PINOPLAST

ITALIAN TECHNOLOGY

PPR-C PIPES AND FITTINGS





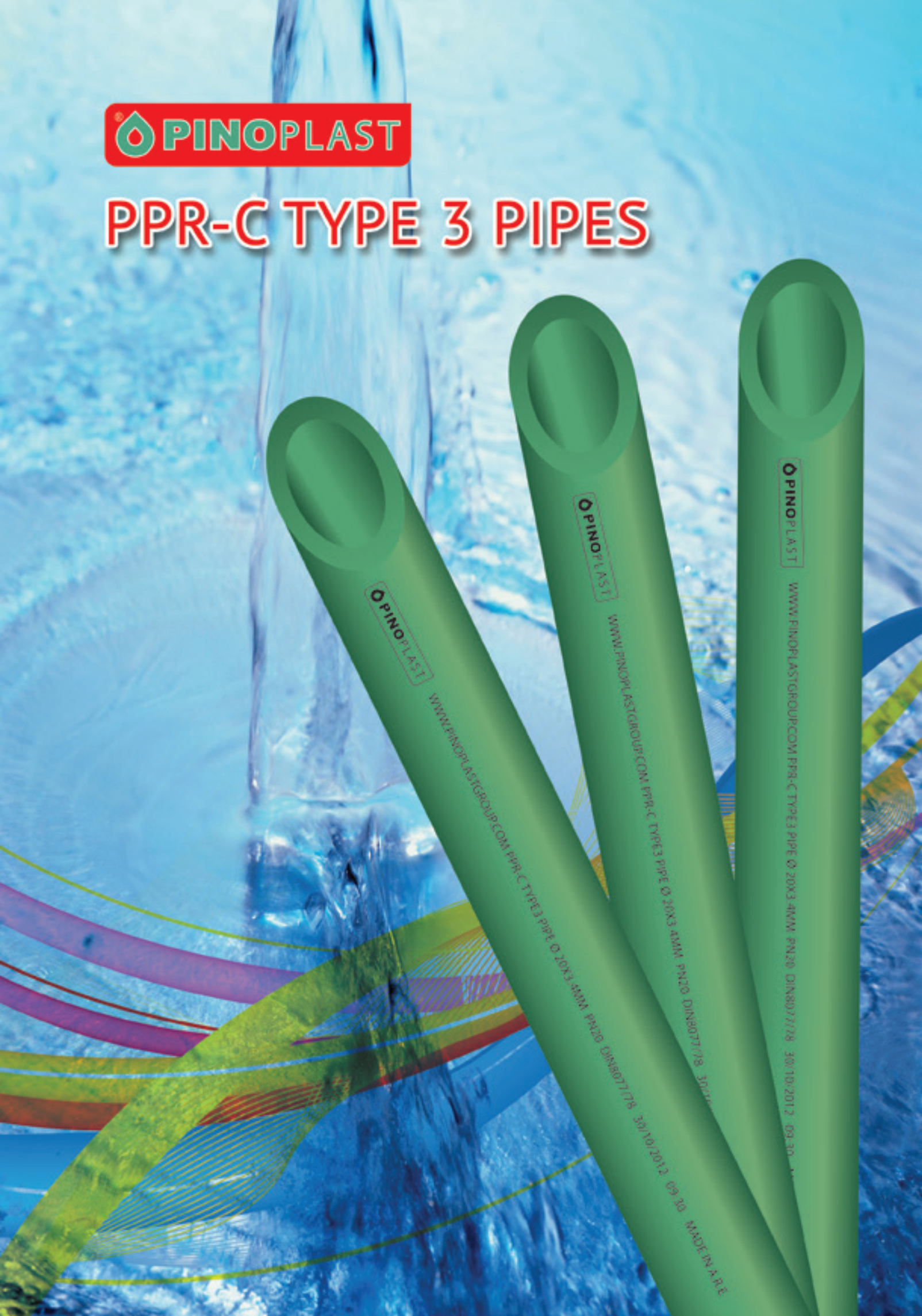


TECHNICAL CATALOUGE

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PINOPLAST

PPR-C TYPE 3 PIPES



PINOPLAST

OUR LIST OF

RAW MATERIAL

PINOPLAST *Pipes and fittings are produced using PP RANDOM COPOLYMER (PPR-C TYPE 3).*

PP RANDOM COPOLYMER (PPR-C TYPE 3)
is commonly used in drinking and hot water heating systems as well as in every kind of liquid distribution systems.

