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Introduction



Gulf manufacturers is one of Rawasi Group companies that widely spread in Arab countries.

GM is one of the major manufactories of pipe and fittings in local and international market, which establish a group of factories to produce all type of plastic pipes and fittings such as (UPVC, CPVC, PE, PP-r) based on the previous experience in the field extended for more than 40 year.

In GM factories we use European technology in all production lines to insure the best quality of our products to guarantee passes all the laboratory testes according to international standards.

our technical support department embrace a well equipped team engineers , always ready to fulfill any kind of requirements and support our client with all propels, advices also provide site demonstrations and training for handling, joining and installation of plastics pipes and fittings (UPVC, CPVC, PE, PP-r).

as a result for our clients confidence and satisfaction the national organization for potable waters and sanitary drainage cuthauiged GM pipes for MDDE (yellow) and HDPE (orange) for using in local and international market for gas application.

In GM we believe in building a long-term business relationship with our customers based on confidence and reliability.

Best regards

Gulf manufacturers company GM. RAWASI



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GM Pipes system





HDPE Pipes and Fittings

- HDPE Review
- Advantages of GM PE Pipes
- Different uses for PE Pipes & Fittings
- Standards
- Laboratory tests at GM Labs
- Pressure test at site
- Joining Methods for PE pipes
- Some of the installation Techniques for PE buried pipelines
- Transmitting, Handling & storing PE pipes
- Repairing methods for PE Pipes
- Chemical resistance data
- HDPE GM FITTINGS


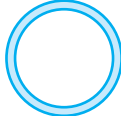
HDPE review

The PE raw material has three generations that started early in 1950 with PE32 & PE63 as 1st generation, 2nd generation, is PE80, and the last & 3rd generation is PE100 early in 1990 which has high performance and economical solution for all application also that stands & thats sutiable for different applications (drinking water, sewage, natural gas..etc) to fight the other traditional pipes.

The main difference between PE80 & PE100 (both PE80 and PE100 is high density polyethylene).

The main difference between PE80 & PE100
 (Both PE80 and PE100 are high denisty polyethylene)

(Table 01)

	PE80	PE100
Min. required strength (MRS)	8 Mpa	10 Mpa
Density	> 0.940 gm/cm ³	> 0.940 gm/cm ³
Elongation at Break	> 500%	> 500%
Pipe P560 PN 10	SDR 11	SDR 17
Min.thickness	41.2mm 	33.2mm 
Weight per metter	66.9 Kg	54.8 Kg

PE100 is more economey than PE80

Advantages of GM PE Pipes



1. High flexibility which allows the network Pipes for elbows to save cost.
2. Excellent traffic load resistance due to its structure which specified as visco_elastic material.
3. PE pipes networks are leakage free as a results for joining by butt fusion welding which form the network as one pipe.
4. Excellent impact resistance.
5. Small pipes diameters deliver in coils which save time and installation cost.
6. Less installation cost due to carrying out all pipe welding outside the trench.



7. Excellent water hammer resistance compared with other type of pipes, the HDPE pipes have visco_elastic beviour which allow the pipe to rereturn back to original shape without any effect.
8. His not affected by harmful material exicted structure of soil for that is not need to cathodic protection.
9. HDPE fittings don't need thrust blocks.
10. High resistance for chemicals at different temperature (see tables).
11. Excellent compatibility with lefiting soil.
12. Excellent resistance to U.V radition - Radiation.
13. High abrasion resistance
14. Do not change the adour and taste of water, for that it is considerd healthy.
15. It is impossible for plant and tree roots to enter in the pipes.
16. Appropriate for under water installation and are not affected by sea water or sea movements.
17. Quick installation.
18. Continuous work without any problem at nominal working pressure for minimum of 50 years.

Different uses for PE pipes

Water Networks:

GM HDPE pipes are used for potable water networks which its not affecting the water properties or validity, as it is chemically inert. In addition, the networks are totally safe and very secure from any leakage problems resulted from water hammering due to the joining methods using butt fusion welding and its high flexibility.

The smooth surface which prevents any kind of bacteria to accumulate makes GM pipes is the most suitable choice when dealing with potable water

Sanitary and industrial drainage:

GM HDPE pipes are used for both sanitary and industrial drainage due to their excellent chemical resistance for (Acids, Alkaline, Salts, ..etc) and their non-penetration nature, besides the network leakage free.

Fire fighting system:

Fire fighting networks suffer from water hammer due to sudden opening and closing valves therefore, HDPE pipes are suitable for these networks with their high resistance for water hammer, this phenomenon (water hammer) has been taken into consideration while drawing regression Curve, which decided the life of HDPE pipes as 50 years (see Chart 01 & .02).

Irrigation flexibility:

Due to flexibility, GM HDPE pipes that have high resistance for environmental conditions, especially ultraviolet rays. Same as PE pipes. One considered the optimum choice for irrigation networks by using it up ground and under ground.

Natural gas networks:

There is no alternative for PE pipes in natural gas networks for their high security levels.

The medium density polyethylene (MDPE) PE 80 yellow colour are used up to 5.5 bar according to PL2 - 1.

GM HDPE (PE 100) pipes with orange color are used with working pressure up to 7.0 Bar according to PL2 - 8. The feeding lines of PE pipes also can be squeezed off in order to stop gas flow during repair & release it again after repairing, according to the regulations of each country.

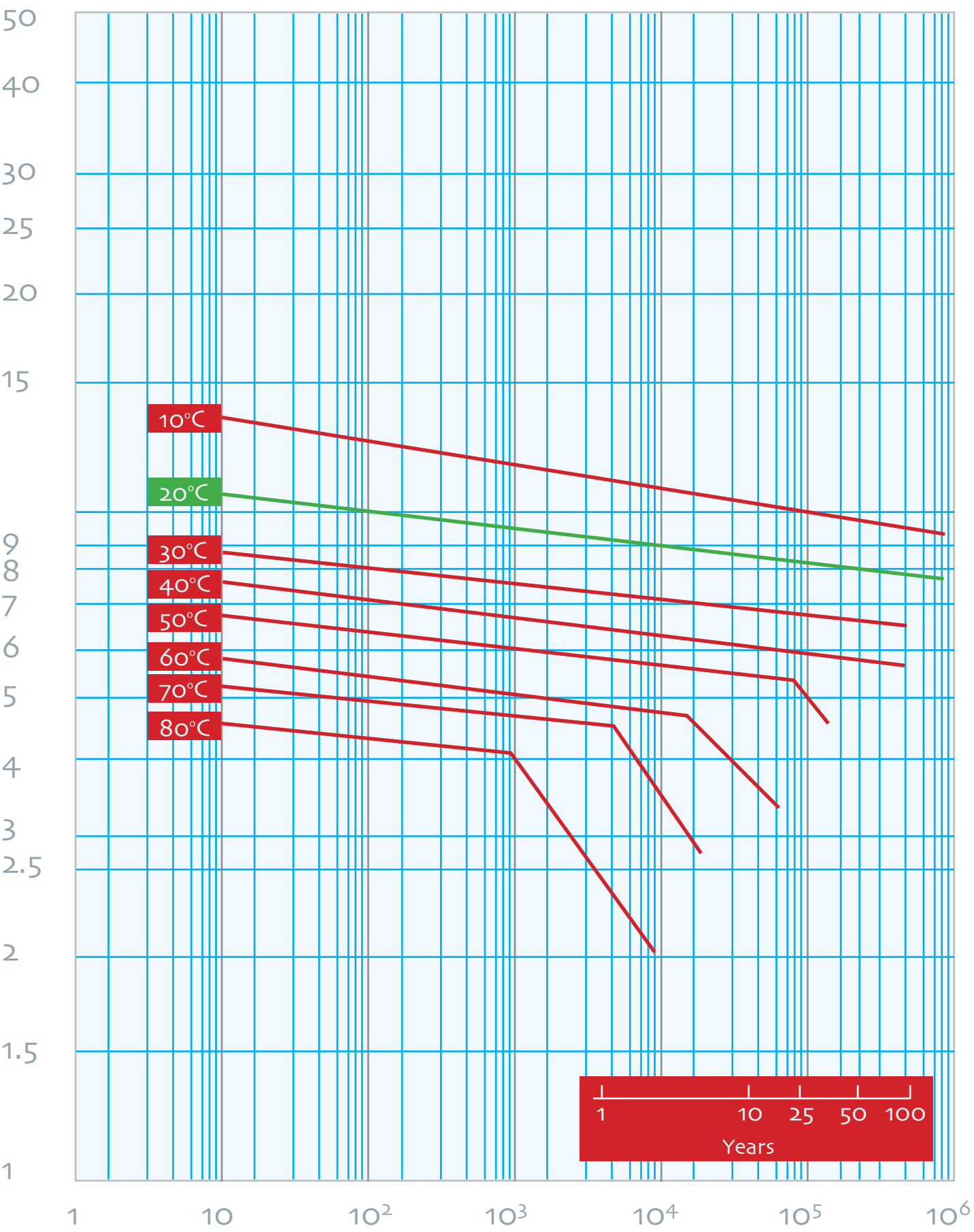
Food stuff transmission lines:

GM (HDPE) pipes are used in foodstuff transmission as (milk products and corns).

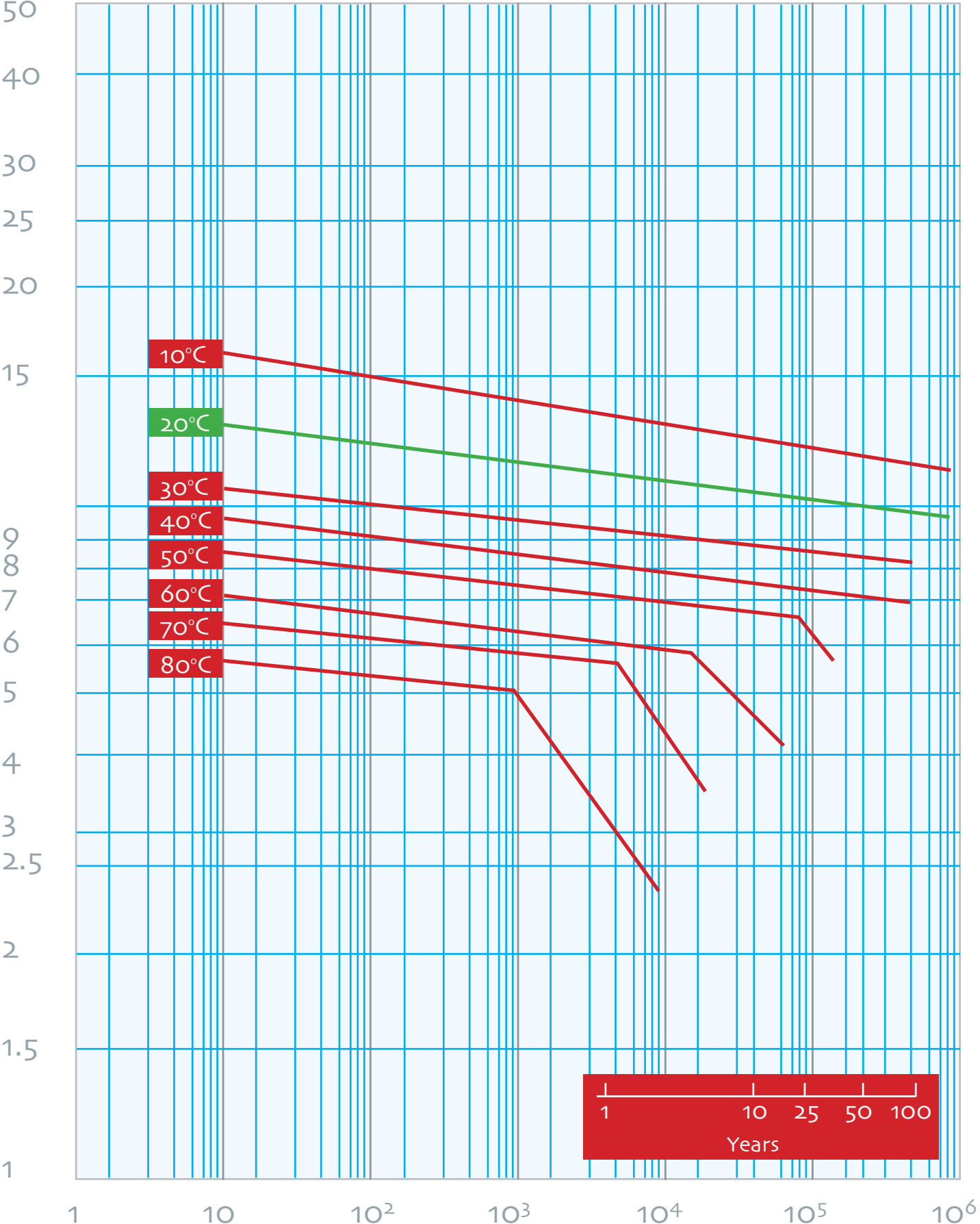
Other uses:

