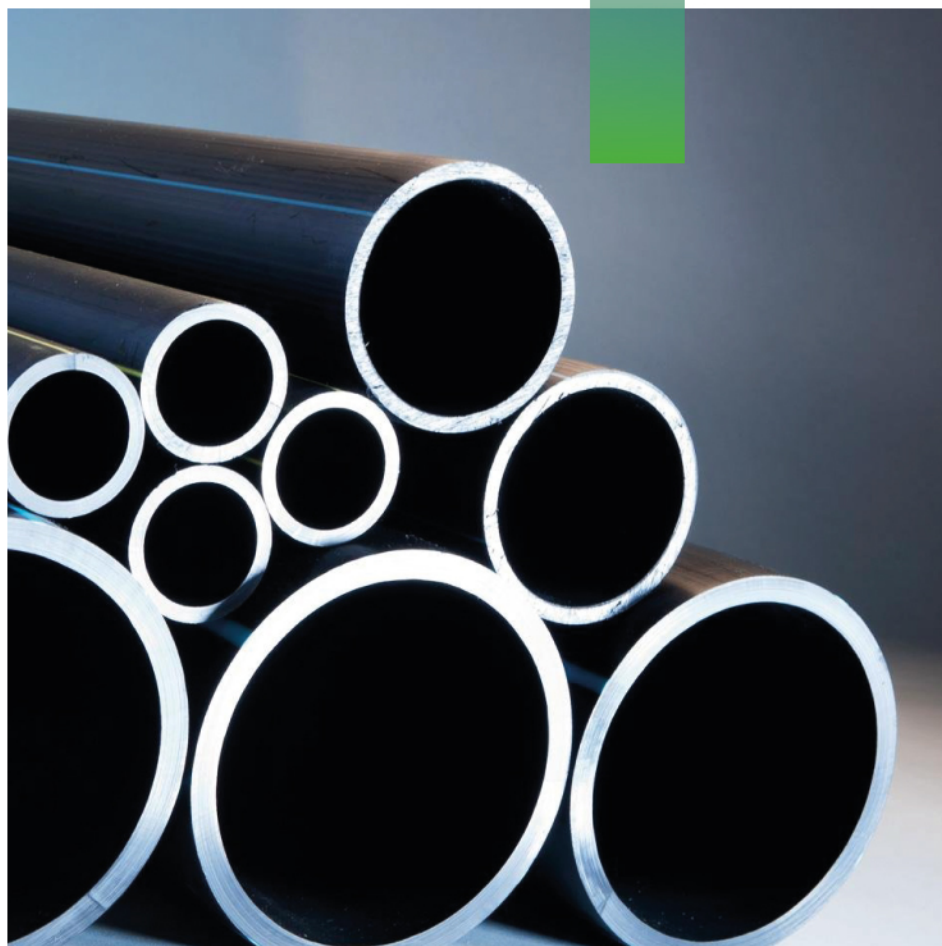




MEGA PIPES

HDPE PIPES

TECHNICAL MANUAL

Table of contents

	Introduction	2
1.1	Polyethylene PE material description	4
1.2	Description of PE100	5
2.	Applications of PE100 pipes	6
3.	Advantages of PE100 pipes	7
4.	Application standards	9
5.	Natural gas pipes	10
6.	Material properties of PE	12
7.	Chemical resistance of HDPE	13
8.	Transportation, packaging, handling and storage of PE pipes and fittings	19
8.1	Instructions for handling and storing	19
8.2	Instructions for transporting and downloading	20
9.	HDPE pipes and fittings dimensions	21
9.1	HDPE PE100 pipes dimensions	21
9.2	HDPE PE80 pipes dimensions	22
9.3	Natural gas pipes dimensions	23
9.4	Coil pipes dimensions	24
9.5	Tolerances on outside diameter and circularity (ovality)	25
9.6	Tolerances on Wall Thickness	26
9.7	Elbow dimensions	27
9.8	Tee dimensions	30
9.9	Cross Tee dimensions	31
9.10	Reducer	32
9.11	Flange adaptor (stub flange)	35
9.12	Flange (steel)	36
10.1	Working pressure with different service life period and different Temp. for PE100	37
10.2	Working pressure with different service life period and different Temp. for PE80	38
11	Quality Control	39
11.1	Lab Equipments and Tests	39
11.2	Lab Equipments For Pipes and fittings	39
11.3	System Control Procedure	40
11.4	Raw Material Tests	41
11.5	The Tests During Production Processes	41
11.6	The pressure test at site	41
12	Connection Methods Of PE100	42
12.1	Butt Welding Method	42
12.2	Electrofusion Welding Method	43
12.3	Connection With Push-Fit Sockets	45
12.4	Connection By Using Flanges	46
12.5	Repair Of a Damaged Pipes	46
12.6	Making Repair Flanges	46
12.7	Making Repair Using Electrofusion Welding Socket	46
13	Pipe installation	47
14	Caution	48



Introduction

MEGA pipes was established in 2019 to produce plastic pipes & fittings by materials UPVC, HDPE, PPR, PPH.

Since the company was formed, it has a steady growth with high quality standards to fulfill the requirements of its customers especially for high quality product for pipes & fittings according to The German standard DIN, British standard BSI, international standard ISO and Egyptian standard demands.

There's also the facility of manufacturing products with special specifications according to the customer requirements.

MEGA's target is to become the major producer in the field of plastic pipes & fittings by having its factories equipped with new advanced, automated and up to date know how extrusion lines which permit high capacity of product with exceptionally high consistency in terms of dimensional accuracy, mechanical strength and surface finish.

Our target is to build a circle of trust for every client by providing the best quality service and price.



MEGA pipes are well accepted and widely used in domestic water system and all types of industrial process pipe works, water distribution and water treatment as well as irrigation systems.

The most highly advantage is the well-equipped laboratory which is established according to the best international standards to control raw materials, final products and also for the researches which is one of the important targets of MEGA to update and develop its product.

There is a series of experiments conducted on our plant's production process that include chemical, physical and mechanical properties.

MEGA pipes has a full range of specialists in the field of pipe installation who are fully prepared to provide our customers with technical advice.

MEGA pipes is considered as one of the largest companies that produces and processes pipes and fittings in the Egyptian market as well as the middle east area and Africa.

MEGA HDPE (PE100) pipes and fittings are produced with diameters starting from 20 mm up to 1600 mm

1.1 Polyethylene PE material description



The Polymers which consist only of carbon and hydrogen (hydrocarbons) are called Polyolefin.



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 & that's suitable for different applications (drinking water, sewage, natural gas..etc) to the other traditional pipes.



The Polyethylene PE material consists of long chain molecules which are made up of the base molecule ethylene C_2H_4 .



These molecule chains are not exclusively straight line, the degree of branching significantly affects the properties of the material.



These are the parts of the structural make up responsible for the strength of the material.



Material properties such as tensile strength and resistance to stress cracking are dependent on the amorphous structures.



PE material nowadays are optimized for use as a pressure pipe material and the designation RC (Resistance to crack) stands for selected PE classified according to the strength of the material PE80, PE100 and PE100-RC.



PE is considered as non-polar material, meaning it doesn't dissolve in common solvents and hardly swells. As a result, PE pipes cannot be cemented. the appropriate joining method for this material is heat fusion.

1.2 Description of PE100



PE100 is a black HDPE designed for water pressure pipes, irrigation, chemical, industrial and underground drainage.



PE100 contains minimum 2% of well dispersed, fine particle size carbon black and stabilizers to ensure excellent weathering resistance and long-term stability.



PE100 can easily be welded by butt fusion, using standard HDPE parameters or electrofusion.



PE100 raw material has the highest performance of all HDPE material (PE63 & PE80).



PE100 shows excellent resistance to rapid crack propagation and slow crack growth, both being important parameters for pressure pipe design.



Advantage of perfect leak proof, no crack, no break and no deformation under pressure.



Many different pressure resistance options, PE pipes can be produced resistant to 12 different pressure classes from 2.5 Bars up to 32 Bars.



Very high resistance to direct sun light (UV resistance) for long time. This is supplied by ultraviolet light resistance agent mixed to the PE raw material.



Very good adoption to earth movements.



PE pipes have very good welding characteristics.



There is no need to take protection precautions at the time of installation like cathodic protection.

2. Applications of PE100 pipes

1- Water networks:

PE100 pipes are used for potable water networks which is not affecting the water properties. 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 welding its high flexibility.

2- Sanitary and industrial drainage:

PE100 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.

3- Irrigation system:

HDPE pipes have high resistance for environmental conditions, especially ultraviolet rays. it is highly resistant to sunlight as raw materials containing UV are used. Same as HDPE pipes one considered the optimum choice for drip and sprinkler irrigation networks by using it up ground and underground.

4- Natural gas networks.

There is no alternative for PE pipes in natural gas networks because their high security levels due to the ultimate mechanical, chemical and physical properties (characteristic).

5- Firefighting applications.

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.

6- Food stuff conveyance lines.

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

7- Cable ducts (Electric and Telephone lines).

8- Supply lines under channel, railway lines and airport runway.

9- Sea water desalination and injection of oil wells.

10- Pipelines for crossing rivers.

3. Advantages of PE100 pipes

01 Ease of installation:

PE100 pipes are easy to install with their light weight and long lengths. PE coiled pipes are widely used in applications such as stock watering, irrigation systems, communications, gas, and reticulated water mains due to rapid installation and the ease and less frequent joining.

