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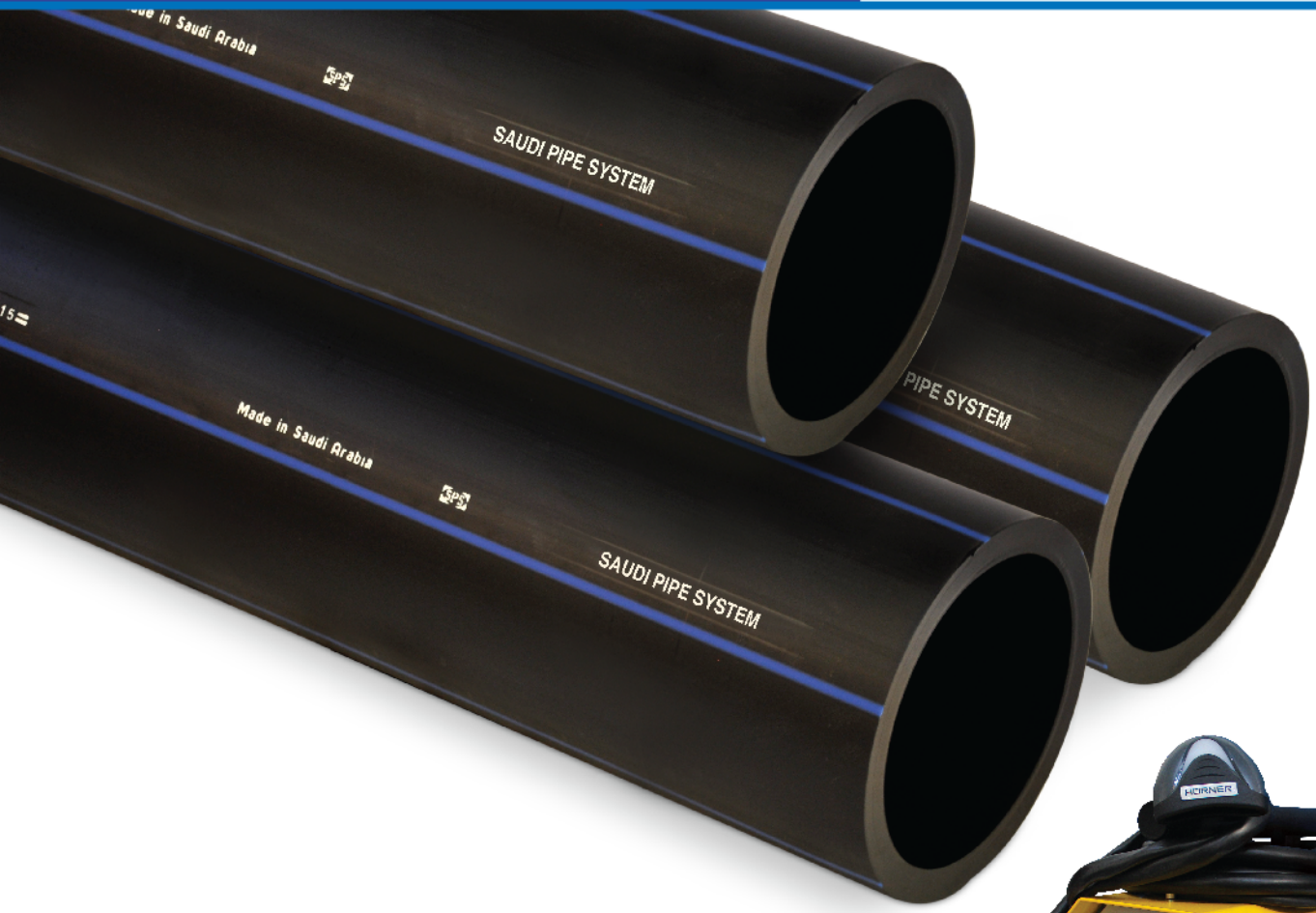
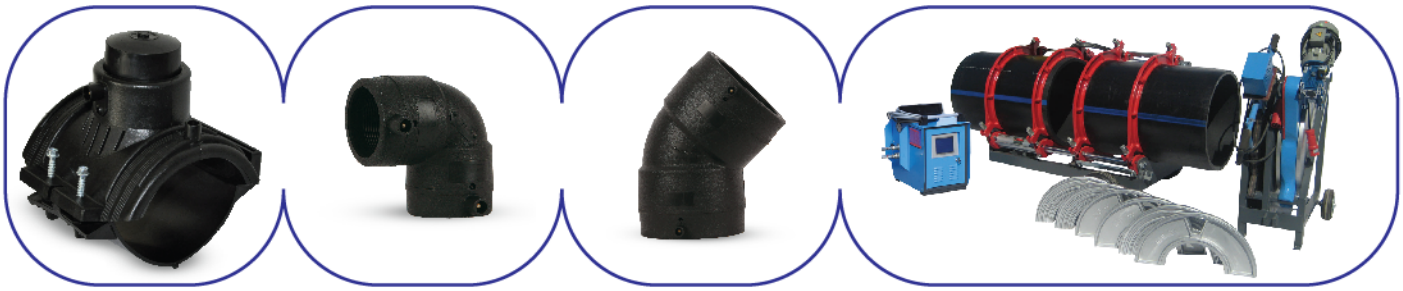
SAUDI PIPES SYSTEMS CO. LTD.®

HDPE PE100 TECHNICAL CATALOGUE



PE 100 Pipes / Fitting and Welding Machines



Only products bearing NSF logo are certified

Only products bearing UL logo are certified

Only products bearing WRAS logo are certified

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية

www.pipes.sa

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SAUDI PIPES SYSTEMS CO. LTD.

ABOUT US

Saudi Pipes Systems Co. Ltd. (SPS), founded in 1995, designs and manufactures Ductile Iron Valves and Fittings, Fire Hydrants, HDPE, GRP and Pre-insulated pipes, and Manhole covers and gratings for water distribution, water transmission, irrigation and water treatment. The company is well poised to support and develop each project worldwide with a full range of water solutions.

SPS is an ISO 9001-2015 certified company and offers the most comprehensive range of products for the use of both potable and sewage applications in the Middle East. Being at the forefront of innovation means that its customers constantly receive state of the art products and top class services.

SPS Products are approved with major government authorities such as: The Ministry of Water and Electricity, Saline Water Conversion Corporation (SWCC), Royal Commission for Jubail & Yanbu and Saudi Electricity Company.

SPS also has Aramco approval for HDPE and SASO Quality Mark approval.

MANUFACTURING FACILITIES & SUSTAINABILITY

SPS has four manufacturing facilities in Saudi Arabia, which are all located in phase 4 in Jeddah's industrial zone area. In order to sustain and lengthen the company's growth, SPS acquired the kingdom's first foundry, formerly known as "Quality Casting" that started its operations over 40 years ago, taking its expertise, SPS decided to enlarge the foundry's size and upgrade its machines over the past decades with fully automated production lines, resulting in outstanding casting quality that can keep up with the markets high volume demands.

At the same time all products and facilities are subject to strict quality controls in accordance with BS, EN, DIN, SASO, Aramco and ISO standards.

SPS Goals are to provide high quality products and cost-effective advanced solutions. We also aim to provide our customers with the best product specifications and the highest international standards by using and investing in innovative engineering techniques and specialized expertise.