- Siphons under canals, railway lines & aircraft runways where the pipes are installed by directional drilling.
- Cables ducts.
- Water injection system of oil wells.

Log scale: Chart 01 Endurance Diagram of PE 80 Pipes According to Temperature



Log scale: Chart 02 Endurance Diagram of PE 100 Pipes According to Temperature





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Standards

- Potable Water, Sanitary and industrial Drainage, Fire fighting Networks,..etc the DIN 8074 / 75, EN 1221, ASTM, ISO & Egyptian Standards can be applied.
- For Natural Gas Networks BGC PL2 - 1 / 8

How to describe PE pipes:

- PE Pipes are described with outside diameters according to GM catalogue or international standards.
- Decide the type of HDPE {PE 80 (MRS* 8.0 Mpa) or PE 100 (MRS* 10.0 MPA)}
- Dicted the mean out side diameter.
- Then the working pressure is specified directly from the table of dimensions or by using SDR**

$$(SDR^{**}) = \frac{\text{MEAN OUTSIDE DIMAETER}}{\text{MINIMUM THICKNESS}}$$

- *MRS: min. required strength
- **SRS: Standard dimension ratio

HDPE PIPES MANUFACTURING FROM PE 80

WATER NETWORK, DRAINAGE, SEWAGE, FIRE FIGHTING SYSTEM

(Table 03)

mean O.D	PN 2.5 bar			PN 3.2 bar			PN 4.0 bar			PN 5.0 bar			PN 6.3 bar			PN 7.5 bar			PN 8 bar			PN 10 bar			PN 12.5 bar			PN 16 bar		
	SDR 51			SDR 41			SDR 33			SDR 26			SDR 21			SDR 17.6			SDR 17			SDR 13.6			SDR 11			SDR 9		
	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)	i.D	S	W (Kg/m)
25																		21.4	1.8	0.137	21.2	1.9	0.144	20.4	2.3	0.171	19.4	2.8	0.2	
32															28.2	1.8	0.179	28.2	1.9	0.187	27.2	2.4	0.232	26.2	2.9	0.272	24.8	3.6	0.327	
40									36.4	1.8	0.227	36.2	1.9	0.239	35.4	2.3	0.285	35.2	2.4	0.295	34	3	0.356	32.6	3.7	0.43	31	4.5	0.509	
50							46.4	1.8	0.287	46	2	0.314	45.2	2.4	0.374	44.2	2.9	0.44	44	3	0.453	42.6	3.7	0.549	40.8	4.6	0.666	38.8	5.6	0.788
63				59.4	1.8	0.364	59	2	0.399	58	2.5	0.494	57	3	0.58	55.8	3.6	0.688	55.4	3.8	0.721	53.6	4.7	0.873	51.4	5.8	1.05	48.8	7.1	1.26
75	71.4	1.8	0.436	71.2	1.9	0.457	70.4	2.3	0.551	69.2	2.9	0.676	67.8	3.6	0.828	66.4	4.3	0.976	66	4.5	1.02	63.8	5.6	1.24	61.4	6.8	1.47	58.2	8.4	1.76
90	68.4	1.8	0.525	85.6	2.2	0.643	84.4	2.8	0.791	83	3.5	0.978	81.4	4.3	1.18	79.8	5.1	1.39	79.2	5.4	1.46	76.6	6.7	1.77	73.6	8.2	2.12	69.8	10.1	2.54
110	105.6	2.2	0.786	104.6	2.7	0.943	103.2	3.4	1.17	101.6	4.2	1.43	99.4	5.3	1.77	97.4	6.3	2.08	96.8	6.6	2.17	93.8	8.1	2.62	90	10	3.14	85.4	12.3	3.78
125	120	2.5	1	118.8	3.1	1.23	117.2	3.9	1.51	115.4	4.8	1.84	113	6	2.27	110.8	7.1	2.66	110.2	7.4	2.76	106.6	9.2	3.37	102.2	11.4	4.08	97	14	4.87
140	134.4	2.8	1.25	133	3.5	1.54	131.4	4.3	1.88	129.2	5.4	2.32	126.6	6.7	2.83	124	8	3.34	123.4	8.3	3.46	119.4	10.3	4.22	114.6	12.7	5.08	108.6	15.7	6.11
160	153.6	3.2	1.63	152	4	2	150.2	4.9	2.42	147.6	6.2	3.04	144.6	7.7	3.72	141.8	9.1	4.35	141	9.5	4.52	136.4	11.8	5.5	130.8	14.6	6.67	124.2	17.9	7.96
180	172.8	3.6	2.05	171.2	4.4	2.49	169	5.5	3.07	166.2	6.9	3.79	162.8	8.6	4.67	159.6	10.2	5.48	158.6	10.7	5.71	153.4	13.3	6.98	147.2	16.4	8.42	139.8	20.1	10.1
200	192.2	3.9	2.46	190.2	4.9	3.05	187.6	6.2	3.84	184.6	7.7	4.69	180.8	9.6	5.78	177.2	11.4	6.79	176.2	11.9	7.05	170.6	14.7	8.56	163.6	18.2	10.4	155.2	22.4	12.4
225	216.2	4.4	3.12	214	5.5	3.86	211.2	6.9	4.77	207.8	8.6	5.89	203.4	10.8	7.3	199.4	12.8	8.55	198.2	13.4	8.93	191.8	16.6	10.9	184	20.5	13.1	174.6	25.2	15.8
250	240.2	4.9	3.83	237.6	6.2	4.83	234.6	7.7	5.92	230.8	9.6	7.3	226.2	11.9	8.93	221.6	14.2	10.6	220.4	14.8	11	213.2	18.4	13.4	204.6	22.7	16.2	194.2	27.9	19.4
280	269	5.5	4.83	266.2	6.9	5.98	262.8	8.6	7.4	258.6	10.7	9.1	253.2	13.4	11.3	248.2	15.9	13.2	246.8	16.6	13.7	238.8	20.6	16.8	229.2	25.4	20.3	217.4	31.3	24.3

Tolerances on outside diameter and ovality:

(Table 05)

O.D	TOLERANCES	CIRCULARITY TOLERANCES	
		STRAIGHT	COILED PIPES
16	0.3	1.2	1.0
20	0.3	1.2	1.2
25	0.3	1.2	1.5
32	0.3	1.3	2.0
40	0.4	1.4	2.4
50	0.5	1.4	3.0
63	0.6	1.6	3.8
75	0.7	1.6	
90	0.9	1.8	
110	1.0	2.2	
125	1.2	2.5	
140	1.3	2.8	
160	1.5	3.2	
180	1.7	3.6	
200	1.8	4.0	
225	2.1	4.5	
250	2.3	5.0	
280	2.6	9.8	
315	2.9	11.1	
355	3.2	12.5	
400	3.6	14.0	
450	3.8	15.8	
500	4.0	17.5	
560	4.3	19.6	
630	4.6	22.1	
710	4.9	24.9	
800	5.0	28.0	
900	5.0	31.5	
1000	5.0	35	
1100	6.0	38.5	
1200	6.0	42.0	
1400	6.0	49.0	
1600	6.0	56.0	

HDPE PIPES MANUFACTURING FROM PE 100

WATER NETWORK, DRAINAGE, SEWAGE, FIRE FIGHTING SYSTEM

(Table 04)

mean O.D.	PN 3.2 bar			PN 4.0 bar			PN 5.0 bar			PN 6.0 bar			PN 8.0 bar			PN 9.6 bar			PN 10 bar			PN 12.5 bar			PN 16 bar			PN 20 bar							
	SDR 51			SDR 41			SDR 33			SDR 26			SDR 21			SDR 17.6			SDR 17			SDR 13.6			SDR 11			SDR 9							
	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)					
25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	19.4	2.8	0.2	
32	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	24.8	3.6	0.327		
40	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	31	4.5	0.509			
50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	38.8	5.6	0.788			
63	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	51.4	5.8	1.05	48.8	7.1	1.26
75	71.4	1.8	0.436	71.2	1.9	0.457	70.4	2.3	0.551	69.2	2.9	0.675	67.8	3.6	0.828	66.4	4.3	0.976	66	4.5	1.02	63.8	5.6	1.24	61.4	6.8	1.47	58.2	8.4	1.76					
90	86.4	1.8	0.525	85.6	2.2	0.643	84.4	2.8	0.791	83	3.5	0.978	81.4	4.3	1.18	79.8	5.1	1.39	79.2	5.4	1.46	76.6	6.7	1.77	73.6	8.2	2.12	69.8	10.1	2.54					
110	105.6	2.2	0.786	104.6	2.7	0.943	103.2	3.4	1.17	101.6	4.2	1.43	99.4	5.3	1.77	97.4	6.3	2.08	96.8	6.6	2.17	93.8	8.1	2.62	90	10	3.14	85.4	12.3	3.78					
125	120	2.5	1	118.8	3.1	1.23	117.2	3.9	1.51	115.4	4.8	1.84	113	6	2.27	110.8	7.1	2.66	110.2	7.4	2.76	106.6	9.2	3.37	102.2	11.4	4.08	97	14	4.87					
140	134.4	2.8	1.25	133	3.5	1.54	131.4	4.3	1.88	129.2	5.4	2.32	126.6	6.7	2.83	124	8	3.34	123.4	8.3	3.46	119.4	10.3	4.22	114.6	12.7	5.08	108.6	15.7	6.11					
160	153.6	3.2	1.63	152	4	2	150.2	4.9	2.42	147.6	6.2	3.04	144.6	7.7	3.72	141.8	9.1	4.35	141	9.5	4.52	136.4	11.8	5.5	130.8	14.6	6.67	124.2	17.9	7.96					
180	172.8	3.6	2.05	171.2	4.4	2.49	169	5.5	3.07	166.2	6.9	3.79	162.8	8.6	4.67	159.6	10.2	5.48	158.6	10.7	5.71	153.4	13.3	6.98	147.2	16.4	8.42	139.8	20.1	10.1					
200	192.2	3.9	2.46	190.2	4.9	3.05	187.6	6.2	3.84	184.6	7.7	4.69	180.8	9.6	5.78	177.2	11.4	6.79	176.2	11.9	7.05	170.6	14.7	8.56	163.6	18.2	10.4	155.2	22.4	12.4					
225	216.2	4.4	3.12	214	5.5	3.86	211.2	6.9	4.77	207.8	8.6	5.89	203.4	10.8	7.3	199.4	12.8	8.55	198.2	13.4	8.93	191.8	16.6	10.9	184	20.5	13.1	174.6	25.2	15.8					
250	240.2	4.9	3.83	237.6	6.2	4.83	234.6	7.7	5.92	230.8	9.6	7.3	226.2	11.9	8.93	221.6	14.2	10.6	220.4	14.8	11	213.2	18.4	13.4	204.6	22.7	16.2	194.2	27.9	19.4					
280	269	5.5	4.83	266.2	6.9	5.98	262.8	8.6	7.4	258.6	10.7	9.1	253.2	13.4	11.3	248.2	15.9	13.2	246.8	16.6	13.7	238.8	20.6	16.8	229.2	25.4	20.3	217.4	31.3	24.3					