02 High impact strength:

the high impact strength of PE100 pipes compared with other materials ensures a greater resistance to the rigor of pipe laying conditions.

03 High flow capacity:

PE100 pipes have lower friction factors than the most non-plastic materials, the surface energy characteristics of PE100 ensure that material deposition is inhibited and the smooth bore characteristic is maintained over the working life of pipe line.

04 Damage resistance:

PE100 pipes has low notch sensitivity, providing a high level of resistance to the effect of external damage, especially important for pipe bursting operations and others were likelihood such damage.

05 Long life:

PE100 pipes have a prover high reliability record across a wide range of industries and applications, now approaching a period of 50years. PE100 also provides alone maintenance free lifetime with low whole life cost, compared to many other materials.

06 Thermal resistance

The operational safe temperature range of PE starts from -20 °C up to 80 °C , this range includes most of applications except the heating applications.

07 Light weight

The light weight of PE pipes and fittings makes it easy for handling and installation in comparison to other materials.

08 Poor heat conductivity

This is one of the most useful properties of PE that make it suitable for the applications where it necessary to secure absence of heat leakage either in or out, like HVAC application.

09 Non- toxic

This property is inherent from the fact that the PE material is inert so the water inside will always be clean and safe. this a big advantage when PE is compared to metal pipes for conveyance of potable drinking water.

10 Elasticity

despite being very rigid, PE stays a polymer material, and this means high degree of elasticity and flexibility. The implications of this are high impact resistance, flexibility and minimum possibility of damaging PE material because of rough trench conditions or reduction of massive number of bends. This characteristic also implies that using these flexible pipes is safer especially in applications that need seismic protection.

11 Wear resistance

High yield strength, high toughness, and high tensile stress, the PE resists hard ambience. Even if the bedding used for this type of pipes contains large granules of rock and sand; this material can withstand up to granule diameter size of 65mm which is really superb.

12 Pre-Fabrication

The PE is friendly for pre-fabrication to make customized products, for example segmented fittings can be pre-fabricated from the pipes of same SDR.

13 Weather resistance

This property is an extension of thermal resistance and wear resistance properties, which means it can be left in any weather no matter how hard it is and nothing will happen to it, PE pipes products are stabilized carbon black protected.

14 Highly suitable for welding

The main process used for manufacturing PE pipes is extrusion which is a hot forming process that ensures high homogeneity for the end product, which leads to homogeneous formation of the molten material at the time of welding

15 Excellent water hammer resistance compared with other type of pipes;

The HDPE pipes have visco_elastic behavior which allow the pipe to return back to original shape without any effect.

16 HDPE fittings don,t need thrust blocks.

17 Small pipes diameters deliver in coils which save time and installation cost.

18 PE pipes networks are leakage free as a result of joining by butt fusion welding which form the network as one pipe.

4. Application standards

DIN 1988	Technical standards for drinking water installations.
DIN 4279- Part 8	Testing of pressure pipelines of PE pipes.
DIN 8074/8075	PE100 pipe
DIN 16963	PE100 Injection fittings
ISO 527-1	Determination of tensile properties.
ISO 4427/1167	PE fittings
ISO 15494	Plastics piping systems for industrial applications - polyethylene PE
EN ISO 1133	Determination of MFR and MVR of thermoplastics
EN 1555 – 1,2,3,4	plastics piping systems for the supply of gaseous fuels of polyethylene Part 1- general. Part 2 – piping. Part 3- valves. Part 4 – fittings.
EN ISO 13479	Polyolefin pipes for the conveyance of fluids.
EN 12201 – 2,3	Production standard for pipes and fittings.
BS 1973 / 3796	Specification for polyethylene pipes.
ES 1832 – 2007	PE pipes (dimensions and tests)
GIS PL 2 Part 1,8	HDPE pipes for natural gas network.

5. Natural gas pipes

- Polyethylene material is the right choice for the pipe gas applications due to its characteristics such as strength, flexibility, light weight and ease of installation and maintenance.
- The manufacturing of HDPE pipes for gas network is produced acc. To GIS PL2 part 1, 8 standards.
- The preferred series of pipes are Standard dimension ratio SDR 11 for gas applications.
- The raw material used for pipes is medium density polyethylene MDPE (PE80) with yellow color, and high density polyethene HDPE (PE100) with orange color.
- Gas pipes are produced with diameters start from 32mm up to 355mm.





- Pipes are available in coils in order to reduce the number of joints to make a cost-effective choice for contractors and clients.
- The available pipes by coils for the sizes from diameters 32mm up to 125mm, while the sizes more than diameter 125mm are produced in length of 12 meters.
- The jointing between pipes can be done by Butt-fusion or Electro-fusion methods.
- HDPE gas pipes are maintenance free with a design life time more than 50 years under normal operating conditions acc. to the production standards.

6. Material properties of PE

The material data table lists typical physical, mechanical and thermal characteristics of polyethylene material as follow

Polymer Data	PE 100	Unit	Test Method
Physical characteristics			
Denisty at (23°C)	0.955	g/cm3	ISO 1183
Viscosity Number	360	cm/gr	ISO 1628-3
MFR (190° / 5 Kg)	0.22	g/10 dak.	ISO 1133
MFR (190° / 25 Kg)	6,6	9/10	ISO 1133
Mechanical characteristics			
Yield Stress	23	MPa	ISO 527
Elongation at Yeild	9	%	ISO 527
Tensile Modulus	900	96	ISO 527
Notched Impact Strenght +23° C	26	KJ/m2	ISO 179/16A
+20° C	13	kJ/m2	ISO 179/eA
Tensile Stress at Yield 50mm/min	25	Mpa	ISO 527-2
Charpy impact, notched (0° C)	16	K.l/m2	ISO 179/1eA
Hardness, Shore D	60	-	ISO 868
Thermal characteristics			
Thermal stability at (210 °C)	≥20	min	EN 728
Carbon Black Content	2,3:02	%	ISO 6964
Carbon Black Dispersion	≤3		ISO 11420
MRS minimum Required Strenght	<10	MPa	ISO 9080
Resistance to S.C.P (Slow Crack Propagation)=4,6 Mpa 80 °C Notched	>3000 <25	h	EN 33479
Resistance to R.C.P (Rapid Crack) Propagation S4 test 110/10 mm 0°C	< 600 1.8 104	bar	ISO DIS 13477
Elongation at break	1.9	%	EN 638 , ISO 527-2
Linear Thermal Expansion	1.8 x 10-4	°C-1	ATSM D 696 (20-60°C)
Specific Heat Capacity	1.9	J / g °C	BPCL
Electrical characteristics			
Electric Strenght	>20	KV / mm	BS 2782 201 B
Volume resistivity	>10-1	Ω m	BS 2782 230A
Surface resistivity	>10-1	Ω	BS 2782 231A
Relative pernitivity	2.6	-	BS 2067 (110 20 MHZ)
Loss tangent	3X10-1	-	BS 2067

7. Chemical resistance of HDPE

The following tables illustrate the effect of some of the chemicals on HDPE pipes on different temperatures.

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
A			
Acetaldehyde		R	LR
Acetate amyl		R	R
Acetate butyl		R	LR
Acetic acid	50		R
Acetic acid, freezes	> 96		R
Acetone	L. tp	LR	LR
Acrylonitril		R	R
Acrylonitril allyl		R	R
Acrylonitril methyl		R	R
Acrylonitril allyl		R	R
Acrylonitril benzyl		R	R
Acrylonitril butyl		R	R
Acrylonitril enthyl	96%	R	R
Acrylonitril furfuryl		R	R
Acrylonitril isopropyl		R	LR
Acrylonitril methoxybutyl		R	LR
Adipic acid	Sat. sol. % 1.4		R
Air	G. tp	R	R
Aliphatic esters		R	R
Allyle alcohol	L. tp	R	R
Aluminium hydroxide	Susp.	R	R
Ammonia		R	R
Ammonium liquid	G. tp	R	R
Ammonium, chloride	Sat. sol.	R	R
Ammonium, dry gas	G. tp	R	R
Ammonium, liquid	Sat. sol.	R	R
Ammonium, sulphide	Sat. sol.	R	R

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
Aniline	Sat.sol.	R	
Antimony chloride		R	R
Antimony trichloride		R	R
Anydride Sulphuric		LR	LR
Anydride sulphuros.		R	R
Anydride acetic		R	LR
Aqua regia		LR	NR
Aromatic acid		R	R
B			
Benzald ehiyde		R	R
Benzene	L. tp	R	LR
Benzene (fuel)	Sat. sol.	R	R
benzoic acid		R	R
Borax		R	R
boric acid		R	R
Brine		R	R
Bromine			NR
Butane, gas	G.tp	R	R
butyric acid		R	LR
C			
Calcium	Sat. sol.	R	R
Calcium	Susp	R	R
Calcium hypochlorite		R	R
Camphor		R	LR
Carbon dioxide moisted gas	G. tp	R	R
Carbon moisted gas	G. tp	R	LR
carbon sulphide		LR	LR
Carbon tetrachloride	G. tp	NR	LR
Carbonic acid		R	R
Cetones		R	R
chloride antimony		R	R
Chlorine (dry gas)	G. tp	NR	LR
chloro benzene		NR	NR
chloroethanol		R	R
Chloroform	L. tp	R	NR
chromic acid	80%	R	NR
citric acid		R	R