Head Office: Jeddah - Industrial Zone Phase (4) Building 4534 - Zip 22426 - Additional 7634 - Unite 1 - Saudi Arabia
Tel.: +966 -12 -637 0999 / 608 1100, Fax: +966 -12 -636 5925 / 637 9439 Email: sps@pipes.sa - Website: www.pipes.sa

FOUNDRY CASTING FACTORY

Saudi Pipe Systems Co. Ltd. (SPS) offers the most comprehensive range of ductile Iron Valves, Fittings, Manhole covers and Gratings in both potable and sewage applications in the Middle East. Being at the forefront of the innovation means that its customers constantly receive state of the art products and top class services.

SPS has a wide range of fittings designed and developed according to the related international standards (BS, EN and ISO). The foundry has high capacity facilities with precise CNC machines operated by highly qualified staff alongside a specialized team that keeps all our testing equipment readily calibrated in order to maintain accurate positive results and efficiency.

VALVES PLANT

SPS was founded in 1995 to produce valves for potable and treatment water. It had become one of the leading establishments of its sector in a short time. As manufacturers, SPS has a wide range of valves in the water and waste-water matters sector. Individually manufactured special valves and complete solutions are also part of our range of products. Our products have been subjected to pressure and performance tests before sales by the quality control department, and technical support services have been given at the installation operation and maintenance stages, after sales, by our experienced engineers. Our customers' satisfaction has top priority for us and has been confirmed by certification in accordance with ISO 9001:2015. Our valves are certified in accordance with the regulations required by the WRAS, UL/FM, SASO and ISO 9001:2015.

Production: The factory relies on the production capacity of the other two units and the participation of selected third-party partners. The complete manufacturing process includes the following steps: Casting, Machining, Coating, Assembly and Quality Control

MANHOLE COVERS AND GRATINGS

SPS with its experience of nearly twenty-five years produces, as per order, a range of cast iron and grey ductile iron. Mainly drainage manhole covers, gas, telecom, sewerage, electricity lids and gratings.

SPS manages the whole production process: from product design to manufacturing to distribution and

sales. Improving itself by continuous Research and Design activities, and by being the leader in its sector, SPS provides high performance solutions particularly in the field of manhole covers and gratings.

On top of our intense R&D activities, is the design and development of quality and high performance ductile iron manhole covers and gratings with automatic locking systems.

These provide protection against unauthorized use and theft, and with gasket system noise pollution suppression, depending on the needs of water and gas features, which are in compliance with EN 124 Standard.

GLASS REINFORCED PLASTIC (GRP) PIPES:

GRP pipes are manufactured using the process of Continuous Filament Winding (CFW).

Famous for being light weight, easy to install and deterioration resistant, our GRP pipes are rust proof and hence do not require periodic maintenance. Their resistance to water and sewage systems' acidic environment are another advantage.

Our GRP pipes are mainly used for transporting drinking water, sewage drainage and seawater, in addition to desalination water, chemical and industrial residues, fire-fighting's systems cooling systems and irrigation.

GRP pipes and fittings are produced in diameters ranging from 80mm to 2800mm.

PRE-INSULATED PIPES AND FITTINGS

SPS manufactures pre-insulated pipes for district cooling, oil and gas and other industrial applications using both insulation methods of injected foam or sprayed foam depending on customer requirements.

The core pipe can be supplied in either Polyethylene (PE) Cross-linked polyethylene (PEX), steel or Glass Reinforced plastic (GRP) pipe, or the jacket pipe which are made from either high density polyethylene or GRP pipe. While the core pipes can range in sizes from 20mm up to 1500mm, the jackets can be made up to the size of 1750mm in diameter.

SPS pre-insulated pipes can also be supplied with leak detection system for district cooling applications depending on customer requirements.

The different types of jacket core pipe configurations include:

* Steel - HDPE
* Steel - GRP
* HDPE-HDPE
* HDPE- GRP
* GRP- HDPE
* GRP- GRP

HDPE (HIGH DENSITY POLYETHYLENE PIPES) PLANT

In January 2004 SPS established the most advanced plant with fully automated extrusion machines producing high density polyethylene pipes (HDPE) with a minimum production output of 8,500 tons per year ranging of 16mm up to 630mm and with pressure rating 5 bars to 16bars.

This plant is measured at 11,250 square meters, and it is located at Jeddah industrial Zone – Phase 5. The above factory specializes in production of HDPE pipes from very small to big sizes.

The factory uses most advanced machinery and equipment which are operated by well qualified engineers and technicians. The SPS plant was certified by Aramco as an approved Aramco Supplier and manufacturer in May 2017, with the approved Vendor Code Number. 10025856, and Plant No. 30003130.

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High Density Polyethylene (HDPE)

HDPE pipes are produced according to EN-12201-DIN 8075, DIN- 8074 & ISO-4427 Standards. HDPE pipes are used in many applications such as water sewage and gas mains.

HDPE Pipes are seamless extruded high density, Ultra-violet stabilized corona-treated, having a material classification according to BSEN12201.

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POLYETHYLENE

For nearly fifty years polyethylene has been used to transport fluids. Its ability to withstand harsh environments and exposure to chemicals without corrosion or leaks has made it the ideal material for the gas industry. The continuing technological improvement of PE materials since the 1970's has resulted in the rapid growth of many usages of PE in both water and gas industries. PE is now the material of choice due to its superb corrosion resistance. Furthermore, butt welding PE material offers leak-free connections which outperforms other competing materials in terms of reliability and longevity, not to mention the remarkable savings on installation costs and material life.

These improvements in PE materials resulted in the water industry adopting PE for its pressure transmission network. The improvements are mainly in in the development of PE80 and PE100, the latter will be the basis for discussion here, although some references will be made for PE80.

Why Opt for High Performance PE100?

Due to its robust mechanical strength, high impact resistance (including very low temperatures) and excellent chemical resistance, design-flow HDPE is the best all around product for your industrial process application.

Excellent Performance

HDPE is characterised by the combination of superior performance for production of pipes with good long-term strength and long life which makes it the best for transportation of water and gaseous fuels.

Resistance to environmental variations:

This property of HDPE is one of the most important in the field of environmental variations such as soil movement. Due to the great flexibility of HDPE pipes, they are not affected by soil movement.

HDPE pipes are competitive:

HDPE pipes are characterised by light, stable, weather-resistant, water-proof and are easy to handle and install. They are easy to handle due to flexibility and light weight and Installation is leak-tight due to excellent fusion-welding.

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HDPE has a long life with low operation cost, and no limitation to PH value of the water, so no corrosion. The taste and odour are neutral.

ADVANTAGE OF POLYETHYLENE (PE100)

- High impact and breakage resistance.
- Very high resistance to direct sunlight for long periods. This is provided by an ultraviolet light resistance agent mixed with the PE raw material.
- There is no need to take precautions at installation, such as cathodic protection.
- Availability of connection at a place out of the trench.
- Unaffected by earth movements such as landslides, earthquakes, etc.
- PE pipes require less fittings for connection because they are elastic and in many places they do not require connection, unlike other types, because PE pipes are bendable with a radius twenty times that of its outer diameter. This is not available in other types.
- PE pipe production facilities are mobile which enables very big savings in transport costs for projects where large diameters are required.
- Higher durability and easy installation and transport without material loss.
- PE pipes do not require welding characteristics.
- PE pipes can be produced resistant to twelve different pressure classes, from 2.5 Bar up to 32 bar.
- High resistance to chemicals, corrosion, decaying and abrasion
- Perfect leak proof, no cracks, no break and no deformat.
- Safe applications in sea. Rivers, lakes.

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HIGH DENSITY POLYETHYLENE PIPES

WHY POLYETHYLENE?

