Catalogue 2012 - 13

Hydro Plast Piping Systems S.L.

HYDRO PLAST™

ABOUT US

HYDRO≈PLAST *Philosophy:*

A few basic values underline our corporate philosophy. These values ensure that you, our customers, receive final products of the highest standard. Our consistency, reliability and relationships of trust that we develop with our customers and partners makes our company stand apart.

We are a group of dynamic, hard working people with great skills and product know how. Our efforts for continuous enhancement of production capacity and product development, lays the solid foundation for the present and future.

In our manufacturing processes, adaptation of vertically integrated structures and stringent quality control measures turns our products into standard setters.

HYDRO≈PLAST *focus:*

Our focus on the following four principles has resulted in highly competitive and reliable products.

Research: To stand out in today's markets, companies need to rapidly respond to customers changing requests. Hydroplast is committed to continuous research and innovation supported by an expert R&D team that systematically analyzes our markets to offer products that provide real solutions to specific needs.

Technology: The entire production process, from product conception to delivery to the customer, is developed using the most advanced technologies to guarantee the highest quality and to minimize errors.

Quality: Our manufacturing processes are supported by a total quality system. Our products are subjected to demanding controls, including 100% verification of all types of fittings.

Service: Customer service is a primary focus of our human resources team. Our customers have direct access to an experienced technical and sales team to address any questions they may encounter regarding our products and their applications.

The Future

Looking back to how far we have come and our many achievements, we cannot help but feel satisfied, we view every day as the first day of a new challenge.

The Catalogue 2012 - 13

In this edition of 2012 catalogue – English version for export market, we have presented most comprehensive technical information database. As always, we thank you for your business and continued interest in our company. We look forward to serving you.

HydroGrip

HydroWeld

WeldMaster

HydroEngg

TECHNICAL SECTION

General properties of PE

As result of continuous development of PE molding materials, the efficiency of PE pipes and fittings have been improved considerably. This fact has been taken into account by the introduction of new international standards (ISO 9080, EN1555, EN12201), which lead to higher permissible operating pressures.

Polyethlene (PE) is no longer classified by its density (for example PE-LD, PE-MD, PE-HD) as it is now divided into MRS-strength classes (MRS = **M**inimum **R**equired **S**trength).

In comparison to other thermoplastics, PE shows an excellent diffusion resistance and has therefore been applied for the safe transport of gases for many years.

Other essential advantages of this material are the UV-stability (if is black coloured), and the flexibility of the molding material (flexible piping system).

Physiological non-toxic

With respect to its composition polyethylene complies with the relevant food stuff regulations (according to OENORM B 5014, Part 1, BGA, KTW guidelines).

PE pipes and fittings are verified and registered regarding potable water suitability according DVGW guideline W270.

Behaviour at radiation strain

Pipes out of polyethylene may be applied across the range of high energy radiation. Pipes out of PE are well established for drainage of radioactive sewage water from laboratories and as cooling water piping systems for the nuclear energy industry.

The usual radioactive sewage waters contain beta and gamma rays. PE piping systems do not become radioactive, even after many years of use.

Also in enviornment of higher radioactivity, pipes out of PE are not damaged if they are not exposed during their complete operation time to a longer, regularly spread radiation dose of < 10^4 Gray.

Advantages of PE

- UV-resistance
- flexibility
- low specific weight of 0,95g/cm^3
- favourable transporation(e. g. coils)
- very good chemical resistance
- weathering resistance
- good weldability
- very good abrasion resistance
- no deposits and no overgrowth possible due to less frictional resistance less pressure
- losses in comparison with e. g. metals
- freeze resistance
- resistant to rodents
- resistant to all kinds of microbic corrosion

Polyethylene type PE 100

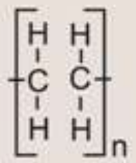
These material can also be described as polyethlene types of the third generation (PE-3) resp. also as MRS 10 materials.

This is a further development of the PE materials which is shown by a modified polymerisation process an amended mol mass distribution.

Therefore PE 100 types have a higher density and by this improved mechanical properties comes a raised stiffness and hardness. Also the creep pressure and the resistance against rapid crack propagation are also increased.

Consequently, this material is suitable for the production of pressure pipes with larger diameters in comparison with usual pressure pipes out of PE with less wall thicknesses the corresponding pressure rating will be achieved.

Chemical structure of polyethylene



Physical properties - Polyethylene compounds for injection molded fittings

It is a bimodal polyethylene compound produced through advance technology, well dispersed carbon black gives outstanding UV resistance. Optimised stabilisation system ensure long term stability. It is classified as MRS 10.0 material (PE 100)

Property	Typical value	Test method
Density (Compound)	959 kg/m³	ISO 1872-2/ISO
Melt Flow Rate (190 ℃/5,0kg)	0,55g/10min	ISO 1133
Tensile Modulus	1.100MPa	ISO 527-2
Tensile Strain at Break	>600%	ISO 527-2
Tensile Stress at Yield	24MPa	ISO 527-2
Carbon black content	2%	ASTM D 1603
Carbon black dispersion	<3	ISO 18553
Oxidation Induction Time (200 ℃),	> 20min	EN 728
Resistance to slow crack growth (9,2 bar/80 ℃)	1.000 h	ISO 13479

Physical properties - Polypropylene Co-polymer for injection molded fittings

Its a impact polypropylene heterophasic co-polymer with optimized mechanical properties intended for the injection molding of compression pipe fittings. The product features very good processability, excellent stress crack resistance and chemical resistance. Its characterized by combination of high stiffness and high impact strength, also at low temperatures.

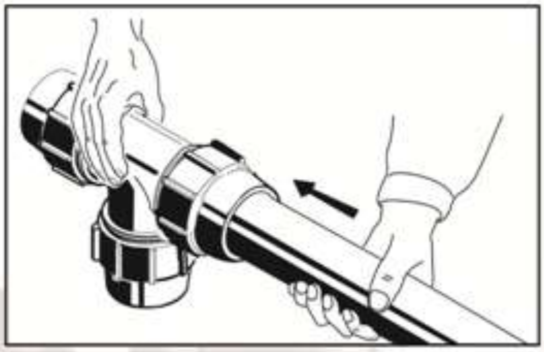
Property	Typical value	Test method
Density	900 kg/m³	ISO 1183
Melt Flow Rate (230 ℃/2,16kg)	0,3g/10min	ISO 1133
Tensile Modulus (1 mm/min)	1.300MPa	ISO 527-2
Tensile Strain at Yield (50 mm/min)	11%	ISO 527-2
Tensile Stress at Yield (50 mm/min)	30 MPa	ISO 527-2
Heat Deflection Temperature B	89 ℃	ISO 75-2
Vicat softening temperature B50,(50N)	89 ℃	ISO 306
Charpy Impact Strength, notched (23 ℃)	50 kJ/m²	ISO 179/1eA
Charpy Impact Strength, notched (-20 ℃)	5 kJ/m²	ISO 179/1eA

Installation of PP Compression Fittings

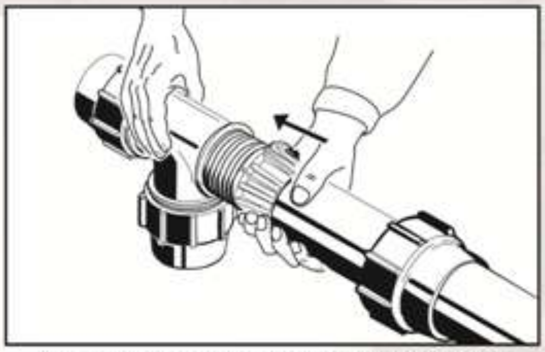
D 20 - 63

Cut the pipe with the pipe cutter, chamfer and clean the pipe before Installation!

Step1: *Unscrew the nut and the grip ring. Put the pipe through the nut and the grip ring with the conic part facing the nut.*

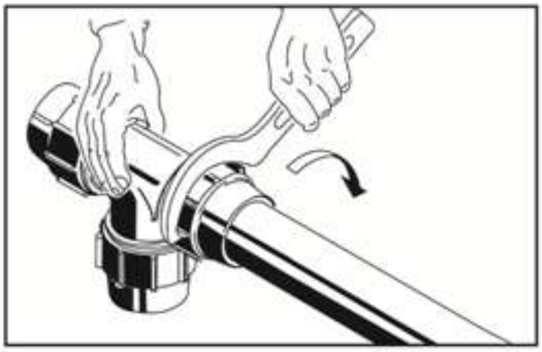


Step2: *Place the pipe into the body until it arrives at the beat.*



Step 3: *Slide the grip ring until it reaches the body of the fitting.*

Step 4: *Slide the nut over the grip ring on the body and tighten it.*



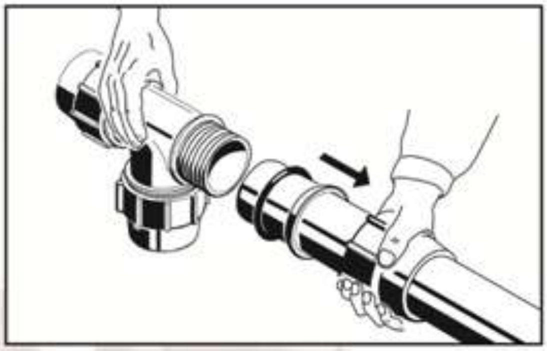
Step 5: *Use a wrench to completely tighten the nut.*

Installation of PP Compression Fittings

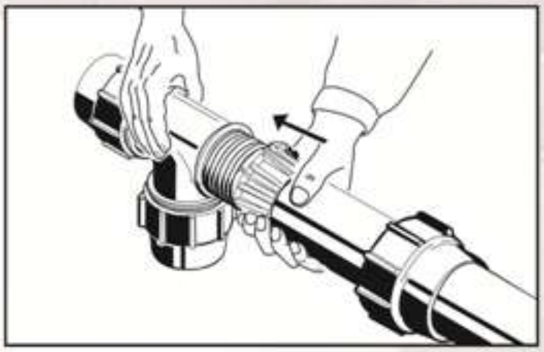
D 75 - 110

Cut the pipe with the pipe cutter, chamfer and clean the pipe before Installation!

Step1: Unscrew the nut, remove the compression ring and o-ring without removing the integeral component locked inside the nut.

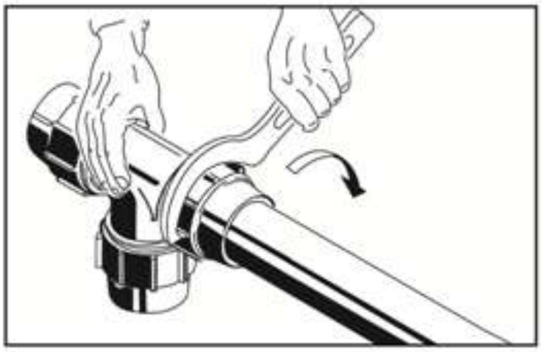


Step2: Place the nut on the pipe with integral components followed by compression ring and o-ring.



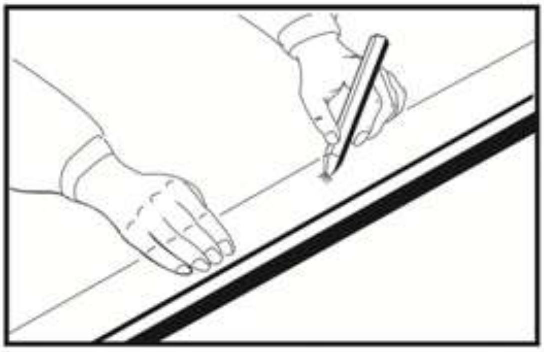
Step 3: Lubricate the pipe extreme and insert it into the body until beat. Push the o-ring and the compression ring inside the body.

Step 4: Screw the nut

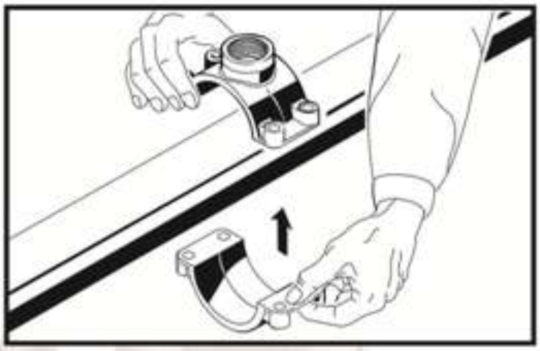


Step 5: Tighten the nut to the body with wrench.

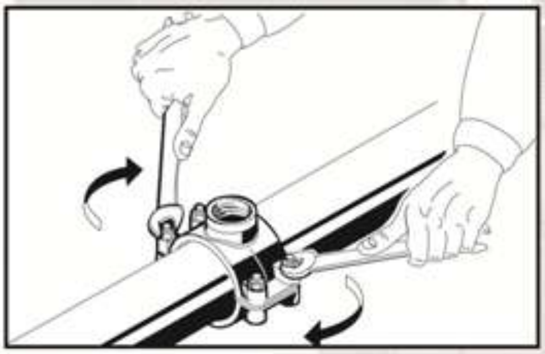
Installation of PP Clamp Saddle



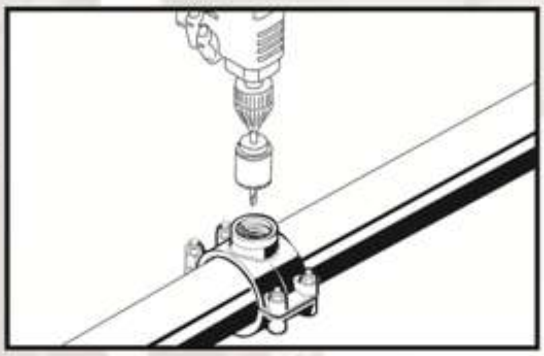
Step1: Select the installation point and make sure that the outer surface of the pipe is free from any scratch, cut or other imperfections in the contact area of the O-ring.



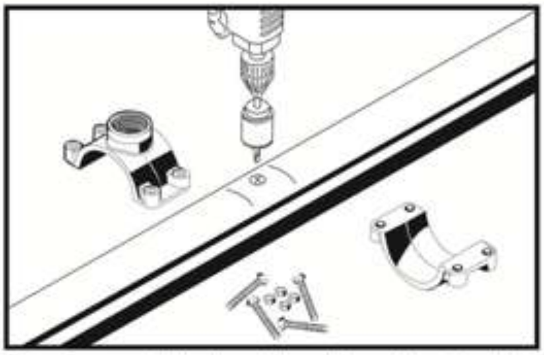
Step2: Position the bottom half of the saddle on the previously selected area of the pipe. Connect the top half of the saddle with the bottom part.