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
Copper (II) sulphate	Sat. sol.	LR	R
Cresol		R	R
Cyclohexanol		R	R
Cyclohexanone		R	LR
D			
Decaline		R	LR
Dibutyl phthalate		R	LR
Dichloro ethylene		NR	NR
dichloroacetic acid	100%	R	LR
dichloroacetic acid	50%	R	R
Dichloroethane		LR	NR
Dioxane		R	LR
E			
Ethanol	40%	R	LR
Ether		LR	NR
Ethylene glycol	L. tp	R	R
F			
fatty acid, higher than 66	60%	R	LR
Ferric chloride		R	R
Fluorine		LR	NR
Formaldehyde	30-40	R	R
formic acid		R	R
Fruit juice		R	R
G			
Gelatin		R	R
Glycerin chlorohydrin		R	R
Glycerine	L. tp	R	R
Glycol		R	R
Glycol butyl		R	R
Glycol methyl		R	R
Glycolic acid		R	R
H			
Hydro chloric acid	30	R	R
Hydrobromic acid	50%	R	R
Hydrocyanic acid		R	R
Hydrofluoric acid	40 to 70%	R	LR
Hydrogen	G. tp	R	R

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
Hydrogen chloride gas	dry, wet	R	R
Hydrogen Peroxide	30%	R	R
hydrogen sulphide		R	R
hypochlorite		R	R
I			
Iron (II) and (III) chloride	Sat. sol.	R	R
Isoctane		R	LR
L			
Lacti acid	96%	R	R
Lead acetate	Sat. sol.	R	R
Iodine (in alcohol)	Op. sol.	R	R
Iodine Tincture		R	LR
M			
magnesium chloride		R	R
maleic acid		R	R
Morpholine		R	R
Mercury	L. tp	R	R
Metallic sulphate		R	R
Methyl Alcohol	L. tp	R	R
methylene Chloride		NR	NR
Methylethyl acetone		R	LR
Milk	Op.sol.	R	R
Mineral oil		R	R
Molasses		R	R
monochloroacetic acid		R	R
morpholine		R	R
N			
Naphta (heavy petrol)		R	LR
Naphtalene		R	LR
Nitric acid	25	R	NR
Nitric acid	10	R	NR
Nitric acid	>50	NR	NR
O			
Oils (vegetable and animal)	G.tp	R	R
oleic acid (con.)	(Con)	R	LR
oxalic acid	50%	R	R
Oxygen, gas	G. tp	LR	R

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
P			
Paraffin		R	R
P-dichloro benzene		LR	NR
perchloric acid	20	R	R
perchloric acid	50	R	LR
perchloric acid	70	R	NR
Petroleum ether		R	LR
Phenol	Sol.	R	R
Phosphorus oxychloride		R	LR
phosphoric acid	50%	R	R
phosphoric acid	95%	R	LR
phthalic acid	50%	R	R
potassium Chloride		R	R
Potassium hydroxide	Sol.	R	
Potassium hydroxide	up to 50	R	R
proponic acid	50%	R	R
proponic acid	100%	R	LR
Pyridine		R	LR
S			
silicic acid		R	R
Sliver nitrate		R	R
Sodium benzoate		R	R
Sodium bicarbonate	Sat. sol.	R	R
Sodium borate		R	R
Sodium carbonate	Sat. sol.	R	R
Sodium carbonate	Up to 50	R	R
Sodium chloride	Sat.sol.	R	R
Sodium hydroxide	Sol.	R	R
Sodium hydroxide	40	R	R
Sodium sulphate	Sat.sol.	R	R
Sodium silicate	R	R	R
Sodium thiosulphate	R	R	R
stearic acid		R	R
succinic acid	50	R	R
sulpho-chromic acid		NR	NR
Sulphur dioxide dry gas		R	R
Sulphuric acid	50	R	NR

Name of Chemical	Con. %	Degree of resistance (20° C)	Degree of resistance (60° C)
S			
Sulphuric acid	98	NR	NR
sulphurous acid		R	R
T			
Tallow		R	R
Tartaric acid		R	R
Tetralin		NR	NR
Tetrahydrofuran		R	LR
Thiophene		LR	LR
Toluene	G.tp	LR	LR
Trichloroacetic acid	100	R	LR
Trichloroacetic acid	50	R	R
Trichloroethylene	G.tp	R	R
Turpentine		R	LR
U			
Urea	Sol.	R	LR
Urine		NR	NR
V			
Vaseline		LR	LR
Vegetables oil	L. tp	R	R
Vinegar	Op. sol	R	R
W			
Water distilled sea		R	R
Water with chlorine	Sat. sol.	NR	R
Water, usage, mineral	Op.sol.	R	R
Water, usage, mineral	10 to 30	R	NR
With fumed nitrogen oxide		NR	R
X			
Xylene		LR	NR
X			
Yeast		R	R
X			
Zinc Chloride		R	R

Con. : concentration

Sat. sol. : saturated solution

G.tp. : Gas in technical purity

R : Resistance

NR : Non- Resistance

Susp. : Suspension

L tp. : Liquid in technical purity

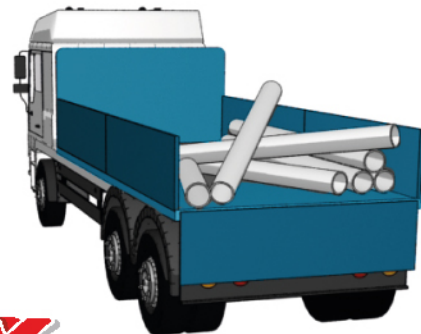
Op. sol. : operational solution

LR : Limited Resistance

8. Transportation, packaging, handling and storage of PE pipes and fittings.

8.1 Instructions for handling and storing:

- 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 shouldn't exceed 1.8 meters, pipes should be stored in a pyramidal shape or multi layers shape.
- 6-If different classes of pipes are kept in the same racks, then the thickness classes of the largest diameter must always be placed at bottom.
- 7-Pipes should be given adequate supports at all times.



8.2 Instructions for transporting and downloading:

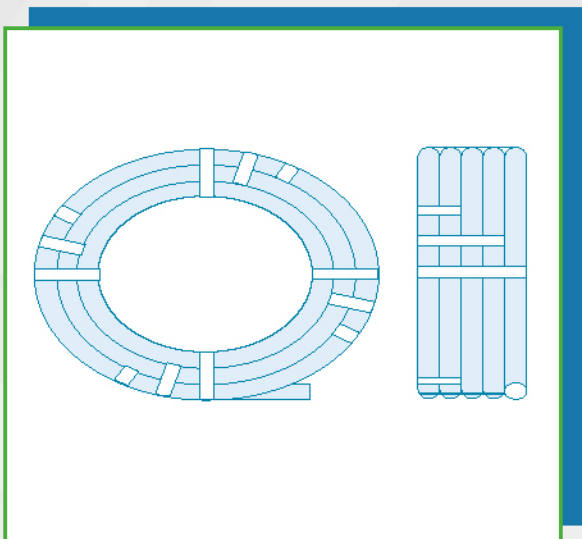
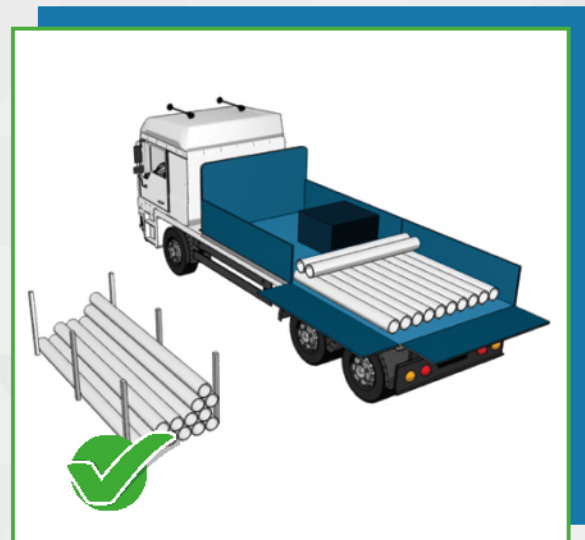
1-The pipes must be transported on wooden walls in a pyramidal shape or in bundles.

2-The pipes are downloading by using a crane, avoid using metal belts touching the pipes.

3-pipes can be downloaded by rolling them on wooden walls.

4-When loading pipes on to vehicles, care must be taken to avoid them coming into contact with any sharp corners to avoid the damage of the pipes.

5-Care being taken to ensure that pipes don't fall one upon another, nor on to any hard or uneven surfaces.



