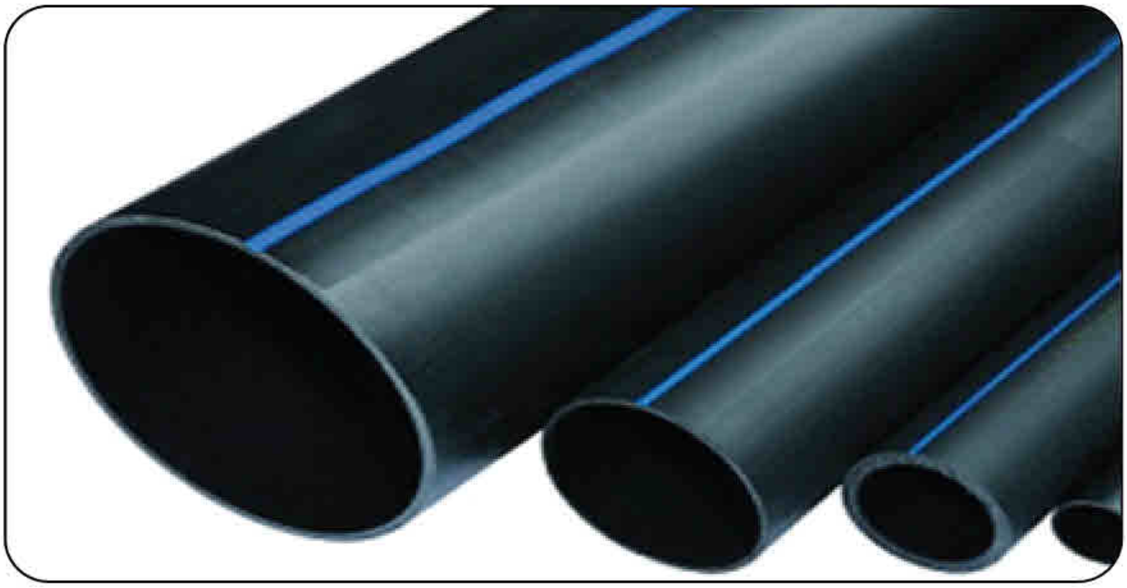
PLASTMIDDLEAST

HDPE PIPES



HDPE PIPES

HIGH DENSITY POLYETHYLENE , since its discovery in 1993 has grown to become one of the world's most widely used and recognized thermoplastic piping materials. Today's modern polyethylene resins such as PE80 and PE100 are highly engineered for rigorous applications such as pressure-rated water, irrigation, firefighting and gas pipes, industrial pipe for transportation of abrasive materials, liner for petroleum flow lines and water/steam injection etc.

Polyethylene is a thermoplastic Polyolefin (Alkene) material generated from the polymerization of Ethylene. As a highly crystalline non-polar thermoplastic with excellent chemical resistance to most household and industrial chemical it provides an excellent base for pipe production.

The success of polyethylene as a piping material over a decade of use has led to its recognition in a wide spectrum and piping applications where a tough, durable material is required to assure long-term performance.

Polyethylene pipes provide a cost-effective solution for a wide range of piping applications including pressure-rated, above-ground, buried, trench-less, floating & submarine installations, pipe-lining etc. One of the major factors that contribute to the growth of polyethylene as a piping material is the cost savings in installation, labor and equipment coupled with lower maintenance cost and increased service life as compared to traditional piping materials.

PIPE DIMENSIONS

Polyethylene pipes are specified in terms of nominal Outside Diameter (OD) rather than by the bore diameter of the pipe. The standard Dimension Ration (SDR) is used to describe the relationship between the pipe diameter and wall thickness.

SDR = Nominal Outside Diameter / Nominal Wall Thickness

Range = 20mm till 1600mm Dia

ADVANTAGES OF POLYETHYLENE PIPE

- Corrosion Resistance
- High Flow Capacity
- Low Installation Cost
- Easy Maintenance
- High Impact Strength
- Length Weight
- Flexible
- Self-restrained Joints
- Leak Proof System
- Long Term Service Life

DESIGN LIFE OF POLYETHYLE PIPES:

The burst pressure of PE pipes is time dependent and therefore it is necessary to define the strength of the material at a reference lifetime. The time normally chosen for this reference value is 50 years, as the various safety factor that are incorporated into the design mean that the actual lifetime will be many times greater. In order to generate the burst strength of the materials at 50 years,in some cases PE 100 association is happy to issue 80 years of life expectancy for PE materials , number of pipe samples are pressure tested to failure in lifetimes between 10 and 10,000 hours.

