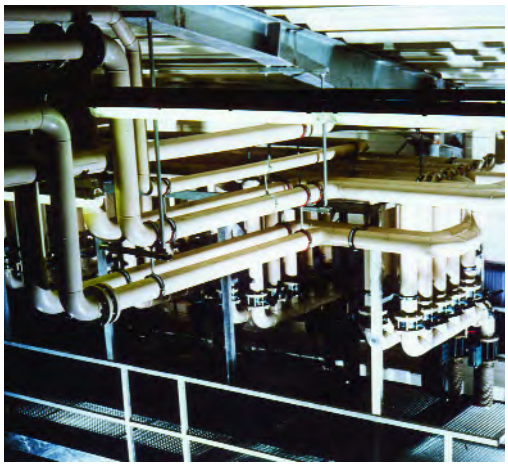
about: polypropylene

Polypropylene (PP) is a thermoplastic from the polyolefin group of materials. It has low density compared to other thermoplastics, and a unique combination of properties including mechanical strength, chemical resistance and thermal stability.



There are two different types of polypropylene that are in common use as piping materials:

PP-H (Homopolymer)
PP-R (Random copolymer)

The pipes, sheets and semi-finished products supplied by IPS are manufactured from nucleoid PP-H 100 (Beta ß -PP), whilst fittings are produced from PP-R (polypropylene random copolymer).

Polypropylene generally exhibits a good resistance against a variety of chemicals, such as salts, acids, and alkalis. Good chemical resistance is also achieved against contact with solvents, such as alcohols, esters and ketones. Consequently, solvent cement welding of polypropylene pipes and fittings is not possible.

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, non-contact Infra-Red (IR) butt welding, and electrofusion welding. In addition, polypropylene systems can be joined using flanges, threaded connections and mechanical couplings.

Polypropylene piping systems are available from IPS in metric dimensions according to DIN 8077/8078 and DIN 16962.

General properties of polypropylene

Polypropylene exhibits thermal stability up to 100°C (short-term 120°C for drainage systems). Polypropylene also shows good impact strength, improving further along with increasing temperature.

Polypropylene is physiologically non-toxic (in accordance with ONORM B5014, Part 1, FDA, BGA, and KTW guidelines) making it ideally suited for a piping material in contact with potable water.

Some important advantages of polypropylene are:

- Low specific weight of 0.91g/cm^3
- High long term creep resistance
- Excellent chemical resistance
- High resistance to thermal ageing
- Outstanding welding characteristics
- Excellent abrasion resistance
- Smooth internal surfaces

Properties of Polypropylene (Average values)		
Property	PP-H	PP-R
Density	0.91g/cm^3	0.91g/cm^3
Tensile Strength	30 MPa	25 MPa
Elongation at Break	>300%	>300%
Notched Impact Strength at 23°C	50 kJ/ m^2	25 kJ/ m^2
Notched Impact Strength at -30°C	5 kJ/ m^2	2 kJ/ m^2
Modulus of Elasticity	1300MPa	900 MPa
Coefficient of Linear Expansion	0.16mm/m°C	0.16mm/m°C
Maximum Operating Temperature	90°C	90°C
Minimum Operating Temperature	-10°C	-10°C
Crystalline Melting Temperature	160-165°C	150-154°C
Melt Flow Index	0.50 g/10min	0.50g/10min
Surface Resistance	>10^{13} Ω	>10^{13} Ω
Thermal Conductivity	0.22 W/m · K	0.24 W/m · K
Flammability	HB UL94	HB UL94
Colour - Beige Grey	7032 RAL	7032 RAL

Characteristics

Chemical resistance

The chemical resistance of polypropylene is considered excellent. It is resistant to dilute (aqueous) solutions of salts, acids and alkalis and to a large number of organic solvents. Polypropylene is resistant to concentrated hydrochloric acid and hydrofluoric acid, however above certain concentration levels diffusion can occur. This does not damage the material itself but it can cause secondary damage to surrounding steel constructions. In this type of application, double containment piping systems have been found ideally suited.

Note: PP-R and Copper:
Direct contact between PP-R and copper, especially at higher temperatures, can lead to deterioration of the physical properties of PP-R. Heat ageing is faster due to the accelerated thermal oxidisation.

Weathering resistance

Piping systems in beige grey polypropylene are not UV stabilised, and therefore they should be suitably protected against degradation when used outdoors - especially where there are high UV levels. Protection against direct solar radiation can be achieved by the application of a UV absorbent coating such as AGRU Coat, or by adding a layer of insulation. It is also possible to compensate for the surface damage that may arise by increasing the wall thickness of the piping system. In such cases, the additional wall thickness should be not less than 2mm. As polypropylene does not contain light stable colour pigments, it may experience a change of colour (fading) because of long-term weathering.