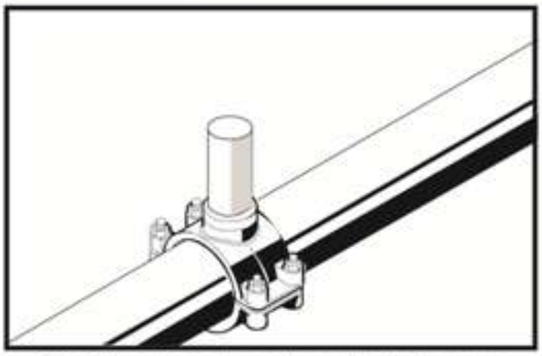
Step 3: Place bolts from bottom. tighten the nuts.



Step 4: Perforate the pipe. Be careful not to damage the thread of the saddle and the O-ring. We recommend to use a spacer to avoid the perforation of the pipe on the other side.



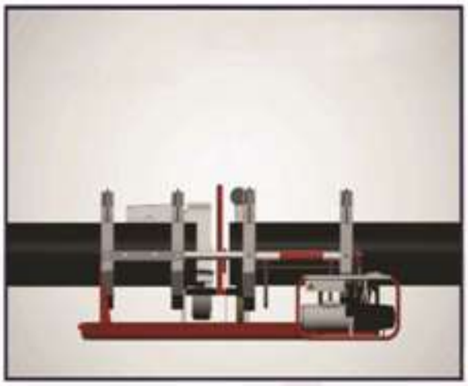
Step 5: once you fix the place of the saddle, mark the points which correspond to the position of the saddle. Perforate the pipe and remove P.E shaving from inside.



Step 6: Assemble the clamp saddle according to the previous position marks. Use a pin to keep the outlet in axis with the hole.

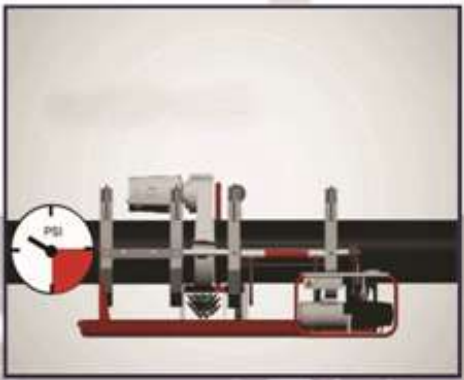
Butt Fusion Welding Procedure

Step1: Polythylene pipe is rolled into the clamping unit with pipe markings alligned.

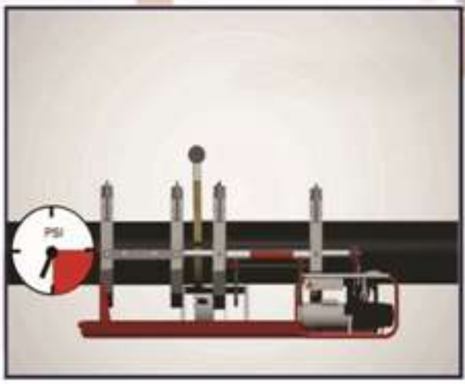


Step2: Lower the clamps and fix with the bolts.

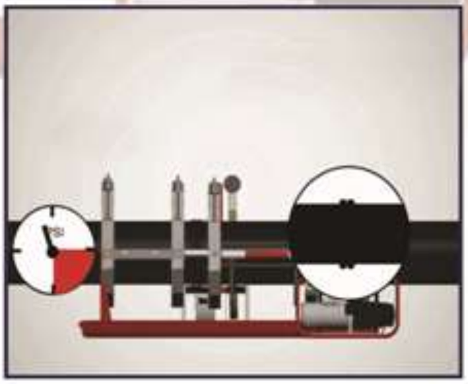
Step3: Facing unit is moved into position. Switch on the facing unit and bring the clamp slowly together.



Step4: The pressure gauge displays facing under pressure. Keep the facing unit turning whilst seperating the clamp to avoid steps on the trimmed surface.



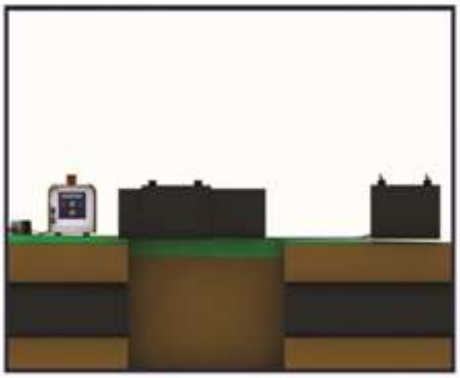
Step5: Remove the facing unit and heating plate is placed into position between two ends. Under pressure heat causes a bead to form at the plate.



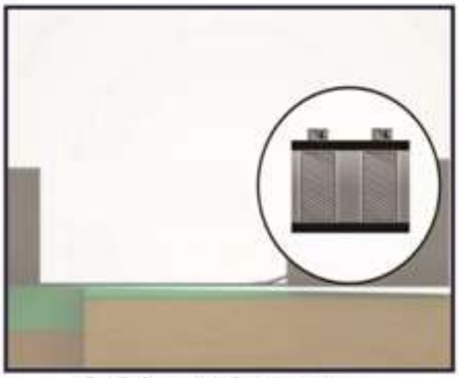
Step 6: Heating plate is removed and pipe ends are brought together under pressure immidiately to create a joint that is stronger then the pipe itself.

HYDRO PLAST

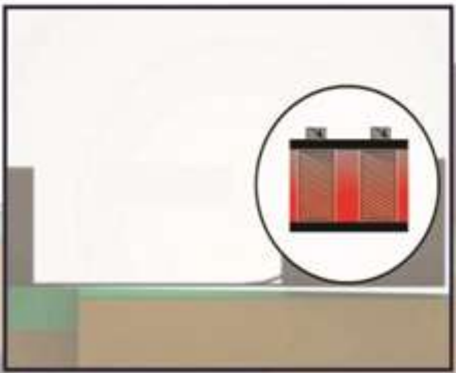
Electro Fusion Welding Procedure



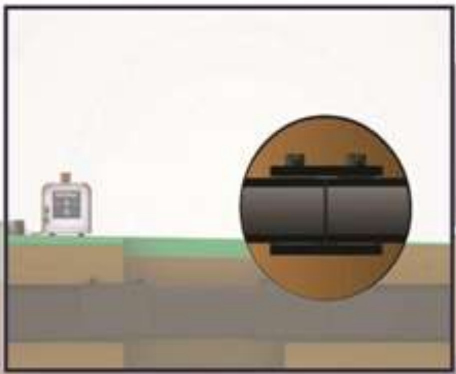
Step1: Pipe must be scrapped and prepared properly.



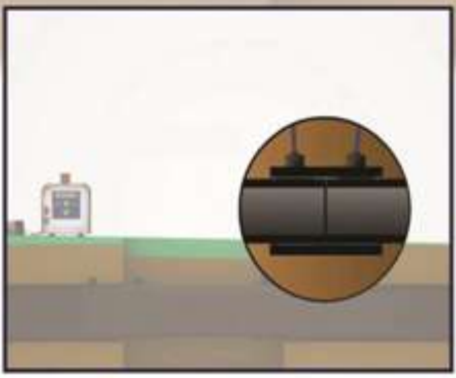
Step2: Connect to the power source.



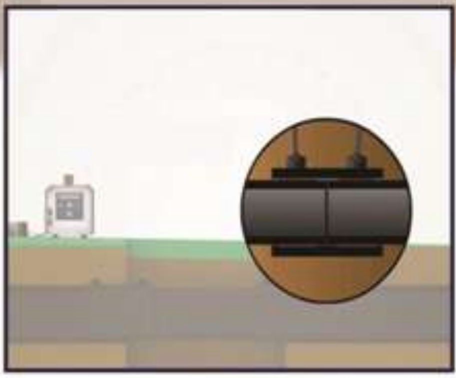
Step3: The coupler has embeded heating coils which fuse the pipe and coupler together.



Step4: Insert the two ends to be joined up to the bead into the socket. Power is supplied to the fusion unit.



Step5: As the heating coils warm, the polyethylene line melts into the coupler, creating a bond.



Step6: Notice! How the melt only occurs hot zones, keeping out flow to minimum.

Permissible component operating presssures (p_s) for PE 100 depending on temperature and operation period

The tables state the data apply to water. They were determined from the creep cure taking into account a safety coefficient of C =1,25.

Temperature [°C]	Operating period [Years]	Diameter-wall thickness relation SDR 17	11	7,4
		Pipes series S 8	5	3,2
		PN 10	16	25
		Permissible component operating pressure (PFA)* [bar]		
10	5	12,6	20,2	31,5
	10	12,4	19,8	31,0
	25	12,1	19,3	30,2
	50	11,9	19,0	29,7
	100	11,6	18,7	29,2
20	5	10,6	16,9	26,5
	10	10,4	16,6	26,0
	25	10,1	16,2	25,4
	50	10,0	16,0	25,0
	100	9,8	15,7	24,5
30	5	9,0	14,4	22,5
	10	8,8	14,1	22,1
	25	8,6	13,8	21,6
	50	8,4	13,5	21,2
40	5	7,7	12,3	19,3
	10	7,6	12,1	19,0
	25	7,4	11,8	18,5
	50	7,2	11,6	18,2
50	5	6,7	10,7	16,7
	10	6,5	10,4	16,2
	15	5,9	9,5	14,8
60	5	4,8	7,7	12,1
70	2	3,9	6,2	9,8

We recommend for the calculation of the operating pressure in piping systems to multiply the table contained operating pressure with a system reduction coefficient fs=0,8 (This value contains installation technical influences such as welding joint, flange or also bending loads).

*The table with the working pressure for the media gas you will find in the ON EN 1555 part 1.

According to the EN12201 part 1 there are following reduction factors for the nominal pressure rate depending on the operating temperature.

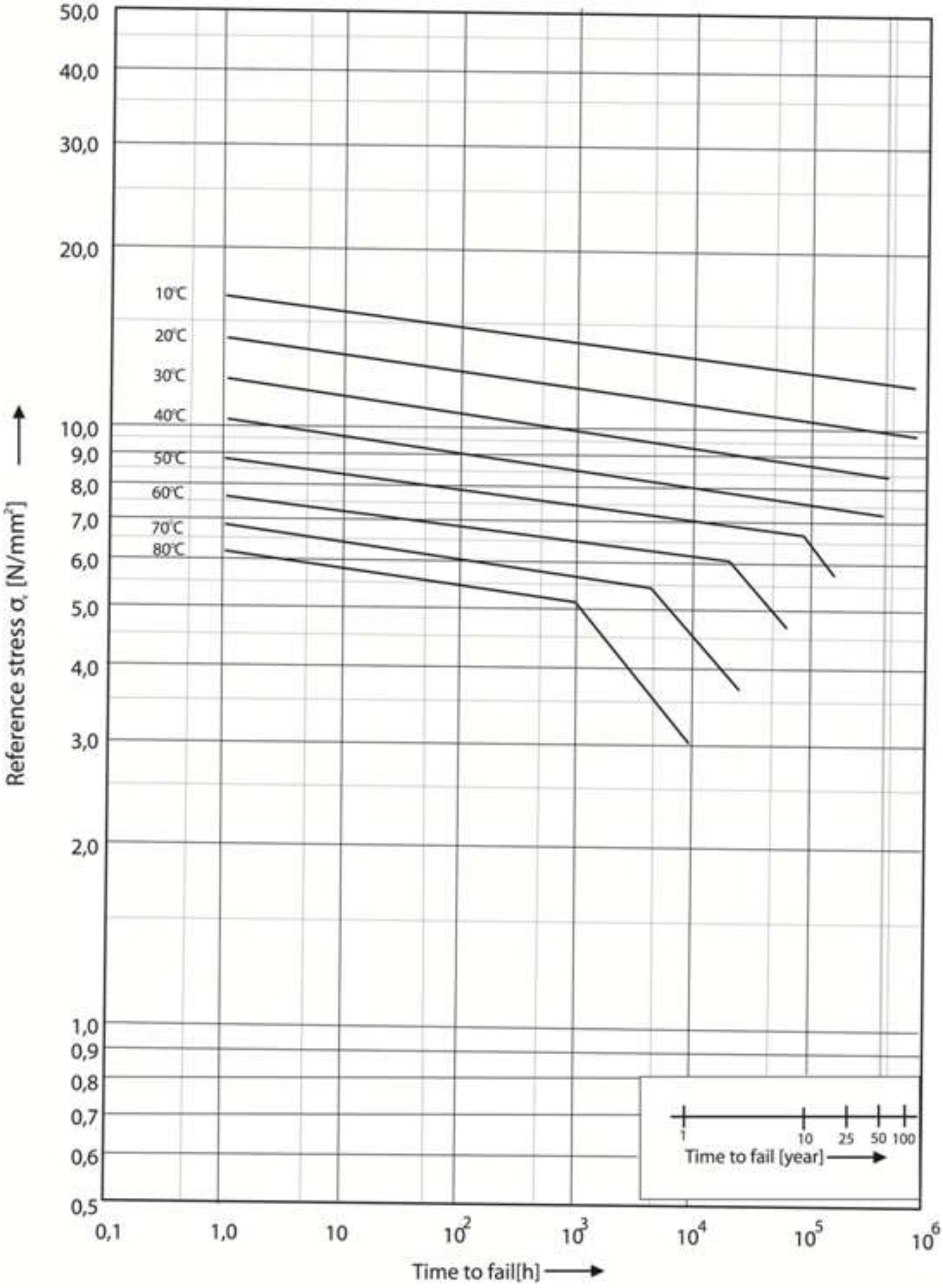
Operating temperature	Reduction coefficient
20°C	1,00
30°C	0,87
40°C	0,74

For pipes and fittings out of PE 100, a smaller wall thickness than for standard PE results due to the higher calculation stress. They can therefore be applied for higher operating pressures at the same wall thickness. Please find the comparison of the SDR- serie, S-seri and PN-pressure ratings in below listed table.