HDPE PIPES MANUFACTURING FROM PE 100

WATER NETWORK, DRAINAGE, SEWAGE, FIRE FIGHTING SYSTEM

(Table 04)

mean O.D	PN 3.2 bar			PN 4.0 bar			PN 5.0 bar			PN 6.0 bar			PN 8.0 bar			PN 9.6 bar			PN 10 bar			PN 12.5 bar			PN 16 bar			PN 20 bar			
	SDR 51			SDR 41			SDR 33			SDR 26			SDR 21			SDR 17.6			SDR 17			SDR 13.6			SDR 11			SDR 9			
	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	
315	302.6	6.2	6.12	299.6	7.7	7.52	295.6	9.7	9.37	290.8	12.1	11.6	279.2	17.9	16.7	277.6	18.7	17.4	268.6	23.2	21.2	266.6	268.6	23.2	21.2	266.6	286	25.6	244.6	30.8	
355	341	7	7.73	337.6	8.7	9.55	333.2	10.9	11.8	327.8	13.6	14.6	314.8	20.1	21.2	312.8	21.1	22.1	302.8	26.1	26.9	290.6	290.6	32.2	32.5	275.6	39.7	39.1			
400	384.2	7.9	9.82	380.4	9.8	12.1	375.4	12.3	15.1	369.4	15.3	18.6	354.6	22.7	26.9	352.6	23.7	28	341.2	29.4	34.1	327.4	327.4	36.3	41.3	310.6	44.7	49.6			
450	432.4	8.8	12.3	428	11	15.3	422.4	13.8	19	415.6	17.2	23.5	396.6	26.7	34	396.6	26.7	35.4	383.8	33.1	43.2	368.2	368.2	40.9	52.3	349.4	50.3	62.7			
500	480.4	9.8	15.2	475.4	12.3	19	469.4	15.3	23.4	461.8	19.1	28.9	443.2	28.4	42	440.6	29.7	43.8	426.4	36.8	53.3	409.2	409.2	45.4	64.5	388.4	55.8	77.3			
560	538	11	19.1	532.6	13.7	23.6	525.6	17.2	29.4	517.2	21.4	36.2	496.6	31.7	52.5	493.6	33.2	54.8	477.6	41.2	66.9	458.4	458.4	50.8	80.8	435	62.5	97			
630	605.4	12.3	24	599.2	15.4	29.9	591.4	19.3	37.1	581.8	24.1	45.9	558.6	35.7	66.5	555.2	37.4	69.4	537.4	46.3	84.6	515.6	515.6	57.2	102		0				
710	682.2	13.9	30.5	675.2	17.4	38	666.4	21.8	47.2	655.6	27.2	58.4	642.2	33.9	71.8	705.2	47.4	88.1	605.6	52.2	107	581	581	64.5	130		0				
800	768.6	15.7	38.8	760.8	19.6	48.1	751	24.5	59.7	738.8	30.6	73.9	709.4	45.3	107	705.2	47.4	112	682.4	58.8	136	654	654	73	165						
900	864.8	17.6	48.9	856	22	60.9	844.8	27.6	75.6	831.2	34.4	93.4	798	51	136	793.4	53.3	141	767.8	66.1	172										
1000	960.8	19.6	60.5	951	24.5	75.2	938.8	30.6	93.1	923.6	38.2	115	886.6	56.7	167	881.4	59.3	175	853	73.5	203										
1100	1056.8	21.6	70	1046.4	26.8	86	1033.2	33.4	107	1015.4	42.3	134	975	62.5	194	970.6	64.7	200	940	80	244										
1200	1153	23.5	87	1141.2	29.4	108	1126.6	36.7	134	1108.2	45.9	166	1064	68	241	1058.8	70.6	250													
1400	1345.2	27.4	118	1331.2	34.4	147	1314.2	42.9	183	1293	53.5	226	1242	79	335	1234	83	328													
1600	1537.4	31.3	154	1521.6	39.2	192	1502	49	238	1477.6	61.2	295	1448	76	372																

Standards

Wall Thickness tolerance:

(Table 06)

Wall thickness	Tolerances
up to 2	0.4
over 2 to 3	0.5
over 3 to 4	0.6
over 4 to 5	0.7
over 5 to 6	0.8
over 6 to 7	0.9
over 7 to 8	1.0
over 8 to 9	1.1
over 9 to 10	1.2
over 10 to 11	1.3
over 11 to 12	1.4
over 12 to 13	1.5
over 13 to 14	1.6
over 14 to 15	1.7
over 15 to 16	1.8
over 16 to 17	1.9
over 17 to 18	2.0
over 18 to 19	2.1
over 19 to 20	2.2
over 20 to 21	2.3
over 21 to 22	2.4
over 22 to 23	2.5
over 23 to 24	2.6
over 24 to 25	2.7
over 25 to 26	2.8

Wall thickness	Tolerances
over 26 to 27	2.9
over 27 to 28	3.0
over 28 to 29	3.1
over 29 to 30	3.2
over 30 to 31	3.3
over 31 to 32	3.4
over 32 to 33	3.5
over 33 to 34	3.6
over 34 to 35	3.7
over 35 to 36	3.8
over 36 to 37	3.9
over 37 to 38	4.0
over 38 to 39	4.1
over 39 to 40	4.2
over 40 to 41	4.3
over 41 to 42	4.4
over 42 to 43	4.5
over 43 to 44	4.6
over 44 to 45	4.7
over 45 to 46	4.8
over 46 to 47	4.9
over 47 to 48	5.0
over 48 to 49	5.1
over 49 to 50	5.2
over 50 to 51	5.3

Wall thickness	Tolerances
Over 51 to 52	5.4
Over 52 to 53	5.5
Over 53 to 54	5.6
Over 54 to 55	5.7
Over 55 to 56	5.8
Over 56 to 57	5.9
Over 57 to 58	6.0
Over 58 to 59	6.1
Over 59 to 60	6.2
Over 60 to 61	6.3
Over 61 to 62	6.4
Over 62 to 63	6.5
Over 63 to 64	6.6
Over 64 to 65	6.7
Over 65 to 66	6.8
Over 66 to 67	6.9
Over 67 to 68	7.0
Over 68 to 69	7.1
Over 69 to 70	7.2

Table – Mean Outside diameter and wall thicknesses for gas pipe (SDR11) according to PL2 - 1 / 8:

(Table 07)

Nominal Outside diameter (size) (d)	Mean outside diameter (de) mm		Wall thicknesses SDR 11 mm	
	Minimum	maximum	Minimum	maximum
Mm				
16*	16	16.3	2.3	2.7
20*	20	2.3	2.3	2.7
25	25	25.3	2.3	2.7
32	32	32.3	3.0	3.4
50	50	50.4	4.6	5.2
63	63	63.4	5.8	6.5
75	75	75.5	6.8	7.6
90	90	90.6	8.2	9.2
125	125	125.8	11.4	12.7
140	140	140.9	12.7	141.1
180	180	181.1	16.4	18.2
200	200	201.2	18.2	20.2
250	250	251.5	22.7	25.1
280	280	281.7	25.4	28.1
315	315	316.9	28.6	31.6
355	355	357.2	32.3	35.7
400	400	402.4	36.4	40.2
500	500	503.0	45.5	50.2



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Laboratory tests at GM Labs

Firstly:
Acceptance tests for raw materials:



These tests are carried out according to the international standards (DIN, ISO, EN, BS, ASTM, Eg, BG requirements) GM labs.

Density:

This test is carried out by using a programmable apparatus through sensitive scale with accuracy up to 0.1 mgm.

Melt flow index:

This test is carried out by using a programmable apparatus, which has the procedure of test according to international standards as built in.

Moisture content:

This test is carried out by using a programmable apparatus, which measures the moisture content in the raw material.

Oxidation induction time:

A programmable carries out this test at different temperature according to international standards.

Secondly:

Tests on PE Pipes & Fittings which are used in potable water, sanitary drainage, fire fighting networks ..etc..

All test carried according To international standards:

Diamenions measurments:

appearance, this means outside diameter, wall thickness & the ovality of pipes. These are measured by using instruments with accuracy up to 0.01mm. these dimensions are measured. Also by using ultrasonic facility equipped with GM production line.

Tensile test:

This test is carried out by using tensile machine, which has the facility to record the yild stress and elongation percentage through PC unit equeppied with tensile machine

Oxidation Induction Time:

This test measure the oxidation induction time of pipes at different levels of wall thickness (outer surface, midlle of wall and inner surface).

Heat revesion test:

This test is carried out by using a furnace with accuracy 0.1°C and a marking apparatus with accuracy 0.01 mm.

Hydrostatic pressure test:

This test is carried by using hydrostatic pressure station and conditional tanks (20 °C, 80°C) which is controlled by PC unit, to hold the pressure test value constant during test period.

Laboratory tests at GM Labs

Tests which are carried on the pipes used in Natural Gas Networks:

All tests are carried out according to BGC-PL2 - 1 for MDPE (PE80) with yellow color & BGC-PL2 - 8 for HDPE (PE100) with orange color.

Batch release test programme for pipes:

(Table 08)

Description of test	Initial frequency of test
Density	Daily, rotating sizes and machines
Melt flow rate	Daily
Outside diameter and wall thickness (wall thickness monitor shall be used)	Every 2h for each size and machine
Ovality of coiled pipe on coil/drum (90 mm and above only)	Every seven days or each batch from polymer supplier as appropriate
Pigment dispersion	Every seven days or each batch from polymer supplier as appropriate
Oxidation induction time	Every seven days on pipes, rotating sizes and machines
Pipe end circumferential reversion	On start up then every working shift of production for each size and machine
Tensile strength and elongation	Every working shift of production for each size and machine
Hydrostatic pressure resistance at 80 °C (unnotched pipe) (below 63mm only)	First product from each extrusion run then one sample/size/extruder per week
Hydrostatic pressure resistance at 80 °C (unnotched pipe) (63mm and above only)	First product from each extrusion run then one sample/size/extruder per week

Pressure test method on site for P.E pipe lines

First method:

- 1- the PE Pipe line must be filled with water 24 hours at least prior to the starting of the pressure test
- 2- ensure that the system is entirely ventilated
- 3- calibrated pressure indicator must be installed with the system.
- 4- Start raising the pressure gradually
- 5- Stop the water pumping at 1.5 working pressure of P.E pipes.
- 6- Keep the pressure for two hours and feed the system with water to compensate the drop of pressure durring the first hour as a result of a relaxtion phenomenon.
- 7- The permissible drop of pressure during the second hour around 15% of pressure test, some factors can be affected by increasing or decreasing the percentage of pressure drop such as pipe network length, pipe diameter, thickness of pipe, (the suitable length is 500 meter, and temperature is 20°C).

