about: polyethylene

Polyethylene (PE) is a thermoplastic from the polyolefin group of materials, characterised by its low density when compared to other thermoplastics. A unique combination of properties including mechanical strength, chemical resistance and thermal stability all combine to make polyethylene a popular piping system material.

Polyethylene has excellent resistance against a variety of chemicals, however strong oxidising acids attack the material. Good chemical resistance is achieved against contact with solvents, such as alcohols, esters and ketones. Consequently, solvent cement welding of PE pipes and fittings is not possible. PE has excellent diffusion resistance, and because of this property, polyethylene has been successfully applied for the safe transportation of gases for many years.

Black coloured PE is stabilised against the effects of UV radiation, and it may therefore safely be used outdoors. The stabilisation also counteracts heat fatigue, increasing the operating life.

There are a number of welding techniques suitable for pressure piping applications. High quality, reliable joints can be achieved using socket fusion jointing, butt fusion welding and electrofusion welding. In addition, PE systems can be joined using flanges, threaded connections and mechanical couplings.

Polyethylene is no longer described by its density (LDPE, MDPE or HDPE), but by its resistance class according to ISO 9080 (PE 63, PE 80 or PE 100). Polyethylene piping systems are available from IPS in metric dimensions according to DIN 8077/8078 and DIN 16962.

General properties of polyethylene

Polyethylene exhibits thermal stability up to 60°C (short-term 70° for drainage systems). Polyethylene shows excellent impact strength, with impact strength rising with increasing temperature.

Some important advantages of polyethylene are:

- Low specific weight of 0.95g/cm^3
- Favourable transportation methods (can be coiled)
- High long term creep resistance
- Very good chemical resistance
- Weathering resistance
- Radiation resistance
- Outstanding weldability
- Excellent abrasion resistance
- Smooth internal surfaces- low friction loss
- Resistant to freezing

Properties of Polyethylene (Average values)		
Property	PE80	PE100
Density	0.94 g/cm^3	0.95 g/cm^3
Tensile Strength	20 MPa	25 MPa
Elongation at Break	>600%	>600%
Notched Impact Strength at 23°C	12 kJ/ m^2	16 kJ/ m^2
Notched Impact Strength at -30°C	4.5 kJ/ m^2	6 kJ/ m^2
Modulus of Elasticity	950 MPa	1100 MPa
Coefficient of Linear Expansion	0.18 mm/m°C	0.18 mm/m°C
Maximum Operating Temperature	60°C	60°C
Minimum Operating Temperature	-40°C	-40°C
Crystalline Melting Temperature	128-131°C	127-130°C
Melt Flow Index	0.40-0.50g/10min	0.30-0.55g/10min
Surface Resistance	>10^{13} Ω	>10^{13} Ω
Thermal Conductivity	0.43 W/m · K	0.40 W/m · K
Flammability	HB UL94	HB UL94
Colour	Black	Black

Characteristics

Chemical resistance

The chemical resistance of polyethylene is considered excellent, due to its non-polar nature. It is resistant to dilute (aqueous) solutions of salts, acids and alkalis and to a large number of organic solvents. Against concentrated hydrochloric acid and hydrofluoric acid polyethylene is resistant, however above certain concentration levels diffusion can occur which does not damage the material but causes secondary damage to surrounding steel constructions. In this type of application, double containment piping systems have been found ideally suited.

Weathering resistance

Piping systems in black polyethylene are UV stabilised, and therefore they do not need to be protected against degradation. To help control the heating effects of UV radiation, the pipe surface may be protected by the application of a UV absorbent coating such as AGRU Coat, or by adding a layer of insulation.

Electrical characteristics

Polyethylenee is non-conductive, therefore systems will remain free from electrolytic corrosion. Precautions should be taken to avoid static discharge should any part of a PE piping system pass through an area where explosive gases may be present.

Radioactivity resistance

Polyethylene pipes and fittings are well established for drainage systems applications handling radioactive waste water from laboratories as well as for cooling water piping systems for the nuclear power industry. PE remains unaffected by regular exposure to a radiation dose of up to 10^4 Gray.

Physiological characteristics

Polyethylene piping systems from IPS are physiologically non-toxic (in accordance with ONORM B5014, Part 1, FDA, BGA, and KTW guidelines) making them ideally suited as a piping material in contact with potable water.

Pressure ratings for polyethylene systems

Maximum continuous pressure ratings

Pipes, fittings and valves are designed to operate continuously for 50 years at their maximum rated pressure at 20°C as follows, unless otherwise stated.

