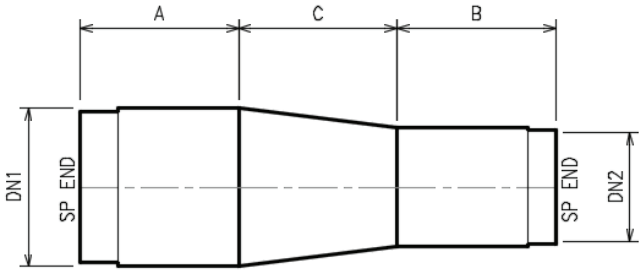
GRP 30 DEG.MITERED ELBOW-SPIGOT END
PRESSURE RATING : PN16

DN	No. of Miters	L LONG	L CENTER	L SHORT
80	1	261	250	239
100	1	263	250	237
125	1	267	250	233
150	1	280	260	240
200	1	297	270	243
250	1	333	300	267
300	1	380	340	300
350	1	457	410	363
400	1	504	450	396
450	1	540	480	420
500	1	577	510	443
600	1	530	450	370
700	1	594	500	406
800	1	657	550	443
900	1	671	550	429
1000	1	734	600	466
1100	1	747	600	453
1200	1	811	650	489
1300	1	874	700	526
1400	1	938	750	562
1500	1	1001	800	599
1600	1	1014	800	586
1700	1	1078	850	622
1800	1	1141	900	659
1900	1	1155	900	645
2000	1	1268	1000	732

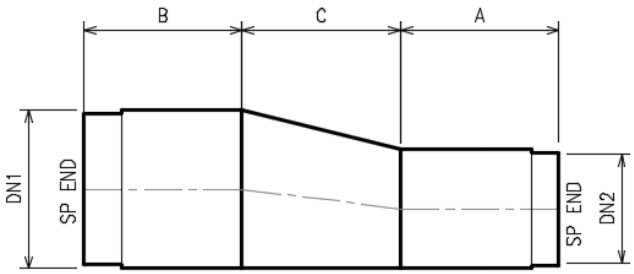
9.2 SEGMENTED REDUCERS – CONCENTRIC –EXCENTRIC

GRP REDUCERS - SPIGOT ENDS
PRESSURE RATING : PN1

DN1	DN2	C	A	B
80	50	75	250	250
100	50	125	250	250
	80	50	250	250
150	80	175	300	300
	100	125	300	300
200	100	250	300	300
	150	125	300	300
250	150	250	300	300
	200	125	300	300
300	200	250	400	400
	250	125	400	400
350	250	250	400	400
	300	125	400	400
400	300	250	400	400
	350	125	400	400
450	350	250	400	400
	400	125	400	400
500	400	250	400	400
	450	125	400	400
600	450	375	400	400
	500	250	400	400
700	500	500	400	400
	600	250	400	400
800	600	500	400	400
	700	250	400	400
900	700	500	400	400
	800	250	400	400
1000	800	500	400	400
	900	250	400	400
1100	900	500	500	500
	1000	250	500	500
1200	1000	500	500	500
	1100	250	500	500
1300	1100	500	500	500
	1200	250	500	500
1400	1200	500	500	500
	1300	250	500	500
1500	1300	500	600	600
	1400	250	600	600
1600	1400	500	600	600
	1500	250	600	600
1700	1500	500	600	600
	1600	250	600	600
1800	1600	500	600	600
	1700	250	600	600
1900	1700	500	600	600
	1800	250	600	600
2000	1800	500	600	600
	1900	250	600	600