> *PP RANDOM COPOLYMER (PPR-C TYPE 3) has a lot of advantages over other plastics such as;*

1. **Light weight**
Because of its low density (density is 0.89-0.92 g/cm^3); due to the light weight, it can reduce the transportation cost and workers for installing.

2. **Long life duration**
Under the normal environment temperature, and working pressure of 10kg/cm^2 its service life is longer than other pipes made of different material, the reason is that it has the antiheat performance (the service life is up to 50 years).

3. **High temperature and pressure resistant**
The water temperature that transport by the piping can reach 95°C when working under the long term consecutive working stress.

4. **Hygiene**
No negative influence on water quality by means it does not affect the water color, odor or taste.

5. **Low thermal conductivity**
Heat conduction is 0.23-0.3W/mk at 20°C

6

Good anti-corrosion property

Ion in the water and the chemical matter in the building can't make the pipe causes extra chemical reaction; it can't rust, erode, and bring the bacillus.

7

Firm pipe fittings connection

Because polypropylene has fine thermal casting performance, thermal casting between the pipe and pipe fittings with the same material as an integration, it can prevent water leakage.

8

Beautiful shape

The inside and outside of the production is very lubricous, fluid resistance is little, color and luster is very meekness and it has attractive appearance.

9

Low noise

Due to the material's high sound insulation value, the noise level is reduced with particularly high water flow speeds and when water hammers are present.



(PPR-C TYPE 3) PROPERTIES

PHYSICAL PROPERTIES

Property	Test method	Units	Mean value
Density at 23^{0}C	ISO 1183	g/cm^3	0.9
Melt mass flow rate MFR at 190°C/ 5Kg	ISO 1133	g/10min.	0.6
Melt mass flow rate MFR at 230° C/ 2.16Kg	ISO 1133	g/10min.	0.3
Melting point	DSC	^{0}C	149

THERMAL PROPERTIES

Property	Test method	Units	Mean value
Thermal conductivity at 20^{0}C	DIN 52612	W/MK	0.3
Specific heat 20^{0}C	Adiabatic calorimeter	KJ/Kg.K	1.68
Heat deflection temperature at 0.45Mpa (HDT/B)	ISO 75-1,-2	^{0}C	70
Heat deflection temperature at 1.8Mpa (HDT/A)	ISO 75-1,-2	^{0}C	45
Vicat softening point, A120	ISO 306	^{0}C	130
Vicat softening point, B120	ISO 306	^{0}C	70
Coefficient of linear expansion, at 20^{0}C	VDE 0304	m/mk (k^{-1})	1.1x10^{-4}

MECHANICAL PROPERTIES

Property	Test method	Units	Mean value
Tensile modulus (1 mm/min.)	ISO 527-1,-2	MPa	850
Tensile stress at Yield (50 mm/min.)	ISO 527-1,-2	MPa	25
Tensile strain at yield (50 mm/min.)	ISO 527-1,-2	%	12
Tensile stress at break (50 mm/min.)	ISO 527-1,-2	MPa	20
Tensile strain at break (50 mm/min.)	ISO 527-1,-2	%	400
Charpy impact strength at 23^{0}C	ISO 179/1eU	KJ/m^2	NB
Charpy impact strength at -20^{0}C	ISO 179/1eU	KJ/m^2	70
Charpy impact strength notched at 23^{0}C	ISO 179/1eA	KJ/m^2	20
Charpy impact strength notched at -20^{0}C	ISO 179/1eA	KJ/m^2	2.5
Flexural modulus (2mm/min.)	ISO 178	MPa	800
Hardness	ISO 2039-2	R scale	75

RAW MATERIAL RESISTANCE CURVE ACCORDING TO DIN8078, ISO15874

There are many factors determining the time resistance of **PINO**PLAST *systems as follows:*

- Pressure.
- Temperature.
- Time.

