PE: Polyethylene

Polyethylene (PE) is a partially-crystalline thermoplastic from the polyolefin in group of materials, and it is characterized 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 one of the most popular piping systems materials.

Polyethylene is non-polar and exhibits a good 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. When compared to other thermoplastics, PE shows excellent diffusion resistance, and because of this property, polyethylene has been successfully applied for the safe transportation of gases for many years.

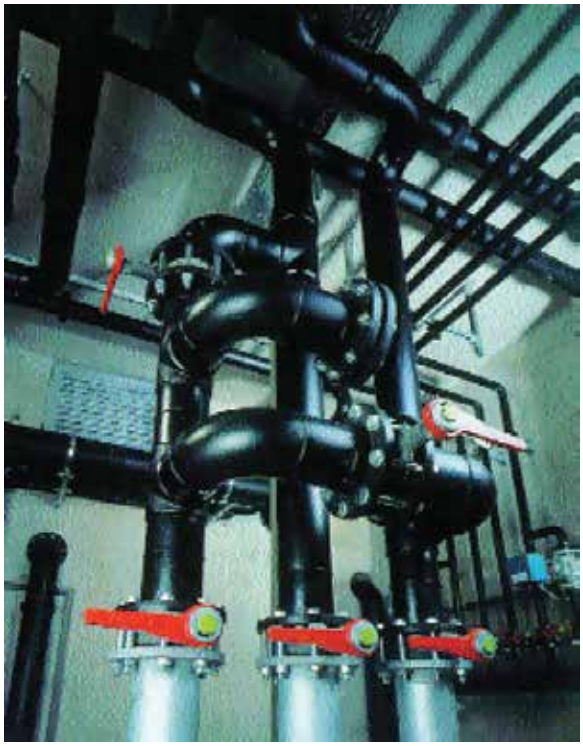
The black colored PE supplied by IPS is stabilized against the effects of UV radiation, and it may therefore safely be used outdoors. The stabilization also counteracts heat fatigue, increasing the operating life.

Polyethylene is ideally suited to a variety of welding techniques for pressure piping applications. High quality, reliable joints can be achieved using heating element socket fusion jointing, heating element butt fusion welding and electro fusion welding techniques. Additionally, PE systems can be joined using flanges, threaded connections and mechanical couplings.

Polyethylene is no longer described by its density (LDPE, MOPE 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 polypropylene (standard types)

In comparison to other thermoplastics, 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 polypropylene are:

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

PP: Polyethylene

Materials

The polyethylene pipes and fittings supplied by IPS are manufactured from PE8O or from third generation PE100 material. This latest generation PE100 material (also known as MRS 10) has a higher density and improved mechanical properties. Because of these enhanced properties, PE100 material can achieve a corresponding pressure rating using a reduced wall thickness when compared to previous generations of polyethylene piping. Some of the improved properties, such as increased stiffness and hardness, also make it ideally suitable for compressed air applications. In addition, PE100 material exhibits excellent resistance to creep pressure and rapid crack propagation.
Special grades of polyethylene can be made with the supplement of additives, modifying the general properties of the material, however, because of these modifications, changes to the mechanical and chemical resistance properties can occur when compared to the original material. When considering a special grade of polyethylene, it is therefore necessary to clarify the suitability of the intended application with our technical department.

Polyethylene pipes and fittings are also available in the following special grades:
PE8O-el: (Polyethylene, electro-conductive) This material develops the electrical conductivity of PE8O. It can be used for safety reasons in the transport of combustible material, especially for the conveying of dust. A connection to earth is possible.
PE100 FM Approved This material hac hoen tested under FM161O and is approved for underground fire service applications.