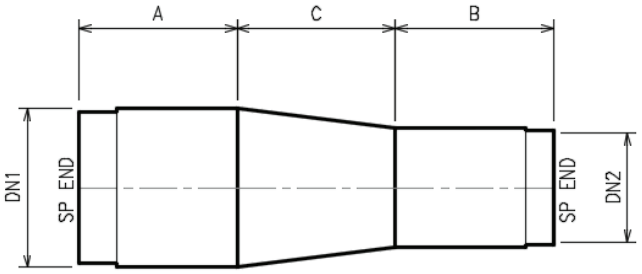
CONCENTRIC



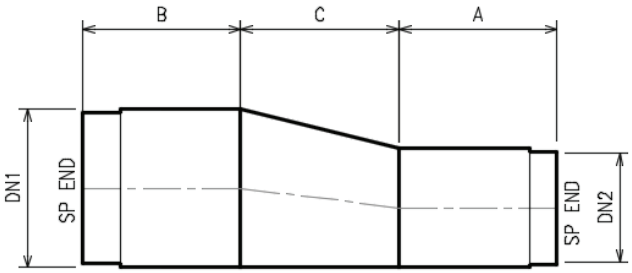
ECCENTRIC

GRP REDUCERS - SPIGOT ENDS
PRESSURE RATING: PN 10

DN1	DN2	C	A	B
80	50	75	250	250
100	50	125	250	250
	80	50	250	250
150	80	175	250	250
	100	125	250	250
200	100	250	300	300
	150	125	300	300
250	150	250	300	300
	200	125	300	300
300	200	250	300	300
	250	125	300	300
350	250	250	350	350
	300	125	350	350
400	300	250	400	400
	350	125	400	400
450	350	250	400	400
	400	125	400	400
500	400	250	450	450
	450	125	450	450
600	450	375	500	500
	500	250	500	500
700	500	500	550	550
	600	250	550	550
800	600	500	600	600
	700	250	600	600
900	700	500	650	650
	800	250	650	650
1000	800	500	700	700
	900	250	700	700
1100	900	500	700	700
	1000	250	700	700
1200	1000	500	750	750
	1100	250	750	750
1300	1100	500	800	800
	1200	250	800	800
1400	1200	500	850	850
	1300	250	850	850
1500	1300	500	900	900
	1400	250	900	900
1600	1400	500	950	950
	1500	250	950	950
1700	1500	500	1000	1000
	1600	250	1000	1000
1800	1600	500	1050	1050
	1700	250	1050	1050
1900	1700	500	1050	1050
	1800	250	1050	1050
2000	1800	500	1100	1100
	1900	250	1100	1100



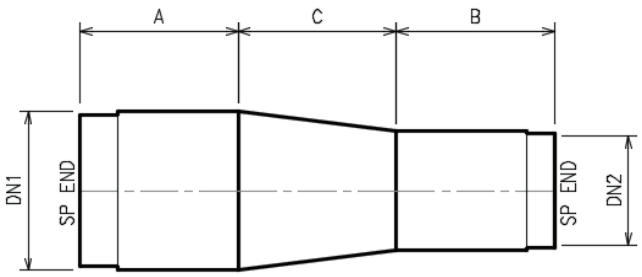
CONCENTRIC



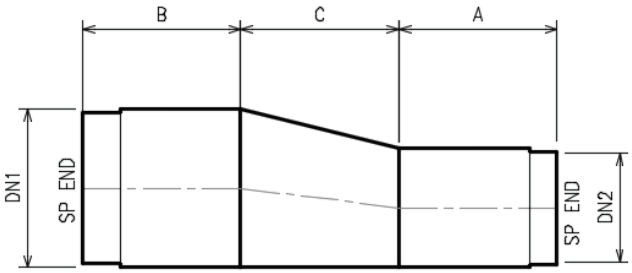
ECCENTRIC

GRP REDUCERS - SPIGOT ENDS
PRESSURE RATING: PN 16

DN1	DN2	C	A	B
80	50	75	250	250
100	50	125	250	250
	80	50	250	250
150	80	175	250	250
	100	125	250	250
200	100	250	300	300
	150	125	300	300
250	150	250	300	300
	200	125	300	300
300	200	250	300	300
	250	125	300	300
350	250	250	350	350
	300	125	350	350
400	300	250	400	400
	350	125	400	400
450	350	250	400	400
	400	125	400	400
500	400	250	450	450
	450	125	450	450
600	450	375	500	500
	500	250	500	500
700	500	500	550	550
	600	250	550	550
800	600	500	600	600
	700	250	600	600
900	700	500	650	650
	800	250	650	650
1000	800	500	700	700
	900	250	700	700
1100	900	500	700	700
	1000	250	700	700
1200	1000	500	750	750
	1100	250	750	750
1300	1100	500	800	800
	1200	250	800	800
1400	1200	500	850	850
	1300	250	850	850
1500	1300	500	900	900
	1400	250	900	900
1600	1400	500	950	950
	1500	250	950	950
1700	1500	500	1000	1000
	1600	250	1000	1000
1800	1600	500	1050	1050
	1700	250	1050	1050
1900	1700	500	1050	1050
	1800	250	1050	1050
2000	1800	500	1100	1100
	1900	250	1100	1100

