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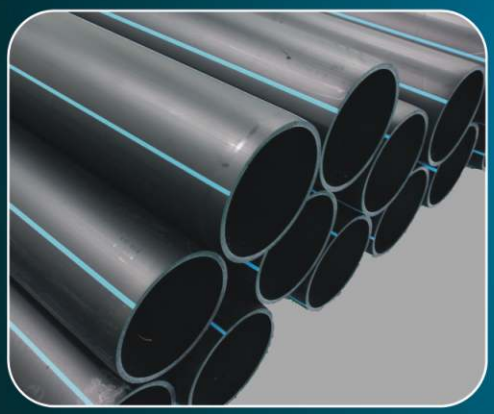
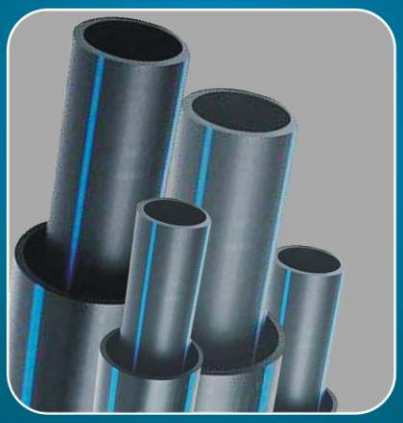
HDPE
WATER PIPES



HDPE
CONDUITS PIPES



MDPE
GAS PIPES

An Innovative Piping System for

Water, Natural Gas and Cable Ducts

QUALITY, DURABILITY RELIABILITY FOR LIFE TIME

Manufactures According To

KAWSAR

HDPE PIPES

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INTRODUCTION

Kawsar has established in 1994 as a manufacturer for water Hand Pumps. Kawsar started its regular production of plastic Polyvinyl Chloride PVC Pressure and non-Pressure pipe system for cold and potable water and other industrial uses from March 2004.After Achievement in PVC Kawsar Now Started PPR-C, HDPE pipes & Fitting with Advance Technology. We aim to set standards in every field we enter. Customer focus, quality and innovation are reflected in every aspect of our business. Our strength lies in pre-empting customer expectations and product demands. KAWSAR today is a hallmark of trust and reliability. This is why KAWSAR employs are highly skilled and experienced labor, KAWSAR utilizes the most advanced technology on its production line and retains the modern management system.

As a group, we have commitment to high ethical business valves, quality of products, committed deliveries and competitive pricing. These are the factor which has taken us to the path of success achieving great heights and we are confident to achieve further heights in the times to come with the new setup. Kawsar has highly qualified staff and has experienced staff about `12 year .

We believe that our strength lies in delighting our customers. That is why, providing quality products backed by superior technical support services, is the KAWSAR promise to all our valued customers.

Besides its unique place in the Pakistan plastic and Hand Pumps industry, KAWSAR products are being exported to various other countries.

CERTIFICATIONS

In our quest to lead by example, our joint efforts have led KAWSAR to ISO 9001:2000 Certification and accreditation for supreme product performance and quality by the Pakistan Standard Institute (PSI) and Pakistan Engineering Council.

100% Food Grade Material

CERTIFIED COMPANY
MOODY INTERNATIONAL ISO 9000:2008

UKAS ENVIRONMENTAL MANAGEMENT 014

Pakistan Standards

Manufactures According To International Standards

UL DIN ASTM INTERNATIONAL Standards Worldwide NEMA BSI British Standards

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ISO 9001-2000

CERTIFIED COMPANY

APPROVED BY

PSI	Pakistan Standards Institution (Govt. of Pakistan)
LGRD	Local Govt. of Rural Development Dept (NWFP)
SGS	Societe General DE Surveillance
WMD	Water Management Deptt. Govt. of NWFP, Punjab
PSQCA	Pakistan Standard & Quality Control Authority
PHED	Public Health Engineering Deptt. Govt. of NWFP.
ISO	International Standards Organization

ENLISTED WITH

DACCAR	Danish Committee for Aid to Afghan Refugee
SCA	Swedish Committee for Afghanistan
IRC	International Rescue Committee
UNDP	United National Development Program
UNICEF	United Nations Children Emergency Fund for Pakistan and Afghanistan
ICRC	International Committee of the Red Cross
QC	Qatar Charity
QRC	Qatar Red Crescent
SRSP	Sarhad Rural Support Programme

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QUALITY POLICY

Kawsar total quality control perceptive is taken as a principal while performing the mission. Our main policy is to provide the present and future needs and demands of our customers in the most economical way and on time. In all our processes, we adopt in the principle of customer oriented understanding.

Aim for improvement full participation of our staff. In this process management, our main goal is to continuously improve our production and to respond the demands of our customers, personals and suppliers.

OUR MISSION

To increase the number of pleased and trusted customers in our sector by satisfying them from our quality.

OUR VISION

To be committed to the mission of being the symbol of trust and contentment in the plastic and fittings market, KAWSAR proceeds to this targets as being the leader in the domestic market. And being a under rental and permanent supplier in the international market.

WHY KAWSAR?

Being one of the best firms in the country in manufacturing sector of PVC, PPRC, HDPE Pipes and Fittings, Kawsar Gives at most of the importance to the Quality control and:

1. Uses the most appropriate material
2. Has the most advanced high technology
3. Has well qualified technical Staff and Experienced Labor
4. Produces Pipes in compliance with the International Standards.
5. Has Well equipped laboratory which is round the clock busy to control the Quality at each stage of production

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QUALITY CONTROL

QUALITY CONTROL DEPARTMENT

Our company has a quality control department under the supervision of Quality Manager to ensure quality at all levels. The quality control department works round the clock to synchronize with shift system of the plant..

RAW MATERIAL QUALITY CONTROL.

All types of Raw material from our supplier are subject to input quality control test .
Before Production Samples chosen from raw material for Test being carried out obtain suitable for Production approval.

PROCESS QUALITY CONTROL

To assure quality of the HDPE Pipes during production process and finish product, Quality Control department ensures that materials used in the manufacturing process are in strict compliance with the end users' requirement and the end product is in conformity with the applicable international standards.

EXTENSIVE QUALITY CONTROL

Kawsar pipe undergoes numerous quality control tests, including regular measurements of critical dimensions, tests for extrusion quality, pipe flattening, burst pressure, impact resistance, joint integrity, and hydrostatic soundness , Melt Flow rate, Internal Hydrostatic Pressure Resistance (ICPR), Longitudinal Reversion (Heat Reversion) , Tensile Strength This ensures optimum quality, reliability and long-term strength.