Second Method:

- 1- The steps from 1 to 5 Completly done.
- 2- During the 2 hours after the network rech to 1.5 working pressure, the pressure value must be compensated.
- 3- The drop in pressure in this case around 5% and depending on length of pipe line, ambient temperature (Suitable length is 500 meters and temperature is 20°C).

Notes:

The working pressure calculated at 20 °C for 50 years according to international standards defination for that when the pipe line tested above ground, the working pressure will be changed aginst ambient temperature changed see table (09, 10) working pressure aginst temparture at 50 years.

Ventilation

Manometer

pressure testing HDPE line

Pressure testing pump

WORKING PRESSURE WITH DIFFERENT SERVICE LIFE PERIODE AND DIFFERENT TEMPERATURE FOR PE80

(Table 09)

Tem- pera- ture, in °C	Years of service	Pipe series													
		25	20	16	12.5	10.5	10	8.3	8	6.3	5	4	3.2	2.5	2
		Standard dimension ratio (SDR)													
		51	41	33	26	22	21	17.6	17	13.6	11	9	7.4	6	5
Allowable working pressure															
10	5	3.1	4.0	5.0	6.3	7.5	7.9	9.4	10.1	12.6	15.8	20.2	25.3	31.6	40.5
	10	3.1	3.9	4.9	6.2	7.4	7.8	9.3	9.9	12.4	15.5	19.8	24.8	31.0	39.7
	25	3.0	3.8	4.8	6.0	7.2	7.6	9.0	9.7	12.1	15.1	19.4	24.2	30.3	38.8
	50	2.9	3.8	4.7	5.9	7.1	7.5	8.9	9.5	11.9	14.8	19.0	23.8	29.7	38.0
	100	2.9	3.7	4.6	5.8	7.0	7.3	8.7	9.3	11.6	14.6	18.7	23.3	29.2	37.4
20	5	2.6	3.4	4.2	5.3	6.3	6.6	7.9	8.5	10.6	13.2	17.0	21.2	26.5	34.0
	10	2.6	3.3	4.1	5.2	6.2	6.5	7.8	8.3	10.4	13.0	16.7	20.8	26.0	33.4
	25	2.5	3.2	4.0	5.0	6.1	6.4	7.6	8.1	10.1	12.7	16.2	20.3	25.4	32.5
	50	2.5	3.2	4.0	5.0	6.0	6.3	7.5	8.0	10.0	12.5	16.0	20.0	25.0	32.0
	100	2.4	3.1	3.9	4.9	5.8	6.1	7.3	7.8	9.8	12.2	15.7	19.6	24.5	31.4
30	5	2.2	2.8	3.6	4.5	5.4	5.6	6.7	7.2	9.0	11.2	14.4	18.0	22.5	28.9
	10	2.2	2.8	3.5	4.4	5.3	5.5	6.6	7.0	8.8	11.0	14.1	17.7	22.1	28.3
	25	2.1	2.7	3.4	4.3	5.1	5.4	6.4	6.9	8.6	10.8	13.8	17.3	21.6	27.6
	50	2.1	2.7	3.3	4.2	5.0	5.3	6.3	6.7	8.4	10.6	13.5	16.9	21.2	27.1
40	5	1.9	2.4	3.1	3.8	4.6	4.8	5.8	6.2	7.7	9.6	12.4	15.5	19.3	24.8
	10	1.9	2.4	3.0	3.8	4.5	4.7	5.7	6.0	7.6	9.5	12.1	15.2	19.0	24.3
	25	1.8	2.3	2.9	3.7	4.4	4.6	5.5	5.9	7.4	9.2	11.8	14.8	18.5	23.7
	50	1.8	2.3	2.9	3.6	4.3	4.5	5.4	5.8	7.2	9.1	11.6	14.5	18.2	23.3
50	5	1.6	2.1	2.6	3.3	4.0	4.2	5.0	5.3	6.7	8.4	10.7	13.4	16.8	21.5
	10	1.6	2.0	2.5	3.2	3.8	4.0	4.8	5.1	6.4	8.1	10.3	12.9	16.2	20.7
	25	1.4	1.8	2.2	2.8	3.4	3.6	4.3	4.5	5.7	7.1	9.1	11.4	14.3	18.3
60	5	1.1	1.4	1.8	2.2	2.7	2.8	3.3	3.6	4.5	5.6	7.2	9.0	11.3	14.4
70	2	0.8	1.1	1.3	1.7	2.0	2.2	2.6	2.7	3.4	4.3	5.5	6.9	8.7	11.1

WORKING PRESSURE WITH DIFFERENT SERVICE LIFE PERIODE AND DIFFERENT TEMPERATURE FOR PE100

(Table 010)

Tem- pera- ture, in °C	Years of service	Pipe series													
		25	20	16	12.5	10.5	10	8.3	8	6.3	5	4	3.2	2.5	2
		Standard dimension ratio (SDR)													
		51	41	33	26	22	21	17.6	17	13.6	11	9	7.4	6	5
Allowable working pressure															
10	5	4.0	5.0	6.3	7.9	9.4	10.1	12.1	12.6	15.7	20.2	25.2	31.5	40.4	50.5
	10	3.9	4.9	6.2	7.8	9.3	9.9	11.9	12.4	15.5	19.8	24.8	31.0	39.7	49.6
	25	3.8	4.8	6.0	7.6	9.0	9.6	11.6	12.1	15.1	19.3	24.2	30.2	38.7	48.4
	50	3.8	4.7	5.9	7.5	8.9	9.5	11.4	11.9	14.8	19.0	23.8	29.7	38.0	47.6
	100	3.7	4.6	5.8	7.3	8.7	9.3	11.2	11.6	14.6	18.7	23.3	29.2	37.4	46.7
20	5	3.3	4.2	5.3	6.6	7.9	8.4	10.2	10.6	13.2	16.9	21.2	26.5	33.9	42.4
	10	3.3	4.1	5.2	6.5	7.8	8.3	10.0	10.4	13.0	16.6	20.8	26.0	33.3	41.6
	25	3.2	4.0	5.0	6.4	7.6	8.1	9.8	10.1	12.7	16.2	20.3	25.4	32.5	40.7
	50	3.2	4.0	5.0	6.3	7.5	8.0	9.6	10.0	12.5	16.0	20.0	25.0	32.0	40.0
	100	3.1	3.9	4.9	6.1	7.3	7.8	9.4	9.8	12.2	15.7	19.6	24.5	31.4	39.2
30	5	2.8	3.6	4.5	5.6	6.7	7.2	8.6	9.0	11.2	14.4	18.0	22.5	28.8	36.0
	10	2.8	3.5	4.4	5.5	6.6	7.0	8.5	8.8	11.0	14.1	17.7	22.1	28.3	35.4
	25	2.7	3.4	4.3	5.4	6.4	6.9	8.3	8.6	10.8	13.8	17.3	21.6	27.6	34.5
	50	2.7	3.3	4.2	5.3	6.3	6.7	8.1	8.4	10.6	13.5	16.9	21.2	27.1	33.9
40	5	2.4	3.0	3.8	4.8	5.8	6.1	7.4	7.7	9.6	12.3	15.4	19.3	24.7	30.9
	10	2.4	3.0	3.8	4.7	5.7	6.0	7.3	7.6	9.5	12.1	15.2	19.0	24.3	30.4
	25	2.3	2.9	3.7	4.6	5.5	5.9	7.1	7.4	9.2	11.8	14.8	18.5	23.7	29.7
	50	2.3	2.9	3.6	4.5	5.4	5.8	7.0	7.2	9.1	11.6	14.5	18.2	23.3	29.1
50	5	2.1	2.6	3.3	4.2	5.0	5.3	6.4	6.7	8.3	10.7	13.4	16.7	21.4	26.8
	10	2.0	2.6	3.2	4.0	4.8	5.2	6.2	6.5	8.1	10.4	13.0	16.2	20.3	26.0
	25	1.9	2.3	2.9	3.7	4.4	4.7	5.7	5.9	7.4	9.5	11.8	14.8	19.0	23.7
60	5	1.5	1.9	2.4	3.0	3.6	3.8	4.6	4.8	6.0	7.7	9.7	12.1	15.5	19.4
70	2	1.2	1.5	1.9	2.4	2.9	3.1	3.7	3.9	4.9	6.2	7.8	9.8	12.5	15.7



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Joining Methods for PE pipes



Butt fusion welding:

This method is carried out as follows:

- fix the pipes at welding machine with clamps
- clean the outsides and inside surfaces by dry cloth
- Match the ends of both pipes using milling machine provided with the welding machine.
- Insert the heating mirror between the two ends of pipes (temperature 210 °C) and apply the pressure on pipes according to table provided with the machine
- Wait till the bead of weld reach approximately 2mm.
- Release the pressure applied on welded pipe (heat up), leave the pipe at the necessary time according to the welding table provided with the machine.
- Remove the heating mirror
- Join the surfaces and increase the pressure up to the value in the welding table provided with the machine
- Check the welding visually.

Electro fusion welding:

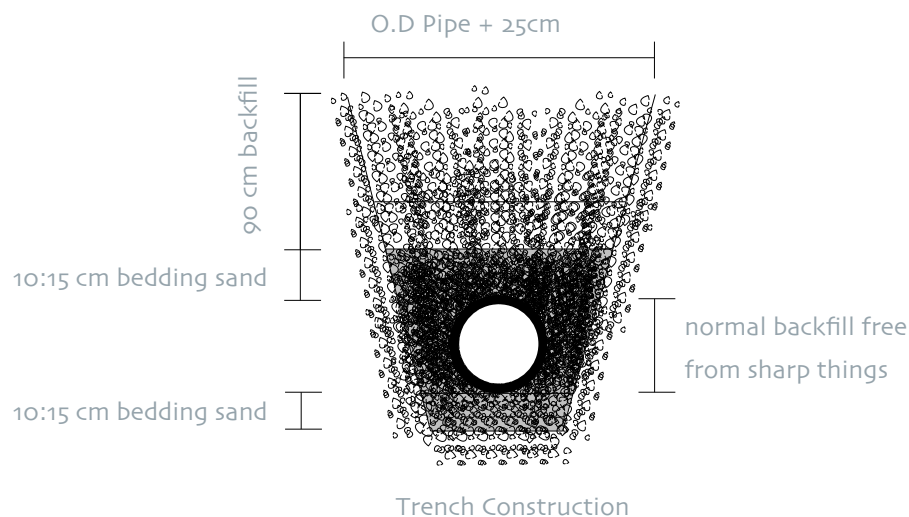
This method is carried out by using a coupler having coil built in and special machine as follows:

1. scrape the part in outer surface of the pipe, which will be connected with the coupler.
2. Clean the two surfaces of both pipes
3. Insert both ends of the two pipes inside the coupler
4. By using bar code, feed the electro fusion machine with a welding parameter founded in coupler.