The lines represented in the below graph are determined through various internal pressure testes at various temperatures using the following equation:

$$\log t = A + (B/T) * \log\sigma + C/T + D*\log\sigma$$

where:

T: temperature in K

t: time in hr.

A,B,C & D: coefficients according to the below table.

Material	Part of reference characteristic curve	A	B	C	D
PP-H	Flat slope	-46.364	-9601.1	20381.5	15,24
	Steep slope	-18.387	0	8918.5	-4.1
PP-B	Flat slope	-56.086	-10157.8	23971.7	13.32
	Steep slope	-13.699	0	6970.3	-3.82
PP-R	Flat slope	-55.725	-9484.1	25502.2	6.39
	Steep slope	-19.98	0	9507	-4.11

Coefficients for calculating the reference characteristic curves

Note:

use the coefficients values of PP-R

To demonstrate conformance to the reference lines; pipe samples should be tested at temperatures of 20, 60-70, 95^{0}C and at various hoop stresses such that at least at the given temperatures, three failure times fall in each of the following time intervals:

Time intervals: 10-100hr, 100-1000hr, 1000-8760hr and above 8760 hr.

Notes:

- In testes lasting more than 8760 hr, once failure is reached at a stress and time at least on or above the reference line, any time after that can be considered as the failure time; testing should be carried out in accordance with EN 921:1994

- Conformance with the reference lines should be demonstrated by plotting the individual experimental results on the graph; at least 97.5% of them should lie on or above the reference line.