MATERIAL PROPERTIES

Property	Units	Typical Value for PE 100 grade of Material
Density	Kg/m^3	959
Tensile strength at yield	MPa	23
Elongation at Break %	%	>600
Tensile Modulus MPa Short term	MPa	950
Melt Flow Rate 190/5	g/10min	0.2
Hardness		64
Thermal Expansion x 10^{-4} /°C	-	2.4
Thermal Conductivity (20°C)	W/m.k	0.4
Poisson's Ratio	m	0.4
Softening point	°C	124
Brittleness Temperature	°C	{-100

DIMENSION OF PE PIPES ACCORDING TO ISO 4427 – 2 : 2007 (E)

SDR	6	7.4	9	11	13.6	17	21	26	33	41
Pipe Series (S)	2.5	3.2	4	5	6.3	8	10	12.5	16	20
Nominal Pressure (P N)[a] (bar)										
PE 80	PN 25	PN 20	PN 16	PN 12.5	PN 10	PN 8	PN 6[c]	PN 5	PN 4	PN 3.2
PE 100	-	PN 25	PN 20	PN 16	PN 12.5	PN 10	PN 8	PN 6[c]	PN 5	PN 4
Nominal size / OD (mm)	Wall Thickness e_{min} (mm)									
20	3.4	3.0	2.3[b]	2.0	-	-	-	-	-	-
25	4.2	3.5	3.0	2.3[b]	2.0[b]	-	-	-	-	-
32	5.4	4.4	3.6	3.0	2.4	2.0	-	-	-	-
40	6.7	5.5	4.5	3.7	3.0	2.4	2.0	-	-	-
50	8.3	6.9	5.6	4.6	3.7	3.0	2.4	2.0	-	-
63	10.5	8.6	7.1	5.8	4.7	3.8	3.0	2.5	-	-
75	12.5	10.3	8.4	6.8	5.6	4.5	3.6	2.9	-	-
90	15.0	12.3	10.1	8.2	6.7	5.4	4.3	3.5	-	-
110	18.3	15.1	12.3	10.0	8.1	6.6	5.3	4.2	-	-
125	20.8	17.1	14.0	11.4	9.2	7.4	6.0	4.8	-	-
140	23.3	19.2	15.7	12.7	10.3	8.3	6.7	5.4	-	-
160	26.6	21.9	17.9	14.6	11.8	9.5	7.7	6.2	-	-
180	29.9	24.6	20.1	16.4	13.3	10.7	8.6	6.9	-	-
200	33.2	27.4	22.4	18.2	14.7	11.9	9.6	7.7	-	-
225	37.4	30.8	25.2	20.5	16.6	13.4	10.8	8.6	-	-
250	41.5	34.2	27.9	22.7	18.4	14.8	11.9	9.6	-	-
280	46.5	38.3	31.3	25.4	20.6	16.6	13.4	10.7	-	-
315	52.3	43.1	35.2	28.6	23.2	18.7	15.0	12.1	9.7	7.7
355	59.0	48.5	39.7	32.2	26.1	21.1	16.9	13.6	10.9	8.7
400	-	54.7	44.7	36.4	29.4	23.7	19.1	15.3	12.3	9.8
450	-	61.5	50.3	40.9	33.1	26.7	21.5	17.2	13.8	11.0
500	-	-	55.8	45.4	36.8	29.7	23.9	19.1	15.3	12.3
560	-	-	62.5	50.8	41.2	33.2	26.7	21.4	17.2	13.7
630	-	-	70.3	57.2	46.3	37.4	30.0	24.1	19.3	15.4
710	-	-	79.3	64.5	52.2	42.1	33.9	27.2	21.8	17.4
800	-	-	89.3	72.6	58.8	47.4	38.1	30.6	24.5	19.6
900	-	-	-	81.7	66.2	53.3	42.9	34.4	27.6	22.0
1000	-	-	-	90.2	72.5	59.3	47.7	38.2	30.6	24.5
1200	-	-	-	-	88.2	70.6	57.2	45.9	36.7	29.4
1400	-	-	-	-	102.9	82.4	66.7	53.5	42.9	34.3
1600	-	-	-	-	117.6	94.1	76.2	61.2	49.0	39.2
1800	-	-	-	-	-	105.9	85.17	69.1	54.5	43.8
2000	-	-	-	-	-	117.6	95.2	76.9	60.6	48.8

JOINTING TECHNIQUES

Polyethylene pipe and fittings can be installed using the state of art effortless techniques utilizing the Electro-Fusion and Butt Fusion technologies. Polyethylene pipes can also be joined by various other methods such as socket fusion, saddle fusion and mechanical connections.