Some of the installation Techniques for PE buried pipelines

Installation at open trench:-

Due to the possibility of welding PE pipes outside the trench and draw it after welding, the trench should have a narrow width which reduce the digging costs. In general, the trench width is about (outside diameter + 25cm) the trench construction and dimensions are shown in the below



Notes:

The dimensions mentioned in this figure one used as a refrance dimensions, the contractors should review this dimension with GM techenical support department

Directional drilling:

This method is carried out by using a drilling tool equipped with a directional apparatus to avoid any obstacles (pipes, cables, ... etc) during drilling. After the drilled reaches the required dimension, weld the pulling head to PE line and drop it inside the hole as shown in the above figure:

Transmitting, Handling and storing PE pipes

Instructions for handling & storing PE pipes

1. avoid dropping the pipes on the ground while downloading them.
2. Avoid any metals to touch the pipes.
3. Avoid exposing the pipes to direct sunrays.
4. The storing place must be away from any heating sources
5. Storing must be on a flat ground the height of storing the pipes shouldnt exceed 1.5 meter, pipes should be stored in a pyramidal shape.



Transmitting & downloading the pipes:

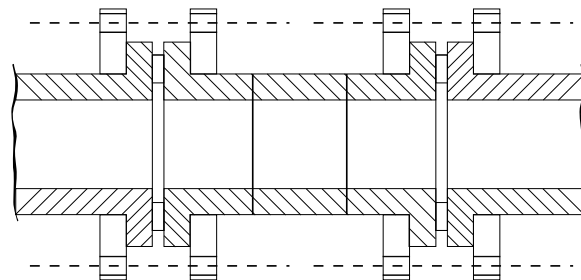
- The pipes are transmitted on wooden walls in a pyramidal shape or in bundles as shown in figure
- The pipes are downloaded by using cranes, avoid using metal belts touching the pipes
- Pipes also can be downloaded by rolling them on wooden walls.

Repairing methods for PE Pipes

1. Using stub flanges:

The steps of repairing are as follows:

1. Cut the defected part of pipe
2. Weld the stub flange at each of the pipes ends
3. Replace the defect pipe with the same length of good pipe equipped with two stubflange.
4. Assemble according to the figure below



2. using steel coupling:

this methods is carried out by using steel coupling equipped with rubber sealing as follows:

if the damage is small that it can be covered through the coupling area, it can hold the coupling directly at the damage area.

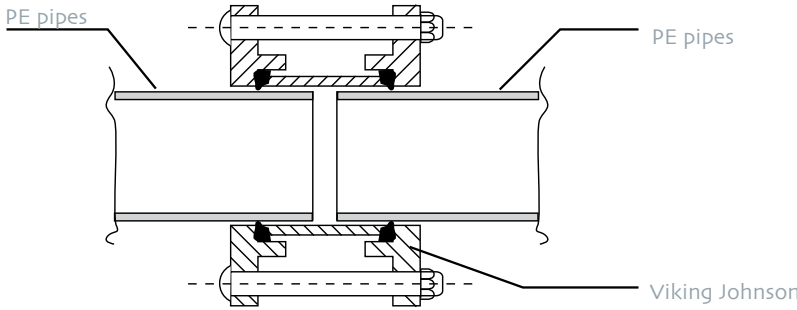
If the damage couldn't be covered by coupling, follow these procedures :

- a. cut the defected pipe part
- b. Assemble the new pipe instead of the removable part using the two steel coupler as shown in the figure:



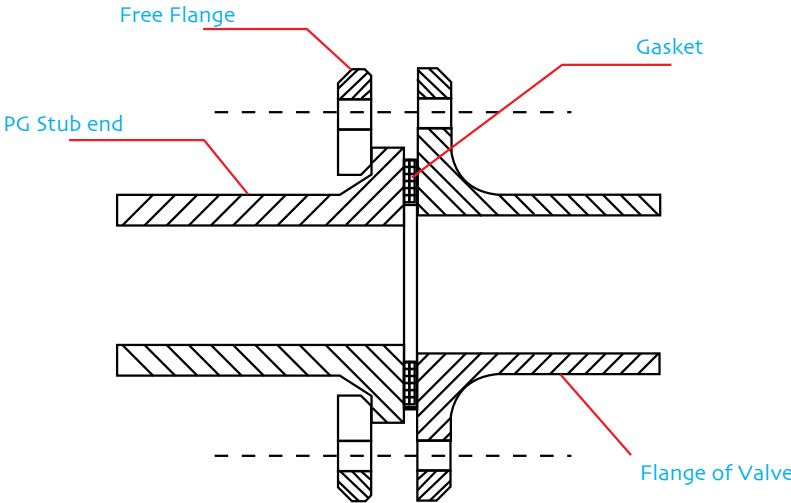
3. Using Viking Johnson:

This method has the same procedures as steel coupling the below figure illustrates the Viking Johnson fitting and how to fit it with PE pipes.



Joining by using stub flange:

This method is carried out by using stub flange with free flange to join the PE pipes with other types of pipes or valves as shown in the figure below



Effect of Chemicals on HDPE:

The following tables illustrate the effect of some of the chemical materials (acids, alkaline, salts,...etc) on HDPE pipes on different temperatures according to the following symbols:

Susp.	Suspension prepared in saturated solution	op.sol.	Operational solution
Sat.sol.	Saturated liquid solution	R	Resistance
l.tp.	liquid in technical purity	LR	Limited Resistance
g.tp.	Gas in technical purity	NR	Non-resistance

Name of Chemical	% Conct.	T (C°)	Degree of Rasistance
Adipic acid	sat.sol. % 1.4	20	
		60	R
Allele alcohol	l.tp	20	R
		60	R
Aluminium hydroxide	susp.	20	R
		60	R
Ammonium, dry gas	g.tp	20	R
		60	R
Ammonium, liquid	sta.sol.	20	R
		60	R
	g.tp	20	R
		60	R
Ammonium chloride	sta.sol.	20	R
		60	R
Ammonium sulphide	sta.sol.	20	R
		60	R
Aniline	sta.sol.	20	R
		60	
Acetic acid	50	20	
		60	R
Acetic acid, freezes	> 96	20	
		60	R
Acetone	l.tp.	20	LR
		60	LR
Copper (II) sulphate	sta.sol.	20	LR
		60	R
Benzene	l.tp	20	
		60	LR
Benzene (fuel)	sta.sol.	20	R
		60	R
Beer	op.sol.	20	
		60	
Vegetables oils	l.tp	20	R
		60	R
Butane, gas	g.tp	20	R
		60	R
Mercury	l.tp	20	R
		60	R
Iron (II) and (III) chloride	sat.sol.	20	R
		60	LR
Ethanol	40	20	R
		60	R
Ethylene glycol	l.tp	20	R
		60	R
Phenol	sol.	20	R
		60	R
Formaldehyde	30 - 40	20	R
		60	R
Glycerine	l.tp	20	R
		60	R
Air	g.tp	20	R
		60	R
Hydrogen	g.tp	20	R
		60	R
Hydrogen peroxide	30	20	R
		60	R
Hydrochloric acid	30	20	R
		60	R
	derisik	20	R
		60	R
urine		20	NR
		60	NR
Iodine (in alcohol)	op.sol.	20	R
		60	R
Calcium	susp	20	
		60	

Name of Chemical	% Conct.	T (C°)	Degree of Rasistance
Calcium	sat.sol.	20	R
		60	R
Carbon dioxide moisted gas	g.tp	20	R
		60	R
Carbon moisted gas	g.tp	20	R
		60	LR
Carbon tetrachloride	g.tp	20	NR
		60	LR
Chlorine (dry gas)	g.tp	20	NR
		60	LR
Water with Chlorine	sat.sol.	20	NR
		60	NR
Chloroform	l.tp	20	NR
		60	R
Lead acetate	sat.sol.	20	R
		60	R
Sulphur dioxide dry gas		20	R
		60	R
Methyl Alcohol	l.tp	20	R
		60	R
	10	20	R
		60	R
Nitric acid	25	20	R
		60	NR
		20	NR
	> 50	60	NR
		20	NR
		60	NR
With fumed nitrogen oxide		20	NR
		60	R
Oxygen, gas	g.tp	20	LR
		60	R
Potassium hydroxide	sol.	20	R
		60	
	up to 50	20	R
		60	R
Cyclohexanole	ts-k	20	R
		60	R
Sodium bicarbonate	sat.sol.	20	R
		60	R
Vinegar	op.sol.	20	R
		60	R
Sodium hydroxide	sol.	20	R
		60	R
	40	20	R
		60	R
Sodium carbonate	sat.sol.	20	R
		60	R
		20	R
	up to 50	60	R
		20	R
		60	R
Sodium chloride	sat.sol.	20	R
		60	R
Sodium sulphate	sat.sol.	20	R
		60	R
Water distilled sea		20	R
		60	R
Water, usage, mineral	op.sol.	20	R
		60	R
		20	R
	10 30	60	R
		20	R
		60	R
Sulphuric acid	50	20	R
		60	NR
		20	NR
	98	60	NR
		20	R
		60	R
Milk	op.sol.	20	R
		60	R
Wine	op.sol.	20	LR
		60	NR
Toluene	g.tp	20	NR
		60	NR
Trichloroethylene	g.tp	20	R
		60	R
Urea	sol.	20	R
		60	LR
Oils (vegetable and animal)	g.tp	20	
		60	



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GM Pipes system





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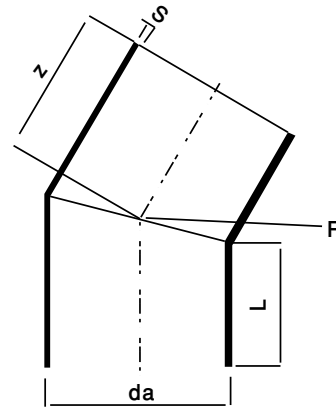
GM Pipes system



HDPE GM FITTINGS

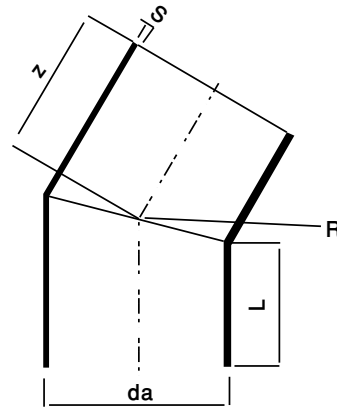
GM fabricates segmented HDPE fittings (Elbows, tees) according to the dimensions in this catalogue. GM can also fabricate the segmented fittings with special dimensions according to customers request.

Stub flanges and reducers are fabricated according to the dimensions in this catalogue by machining operation or injection also GM can manufacturers reducers and stub flanges with special dinemnsions according to customer request. All HDPE fittings are tested according to international standards.