Raw material resistance curve according to DIN8078, ISO15874

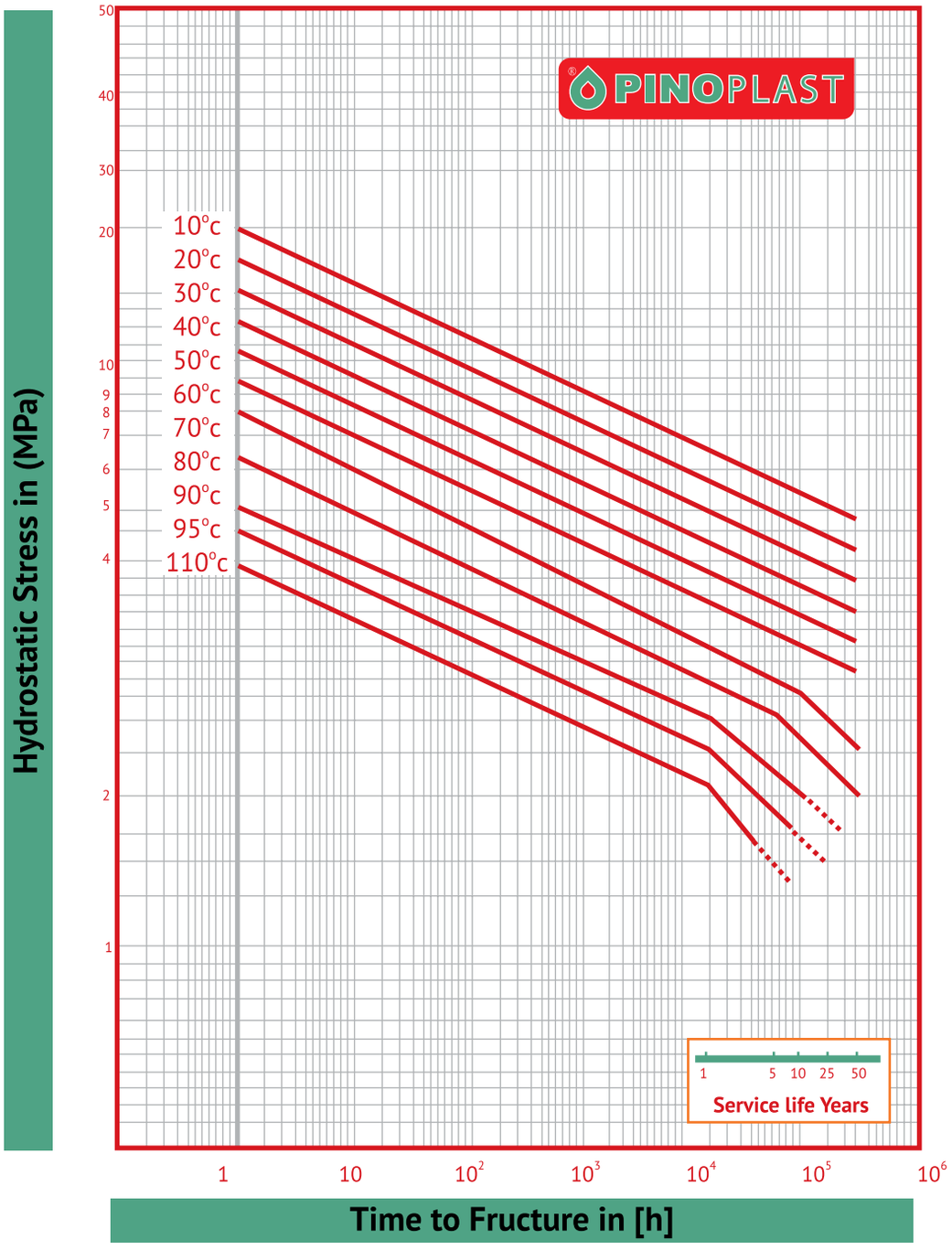


FIGURE (01)

RESISTANCE OF PPR-C AGAINST CHEMICAL MATERIALS

PPR-C TYPE3 has high resistance to a large number of aggressive substances, and therefore it is particularly suitable for special applications.

NOTES

- The below tables provide the resistance of the PPR-C TYPE3 to various chemicals.
- The tables refer to the raw material only, and not subjected to outside mechanical stresses and atmospheric pressure.
- Take care when the installation is to carry water with chlorine content over the limits permitted by law and/or contains elements which induce oxidation in general.

R: resistant

H: highly resistant

FR: fairly resistant

SR: scarcely resistant

NR: non resistant

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Acetic Acid	100	R	FR	NR
Acetic acid aq.	50	R	R	
See also vinegar	10	R	R	R
Acetic Anhydride	100	R		
Acetone (boiling point 56.3°C)	100	R	FR	
Alcoholic iodine		R		
Alum	sat.	R	R	
Alums aq.	any	R	R	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Aluminim salts aq.	any	R	R	R
Ammonia,gaseous	100	R	R	
Ammonia aq.	conc.	R	R	
	10	R	R	
Ammonium acetate aq.	any	R	R	R
Ammonium carbonate aq.	any	R	R	R
Ammonium chloride aq.	any	R	R	R
Ammonium nitrate aq.	any	R	R	R
Ammonium phosphate aq.	any	R	R	R
Ammonium sulphate aq.	any	R	R	R
Amyl alcohol, pure		R	R	
Aniline	100	R	H	
Antifreeze agent(cars)**		R	R	
Apple juice		R	R	
Apple sauce		R	R	H
Aqua regia		R	NR	
Asphalt**		R	FR	
Aspirin		R		
Barium salts	any			
Beer		R	R	R
Benzaldehyde	100	R	R	
Benzaldehyde aq.	sat.	R		
	0.30	R		
Benzene	100	R		
Benzoic acid	100	NR	NR	
Benzoic acid aq.	sat.	R	R	
Bleaching solution		R	R	R
(12.5% active chlorine)		FR	FR	
Borax aq.	sat.	R	H	
Boric acid	100	R	R	
Boric acid aq.	sat.	R	R	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
	4.9	R	R	
Brake Fluid**			R	R
Bromine Liquid	100			
Bromina vapours	high	R		
	low	NR	NR	
Bromina water	sat.	FR	NR	
Butane, gaseous	100	NR	NR	
Butane liquid	100	R	R	
Butter		R	R	
Buttermilk	100	R		
Butly acetate	100	R	FR	
n-Butyl alcohol(n-butanol)		R	R	
Cake		R	R	H
Calcium chloride aq.	sat.	R	R	R
Calcium nitrate aq.	sat.	R	R	R
Camphor		R		
Carbon bisulphide (Boling point 46.2°C)	100	FR		
Carbon tetrachloride	100	FR	NR	
Caustic potash solution	50	R	R	
	25	R	R	
	10	R	R	
Caustic soda solution	50	R	R	
	25	R	R	
	10	R	R	
Cheese		R		
Chloride of lime		R	R	
Chlorine , gas , dry	100	NR	NR	NR
Chlorine , gas , humid	10	FR	NR	NR
Chlorine liquid	100	NR		
Chlorine water	sat.	FR	NR	
Chlorobenzene	100	NR	NR	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Chloroform	100	NR	NR	
Chlorosulphonic acid	100	R	R	
Chromic/sulfuric acid		R	R	
Chromium plating solution**		R		
Chromium salts	sat.	R	FR	
Cinnamon(cane)		R		
Cinnamon(ground)		R		
Citric acid aq.	sat.	R	R	
Clove oil		R	FR	R
Coca-cola		R		
Cocoa(powdered)		R		
Cocoa(ready to drink)		R	R	H
Coconut oil		R	H	
Cod-liver oil		R	R	
Coffee(beans and ground)		R		
Coffee(ready to drink)		R	R	
Common salt , dry		R	R	
Copper salts aq.		R	R	
Corn seed oil		R	FR	
Cream , whipped cream		R		
Cresol solution		R		
Cresol		R	FR	
Cresols aq.		R	FR	
Curds		R		
Cyclohexane		R		
cyclohexanol		R	R	
cyclohexanone		R	NR	
Decahydrunaphthalene	100	FR	NR	NR
Detergents, synthetic**	high	R	R	
Dibutylphthalate (see plasticizers)				
Dimethylformamide	100	R		