THIRD-PARTY INSPECTION

Independent inspection provides added assurance that Kawsar HDPE Pipes meets applicable standards and specifications. This is done through unannounced plant audits, verification of materials, procedures and test equipment, as well as through random sampling and testing of pipe and materials.

HIGH QUALITY AND PERFORMANCE STANDARDS

The quality and performance of HDPE Pipes are assured by a wide array of tough standards,

control tests and independent certifications

Kawsar HDPE Pipes maintain the quality of the products as per the revised and the latest standard ISO 9001/ which also is in line with the international standards on product quality

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HDPE WATER PIPES

Meeting the challenges of the 21st century Piping made from polyethylene is a cost effective solution for a broad range of piping problems in municipal, industrial, marine ,mining, landfill, duct and agricultural applications. It has been tested and proven effective for above ground, surface, buried, sliplined, floating, and sub-surface marine applications.

High-density polyethylene pipe (HDPE) can carry potable water, wastewater, slurries, chemicals, hazardous wastes, and compressed gases. In fact, polyethylene pipe has a long and distinguished history of service to the gas, oil, mining and other industries. It has the lowest repair frequency per mile of pipe per year compared with all other pressure pipe materials used for urban gas distribution.

Polyethylene is strong, extremely tough and very durable. Whether you're looking for long service, trouble-free installation, flexibility, resistance to chemicals or a myriad of other features, high-density polyethylene pipe will meet all your requirements.

- **HIGH DENSITY POLYETHYLENE - HDPE - IS A VERY POPULAR MATERIAL FOR WATER PIPES. IT IS**
  - **RESISTANT TO CHEMICALS**
  - **EASY AND LIGHT WEIGHTED**
  - **LONG LIVING**
  - **LOW FRICTION**
  - **RELATIVELY CHEAP**
  - **FLEXIBLE**
  - **SUN RESISTANT**

Polyethylene's are divided into 3 groups according to their densities as

(LDPE)	Low Density
(MDPE)	Medium Density
(HDPE)	High Density

PE pipes can be used in range of temperatures -40oC to 60oC considering the change of operating pressure. Typically the standard specification identify class of a HDPE pipe is by the nominal pressure class - PN - up to PN 20 or 20 bar. HDPE pipe can also be classified by the material used - PE 100, PE 80, PE63, PE 40 or PE 32.

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PRESSURE NOMINAL -PN

PE pipes are produced in different pressure grades (P N grades), which indicates the pressure in bars the pipe can support with water at $20^{o}C$.

The pressure grades available according to European standards are

PN 2.5	max pressure *2.5 bar*
PN 4	max pressure *4 bar*
PN 6	max pressure *6 bar*
PN 10	max pressure *10 bar*
PN 16	max pressure *16 bar*

1 bar = 10^{5} Pa (N/m^{2}) = 0.1 N/mm^{2} = 10,197 kp/m^{2} = 10.20 m $H_{2}O$ = 0.9869 atm = 14.50 psi (lbf/in^{2}) = 10^{6} dyn/cm^{2} = 750 mmHg

Designation of material	MRS at 50 year sand 20°C Mpa (bar)
PE 100	10 (100)
PE 80	8 (80)
PE 63	6.3 (63)
PE 40	4 (40)
PE 32	3.2 (32)

The Minimum Required Strength -MRS - according ISO 4427 for the different materials are:

CLASSED BY MATERIALS

Polyethylene pipes are also classified by the type of material used:

PE 32	low pressure piping systems
PE 40	low pressure piping systems
PE 63	medium pressure piping systems irrigation system - drinking water connections
PE 80	gas pipe for natural gas distribution network with pressure rate up to *4 bars*- drinking water pipe with pressure rate up to *16 bar*- sewers, outfall pipes, industrial pipes
PE 100	high demands piping applications

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KAWSAR WATER HDPE

STANDARDS

- DIN 8074 & 8075
- ISO 4427 & 4437
- ASTM D2447 & F2160
- ASTM D2239
- ASTM D2737
- ASTM D3035
- ASTM D2513
- PS 3580

ADVANTAGES

Lower life cycle costs

- Corrosion resistance. Does not rust, rotor corrode.
- Leak tight. Heat-fused joints create a homogenous, monolithic system. The fusion joint is stronger than the pipe.
- Excellent water hammer characteristics. Designed to with stand surge events.
- High strain allowance. Virtually eliminates breakage due to freezing pipes.
- Additional cost savings are achieved by lower instance of repairs.
- With no exfiltration or infiltration, potable water losses and groundwater nuisance treatment costs encountered in traditional piping systems are eliminated.

REDUCED INSTALLATION COSTS

- Material of choice for. Used in directional boring, plowing, river crossings, pipe bursting and slip lining.
- Fewer fittings due to pipe flexibility. Allowable bending radius of 20 to 25 times outside diameter of pipe.
- Lighter equipment required for handling and installation than with metallic materials.
- Eliminates the need for thrust blocking. Heat fused joints are fully restrained.
- Light weight and longer lengths allow for significant savings in labor and equipment.

LEAK FREE.

Polyethylene pipe is normally joined by heat fusion. Butt, socket, sidewall fusion and Electro fusion create a joint that is as strong as he pipe itself, and is virtually leak free. This unique joining method produces significant cost reductions compared to other materials.

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- **CORROSION, ABRASION , AND CHEMICAL RESISTANT.**

  Polyethylene piping's performance in mining, dredging and similar applications proves it will outwear many more costly piping materials when conveying a variety of abrasive slurries. HDPE has excellent corrosion resistance and is virtually inert.
  It does not need expensive maintenance or cathodic protection. It offers better overall resistance to corrosive acids, bases and salts than most piping materials. In addition, polyethylene is unaffected by bacteria, fungi and the most “aggressive” naturally occurring soils. It has good resistance to many organic substances, such as solvents and fuels.

- **EXCELLENT FLOW CHARACTERISTICS.**

  Because polyethylene is smoother than steel, cast iron, ductile iron, or concrete, a smaller PE pipe can carry an equivalent volumetric flow rate at the same pressure.
  It has less drag and a lower tendency for turbulence at high flow. Its superior chemical resistance and “non-stick” surface combine to almost eliminate scaling and pitting and preserve the excellent hydraulic characteristics throughout the pipe service life.