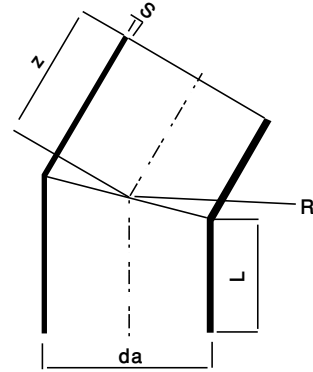
11.25° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	160
90	150	135	162
110	150	165	165
125	150	188	167
140	150	210	168
160	150	240	171
180	150	270	174
200	150	300	177
225	150	338	180
250	250	375	283
280	250	420	288
315	300	473	342
355	300	533	348
400	300	600	353



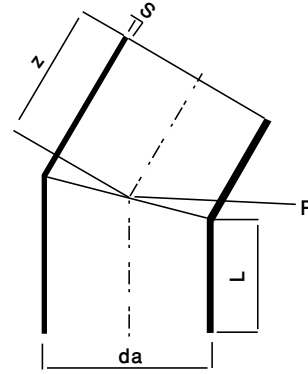
11.25° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	361
500	300	750	367
560	350	840	425
630	350	945	435
710	350	1065	445
800	350	1200	458
900	400	1350	520
1000	400	1500	534
1100	400	1650	552
1200	400	1800	561
1400	450	2100	582
1600	450	2400	595



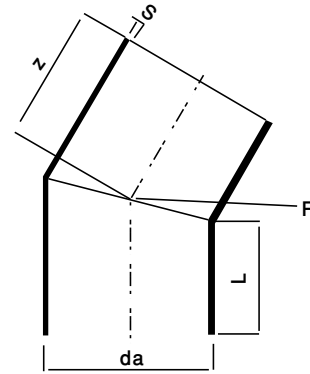
22.5° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	200
90	150	135	202
110	150	165	211
125	150	188	223
140	150	210	231
160	150	240	243
180	150	270	255
200	150	300	266
225	150	338	281
250	250	375	345
280	250	420	363
315	300	473	484
355	300	533	507
400	300	600	533



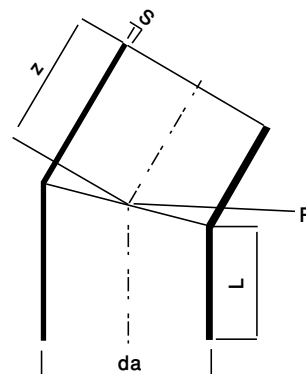
22.5° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	562
500	300	750	591
560	350	840	676
630	350	945	717
710	350	1065	763
800	350	1200	816
900	400	1350	820
1000	400	1500	834
1100	400	1650	852
1200	400	1800	861
1400	450	2100	882
1600	450	2400	895



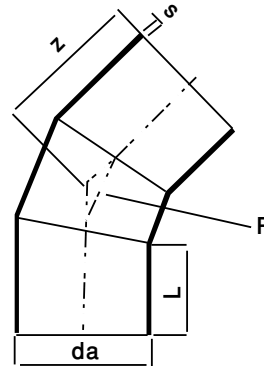
30° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	200
90	150	135	202
110	150	165	211
125	150	188	223
140	150	210	231
160	150	240	243
180	150	270	255
200	150	300	266
225	150	338	281
250	250	375	345
280	250	420	363
315	300	473	484
355	300	533	507
400	300	600	533



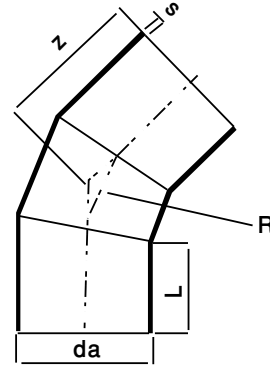
30° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	562
500	300	750	591
560	350	840	676
630	350	945	717
710	350	1065	763
800	350	1200	816
900	400	1350	820
1000	400	1500	834
1100	400	1650	852
1200	400	1800	861
1400	450	2100	882
1600	450	2400	895



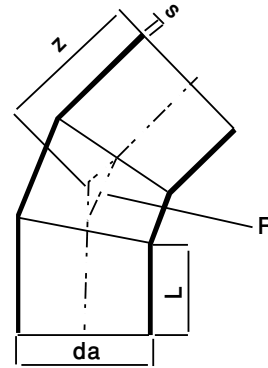
45° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	200
90	150	135	202
110	150	165	211
125	150	188	223
140	150	210	231
160	150	240	243
180	150	270	255
200	150	300	266
225	150	338	201
250	250	375	354
280	250	420	367
315	300	473	431
355	300	533	447
400	300	600	467



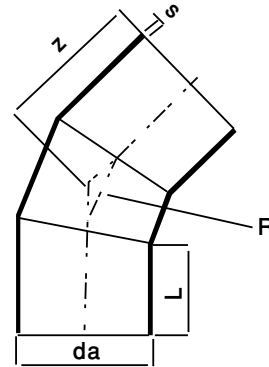
45° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	487
500	300	750	508
560	350	840	583
630	350	945	612
710	350	1065	646
800	350	1200	683
900	400	1350	765
1000	400	1500	850
1100	400	1650	935
1200	400	1800	1020
1400	450	2100	1190
1600	450	2400	1310



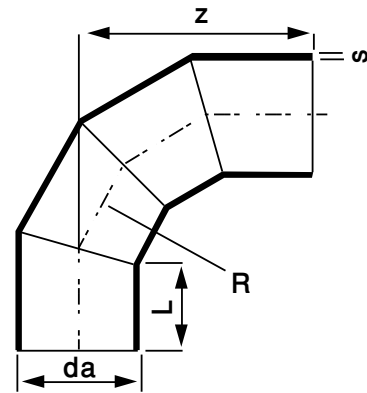
60° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	200
90	150	135	202
110	150	165	211
125	150	188	223
140	150	210	231
160	150	240	243
180	150	270	255
200	150	300	266
225	150	338	281
250	250	375	345
280	250	420	363
315	300	473	484
355	300	533	507
400	300	600	533



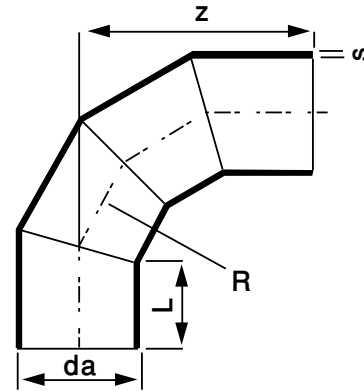
60° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	487
500	300	750	508
560	350	840	583
630	350	945	612
710	350	1065	646
800	350	1200	683
900	400	1350	765
1000	400	1500	850
1100	400	1650	935
1200	400	1800	1020
1400	450	2100	1190
1600	450	2400	1310



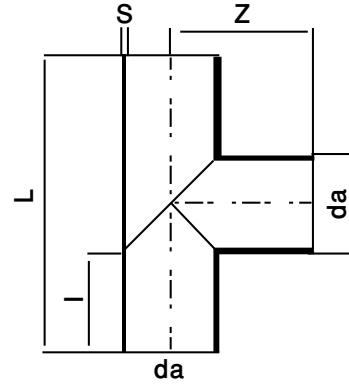
90° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
75	150	113	200
90	150	135	202
110	150	165	211
125	150	188	223
140	150	210	231
160	150	240	243
180	150	270	255
200	150	300	266
225	150	338	281
250	250	375	548
280	250	420	585
315	300	473	676
355	300	533	724
400	300	600	778



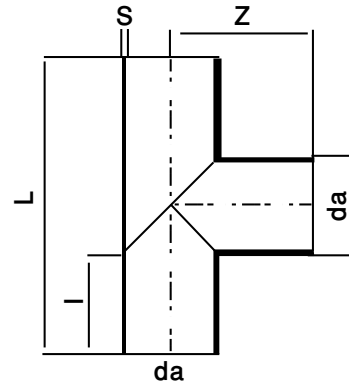
90° Elbow

da (mm)	L (mm)	R (mm)	Z (mm)
450	300	675	838
500	300	750	897
560	350	840	1019
630	350	945	1103
710	350	1065	1198
800	350	1200	1306
900	400	1350	1475
1000	400	1500	1600
1100	400	1650	1760
1200	400	1800	1836
1400	450	2100	2240
1600	450	2400	2560



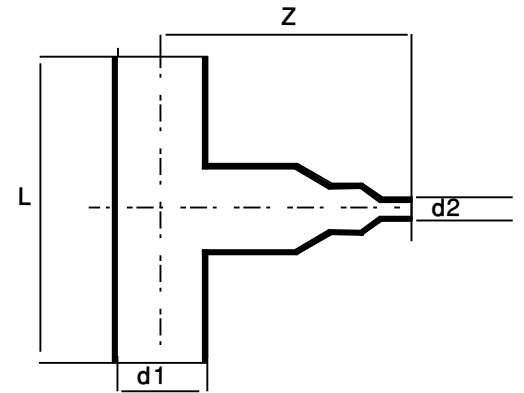
Equal Tee

da (mm)	L (mm)	l (mm)	Z (mm)
75	350	150	187
90	400	150	195
110	410	150	205
125	430	152.5	215
140	440	150	220
160	460	150	230
180	480	150	240
200	500	150	250
225	530	152.5	265
250	750	250	375
280	780	250	390
315	930	302.5	460
355	860	302.5	480
400	1000	300	500



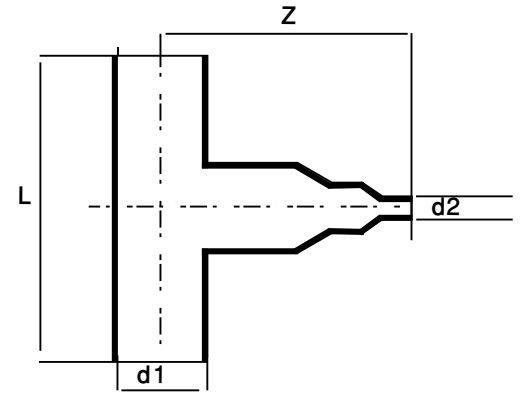
Equal Tee

da (mm)	L (mm)	l (mm)	Z (mm)
450	1050	300	525
500	1200	350	600
560	1260	350	630
630	1330	350	665
710	1410	350	705
800	1500	350	750
900	1500	400	890
1000	1500	400	900
1100	1600	500	1050
1200	1600	500	1100
1400	1700	600	1300
1600	1700	600	1400



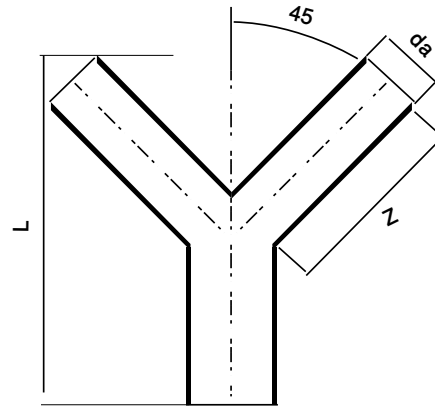
Reducing tee

d1	d2	L	Z
75	63 / 50	400	150
90	75 / 63 / 50	400	150
110	90 / 75 / 63 / 50	400	150
125	110 / 90 / 75 / 63 / 50	400	190 : 300
140	125 / 110 / 90 / 75 / 63 / 50	400	190 : 380
160	140 / 125 / 110 / 90 / 75 / 63 / 50	400	190 : 380
180	160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	400	190 : 550
200	180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	400	190 : 550
225	200 / 180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	450	280 : 600
250	225 / 200 / 180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	450	280 : 700
280	250 / 225 / 200 / 180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	540	340 : 750
315	280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	540	400 : 850
355	315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110 / 90 / 75 / 63 / 50	520	450 : 900
400	355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110 / 90	600	480 : 950