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Dioxane	100	R	R	NR
liquid		R	R	R
DIXAN	ready for use			
ether(Diethyl ether)**	100			
Ethyl acetate	100			
Ethyl alcohol	100			
Fixing salt (see also sodium thiosulphate)	10	R	R	
Floor wax**			R	FR
Flour		R		
Fluoric acid	40	R	R	
Formaldehyde aq.Ghc	40	R	R	
	30	R	R	
	10	R	R	
Formalin		R	R	
formic acid	98	R	FR	
	90	R		
	50	R	R	
	10	R	R	R
Fruit juice		R	R	
Fruit salad		R		
Fuel	q			
Petrol, normal		R	FR	
according to DIN 51635 q				
Petrol, regular		H	NR	
Petrol, super	q	FR	NR	
Diesel oil**	q	R	FR	
Fuel oil**	q	R	FR	
Furniture polish**		R	FR	NR
Gin	40	R		
Glycerine	100	R	R	
Glycerine aq.	high	R	R	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
	low	R	R	R
Glycol	100	R	R	
Glycol aq.	high	R	R	
	low	R	R	R
Graperfruit juice		R	R	
Gravy		R	R	R
Hair shampoo**		R	R	
Heptane	100	R	FR	H
Hexane	100	R	FR	
Honey		R	R	
Horse-radish, ready-to-eat		R		
Hydrochloric acid	conc.	R	R	
Hydrogan chloride, gaseous	10	R	R	
(see also Hydochloric acid)	high	R	R	
Hydrogan peroxide aq.	low	R	R	
	30	R	FR	
	10	R	R	R
	3	R	R	R
Hydrogen sulphide	low	R	R	
Ink**		R	R	
Iron salts aq.	sat.	R	R	R
Isooctane	100	R	FR	
Isoproply alcohol	100	R	R	
Jam		R	R	H
Jelly		R	R	H
Lactic acid aq.		90	R	R
		50	R	R
	10.00	R	R	R
LANOLIN		R	FR	
Lard		R	R	FR
Lemonades		R		