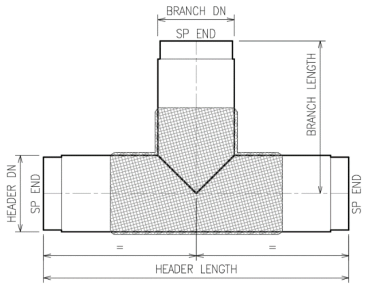


CONCENTRIC



ECCENTRIC

9.3 SEGMENTED TEES
PRESSURE RATING: PN 1

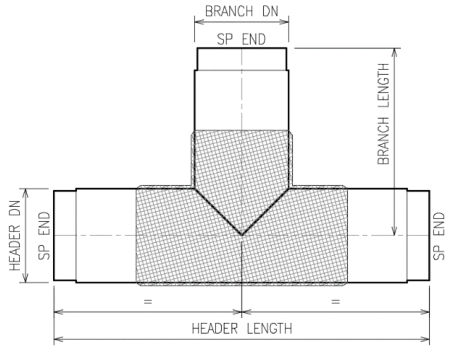


HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
100	100	600	300
150	100	600	300
	150	600	300
200	100	600	350
	150	600	350
	200	700	350
250	100	600	350
	150	600	350
	200	700	350
	250	700	350
300	100	700	400
	150	700	400
	200	800	400
	250	800	400
	300	900	450
350	100	700	400
	150	700	400
	200	800	400
	250	800	400
	300	900	450
	350	900	450
400	100	700	450
	150	700	450
	200	800	450
	250	800	450
	300	900	500
	350	1000	500
	400	1000	500
500	100	700	500
	150	700	500
	200	800	500
	250	800	500
	300	900	550
	350	1000	550
	400	1000	550
	500	1200	600
600	300	900	600
	400	1100	600
	500	1200	600
	600	1300	650

HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
700	300	900	650
	400	1100	650
	500	1200	700
	600	1300	700
	700	1400	700
800	300	900	700
	400	1100	700
	500	1200	750
	600	1400	750
	700	1500	800
	800	1600	800
900	300	900	750
	400	1100	750
	500	1200	800
	600	1400	850
	700	1500	850
	800	1600	850
	900	1700	850
1000	300	900	800
	400	1100	800
	500	1200	850
	600	1400	900
	700	1500	900
	800	1600	900
	900	1800	950
	1000	1900	950
1200	300	1000	900
	400	1100	950
	500	1200	950
	600	1400	1000
	700	1600	1000
	800	1700	1050
	900	1800	1050
	1000	1900	1100
	1200	2200	1100
1400	300	1000	1000
	400	1100	1050
	500	1300	1050
	600	1400	1100
	700	1500	1100
	800	1700	1150
	900	1900	1150
	1000	2000	1200
	1200	2200	1200
	1400	2500	1250
1500	300	1000	1150
	400	1200	1150
	500	1300	1200
	600	1400	1200
	700	1600	1250
	800	1700	1250
	900	1800	1300

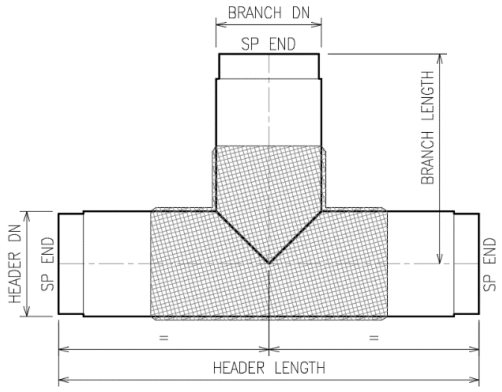
HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
1500	1000	2000	1300
	1200	2300	1350
	1400	2500	1350
	1500	2800	1400
1600	300	1000	1150
	400	1200	1150
	500	1300	1200
	600	1400	1200
	700	1600	1250
	800	1700	1250
	900	1800	1300
	1000	2000	1300
	1200	2300	1350
	1400	2500	1350
	1500	2800	1400
	1600	2800	1400
1800	300	1000	1250
	400	1200	1250
	500	1300	1300
	600	1400	1300
	700	1600	1350
	800	1700	1350
	900	1000	1350
	1000	1200	1400
	1200	1300	1400
	1400	1500	1450
	1500	1600	1450
	1600	1700	1450
	1800	1900	1500
2000	300	1000	1350
	400	1200	1400
	500	1300	1400
	600	1500	1450
	700	1600	1450
	800	1700	1450
	900	1900	1500
	1000	2000	1500
	1200	2400	1550
	1400	2600	1600
	1600	2900	1650
	1800	3100	1650
	2000	3400	1700