Fusion Welded Joint

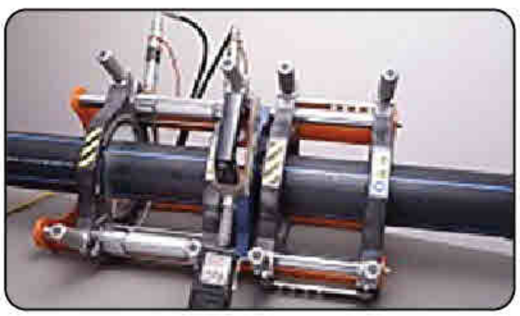
Fusion welded is carried out by melting the polyethylene material at the joint surfaces and bringing the molten surfaces together under closely controlled pressure and holding the surfaces together until the joint has cooled. In all fusion weld process, the field pipe jointing should only be performed by trained fusion operators using properly maintained and calibrated fusion machines. The fusion compatibility of polyethylene material must be established before carrying out welding work.

a) Butt-fusion

The principle of heat fusion is to join molten surfaces of pipes under controlled pressure causing the molten materials flow, mix, and fuse together. When PE pipe is heated, the molecular structure is transformed from a crystalline state into an amorphous condition and under fusion pressure the molecules from each pipe end mix together. As the joint cools, the molecules return to their crystalline form making the joint a homogenous weld. Butt fusion can be used to join both PE80 and PE100 materials for pipe sizes of 90mm and above of the same SDR.

Equipments and Tools required for the Butt fusion process:

- Automatic Butt Fusion Machine suitable for the pipe size.
- Power source compatible with the machine power.
- Bead gauge and Bead remover.
- Pipe Cutter.
- Pipe Rollers.



It is important to observe the following points when carrying out butt fusion jointing:

1) Cleanliness of the welding surfaces and heating plate
2) Squareness of the welding surfaces
3) Alignment of pipe surfaces
4) Uniform heating of the plates

b) Electro-fusion

Electro-fusion fittings incorporate an electrical heating element, which is energized via an electro-fusion control box to heat the elements. When the fitting is energized, the material around the heating element becomes molten and in turn causes the pipe surface alsoto melt, resulting in a molten pool of materials, fusing the materials of fitting and pipe. Once cooled, it produces a fully fused leak-proof joint. This operation is carried out in a fully automatic specialist machine. Electro-fusion fittings are supplied with a barcode sticker pasted on it. By scanning the bar code the Electro-fusion machine inputs all the welding parameters and automatically carries out the welding. The machine also stores the welding data in its memory which can be retrieved or printed out later.

Equipments and Tools required for the Electro fusion process:

- Automatic Electro-Fusion Machine.
- Power source compatible with the machine power.
- Suitable pipe clamps.
- Pipe Cutter.
- Electro fusion fittings with size similar to the pipe size.
- Scrubbing Tools.
- Marker pen

It is important to observe the following points when carrying out butt fusion jointing:

1) Squareness of the pipe ends and cleanliness of the welding surface.
2) Scraping of the outer surface of the pipe before welding.
3) Marking of the insertion length on pipe and proper insertion of the pipe inside Electro-fusion fitting.
4) Proper power supply

ADVANTAGES OF BUTT FUSION ELETRO-FUSION TECHNIQUES

Butt Fusion and Electro-Fusion techniques eliminate the potential for leakage points which could be incurred by spigot and socket type pipe connections.

The Life Cycle Cost of polyethylene pipe differs from other pipe materials due to the zero leakage rate of a properly fused joint.

Polyethylene pipe fused joints are self-restraining therefore eliminating costly thrust restraints or thrust blocks.

Polyethylene pipes' fused joints eliminate infiltration and exfiltration problems, which can be experienced with alternate pipe joint systems.

TRENCHING & BACK FILLING

Polyethylene pipe systems are designed to make installation quicker, easier and more cost-effective. Installation is as much part of the costing equation as ease of maintenance and the price of the pipe system itself.

Advantage of polyethylene in installation is its lightness and flexibility, coupled with itsdurability and totally secure joining methods. For all modern pipe laying techniques, whether in rehabilitation work or the construction of new pipelines Polyethylene pipes usually provide the simplest and most economical solution.

Generally, at least 3 pipe lengths of ground should be excavated ahead of mains laying to expose any obstructions which may necessitate deviation from the planned route.