- **LIGHTWEIGHT AND FLEXIBLE.**

  Polyethylene pipe is produced in straight lengths or in coils. Made from materials about one-eighth the density of steel, it is lightweight and does not require the use of heavy lifting equipment for installation. It reduces the need for fittings, is excellent
  in shifting soils and performs well in earthquake-prone areas. HDPE resists the effects of freezing and allows bending without the need for an excessive number of fittings. Since HDPE is not a brittle material, it can be installed with bends over uneven terrain easily in continuous lengths without additional welds or couplings

- **DUCTILITY AND TOUGHNESS.**

  Polyethylene pipe and fittings are inherently tough, resilient and resistant to damage caused by external loads, vibrations, and from pressure surges such as water hammer. Even in cold weather polyethylene pipe is tolerant to handling and bending.

- **MINERAL BUILD-UP RESISTANCE**

  KAWSAR HDPE resists scaling and internal deposits. Chlorine Resistance HDPE exceeds the requirements of ASTM F876 for chlorine resistance, when tested in accordance with ASTM F2023.

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FREEZE RESISTANCE

Unlike HDPE and copper pipes, Kawsar HDPE PIPES will not split when frozen, if allowed to expand along its entire length. It will return to its original shape when thawed. In addition HDPE will freeze at a slower rate than copper due to its significantly lower (four orders of magnitude) coefficient of thermal conductivity.

1. Thawing can be performed by using available hot water injection equipment. After thawing, HDPE can immediately be put back into service.

2. Thawing can also be performed by applying hot air to the pipe. When using a hot air gun to heat frozen areas, ensure that the temperature of the pipe does not exceed 210°F (93.3°C). Do not use an open flame to thaw Kawsar HDPE pipes.

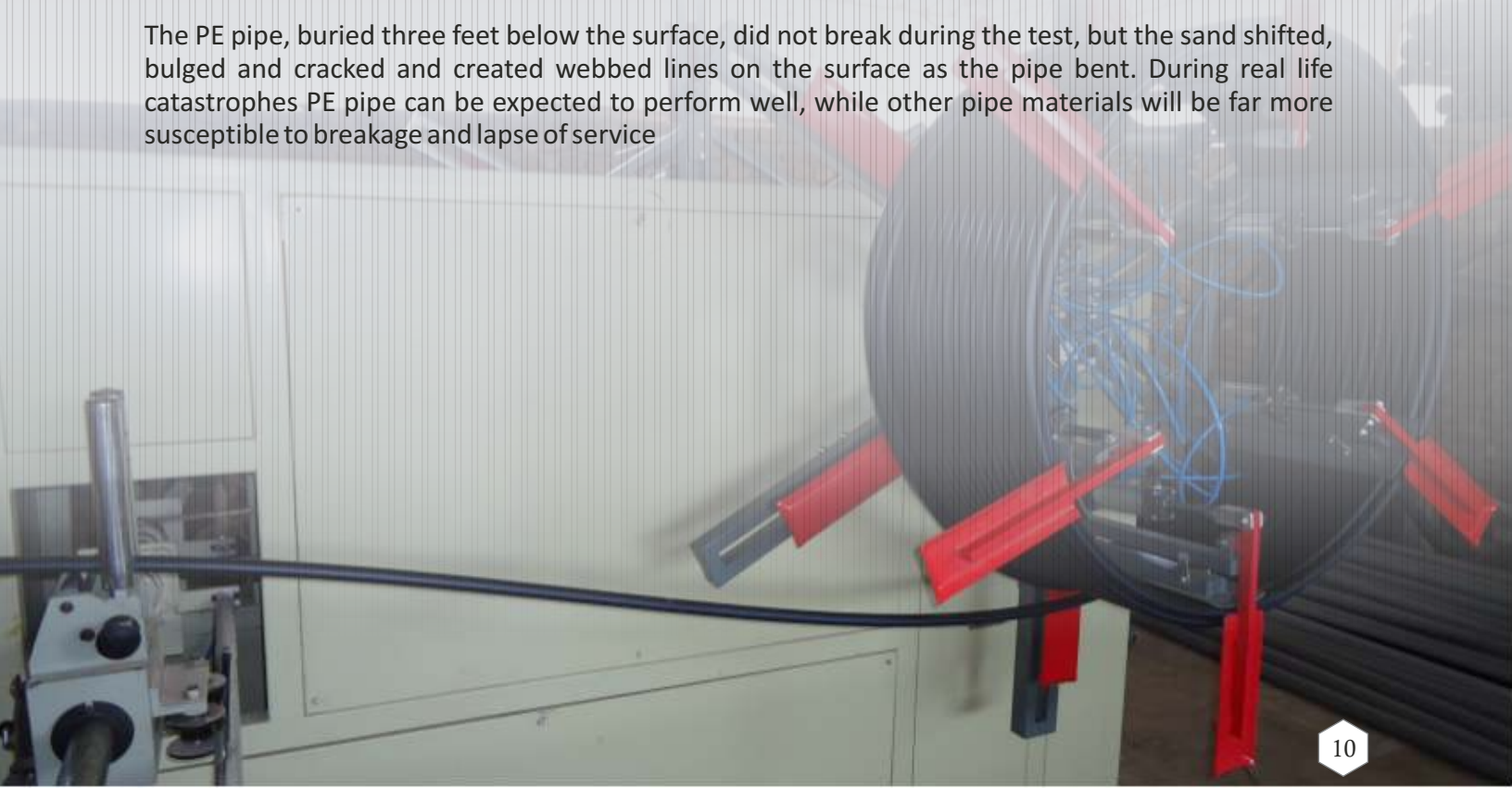
HIGH IMPACT RESISTANCE

Kawsar HDPE is more flexible than other piping materials, and will not crush, kink or collapse when proper backfill techniques are used. Kawsar also has high resistance to gouges or scratches and outstanding resistance to slow crack growth.

HDPE PIPE– EARTHQUAKE SIMULATION TESTED

In addition to being tested during actual earthquakes throughout the US, Canada and the globe, Cornell University researchers simulated, on April 6, 2006, an earthquake's effects on gas and water polyethylene (PE) pipes by exerting a 120,000-pound force on a 16-inch diameter, 35-foot-long pipe - the largest test of ground rupture effects that has ever been performed in a lab.

The PE pipe, buried three feet below the surface, did not break during the test, but the sand shifted, bulged and cracked and created webbed lines on the surface as the pipe bent. During real life catastrophes PE pipe can be expected to perform well, while other pipe materials will be far more susceptible to breakage and lapse of service



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PHYSICAL AND MECHANICAL PROPERTIES

Physical Properties	Units	HDPE
Density	kg/m3	0.958 x 103
Co-efficient of linear expansion	K-1	16 x 10-5
Thermal conductivity at 20oC	W/m/K	0.50
Specific heat	J/kg/K	2.3 x 103
Softening point (Vicat)	oC	67
Flammability	-	Flammable

Mechanical Properties	Units	HDPE
Tensile strength at yield	MPa	26
Elongation at yield	%	10
Modulus of elasticity	MPa	900
Rockwell hardness (Shore)	-	61
Dielectric strength	kV/mm	70

TEMPERATURE/PRESSURE DERATING

The rated working pressure of an HDPE pipe is determined at 20oC. Where the operating temperature of the fluid in the pipe exceeds 20oC, the pressure rating of the pipe has to be de-rated in order to maintain the designed safety factors of the pipe.