Long Life: As against only a few years of life of conventional pipes such as CI, PVC, Gi, Stee Cement etc. The calculated life of HDPE pipes is 50 years at normal working temperature and pressure.

Tough & Strong: HDPE pipes bear high impact resistance and thus are strong and resilient to withstand static and dynamic loads due to internal (fluid) as well as external (soil) pressures Rough handling, traffic loads and even freezing condition do not cause the pipe to break or crack.

Light Weight: As HDPE pipes & ducts are many times lighter than conventional pipes, transportation installation is easy and very cost effective.

Smooth Inner Surface: In addition to the smooth external surface, the pipes & ducts have an extremely smooth inner surface too, thus offering very low frictional resistance to fluid flow. Further the non-adhering characteristics of HDPE allow even solid particles to be carried along the fluids Inside the pipes.

Flexible: HDPE pipes & ducts are extremely flexible and bend without cracking. This property enables long lengths of the small diameter pipe to be transported as coils thus saving on joints.

Inert to Chemicals: The pipes possess excellent resistance to chemicals making it suitable for handling most of the corrosive acids and also alkalines. The pipes are completely neutral to chemicals and hence widely useful in chemical plants.

Non-Hazardous: Due to its property of being non-toxic and inert, HDPE is non-hazardous. This enables HDPE pipes to be used to convey potable water.

Corrosion Resistant: Resistance to electrolytic as well as galvanic corrosion makes HDPE pipes & ducts best suited for underground installations.

High Electrical Resistance: As the dielectric strength of HDPE is very high, the pipes are extensively used outside.

Lower Thermal Conductivity: The fluid transportation in HDPE pipes remains at uniform temperature than in other types of pipes. This is due to the lower thermal conductivity of HDPE as result of which the transfer of heat on the outer

surface from the atmosphere is much slower. Further, due to the superior elongation property of HDPE PIPES they can be used in very cold climatic conditions too.

PE100 pipes are used in various application such as:

Water Transportation underground and over ground
- Potable water Systems.
- Irrigation systems.
- Fire water systems.

Distribution of Energy
- Natural gas systems.
- Cooling water systems.
- Geothermal pipe systems.

Discharging waste water.
- Sewage disposal systems.
- Sanitary systems.
- Deep sea discharge systems.

Telecommunication systems.
- Cable pipes / conduit.
- Conduit for OFC.

PRODUCT SPECIFICATIONS

Manufacturing standards:

- BSEN 12201 : Plastics piping systems for water supply, Drainage and sewerage under pressure. Polyethylene (PE).
- ISO 4427 : Plastics piping systems -- Polyethylene (PE) pipes and Fittings for water supply.
- DIN 8074 : Polyethylene (PE) Pipes PE 80, PE 100-Dimensions
- DIN 8075 : Polyethylene (PE) Pipes PE 80, PE 100-General Quality Requirements, testing.
- AWWA 906 : Polyethylene (PE) Pressure Pipe and fittings, 4 in. through 65 in. (100 mm through 1,650 mm), for waterworks.
- ISO 4437 : Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE).

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DIMENSIONAL CHARACTERISTICS OF HDPE PE 100

(Outside Diameter & Wall Thickness)

OUTSIDE DIAMETER OD mm	SDR		
	SDR 26	SDR 17	SDR 11
	NOMINAL PRESSURE		
	PN 6	PN 10	PN 16
	e_n Wall Thickness	e_n Wall Thickness	e_n Wall Thickness
16	-	-	-
20	-	-	2
25	-	-	2.3
32	-	2	3
40	-	2.4	3.7
50	2	3	4.6
63	2.5	3.8	5.8
75	2.9	4.5	6.8
90	3.5	5.4	8.2
110	4.2	6.6	10
125	4.8	7.4	11.4
140	5.4	8.3	12.7
160	6.2	9.5	14.6
180	6.9	10.7	16.4
200	7.7	11.9	18.2
225	8.6	13.4	20.5
250	9.6	14.8	22.7
280	10.7	16.6	25.4
315	12.1	18.7	28.6
355	13.6	21.1	32.2
400	15.3	23.7	36.3
450	17.2	26.7	40.9
500	19.1	29.7	45.4
560	21.4	33.2	50.8
630	24.1	37.4	57.2

en - Nominal Wall Thickness
SDR - Standard Dimension Ratio
Dimension - mm

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DIMENSIONAL CHARACTERISTICS OF HDPE PE 80

(Outside Diameter & Wall Thickness)

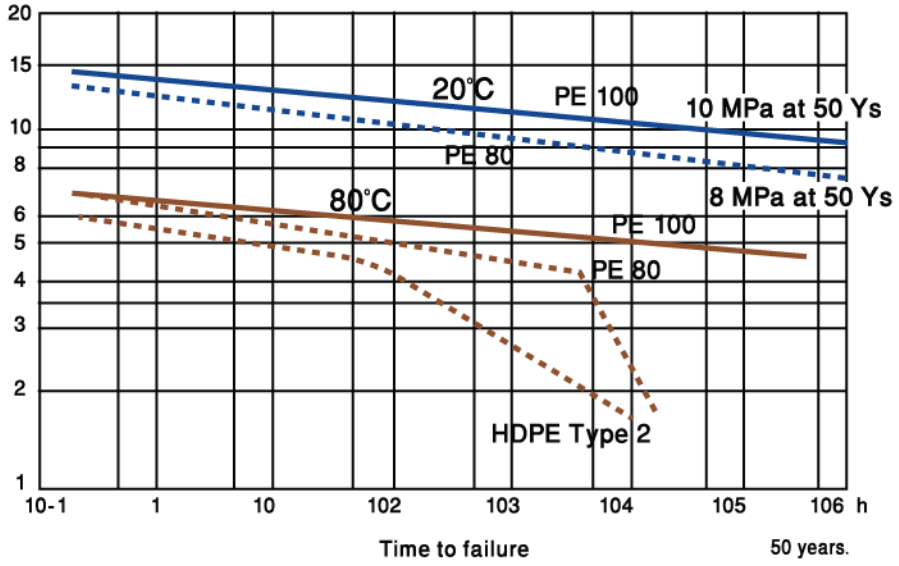
OUTSIDE DIAMETER OD mm	SDR		
	SDR 26	SDR 17	SDR 11
	NOMINAL PRESSURE		
	PN 5	PN 8	PN 12.5
	e_n Wall Thickness	e_n Wall Thickness	e_n Wall Thickness
16	-	-	-
20	-	-	2
25	-	-	2.3
32	-	2	3
40	-	2.4	3.7
50	2	3	4.6
63	2.5	3.8	5.8
75	2.9	4.5	6.8
90	3.5	5.4	8.2
110	4.2	6.6	10
125	4.8	7.4	11.4
140	5.4	8.3	12.7
160	6.2	9.5	14.6
180	6.9	10.7	16.4
200	7.7	11.9	18.2
225	8.6	13.4	20.5
250	9.6	14.8	22.7
280	10.7	16.6	25.4
315	12.1	18.7	28.6
355	13.6	21.1	32.2
400	15.3	23.7	36.3
450	17.2	26.7	40.9
500	19.1	29.7	45.4
560	21.4	33.2	50.8
630	24.1	37.4	57.2

en - Nominal Wall Thickness
SDR - Standard Dimension Ratio
Dimension - mm

ADVANTAGE OF MINIMUM 50 YEARS SERVICE LIFE OF PE PIPES

The curve in the figure below shows the change in the physical properties of PE 100 pipe's time. The production design of PE 100 pipes is done for a services life of 50 years so the minimum service life of PE 100 pipes is 50 years.