PRESSURE RATING: PN 10



HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
100	100	600	300
150	100	700	400
	150	800	400
200	100	900	450
	150	900	500
	200	1000	500
250	100	800	500
	150	1000	550
	200	1100	600
	250	1200	600
300	100	1000	550
	150	1200	650
	200	1300	650
	250	1300	650
	300	1400	700
350	100	1100	600
	150	1100	600
	200	1400	750
	250	1400	750
	300	1500	800
	350	1600	800
400	100	1100	650
	150	1200	700
	200	1500	800
	250	1500	800
	300	1600	850
	350	1700	850
	400	1700	850
500	100	1300	800
	150	1400	800
	200	1400	850
	250	1800	950
	300	1800	1000
	350	1900	1000
	400	1900	1000
	500	2000	1000
600	300	1100	700
	400	1400	750
	500	1500	750
	600	1700	850
700	300	1200	750
	400	1500	850
	500	1600	850
	600	1700	900
	700	1900	900
800	300	1300	850
	400	1400	850
	500	1700	950
	600	1800	1000
	700	1900	1000
	800	2100	1050
900	300	1400	950
	400	1500	950
	500	1700	1000
	600	1900	1050
	700	2000	1050
	800	2100	1100
	900	2300	1150
1000	300	1400	1000
	400	1500	1000
	500	1600	1000
	600	1900	1150
	700	2000	1150
	800	2200	1200
	900	2300	1200
	1000	2500	1250
1200	300	1500	1200
	400	1600	1200
	500	1700	1200
	600	1800	1200
	700	2200	1350
	800	2300	1350
	900	2400	1350
	1000	2500	1350
	1200	2800	1400
1400	300	1600	1350
	400	1700	1350
	500	1800	1350
	600	2000	1400
	700	2100	1400
	800	2400	1500
	900	2500	1500
	1000	2600	1500
	1200	2900	1550
	1400	3200	1600
1600	300	1700	1500
	400	1800	1500
	500	2000	1500
	600	2100	1550
	700	2200	1550
	800	2300	1550
	900	2700	1700
	1000	2800	1700
	1200	3100	1750
	1400	3400	1800
	1600	3600	1800

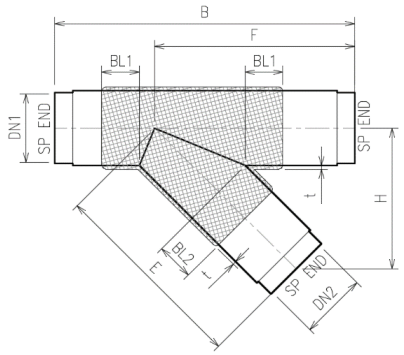
PRESSURE RATING: PN 16



HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
100	100	800	400
150	100	900	500
	150	1000	500
200	100	1100	600
	150	1200	600
	200	1300	650
250	100	1100	600
	150	1400	700
	200	1400	750
	250	1500	750
300	100	1300	700
	150	1600	850
	200	1700	850
	250	1700	850
	300	1800	900
350	100	1400	750
	150	1500	800
	200	1800	950
	250	1900	950
	300	2000	1000
	350	2000	1000
400	100	1500	850
	150	1600	850
	200	2000	1050
	250	2100	1100
	300	2100	1100
	350	2200	1100
	400	2300	1150
500	100	1700	1000
	150	1800	1050
	200	1900	1050
	250	2400	1300
	300	2500	1350
	350	2600	1350
	400	2700	1350
	500	2700	1350
600	300	1400	800
	400	1700	900
	500	1800	900
	600	1900	950

HEADER DN	BRANCH DN	HEADER Length	BRANCH Length
(mm)	(mm)	(mm)	(mm)
700	300	1500	900
	400	1800	1000
	500	1900	1000
	600	2000	1050
	700	2100	1050
800	300	1600	1000
	400	1700	1000
	500	2000	1150
	600	2100	1150
	700	2200	1150
	800	2300	1150
900	300	1600	1100
	400	1800	1100
	500	2100	1250
	600	2200	1300
	700	2400	1300
	800	2500	1300
	900	2600	1300
1000	300	1700	1200
	400	1800	1200
	500	2000	1200
	600	2400	1400
	700	2500	1400
	800	2600	1400
	900	2800	1400
	1000	2900	1400
1200	300	1800	1350
	400	2000	1350
	500	2100	1350
	600	2200	1400
	700	2700	1600
	800	2800	1600
	900	2900	1600
	1000	3000	1600
	1200	3200	1600