Properties of Polypropylene (average values)			
	PE80	PE100	
Property	Vlaue	Vlaue	Unit
Density	0.94	0.95	g / cm^3
Tensile Strength	20	25	MPa
Elongation at Break	>600	>600	%
Notched Impact Strength at 23°C	12	16	kJ/ m^2
Notched Impact Strength at -30°C	4.5	6	kJ/ m^2
Modulus of Elasticity (Young's Modulus)	950	1100	MPa
Coefficient of liner Expansion	0.18	0.18	mm/m °C
Maximum Operating Temperature	60	60	°C
Minimum Operating Temperature	-40	-40	°C
Crystalline Melting Temperature	128-131	127-130	°C
Melt Flow Index	0.40 - 0.50	0.30 - 0.55	g/10min
Surface Resistance	$>10_{13}$	$>10_{13}$	Ω
Thermal Conductivity	0.43	0.40	w / m · K
Flammability	HB	HB	UL_{94}
Colour	Black	Black	

PP: Polyethylene

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 do 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. For further details of the suitability of polyethylene for your application, please consult our chemical resistance tables or our technical department.

Weathering resistance

Piping systems in black polyethylene are UV stabilized, 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.

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.

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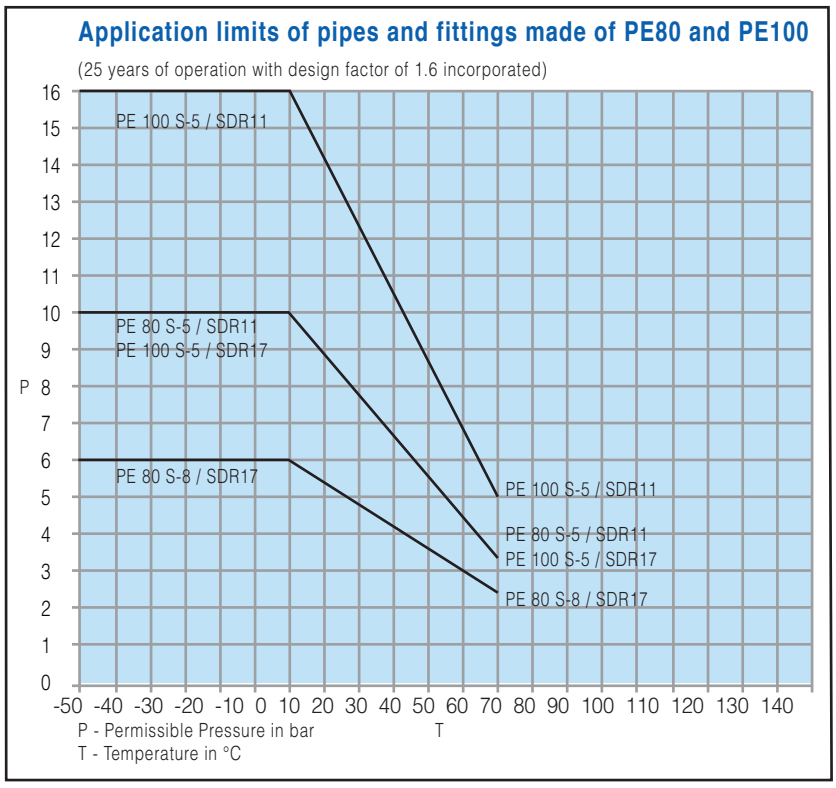
Pressure ratings for polypropylene pipe, fittings and valves

For guidance, the following table gives an indication of the available pressure ratings for polyethylene pipes, fittings and valves the pressure rating of individual items should always be verified with our technical department before installation.

Product	Size (O.D.)	Pressure Rating at 20°C
PP80 Pipes S - 20 / SDR41	63mm - 1400mm	2.5 bar
PP80 Pipes S - 16 / SDR33	50mm - 1400mm	3.2 bar
PP80 Pipes S - 12.5 / SDR26	40mm - 630mm	4.0 bar
PP80 Pipes S - 8.3 / SDR17.6	20mm - 800mm	6.0 bar
PP80 Pipes S - 5 / SDR11	16mm - 630mm	10.0 bar
PP100 Pipes S - 3.2 / SDR17.6	40mm - 800mm	10.0 bar
PP100 Pipes S - 5 / SDR11	20mm - 630mm	16.0 bar
PP80 Socket Fusion Fittings	20mm - 110mm	10.0 bar
PP80 Butt Fusion Fittings S - 8.3 / SDR17.6	63mm - 315mm	6.0 bar
PP80 Butt Fusion Fittings S - 5 / SDR11	20mm - 315mm	10.0 bar
PP100 Butt Fusion Fittings S - 16 / SDR33	110mm - 500mm	5.0 bar
PP100 Butt Fusion Fittings S - 8.3 / SDR17.6	50mm - 500mm	10.0 bar
PP100 Butt Fusion Fittings S - 5 / SDR11	20mm - 500mm	16.0 bar
PP100 Electro-Fusion Fittings	20mm - 400mm	1.0 bar
PP100 Ball Valves	32mm - 180mm	10.0 bar