Circumferential stress



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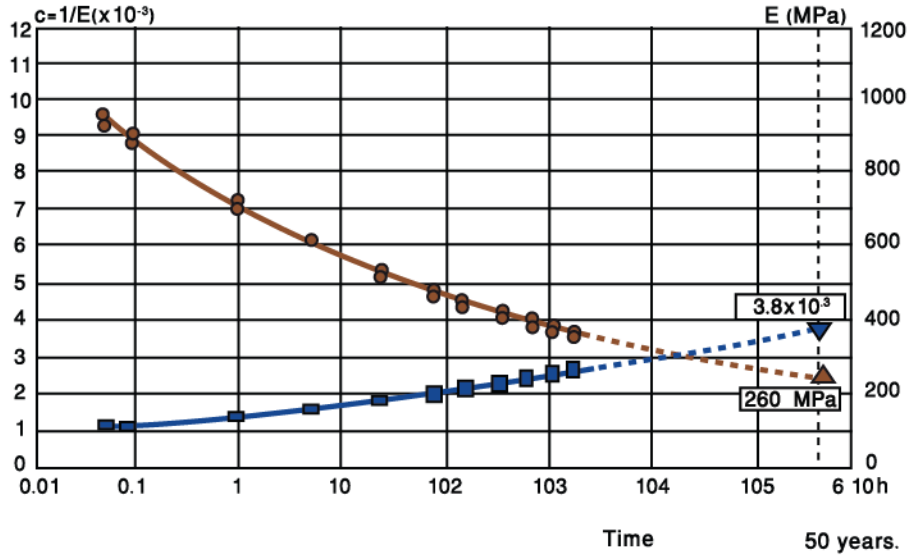

HDPE Properties

HDPE is a thermoplastic material which is supplied by the manufacturer in a ready to use' pelletized form. The grades suitable for pipe manufacture are PE 63, PE 80 and PE 100. The pipe manufacturer converts this material into pressure pipe.

Physiological properties

The black material types from PE100 grade are used in food applications. The HDPE is odorless and tasteless as well as physiologically inert. Usage in all related areas in thus possible.

Table of Physical & Mechanical Properties

The properties given below are for HDPE grades used to manufacture pipes.

- Mechanical Properties
- Electrical Properties
- Chemical, weathering, and abrasion resistance
- Thermal properties
- Other Properties

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Mechanical Properties

Modern PE100 grades show a bimodal molecular weight distribution, i.e. they consist of two different kinds of molecular chains (short and long). These combine high tensile strength with a high resistance against fast and slow crack propagation. in addition, the short molecular chains provide a good process ability.

Mechanical Properties

Property		Value	Unit	Test Method
Density at 23°c		0.958	g/cm³	ISO 1183
Viscosity Number		380	ml/g	ISO 1628-3
Melt Flow Rate	MFR 190/5	0.23	g/10min	ISO 1133
	MFR 190/21.6	6.5	g/10min	
Tensile Properties	Yield Stress	26	N/mm²	ISO 527 Test Rate 50mm/min
	Elongation at Yield Stress	10	%	ISO 527 Test Rate 50mm/min
	Tensile Modulus of Elasticity (secant between 0.05 & 0.25% Strain)	900	N/mm²	ISO 527
	Tensile Creep Modulus (1 hour value)	650	N/mm²	ISO 899 Test Load n/mm²
	Tensile Creep Modulus (1000 hour value)	350	N/mm²	
Flexural Properties	Flexural Creep Modulus (1 min value)	1100	N/mm²	DIN 54852-Z4 Qb=2 n/mm2
	Flexural stress (3.5% deflection)	20	N/mm²	ISO 178 Test Rate mm/min
Stiffness in Torsion		180	N/mm²	DIN 53447
Hardness	Ball Indentation hardness	41	N/mm²	ISO 2039 part 1 Test Load 132N
	shore hardness D (3 sec value)	61	-	ISO 868
	shore hardness D (15 sec value)	59	-	
Notched impact Strength acN (test specimen from compression molded sheet)	At 23 °c	20	kj /m²	ISO 179/1eA
	At -30 °c	10	kj /m²	
vicat softening Point VST/B/50		67	°c	ISO 306
Oxidation Induction Time	200 °c in O_2	≥ 20	min	ISO 11357

Electrical properties

Because of the low water absorption of PE, its electrical properties are hardly affected by continuous water contact.

Since PE is non-polar hydrocarbon polymer, It is an outstanding insulator. These properties however, can be worsened considerably as a result of pollution effects of oxidizing media or weathering. The specific volume resistance is >10 ncm; the dielectric strength is 220 kv/mm. Because of the possible development of electro-static charges, caution is recommended when using PE in applications where the danger of fires or explosion is given.

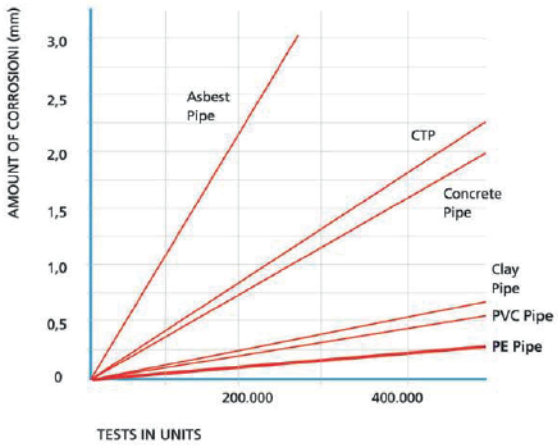
Mechanical Properties

Property	Value	Unit	Test Method
Electric strength	>20	Kv/mm	BS 2782 201 b
Volume resistivity	>10^13	© m	BS 2067 201 a
Surface rosistivity	>10^19		BS 2782 201 a
Relative permittivity	2.6		BS 2067 (1 to 20mhz)
Loss tangent	3 x 10^-4		BS 2067

Chemical, weathering, and abrasion resistance

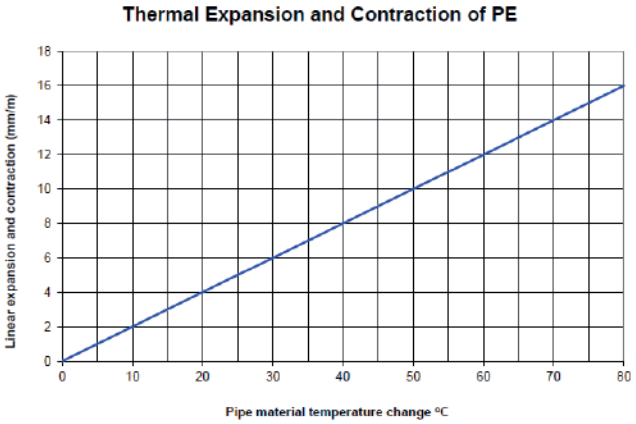
Due to its non-polar nature as hydrocarbon of high molecular weight, polyethylene shows a high resistance against chemical attack, PE is resistant to acidic, alkaline solutions, solvents, alcohol and water.

Most of natural and plastic materials are exposed to direct sunlight over a long period of time and will get damaged by short wave UV portion of sunlight together with oxygen in the air, causing photo-oxidation. Because of this our HDPE pipes are black polyethylene grades, which are effectively stabilized against UV light by adding carbon black.