9. HDPE pipes and fittings dimensions

9.1 HDPE PE100 PIPES DIMENSIONS

Acc. To DIN 8074/ 8075 , ISO 4427 and ES1832 Standard
Table of Dimensions mm , Weights kg/m and Pressures PN

Pipe Series	20		16		12.5		10		8		6.3		5		4		3.2		2.5	
SDR PN	41 PN4		33 PN5		26 PN6		21 PN8		17 PN10		13.6 PN12.5		11 PN16		9 PN20		7.4 PN25		6 PN32	
d mm	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m
25	-	-	-	-	-	-	-	-	-	-	2.0	0.151	2.3	0.173	3.0	0.202	3.5	0.243	4.2	0.281
32	-	-	-	-	-	-	-	-	2.0	0.198	2.4	0.235	3.0	0.282	3.6	0.331	4.4	0.390	5.4	0.458
40	-	-	-	-	1.8	0.229	2.0	0.251	2.4	0.299	3.0	0.360	3.7	0.434	4.5	0.514	5.5	0.607	6.7	0.708
50	-	-	1.8	0.290	2.0	0.314	2.4	0.374	3.0	0.453	3.7	0.549	4.6	0.666	5.6	0.788	6.9	0.936	8.3	1.09
63	1.8	0.368	2.0	0.403	2.5	0.494	3.0	0.580	3.8	0.721	4.7	0.873	5.8	1.05	7.1	1.26	8.6	1.47	10.5	1.73
75	1.9	0.462	2.3	0.557	2.9	0.675	3.6	0.828	4.5	1.02	5.6	1.24	6.8	1.47	8.4	1.76	10.3	2.09	12.5	2.44
90	2.2	0.647	2.8	0.800	3.5	0.98	4.3	1.18	5.4	1.46	6.7	1.77	8.2	2.12	10.1	2.54	12.3	3.00	15.0	3.51
110	2.7	0.952	3.4	1.19	4.2	1.46	5.3	1.77	6.6	2.17	8.1	2.62	10.0	3.14	12.3	3.78	15.1	4.49	18.3	5.24
125	3.1	1.25	3.9	1.53	4.8	1.88	6.0	2.27	7.4	2.76	9.2	3.37	11.4	4.08	14.0	4.87	17.1	5.77	20.8	6.75
140	3.5	1.56	4.3	1.90	5.4	2.32	6.7	2.83	8.3	3.46	10.3	4.22	12.7	5.08	15.7	6.11	19.2	7.25	23.3	8.47
160	4.0	2.02	4.9	2.45	6.2	3.04	7.7	3.72	9.5	4.52	11.8	5.50	14.6	6.67	17.9	7.96	21.9	9.44	26.6	11.0
180	4.4	2.51	5.5	3.10	6.9	3.79	8.6	4.67	10.7	5.71	13.3	6.98	16.4	8.42	20.1	10.1	24.6	11.9	29.9	14.0
200	4.9	3.08	6.2	3.88	7.7	4.69	9.6	5.78	11.9	7.05	14.7	8.56	18.2	10.4	22.4	12.4	27.4	14.8	33.2	17.2
225	5.5	3.90	6.9	4.82	8.6	5.89	10.8	7.30	13.4	8.93	16.6	10.9	20.5	13.1	25.2	15.8	30.8	18.6	37.4	21.8
250	6.2	4.88	7.7	5.98	9.6	7.30	11.9	8.93	14.8	11.0	18.4	13.4	22.7	16.2	27.9	19.4	34.2	23.0	41.5	27.0
280	6.9	6.04	8.6	7.47	10.7	9.10	13.4	11.3	16.6	13.7	20.6	16.8	25.4	20.3	31.3	24.3	38.3	28.9	46.5	33.8
315	7.7	7.52	9.7	9.37	12.1	11.6	15.0	14.2	18.7	17.4	23.2	21.2	28.6	25.6	35.2	30.8	43.1	36.5	52.3	42.7
355	8.7	9.55	10.9	11.8	13.6	14.6	16.9	18.0	21.1	22.1	26.1	26.9	32.2	32.5	39.7	39.1	48.5	46.3	59.0	54.3
400	9.8	12.1	12.3	15.1	15.3	18.6	19.1	22.9	23.7	28.0	29.4	34.1	36.3	41.3	44.7	49.6	54.7	58.8	-	-
450	11.0	15.3	13.8	19.0	17.2	23.5	21.5	28.9	26.7	35.4	33.1	43.2	40.9	52.3	50.3	62.7	61.5	74.4	-	-
500	12.3	19.0	15.3	23.4	19.1	28.9	23.9	35.7	29.7	43.8	36.8	53.3	45.4	64.5	55.8	77.3	-	-	-	-
560	13.7	23.6	17.2	29.4	21.4	36.2	26.7	44.7	33.2	54.8	41.2	66.9	50.8	80.8	62.5	97.0	-	-	-	-
630	15.4	29.9	19.3	37.1	24.1	45.9	30.0	56.4	37.4	69.4	46.3	84.6	57.2	102.0	70.3	122.5	-	-	-	-
710	17.4	38.0	21.8	47.2	27.2	58.4	33.9	71.8	42.1	88.1	52.2	107.0	64.5	130.0	79.3	155.8	-	-	-	-
800	19.6	48.1	24.5	59.7	30.6	73.9	38.1	91.1	47.4	112.0	58.8	136.0	72.6	164.7	89.3	197.7	-	-	-	-
900	22.0	60.9	27.6	75.6	34.4	93.4	42.9	115.0	53.3	141.0	66.2	172.4	81.7	208.5	-	-	-	-	-	-
1000	24.6	75.2	30.6	93.1	38.2	115.0	47.7	142.0	59.3	175.0	72.5	210.0	90.2	256.0	-	-	-	-	-	-
1200	29.4	108.0	36.7	134.0	45.9	166.0	57.2	205.0	67.9	240.2	88.2	306.2	-	-	-	-	-	-	-	-
1400	34.3	147.0	42.9	183.0	53.5	226.0	66.7	278.0	82.4	339.3	102.9	416.6	-	-	-	-	-	-	-	-
1600	39.2	192.0	49.0	238.0	61.2	295.0	76.2	363.2	94.1	442.9	117.6	544.2	-	-	-	-	-	-	-	-

9.2 HDPE PE80 pipes dimensions

Acc. To DIN 8074/ 8075 , ISO 4427 and ES1832 Standard
Table of Dimensions mm , Weights kg/m and Pressures PN

Pipe Series	16		12.5		10.5		8		6.3		5		4		3.2		2.5		2	
SDR PN	33 4		26 5		22 6		17 8		13.6 10		11 12.5		9 16		7.4 20		6 25		5 32	
d mm	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m	wall th.	wt. Kg/m
25	-	-	-	-	-	-	-	-	2.0	0.151	2.3	0.173	3.0	0.202	3.5	0.243	4.2	0.281	5.1	0.323
32	-	-	-	-	-	-	2.0	0.198	2.4	0.235	3.0	0.282	3.6	0.331	4.4	0.390	5.4	0.458	6.5	0.525
40	-	-	1.8	0.229	1.9	0.240	2.4	0.299	3.0	0.360	3.7	0.434	4.5	0.514	5.5	0.607	6.7	0.708	8.1	0.818
50	1.8	0.290	2.0	0.317	2.3	0.365	3.0	0.458	3.7	0.55	4.6	0.673	5.6	0.796	6.9	0.945	8.3	1.10	10.1	1.27
63	2.0	0.403	2.5	0.500	2.9	0.569	3.8	0.728	4.7	0.883	5.8	1.06	7.1	1.27	8.6	1.49	10.5	1.74	12.8	2.02
75	2.3	0.557	2.9	0.683	3.5	0.816	4.5	1.03	5.6	1.25	6.8	1.48	8.4	1.78	10.3	2.12	12.5	2.44	15.3	2.85
90	2.8	0.800	3.5	0.988	4.1	1.15	5.4	1.47	6.7	1.79	8.2	2.12	10.1	2.57	12.3	3.03	15.0	3.51	18.1	4.09
110	3.4	1.19	4.2	1.45	5.0	1.69	6.6	2.19	8.1	2.64	10.0	3.18	12.3	3.82	15.1	4.54	18.3	5.24	22.1	6.10
125	3.9	1.53	4.8	1.86	5.7	2.19	7.4	2.79	9.2	3.40	11.4	4.12	14.0	4.92	17.1	5.84	20.8	6.75	25.1	7.87
140	4.3	1.90	5.4	2.35	6.4	2.75	8.3	3.50	10.3	4.26	12.7	5.13	15.7	6.18	19.2	7.33	23.3	8.47	28.1	9.87
160	4.9	2.45	6.2	3.08	7.3	3.58	9.5	4.57	11.8	5.56	14.6	6.74	17.9	8.04	21.9	9.54	26.6	11.20	32.1	12.9
180	5.5	3.10	6.9	3.83	8.2	4.52	10.7	5.77	13.3	7.05	16.4	8.51	20.1	10.2	24.6	12.1	29.9	14.1	36.1	16.30
200	6.2	3.840	7.7	4.69	9.1	5.510	11.9	7.05	14.7	8.560	18.2	10.40	22.4	12.40	27.4	14.8	33.2	17.2	40.1	20.1
225	6.9	4.770	8.6	5.89	10.3	7.000	13.4	8.93	16.6	10.900	20.5	13.10	25.2	15.80	30.8	18.6	37.4	21.8	45.1	25.4
250	7.7	5.920	9.6	7.30	11.4	8.590	14.8	11.0	18.4	13.400	22.7	16.20	27.9	19.40	34.2	23.0	41.5	27	50.1	31.4
280	8.6	7.400	10.7	9.10	12.8	10.800	16.6	13.7	20.6	16.800	25.4	20.30	31.3	24.30	38.3	28.9	46.5	33.8	56.2	39.4
315	9.7	9.47	12.1	11.7	14.4	13.8	18.7	17.6	23.2	21.5	28.6	25.9	35.2	31.1	43.1	36.9	52.3	43.2	63.2	49.8
355	10.9	12.0	13.6	14.8	16.2	17.5	21.1	22.4	26.1	27.2	32.2	32.9	39.7	39.5	48.5	46.8	59.0	54.8	-	-
400	12.3	15.2	15.3	18.8	18.2	22.1	23.7	28.3	29.4	34.5	36.3	41.7	44.7	50.1	54.7	59.4	66.5	69.6	-	-
450	13.8	19.2	17.2	23.7	20.5	28.0	26.7	35.8	33.1	43.7	40.9	52.8	50.3	63.4	61.5	75.2	-	-	-	-
500	15.3	23.6	19.1	29.2	22.8	34.5	29.7	44.2	36.8	53.9	45.4	65.2	55.8	78.1	68.3	92.8	-	-	-	-
560	17.2	29.7	21.4	36.6	25.5	43.2	33.2	55.4	41.2	67.9	50.8	81.7	62.5	98.0	-	-	-	-	-	-
630	19.3	37.5	24.1	46.4	28.7	54.7	37.4	70.2	46.3	85.5	57.2	103	-	-	-	-	-	-	-	-
710	21.8	47.7	27.2	59.0	32.3	69.4	42.1	89.0	52.2	109.0	64.5	131	-	-	-	-	-	-	-	-
800	24.5	60.4	30.6	74.7	36.4	88.1	47.4	113	58.8	138.0	72.6	164.7	-	-	-	-	-	-	-	-
900	27.6	76.4	34.4	94.4	41.0	112	53.3	143	66.1	174.0	81.7	208.5	-	-	-	-	-	-	-	-
1000	30.6	94.1	38.2	117.0	45.5	138	59.3	176	72.5	210.0	90.2	256.0	-	-	-	-	-	-	-	-
1200	36.7	135	45.9	168.0	54.6	198	67.9	240.2	88.2	306.2	-	-	-	-	-	-	-	-	-	-
1400	42.9	184	53.3	230.0	63.7	160	82.4	339.3	102.9	416.6	-	-	-	-	-	-	-	-	-	-
1600	49.0	238	61.2	295.0	76.2	363.2	94.1	442.9	117.6	544.2	-	-	-	-	-	-	-	-	-	-