* Note that FM approved PE100 systems are rated for continuous use at 12 bar.

Pressure ratings for thermoplastic pipes are determined in a water environment at a temperature of 20°C. As the temperature of the media (and/or the piping environment) increases, the thermoplastic material becomes more ductile, causing a decrease in the tensile strength. Because of this, the pressure rating of the system must be reduced as the temperature rises to allow for safe operation. The application limits for PE piping is shown in the following diagram:



PE80 Polyethylene pipe availability

Metric Sizes DIN 8074												
Size	Series SDR Working Pressure	Ventilation	S-20 SDR41 PN2.5	S-16 SDR33 PN3.2	S-12.5 SDR26 PN4	S-8.3 SDR17.6 PN6	S-5 SDR11 PN10	S-3.2 SDR7.4 PN16	S-16 SDR33 PN3.2	S-8.3 SDR17.6 PN6	S-5 SDR11 PN10
10	O.D (mm) Wall (mm) Weight/m (kg)							10 1.8 0.05			
12	O.D (mm) Wall (mm) Weight/m (kg)							12 1.8 0.06			
16	O.D (mm) Wall (mm) Weight/m (kg)						16 1.8 0.08	16 2.2 0.09			
20	O.D (mm) Wall (mm) Weight/m (kg)					20 1.8 0.11	20 2.5 0.14	20 2.8 0.15			
25	O.D (mm) Wall (mm) Weight/m (kg)					25 1.8 1.14	25 2.7 0.19	25 3.5 0.24			
32	O.D (mm) Wall (mm) Weight/m (kg)					32 1.9 0.19	32 2.9 0.27	32 4.4 0.38			32 2.9 0.28
40	O.D (mm) Wall (mm) Weight/m (kg)				40 1.8 0.23	40 2.3 0.28	40 3.7 0.43	40 5.5 0.60			40 3.7 0.45
50	O.D (mm) Wall (mm) Weight/m (kg)			50 1.8 0.29	50 2.0 0.31	50 4.9 0.44	50 4.6 0.67	50 6.9 0.94			50 4.6 0.69
63	O.D (mm) Wall (mm) Weight/m (kg)		63 1.8 0.36	63 2.0 0.40	63 2.5 0.49	63 3.6 0.69	63 5.8 1.05	63 8.6 1.47			63 5.8 1.10
75	O.D (mm) Wall (mm) Weight/m (kg)		75 1.9 0.46	75 2.3 0.54	75 2.9 0.68	75 4.3 0.97	75 6.8 1.47	75 10.3 2.09			75 6.8 1.53
90	O.D (mm) Wall (mm) Weight/m (kg)		90 2.2 0.63	90 2.8 0.79	90 3.5 0.98	90 5.1 1.38	90 8.2 2.11	90 12.3 2.99		90 5.1 1.44	90 8.2 2.20
110	O.D (mm) Wall (mm) Weight/m (kg)		110 2.7 0.94	110 3.4 1.16	110 4.2 1.42	110 6.3 2.07	110 10.0 3.14	110 15.1 4.48	110 3.4 1.21	110 6.3 2.15	110 10.0 3.28
125	O.D (mm) Wall (mm) Weight/m (kg)		125 3.1 1.22	125 3.9 1.51	125 4.8 1.84	125 7.1 2.65	125 11.4 4.06	125 17.1 5.76	125 3.9 1.58	125 7.0 2.77	125 11.4 4.23
140	O.D (mm) Wall (mm) Weight/m (kg)		140 3.5 1.54	140 4.3 1.86	140 5.4 2.30	140 8.0 3.34	140 12.7 5.08	140 19.2 7.24			
160	O.D (mm) Wall (mm) Weight/m (kg)		160 4.0 2.00	160 4.9 2.42	160 6.2 3.02	160 9.1 4.33	160 14.6 6.67	160 21.9 9.44	160 4.9 2.53	160 9.1 4.51	160 14.6 6.95