Thermal properties

Polyethylene pipes can be used at temperatures ranging from -50'C to +60°C. At higher temperatures, the tensile strength and stiffness of the material are reduced. Like all thermoplastics, PE shows a higher thermal expansion than metal. Our PE has coefficient of linear thermal expansion of 0.15 to 0.20 mm/m K, which is 1.5 times greater than that of e.g. PVC. As long as this is taken into account during the planning of the installation.



Other Properties

Other Properties

Property	Value	Unit	Test Method
Oxidation-Induction time at 210 C	>20	Min	ISO 11357
Carbon black dispersion	2.3 ± 0.2	%	ISO 6964
Carbon black content	GRADE 3	-	ISO 18553
Minimum Required Strength (MRS)	>10	Mpa	ISO TR 9080
Resistance to Slow Crack Propagation (SCP) 4.6 Mpa 80*C Notched	>3000	H	EN 33479
Resistance to Rapid Crack Propagation (RCP) S4 Test 110/10mm at o'c	>25	Bar	ISO DIS 13477
Elongation at break	350	%	EN ISO 6259
Linear thermal expansion		%	EN 638
Specific thermal capacity		C-1	ASTM D 696 (20-60 C)

Comparison with Other Plastic Materials

Property	HDPE	PP	PVC	PVC-C	PB*
Surface feel	Waxy	Waxy	Smooth	Smooth	Waxy
Appearance (water pipes)	Black	pale Grey-beige	Blue	Grey-beige	Black
Sound produced when dropped	Medium Clatter	High Clatter	High Clatter	High Clatter	Dull thud
Combustibility and appearance of flame	Bright flame: Drops continue to burn after falling	Bright flame: Drops continue to burn after falling	Carbonizes in flame: Extinguishes away from flame	Bright flame: Drops continue to burn after falling	Bright flame: Drops continue to burn after falling
door of smoke after flame is extinguished	like candles	like resin	Pungent like hydrochloric acid	Pungent like hydrochloric acid	like candles but more Acrid than HDPE
vail test (impression made by finger mall)	impression possible	Very light impression possible	impression not possible	impression not possible	impression easily Produced
Special features					Smears When Sawn
Floats in water	yes	yes	yes	No	Yes
Notch sensitivity	No	Slight	No	Yes	Yes
Weather resistance	Stabilized, good	Stabilized, good	Stabilized, good	Stabilized, good	Stabilized, good
Method of permanent Joining	Fusion	Fusion	Fusion	Fusion	Fusion
Suitable for mechanical Joining	Yes	Yes	Yes	Yes	Yes
Stress crack sensitivity with regard to joining with safe media, e.g, water	Some	Slight	Slight	Some	None
near expansion mm/m/"C	0.2	0.15	0.2	0.2	0.12
Thermal conductivity kcal/mh'C	0.4	0.19	0.4	0.4	0.2
Specific heat kcal/mh'C	0.42	0.4	0.42	0.42	0.47
Specific weight kg/cm²	0.955	0.905	0.955	0.955	0.92
Tensile strength at 20C kp/cm²	240	320	240	240	200
dulus of elasticity at 20c kg/cm²	8000	15000	30000	30000	5000

Hydrostatic Design Stress (HDS)

Designation of material	MRS at 50 years and 20°C - Mpa	Maximum allowable hydrostatic design stress,ó - Mpa
PE 63	6.3	5
PE 80	8	6.3
PE 100	10	8

Notes on Pipe Dimension Tables:

1) HDS (Hydrostatic Design Stress), in (MPA), is obtained by applying design factor of not less than 1.26 to the minimum required strength value of the pipe.
2) Out of roundness (Ovality) Grade N PE 63 material is NLA. Therefore PE 80 material is used to manufacture PE 63 specification, increasing the design safety factor from 1.26 to 1.6
3) SDR = Standard Dimension Ratio
   = Outside diameter/wall thickness

Relationship between SDR & PN

Relationship between the admissible nominal pressure PN, SDR and performance classes PE 80, PE 100 (for water 20°C, 50 years service life and C-1.25).

Nominal Pressure PN (Bar)	SDR PE 80	SDR PE 100
6	22	26
10	13.6	17
16	9	11

Design Stress and Safety Factor (Service factor)

Safety factors take into account handling conditions, service conditions and other circumstances not directly considered in the design. In terms PE 100 of BSEN 12201 the minimum safety factor is 1.25.This factor, when applied to the Minimum Required Strength (MRS), for the particular material classification (e.g. PE 80, PE 100), gives the maximum allowable hydrostatic design stress for the designated material.

Designation of material	MRS at 50 years and 20°C - Mpa	Maximum allowable hydrostatic designstress, σ - Mpa
PE 100	10	8
PE 80	8	6.3
PE 63	6.3	5

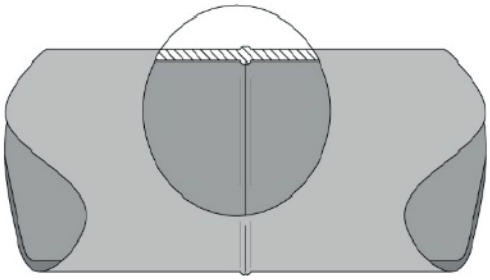
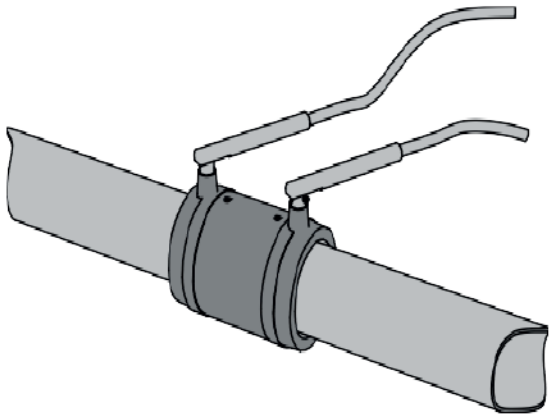
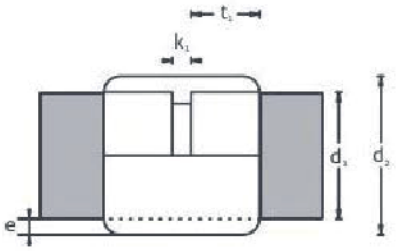
Considerations of Temperature Effect on Pressure

Pressure de-rating factors should be applied to HDPE pipes when operating temperatures rise above 20°C. The de-rating factors below are applicable to HDPE

Temperature	
Temperature	**Multiply Working Pressure by**
0 - 20°C	1
20° - 25°C	0.8
25° - 30°C	0.63
30° - 35°C	0.5
35° - 40°C	0.4
40° - 45°C	0.32
45° - 50°C	0.25

Heat fusion Jointing:

Heat fusion Jointing Heat fusion (sometimes called heat welding, butt welding or simply fusion) is a welding process used to join two different pieces of a thermoplastic. This process involves heating both pieces simultaneously and pressing them together. The two pieces then cool together and form a permanent bond. When done properly, the two pieces become bonded and indistinguishable from each other. Dissimilar plastics can result in improper bonding.