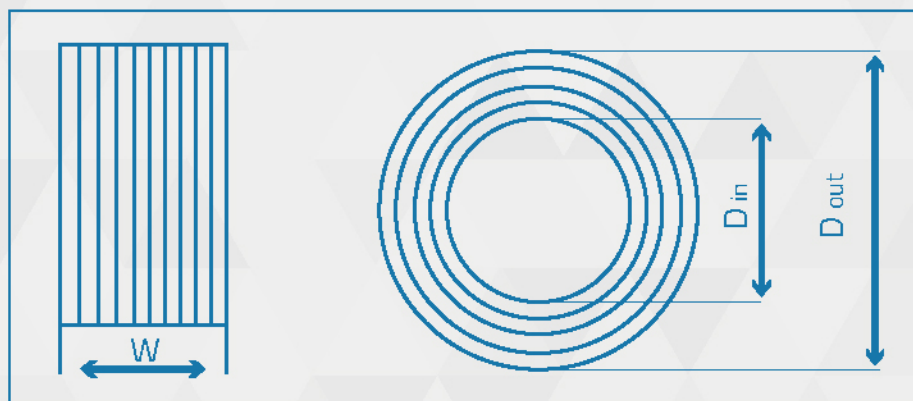
9.3 Natural gas pipes dimensions

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

HDPE (PE 100) pipes with orange color are used with working pressure up to 7.0 Bar according to PL2 - 8.

COLOUR	Orange		Yellow	
MATERIAL	PE 100		PE 80	
WORKING PRESSURE	7		5.5	
SDR.	11		11	
O.D. mm	Wall thickness mm	Weight/Kg	Wall thickness mm	Weight/Kg
20	2.3	0.133	2.3	0.133
25	2.3	0.171	2.3	0.171
32	2.9	0.272	2.9	0.272
40	3.7	0.430	3.7	0.430
50	4.6	0.666	4.6	0.666
63	5.8	1.050	5.8	1.050
75	6.8	1.470	6.8	1.470
90	8.2	2.120	8.2	2.120
110	10	3.140	10	3.140
125	11.4	4.080	11.4	4.080
140	12.7	5.080	12.7	5.080
180	16.4	8.420	16.4	8.420
200	18.2	10.400	16.2	10.400
250	22.7	16.200	22.7	16.200
280	25.4	20.300	25.4	20.300
315	28.6	25.500	28.6	25.500
355	32.2	32.900	32.2	32.900

9.4 Coil pipes dimensions



Pipe		Coil		
O.d. (mm)	Lenth(m)	D out (mm)	D in (mm)	W (mm)
20	100	1080	900	140
	200	1190	900	180
25	100	1130	900	190
	200	1260	900	220
32	100	1190	900	240
	200	1300	900	280
40	50	1120	900	290
	100	1260	900	290
	200	1400	900	370
50	50	1590	1400	320
	100	1760	1400	320
	200	1940	1400	380
63	50	1840	1600	340
	100	2050	1600	340
75	50	2180	1900	375
	100	2310	1900	400
90	50	2540	2200	360
110	50	2610	2200	440
125	50	2667	2200	500

9.5 Tolerances on outside diameter and circularity (ovality)

Acc. To DIN 8074

O.D. mm	Limit deviations for mean outside dia. mm		Circularity Tolerance (MM)	
			Straight Pipes	Coiled Pipes
25	+0.3	-0	1.2	1.5
32	+0.3	-0	1.3	2.0
40	+0.4	-0	1.4	2.4
50	+0.5	-0	1.4	3.0
63	+0.6	-0	1.6	3.8
75	+0.7	-0	1.6	
90	+0.9	-0	1.8	
110	+1.0	-0	2.2	
125	+1.2	-0	2.5	
140	+1.3	-0	2.8	
160	+1.5	-0	3.2	
180	+1.7	-0	3.6	
200	+1.8	-0	4.0	
225	+2.1	-0	4.5	
250	+2.3	-0	5.0	
280	+2.6	-0	9.8	
315	+2.9	-0	11.1	
355	+3.2	-0	12.5	
400	+3.6	-0	14.0	
450	+3.8	-0	15.8	
500	+4.0	-0	17.5	
560	+4.3	-0	19.6	
630	+4.6	-0	22.1	
710	+4.6	-0	24.9	
800	+5.0	-0	28.0	
900	+5.0	-0	32.0	
1000	+5.0	-0	35.0	
1200	+6.0	-0	42.0	
1400	+6.0	-0	49.0	
1600	+6.0	-0	56.0	

9.6 Tolerances on Wall Thickness

Acc. To DIN 8074

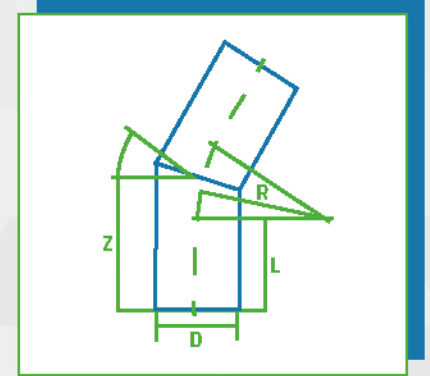
Wall thickness	Tolerances
up to 2	0.4
over 2 to 3	0.5
over 3 to 4	0.6
over 4 to 5	0.7
over 5 to 6	0.8
over 6 to 7	0.9
over 7 to 8	1.0
over 8 to 9	1.1
over 9 to 10	1.2
over 10 to 11	1.3
over 11 to 12	1.4
over 12 to 13	1.5
over 13 to 14	1.6
over 14 to 15	1.7
over 15 to 16	1.8
over 16 to 17	1.9
over 17 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
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

Wall thickness	Tolerances
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
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

9.7 Elbow dimensions

9.7.1 Elbow 11.25° - 22.5° - 30°

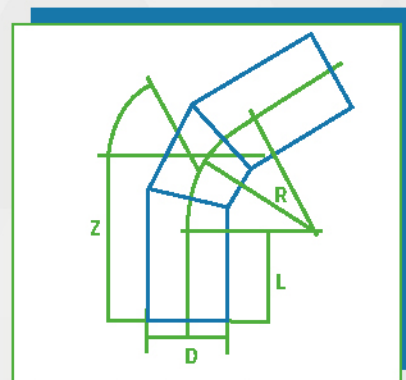
Fabricated - 2 segments



D	L	R	Z mm		
mm	mm	mm	11.25°	22.5°	30°
75	150	115	175	180	185
90	150	135	180	185	190
110	150	165	185	190	195
125	150	188	190	195	200
140	150	210	195	200	205
160	150	240	200	205	214
180	150	270	210	216	222
200	150	300	216	222	230
225	150	338	222	230	241
250	250	375	330	340	350
280	250	420	340	350	362
315	300	475	385	405	425
355	300	533	405	425	443
400	300	600	425	445	461
450	300	675	440	460	481
500	350	750	455	480	551
560	350	840	480	510	575
630	350	945	510	545	603
710	350	1065	545	570	635
800	350	1200	570	600	672
900	400	1350	610	680	762
1000	400	1500	670	720	816
1200	400	1800	720	820	875
1400	450	2100	820	875	940
1600	450	2400	875	940	1010