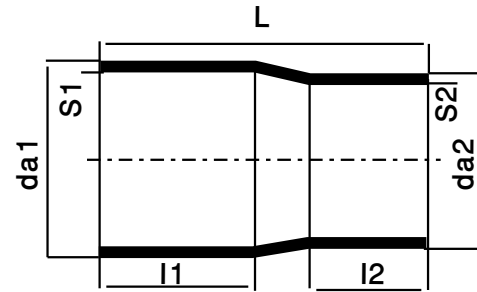
Reducing tee

d1	d2	L	Z
450	400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110 / 90	620	520 : 1000
500	450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	550 : 1100
560	500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	580 : 1200
630	560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	625 : 1300
710	630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	650 : 1400
800	800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	700 : 1500
900	800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	620	520 : 1000
1000	900 / 800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	550 : 1100
1100	900 / 800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	580 : 1200
1200	1000 / 900 / 800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	625 : 1300
1400	1200 / 1100 / 900 / 800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	650 : 1400
1600	1400 / 1200 / 1100 / 900 / 800 / 710 / 630 / 560 / 500 / 450 / 400 / 355 / 315 / 280 / 250 / 225 / 200 / 180 / 160 / 140 / 125 / 110	660	700 : 1500



Y Branch

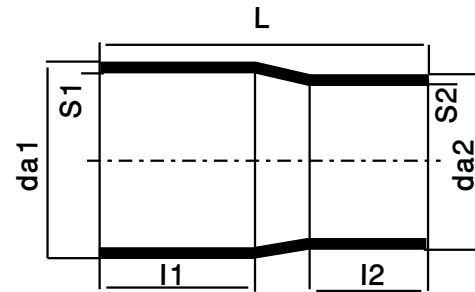
da (mm)	L (mm)	Z (mm)
75	350	250
90	450	300
110	520	340
125	520	340
140	570	380
160	640	450
180	640	450
200	800	530
225	800	530
250	1000	660
280	1000	660
315	1300	840



Reducer

da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
25 / 20	50	23	25
32 / 20	50	22	22
32 / 25	50	22	25
40 / 20	50	21	21
40 / 25	50	21	22
40 / 32	50	21	24
50 / 25	50	20	20
50 / 32	50	20	21
50 / 40	50	20	24
63 / 32	60	25	22
63 / 40	60	25	24
63 / 50	60	25	27
75 / 32	70	30	25
75 / 40	70	30	25
75 / 50	70	30	28
75 / 63	70	30	33
90 / 50	80	35	28
90 / 63	80	35	32
90 / 75	80	35	36
110 / 50	90	35	34

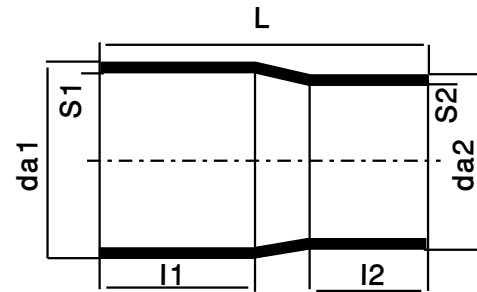
da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
110 / 63	90	35	35
110 / 75	90	35	38
110 / 90	90	35	43
125 / 63	100	40	38
125 / 75	100	40	39
125 / 90	100	40	43
125 / 110	100	40	51
140 / 75	110	50	37
140 / 90	110	50	39
140 / 110	110	50	45
140 / 125	110	50	51
160 / 90	120	55	40
160 / 110	120	55	44
160 / 125	120	55	48
160 / 140	120	55	53
180 / 90	130	60	44
180 / 110	130	60	45
180 / 125	130	60	47
180 / 140	130	60	50
180 / 160	130	60	58



Reducer

da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
200 / 140	140	60	48
200 / 160	140	60	54
200 / 180	140	60	63
225 / 140	160	65	55
225 / 160	160	65	58
225 / 180	160	65	65
225 / 200	160	65	73
250 / 160	180	75	63
250 / 180	180	75	66
250 / 200	180	75	72
250 / 225	180	75	83
280 / 180	200	85	70
280 / 200	200	85	72
280 / 225	200	85	80
280 / 250	200	85	90
315 / 200	230	95	85
315 / 225	230	95	88
315 / 250	230	95	95

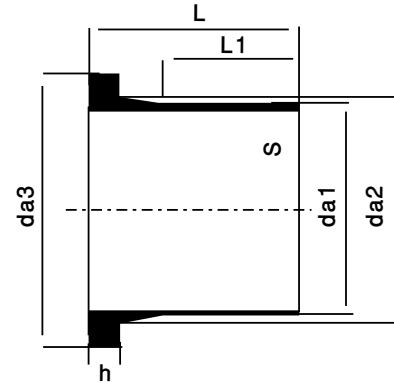
da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
315 / 250	230	95	95
315 / 280	230	95	107
355 / 225	140	57	40
355 / 250	130	54	40
355 / 280	120	53	40
355 / 315	110	53	40
400 / 225	160	64	40
400 / 250	150	61	40
400 / 280	140	60	40
400 / 315	120	50	40
400 / 355	110	51	40
450 / 280	160	65	40
450 / 315	140	55	40
450 / 355	130	57	40
450 / 400	120	60	40
500 / 315	170	71	40
500 / 355	150	62	40
500 / 400	140	65	40



Reducer

da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
500 / 450	120	60	40
560 / 355	170	65	40
560 / 400	160	68	40
560 / 450	140	62	40
560 / 500	130	67	40
630 / 400	190	78	40
630 / 450	170	72	40
630 / 500	150	67	40
630 / 560	130	64	40
710 / 500	190	84	40
710 / 560	170	81	40
710 / 630	140	71	40
800 / 560	200	85	40
800 / 630	180	85	40
800 / 710	150	78	40
900 / 800	180	80	40
900 / 710	180	80	40
900 / 630	180	80	40

da 1 / da 2 (mm)	L (mm)	L 1 (mm)	L 2 (mm)
1000 / 900	180	80	40
1000 / 800	180	80	40
1000 / 710	180	80	35
1100 / 900	180	80	40
1100 / 800	180	80	40
1100 / 710	180	80	35
1200 / 1000	180	80	40
1200 / 900	180	80	40
1400 / 1200	180	80	40
1400 / 1000	180	80	40
1600 / 1400	200	100	50
1600 / 1200	200	100	50

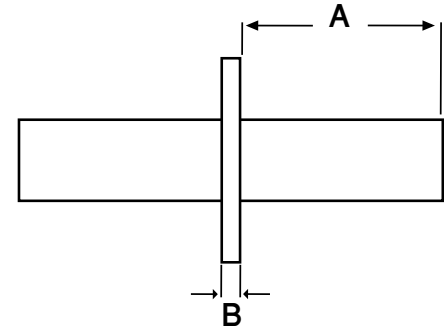


Flange adapter

da 1 (mm)	da 2 (mm)	da 3 (mm)	L (mm)
20	27	45	85
25	33	58	85
32	40	68	85
40	50	78	85
50	61	88	85
63	75	102	95
75	89	122	125
90	105	138	140
110	125	158	160
125	132	158	170
140	155	188	200
160	175	212	200
180	180	212	200
200	232	268	200
225	235	268	200
250	285	320	275
280	291	320	375
315	335	370	375
355	373	430	375

da 1 (mm)	da 2 (mm)	da 3 (mm)	L (mm)
400	427	482	400
450	514	585	400
500	530	585	400
560	615	685	400
630	642	685	400
710	737	800	400
800	840	905	400
900	944	1005	
1000	1047	1010	400
*1100			
1200	1245	1330	400
1400	1450	1535	
1600	1652	1737	400

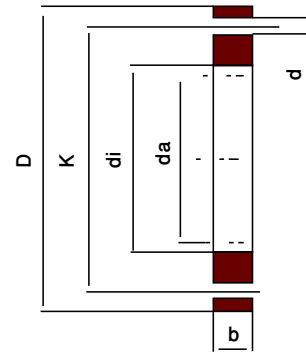
* Special manufactured to be compatible with $\varnothing 1000$ with special design not obey the above drawing



O.D	A	B
90	250	15
110	250	15
125	300	15
140	300	15
160	300	15
180	350	15
200	350	15
225	350	15
250	350	15
280	375	15
315	375	20
355	375	20
400	400	20
450	500	25
500	500	25
560	500	25
630	500	30
710	500	30
800	500	30

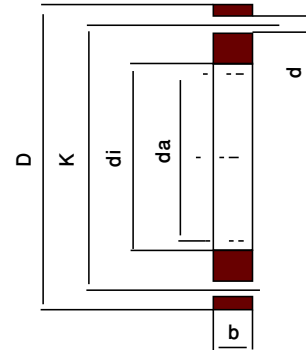
O.D	A	B
900	500	30
1000	500	30
1100	500	30
1200	500	30
1400	500	30
1600	500	30

All Dimensions are in (mm)



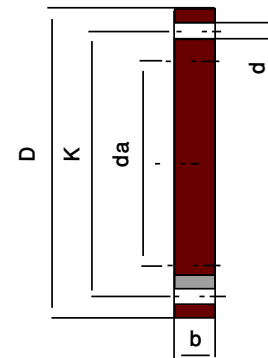
Steel Flange (Galvanize Coated)

da mm	di mm	PN 6					PN 10					PN 16				
		K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm
20	28	55	80	11	4	12	65	95	14	4	14	65	95	14	4	14
25	34	65	90	11	4	14	75	105	14	4	16	75	105	14	4	16
32	42	75	100	11	4	14	85	115	14	4	16	85	115	14	4	16
40	51	90	120	14	4	14	100	140	18	4	16	100	140	18	4	16
50	62	100	130	14	4	14	110	150	18	4	16	110	150	18	4	16
63	78	110	140	14	4	14	125	165	18	4	18	125	165	18	4	18
75	92	130	160	14	4	14	145	165	18	4	18	145	165	18	4	18
90	108	150	190	18	4	16	160	200	18	8	20	160	200	18	4	20
110	125	170	210	18	4	16	180	220	18	8	20	180	220	18	4	20
125	135	170	210	18	8	16	180	220	18	8	20	180	220	18	8	20
140	158	200	240	18	8	18	210	250	18	8	22	210	250	18	8	22
160	178	225	285	18	8	18	240	285	23	8	22	240	285	23	8	22
180	188	225	285	18	8	18	240	285	23	8	22	240	285	23	8	22
200	235	280	320	18	8	20	295	340	23	8	24	295	340	23	8	24
225	238	280	320	18	12	20	295	340	23	8	24	295	340	23	12	24
250	288	335	375	18	12	22	350	390	23	12	26	355	405	27	12	26