9.4 GRP WYE
PRESSURE RATING: PN 1

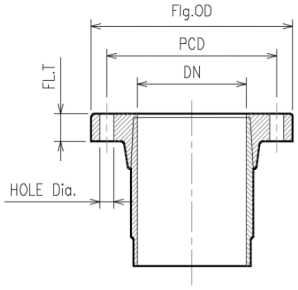


DN1	DN2	B	H	F	E
100	100	600	300	350	420
150	100	600	300	375	420
	150	700	300	425	420
200	100	600	300	400	420
	150	700	350	450	500
	200	800	350	500	500
250	100	600	350	425	500
	150	700	350	475	500
	200	800	400	525	570
	250	900	400	575	570
300	100	700	350	500	500
	150	800	400	550	570
	200	900	400	600	570
	250	1000	450	650	640
	300	1100	500	700	710
350	100	700	400	550	570
	150	800	400	575	570
	200	900	450	625	640
	250	1000	450	675	640
	300	1100	500	725	710
	350	1200	550	775	780
400	100	700	400	550	570
	150	800	450	600	640
	200	900	450	650	640
	250	1000	500	700	710
	300	1100	550	750	780
	350	1200	600	800	850
	400	1300	600	850	850
500	100	700	500	600	710
	150	800	500	650	710
	200	900	550	700	780
	250	1000	550	750	780
	300	1100	600	800	850
	350	1200	650	850	920
	400	1300	650	900	920
	500	1500	700	1000	990

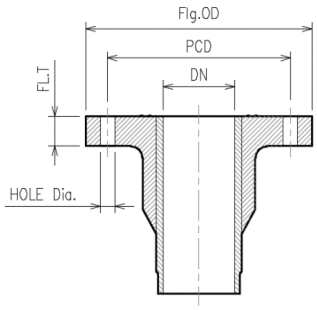
DN1	DN2	B	H	F	E
600	300	1100	650	850	920
	400	1300	700	950	990
	500	1500	750	1050	1060
	600	1600	800	1100	1130
700	300	1100	700	900	990
	400	1300	750	1000	1060
	500	1500	800	1100	1130
	600	1700	850	1200	1200
	700	1900	900	1300	1270
800	300	1100	750	950	1060
	400	1300	800	1050	1130
	500	1500	850	1150	1200
	600	1700	900	1250	1270
	700	1900	950	1350	1340
	800	2100	1000	1450	1410
900	300	1100	800	1000	1130
	400	1300	850	1100	1200
	500	1500	900	1200	1270
	600	1700	1000	1300	1410
	700	1900	1050	1400	1490
	800	2100	1100	1500	1560
	900	2300	1150	1600	1630
1000	300	1100	850	1050	1200
	400	1300	900	1150	1270
	500	1500	950	1250	1340
	600	1800	1050	1400	1490
	700	1900	1100	1450	1560
	800	2100	1150	1550	1630
	900	2300	1200	1650	1700
	1000	2500	1250	1750	1770
1200	300	1200	950	1200	1340
	400	1400	1000	1300	1410
	500	1500	1050	1350	1490
	600	1700	1100	1450	1560
	700	2000	1200	1600	1700
	800	2200	1250	1700	1770
	900	2400	1300	1800	1840
	1000	2500	1350	1850	1910
	1200	2900	1450	2050	2050
1400	300	1200	1100	1300	1560
	400	1400	1150	1400	1630
	500	1600	1200	1500	1700
	600	1800	1250	1600	1770
	700	2000	1300	1700	1840
	800	2200	1400	1800	1980
	900	2400	1400	1900	1980
	1000	2600	1450	2000	2050

DN1	DN2	B	H	F	E
1400	1200	2900	1550	2150	2190
	1400	3300	1650	2350	2330
1600	300	1200	1200	1400	1700
	400	1400	1250	1500	1770
	500	1600	1300	1600	1840
	600	1800	1350	1700	1910
	700	2000	1400	1800	1980
	800	2200	1450	1900	2050
	900	2400	1550	2000	2190
	1000	2600	1600	2100	2260
	1200	3000	1700	2300	2400
	1400	3400	1800	2500	2550
	1600	3700	1900	2650	2750
1800	300	1300	1300	1550	1800
	400	1500	1350	1650	1875
	500	1700	1380	1750	1940
	600	1800	1450	1800	2025
	700	2000	1500	1900	2100
	800	2200	1550	2000	2175
	900	2400	1600	2200	2250
	1000	2700	1700	2250	2350
	1200	3100	1800	2450	2500
	1400	3400	1900	2600	2650
	1600	3800	2000	2800	2800
	1800	4100	2100	2950	2950
2000	300	1300	1400	1650	1850
	400	1500	1450	1750	1925
	500	1700	1500	1850	2000
	600	1900	1600	1950	2100
	700	2100	1650	2050	2175
	800	2300	1700	2150	2250
	900	2400	1750	2200	2325
	1000	2700	1800	2350	2400
	1200	3100	1900	2550	2550
	1400	3500	2000	2750	2700
	1600	3800	2100	2900	2850
	1800	4200	2200	3100	3000
	2000	4500	2300	3250	3150