180	O.D (mm) Wall (mm) Weight/m (kg)		180 4.4 2.46	180 5.5 3.07	180 6.9 3.79	180 10.2 5.54	180 16.4 8.40	180 24.6 11.90	180 5.5 3.19	180 10.2 5.68	180 16.4 8.75
200	O.D (mm) Wall (mm) Weight/m (kg)		200 4.9 3.05	200 6.2 3.81	200 7.7 4.69	200 11.4 6.76	200 18.2 10.40	200 27.4 14.70	200 6.2 3.97	200 11.4 7.04	200 18.2 10.80
225	O.D (mm) Wall (mm) Weight/m (kg)		225 5.5 3.86	225 6.9 4.77	225 8.6 5.89	225 12.8 8.55	225 20.5 13.10	225 30.8 18.60	225 6.9 4.99	225 12.8 8.91	225 20.5 13.70
250	O.D (mm) Wall (mm) Weight/m (kg)		250 6.2 4.79	250 7.7 5.92	250 9.6 7.30	250 14.2 10.50	250 22.7 16.20	250 34.2 23.00	250 7.7 6.17	250 14.2 11.00	250 22.7 16.80
280	O.D (mm) Wall (mm) Weight/m (kg)		280 6.9 5.98	280 8.6 7.40	280 10.7 9.10	280 15.9 13.20	280 25.4 20.20	280 38.3 28.80			
315	O.D (mm) Wall (mm) Weight/m (kg)		315 7.7 7.51	315 9.7 9.37	315 12.1 11.50	315 17.9 16.70	315 28.6 25.60	315 43.1 36.50	315 9.7 9.76	315 17.9 17.40	315 28.6 26.70
355	O.D (mm) Wall (mm) Weight/m (kg)		355 8.7 9.55	355 10.9 11.80	355 13.6 14.60	355 20.1 21.10	355 32.2 35.50	355 48.8 46.30			
400	O.D (mm) Wall (mm) Weight/m (kg)	400 8.0 9.93	400 9.8 12.10	400 12.3 15.00	400 15.3 18.50	400 22.7 26.90	400 36.3 41.20	400 54.7 58.80	400 12.3 15.60		
450	O.D (mm) Wall (mm) Weight/m (kg)	450 8.0 11.20	450 11.0 15.20	450 13.8 19.00	450 17.2 23.40	450 25.5 34.00	450 40.9 52.30				
500	O.D (mm) Wall (mm) Weight/m (kg)	500 8.0 12.50	500 12.3 18.90	500 15.3 23.30	500 19.1 28.90	500 28.3 41.80	500 45.4 64.50				
560	O.D (mm) Wall (mm) Weight/m (kg)	560 10.0 17.40	560 13.7 23.60	560 17.2 29.40	560 21.4 36.20	560 31.7 52.50	560 50.8 80.80				
630	O.D (mm) Wall (mm) Weight/m (kg)	630 10.0 19.60	630 15.4 29.80	630 19.3 37.00	630 24.1 44.80	630 35.7 66.50	630 57.2 102.00				
710	O.D (mm) Wall (mm) Weight/m (kg)	710 12.0 26.40	710 17.4 37.90	710 21.8 47.20	710 27.2 58.30	710 40.2 84.00					
800	O.D (mm) Wall (mm) Weight/m (kg)	800 12.0 29.80	800 19.6 48.10	800 24.5 59.70	800 30.6 73.90	800 45.3 107.00					
900	O.D (mm) Wall (mm) Weight/m (kg)	900 15.0 41.80	900 22.0 60.70	900 27.6 75.60	900 34.4 93.30						
1000	O.D (mm) Wall (mm) Weight/m (kg)	1000 15.0 46.60	1000 24.5 75.20	1000 30.6 93.10	1000 38.2 115.00						
1200	O.D (mm) Wall (mm) Weight/m (kg)	1200 18.0 67.00	1200 29.4 108.00	1200 36.7 134.00	1200 45.9 166.00						
1400	O.D (mm) Wall (mm) Weight/m (kg)	1400 20.0 86.80	1400 34.3 147.00	1400 42.9 183.00							