General Points on Trench Excavation

Installation of Polyethylene pipeline systems requires minimal trench width; therefore considerable saving can be made in terms both of reduced labour costs and less waste spoil to be removed from site. Additionally, reinstatement costs are cut and smaller quantities of imported backfill are needed.

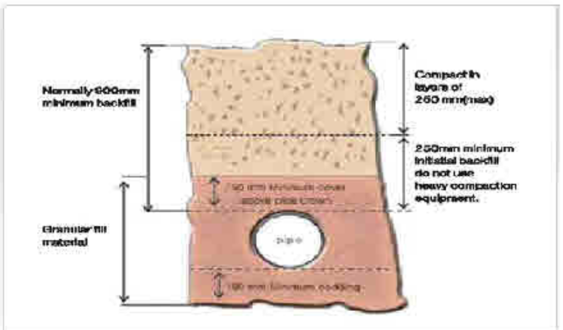
The dimensions of trench line opening are normally governed by the pipe diameter, method of jointing and site conditions. Normal minimum depth of cover for main should be 900mm from ground level to the crown of the pipe. Trench width should be as narrow as possible, but never less than the outside diameter of the pipe plus 250mm to allow for correct compaction of side fill.

In some instances it may be acceptable to lay HDPE pipe directly on the bottom of the trench – but only where the soil is uniform, relatively soft and fine-grained without large flints, stones and other hard objects. The trench bottom should be brought to an eve finish, providing consistent support for pipes along their whole length.

In other cases, the trench should be cut to a depth, which will allow for the necessary thickness of selected bedding material below the bottom of the pipe. If soil from the excavation is unsuitable, granular material should be imported. Gravel or broken stone graded between five and ten millimetres in size provides suitable bedding, since it needs little compaction. Coarse sand, a sand and gravel mix, or gravel smaller than 20mm are also all acceptable straight from the quarry.

Excavators with narrow buckets are best suited to conventional trenching methods. Pipes are located by being lifted into the correct position. After installation, the ground can be backfilled and consolidated.

RECOMMENDED TRENCH COMPOSITION



BACK FILLING

Unless special procedures apply, such as local agreements for carriageway reinstatement, appropriate excavated material may be returned to the trench and compacted in layers of a thickness specified by the appropriate utility. Ensure the trenches should be compacted properly after the initial backfilling, to prevent lateral movement of pipes. Heavy compaction equipment should not be used until the fill over the crown of the pipe is at least 300mm.

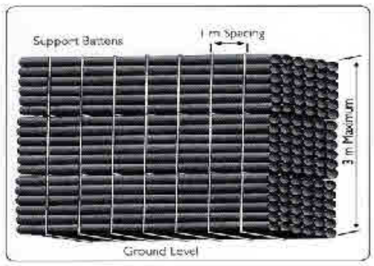
STORAGE

Straight length pipes must be supported by timber spacers of minimum width 75 mm placed at 1.5 meter part. For rectangular stacks, additional vertical supports at 3 meter spacing should be used. The recommended maximum height of long-term stacks is 1 m.

For pyramid stacks, the bottom pipe layers also need to be choked to prevent stack collapse. For large diameter pipes (DN630 and above) it may be necessary to tom, or internally support the ends of the pipe in order to prevent distortion. The height of the stack shall be limited to 1 m.

Where pipes are crated, the crates may be stacked on timber to timber; in stacks up to 3 meters high.

PE pipes are capable of supporting combustion, and need to be isolated from ignition resources. PE pipes must be kept away from high temperature sources, and not be in contact with objects of temperature higher than70^{0}C. Black pipes do not need protection from the effects of UV exposure. In selecting the method of protection consideration may need to be given to temperature effects, as elevated temperatures may lead to pipe distortion.



TRANSPORTATION

PE pipes stacked for transport must be evenly supported in order to prevent distortion. All load bearing surfaces must be free from contact with sharp objects. Any projecting sections such as stub flanges must be supported to prevent damage. Where different sizes of pipe are to be transported together larger diameter pipe should be loaded first with the vehicle having side supports at no larger than 1.5 meter intervals.

HANDLING

- Care and attention should always be applied when handling pipes.
- This should be done not only for the protection of the pipes but also for the safety of the handling personnel.
- Pipes should be never dropped onto hard or uneven surfaces.
- Pipes should never be thrown from vehicles.
- Pipes should never be dragged or rolled along the ground.
- Where possible, pipes should always be unloaded individually. In cases where pipes are already bundled into frames, proper lifting equipment (lift truck etc.) should be used.
- Where pipe weights exceed practical personnel handling weight capability, rope or web slings should be used with mechanical lifting equipment.
- Metal chains, hooks or ropes should never be used