9.5 GRP FLANGE - FLAT FACE
ISO 7005 / BS EN 1092 PN 10



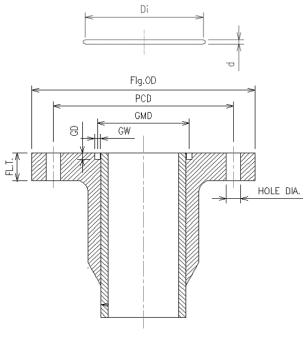
DN 25 - DN 300



DN 400 ABOVE

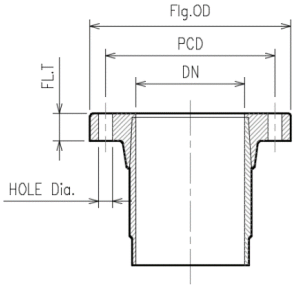
DN	Flg.OD	PCD	HOLE Dia.	BOLT SIZE	NO. OF HOLES	Flange Thickness			Blind Flange Thickness		
						PN 16	PN 10	PN 1	PN 16	PN 10	PN 1
15	95	65	14	M12	4	30	30	20	31	31	31
20	105	75	14	M12	4	30	30	20	31	31	31
25	115	85	14	M12	4	30	30	24	31	31	31
32	140	100	18	M16	4	30	30	21	28	28	27
40	150	110	18	M16	4	30	30	21	28	28	27
50	165	125	18	M16	4	35	35	21	28	28	27
65	185	145	18	M16	8	35	35	30	40	40	39
80	200	160	18	M16	8	40	40	30	40	40	39
100	220	180	18	M16	8	40	40	30	40	40	39
125	250	210	18	M16	8	45	45	30	41	41	39
150	285	240	22	M20	8	45	45	30	39	39	35
200	340	295	22	M20	8	45	45	30	41	40	35
250	397	350	23	M20	12	55	55	33	50	49	43
300	447	400	23	M20	12	55	55	33	53	51	43
350	507	460	23	M20	16	75	60	38	70	58	38
400	567	515	27	M24	16	85	70	38	81	69	35
450	617	565	27	M24	20	95	70	40	87	73	40
500	672	620	27	M24	20	100	75	40	94	78	40
600	782	725	31	M27	20	115	85	40	106	88	38
700	897	840	31	M27	24	125	95	42	123	103	42
800	1017	950	34	M30	24	145	115	42	136	113	40
900	1117	1050	34	M30	28	170	135	43	148	122	43
1000	1232	1160	37	M33	28	180	140	43	161	133	42
1200	1457	1380	40	M36	32	200	155	44	191	157	44

DN	Flg.OD		PCD		HOLE Dia.		BOLT SIZE	NO. OF HOLES	Flange Groove (PN16 & PN10 Only)			O-RING		Flange Thickness			Blind Flange Thickness		
									GMD	GW	GD	Di	d	PN 16	PN 10	PN 1	PN 16	PN 10	PN 1
1400	1679	+7/-2	1590	±2	44	±2	M39	36	1465	29	13	1436	22	145	133	45	215	176	48
1600	1917		1820		50		M45	40	1669	29	13	1640	22	159	146	46	242	198	54
1800	2119	+10/-2	2020	±3	50	±3	M45	44	1877	33	15	1844	25	179	164	48	270	220	60
2000	2329		2230		50		M45	48	2081	33	15	2048	25	194	176	51	295	240	66