HDPE pipe is not recommended in applications where the fluid temperature exceeds 50oC.

Temperature of the Fluid in the Pipe	Derating Factor apply to maximum working pressure
0-20	1,0
20-25	0,9
25-30	0,8
30-35	0,7
35-40	0,6
40-45	0,5
45-50	0,4



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KAWSAR HDPE PIPE STANDARD

PE 100	PN 3.2	PN 4	PN 5	PN 6.4	PN 7.8	PN 8	PN 9.6	PN 10	PN 12.7	PN 16	PN 20	PN 25
PE 80	PN 2.5	PN 3.2	PN 4	PN 5	PN 6	PN 6.4	PN 7.7	PN 8	PN 10	PN 12.5	PN 16	PN 20
PE63	PN	PN 2.5	PN 3.2	PN 4	PN 4.8	PN 5	PN 6	PN 6.3	PN 8	PN 10	PN 12.6	PN 16

	25		20		16		12.5		10.5		10		8.3		8		6.3		5		4		3.2	
	51		41		33		26		22		21		17.6		17		13.6		11		9		7.4	
	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M	S	Kg/M
20																	1.8	0.107	1.9	0.112	2.3	0.133	2.8	0.154
25															1.8	0.137	1.9	0.144	2.3	.0.171	0.2	3.5	0.24	
32													1.8	0.179	1.9	0.187	2.4	0.232	2.9	0.272	3.2	0.327	4.4	0.386
40							1.8	0.227	1.9	0.238	1.9	0.239	2	0.285	2.4	0.295	3	0.356	3.7	0.43	4.5	0.509	5.5	0.6
50					1.8	0.287	2	0.314	2.3	0.361	2.4	0.374	2.9	0.44	3	0.453	3.7	0.549	4.6	0.668	5.6	0.788	6.9	0.936
63			1.8	0.364	2	0.399	2.5	0.494	2.9	0.563	3	0.58	3.6	0.688	3.8	0.721	4.7	0.873	5.8	1.05	7.1	1.26	8.6	1.47
75	1.8	0.436	1.9	0.457	2.3	0.551	2.9	0.675	3.5	0.807	3.6	0.828	4.3	0.976	4.5	1.02	5.6	1.24	6.8	1.47	8.4	1.76	10.3	2.09
90	1.8	0.526	2.2	0.643	2.8	0.791	3.5	0.978	4.1	1.14	4.3	1.18	5.1	1.39	5.4	1.46	6.7	1.77	8.2	2.12	10.1	2.54	12.3	3
110	2.2	0.706	2.7	0.943	3.4	1.17	4.2	1.43	5	1.67	5.3	1.77	6.3	2.08	6.6	2.17	8.1	2.62	10	3.14	12.3	3.78	15.1	4.49
125	2.5	1	3.1	1.23	3.9	1.51	4.8	1.84	5.7	2.16	6	2.27	7.1	2.66	7.4	2.76	9.2	3.37	11.4	4.08	14	4.87	17.1	5.77
140	2.8	1.25	3.5	1.54	4.3	1.88	5.4	2.32	6.4	2.72	6.7	2.83	8	3.34	8.3	3.46	10.3	4.22	12.7	5.08	15.7	6.11	19.2	7.25
160	3.2	1.53	4	2	4.9	2.42	6.2	3.04	7.3	3.53	7.7	3.72	9.1	4.35	9.5	4.52	11.8	5.5	14.6	6.47	17.9	7.96	21..9	9.44
180	3.6	2.5	4.4	2.4	5.5	3.07	6.9	3.79	8.2	4.47	8.6	4.67	10.2	5.48	10.7	5.71	13.3	6.98	16.4	8.42	20.1	10.1	24.6	11.9
200	3.9	2.46	4.9	3.05	6.2	3.84	7.7	4.69	9.1	5.51	9.6	5.78	11.4	6.79	11.9	7.05	14.7	8.56	18.2	10.4	22.4	12.4	27.1	14.8
225	4.4	3.12	5.5	3.86	6.9	4.77	8.6	5.89	10.3	7	10.8	7.3	12.6	8.55	13.4	8.93	16.6	10.9	20.5	13.1	25.2	15.8	30.8	18.6
250	4.9	3.83	6.2	4.83	7.7	5.92	9.6	7.3	11.4	8.59	11.9	8.93	14.2	10.6	14.8	11	18.4	13.4	22.7	16.2	27.9	15.4	34.2	23
280	5.5	4.83	6.9	5.98	8.6	7.4	10.7	9.1	12.8	10.8	13.4	11.3	15.9	13.2	16.6	13.7	20.5	16.8	25.4	20.3	31.3	15.4	38.3	28.9
315	6.2	6.12	7.7	7.52	9.7	9.37	12.1	11.6	14.4	13.6	15	14.2	17.9	16.7	18.7	17.4	23.2	21.2	28.6	25.6	35.2	30.8	39.1	36.5
355	7	7.73	8.7	9.55	10.9	11.8	13.6	14.6	16.2	17.3	16.9	18	20.1	21.2	21.1	22.1	26.1	32.2	32.5	32.5	39.7	39.1	48.5	46.5
400	7.9	9.82	9.8	12.1	12.3	16.1	15.3	18.6	18.2	29.1	19.1	22.9	22.7	26.9	23.7	28	29.4	34.1	36.3	41.3	44.7	49.6	54.7	58.8

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HDPE CONDUIT PIPE

High density polythelence KawsarHDPE Conduit , with its high performance characteristics, crush strength , bending radius, and superior pulling ability, gives buried cable much needed security and protection against road utility construction, random dig ups, and rodent damage. Cable and fiber optic Its high tensile strength-to-weight ratio, superior crush resistance, and low coefficient of friction when installing cable makes it ideal for directional boring.

HDPE IS Non metallic flexible race way offering a protective pathway for cables and wires, and is used in underground\or inner duct applications.