Butt welding The butt fusion jointing is to heat two pipe or fitting ends by means of a heater plate to a designated temperature, then fuse them together by applying pressure and cool them under pressure for a designated time.	
Electro fusion welding Electro fusion welding is the process of joining two plastic pipes together using a single coupler that has an integrated Wire heating coil. The electro fusion control unit supplies electricity to this coil, heating it up and causing the plastic to melt. When this cools, a gas-tight joint is formed.	
Socket fusion welding Socket fusion welding process where a socket tool is used to preheat the external surface of the pipe and internal surface of the socket. The socket is then pushed onto the pipe to form the weld	 

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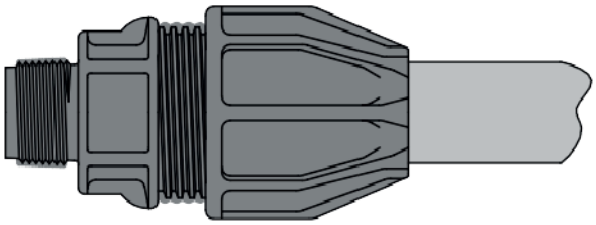
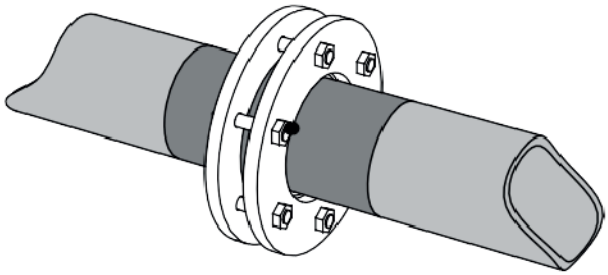
Compression fittings Small diameter pipes are joined by different mechanical couplings. These are usually made of corrosion-resistant metal or plastic and are very simple to use. These couplings are normally used when pipes are coiled and the number of joints is small.	
Flange joints Flange joint a stub-end must to be welded to the end of each pipe. These are then connected to each other by P.P. Coated backing ring, gasket, bolts & nuts.	

Other jointing methods

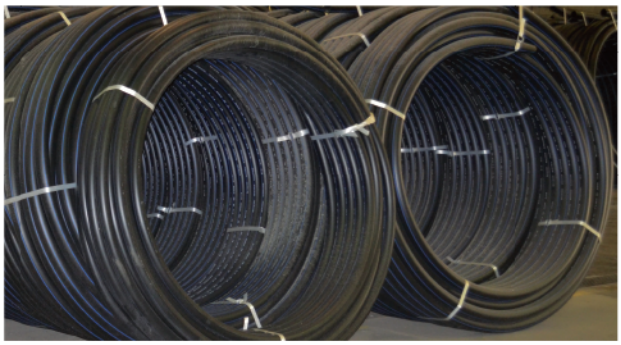
One of the greatest features of HDPE pipes is the fact that a wide variety of jointing system are available to suit a whole range of applications. The jointing systems can be divided into permanent jointing and detachablè jointing.

Pipe Length:

Straight Pipes - The standard length of HDPE pipe are manufactured in 6 Meters and 12 Meters effective length. Special length is manufactured on request.




Coil Pipes The standard length of HDPE pipe in coiled are 50, 100, and 150 m Unless special order is done.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SAUDI PIPES SYSTEMS CO. LTD.

MATERIAL HANDLING

Lifting and Handling HDPE Pipes and Fittings

- Lifting and handling HDPE pipes and fittings must be done by trained people.
- Safety shoes or boots with impact protection are required any time an employee is engaged in lifting or carrying heavy objects.
- Employer of pipe fitters should routinely consider eye and face protection when working with pipe.
- When lifting equipment used; safety precautions must be followed.

Loading, Unloading and Transporting HDPE Pipes and Fittings

- Pipes are loaded into flatbed trailers fitted with metal stacks on the side.
- Loose loaded pipes shall be loaded in layers according to specified quantities and patterns.
- When pipes are unloaded all safety precautions must be followed.
- Avoid any sharp tools that may cause damage to the pipes and fittings.
- If the load would be carried in bulk, loading surface of the vehicle should be smooth and free of sharp objects.
- Pipes and fittings must be carefully placed away from heat sources and from oils, which may cause contamination.

MATERIAL HANDLING

STORAGE OF PIPES, PIPE BUNDLES AND FITTINGS

Polyethylene is a resilient material, lightweight and easy to handle. Nonetheless, care should be taken. Badly stacked pallets, coils, bundles and fittings may slip or collapse, causing injury to personnel or damage to the pipe or fittings.

It is preferable that pipes & fittings stored onsite to be kept in a warehouse. If they are stored in open construction sites, the pipes & fittings are preferable to be stacked in the shade, under a roof, preventing direct sun exposure, but allowing the wind to freshen the air (to avoid an oven-effect).

The storage area should provide adequate protection against physical damage to components.

It should be large enough to accommodate piping components as well as allow handling equipment to remove about freely.

The storage area should have a relative smooth, level surface free of stones, debris or other materials that could damage the pipe or fittings

IF THE PIPES ARE STORED OFF-SITE:

- Store small pipes in racks according to the length and size of pipe.
- Block or strap the pipe to prevent it from rolling or falling off the rack.
- Pipes larger than 63mm in diameter should be stacked with spacing strips between each row.
- Arrange and block each row of stacked pipes to prevent it from rolling off the pipe.

IF THE PIPES ARE STORED IN JOB-SITE:

- When pipes of variable wall thickness are received, it is recommended that the pipes be segregated into piles, each pile containing a single size and pressure rating to minimize confusion at a later date.
- The thickest pipe should always be stored at the bottom of the pile.
- The pile should be constructed in a pyramidal, freestanding manner, with each successive layer having one less pipe than the layer below.
- The bottom layer should be braced to prevent movement.
- Pipe coils should be stored upright on a level surface.

INDOOR / OUTDOOR STORAGE

SPS black HDPE pipe generally contains greater than 2-25 % carbon black, it will resist damage from sunlight.
Expansion and contraction caused by uneven heating in the sun may cause the pipe to bow if not restrained by racks.

STORAGE-LENGTH OF PIPES

Pipe lengths stored individually should be stacked like a pyramid, not exceeding one meter high, with the bottom layer fully restrained by wedges.

STORAGE - BUNDLES

Bundled packs of pipes should be stored on clear leveled ground, with the battens support from the outside by timbers or concrete blocks for safety. bundles should not be stacked more than three meters high.

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INSTALLATION OF PLASTIC PIPES