SDR	S	PN- pressure rate PE80	PE100
41	20	3.2	4
33	16	4	5
26	12,5	5	6,3
17,6	8,3	7,5	9,6
17	8	8	10
11	5	12,5	16
7,4	3,2	20	25

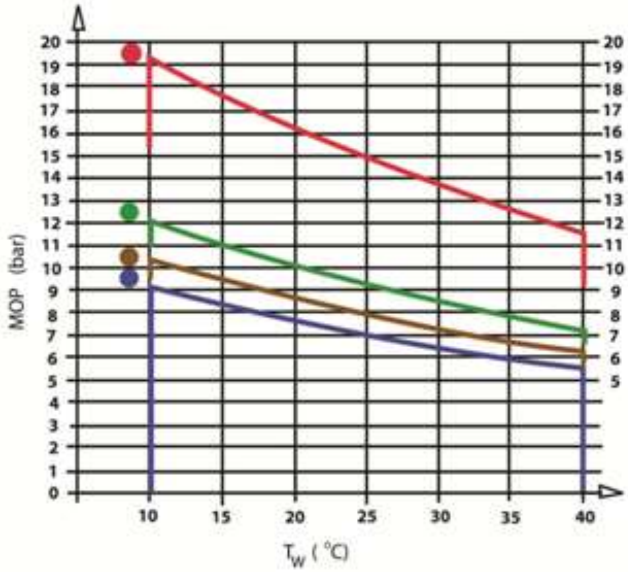
Valid for 20°C and 50 years life time C=1,25

Pressure curve for pipes out of PE100

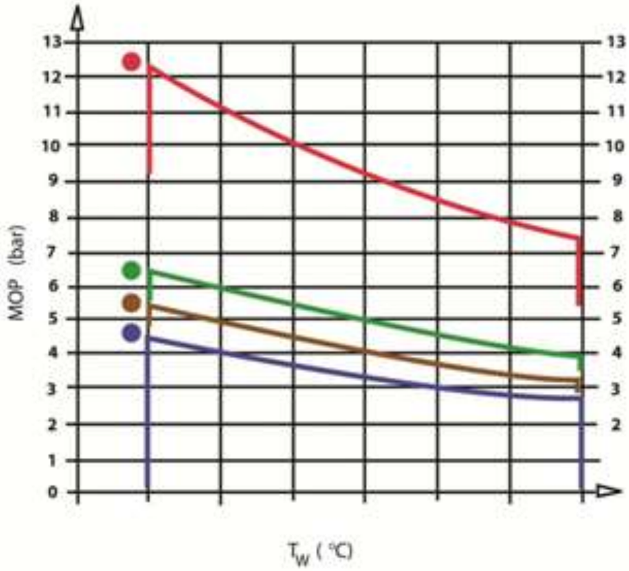


Pressure curve for injection molded and welded fittings of PE100

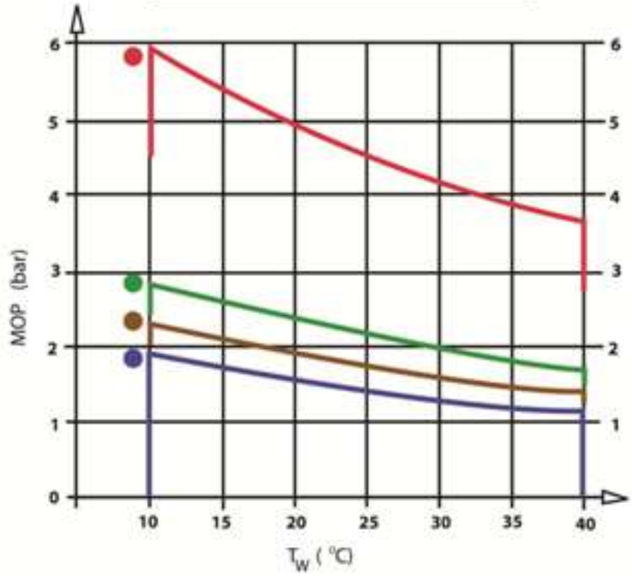
PE 100/SDR11



PE 100/SDR17



PE 100/SDR33



The indicated values do not apply to pipes exposed to UV radiation. Maximum operating pressures of <1 are not included in the tables.

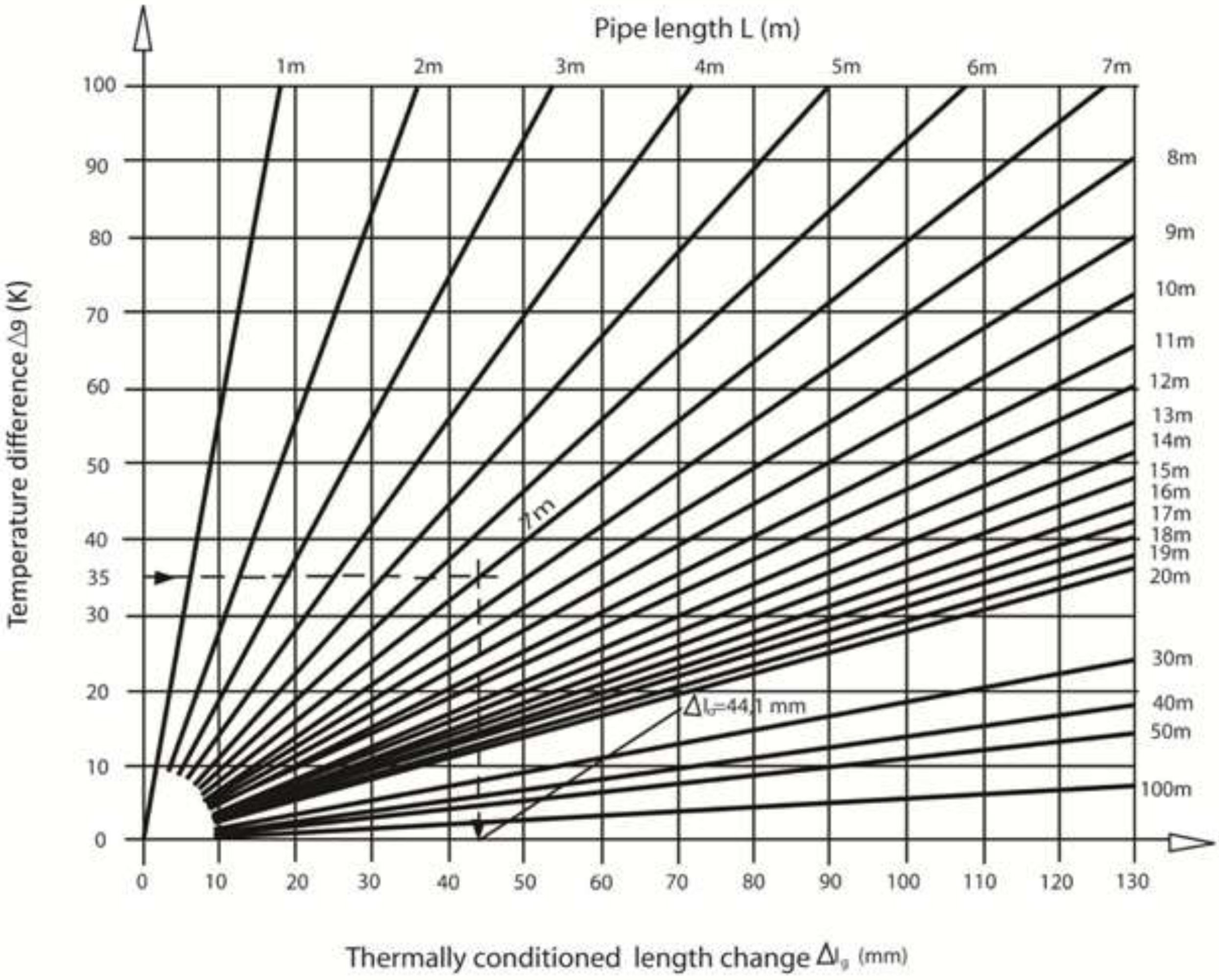
- (red) = Pipe, injection fittings, seamless bends and welded bends = 30°
- (green) = Welded bends > 30° - 90° , tees 90° welded
- (brown) = Welded 60° tees
- (blue) = Welded 45° tees

SF = Safety factor 1.25
t_{ld} = Lifespan 25a
MOP = Internal pressure
T_W (°C) = Pipe wall temperature

Thermal length change in PE 100 pipe systems

Linear expansion coefficient for PE100
$\alpha^{\vartheta} = 0.18$ mm/(mK)

α^{ϑ} = Average linear expansion coefficient



Piping systems above ground installation guidelines

Due to the lower stiffness and rigidity as well as to the enoromous length expansion (caused by changes in temperature) of thermoplastics in comparison with metallic materials, the following requirements for the fixing of piping components should be met.

Fixing by means of pipe clips

Supports made of steel or of thermoplastics are available for PE piping system. Steel clips have at any rate to be lined with tapes made of PE or elastomers, otherwise the surface of the plastic pipe may be damaged.

HYDROPLAST pipe clips as well as pipe holders are very suitable for installation. These may be commonly applied and have been especially adjusted to the tolerance of the plastic pipes.

Therefore they serve as a sliding bearing for horizontal installed piping systems in order to take up vertical stresses. A further application range of the HYDROPLAST pipe clip is the function of a guiding bearing which should hinder a lateral buckling of the piping system as it can also absord tranversal stresses.

It is recommended for smaller pipe diameter (<OD 63mm), to use steel half-round pipes as support of the piping system in order to enlarge the support distance.

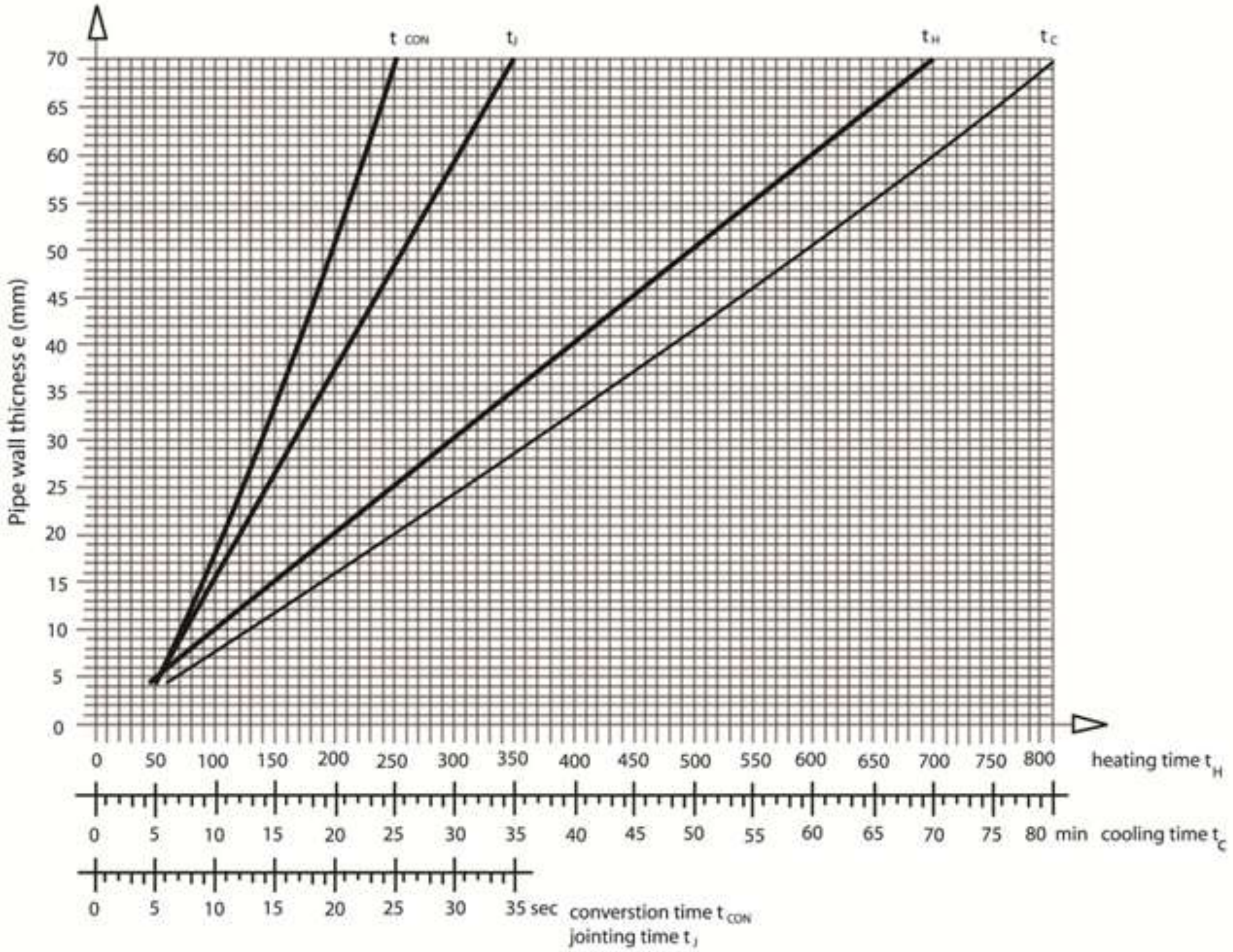
Installation temperature

A minimum installation temperature of >0℃ is to be observed.

- On laying of pipes, above ground expansion of pipes in both radial and axial directions must not be hindered - that means, installation with radial clearance, precision of compensation facilities, control of changes in length by reasonable arrangement of fixed points.
- Attachments have to be calculated so as to avoid pin point stresses, that means the bearing areas have to be as wide as possible and adapted to the outside diameter (If possible, the enclosing angle has to be chosen >90°)
- The quality of the surface of the attachments should help avoid mechanical damage to the pipe surface.
- Valves (in certain cases also tees) should basically be installed on a piping system as fixed points. Valve constructions with the attachment devices being integerated within the valve body are most advantageous.