STANDARDS

- DIN 8074 & 8075
- ISO 4427 & 4437
- ASTM D2447 & F2160
- ASTM D2239
- ASTM D2737
- ASTM D3035
- ASTM D2513
- PS 3580

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ADVANTAGES

- Meets NEMA Tc7
- Long term strength for extended life and performance
- Strength to withstand external loads.
- Lightweight and flexible, allowing for various installation methods
- Low Coefficient of friction, allowing longer and faster cable installations.
- Mechanical protection for Cables.
- Resistance to corrosive chemical and aggressive soils
- Moister free and water tight
- Protection against rodents
- Available in long length requiring fewer joints, lowering installation costs.
- Heat fused, fully restrained, leak-proof joints
- Durability ,long –term sustained strength and integrity
- Non-Toxic, environmentally safe
- Ease of handling, shipping, and identification

APPLICATION

Kawsar HDPE conduit has been used by leading data and communication network builders. Kawsar Conduit houses and protect Fiber Optic cable as well as any other type of data or communication transmission lines. It can be used for everything from cable TV in residential construction, domestic and international telephone networks, intra-city fiber optic and long distance and city fiber optic networks. The flexibility of our pipe for ease of installation ,it may be pulled in through existing conduit, buried in open trench, and run above ground.

TEMPERATURE AND PRESSURES

Kawsar HDPE Conduit design operating temperature range is from 100F to 140F Cold ambient temperature does not have an adverse effect on conduit strength or characteristics.

The maximum safe pressure for a given Kawsar HDPE Pipe is determined by the pipe's wall thickness and Hydrostatic Design Basis (HDB), the PE pipe Industry's pressure rating method. The resultant maximum safe pressure is then modified by a design factor of 0.32(established by the Department of Transportation, USA) to arrive at a design pressure rating or the safety factor can be customized to a clients particular requirement.

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HDPE CONDUIT PIPES

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INSTALLATION AND JOINTING

Installation of Kawsar HDPE Conduit Pipe is similar to that of standard cable systems conduit can be trench-laid ,plowed directionally bored. Although benign to chemically aggressive native soil, installation of Kawsar HDPE Conduit in soils contaminated with organic solvents (oil,gasoline) is not recommended.

MAINTENANCE

Properly designed and installed, Kawsar HDPE Conduit system require little on-going maintenance. Kawsar Hdpe is resistant to most ordicany chemicals and because it is non- conducting it is not susceptible to galvanic corrosion nor will it contribute to electrical interference.

Because the pipes can be produced as a coil, they provide advantages in furnishing. Because the welding quantity decreases, the short lines can be furnished and they provide fitting and workmanship savings. In order to cancel out the natural gas leakage probability from the weld, only electro fusion welding is used which is the most safe welding method. The current is passed from the copper wires which are placed inside the fittings. The wire in which the current is passed is heated. The released energy melts the plastic. The volume of the melted plastic increases and melts the pipe by contacting with it. The molecular welding is performed with the pressure strength which is formed by the compaction in the intermediary region. It does not get harmed in earthquakes with its flexible structure and it eliminates the explosion risk.

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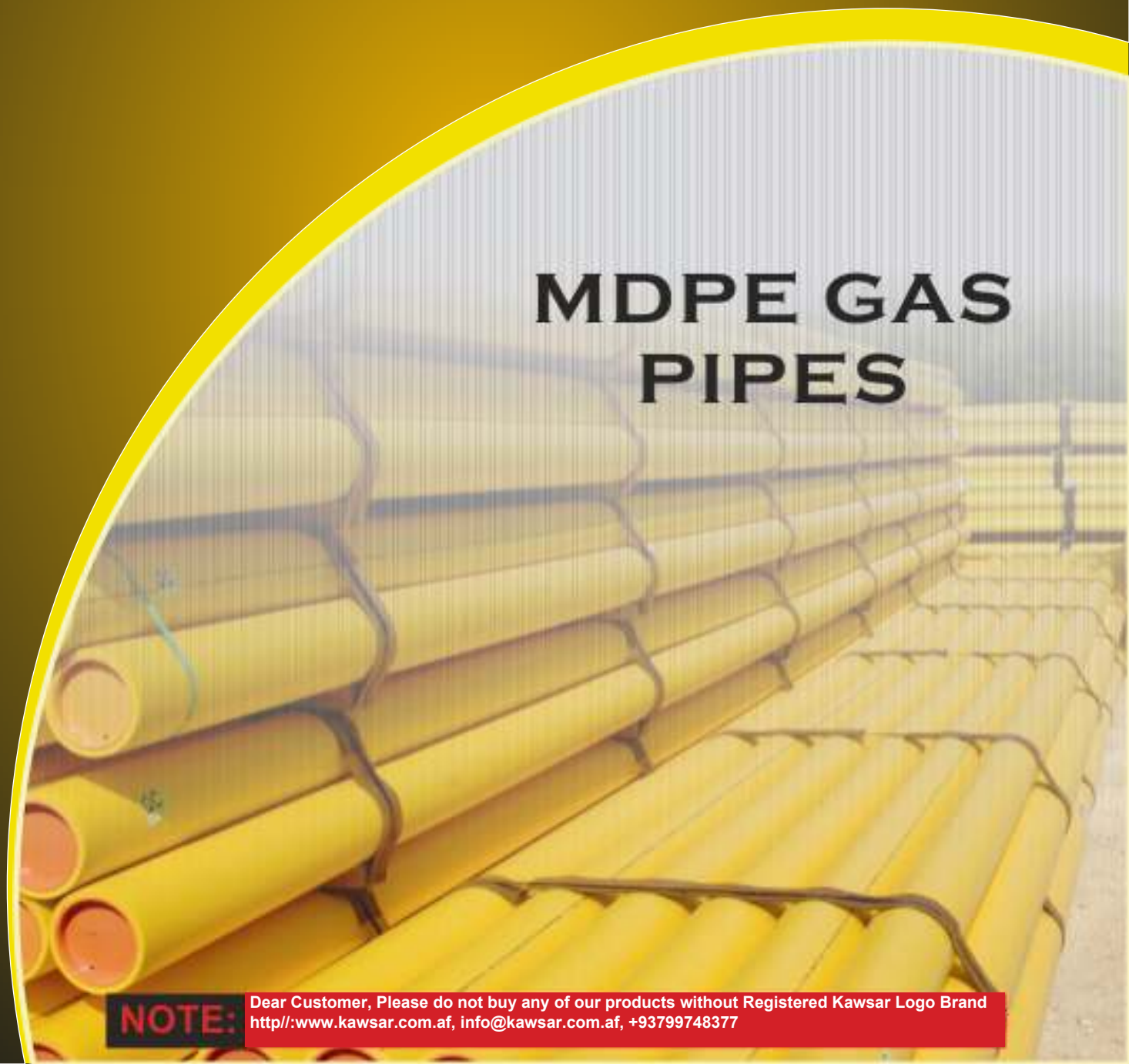
MDPE GAS PIPES



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MDPE GAS PIPE

Gas distribution was among the first application of the medium density polyethene (MDPE) pipe. In fact , many of the systems currently in use have been in continuous service since 1960 with great success. Today , over 90% of the pipe installed for the natural gas distribution industry in the U.S and Canada is plastic, and of the, 99% is polyethylene .