9.7.2 Elbow 45° - 60°

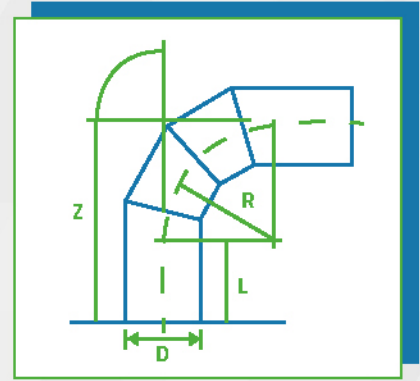
Fabricated - 3 segments



D	L	R	Z mm	
mm	mm	mm	45°	60°
75	150	115	198	210
90	150	135	205	225
110	150	165	218	245
125	150	188	228	258
140	150	210	237	270
160	150	240	249	288
180	150	270	262	305
200	150	300	275	323
225	150	338	290	345
250	250	375	410	465
280	250	420	425	490
315	300	475	500	575
355	300	533	520	610
400	300	600	550	645
450	300	675	580	690
500	350	750	665	785
560	350	840	700	835
630	350	945	740	895
710	350	1065	790	965
800	350	1200	850	1045
900	400	1350	960	1180
1000	400	1500	1020	1265
1200	400	1800	1190	1355
1400	450	2100	1250	1440
1600	450	2400	1350	1550

9.7.3 Elbow 90°

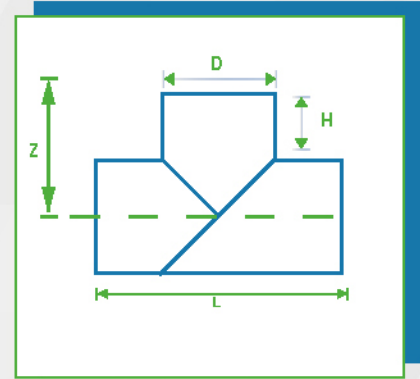
Fabricated - 4 segments



D	L	R	Z
mm	mm	mm	mm
75	150	115	270
90	150	135	295
110	150	165	315
125	150	188	338
140	150	210	360
160	150	240	390
180	150	270	420
200	150	300	450
225	150	338	490
250	250	375	625
280	250	420	670
315	300	473	775
355	300	533	835
400	300	600	900
450	300	675	975
500	350	750	1100
560	350	840	1190
630	350	945	1295
710	350	1065	1415
800	350	1200	1550
900	400	1350	1750
1000	400	1500	1900
1200	400	1800	2050
1400	450	2100	2300
1600	450	2400	2550

9.8 Tee 90°

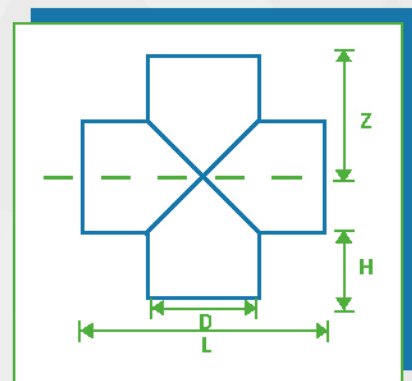
Fabricated - 3 segments



D	H	L	Z
mm	mm	mm	mm
75	150	375	188
90	150	390	195
110	150	410	205
125	150	425	215
140	150	440	220
160	150	460	230
180	150	480	240
200	150	500	250
225	250	525	265
250	250	750	375
280	250	780	390
315	300	915	460
355	300	955	480
400	300	1000	500
450	300	1050	525
500	350	1200	600
560	350	1260	630
630	350	1330	665
710	350	1410	705
800	350	1500	750
900	400	1700	850
1000	400	1800	900
1200	400	2000	1000
1400	450	2300	1150
1600	450	2500	1250

9.9 Cross Tee 90°

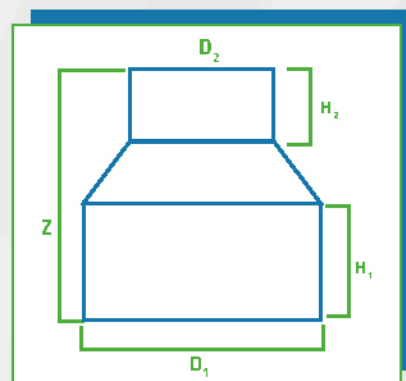
Fabricated - 4 segments



D	H	L	Z
mm	mm	mm	mm
75	150	375	188
90	150	390	195
110	150	410	205
125	150	425	215
140	150	440	220
160	150	460	230
180	150	480	240
200	150	500	250
225	250	525	265
250	250	750	375
280	250	780	390
315	300	915	460
355	300	955	480
400	300	1000	500
450	300	1050	525
500	350	1200	600
560	350	1260	630
630	350	1330	665
710	350	1410	705
800	350	1500	750
900	400	1700	850
1000	400	1800	900
1200	400	2000	1000
1400	450	2300	1150
1600	450	2500	1250

9.10 Reducer

Fabricated



D_1	D_2	H_1	H_2	Z
mm	mm	mm	mm	mm
50	32	56	48	115
50	40	56	51	110
63	32	67	48	134
63	40	67	51	130
63	50	67	56	128
75	40	74	51	142
75	50	74	56	143
75	63	74	67	147
90	50	83	56	158
90	63	83	67	168
90	75	83	74	170
110	50	90	56	180
110	63	90	67	183
110	75	90	74	184
110	90	90	80	194
125	63	90	67	190
125	75	90	75	190
125	90	90	80	196
125	110	90	90	198
140	90	96	80	205
140	110	96	90	205
140	125	96	94	200
160	90	105	80	225
160	110	105	90	225
160	125	105	94	220
160	140	105	97	215
180	110	105	90	240
180	125	105	94	236

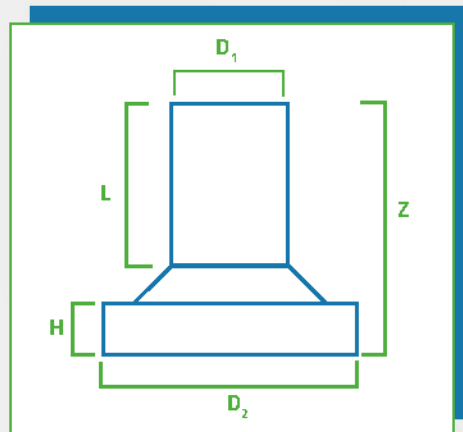
D ₁	D ₂	H ₁	H ₂	Z
mm	mm	mm	mm	mm
180	140	105	97	216
180	160	105	99	216
200	140	112	97	240
200	160	112	105	234
200	180	112	105	250
225	160	120	105	260
225	180	120	105	270
225	200	120	112	260
250	180	130	105	290
250	200	130	112	275
250	225	130	120	280
280	200	140	112	281
280	225	140	120	290
280	250	140	130	298
315	200	150	112	292
315	225	150	120	300
315	250	150	130	309
315	280	150	140	320
355	250	165	130	325
355	280	165	140	335
355	315	165	150	345
400	280	180	140	350
400	315	180	150	360
400	355	180	165	375
450	315	195	150	375
450	355	195	165	389
450	400	195	180	404
500	355	212	165	406
500	400	212	180	420
500	450	212	195	437
560	400	235	180	445
560	450	235	195	460
560	500	235	212	475
630	450	255	195	480
630	500	255	212	497
630	560	255	235	520

D_1	D_2	H_1	H_2	Z
mm	mm	mm	mm	mm
710	500	255	212	497
710	560	255	235	520
710	630	255	255	540
800	630	255	255	540
800	710	255	255	540
900	630	270	255	560
900	710	270	255	565
900	800	270	255	580
1000	710	285	255	600
1000	800	285	255	600
1000	900	285	270	600



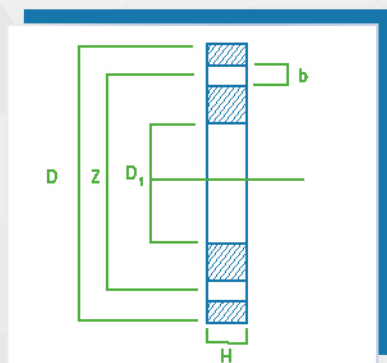
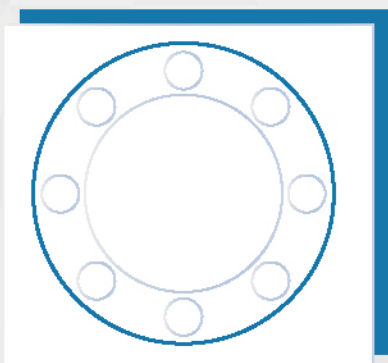
9.11 Flange adaptor (stub flange)

Fabricated



D_1	D_2	L	H	Z
mm	mm	mm	mm	mm
90	140	110	18	150
110	158	117	18	160
125	168	125	25	170
140	185	147	25	200
160	212	147	25	200
180	212	150	30	200
200	268	150	32	200
225	268	155	32	200
250	320	160	35	220
280	320	165	35	230
315	370	170	35	235
355	425	170	40	240
400	480	180	45	255
450	585	195	50	275
500	585	212	50	292
560	690	235	55	320
630	690	235	55	340
710	800	255	60	345
800	900	255	60	345
900	1020	260	60	360
1000	1130	260	60	370

9.12 Flange (steel)



d	D_1	D	Z	b	H
mm	mm	mm	mm	mm	mm
90	108	200	160	18	20
110	125	220	180	18	20
125	135	220	180	18	20
140	158	250	210	18	22
160	178	285	240	23	22
180	188	285	240	23	22
200	235	340	295	23	24
225	238	340	295	23	24
250	288	405	355	27	26
280	295	405	355	27	26
315	338	465	410	27	28
355	376	520	470	27	30
400	430	580	525	30	32
450	517	715	650	33	34
500	533	715	650	33	34
560	618	840	770	36	38
630	645	840	770	36	38
710	740	910	840	39	38
800	843	1025	950	39	38
900	947	1125	1050	39	40
1000	1050	1255	1170	42	42