Primary times for butt-welding of PE100 pipes and fittings

Total PT = $t_{AT} + t_H + t_{CON} + t_J + t_C$



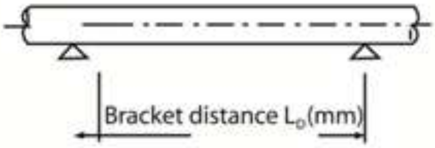
t_{AT} = time until pipe or fittings lie full face against heating element (adapting time). Duration = t_H

t_H = time until full face of pipe or fitting of appropiate thickness is plasticised (heating time)

t_{CON} = time until removal of the element and bringing together of weld surfaces (conversion time)

$t_J + t_C$ = time for the application of the full jointing pressure (jointing time) and time for cooling of the weld seam to about 20 °C (cooling time)

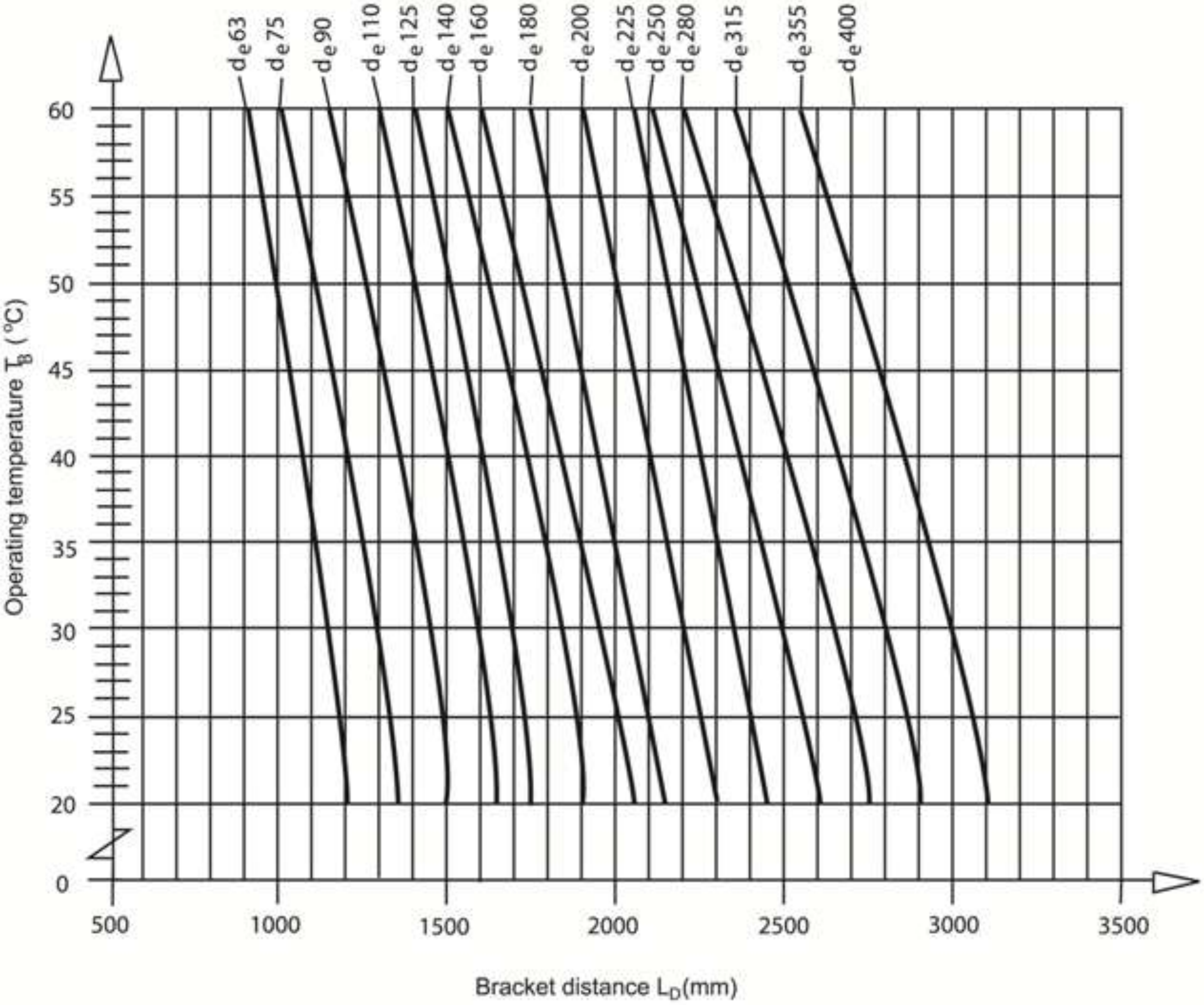
Acceptable support distance for water-filled PE100 pipes according to DVS guideline 2201 P1



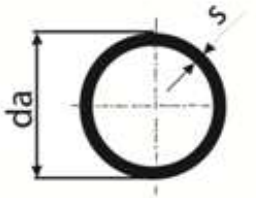
Omrekeningsfactoren f_L:

PE100	
SDR 17	**SDR 11**
PN 10	PN 16
0.91	1.00

Area of validity:
Installation temperature T_M = 20°C
Lifespan t_{LD} = 25 years



SDR - Standard Dimension Ratio



$$SDR = \frac{da}{s}$$

SDR ... Diameter - wall thickness relation

da ... outside diameter [mm]

s ... wall thickness

Example:
da = 110mm
s = 10mm

$$SDR = \frac{da}{s} = \frac{110}{10} = 11$$

s - series

$$S = \frac{SDR - 1}{2}$$

SDR ... Diameter wall thickness relation

Example
*SDR*11

$$S = \frac{SDR - 1}{2} = \frac{11 - 1}{2} = 5$$

Component operating pressure

$$P = \frac{20 \cdot \sigma_v}{(SDR-1) \cdot C_{min}}$$

P_s ... Component operating pressure [bar]

σ_v ... Reference strength [N/mm²]
(see the pressure curve for each material)

SDR ... S tandard Dimension Ratio
C_{min} ... Minimum safety factor
(see following table)

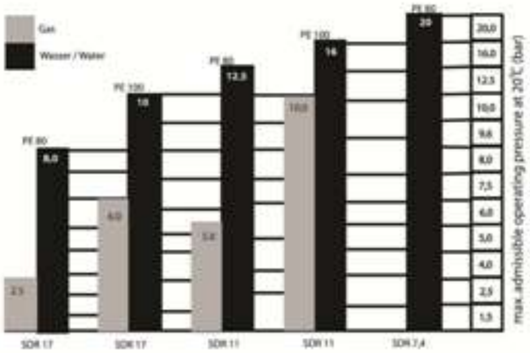
Material	Temperature		
	10 to 40℃	40 to 60℃	over 60℃
PE 80	1,25 FOR WATER / 2,0 FOR GAS		
PE 100	1,25 FOR WATER / 2,0 FOR GAS		

Example
PE 100, 20℃, 50 years, weather (d.h. σ_v = 10)
*SDR*11
C_{min}=1,25

$$P = \frac{20 \cdot \sigma_v}{(SDR-1) \cdot C_{min}} = \frac{20 \cdot 10}{(11-1) \cdot 1{,}25} = 16$$

Operating pressure depending on the media

On the accompanying chart the interrelationship between SDR-value,medium (gas or water) and normal pressure is shown.



Calculation of the permissible wall thickness S_{min}

The vessel formula is applied for the calculation of the pipe wall thickness. The permissible tension for the calculation of the pipe wall thickness for water and non- dangerous fluids at a temperature of 20℃ and 50 years lifetime is 8 N/mm² for pipes and fittings made of PE 80 and 10 N/mm² for PE 100.

For dangerous fluids, the permissible tension has to be decreased by the corresponding reducing factors.

$$S_{min} + \frac{p \cdot da}{20 \cdot \sigma_{zul} = p}$$

$$\sigma_{zul} = \frac{\sigma_v}{C_{min}}$$

S_{min}	... Minimum wall thickness	[mm]
p	... Operating pressure	[bar]
da	... Pipe outside diameter	[mm]
σ_{zul}	... Reference stress	[N/mm²]
σ_v	... Reference stress	[N/mm²]
C_{min}	... Minimum safety factor	

If necessary, the reference stress σ_v and the operating pressure p can also be calculated from this formula.

$$\sigma_{zul} = \frac{p \cdot (da - s_{min})}{20 \cdot s_{min}}$$

$$p = \frac{20 \cdot \sigma_{zul} \cdot s_{min}}{da - s_{min}}$$

Example :
PE 100, 20 ℃, 50 years, water (d.h. σ_v=10 N/mm²)
Operating pressure 16 bar
Outside diameter da=110mm

$$\sigma_{zul} = \frac{\sigma_v}{C_{min}} = \frac{10}{1,25} = 8$$

$$S_{min} = \frac{p \cdot da}{20 \cdot \sigma_{zul} = p} = \frac{16 \cdot 110}{20 \cdot 8 + 16} = 10$$

$$\sigma_{zul} = \frac{p \cdot (da - s_{min})}{20 \cdot s_{min}} = \frac{16 \cdot (110-10)}{20 \cdot 10} = 8$$

$$\sigma_v = \sigma_{zul} \cdot C_{min} = 8 \cdot 1,25 = 10$$

Load external pressure (buckling pressure)

In certain cases, piping systems are exposed to external pressure:
-Installation in water or buried below groundwater table
-Systems for vacuum. e. g. suction pipes

$$p_k = \frac{10 \cdot E_c}{4.(1-\mu^2)} \cdot \left(\frac{s}{r_m}\right)^3$$

p_k .... Criticle buckling pressure [bar]

E_c .... Creep modulus (see tables) [N/mm²] for t=25a

μ .... Transveral contraction factor (for thermoplastics generally 0,4)

s .... Wall thickness [mm]

r_m .... Medium pipe radius [mm]

Example:
PE 80 pipe SDR17
40°C,25 years
E = 120N/mm (creep ,modulus curve)
outside diameter da=110
Wall thickness =6,3mm
Additional safety factor 2,0 (Minimum security factor for stability calculation).

$$p_k = \frac{10 \cdot E_c}{4.(1-\mu^2)} \cdot \left(\frac{s}{r_m}\right)^3 =$$

$$= \frac{10.120}{4.(1-0,4^2)} \cdot \left(\frac{6,3}{53,3}\right)^3 = 0,58$$

$$p_k = \frac{0,58}{2,0} = 0,29$$

The buckling tension can then be calculated directly:

$$\sigma_k = p_k \cdot \frac{r_m}{s}$$

$$\sigma_k = p_k \cdot \frac{r_m}{s} = 0,58 \cdot \frac{53,3}{6,3} = 4,90$$

Determination of the pipe cross section

Flowing processes are calculated by means of the continuity equation. For fluids with constant volume flow, the equation is:

$$\dot{V} = 0{,}0036 \,.\, A \,.\, v$$

$\dot{V}$	.... Volume flow	[m³/ h]
A	... Free pipe cross section	[mm²]
v	.... Flow velocity	[m/s]

For gases and vapours, the material flow remains constant. There, the following equation results:

$$\dot{m} = 0{,}0036 \,.\, A \,.\, v \,.\, p$$

$\dot{m}$	.... Material flow	[kg/h]
p	.... Density of the medium depending on presure and temperature	[kg/m³]

If in these equations the constant values are summarized, the formulas used in practice for the calculation of the required pipe cross section result there of:

$$d_i = 18{,}8.\sqrt{\frac{Q'}{v}}$$

$$d_i = 35{,}7.\sqrt{\frac{Q''}{v}}$$

d_i	.... Inside diameter of pipe	[mm]
Q'	.... Conveyed quantity	[m³/h]
Q''	.... Conveyed Quantity	[l/s]
v	.... Flow velocity	[m/s]

Reference values for the calculation of flow velocity may be for fluids:

v~0,5÷1,0 m/s (suction side)
v~1,0÷3,0 m/s (pressure side)
Reference values for the calculation of flow velocities may be for glasses
v~10÷30 m/s

Determination of the hydraulic pressure losses

Flowing media in pipes cause pressure losses and consequently energy losses within the conveying system.
Important factors for the extent of the losses
-Length of the piping system
-Pipe cross section
-Roughness of the pipe surface
-Geometry of fittings, mountings and finished joints or couplings
-Viscosity and density of the flowing medium

Calculation of the several pressure losses

Pressure loss in straight pipes ΔP_R

The pressure loss in an straight pipe length is reversed proportional to the pipe cross section.

$$\Delta p_R = \lambda \cdot \frac{L}{d_i} \cdot \frac{p}{2.10^2} \cdot v^2$$

λ .... Pipe frictional index (in most cases 0,02 is sufficient)

L	.... Length of piping system	[m]
d_i	.... Inside diameter of pipe	[mm]
p	.... Medium density	[kg/m³]
v	.... Flow velocity	[m/s]

Pressure loss in fitting Δp_{RF}

There appear considerable losses regarding friction, reversion and detachment.
The calculation necessary resistance coefficient can be seen in the DVS 2210, table 9 or special technical literature.

$$\Delta p_{RF} = \zeta \cdot \frac{p}{2.10^5} \cdot v^2$$

ζ	.... Resistance coefficient for fittings	[-]
p	.... Density of medium	[kg/m³]
v	.... Flow velocity	[m/s]

The whole pressure loss Δp_{ges} results from the sum of the following individual losses:

$$\Delta p_{ges} = \Delta p_R + \Delta p_{RF} + \Delta p_{RA} + \Delta p_{RV}$$

Pressure loss in mountings ΔP_{RA}

$$\Delta p_{RA} = \zeta \cdot \frac{p}{2.10^5} \cdot v^2$$

ζ .... Resistance coefficient for mountings [-]
p .... Density of medium [kg/m³]
v .... Flow velocity [m/s]

The calculation necessary resistance coefficient can be seen in DVS 2210, table 10

Pressure loss of finished joints or couplings ΔP_{RV}

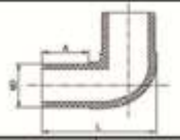
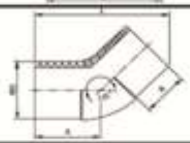
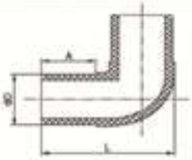
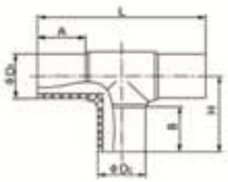
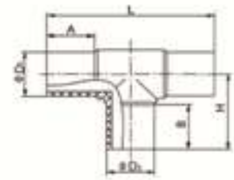
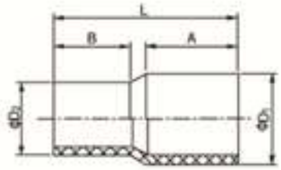
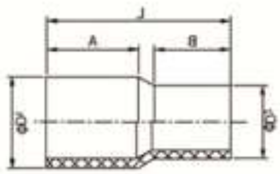
It is impossible to give information, because types and qualities of joints (welding joints, unions, flange joints) vary.
It is recommended to calculated a resistance coefficient of each.