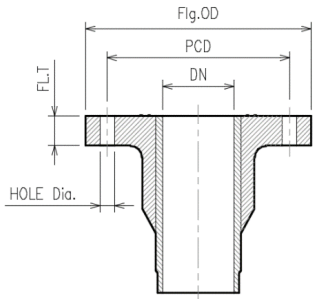


FLANGE – ABOVE DN1200

ISO 7005 / BS EN 1092 PN 16



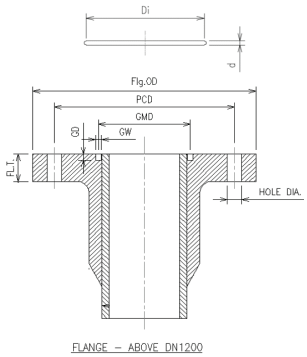
DN 25 - DN 300



DN 400 ABOVE

DN	Flg.OD	PCD	HOLE Dia.	BOLT SIZE	NO. OF HOLES	Flange Thickness			Blind Flange Thickness		
						PN 16	PN 10	PN 1	PN 16	PN 10	PN 1
15	95	65	14	M12	4	30	30	20	31	31	31
20	105	75	14	M12	4	30	30	20	31	31	31
25	115	85	14	M12	4	30	30	24	31	31	31
32	140	100	18	M16	4	30	30	21	28	28	27
40	150	110	18	M16	4	30	30	21	28	28	27
50	165	125	18	M16	4	35	35	21	28	28	27
65	185	145	18	M16	8	35	35	30	40	40	39
80	200	160	18	M16	8	40	40	30	40	40	39
100	220	180	18	M16	8	40	40	30	40	40	39
125	250	210	18	M16	8	45	45	30	41	41	39
150	285	240	22	M20	8	45	45	30	39	39	35
200	340	295	22	M20	12	45	45	30	41	40	35
250	407	355	27	M24	12	55	55	33	50	49	43
300	462	410	27	M24	12	55	55	33	53	51	43
350	522	470	27	M24	16	75	60	38	70	58	38
400	582	525	31	M27	16	85	70	38	81	69	35
450	642	585	31	M27	20	95	70	40	87	73	40
500	717	650	34	M30	20	100	75	40	94	78	40
600	842	770	37	M33	20	115	85	40	106	88	38
700	912	840	37	M33	24	125	95	42	123	103	42
800	1027	950	40	M36	24	145	115	42	136	113	40
900	1127	1050	40	M36	28	170	135	43	148	122	43
1000	1257	1170	43	M39	28	180	140	43	161	133	42
1200	1487	1390	50	M45	32	200	155	44	191	157	44

+5/-1 | ±1.5 | ±1.5
+6/-1.5 | ±2 | ±2
+7/-2

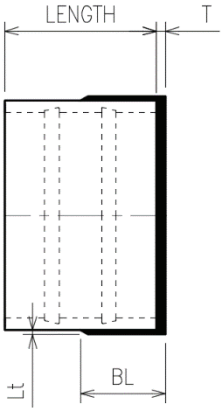


FLANGE – ABOVE DN1200

DN	Flg.OD	PCD	HOLE Dia.	BOLT SIZE	NO. OF HOLES	Flange Groove (PN16 & PN10 Only)			O-RING		Flange Thickness			Blind Flange Thickness		
						GMD	GW	GD	Di	d	PN 16	PN 10	PN 1	PN 16	PN 10	PN 1
1400	1689	1590	50	M45	36	1465	29	13	1436	22	145	133	45	215	176	48
1600	1934	1820	58	M52	40	1669	29	13	1640	22	159	146	46	242	198	54
1800	2134	2020	58	M52	44	1877	33	15	1844	25	179	164	48	270	220	60
2000	2349	2230	64	M56	48	2081	33	15	2048	25	194	176	51	295	240	66

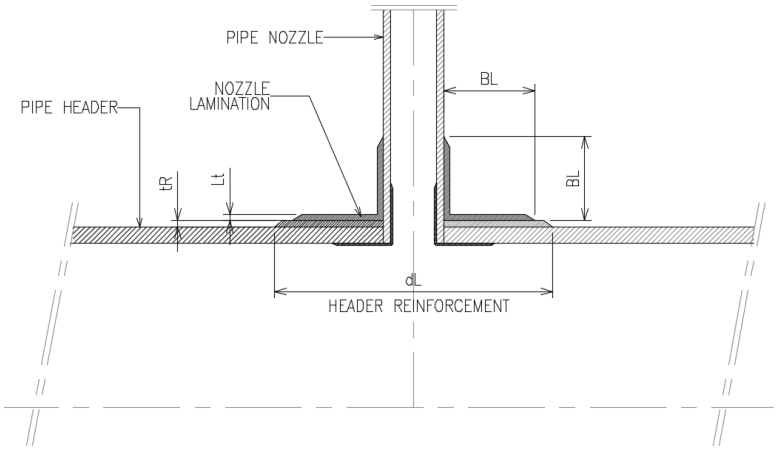
+7/-2 | ±2 | ±2
+10/-2 | ±3 | ±3

9.6 ENDCAP - FLAT



DN	LENGTH	PN 16			PN 10			PN 1		
		T	BL	Lt	T	BL	Lt	T	BL	Lt
80	150	9	100	5	4	100	5	2	100	5
100	150	12	100	5	9	100	5	3	100	5
150	150	18	100	5	14	100	5	4	100	5
200	150	23	100	5	19	100	5	6	100	5
250	150	29	110	6	23	100	5	7	100	5
300	150	35	135	7	28	100	5	9	100	5
350	150	41	155	8	32	115	5	10	100	5
400	150	47	175	9	37	130	6	12	100	5
450	150	53	200	11	42	145	7	13	100	5
500	150	59	220	12	46	165	7	15	100	5
600	150	70	265	14	56	195	9	18	100	5
700	150	82	310	16	65	225	10	21	105	5
800	150	94	350	19	74	260	12	23	120	5
900	150	106	395	21	84	290	13	26	135	5
1000	150	117	440	24	93	325	15	29	145	5
1100	150	129	485	26	102	355	16	32	160	5
1200	150	141	525	28	111	385	18	35	175	5