TRENCH CONSTRUCTION

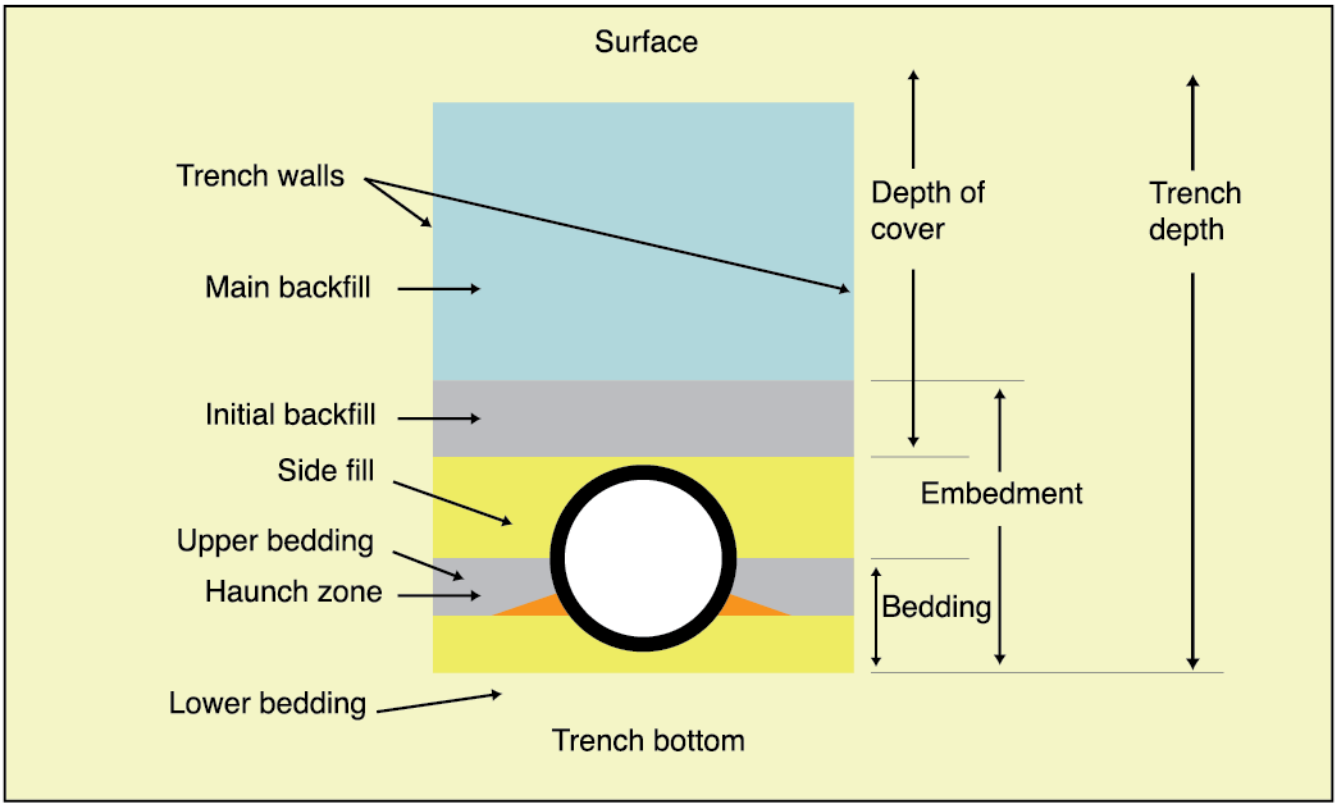
GENERAL

Excavate trenches to ensure that sides will be stable under all working conditions. Excavated material should be stockpiled in a manner that will not endanger the work.

MINIMUM TRENCH WIDTH

The following table shows the relation between Nominal Pipe Size and Minimum Trench Width

Nominal Pipe Size (mm)	Minimum Trench Width (mm)
< 90	300
90 - 630	Pipe OD + 300
630 - 1600	Pipe OD + 600



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Preparation of Trench Bottom

The trench bottom should be constructed to provide a firm, stable, and uniform suport for full length of the pipe. When an unstable sub-grade condition is encountered which will provide adequate pipe support, additional trench depth should be excavated and refilled with suitable foundation material as specified by the engineer. The ground water level in the trench should be kept below the pipe.

Bedding

Bedding is required primarily to bring the trench bottom up to grade. Bedding materials should be placed to provide uniform and adequate longitudinal support under the pipe. A completed depth of to 6 inches (100 to 150 mm) is generally sufficient bedding thickness. Bedding material should be free of ridges, hollows and lumps. The trench bottom should be smooth and free of rock. Bedding should consist of free flowing material such as gravel, sand, salty sand or clay-sand that is free of stones or hard particles larger than 1½ inch.

Haunching

The most important factor affecting pipe performance and deflection is the haunching material and its density. Material should be placed and consolidated under the pipe haunch to provide adequate side support to the pipe while avoiding both vertical and lateral displacement of the pipe from proper alignment. Where coarse materials with voids have been used for bedding, the same coarse material should also be used for haunching and consideration should be given to native soil migration. Haunching is placed up to the pipe spring line.

Initial Backfill

Initial backfill is that portion of the pipe embedment beginning at the spring line of extending some distance over the pipe and the top of the pipe. Since little or no additional side support is gained above the spring line, native soils may be used without special compaction efforts. The sole purpose of somewhat careful placement of these native trench materials is to protect the pipe from the dropping of large racks or other impact loads that may occur during final backfill. Minimum cover is recommended to be 6 inch (150mm).

Main Backfill

The material used in the main backfilling operation need not be as carefully selected as was the bedding, haunching, and initial backfill. In the main backfill material, exclude boulders, frozen clumps of dirt, and rubble which could damage the pipe.

Embedment Materials

Embedment material includes bedding, haunching and initial backfill material.

Quality control:

SPS HDPE Pipes are subject to strict quality control programs that monitors three critical aspects of the manufacturing process: the incoming raw material pipe production and finished goods.

Incoming materials is tested to ensure that it meets all standard requirements before being released for production.

During production pipes will be physically tested to ensure that their dimensional mechanical and physical characteristics are in full compliance with the requirements of the standard they are produced to.

The finished product is subjected to further testing to ensure that it has met all the applicable specifications and requirements.

SPS has an ISO 9001:2008 quality management system which ensures continuous improvement to its products, services and other operational processes. As a manufacturer, SPS has always stayed focused on finding new ways to design, produce, sell and deliver quality products economically.

Many of the company's products are approved by the third party certification agencies such as Aramco, NSF 61, and FM.

Equipment	Test	Reference Standard	Standard Value
	Determination of Density	ISO 1183	≥ 930 kg/m^3
	Determination of Melt mass Flow Rate (MFR)	ISO 1133	(0.2 - 1.4) g/10min
	Determination of Carbon Black Contents	ASTM D 1603	2.25 ± 0.25 %
	Determination of thermal stabilities of polyethylene (OIT)	ISO 10837	≥ 20 min at 200°C

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Equipment	Test	Reference Standard	Standard Value
	Determination of the resistance to internal pressure	ISO 1167	5.5 Mpa (165 h at 80°C) 12.4 Mpa (100 h at 20°C)
	Determination of tensile properties	ISO 6259 Part 1 & 3	≥ 350 %
	Determination of Environmental Stress Cracking Resistance	ASTM D 1693	> 10,000 hrs
	Method for the assessment of the degree of Carbon Black Dispersion	ISO 11420	≤ 3 Grade
	Logitudinal Reversion	ISO 2505	≤ 3 %

Maintenance and Repair

Refer to PPI TN-35 repairing buried HDPE potable water pressure pipe for additional repair options.

Figure: Electrofusion Repair Schematic

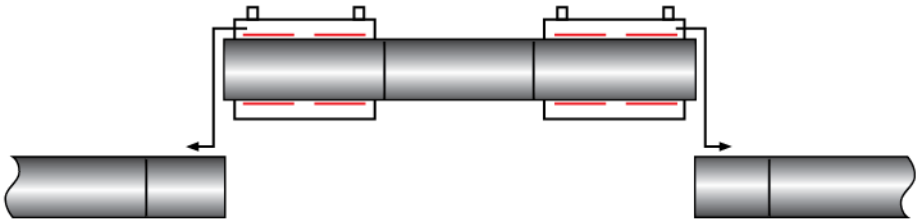
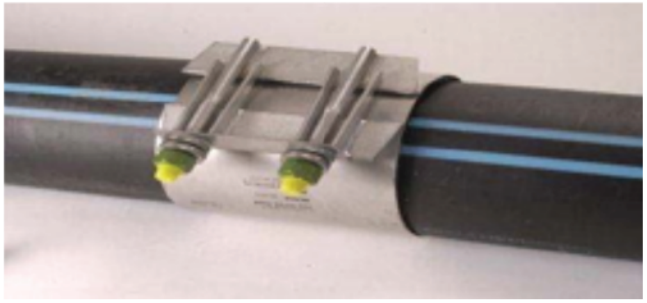


Figure: Electrofusion Field Repair

Figure: Flange Repair Schematic

Figure: Mechanical Repair Sleeve



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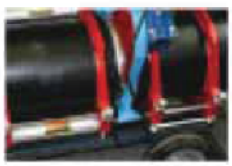
EXECUTION OF A BUTT WELDING ACCORDING TO DV's 2007 STANDART;

1) The parts to be welded are inserted in the clamps of the machine and the trimmer unit is put between the parts.