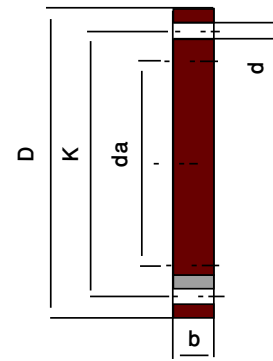
Steel Flange (Galvanize Coated)

da mm	di mm	PN 6					PN 10					PN 16				
		K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm
280	294	335	375	18	12	22	350	395	23	12	26	355	405	27	12	26
315	338	395	440	22	12	22	400	445	23	12	26	410	465	27	12	28
355	376	445	440	22	12	22	460	505	30	16	26	470	520	27	12	30
400	430	495	540	22	16	22	515	565	30	16	26	525	580	30	16	32
450	517	495	645	22	20	24	620	670	30	20	28	650	715	33	20	34
500	533	600	645	22	20	24	620	670	30	20	28	650	715	33	20	34
560	618	705	755	26	20	24	725	780	30	20	28	770	840	36	20	38
630	645	705	755	26	20	24	725	780	30	20	28	770	840	36	20	36
710	740	810	860	26	24	24	840	895	30	24	30	840	910	39	24	36
800	843	920	975	30	24	24	950	1015	33	24	32	950	1025	39	24	38
900	947	1020	1075	30	8	24	1050	1115	33	28	34	1050	1125	39	24	40
1000	1050	1120	1175	30	8	26	1160	1230	36	28	34	1170	1255	42	26	42
1200	1260	1340	1405	33	24	32	1380	1455	39	32	38	1390	1485	48	32	48
1400	1436	1560	1630	36	24	36	1590	1675	42	36	42	1590	1685	48	36	52
1600	1640	1760	1830	36	8	40	1890	1915	48	40	46	1820	1930	56	40	58



Steel End Flange

da mm	PN 6					PN 10					PN 16				
	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm
20	55	80	11	4	12	65	95	14	4	14	65	95	14	4	14
25	65	90	11	4	14	75	105	14	4	16	75	105	14	4	16
32	75	100	11	4	14	85	115	14	4	16	85	115	14	4	16
40	90	120	14	4	14	100	140	18	4	16	100	140	18	4	16
50	100	130	14	4	14	110	150	18	4	16	110	150	18	4	16
63	110	140	14	4	14	125	165	18	4	18	125	165	18	4	18
75	130	160	14	4	14	145	165	18	4	18	145	165	18	4	18
90	150	190	18	4	16	160	200	18	8	20	160	200	18	4	20
110	170	210	18	4	16	180	220	18	8	20	180	220	18	4	20
125	170	210	18	8	16	180	220	18	8	20	180	220	18	8	20
140	200	240	18	8	18	210	250	18	8	22	210	250	18	8	22
160	225	285	18	8	18	240	285	23	8	22	240	285	23	8	22
180	225	265	18	8	18	240	285	23	8	22	240	285	23	8	22
200	280	320	18	8	20	295	340	23	8	24	295	340	23	8	24
225	280	320	18	12	20	295	340	23	8	24	295	340	23	12	24
250	335	375	18	12	22	350	390	23	12	26	355	405	27	12	26



Steel End Flange

da mm	PN 6					PN 10					PN 16				
	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm	K mm	D mm	d mm	n mm	b mm
280	335	375	18	12	22	350	395	23	12	26	355	405	27	12	26
315	395	440	22	12	22	400	445	23	12	26	410	465	27	12	28
355	445	440	22	12	22	460	505	30	16	26	470	520	27	12	30
400	495	540	22	16	22	515	565	30	16	26	525	580	30	16	32
450	495	645	22	20	24	620	670	30	20	28	650	715	33	20	34
500	600	645	22	20	24	620	670	30	20	28	650	715	33	20	34
560	705	755	26	20	24	725	780	30	20	28	770	840	36	20	38
630	705	755	26	20	24	725	780	30	20	28	770	840	36	20	36
710	810	860	26	24	24	840	895	30	24	30	840	910	39	24	36
800	920	975	30	24	24	950	1015	33	24	33	950	1025	39	24	38
900	1020	1075	30	24	26	1050	1115	33	28	33	1050	1125	39	24	40
1000	1120	1175	30	26	26	1160	1230	36	28	33	1170	1255	42	26	42
1200	1340	1405	33	32	28	1380	1455	39	32	36	1390	1485	48	32	48
1400	1560	1630	36	36	32	1590	1675	42	36	42	1590	1685	48	36	52
1600	1760	1830	36	36	32	1890	1915	48	40	46	1820	1930	56	40	58

Fittings with special specification:



GM can carry any fittings with special specification according to customer requirements. Also **GM** tests these fittings before delivery according to site service requirements.

GM Certificates

Certificate

Standard: **ISO 9001:2008**
 Certificate Register No.: 01-180-2008/01



Gulf Manufacturers Co.
8th of October City - Egypt



TÜVRheinland
Productivity. Rights.

Certificate Holder: TÜV Rheinland Cert GmbH, Germany

Scope: Manufacturing of Pipes and Fittings for PVC, PE and PP-R

Validity: An audit was performed, Report No. 9928/01. Proof test items furnished that the requirements according to ISO 9001:2008 are fulfilled.
 The due date for all future audits is 25-01-2010 (01.01.2010).
 The certificate is valid from 2008-03-16 until First Certification 2008



Signature



IAF
TIA 2016-01-01



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العائلة الوطنية
لبناء الشبكات والصرف الصحي
للمؤسسات والهيئات العامة
في مصر
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التدريب والتعليم
التقني
التقني
التقني

الهيئة الوطنية
للمؤسسات والهيئات العامة
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شركة/مؤسسة/مكتب/مكتب
التدريب والتعليم
التقني
التقني
التقني

تم تنفيذ المعاينة في 11 مارس 2008 بحضور ممثلين من 11 من
المؤسسات والهيئات العامة في مصر
تم تنفيذ المعاينة في 11 مارس 2008 بحضور ممثلين من 11 من
المؤسسات والهيئات العامة في مصر
تم تنفيذ المعاينة في 11 مارس 2008 بحضور ممثلين من 11 من
المؤسسات والهيئات العامة في مصر



Signature



TYPE APPROVAL CERTIFICATE

AWARDED TO

Gulf Manufacturers Co.



The following products by Gulf Manufacturers Co. have successfully completed Phase 1 and Phase 2 Type Approval Tests.

The certificate covers all pipes in the size range 50mm to 315mm subgrade manufactured by Gulf Manufacturers Co. in their factory situated at 6 October City, 8th Industrial Zone, Cairo, Egypt

Pipes manufactured in 8H Highway Elmas TUB 12000025 PE100 Resin

I hereby certify that the products listed above have been tested and have met the requirements of Technical Specification for Polyethylene (PE) Pipes and Fittings for Natural Gas and Schedule 40/40S Manufactured by Gulf Manufacturers Co. in accordance with EN 12201-1-2000.

 Signed
 _____ Dated

Notes

Notes

Notes

Notes

www.gmpipe.com

HDPE PIPES MANUFACTURING FROM PE 100

WATER NETWORK, DRAINAGE, SEWAGE, FIRE FIGHTING SYSTEM

(Table 04)

mean O.D	PN 3.2 bar			PN 4.0 bar			PN 5.0 bar			PN 6.0 bar			PN 8.0 bar			PN 9.6 bar			PN 10 bar			PN 12.5 bar			PN 16 bar			PN 20 bar										
	SDR 51			SDR 41			SDR 33			SDR 26			SDR 21			SDR 17.6			SDR 17			SDR 13.6			SDR 11			SDR 9										
	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)	i.D	S	W (kg/m)								
315	302.6	6.2	6.12	299.6	7.7	7.52	295.6	9.7	9.37	290.8	12.1	11.6	279.2	17.9	16.7	277.6	18.7	17.4	268.6	23.2	21.2	266.6	268.6	23.2	21.2	266.6	286	25.6	244.6	257.8	28.6	25.6	244.6	286	25.6	244.6	35.2	30.8
355	341	7	7.73	337.6	8.7	9.55	333.2	10.9	11.8	327.8	13.6	14.6	314.8	20.1	21.2	312.8	21.1	22.1	302.8	26.1	26.9	290.6	302.8	26.1	26.9	290.6	32.2	32.5	275.6	290.6	32.2	32.5	275.6	39.7	39.1			
400	384.2	7.9	9.82	380.4	9.8	12.1	375.4	12.3	15.1	369.4	15.3	18.6	354.6	22.7	26.9	352.6	23.7	28	341.2	29.4	34.1	327.4	341.2	29.4	34.1	327.4	36.3	41.3	310.6	327.4	36.3	41.3	310.6	44.7	49.6			
450	432.4	8.8	12.3	428	11	15.3	422.4	13.8	19	415.6	17.2	23.5	399	25.5	34	396.6	26.7	35.4	383.8	33.1	43.2	368.2	383.8	33.1	43.2	368.2	40.9	52.3	349.4	368.2	40.9	52.3	349.4	50.3	62.7			
500	480.4	9.8	15.2	475.4	12.3	19	469.4	15.3	23.4	461.8	19.1	28.9	443.2	28.4	42	440.6	29.7	43.8	409.2	36.8	53.3	388.4	426.4	36.8	53.3	388.4	45.4	64.5	388.4	409.2	45.4	64.5	388.4	55.8	77.3			
560	538	11	19.1	532.6	13.7	23.6	525.6	17.2	29.4	517.2	21.4	36.2	496.6	31.7	52.5	493.6	33.2	54.8	477.6	41.2	66.9	458.4	477.6	41.2	66.9	458.4	50.8	80.8	435	458.4	50.8	80.8	435	62.5	97			
630	605.4	12.3	24	599.2	15.4	29.9	591.4	19.3	37.1	581.8	24.1	45.9	558.6	35.7	66.5	555.2	37.4	69.4	537.4	46.3	84.6	515.6	537.4	46.3	84.6	515.6	57.2	102	0	515.6	57.2	102	0	0	0			
710	682.2	13.9	30.5	675.2	17.4	38	666.4	21.8	47.2	655.6	27.2	58.4	642.2	33.9	71.8	705.2	47.4	112	682.4	58.8	136	682.4	682.4	58.8	136	682.4	66.1	172	0	682.4	66.1	172	0	0	0			
800	768.6	15.7	38.8	760.8	19.6	48.1	751	24.5	59.7	738.8	30.6	73.9	709.4	45.3	107	705.2	47.4	112	682.4	58.8	136	682.4	682.4	58.8	136	682.4	66.1	172	0	682.4	66.1	172	0	0	0			
900	864.8	17.6	48.9	856	22	60.9	844.8	27.6	75.6	831.2	34.4	93.4	798	51	136	793.4	53.3	141	767.8	73.5	203	767.8	767.8	73.5	203	767.8	66.1	172	0	767.8	66.1	172	0	0	0			
1000	960.8	19.6	60.5	951	24.5	75.2	938.8	30.6	93.1	923.6	38.2	115	886.6	56.7	167	881.4	59.3	175	853	73.5	203	853	853	73.5	203	853	73.5	203	0	853	73.5	203	0	0	0			
1100	1056.8	21.6	70	1046.4	26.8	86	1033.2	33.4	107	1015.4	42.3	134	975	62.5	194	970.6	64.7	200	940	80	244	940	940	80	244	940	80	244	0	940	80	244	0	0	0			
1200	1153	23.5	87	1141.2	29.4	108	1126.6	36.7	134	1108.2	45.9	166	1064	68	241	1058.6	70.6	250	1058.6	80	244	1058.6	1058.6	80	244	1058.6	70.6	250	0	1058.6	70.6	250	0	0	0			
1400	1345.2	27.4	118	1331.2	34.4	147	1314.2	42.9	183	1293	53.5	226	1242	79	335	1234	83	328	1234	80	244	1234	1234	83	328	1234	70.6	250	0	1234	83	328	0	0	0			
1600	1537.4	31.3	154	1521.6	39.2	192	1502	49	238	1477.6	61.2	295	1448	76	372	1448	76	372	1448	76	372	1448	1448	76	372	1448	76	372	0	1448	76	372	0	0	0			