$RV = 0{,}1$

for joints in thermoplastic piping system, such as butt and socket welding as well as flanges.

Determination of the hydraulic pressure losses

Hydraulic resistance coefficient of fittings (acc. DVS 2210 part 1,)

Kind of Fitting	Parameter	Resistance coefficient ζ			Drawing
bend α = 90°	R =1,0 x da	0,51			
	=1,5 x da	0,41			
	=2,0 x da	0,34			
	=4,0 x da	0,23			
bend α = 45°	R =1,0 x da	0,34			
	=1,5 x da	0,27			
	=2,0 x da	0,20			
	=4,0 x da	0,15			
elbow	σ =45	0,30			
	30°	0,14			
	20°	0,05			
	15°	0,05			
	10°	0,04			
tee 90° (flow collection)	v_z/v_s =0,0	-1,20	0,06		
	0,2	0,4	0,20		
	0,4	0,10	0,30		
	0,6	0,50	0,40		
	0,8	0,70	0,50		
	1	0,90	0,60		
tee 90° (flow separation)		ζ_a	ζ_d		
	v_a/v_s =0,0	0,97	0,10		
	0,2	0,90	-0,10		
	0,4	0,90	-0,05		
	0,6	0,97	0,10		
	0,8	1,10	0,20		
	1,0	1,30	0,35		
reducers concentric (pipe extension)	Angle σ	4.....8°	16°	24°	
	d_2/d_1 =1,2	0,10	0,15	0,20	
	1,4	0,20	0,30	0,50	
	1,6	0,50	0,80	1,50	
	1,8	1,20	1,80	3,00	
	2,0	1,90	3,10	5,30	
reducers concentric (pipe throat)	Angle σ	4°	8°	20°	
	d_2/d_1 =1,2	0,046	0,023	0,010	
	1,4	0,067	0,033	0,013	
	1,6	0,076	0,038	0,015	
	1,8	0,031	0,041	0,016	
	2,0	0,034	0,042	0,017	

positive ζ- values: pressure drop
negative ζ- values: pressure increase
Va: outgoing volume flow
Vd: continuous volume flow
Vs: total volume flow
Vz: additional volume flow

Determination of the hydraulic pressure losses

Hydraulic resistance coefficient of mountings (acc. DVS 2210)

Nominal width ø	MV	GSV	SSV	S	KH	K	RV	RK
	Resistance coefficient (ζ)							
25	4,0	2,1	3,0				2,5	1,9
32	4,2	2,2	3,0				2,4	1,6
40	4,4	2,3	3,0				2,3	1,5
50	4,5	2,3	2,9				2,0	1,4
65	4,7	2,4	2,9	0,1...0,3	0,1...0,15	0,3 ... 0,6	2,0	1,4
80	4,8	2,5	2,8				2,0	1,3
100	4,8	2,4	2,7				1,6	1,2
125	4,5	2,3	2,3				1,6	1,0
150	4,1	2,1	2,0				2,0	0,9
200	3,6	2,0	1,4				2,5	0,8

Annotation: The hydraulic resistance coefficients mentioned are reference values and are suitable for rough calculation of pressure loss. For material related calculations use the values of particular manufacturer.

Criteria for choice of gate valves
(ass.DVS 2210)

Selection criteria	MV/GSV/SSV	S	KH	K	RV	RK
	Assessment					
Flow resistance	big	low	low	moderate	big	moderate
Aperture-and Closing time	medium	long	short	short	short	
Operation moment	low	low	big	moderate		
Wear	moderate	low	low	moderate	moderate	
Flow regulation	suitable	less suitable				
Face-to-face length acc.row F	medium	big	big	big	mittel	big
Face-to-face length acc.row K			low	low		low

no criteria

Legend	for table above:
MV	diaphragm valve
SSV	angle seat valve
GSV	straight valve
S	gate valve
KH	ball valve
K	butterfly valve
RV	check valve
RK	swing type check valve

Dog bone load

Dog bones should prevent a sliding or moving of the piping system in each direction. They serve further more for compensators of the reaction forces of compensators such as sliding sockets and push-fit fittings. The dog bone has to be dimensioned for all appearing forces:

- Force by hindered thermal length expansion
- Weight of vertical piping systems
- Specific weight of the flow medium
- Operating pressure
- Inherent resistance of the compensators

Dog bones which have not been determined should be chosen in a way so as to make use of direction alterations in the course of the piping system for the absorption of the length alterations. As dog bones, edges of fiittings sockets or special dog bone fitting are suitable. Swinging clips are not appropriate to be used as dog bones or the clamping of the pipes.

Rigid system

If the length alteration of a piping system is hindered, a fixed system is developed.
The rigid or fixed piping length has no compensation elements and has to be considered concerning the dimensioning as special application.

The following system sizes have to be determined therefore by calculation:

- Dog bone load
- Permissible guiding element distance under consideration of the critical buckling length
- Appearing tensile and pressure stresses

Dog bone load at fixed systems

The largest dog bone load appears at the straight, fixed piping. it is in general kind:

$$F_{FP} = A_R \,.\, E_C \,.\, \varepsilon$$

F_{FP} .... Dog bone force [N]

A_R .... Pipe wall ring area [mm^2]

E_C .... Creep modulus [N/mm^2] for t=100min

ε .... Prevented length expansion by heat expansion, internal pressure or swelling [-]

Under consideration of the possible loads, ε has to be determined as follows:

Load by heat expansion

$$\varepsilon = \alpha \,.\, \Delta T$$

a .. Linear heat expansion coefficient [1/°K]

ΔT ... Max. temperature difference [°K]

Load by internal pressure

$$\varepsilon = \frac{0{,}1 \,.\, p \,.(1-2\mu)}{E_C \,.\left(\frac{da}{di} - 1\right)}$$

p ... Operating pressure [bar]

μ ... Transversal contraction coefficient [-]

E_c ... Creep modulus [N/mm^2] for t=100min

da ... Pipe outside diameter [mm]

di ... Pipe inside diameter [mm]

Behaviour at abrasive fluids

In principle, thermoplastic pipes are better suited for the conveying of fluid - solid - mixtures than concrete pipes or also steel pipes. We have already resulted positive experiences of different applications.

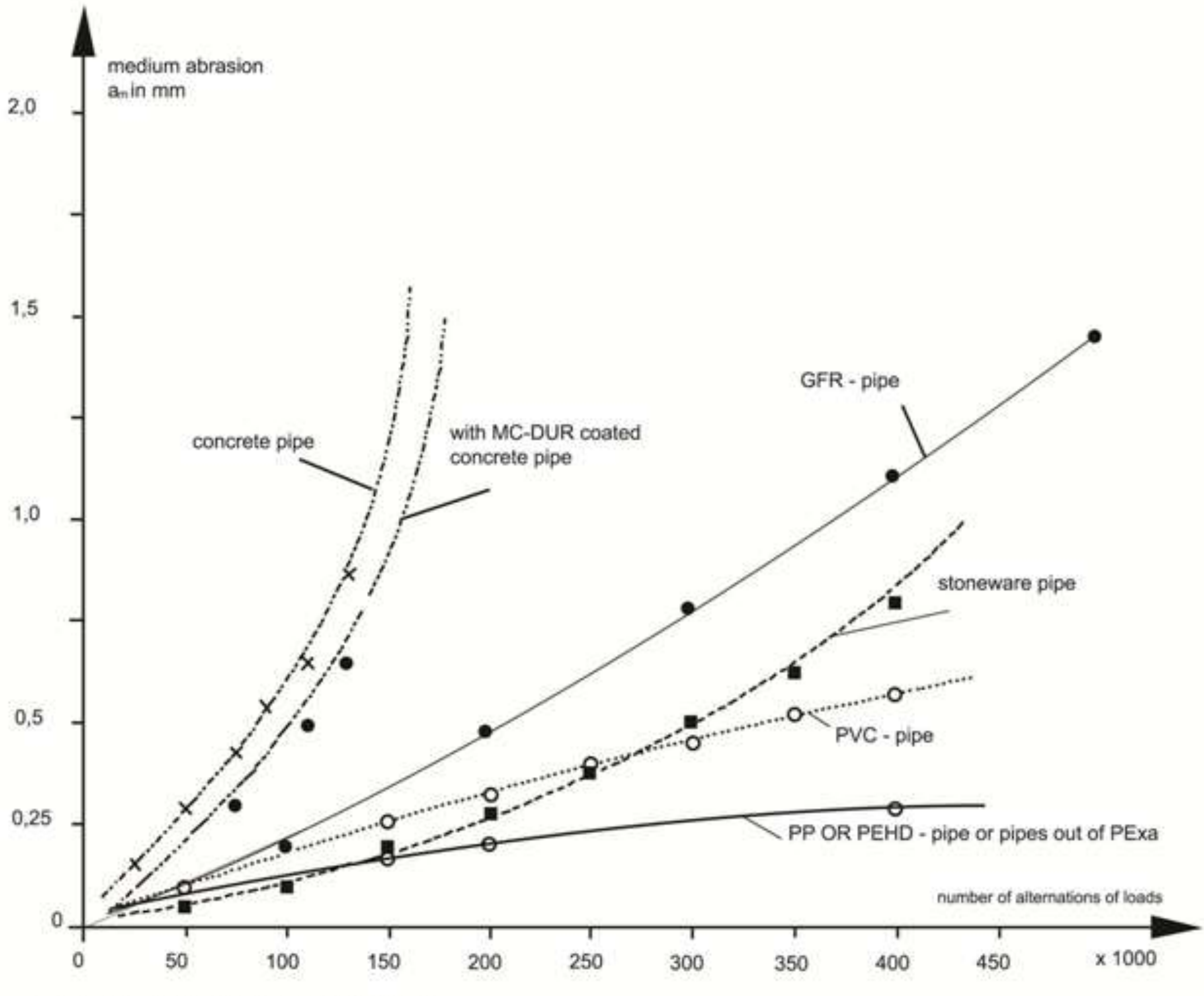
At the developed method of the Technical University Darmstadt a 1 m long half-pipe is titled with a frequency of 0,18 Hz. The local deduction of the wall thickness after a certain loading time is regarded as measure for the abrasion.

The advantage of thermoplastic pipes for the transporation of solids in open channels can clearly be seen from the test result.

The fittings are not recommeneded for use in installations where water velocities could exceed >15ft/s(4,6m/sec.)

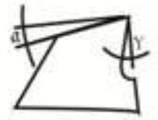
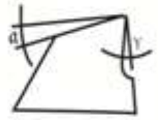
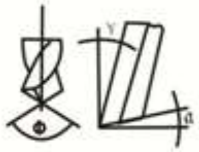
Abrasion behavior according to method Darmstadt

Medium: Silica sand-gravel-water-mixture 46 Vol,-% Silica sand/gravel, grain size up to 30mm



Source: Technical University of Darmstadt

Machining of PE
(valid for cutting, turning, miling and driling

	**Cutting** Clearance angle α Rake angle γ Pitch t cutting speed	 [°] [°] [mm] [m/min]	 30÷40 0÷5 3÷5 upto 3000	Band sews are appropiate for the cutting of pipes, blocks, thick sheets and for round bars
	**Cutting** Clearance angle α Rake angle γ Pitch t cutting speed	 [°] [°] [mm] [m/min]	 10÷15 0÷15 3÷5 upto 3000	Circular saws can be used for the cutting of pipes, blocks ad sheets. HM saws have a considerably longer working life
	**Turning** Clearance angle α Rake angle γ Tool angle λ cutting speed Feed Cutting depth a	 [°] [°] [°] [m/min] [mm/Umdreh] [mm]	 5÷15 0÷15 45÷60 200÷500 0,1÷0,5 upto 8	The peak radius (r) should be at least 0,5mm. High surface quality is obtained by means of a cutting tool with a wide finishing blade. Cut-off: Sharpen turning tool like a knife.
	**Miling** Clearance angle α Rake angle γ cutting speed Feed	 [°] [°] [m/min] [mm/Umdreh]	 5÷15 upto÷10 upto 1000 0,2÷0,5	High surface quality is obtained by means of a miling machine with fewer blade - this increases cutting capacity.
	**Driling** Clearance angle α Rake angle γ Centre angle Φ cutting speed Feed	 [°] [°] [°] [m/min] [mm/Umdreh]	 12÷16 3÷5 approx.100 50÷100 0,1÷0,3	Spiral angles 12 -15 , For holes ith diameters of 40 - 150mm. hollow drills should be used;for holes < 40mm diameter, use a normal SS-twist drill.

The cutting speed, conveying and cutting geometry should be designed in a way that any subsequent heat can mainly be removed through the shavings (too much pre-heating can lead to melting resp. discolouration of the processed surfac).

All usual metal and wood processing machines may be applied.

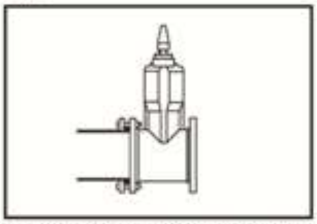
Connecting PE to iron flanges

It is not possible to join polyethylene pipe to pipe made from other materials by fusion welding. In the case of mains pipe sizes it is necessary to use PE flange adaptors, male/female threaded adaptors or specialist fabricated metal fittings eg. from Crane-Viking Johnson or Crane-WASK, that grip the pipe.

Since polyethylene systems are end-load bearing, precautions must be taken where connection is made to pipe of another material, to prevent pull-out of any non end-load bearing joints in that pipe line. The transition may need to be externally harnessed or anchor/thrust blocked.

In larger pipe sizes there can be a discrepancy (in bore size and bolting) when jointing polyethylene pipe to iron pipe as PE pipe has much thicker walls. When considering multi-material piping systems it is important to remember that PE pipe is always sized by its OD, whereas iron pipe is sized by its nominal bore, referred toas its DN (Diametre Nominal).