2) The ends of the parts to be welded are trimmed till that 100% contact is obtained between the ends of the parts.

3) Trimmer is taken out and the heater which was heated till 220ºc is inserted between the parts. For the purpose of equalizing the temperatures of each part, at the beginning the parts are heated for a certain period under a pushing pressure of 0.15 N/mm2



4) After the time for heating under pressure elapsed, the parts are continued to be heated under a very small pushing pressure of 0.01 NImm2 (or zero pressure).

5) After the pressurless heating period has elapsed, the heater is taken out and the parts are pushed towards each other with a pushing pressure of 0.15 N/mm2.

6) After the period for pushing without heater under pressure has elapsed, the pressure is released to zero and the parts are left to cool down.

EXECUTION OF AN ELECTROFUSION WELDING ACCORDING TO DVS 2207 STANDART:

1) The pipes' upper surface is cleaned from dirt and dust using a scraper and alcohol.

2) The extend of the welding on the pipe is marked according to the insertion point in the socket.

3) Socket is inserted on the pipe.

4) The electrodes of the electrofusion welding machine are inserted to the jacks on the socket.

5) The records of the socket is transferred to the welding machine by rubbing the electrode of the welding machine to the barcode on the socket.

6) When the note "Ready" appears on the screen of the machine, START button is pressed and welding is started.

WARNING: In case of interruption of electrofusion operation after start due to any reason, it is recommended to make the operation again from the beginning using a new socket, because, if you continue welding, there is a risk of less or excess heating of the wires resulting with inproper or insufficient fusion. To be on the safe side, it will be better to renew the welding operation with a new socket.

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SAUDI PIPES SYSTEMS CO. LTD.

HDPE Approvals

NSF International
789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Saudi Pipe Systems Co., Ltd.
Saudi Arabia

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

October 9, 2017
Certificate# C0869745 - 01

Theresa Bellish
General Manager, Water Systems

June 14, 2017

SRQU-054-17

Nabil Al-Husseini, Management Representative
SAUDI PIPE SYSTEM COMPANY LIMITED
P.O. BOX 34672
JEDDAH 21478

Fax 12 636 5925

Mr. Al-Husseini,

We are pleased to inform you that your company is now included in the Saudi Aramco Supplier Information System under Vendor Code No. **10025856**, Plant No. **30003130** for the following products provided your company continues to meet relevant Saudi Arabian and Saudi Aramco standards.

SCOM	Description
6000000039*	PIPE & FITTINGS; NONMETALLIC, SOLID WALL

*Approved with limitation

This approval, however, should not be construed as a commitment by Saudi Aramco to purchase from you. Being approved as a supplier only grant your company the opportunity, along with other approved sources, to respond to requests for submitting proposals in accordance with Saudi Aramco's established policies and procedures. All purchase agreements and orders will be issued based on the name and address stated in your commercial registration (CR), as stated above.

Saudi Aramco wishes to remind you that being recognized as a potential supplier is a privilege which carries with it serious obligations and responsibilities to act in a legal and ethical manner. We wish to remind you of the Saudi Aramco Supplier Code of Conduct (SCOC) which you acknowledged. Failure to abide by the principles set forth in the SCOC can result in adverse actions being taken by Saudi Aramco against you including suspension of you as a supplier. Saudi Aramco also expects each of its suppliers to satisfy each of the requirements of any purchase agreements or orders which might be placed and to act responsibly and reliably as a supply chain supplier.

NSF International

OFFICIAL LISTING

Saudi Pipe Systems Co., Ltd.
Industrial Zone Phase 4
P.O. Box 34672
Jeddah 21478
Saudi Arabia
966 2 637 0999

Facility: Jeddah, Saudi Arabia

Pipes and related products

Trade Designation	Size	Water contact temp	Water contact material
Fittings			
SPS	400 - 2600 mm	CLD 23	PRP
Pipe			
SPS	20 - 400 mm	CLD 23	PE
SPS	400 - 2600 mm	CLD 23	PRP

Approval Number: 1709522
Test Report: MATLAB 140A, 142A & 144A

4th October 2017

Saudi Pipe Systems Co. Ltd.
Po Box 34572,
Jeddah - 21478,
Jeddah Industrial Estate - Phase 4,
Jeddah,
Kingdom of Saudi Arabia

Water Regulations Advisory Scheme Ltd.
Unit 13,
Willow Road,
Pen y Fan Industrial Estate,
Crumlin,
Gwent,
NP11 4EG

WATER REGULATIONS ADVISORY SCHEME LTD. (WRAS)
MATERIAL APPROVAL

The material referred to in this letter is suitable for contact with wholesome water for domestic purposes having met the requirements of BS6920-1:2000 and/or 2014 'Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water'.

The reference relates solely to its effect on the quality of the water with which it may come into contact and does not signify the approval of its mechanical or physical properties for any use.

POLYETHYLENE - COMPONENTS. 5240

'SPS HDPE Pipe'. Black coloured (with blue stripes), extruded PE 100 pipe. For use with water up to 85°C.

APPROVAL NUMBER: 1709522
APPROVAL HOLDER: SAUDI PIPE SYSTEMS CO. LTD.

The Scheme reserves the right to review approval.
Approval 1709522 is valid between September 2017 and September 2022

An entry, as above, will accordingly be included in the Water Fittings Directory on-line under the section headed, "Materials which have passed full tests of effect on water quality".

The Directory may be found at: www.wras.co.uk/directory

Yours faithfully

Jason Furnival
Approvals & Enquiries Manager
Water Regulations Advisory Scheme

The Water Regulations Advisory Scheme Ltd. Registered in England No. 3860305 Registered office: 63 Lovatt Close, Hazel Grove, Stockport, SK7 4BD
Tel:+44(0)333 207 9520 Fax:+44(0)161 240 043 Email:info@wras.co.uk website:www.wras.co.uk

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Yours faithfully

Jason Furnival
Approvals & Enquiries Manager
Water Regulations Advisory Scheme

Consult our Factory for Diminisions & Technical Data

PE 100 Fitting / (Ø 20 mm - Ø 1600 mm)

SPS

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SAUDI PIPES SYSTEMS CO. LTD.

Saudi Pipe Systems Products

صمامات وقطع دكتايل • أنابيب وقطع من الفايبر المقوى بالبوليستر • أنابيب وقطع مسبقة العزل
أنابيب وقطع عالية الكثافة من البولي إيثلين • أغطية وشبكات غرف التفتيش

GRP Pipes & Fittings • DI Valves & Fittings • HDPE Pipes & Fittings • Pre-Insulated Pipes & Fittings • Manhole Covers & Gratings

SASO QUALITY MARK

NSF Only products bearing NSF logo are certified

UKAS QUALITY MANAGEMENT

ISO 9001:2015 SGS

UL FM APPROVED Only products bearing UL logo are certified

WRAS APPROVED MATERIAL Only products bearing WRAS logo are certified

شركة المياه الوطنية National Water Company

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية

Main Office: Jeddah - Industrial Zone Phase 4
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