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Lemon aroma			R	
Lemon juice		R	R	
Lemon peel		R		
Lemon peel oil		R		
Linseed oil		R	R	
LITEX		R	R	
Liqueur	any	R		
LYSOL		R	FR	
Magnesium salts aq.	sat.	R	R	NR
Margarine		R	R	
MARLIPAL MG	50	R	R	
MARLON		R	R	
(42%active detergent)	100	R		
MARLOPHEN 83	20	R		
MARLOPHEN 89	100	R		
	5	R		
MARLOPHEN 810	100	R		
	20	R		
	5	R		
MARLOPHEN 820	100	R		
	20	R	R	
	5	R	R	
Mashed potatoes		R	R	H
Mayonnaise		R		
Menthole		R		
Mercuric salts aq.	sat.	R	R	
Mercury	100	R	R	
Methyl alcohol	100	R	R	
Methyl alcohol aq.	50	R	R	
Methylene chloride (Boiling point 40.7°C)	100	FR		
Methyl ethyl ketone	100	R	FR	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Milk		R	R	R
Milk food		R	R	H
Mineral oil**		R	FR	NR
(without aromatic hydrocarbons)		R		
Moth balls**		R	FR	NR
Motor oil (cars)** (see also Two-stoke oil and oil		R		
Mustard				NR
Nail polish (Boiling point 40.7°C)		R	FR	
Nail polish remover Boiling point 40.7°C		R	FR	
Naphtalene	100	R		
Nickel salts aq.	sat.	R	R	
Nitric acid	50	FR	NR	
	25	R	R	
	10	R	R	
Nitrobenzene	100	R	FR	
Octance (see isooctane)				
Oil no.3 acc. to ASTM 380-59	100	R	FR	NR
Oil of bitter almonds		R		
Olecic acid	100	R		
Oleum	any	NR	NR	R
Ollve Oil		R	R	
Orange juice		R	R	
Orange peel		R		
Orange peel oil		R		
Oxalic acid aq.	sat.	R	R	R
Ozone(<0.5 ppm)		H	NR	
Palm oil		R	FR	
Paprika		R	R	
Parafin	100	R	R	NR
Parafin oil	100	R	FR	NR
Peanut oil		R	H	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Pectin	sat.	R	R	
Pepper		R	R	
Peppermint oil		R		
Petroleum	100	R	FR	
Petroleum ether	100	R	FR	
Phenol (aqueous phase)	sat.(appr 0.9)	R	R	
(Phenolic phase)	sat.(appr 0.7)	R		
Phosphoric acid	sat.(85)	R	FR	
	50	R	R	
	10	R	R	R
Phosphorus pentoxide	100	R		
Photographic developers** comm.		R	R	
	ready for use	R	R	
Pickled cabbage, ready-to-eat		R	R	H
Picked fish		R	R	H
Pineapple juice		R	R	
Pine needle oil	100	R	H	
Dibutyphthalate (VESTINOL C)		R	FR	
Dibutylsebecate		R		
Dihexylphthalate		R		
Dinonyladipate		R		
Diisononylphthalate (VESTINOL N)		R		
Dioctylphthalate (VESTINOL AH)		R		
Tricesylphosphate		R		
Trictylphosphate		R		
Porridge		R	R	H
Potassium carbonate aq. (potash)	sat.	R	R	
Potassium chlorate aq.	sat.	R	R	
Potassium chloride aq.	sat.	R	R	R
Potassium dichromate aq.	sat.	R	R	R
Potassium iodide aq.	sat.	R	R	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Potassium nitrate aq.	sat.	R	R	
Potassium permanganate aq.	sat.	R	H	
Potassium persulphate aq.	sat.	R		
Potassium sulphate aq.	sat.	R	R	R
Potato salad		R		
Propane , gaseous	100	R	R	
Propane , liquid	100	R	R	
Pudding		R	R	
Pyridine	100	R	FR	
Rum	40	R	R	
Rum aroma		R		
SAGROTAN		R	FR	
Salad oil, animal		FR		
Salad oil, vegetable		FR		
Salted water	any	R	R	R
Sausage		R	R	
Sea water		R	R	R
Shoe polish**		R	FR	
Silicone oil**		R	H	
Silver salts aq.	sat.	R	R	
Soap, cake soap		R	R	
Soap solution	sat.	R	R	
	10	R	R	R
Soda water		R		
Sodium bocarbonate aq.	sat.	R	R	R
Sodium bisuiphite aq.	sat.	R	R	
Sodium carbonate aq.	sat.	R	R	
	10	R	R	
Sodium chlorate aq.	25	R	R	
Sodium chloride aq.	sat.	R	R	R
Sodium chlorite aq.	5	R	R	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Sodium hydroxide see (Caustic soda)				
Sodium hypochlorite aq.	5	R	R	
Sodium nitrate aq.	sat.	R	R	
Sodium nitrite aq.	sat.	R		
Sodium perborate aq.	sat.	R	R	R
Sodium phospates aq.	sat.	R	R	R
Sodium sulphate aq.	sat.	R	R	R
Sodium sulphide aq.	sat.	R	R	
Sodium sulphide aq.	sat.	R	R	
Sodium thiosulphate aq.	sat.	R	R	R
Soft soap		R	R	
Soybean oil		R	FR	
Stannous chloride	sat.	R	R	
Starch, starch solution aq.	any	R	R	
Stearic acid	100	R		
Storage-battery acid		R		
Succinic acid aq.	sat.	R	R	
Sugar (dry)		R	R	
Sugar beet sirup		R	R	
Sugar solution aq.	any	R	R	R
Sulphur	100	R	R	H
Sulphur dioxide (sulphurous anhydride)	low	R	R	H
Sulphuric acid	96	R	FR	
	50	R	R	
	25	R	R	
	10	R	R	R
Tar	sat.	R	FR	
Tartaric acids aq.	100	R	R	
Tea (leaves)	100	R	R	
Tea(ready-to-drink)		R	R	
Tetrachlorethane	100	NR	NR	