10.1 Working pressure with different service life periode and different Temp. for PE100

Acc. To DIN 8074

Temp 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	31.6	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	19.4	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	23.5	29.7	38.0	47.6
	100	3.7	4.6	5.8	7.3	6.7	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	25.0	30.3	41.5
	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	19.5	24.5	31.4	39.2
30	5	2.8	3.6	4.5	5.6	6.7	7.2	8.6	9.8	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	9.0	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	8.8	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	8.6	10.6	13.5	16.9	21.2	27.1	33.9
40	5	2.4	3.1	3.8	4.8	5.8	6.1	7.4	8.4	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	7.7	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	7.6	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	7.4	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	7.2	8.3	10.7	13.4	16.7	21.4	26.8
	10	2.0	2.5	3.2	4.0	4.8	5.2	6.2	6.4	8.1	10.4	13.0	16.2	20.3	26.0
	25	1.9	2.2	2.9	3.7	4.4	4.7	5.7	5.7	7.4	9.5	11.6	14.8	18.0	23.7
60	5	1.5	1.9	2.4	3.0	3.5	3.8	4.6	4.5	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	3.4	4.9	6.2	7.8	9.8	12.5	15.7

10.2 Working pressure with different service life period and different Temp. for PE80

Acc. To DIN 8074

Temp 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	9.4	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	9.8	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	9.0	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	8.8	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	8.6	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	8.4	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	7.7	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	7.6	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	7.4	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	7.2	8.4	10.7	13.7	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

11. Quality Control

11-1 Lab Equipment and tests

Mega pipes has built a modern and efficient Laboratory with high performance Equipments from Ecuropion suppliers to cover the pressure test, Charpy impact tensile tests in order to accept raw materials it is very important to carry out density and fluidity test on polypropylene deliveries.

Product dimensional Test of dimensional variation Test after heat exposure.

Microscope check about the homogeneity of the modified material. Temperature and pressure resistance tests as follow:

- Tensile strength tests
- Heat resistance test
- Melt flow index
- Density Control
- Shock tests

The audit quality manager checks all the results and give the approval to proceed with the production.



Melt flow index

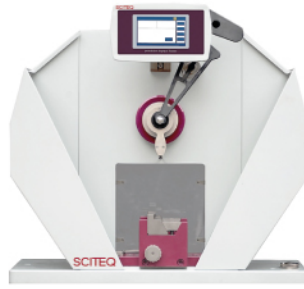
11.2 Laboratory equipment's for pipes and fittings

Mega pipes laboratory has all equipment which covers all the tests of raw materials, production process and final product listed as follow:

- | | |
|-----------------------------|----------------------------------|
| 1-Melt flow index tester. | 2-Sieve analysis tester. |
| 3-Flow tester. | 4-Heat stability tester. |
| 5-Bulk density tester. | 6-Falling impact tester. |
| 7-Pendulum impact tester. | 8-VST tester. |
| 9-Chemical effect tester. | 10- Hydrostatic pressure tester. |
| 11-Burst pressure tester. | 12-Oven (Heat reversion) tester. |
| 13-Tensile strength tester. | 14-Compression tester. |
| 15-Hardness tester. | 16-Thermocycling tester. |



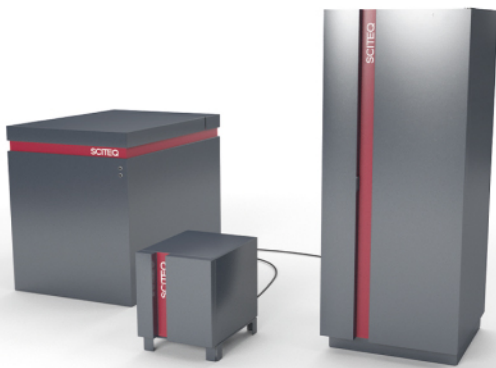
Melt flow rate tester



Pendulum impact tester



Bulk density tester



Hydrostatic pressure tester



Tensile tester



Weighting tester

11.3 System control procedure

The production of a quality-controlled pipe systems demands the supervision, regulation and control of all work operations. All results and processes have to be documented this requires:

- Test and acceptance of incoming goods: raw materials tests before processing stage.
- Process control.
- In process inspection and test: during the production process.
- Final inspection and test: dimension control, surface finish, melt flow index, OIT measurement, heat reversion test, carbon black content, pressure test, tensile test.

11.4 Raw material testes

- 1-Melt flow rate test acc. To ISO 1133.
- 2-Density test acc. To ISO 1183.
- 3-Oxidation induction time test OIT acc. To ISO 728.
- 4-Moisture content test.

11.5 The tests during production processes

- 1-Visual inspection acc. To DIN 8074, ES 1832.
- 2-Dimensional measuring acc. To DIN 8074, ES 1832.
a-Wall thickness. b-Outside diameter c-Ovality.
- 3-Tensile strength at yield acc. To ISO 527.
- 4-Elongation at break acc. To ISO 527, ES 1832.
- 5-Heat reversion test acc. To DIN 8074, ES 1832.
- 6-Hydrostatic pressure test (long term) acc. To DIN 8074, ES1832.

11.6 The pressure test at site

In case of testing the pipeline at site, we must do the steps as follow:

- 1- Maximum pipeline length in then beginning is about 500 meters and not exceeds 1000 meters, thin must also cover the pipeline.
- 2- We must cover the pipeline by soft soil.
- 3- Discharge the pipeline from the air by installing air valves before testing.
- 4- Use water until this process is also performed to clean the line from the dust various materials inside as a result of drilling.
- 5- The pressure test at site is equal to one and half times of allowable working pressure for period of not less than half an hour at 20 C.

The pressure reduction factor versus temperature up to 40 C , applicable to 50 years life time acc. to ISO 4427 for PE100 lestest as follow:

Temperature	20°C	25°C	30°C	35 C	40 C
Factor.	1.0	0.93	0.87	0.80	0.74

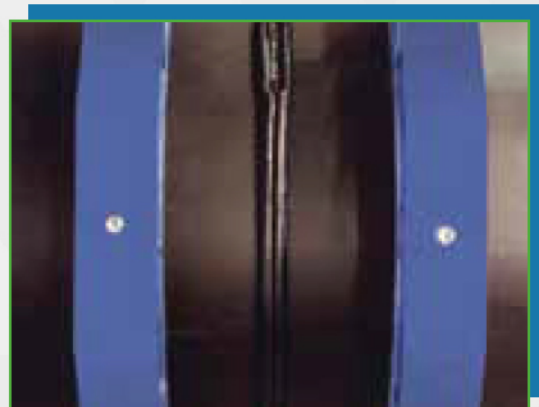
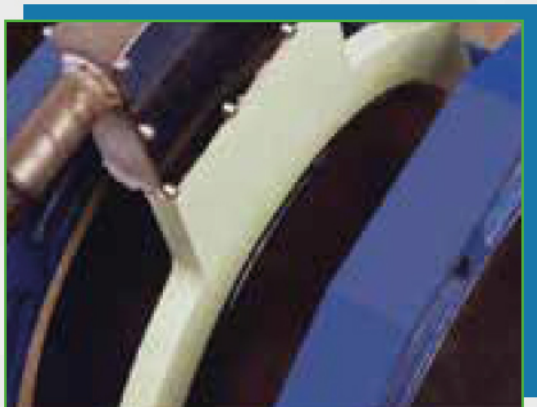
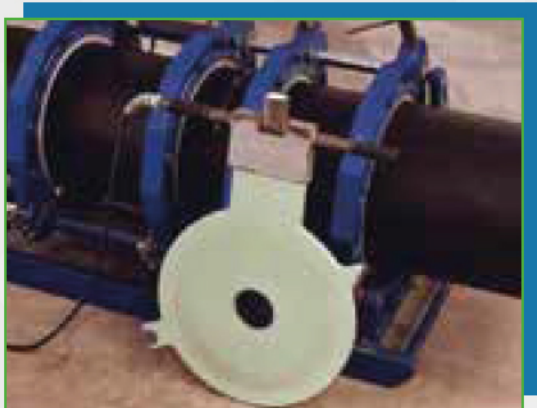
12. Connection methods of PE100

The connection methods that can be used for PE100 pipes and fittings are as follows:

12.1.1 Butt welding method

Butt welding technique is most commonly used technique to join polyethylene pipes and additional parts due to its many advantages. Butt welding method is recommended to be applied to pipes with diameter and wall thickness more than 63 mm, and 3 mm respectively. Butt welding method is the process of fusion welding via trimming the tips of the pipes to be welded and pushing them to each other at certain temperature by the use of a welding machine. Pipes up to 1600 mm diameter can be welded end to end using butt welding method. Relevant standard to be followed for butt welding process is DVS 2207.

If the electric power is to be supplied by generator, the power output of the generator must be minimum 4 KW. The generator must have voltage regulator, in case of excess wind or rain, some precautions must be taken into consideration for protection of the welding place.