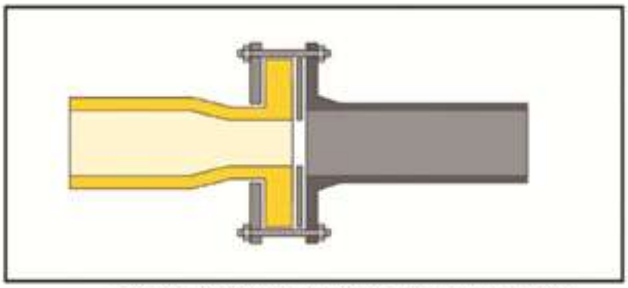
For example, a 450mm OD PE100 SDR17 pipe (with a bore of400mm) can be jointed to a 450mm PN16 valve using a traditional 450mmx450mm PE flange adaptor. But this means that the bore size between the two components changes from 400mm (PE) to 450mm (iron).



450mm PE100 (Excel) Pipe and conventional PE flange adaptor bolted to a DN450 valve.

Flange adaptor incorporating a polyethylene reducer

A fabricated fittings in incorporating a reducer and a stub end is a solution to accommodate reduced bore problem. when moving from DIN/ISO to IPS sizes and vice versa. Note there is a temporary reduction in bore with this fitting and also it may be desirable to incorporate a metal reinforcing plate between the PE flange and the metal flange to help stabilise the assembly. Please consult our Technical Support Department before specifying one of these 'combination'flanges.



450mm x 400 PN16 'combination' flange adaptor

Mechanical Joints: Recommended procedure for bolting up flange adaptors

Flanged joints should be made using a single full face or Corrugasket® rubber gasket or for more critical applications at above 10 bar, steel reinforced gaskets (details on request) of the correct size. All four mating surfaces must be undamaged, clean and free from contamination.
A jointing compound should not be used. Wherever possible, flange joints should be made before other joints are completed. Pipework configuration shall be such that mating faces are aligned and butted squarely to each other with a maximum separation of 5-10mm prior to bolting up, irrespective of pipe diameter.

Only clean undamaged nuts and bolts of the correct size should be employed, with standard thick (Form A) washers at both ends, also of the correct size. Care must be taken to ensure that the gasket is centred properly between the two flanges before tightening commences. The nuts and bolts must be tightened as uniformly as possible using a torque wrench, in diagonally opposite sequence, progressively from a finger tight start.

For example:
Fingertight • 5% of final torque • 20% of final torque • 50% of final torque • 75% of final torque • 100% of final torque.
For PE diameters above 180mm, it is recommended that two operators work simultaneously on diametrically opposite bolts where possible. To guarantee subsequent leak tightness, final torquing up should be repeated after the assembly has been allowed to relax for an hour or so. Evenness of tightening is as important as final torque values - see the table below. The torques shown are for SDR11 and SDR17 pipe, in both PE80 and PE100.

Typical bolting torques for flanges (PE to PE or PE to metal flanges)

Nominal PE size (mm)	Nominal Iron size (mm)	Standard Flanges Bolting	Torque (Nm) ±10%
63	50	M16x4	35
90	80	M16x8	35
125	100	M16x8	35
180	150	M20x8	60
200	200	M20x12	80
225	200	M20x12	80
250	250	M24x12	100
280	250	M24x12	100
315	300	M24x12	120
355	350	M24x16	150
400	400	M27x16	200
450	450	M27x20	250
500	500	M30x20	300
560	600	M33x20	350

System of units

Size	Technical system of unit	SI - unit (MKS-system) Legal unit	ASTM - unit
Length	m	m 1m = 10dm = 100cm = 1000mm 1000m =1km	ft 1,609km(statute) = 1Meile = 1,852km(naut.) = 1 Mile 0,9144m = 1yd = 3ft 25,4m = 1inch
Area	m^2	m^2 $1m^2 = 100dm^2 = 10000\ cm^2$	yd^2 $0m836m^2 = 1yd$ $1yd^2 = 9ft^2$
Volume	m^3	m^3 $1m^3 = 10^3dm^3 = 10^6cm^3$	yd^3 $0{,}765m^3 = 1yd^3$ $1yd^3 = 27ft^3$
Force	kp 1N=0,102kp 1kp=9,81N	N $1N = 1kgm/s^2 = 10^5dyn$	lb 1lbf = 4,447N = 32poundals
Pressure	kp/m^2 $1N/cm^2 = 0{,}102kp/cm^2$ 0,1bar=1mWS 1bar=750Torr 1bar = 750mmHg 1bar = 0,99atm	bar $1bar = 10^5Pa = 0{,}1\ N/mm^2$ $10^6Pa = 1MPa -1N/mm^2$	psi 1bar = 14,5psi = 14,5lb/sq in
Mechanical stress	kp/mm^2 $1N/mm^2 = 0{,}102kp/mm^2$	N/mm^2	psi $1N/mm^2 = 145{,}04psi$ =145,04lb/sq in
Velocity	m/s	m/s	ft/sec. 1m/s = 3,2808ft/sec
Density	g/cm^3	g/cm^3	psi $1g/cm^3 = 14{,}22x10^3psi$
Volume	m^3	m^3	cu ft $1m^3 = 35{,}3147$ cu ft = 1,3080 cu yd $1cm^3 = 0{,}061$ cu in
Temperature	°C	°C 1°C = 1K	°F °F = 1,8 x °C + 32

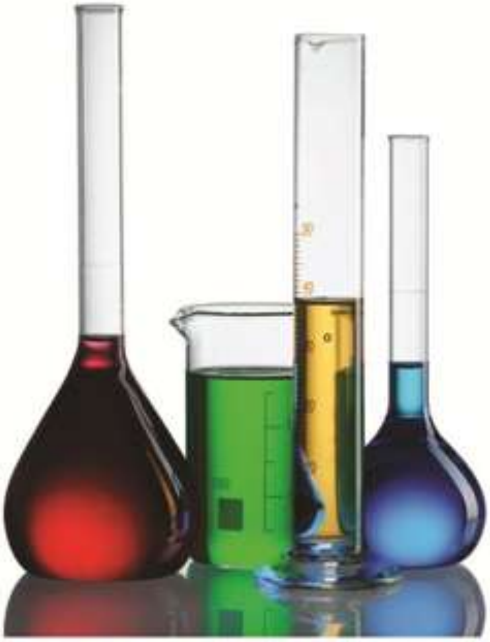
Chemicals Resistance Table: High Density Polyethylene P.E 100

This document establishes a provisional classification of the chemical resistance of high density polyethylene with respect to about 300 fluids. It is intended to provide general guidlines on the possible utilisation of high density polyethylene.

- at temperature up to 20℃ - 60℃
- in the absence of internal pressure and external machanical stress.(for example flexural stresses, stresses due to thrust, rolling loads etc).

This table contains an evaluation of the chemical resistance of a number of fluids judged to be either aggressive or not towards high density polyethylene.

This evalution is based on values obtained by immersion of high density polyethylene test specimens in the fluid concerned at 20 °C and 60 °C and atmospheric pressure, followed in certain cases by the determination of tensile characteristics.



Chemical	Concentration %	20°C	60°C
Acetaldehyde	100%	S	L
Acetanilide	-	-	-
Acetic acid	10%	S	S
Acetic acid	60%	S	S
Acetic anhydride	100%	S	L
Acetone	100%	L	L
Acrylnitrile	-	S	S
Acetylsilicacid	-	S	S
Aliphatic hydrocarbons	-	L	L
Allyl actate	-	S	L
Allyl alcohol	96%	S	S
Aluminium chloride	Sat.sol	S	S
Aluminium fluride	Sat.sol	L	S
Aluminium hydroxide	Sat.sol	S	S
Aluminium nitrate	Sat.sol	S	S
Aluminium sulphate	Sat.sol	S	S
Alums	Sol	S	S
Ammonia,dry gas	100%	S	S
Ammonia, liquid	100%	S	S
Ammonia, aqueous	Dil.sol	S	S

Chemical	Concentration %	20°C	60°C
Ammonium acetate	-	S	S
Ammomium chloride	Sat.sol	S	S
Ammonium fluoride	Sol	S	S
Ammonium hydroxide	30%	S	S
Ammonium nitrate	Sat.sol	S	S
Ammonium phosphate	Sat.sol	S	S
Ammonium sulphate	Sat.sol	S	S
Amyl acetate	100%	S	L
Amyl alcohol	100%	-	-
Amyl phthalate	-	S	S
Anilinchlorohydrate	-	S	L
Antimony (III) chloride	90%	S	NS
Antimony (III) chloride	Sat.sol	S	NS
Antimony trichloride	Sol	S	S
Aqua regia	HCl/HNO_3 = 3/1	NS	S
Aromatic hydrocarbons	-	S	S
Ascorbic acid	10%	S	S
Barium bromide	Sat.sol	S	S
Barium carbonate	Sat.sol	S	S
Barium chloride	Sat.sol	S	S

S= Satisfactory **L**= Limited **NS**= Not Satisfactory

Chemical	Concentration %	20°C	60°C
Barium hydroxide	Sat.sol	S	S
Barium sulphate	Sat.sol	S	S
Barium sulphide	Sat.sol	S	L
Beer	-	S	S
Benzaldehyde	100%	S	L
Benzene	100%	L	L
Benzoic acid	Sat.sol	S	S
Benzyl alcohol	-	S	S
Bleach lye	10%	S	S
Borax	Sat.sol	S	S
Brine	-	S	S
Bromine, dry gas	100%	NS	NS
Bromine, liquid	100%	NS	NS
Butane, gas	100%	S	S
Butanol	100%	S	S
Butyl acetate	100%	S	L
Butyl alcohol	100%	S	S
Butylene glycol	100%	S	S
Butyraldehyde	-	S	L
Calcium benzote	-	S	S
Calcium carbonate	Sat.sol	S	S
Calcium chlorate	Sat.sol	S	S
Calcium chloride	Sat.sol	S	S
Calcium chromate	40%	S	S
Calcium hydroxide	Sat.sol	S	S
Calcium sulphate	Sat.sol	L	L
Carbon dioxide, dry gas	100%	S	S
Carbon dioxide, wet	-	S	S
Carbon disulphide	100%	L	NS
Carbon monoxide	100%	S	S
Carbon tetrachloride	100%	L	NS
Carbonic acid	-	S	S
Chlorine, water	2%Sat.sol.	S	S
Chlorine aqueous	Sat.sol.	L	NS
Chlorine, dry gas	100%	L	NS
Chlorobenzene	100%	NS	NS
Chloroethanol	100%	S	S
Chloromethane, gas	100%	L	-

Chemical	Concentration %	20°C	60°C
Chlorosulphonic acid	100%	NS	NS
Citric acid	Sat.sol	S	S
Citric acid	25%	S	S
Cresylic acid	Sat.sol	L	-
Cyclanone	-	S	S
Cyclohexane	-	NS	NS
Cyclohexanol	100%	S	S
Cyclohexanone	100%	S	L
Detergents, synthetic	-	S	S
Diacetone alcohol	-	L	L
Dibutyl amine	-	L	NS
Dibuthyl ether	-	L	-
Dibutylphthalate	-	S	L
Diesel oil	-	S	L
Diethyl ether	100%	L	-
Diethyl ketone	-	L	L
Diethylene glycol	-	S	S
Dimethyl amine	100%	-	-
Dimethyl formamid	-	S	S
Dioctyl phthalate	100%	S	L
Dipentene	-	NS	NS
Disodium phosphate	-	S	S
Ethanol	40%	S	L
Ethanol	96%	-	-
Ethyl acetate	100%	S	NS
Ethyl acrylate	100%	L	NS
Ethyl alcohol	35%	S	S
Ethyl alcohol	100%	S	S
Ethyl chloride	100%	NS	NS
Ethylene chloride	100%	NS	NS
Ethylene glycol	100%	S	S
Ferric sulphate	Sat.sol	S	S
Ferrous chloride	Sat.sol	S	S
Ferrous sulphate	Sat.sol	S	S
Fluorine gas	100%	NS	NS
Fluorine gas, dry	100%	NS	NS
Fluorine gas, wet	100%	NS	NS
Fluorosilic acid	Conc	S	L

S= Satisfactory **L**= Limited **NS**= Not Satisfactory

Chemical	Concentration %	20°C	60°C
Formaldehyde	40%	S	S
Fructose	Sat.sol	S	S
Gasoline, petrol	-	L	L
Gelatine	-	S	S
Glucose	Sat.sol	S	S
Glycerine	100%	S	S
Glycerol	100%	S	S
Hexachlorobenzene	-	S	L
Hexachlorophene	-	L	L
Hydrobromic acid	up to 100%	S	S
Hydrochloric acid	Conc	S	S
Hydrocyanic acid	Sat.sol	S	S
Hydrofluoric acid	40%	S	S
Hydrofluoric acid	60%	S	L
Hydrogen chloride	Dry gas	S	S
Hydrogen peroxide	30%	S	S
Hydrogen peroxide	90%	S	NS
Iodine (in potassium sol)	-	NS	NS
Iodine (in alcohol)	-	NS	NS
Iron (II) chloride	Sat.sol	S	S
Iron (II) nitrate	Sol	S	S
Iron (II) sulphate	Sat.sol	S	S
Iso octane	100%	S	L
Iso pentane	-	NS	NS
Isopropanol	-	S	S
Isopropyl amine	-	NS	NS
Isopropyl ether	100%	S	NS
Kerosene	-	NS	NS
Lactic acid	up to 100%	S	S
Lead acetate	Sat.sol	S	S
Magnesium carbonate	Sat.sol	S	S
Magnesium chloride	Sat.sol	S	S
Magnesium nitrate	Sat.sol	S	S
Magnesium sulphate	Sat.sol	S	S
Mercury	-	S	S
Methyl alcohol	100%	S	S
Methyl bromide	100%	NS	NS
Methyl chloride	100%	NS	NS