Although the pipe resistance and stiffness increase from the bottom to the top, in contrast, its flexibility and impact strength increase. Because the natural gas pipes are more flexible and their impact strength are higher than the high density ones, they are recommended.

Natural gas pipes are in PE80 class. The environmental strength value to be reached in the medium density is 8.0 MPa for now. When this level increases, the wall thickness will decrease and the fluid quantity passing through will increase. When they are used for water, they can be used at 4 bar pressure in the natural gas line by changing the safety coefficient from 1,25 to 2,5 when used in PN 12,5 bar. Because the polymer chain is affected from the hydrocarbon structures, the safety coefficient is selected as high.

KAWSAR HDPE is lightweight, flexible and available in long coils there by making it easy to install and minimizing the number of joints in the piping system. KAWSAR HDPE pipe can be joined by the heat fusion or mechanical fitting and does not corrode like metal pipe. It provides long term resistance to variety of service condition such as , abrasion, temperature and soil shifts, bending, weathering , internalk pressure , direct burial point loading and squeeze –off –advantages that give confidence to gas engineers the world over to specify Kawsar PE pipe for their distribution systems.

STANDARDS

ISO 4437 (1997)	RAW MATERIAL SPECIFICATIONS
ASTM D-2513 (2000)	Medium Density Polyethylene (PE-80)
Other standards upon request	High Density Polyethylene (PE-100)

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ADVANTAGES

- It is not affected by the earthquake by its flexible structure.
- It keeps its flexibility when the temperature decreases to - 40 °C.
- Can be used on the building site as coil.
- Show high resistance to chemicals.
- Does not face corrosion by the fluid inside and by the structure of soil outside.
- It is light as 1/8 of steel as its volume being 0.940 gr/cm3.
- It can be combined out of channel and then released to channel. Decreases the excavation amount.
- It dos not require the ground to be sensible excavated progressively.

TEMPERATURE AND PRESSURE .

The maximum safe pressure for a given Kawsar MDPE Pipe is determined by the pipe's wall thickness and Hydrostatic Design Basis (HDB), the PE pipe Industry's pressure rating method. The resultant maximum safe pressure is then modified by a design factor of 0.32.

Kawsar MDPE pipe's operating temperature range is from – 20F to 140F in pressure service. The system and fitting not be operated above 100F unless components have demonstrated that gas can be safely transported at the higher temperature and expected pressure. Cold ambient temperature does not have an adverse effect on plastic pipe strength or characteristics.

MDPE80 natural gas pipes are used in the 4 bar pressurized regions of the natural gas lines. The natural has lines consist of 20 bar steel pipe, 4 bar intermediary line and 0.4 bar indoor lines

Because the pipes can be produced as a coil, they provide advantages in furnishing. Because the welding quantity decreases, the short lines can be furnished and they provide fitting and workmanship savings. In order to cancel out the natural gas leakage probability from the weld, only electro fusion welding is used which is the most safe welding method. The current is passed from the copper wires which are placed inside the fittings. The wire in which the current is passed is heated. The released energy melts the plastic. The volume of the melted plastic increases and melts the pipe by contacting with it. The molecular welding is performed with the pressure strength which is formed by the compaction in the intermediary region. It does not get harmed in earthquakes with its flexible structure and it eliminates the explosion risk.

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MATERIAL PROPERTIES (TYPICAL)

PROPERTY	TYPICAL	UNITS	TEST METHODS
Melt Flow Rate (190 C, 5 kg)	0.5	g/10 min	ISO 1133
Density of Colored Compound	940	kg/m3	ISO 1872/1
Tensile Street at yield	19	Mpa	ISO /R527
Eloogation at Break	>600	%	ISO /R527
Flexural Modules	750	Mpa	ISO 178
Vicat Softening Temprature	116	^{0}C	ISO 306
Thermal Conductivity	0.4	W/m ^{0}C	BS 874 (at 23 ^{0}C)
Linear Thermal Expansion	1.5 X 10^{-4}	$^{0}C^{-1}$	ASTM D 696 (20-60 ^{0}C)
Environmental stress Crack Resist.	>1000	Hrs	ASTM D 1693 B
Minimum Reoccurred Strength (MRS)	8.0	Mpa	ISO TR 9080 (97.5% LCL)

*Test conducted by manufacturers of raw material.

(SNGPL SPECIFICATION)

ITEM	SIZE	Diameter (mm)		Thickness		SDR
		MIN	MAX	MIN	MAX	
YELLOW PE-80	3/4"	26.57	26.77	2.41	2.92	11
YELLOW PE-80	1"	33.27	33.53	3.02	3.68	11
YELLOW PE-80	1-1/4"	42.03	42.29	4.22	4.7	10
YELLOW PE-80	2"	60.18	60.48	5.49	6.15	11
YELLOW PE-80	4"	114.07	114.53	10.39	11.63	11
YELLOW PE-100 SDR-11(GAS)	6"	168	168.56	15.29	17.12	11

(SSGC SPECIFICATION)

	SIZE	Diameter (mm)		Thickness		SDR
		MIN	MAX	MIN	MAX	
ORANGE PE-100						
ORANGE PE-100						
ORANGE PE-100	40	40	40.4	3.7	4.1	11
ORANGE PE-100	63	63	63.4	5.8	6.5	11
ORANGE PE-100	125	125	125.8	11.4	12.6	11
ORANGE PE-100	180	180	181.1	16.4	18.2	1

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I.S.O. 4437: 1997 (E) Dimensions in millimeter

NOMINAL OUTSIDE DIAMETER	MINIMUM WALL THICKNESS	
dn	ey.min.	
	SDR 17.6	SDR 11
16	2.3	3.0
20	2.3	3.0
25	2.3	3.0
32	2.3	3.0
40	2.3	3.7
50	2.9	4.6
63	3.6	5.8
75	4.3	6.8
90	5.2	8.2
100	6.3	10.0
125	7.1	11.4
140	8.0	12.7
160	9.1	14.6
180	10.3	16.4
200	11.4	18.2
225	12.8	20.5
250	14.2	22.7
280	15.9	25.4
315	17.9	28.6
355	20.2	32.3
400	22.8	36.4
450	25.6	40.9
500	28.4	45.5
560	31.9	50.9
630	35.8	57.3

Standard Tables

Minimum wall thicknesses for pipe SDR's most commonly used for gas pipe diameter < 40mm, SDR17.6 and > 32mm,SDR 11, are characterized by SDR.