9.7 GRP NOZZLE



NOZZLES		PN-10				PN-12				PN-16				PN-20				PN-25		
DN	DN1	tR	dL	BL	Lt	tR	dL	BL	Lt	tR	dL	BL	Lt	tR	dL	BL	Lt	tR	dL	BL	Lt
300	20	3	196	75	5	3	181	75	5	3	181	75	5	3	181	75	5	3	181	75	5
350	20	3	196	75	5	3	181	75	5	3	181	75	5	3	181	75	5	3	181	75	5
400	20	3	196	75	5	3	181	75	5	3	181	75	5	3	181	75	5	3	181	75	5
450	20	3	196	75	5	3	181	75	5	3	181	75	5	3	181	75	5	3	183	75	5
500	20	3	196	75	5	3	181	75	5	3	181	75	5	3	181	75	5	4	186	75	5
600	20	3	196	75	5	3	181	75	5	3	181	75	5	3	185	75	5	4	192	75	5
700	20	3	196	75	5	3	181	75	5	3	183	75	5	4	189	75	5	5	198	75	5
800	20	3	196	75	5	3	181	75	5	4	187	75	5	5	194	75	5	6	203	75	5
900	20	3	196	75	5	3	182	75	5	4	190	75	5	5	199	75	5	7	209	75	5
1000	20	3	196	75	5	3	185	75	5	5	194	75	5	6	203	75	5	7	215	75	5
1100	20	3	198	75	5	4	188	75	5	5	198	75	5	6	208	75	5	8	221	75	5
1200	20	3	200	75	5	4	190	75	5	6	202	75	5	7	213	75	5	9	227	75	5
300	50	3	226	75	5	3	181	75	5	3	185	75	5	4	192	75	5	5	200	75	5
350	50	3	226	75	5	3	181	75	5	4	189	75	5	5	198	75	5	6	208	75	5
400	50	3	226	75	5	3	185	75	5	5	194	75	5	6	203	75	5	7	215	75	5
450	50	3	228	75	5	4	188	75	5	5	199	75	5	7	209	75	5	8	222	75	5
500	50	4	231	75	5	4	192	75	5	6	203	75	5	7	215	75	5	9	229	75	5
600	50	4	237	75	5	5	199	75	5	7	213	75	5	9	227	75	5	11	244	75	5
700	50	5	243	75	5	6	206	75	5	8	222	75	5	10	238	75	5	13	258	75	5
800	50	6	248	75	5	7	213	75	5	9	231	75	5	12	250	75	5	14	273	75	5
900	50	7	254	75	5	8	220	75	5	10	240	75	5	13	261	75	5	16	287	75	5
1000	50	7	260	75	5	9	227	75	5	12	250	75	5	14	273	75	5	18	302	75	5
1100	50	8	266	75	5	10	234	75	5	13	259	75	5	16	285	75	5	20	316	75	5
1200	50	9	272	75	5	10	240	75	5	14	268	75	5	17	296	75	5	22	331	75	5
300	80	3	260	75	5	4	190	75	5	6	202	75	5	7	213	75	5	9	227	77	5
350	80	4	264	75	5	5	196	75	5	6	209	75	5	8	222	75	5	10	238	77	5
400	80	5	269	75	5	6	202	75	5	7	216	75	5	9	231	75	5	12	250	77	5
450	80	5	274	75	5	6	207	75	5	8	224	75	5	10	240	75	5	13	261	77	5
500	80	6	278	75	5	7	213	75	5	9	231	75	5	12	250	75	5	14	273	77	5
600	80	7	288	75	5	8	224	75	5	11	246	75	5	14	268	75	5	17	296	77	5
700	80	8	297	75	5	10	235	75	5	13	261	75	5	16	287	75	5	20	319	77	5
800	80	9	306	75	5	11	246	75	5	15	276	75	5	19	305	75	5	23	343	77	5
900	80	10	315	75	5	13	257	75	5	17	291	75	5	21	324	75	5	26	366	77	5
1000	80	12	325	75	5	14	268	75	5	19	305	75	5	23	343	75	5	29	389	77	5
1100	80	13	334	75	5	15	279	75	5	20	320	75	5	26	361	75	5	32	412	77	5
1200	80	14	343	75	5	17	291	75	5	22	335	75	5	28	380	75	5	35	435	77	5

شركة أميانتيت قطر للانابيب و ملحقاتها

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