Chemical	Concentration %	20°C	60°C
Methyl ethyl ketone	100%	S	L
Methylene chloride	-	NS	NS
Naphtha	-	L	NS
Naphthhalene	-	L	-
Nickel chloride	Sat.sol	S	S
Nickel nitrate	Sat.sol	S	S
Nickel sulphate	Sat.sol	S	-
Nitric acid	25%	S	S
Nitric acid	70%	S	L
Nitric acid	95%	NS	NS
Octyl alcohol	-	S	NS
Orthophosphoric	50%	S	S
Orthophosphoric	95%	S	L
Oxalic acid	Sat.sol	S	S
Perchloric acid	20%	S	S
Perchloric acid	50%	S	L
Perchloric acid	70%	S	NS
Phenol	Sol	S	S
Phosphoric acid	25 to 50%	S	S
Phosphoric (III) chloride	100%	S	L
Phosphorous (II) chloride	100%	S	L
Phosphorous pentoxide	100%	S	S
Phosphorous trichloride	100%	S	L
Phtalic acid	50%	S	S
Plating solutions	-	S	S
Potassium acetate	-	S	S
Potassium aluminium sulphate	Sat.sol	S	S
Potassium benzoate	-	S	S
Potassium bicarbonate	Sat.sol	S	S
Pottasium borate	Sat.sol	S	S
Potassium bromide	Sat.sol	S	S
Potasium carbonate	Sat.sol	S	S
Potassium chloride	Sat.sol	S	S
Potassium cyanide	Sol	S	S
Potassium dichromate	Sat.sol	S	S
Potassium hydrogen carbonate	Sat.sol	S	S
Potassium hydrogen sulphate	Sat.sol	S	S
Potassium hydrogen sulphide	Sol	S	S

S= Satisfactory **L**= Limited **NS**= Not Satisfactory

Chemical	Concentration %	20°C	60°C
Potassium hydroxide	sol	S	S
Potassium hypochlorite	Sol	S	S
Potassium nitratre	Sat.sol	S	S
Potassium persulphate	Sat.sol	S	S
Potassium phosphate	Sat.sol	S	S
Potassium sulphate	Sat.sol	S	S
Potassium sulphide	Sol	S	S
Potassium sulphite	Sat.sol	-	-
Potassium thiosulphate	Sat.sol	S	S
Propylene dichloride	100%	NS	NS
Propylene glycol	-	S	S
Pyridine	100%	S	L
Salicylic acid	Sat.sol	S	S
Sea water	-	S	S
Silver acetate	Sat.sol	S	S
Silver cyanide	Sat.sol	S	S
Soap solution	100%	S	S
Sodium acetate	Sat.sol	-	-
Sodium benzoate	Sat.sol	S	S
Sodium bicarbonate	Sat.sol	S	S
Sodium bisulphite	Sat.sol	S	S
Sodium bromide	Sat.sol	S	S
Sodium carbonate	Sat.sol	S	S
Sodium chlorate	Sat.sol	S	S
Sodium chloride	Sat.sol	S	S
Sodium fluoride	Sat.sol	S	S
Sodium hexacyanoferrate (III)	Sat.sol	S	S
Sodium hexafluorosilicate	Sat.sol	S	S
Sodium hydrogen carbonate	Sat.sol	S	S
Sodium hydrogen sulphate	Sat.sol	S	S
Sodium hydroxide	40%	S	S
Sodium hypochloride	-	S	S
Sodium nitrate	Sat.sol	S	S
Sodium nitrite	Sat.sol	S	S
Sodium oxalate	Sat.sol	S	S
Sodium phosphate	Sat.sol	S	S
Sodium silicate	Sol	S	S
Sodium sulphate	Sat.sol	S	S

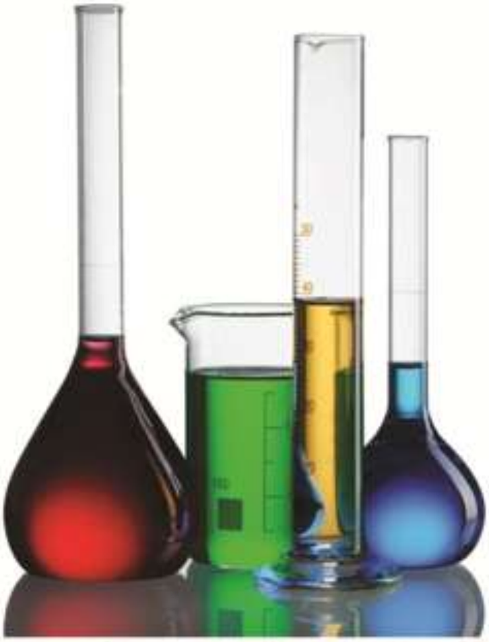
Chemical	Concentration %	20°C	60°C
Sodium sulphide	Sat.sol	S	S
Stannic chloride	Sat.sol	S	S
Starch solution	Sat.sol	S	S
Styrene	Sol	L	NS
Sulphur dioxide, dry	100%	S	S
Sulphur trioxide	100%	NS	NS
Sulphuric acid	50%	S	S
Sulphuric acid	70%	S	L
Sulphuric acid	80%	S	NS
Sulphuric acid	98%	S	NS
Sulphuric acid	Fuming	NS	NS
Sulphurous acid	30%	S	S
Sulphurous acid	Sol	S	S
Tallow	-	S	L
Tartaric acid	Sat.sol	S	S
Tartaric acid	Sol	S	S
Tetrahydonaphthalene	100%	S	L
Thionyl chloride	100%	NS	NS
Titanium tetrachloride	Sat.sol	NS	NS
Tribromomethane	-	NS	NS
Triethanolamine	100%	S	-
Triethanolamine	Sol	S	L
Triethylene glycol	-	S	S
Trisodium phosphate	Sat.sol	-	NS
Turpentine	-	NS	NS
Urea	up to 30%	S	S
Vaseline	-	S	S
Vegetables oils	-	S	S
Vinegar	-	S	S
Water	-	S	S
Wines and spirits	-	S	S
Xylene	100%	L	NS
Yeast	Sol	S	S
Zinc carbonate	Sat.sol	S	S
Zinc chloride	Sat.sol	S	S
Zinc oxide	Sat.sol	S	S
Zinc stearate	-	S	S
Zinc sulphate	Sat.sol	S	S

S= Satisfactory **L**= Limited **NS**= Not Satisfactory

Chemicals Resistance Table: Polypropylene Co-polymer

This document establishes a provisional classification of the chemical resistance of Polypropylene Co-polymer with respect to about 300 fluids. It is intended to provide general guidlines on the possible utilisation of PP-B fittings with NBR O-rings in polyethylene piping system in the absence of internal pressure and external mechanical stress (for example flexural stresses, stresses due to thrust, rolling loads etc).

This table contains an evaluation of the chemical resistance of a number of fluids judged to be either aggressive or not towards Polypropylene Co-polymer. This evalution is based on values obtained by immersion of Polypropylene Co-polymer test specimens in the fluid concentrated at levels given below and atmospheric pressure, followed in certain cases by the determination of tensile characteristics.



Chemical	Concentration %	PP-B	NBR
Acetaldehyde	40%	L	NS
Acetic acid	10%	S	S
Acetic acid anhydride	tg-l	S	NS
Acetone	tg-l	S	NS
Acrytonitrile	tg-l	S	NS
Adipic acid	Sat.sol.	S	S
Alchoholic Spirits	40%ethyl alcohol	S	S
Allyl Alchohol	tg-l	S	S
Alum	-	-	-
Aluminium Chloride	Sat.sol.	S	S
Almunium Sulphate	Sat.sol.	S	S
Aluminium potassium sulphate	50%	S	S
Ammonia	tg-g	S	S
Ammonium acetate	Sat.sol.	S	S
Ammonium carbonate	50%	S	S
Ammonium chloride	Sat.sol.	S	S
Ammonium hydroxide	Susp.	S	S
Ammonium nitrate	Sat.sol.	S	S
Ammonium phosphate	Sat.sol.	S	S
Ammonium sulphate	Sat.sol.	S	S

Chemical	Concentration %	PP-B	NBR
Ammonium sulphide	Sat.sol.	S	S
Antimony trichloride	Sat.sol.	S	NS
Aqua regia	-	NS	NS
Arsenic acid	80%	S	S
Barium hydroxide	Sat.sol.	S	S
Barium salts	Sat.sol.	S	S
Battery acid	40%	S	L
Beef tallow emulsion, sulphonated	Work.sol.	S	S
Beer	Work.sol.	S	S
Benzaldehyde	Sat.sol.	-	L
Benzene	tg-l	L	L
Benzine	Work.sol.	L	S
Benzoic acid	Sat.sol	S	S
Benzyl alcohol	tg-l	S	NS
Borax	Sol.	S	S
Boric acid	Sat.sol.	S	S
Brine, see water	-	S	S
Bromine, liquid	tg-l	NS	NS
Bromine, gas	tg-g	NS	NS
Bromine , water	Sat.sol.	NS	NS

Chemical	Concentration %	PP-B	NBR
Butadiene, gas	tg-g	S	NS
Butane,gas	tg-g	S	S
Butanediol	10%	S	S
Bu tanol	tg-l	S	S
Butyl acetate	tg-l	L	NS
Butylene glycol	tg-l	S	NS
Calcium bisulphite	Sat.sol.	-	NS
Calcium chloride	Sat.sol.	S	S
Calcium hydroxide	Sat.sol.	S	S
Calcium hypochlorite	Sol.	S	S
Calcium nitrate	Sol.	S	S
Carbon dioxide, aqueous sol,	Sat.sol.	S	S
Carbon dioxide, gas	tg-g	S	S
Carbon disulphide	tg-l	S	NS
Carbon monoxide, gas	tg-g	S	-
Carbon tetrachloride	tg-l	NS	NS
Caustic potash solution	50%	S	L
Caustic soda solution	40%	S	S
Caustic soda solution	50%	S	L
Chlorine gas	tg-l	NS	NS
Chlorine , water	Sat.sol.	S	NS
Chloroacetic acid mono	Sol.	S	NS
Chloroform	tg-l	L	NS
Chlorosulphonic acid	tg-s	NS	NS
Chrome alum [chromium potassium sulphate]	Sol.	S	S
Cider	-	S	S
Citric acid	10%	S	S
Coal gas, benzene free	-	S	S
Coconut fat alcohol	Work.sol.	S	S
Coconut oil	Work.sol.	S	S
Compressed air containing oil	-	L	S
Cooking salt	-	-	-
Copper salts	Sat.sol.	S	S
Corn oil	Work.sol.	S	S
Cresol	tg-l	S	L
Crotonic aldehyde	Sat.sol.	S	S
Cyclohexane	tg-l	S	S
Cyclohexanol	Sat.sol.	S	L

Chemical	Concentration %	PP-B	NBR
Cyclohexanone	tg-l	L	NS
Detergents (washing powder)	Work.sol.	S	S
Dextrine (starch gum)	Work.sol.	S	S
Dextrose	-	-	-
Diesel oil	-	L	S
Ethyl alcohol	tg-l	S	S
Ethyl alcohol + acetic acid (fermentation mixture)	Work.sol.	S	L
Ethyl benzene	tg-l	L	NS
Ethyl chloride	tg-g	L	NS
Ethyl eter	tg-l	S	NS
Ethylene chloride	tg-l	L	L
Ethylene glycol	tg-l	S	S
Fertilizer salts	Work.sol.	S	S
Fluorine	tg-g	NS	NS
Flurosilicic acid	32%	S	L
Formaldehyde	40%	S	S
Formamide	tg-l	S	S
Formic acid	50%	S	NS
Frigen 12 (Freon 12)	Work.sol.	NS	L
Fruit juice	Work.sol.	S	S
Fruit pulp	Work.sol.	S	S
Fuil oil (Gasoline)	Work.sol.	L	S
Gelatine	Sol.	S	S
Glucose	Sol.	S	S
Glycerine	tg-l	S	S
Glycocoll	10%	S	S
Glycol	see ethylene glycol	-	-
Glycolic acid	37%	S	S
Heptane	tg-l	S	S
Hexane	tg-l	S	S
Hydrobromic acid	50%	S	L
Hydrochloric acid	10%	S	L
Hydrocyanic acid	tg-l	S	L
Hydrofluoric acid	40%	S	NS
Hydrogen	tg-g	S	S
Hydrogen chloride	tg-g	S	L
Hydrogen peroxide	10%	S	L
Hydrogen sulphate	Sat.sol	S	L

S= Satisfactory L= Limited NS= Not Satisfactory

Chemical	Concentration %	PP-B	NBR
Hydroxylamine sulphate	Sat.sol.	S	S
Iodine solution	6.5%iodine in ethanol	S	S
Iron salt	Sat.sol.	S	S
Iso-octane	tg-l	L	S
Isopropyl aclohol	tg-l	S	S
Isopropyl ether	tg-l	L	NS
Lactic acid	10 %	S	NS
Lanolin	Work.sol.	S	S
Linseed oil	Work.sol.	S	S
Liqueurs	Sol.	S	S
Lead acetate	Sat.Sol.	S	S
Lubricaating oils	-	L	S
Lubricating oils free of aromatic compounds	-	S	S
Magnesium salts	Sat.sol.	S	S
Marmelade	-	S	S
Mercury	tg-l	S	S
Mercury salts	Sat.sol.	S	L
Methane (natural gas)	tg-g	S	S
Methanol [methyl alcohol]	tg-l	S	S
Methyl acetate	tg-l	S	NS
Methyl amine	32%	S	NS
Methyl bromide	-	NS	NS
Methyl chloride	tg-g	NS	NS
Methylene acetate	tg-l	L	NS
Methyl ethyl ketone	tg-l	S	NS
Milk	-	S	S
Mineral wort	-	S	S
Molasses	-	S	S
Molasses water	-	S	S
Mowilith D	Work.sol.	S	S
Nophthalene	tg-l	S	S
Nickel salts	Sat.sol.	S	S
Nitric acid	63%	S	NS
Oleic acid	tg-l	S	L
Oleum	-	NS	NS
Olive oil	-	S	S
Oxalic acid	Sat.sol.	S	L
Oxigen	tg-g	S	NS