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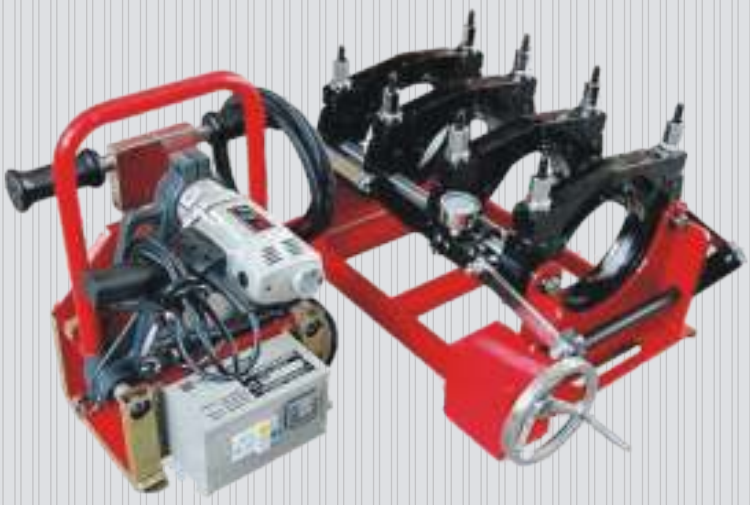
JOINTING METHODS

There are available number of types of jointing HDPE pipes depending on the size and type of application. The first common type of Jointing HDPE pipe is Mechanical Jointing which composes of Compression type and Flange type, and the other is the Permanent Jointing which compose of Butt Fusion Welding and Electro fusion Welding.

BUTT WELDING

Butt welding or Butt Fusion is a simplest and space-saving jointing method to connect the pipe and fittings of PE. The process starts by cutting the pipe ends straight and square to the axis and cleaned carefully by and electric planer. The pipes and fittings are held tight and pressed against a coated heating plate. As soon as the heating time and the required bead are reached, the heating plate is quickly withdrawn from the weld faces and the connection are pressed together to form a permanent joint.



COMPRESSION TYPE

For small bore pipe connections up to size 125MM OD, compression type joints are satisfactory.

The installation process started with the cutting of pipe ends square or 90º in relation to its axis. Fit the collar and clinching ring into the pipe and place the rubber O-ring at the tip of the pipe.

Then push the body of the fitting until the pipe ends reaches its full stop. Slide the clinching ring and Collar(Nut) until it catches the fitting and tight fully using a belt or chain wrench.

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FLANGE TYPE

Flange type is another type of conventional mechanical jointing. A HDPE Flange adaptor(Stubend) is butt welded to the pipe with the loose steel backing flange inserted inside. A standard number of bolts will be fitted to tighten the connection. This type of connection is practical for application which requires easy serviceability in the future.

ELECTROFUSION WELDING

This is an easy system for jointing pipes and fittings of HDPE. A pre-installed resistance wires are embedded in the inside surface of the electrofusion coupling. When the pipes or fittings are inserted in the coupling and the wires are connected to the welding unit, the contact surfaces become warm and consequently melt into each other until it forms a rigid and durable joint. A welding unit is available for this procedure which operates the timing automatically. This makes the whole operation very easy and practical especially in narrow and tight installations.

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BUTT FUSION TIME CYCLE

Pipe Size	Heat Time (sec)	Cooling Time (sec)
½ CTs	6 - 7	60
1CTs	8 - 10	60
½ IPS	6 - 7	60
3/4 IPS	7 - 9	60
1 IPS	10 - 12	60
1 1/4 IPS	12 - 14	60
1 ½ IPS	14 - 18	60
2 IPS	14 - 18^{-4}	60
3 IPS	20 - 24	60

Do not remove joint from root for an additional 3 minutes.
Do not stress joint for at least 10 minutes after removal from root.

SOCKETT FUSION TIME CYLCLES

Pipe size	Heat Time (sec)	Holding Time (sec)
½ CTs	6 - 7	60
1CTs	8 - 10	60
½ IPS	6 - 7	60
3/4 IPS	7 - 9	60
1 IPS	10 - 12	60
1 1/4 IPS	12 - 14	60
1 ½ IPS	14 - 18	60
2 IPS	14 - 18^{-4}	60
3 IPS	20 - 24	60

Do not remove cold ring for an additional 3 minutes
Do not stress joint for at least 10 minutes
after the cold ring has been removed

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CHEMICAL RESISTANCE TABLE

The following chart rates the resistance of unplasticised polyvinylchloride, polyethylene, polypropylene and two commonly used rubber seal rings to various chemicals at various concentrations and temperatures. The chart is intended as a guide only and should not be regarded as applicable to all working conditions. Should there be any doubt about the behaviour of the pipe under specific conditions, please contact the Technical Department.

Use the index below as a reference guide to the tables which follow.

Abbreviations	Material	Maximum permissible temperatures (water)		Remarks
		Constant	Short Term	
		oC	oC	
PVC-U	Unplasticised polyvinylchloride	60	60	Good resistance to most solutions of acids, alkalis and salts, and to solvents miscible with water. Not resistant to aromatic and chlorinated hydrocarbons.
PE	Polyethylene (High Density)	60	80	Good resistance to solutions of acids, alkalis and salts, as well as to large numbers of organic solvents. Unsuitable for concentrated oxidising acids.
PP	Polypropylene	90	110	Chemical resistance similar to that of PE, but suitable for higher temperatures.
CR	Chloroprene Rubber (Neoprene)	80	110	Chemical resistance similar to that of PVC-U and between that of Nitrile and Butyl Rubber
NR	Natural Rubber	70	110	Unsuitable with oil and oxidizing media.