Electrical characteristics

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

Physiological characteristics

Polypropylene 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 polypropylene 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 Polypropylene pipes according to DIN 8077 & DIN 8078 and Polypropylene fittings according to DIN 16962 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 Polypropylene pipes and fittings according to the nominal pressure system is as follows:-

		Size Range	Max. Operating Pressure
Pipe	PN16	10mm to 225mm	16 Bar
	PN10	16mm to 500mm	10 Bar
	PN6	20mm to 710mm	6 Bar
	PN4	40mm to 1000mm	4 Bar
	PN3.2	50mm to 1200mm	3.2 Bar
	PN2.5	63mm to 1400mm	2.5 Bar

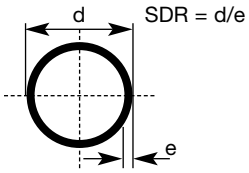
		Size Range	Max. Operating Pressure
Fittings			
Socket Fusion	PN10	20mm to 110mm	10 Bar
Spigot Fusion	PN10	20mm to 500mm	10 Bar
	PN6	50mm to 1000mm	6 Bar
	PN3.2	110mm to 1000mm	3.2 Bar
Threaded	PN10	1/4" to 4"	10 Bar

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:

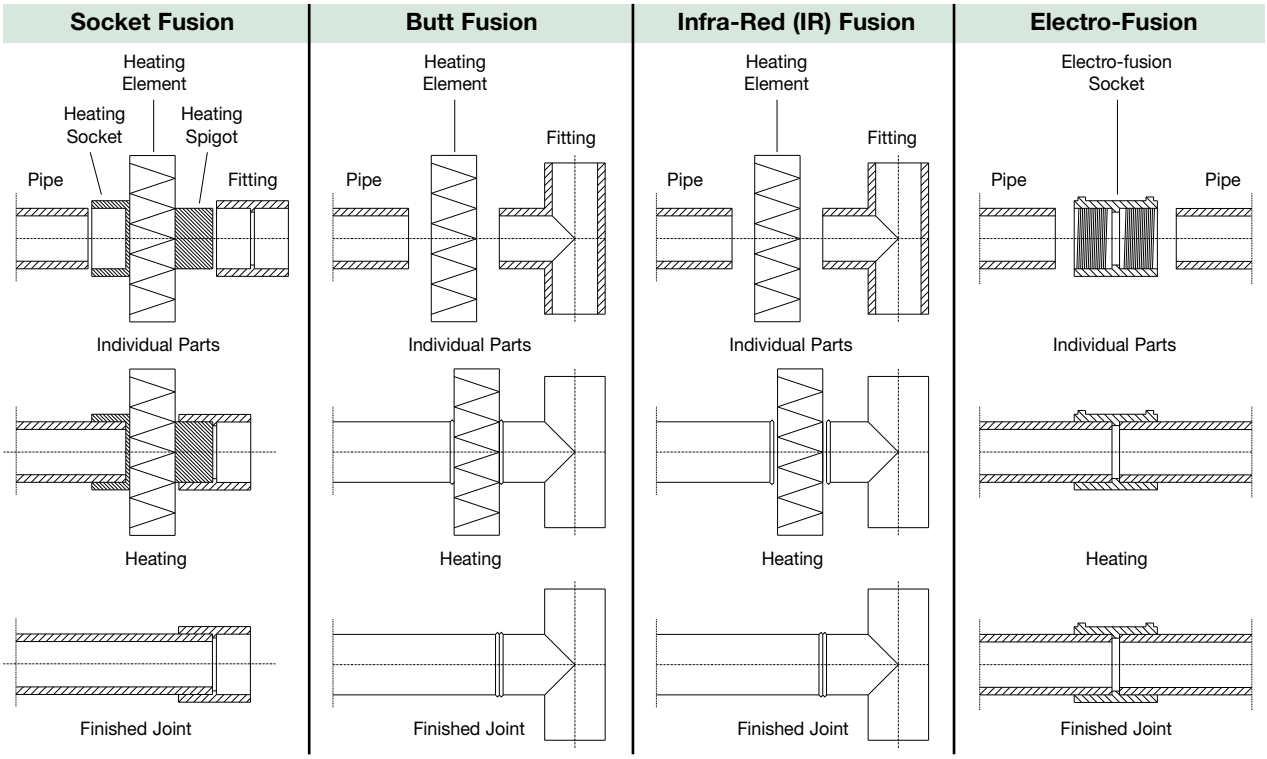
$$SDR = \frac{d}{e}$$

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



Jointing Polypropylene Systems

PP 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.