Chemical	Concentration %	PP-B	NBR
Ozone	tg-g	-	NS
Palm oil, palm nut oil	-	S	S
Paraffin emulsion	Work.sol.	S	S
Paraffin oil	Work.sol.	S	S
Petroleum	Work.sol.	S	S
Petroleum ether	Work.sol.	L	L
Petrolium jelly	Work.sol.	S	S
Phenol	10%	S	NS
Phenylhydrazine	tg-l	L	NS
Phenylhydrazine hydrochloride	Dil.sol.	S	L
Phosgene	tg-l	L	L
Phosphoric acid	50%	S	L
Phosphorus chlorides	tg-l	S	NS
Phosphorus pentoxide	tg-l	S	L
Photographic emulsion	-	S	L
Photographic developer	Work.sol.	S	L
Photographic fixer	Work.sol.	S	S
Phtalic acid	Sat.sol.	S	NS
Potash (potassium carbonate)	Sat.sol.	S	S
Potassium almunium sulphate	50%	S	S
Potassium bichromate	Sat.sol.	S	S
Potassium borate	10%	S	S
Potassium bromate	Sat.sol.	S	S
Potassium bromide	Sat.sol.	S	S
Potassium carbonate	Sat.sol.	S	S
Potassium chlorate	Sat.sol.	S	S
Potassium chloride	Sat.sol.	S	S
Potassium chromate	Sat.sol.	S	S
Potassium cyanide	Sat.sol.	S	S
Potassium hydroxide	50%	S	L
Potassium iodide	Sat.sol.	S	S
Potassium nitrate	50%	S	S
Potassium perchlorate	Sat.sol.	S	S
Potassium permanganate	Sat.sol.	S	L
Potassium persulphate	Sat.sol.	S	NS
Potassium phosphates	Sat.sol.	S	S
Potassium sulphate	Sat.sol.	S	S
Propane	tg-l; tg-g	S	S

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Chemical	Concentration %	PP-B	NBR
Propanol, n- and iso-	tg-l	S	L
Proparcyl alchohol	7%	S	S
Proponic acid	50%	S	NS
Propylene glycol	tg-l	S	S
Pyridine	tg-l	L	NS
Salpetre	50%	S	S
Silicone oil	-	S	S
Silver salts	Sat.sol.	S	S
Soap	Sol.	S	S
Soda	Sat.sol.	S	S
Sodium acetate	Sat.sol.	S	S
Sodium benzoate	Sat.sol.	S	S
Sodium bicarbonate	Sat.sol.	S	S
Sodium bisulphate	10%	S	S
Sodium bisulphite	Sat.sol.	S	L
Sodium bromate	Sat.sol.	S	S
Sodium bromide	Sat.sol.	S	S
Sodium carbonate	Sat.sol.	S	S
Sodium chlorate	Sat.sol.	S	S
Sodium chloride (cooking salt)	Sat.sol.	S	S
Sodium chlorite	DIL.sol	S	NS
Sodium chromate	DIL.sol	S	S
Sodium disulphite	Sat.sol.	S	L
Sodium dithionite (hyposulphite)	10%	S	S
Sodium fluorite	Sat.sol.	S	S
Sodium hydroxide	40%	S	S
Sodium Hypochlorite	125%	L	NS
Sodium iodide	Sat.sol.	S	S
Sodium nitrate	Sat.sol.	S	S
Sodium nitrite	Sat.sol.	S	S
Sodium oxalate	Sat.sol.	S	S
Sodium persulphate	Sat.sol.	S	NS
Sodium phosphate	Sat.sol.	S	S
Sodium silicate	Sat.sol.	S	S
Sodium sulphate	Sat.sol.	S	S
Sodium sulphide	Sat.sol.	S	S
Sodium sulphite	Sat.sol.	S	S
Sodium thiosulphate	Sat.sol.	S	S

Chemical	Concentration %	PP-B	NBR
Spindle oil	-	S	S
Spirits	Work.sol.	S	S
Stannous chloride	Sat.sol.	S	S
Starch solution	Work.sol.	S	S
Starch syrup	Work.sol.	S	S
Stearic acid	tg-l	S	S
Succinic acid	Sat.sol.	S	S
Sugar syrup	Work.sol.	S	S
Sulphur dioxide	tg-g	S	NS
Sulphur troxide	tg-g	NS	NS
Sulphuric acid	40%	S	L
Sulphurous acid	Sat.sol.	S	NS
Sulphuryl chloride	tg-l	NS	NS
Tallow	tg-l	S	S
Tannic acid	Sol.	S	S
Tanning extracts from plants	Work.sol.	S	S
Tartaric acid	Sat.sol.	S	S
Tetrachloroethane	tg-l	L	NS
Tetrathyl lead	tg-l	S	S
Toluene	tg-l	L	NS
Trichloroethane	tg-l	L	NS
Trichloromethane	tg-l	L	NS
Triethanolamine	Sol.	S	L
Trioctyl phosphate	-	S	L
Turpentine oil	-	NS	S
Urea	30%	S	S
Urine	-	S	S
Vegetable oils and fats	-	S	S
Vinegar	Work.sol.	S	NS
Vinyl acetate	tg-l	S	S
Water	-	S	S
Wax alcohol	tg-l	L	S
Wetting agents	5%	S	S
Wines	Work.sol.	S	S
Wine vinegar	Work.sol.	S	NS
Xylene	tg-l	NS	NS
Yeast	Susp.	S	S
Zinc salts	Sol.	S	S

S= Satisfactory **L**= Limited **NS**= Not Satisfactory

Unit Weight of PE 100 Pipes

MRS = 10 Mpa   C = 1,25   Ó = 8,0Mpa

PN	4		5		6		8		10	
SDR	41		33		27.6		21		17	
size (mm)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)
16										
20										
25									2,0	0,140
32									2,0	0,190
40							2,0	0,240	2,4	0,280
50					2,0	0,300	2,4	0,360	3,0	0,440
63			2,0	0,380	2,3	0,440	3,0	0,570	3,8	0,710
75	2,0	0,460	2,3	0,530	2,9	0,660	3,6	0,810	4,5	1,000
90	2,3	0,640	2,8	0,770	3,3	0,900	4,3	1,160	5,4	1,440
110	2,7	0,910	3,4	1,140	4,0	1,340	5,3	1,750	6,6	2,150
125	3,1	1,190	3,9	1,490	4,6	1,740	6,0	2,250	7,4	2,740
140	3,5	1,510	4,3	1,840	5,1	2,170	6,7	2,810	8,3	3,440
160	4,0	1,970	4,9	2,390	5,8	2,820	7,7	3,690	9,5	4,500
180	4,4	2,430	5,5	3,020	6,5	3,550	8,6	4,640	10,7	5,710
200	4,9	3,010	6,2	3,790	7,3	4,430	9,6	5,760	11,9	7,050
225	5,5	3,800	6,9	4,740	8,2	5,600	10,8	7,290	13,4	8,930
250	6,2	4,760	7,7	5,880	9,1	6,910	11,9	8,930	14,8	10,970
280	6,9	5,940	8,6	7,350	10,2	8,670	13,4	11,250	16,6	13,770
315	7,7	7,450	9,7	9,330	11,4	10,900	15,0	14,180	18,7	17,450
355	8,7	9,490	10,9	11,820	12,9	13,900	16,9	18,000	21,1	22,190
400	9,8	12,050	12,3	15,020	14,5	17,610	19,1	22,920	23,7	28,090
450	11,0	15,210	13,8	18,960	16,3	22,270	21,5	29,020	26,7	35,600
500	12,3	18,900	15,3	23,360	18,1	27,480	23,9	35,850	29,7	44,000
560	13,7	23,520	17,2	29,410	20,3	34,510	26,7	44,860	33,2	55,100
630	15,4	29,820	19,3	37,130	22,8	43,610	30,0	56,700	37,4	69,820
710	17,4	37,960	21,8	47,260	25,7	55,400	33,9	72,200	42,1	88,580
800	19,6	48,190	24,5	59,850	29,0	70,440	38,1	91,450	47,4	112,380
900	22,0	60,850	27,6	75,850	32,6	89,080	42,9	115,830	53,3	142,170
1000	24,5	75,290	30,6	93,450	36,2	109,910	47,7	143,100	59,3	175,730
1200	29,4	108,420	36,7	134,490	43,5	158,480	57,2	205,930	70,6	251,190
1400	34,3	147,570	42,9	183,410	50,7	215,510	66,7	280,150	82,4	342,020
1600	39,2	192,740	49,0	239,420	58,0	281,740	76,2	365,790	94,1	446,410

s : Wall thickness **m**: Unit Weight (kg/mt) **c**: Safety Coefficient
MRS: Minimum required strength (MPA) **Ó**: Design Stress

Unit Weight of PE 100 Pipes

MRS = 10 Mpa C = 1,25 σ́ = 8,0Mpa

PN	12,5		16		20		25		32	
SDR	13,6		11		9		7,4		6	
size (mm)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)	s (mm)	m (kg/mt)
16					2,0	0,090	2,3	0,100	3,0	0,120
20			2,0	0,110	2,3	0,130	3,0	0,160	3,4	0,180
25	2,0	0,150	2,5	0,170	3,0	0,210	3,5	0,240	4,2	0,280
32	2,4	0,220	3,0	0,270	3,6	0,320	4,4	0,380	5,4	0,450
40	3,0	0,350	3,7	0,420	4,5	0,500	5,5	0,600	6,7	0,700
50	3,7	0,540	4,6	0,660	5,6	0,780	6,9	0,940	8,3	1,090
63	4,7	0,860	5,8	1,050	7,1	1,250	8,6	1,470	10,5	1,740
75	5,6	1,220	6,8	1,460	8,4	1,760	10,3	2,100	12,5	2,460
90	6,7	1,760	8,2	2,110	10,1	2,540	12,3	3,010	15,0	3,540
110	8,1	2,600	10,0	3,150	12,3	3,790	15,1	4,510	18,3	5,290
125	9,2	3,360	11,4	4,080	14,0	4,900	17,1	5,810	20,8	6,830
140	10,3	4,210	12,7	5,090	15,7	6,150	19,2	7,310	23,3	8,570
160	11,8	5,510	14,6	6,690	17,9	8,010	21,9	9,530	26,6	11,180
180	13,3	6,980	16,4	8,450	20,1	10,120	24,6	12,040	29,9	14,140
200	14,7	8,580	18,2	10,420	22,4	12,530	27,4	14,900	33,2	17,450
225	16,6	10,900	20,5	13,210	25,2	15,860	30,8	18,840	37,4	22,100
250	18,4	13,420	22,7	16,250	27,9	19,520	34,2	23,250	41,5	27,260
280	20,6	16,830	25,4	20,370	31,3	24,520	38,3	29,160	46,5	34,200
315	23,2	21,330	28,6	25,800	35,2	31,030	43,1	36,920	52,3	43,280
355	26,1	27,040	32,2	32,740	39,7	39,430	48,5	46,830	59,0	55,020
400	29,4	34,320	36,3	41,590	44,7	50,030	54,7	59,500	66,7	70,030
450	33,1	43,470	40,9	52,710	50,3	63,340	61,5	75,270		
500	36,8	53,700	45,4	65,020	55,8	78,080				
560	41,2	67,330	50,8	81,490	62,2	97,540				
630	46,3	85,140	57,2	103,210						
710	52,2	108,170	64,5	131,160						
800	58,8	137,300	72,8	166,770						
900	66,2	173,890								
1000	73,5	214,520								
1200										
1400										
1600										

s : Wall thickness **m**: Unit Weight (kg/mt) **c**: Safety Coefficient
MRS: Minimum required strength (MPA) **Ó**: Design Stress

Notes

Notes

Sales Terms

The specifications contained in this document are applicable to any order. Any modifications will require the written acceptance of HYDROPLAST piping systems S.L. The specifications and rates may be revised at any time with respect to all or any of the orders in progress at the date of revision.

Orders: Orders must be placed in writing and indicate the references and specifications contained in the official catalogue of HYDROPLAST piping systems S.L. maintaining the amounts shown therein.

Delivery: The date of dispatch of the orders from our warehouses will be the date of delivery. Orders may be partly filled without this impyling their cancellation.

Prices: The prices shown on the price list of HYDROPLAST piping systems S.L. include packaging; any other expenses, such as taxes or local assessments, will be for the account of the purchaser. Invoices will be issued upon delivery at the prices applicable on the date of despatch.

Transport: The transport of goods is the entire responsibility of the purchaser, even in those cases in which it is carried out on a carriage paid basis. Other expenses not specified in our price list (packing for transport by sea or air, etc) shall be for the account of the purchaser.

Warranty: HYDROPLAST piping systems S.L. products are warranted for **one year** from the date of despatch of the goods against any problem deriving from a defect of manufacture.

The warranty of our materials is limited to the replacement of the product, model or component recognized as defective. The expenses of return and reshipment shall be for the account of the purchaser.

Payment: All payments shall be made in cash except in those cases in which a written agreement exists. Modifications in the term of payment or in the form or date thereof, must have our written authorization. Any expense, tax or local levy applicable after the order has been placed shall be for the account of the purchaser.

The purchaser shall reimburse to the seller by way of damages any bank and judicial charges incurred as a result of the return of dishonoured drafts.

Claims and returns: No returns or claims shall be admitted after 10 days from the receipt of your order. If your claim is accepted by HYDROPLAST piping systems S.L. you should send us the defective material properly packed, the expenses of shipment being for your account.

If a return is not approved by HYDROPLAST piping systems S.L. any risk or expenses shall be for the account of the purchaser, a 10% handling cost will be applicable.

Cancellation: HYDROPLAST piping systems S.L. reserves the right to cancel or terminate any sales operation in the event that any of the conditions set out herien is not fulfilled, as well as in the event of non-payment, in whole or in part, of any order or any delay in payment of any previous order, or if it is necessary to bring executive proceedings against the purchaser or if the purchaser is declared in suspension of payment or bankruptcy.

Reservation of title: The materials supplied shall remain the property of HYDROPLAST piping systems S.L. until they have been paid for.

HYDROPLAST piping systems S.L reserves the right to remove the goods, in whole or in part, from the premises of the purchaser if the purchaser fails to make any payment.

Competent jurisdiction: For the settlement of any disputes that may arise in connection with the application of these conditions, both HYDROPLAST piping systems S.L. and the purchaser agree to submit to the Courts and Tribunals of Spain, waiving their right to any other jurisdiction to which may be entitled.

The contents of this document and the specifications of our products may be modified, in whole or in part by HYDROPLAST piping systems S.L. without prior notice.

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