			Chemical Resistance				
Medium	Concentration	oC	PVC-U	PE	PP	NR	CR
Acetic acid, aqueous	Up to 25%	40	▼	▼	▼	▼	Ø
	Up to 25%	60	Ø	▼	▼	▼	Ø
	80%	40	Ø	Ø	▼	▼	Ø
	80%	100	-	-	-	-	-
	85%	80	-	-	Ø	-	-
	85%	100	-	-	-	-	-
Ammonia water	Warm saturated	40	▼	▼	▼	▼	▼
	Warm saturated	60	Ø	▼	▼	▼	▼
	Warm saturated	80	-	Ø	Ø	-	▼
	Saturated	100	-	-	Ø	-	Ø
Battery acid		60	▼	▼	▼	Ø	▼
Benzene	Technically pure	20	-	-	-	-	-
Benzine (Petrol)	Technically pure	60	▼	▼	-	-	-
Butane gaseous	50 %	20	▼	▼	▼	-	▼
Carbon dioxide, dry	100%	60	▼	▼	▼	▼	▼
	100%	80	-	Ø	▼	-	▼
Carbon monoxide	100%	60	▼	▼	▼	▼	▼
Caustic soda solution	Up to 40%	60	▼	▼	▼	▼	▼
	50 / 60%	60	▼	▼	▼	▼	▼
Chlorine, gaseous, dry	100%	20	▼	Ø	Ø	-	-
Chlorine, liquid		20	-	-	-	-	▼
Chlorine water	Saturated	20	Ø	-	-	Ø	-
Citric acid, aqueous	Up to 10%	40	▼	▼	▼	▼	▼
	Up to 10%	60	Ø	▼	▼	▼	▼
	Saturated	60	Ø	▼	▼	▼	▼
Coconut oil	Technically pure	60	▼	Ø	Ø	-	Ø
Corn oil		20	Ø	▼	▼	-	Ø
Cyclohexanol	Technically pure	20	-	▼	▼	-	Ø
Diesel Oil		60	Ø	Ø	Ø	-	▼
Ethyl alcohol, denatured (with 2% toluene)	95%	20	▼	Ø	Ø	▼	▼
Ethylene glycol	Technically pure	20	▼	▼	▼	▼	▼
	Technically pure	60	Ø	▼	▼	Ø	▼
Fatty acids	Technically pure	60	▼	Ø	Ø	-	▼
Formaldehyde, aqueous	Diluted	40	▼	▼	▼	▼	▼
	Diluted	60	▼	▼	▼	▼	▼
	40%	60	▼	▼	▼	▼	▼
Fruit juices	Usual concentration	60	▼	▼	▼	▼	▼
		100	-	Ø	▼	-	▼
Fuel oil		20	Ø	Ø	Ø	-	▼
Hydrochloric acid, aqueous	Up to 30%	40	▼	▼	▼	-	▼
	Up to 30%	60	Ø	▼	▼	-	▼
	Over 30%	20	▼	▼	▼	-	Ø
	Over 30%	60	▼	Ø	▼	-	Ø

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			Chemical Resistance				
Medium	Concentration	°C	PVC-U	PE	PP	NR	CR
Hydrochloric acid, aqueous	Over 30 %	80	-	-	-	-	Ø
Hydrogen	100 %	60	▼	▼	▼	▼	▼
	100 %	100	-	-	-	-	▼
Linseed oil	Technically pure	80	Ø	Ø	▼	Ø	▼
	Technically pure	100	-	-	▼	-	-
Lubricating oils	Technically pure	20	▼	-	Ø	-	▼
Methyl alcohol	Technically pure	40	▼	▼	▼	▼	▼
	Technically pure	60	Ø	▼	▼	-	Ø
	Technically pure	65	-	Ø	Ø	-	Ø
Milk	Usual commercial	20	▼	▼	▼	▼	▼
Mixed acids 1 (sulphuric acid/nitric acid/water)	48 / 49 / 3 %	20	▼	-	-	-	Ø
	48 / 49 / 3 %	40	Ø	-	-	-	Ø
	50 / 50 / 0 %	20	Ø	-	-	-	Ø
	50 / 50 / 0 %	40	-	-	-	-	Ø
	10 / 87 / 3 %	20	Ø	-	-	-	Ø
	50 / 31 / 19 %	30	▼	-	-	-	Ø
Motor oils	Usual commercial	60	Ø	Ø	Ø	-	▼
Nitric acid, aqueous	Up to 30 %	50	▼	▼	▼	-	Ø
	30 / 50 %	50	▼	Ø	-	-	Ø
	40 %	70	-	-	-	-	Ø
	40 %	90	-	-	-	-	Ø
	48 %	80	-	-	-	-	Ø
	70 %	20	▼	Ø	-	-	Ø
	70 %	60	Ø	-	-	-	Ø
	98 %	20	-	-	-	-	Ø
	98 %	60	-	-	-	-	Ø
Oleum	10 %	20	-	-	-	-	-
Oxygen	All	60	▼	▼	-	Ø	▼
Palm oil		20	-	▼	▼	-	Ø
		60	-	Ø	Ø	-	Ø
Paraffin		60	▼	Ø	▼	-	▼
Paraffin oil		60	▼	Ø	▼	-	▼
Petroleum	Technically pure	60	Ø	Ø	▼	-	▼
Sea water		40	▼	▼	▼	Ø	▼
		60	▼	▼	▼	Ø	▼
		100	-	-	Ø	-	▼
Soap solution, aqueous	Concentrated	20	▼	▼	▼	▼	▼
	Concentrated	60	▼	▼	▼	▼	▼
Soda, aqueous	Diluted	40	▼	▼	▼	▼	▼
	Diluted	60	▼	▼	▼	▼	▼
	Saturated	60	▼	▼	▼	▼	▼
Starch, aqueous	All	40	▼	▼	▼	▼	▼
	All	60	▼	▼	▼	▼	▼
Sulphuric acid, aqueous	Up to 40 %	40	▼	▼	▼	▼	▼
	Up to 40 %	60	Ø	▼	▼	Ø	▼
	70 %	20	▼	▼	▼	-	-
	70 %	60	Ø	Ø	Ø	-	-
	80 – 90 %	40	▼	Ø	Ø	-	-
	96 %	20	▼	Ø	Ø	-	-
	96 %	60	Ø	Ø	-	-	-
Toluene	Technically pure	20	-	-	▼	-	-
Turpentine oil	Technically pure	60	Ø	Ø	-	-	-
Urine	Normal	40	▼	▼	▼	▼	▼
	Normal	60	▼	▼	▼	▼	▼
Vinegar (wine vinegar)	Usual commercial	40	▼	▼	▼	▼	▼
	Usual commercial	100	-	-	-	-	-
Water, distilled		40	▼	▼	▼	▼	▼
		100	-	Ø	▼	-	▼
Water, potable, chlorinated see Water distilled							

Explanation of symbols:

▼ Resistant

Ø Conditionally resistant (more favourable at temperatures lower than those quoted)

- Not Recommended

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