12.1.2 Rules for Butt fusion

1. Never attempt to weld together pipes of different SDR (wall thickness).
2. Never touch trimmed pipe ends.
3. Never leave trimming Swarf inside pipe or on welding machine
4. Never allow equipment to get wet or dusty.
5. Never use non-approved machinery
6. Never remove a welded pipe from the machine before Cooling time has elapsed
7. Never allow untrained personnel to use welding equipment
8. Never cut Corners in any part of the welding procedure
9. Never weld pipes of different material on site
10. Never use a generator of inadequate Capacity

12.1.3 The advantages of Butt Welding

- It does not require special fitting for connection.
- With butt welding, some fittings like bends and T pieces can be produced at the site.
- The butt welding machines are easy to supply in all corners of the world.
- The fittings produced for butt welding have low production costs.
- Butt welding can be applied for all diameters and for all pressure ratings (For best results the minimum wall thickness must be 3 mm.)
- The lips forming inside and outside the pipe increases the welding area's cross-section hence increasing the safety of the welded area.
- Butt welding operation is very easy to learn.

12.2 Electrofusion welding method

The principle of electrofusion welding method is to fuse two pieces by melting some certain outer part of both pieces via warming by electrifying the copper wires in the part with socket. An electrofusion welding machine to provide the electricity is required for warming the copper wires in the socket.

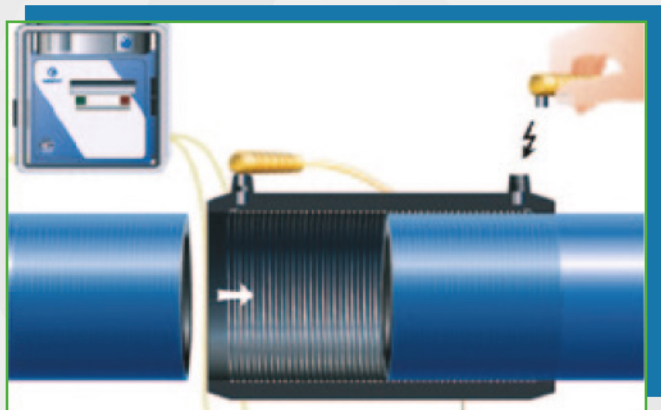
The electrofusion socket's internal surface is cleaned with alcohol.

Pipes from 50 mm up to 1600 mm diameter can be welded electrofusion welding method. Electrofusion welding process is also required to be performed in compliance with DVS 2207 standard.

Electrofusion welding is economical to apply for small diameter pipes of 20 mm up to 110mm.

The voltage input must be in between 220 – 240 volts and not less than 220 volts, if the electricity will be supplied by a generator, the output of the generator must be at least 3.5 KW.

The welded pipes must not be moved until complete cooling and they must be protected from contact with water.



Electrofusion principles:

Hot and cold zones, sometimes called melt and freeze zones, are formed after energising the coil. The length of these zones is particularly important.

Each zone ensures that fusion is controlled to a precise length of the socket of the fitting and that the melt pressure is also controlled throughout the entire jointing process.

The precisely controlled pitch and positioning of the coil in relation to the inner surface of the socket ensures uniform heat distribution.

Electrofusion fittings are supplied for mainly 39.5 volt operation although some sizes and materials are available for 80 volt operation.

12.3.1 Connection with push-fit sockets

PE100 pipes can also be produced as suitable for connection with O-ring push fit fittings (Compression fittings) have double O-ring. The first O-ring ensures the leak proof and the second plays the role of lock which avoids the out going of the pipe easily from the fittings for the success of this connection method. The most important point is proper cutting of the pipe ends. The external corners of the pipe ends must be rounded. A sliding agent can be used for easy insertion of the pipe into the fitting or when necessary, a pulling equipment must be used for this purpose.

12.3.2 Compression fittings

Polypropylene compression fittings provide the simplest and most economic solution that ensure fast and safe connection and their suitability for reuse are its outstanding features. All compression fittings (Elbow, Tee, coupling, reducer, etc.) are available for PE pipes from dia. 20 mm up to 125 mm. They are easy to use and not required especially skilled operatives to install.

12.3.3 Assembly Instructions

1. Clean off the pipe ends of loose dirt and embedded grit.
2. Bevel the pipe ends with the chamfering tool (a knife or file may also be used)
3. Dismantle the fittings and leaving the grip ring to one side, thread the nut, the insert and the 'O'-ring on to the pipe.



4. Push the pipe into the fitting until it reaches the internal edge stopper. The advance the 'O'-ring and the insert up to the body of the fitting.



5. Tighten the nut, using a suitable wrench, until it reaches the end of the thread. The 'O'-ring and insert rings now correctly positioned.



6. Completely unscrew the nut from the body of the fitting. Take care not to disturb the pipe, 'O'-ring or inset from their position.



7. Open the grip ring and place it on the pipe between the nut and the insert.



8. Offer up the nut, the fitting is now ready for final tightening.



9. Tighten the nut using a suitable wrench.



10. Repeat for the other pipe.

12.4 Connection by using flanges

In this method, steel flange is inserted on the flange adaptor and this adaptor is welded to the pipe end by butt welding.

12.5 Repair of a damaged PE pipe

The pipe can be damaged in any case. The repair of the pipe can be done using several methods. It is necessary to choose the best of the these repair methods which suits to the type and place of the damaged part on the pipe.

12.6 Making repair using flange

The damaged area of the pipe is unearthed to an extend where the pipe can be moved towards each side.

The equipment's necessary for making a flange connection to PE pipe end are the followings:

- Butt welding machine.
- Gasket for flange.
- Electric power supply.
- Two pieces of flanges.
- Bolts and nuts for flanges.

12.7 Making repair using electrofusion welding socket

This method of repair gives good results at places where there isn't a good working condition. The area of damage on the pipe is unearthed sufficiently to allow a little bending of the pipe.

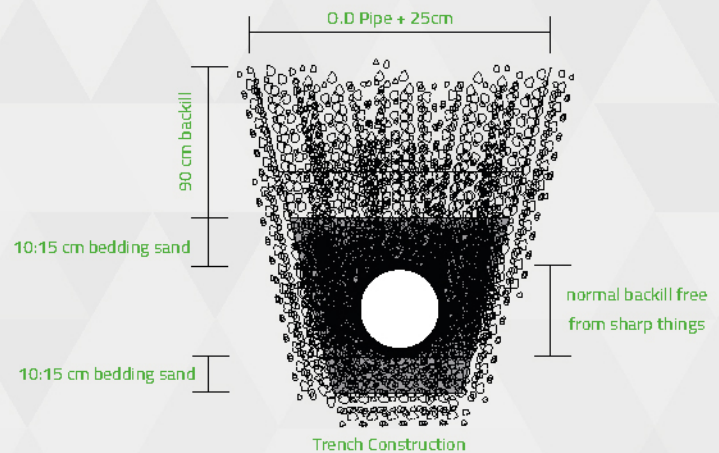
The equipment's necessary for making a repair with electrofusion welding socket are the followings:

- Electrofusion welding machine.
- One (if the damage is small) or two electrofusion sockets (if the damage is big).
- Electric power supply.
- Alcohol for cleaning the welding area on the pipe.
- Pooling tool for scraping the oxidized surface layer on the welding.

13. Pipe installation

1- Trenching:

The trench should be kept to a minimum width , due to the possibility of welding PE100 pipes outside the trench and draw it after welding but should still allow for good compaction during back-filling. This will reduce the digging costs .



2- Bedding:

The trench bottoms should be excavated to provide a reasonably even bed along the pipe length and free of sharp stones or other objects that could damage the pipes , sand for pipes bedding should be used where possible and soil containing sharp , angular gravel or cobbles should not be used for bedding of PE pipes.

3- Laying:

- **Under ground:** for gas and water distribution mains and gravity pumped ,sewer mains to avoid exposure to external possible mechanical load.
- **Above ground:** for industrial and process pipe work , but the pipes should be protected against mechanical damage and UV degradation.

4- Side filling:

Same material used for bedding should be used to fill space between the pipes and the trench wall , the height of the side filling should be half of the diameter of the pipe above the crown.

5- Back filling:

It should be in the form of layers and each layer being well compacted. The pipe properties are such that no restriction of the grain size of the bedding and backfilling materials is necessary.

14. Caution

- PE 100 plastic piping systems will give excellent, maintenance free performance over many years use when the applications and system designs are correct for the product and installation is properly done.
- It's most important to know the physical properties and limitations of PE plastic pipes when selecting the system for their use. These points should be taken into consideration in order to avoid problems caused by misapplication or poor installation.
- Impact resistance is lower than that of metals therefore plastic pipes must be protected from contact with hard and pointed objects.
- Expansion and contraction are greater than that of metals. This can cause breaks and leaking joints if system design is not flexible to allow for movement.
- Temperature pressure relationship has to be taken into consideration. The pressure rating (tensile strength) of PE 100 decreases as temperature increases.
- Extremes of heat and cold can cause failure. Allowing liquids to freeze inside of PE can cause the pipe and / or the fittings to crack. Heat beyond design limits can cause failures as well.
- Every chemical should be verified and approved in the manufacture's chemical resistance chart.
- Certain chemicals, especially petroleum distillates and derivatives, can cause failure.
- Professional engineering design of the system and close supervision of the assembly installation procedures are recommended. Any questions concerning the application or installation or PE piping products should be directed to the supplier, manufacturer or consultant.
- In every case installation procedure should be carefully read followed. It's very important to know the reputation and abilities of your installation crew or contractor.



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