The pressure ratings for Polyethylene pipes according to DIN 8074 and Polyethylene fittings according to DIN 16963 are defined by the 'nominal pressure' method, **whereby** pipes, fittings and valves are grouped together according to a single nominal pressure rating. The PN rating is the maximum permitted operational pressure in bars calculated at 20°C, for example PN6 indicates a maximum working pressure of 6 bars. According to this method the pressure ratings of Polyethylene pipes and fittings according to the nominal pressure system is as follows:-

PE80		Size Range	Max. Operating Pressure
Pipe	PN16	10mm to 400mm	16 Bar
	PN10	16mm to 630mm	10 Bar
	PN6	20mm to 800mm	6 Bar
	PN4	40mm to 1200mm	4 Bar
	PN3.2	50mm to 1400mm	3.2 Bar
	PN2.5	63mm to 1400mm	2.5 Bar

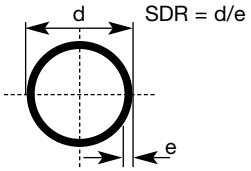
PE100		Size Range	Max. Operating Pressure
Pipe	PN16	10mm to 630mm	16 Bar
	PN10	40mm to 800mm	10 Bar
Fittings			
Socket Fusion	PN16	20mm to 110mm	16 Bar*
	* Unions and threaded fittings PN10		
Spigot Fusion	PN16	20mm to 500mm	16 Bar
	PN10	50mm to 500mm	10 Bar
	PN6	110mm to 500mm	6 Bar
Threaded	PN10	1/2" to 2"	10 Bar
Electrofusion	PN16	20mm to 500mm	16 Bar
	PN10	450mm to 710mm	10 Bar

Standard Dimensional Ratio (SDR)

Standard Dimensional Ratio (SDR) is used to define thermoplastic pipes in a variety of materials including polypropylene, polyethylene, and PVC-U. Taken from ISO 4065, SDR is described as being 'the ratio of the nominal outside diameter of a pipe to its nominal wall thickness'. To calculate the SDR according to ISO 4065 the following equation can be used:

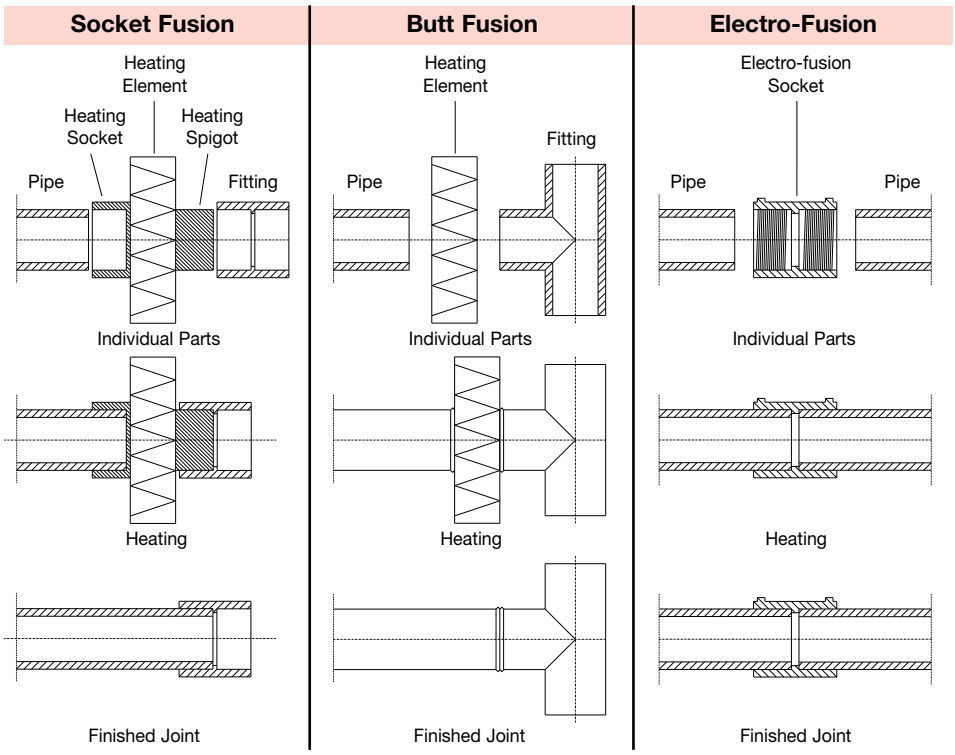
$$SDR = \frac{d}{e}$$

where:
SDR = Value to be calculated
e = Thickness of the pipe wall (mm)
d = Pipe outside diameter (mm)



Jointing Polyethylene Systems

PE pipe to pipe and pipe to fitting joints are easy to make, using socket fusion, butt fusion or electrofusion welds.



Welding equipment is available for sale or hire - see Tools and Installation Equipment.
Detailed installation instructions, as well as free training, is available on request.