PE100 Polyethylene pipe availability

Metric Sizes DIN 8074		PE100		PE100 FM Approved
Size	Series SDR Working Pressure	S-5 SDR 17 PN10	S-5 SDR 11 PN16	S-5 SDR 11 PN12
20	O.D (mm) Wall (mm) Weight/m (kg)		20 2.0 0.12	
25	O.D (mm) Wall (mm) Weight/m (kg)		25 2.3 0.17	
32	O.D (mm) Wall (mm) Weight/m (kg)		32 2.9 0.27	
40	O.D (mm) Wall (mm) Weight/m (kg)	40 2.4 0.29	40 3.7 0.43	
50	O.D (mm) Wall (mm) Weight/m (kg)	50 3.0 0.46	50 4.6 0.67	
63	O.D (mm) Wall (mm) Weight/m (kg)	63 3.8 0.72	63 5.8 1.05	63 5.8 1.05
75	O.D (mm) Wall (mm) Weight/m (kg)	75 4.5 1.01	75 6.8 1.47	75 6.8 1.47
90	O.D (mm) Wall (mm) Weight/m (kg)	90 5.4 1.46	90 8.2 2.11	90 8.2 2.11
110	O.D (mm) Wall (mm) Weight/m (kg)	110 6.6 2.15	110 10.0 3.14	110 10.0 3.14
125	O.D (mm) Wall (mm) Weight/m (kg)	125 7.4 2.76	125 11.4 4.06	125 11.4 4.06
140	O.D (mm) Wall (mm) Weight/m (kg)	140 8.3 4.45	140 12.7 5.08	140 12.7 5.08
160	O.D (mm) Wall (mm) Weight/m (kg)	160 9.5 4.52	160 14.6 6.67	160 14.6 6.67
180	O.D (mm) Wall (mm) Weight/m (kg)	180 10.7 5.69	180 16.4 8.40	180 16.4 8.40
200	O.D (mm) Wall (mm) Weight/m (kg)	200 11.19 7.05	200 18.2 10.40	200 18.2 10.40
225	O.D (mm) Wall (mm) Weight/m (kg)	225 13.4 8.93	225 20.5 13.10	225 20.5 13.10
250	O.D (mm) Wall (mm) Weight/m (kg)	250 14.8 10.90	250 22.7 16.20	250 22.7 16.20
280	O.D (mm) Wall (mm) Weight/m (kg)	280 16.6 13.70	280 25.4 20.20	280 25.4 20.20
315	O.D (mm) Wall (mm) Weight/m (kg)	315 18.7 17.40	315 28.6 25.60	315 28.6 25.60
355	O.D (mm) Wall (mm) Weight/m (kg)	355 21.1 22.10	355 32.2 32.50	355 32.2 32.50
400	O.D (mm) Wall (mm) Weight/m (kg)	400 23.7 28.00	400 36.3 41.20	400 36.3 41.20
450	O.D (mm) Wall (mm) Weight/m (kg)	450 26.7 35.40	450 40.9 52.30	
500	O.D (mm) Wall (mm) Weight/m (kg)	500 29.7 43.80	500 45.4 64.50	
560	O.D (mm) Wall (mm) Weight/m (kg)	560 33.2 54.80	560 50.8 80.80	
630	O.D (mm) Wall (mm) Weight/m (kg)	630 37.4 69.40	630 57.2 102.00	
710	O.D (mm) Wall (mm) Weight/m (kg)	710 42.1 88.10		
800	O.D (mm) Wall (mm) Weight/m (kg)	800 47.4 112.00		