Chemicals	Concentration %	Temperature		
		20°C	60°C	100°C
Tetrachlorethylene (perchlorethylene)	100	FR	NR	
Tetrahydrofuran	100	FR	NR	
Tetrahydronapthalene	100	FR	NR	
Thick(semolina) gruel		R	R	H
Thiophene		FR	NR	
Toluene		FR	NR	
Tomato juice		R	R	
Tomato ketchup		R	R	
Toothpastes		R	R	
Transformer oil**	100	FR		
Trichlorethylene		FR	NR	
Turpentine oil		FR	NR	
Two-stroke oil		FR	FR	
Typewriter oil		R	H	
Urea aq.	sat.	R	R	
Vanilla		R	R	
Vaseline		R	FR	
Vegetables(ready-to-eat)		R	R	H
Vinegar	comm.	R	R	
Vinegar essence	comm.	R	R	
Water	100	R	R	R
Water glass		R	R	
Whisky	40	R		
White spirit		R	FR	
Wine, mulled claret		R	R	
Xylene	100	FR	NR	
Zinc salts aq.	sat.	R	R	

For Concentration:

Sat.: saturated at room temperature.
any: saturated (with 20^0C), Hydrous solution.
comm.: usual in trade composition.
aq.: aqueous

PINOPLAST PPR-C PIPES

ALLOWABLE WORKING PRESSURE

The tables listed below show the operating conditions related to pressure and temperature as a basis for pipe connection and refer to potable water installation based on a theoretical service life of 100 years.

ALLOWABLE WORKING PRESSURE FOR PIPES MADE OF PPR-C TYPE3 AND WITH SAFETY FACTOR 1.5(SF=1.5)

Temperature in °C	Years of Service	Pipe Series (S)							
		20	16	12.5	8.3	5	3.2	2.5	2
		Standard Dimention Ratio (SDR)							
		41	33	26	17.6	11	7.4	6	5
		Allowable working Pressure, In bar							
10	1	4.4	5.6	7.0	10.6	17.6	27.8	35.0	44.2
	5	4.2	5.3	6.6	10.0	16.6	26.4	33.2	41.8
	10	4.0	3.1	6.4	9.7	16.1	25.5	32.1	40.4
	25	3.9	4.9	6.2	9.4	15.6	24.7	31.1	39.1
	50	3.8	4.8	6.0	9.1	15.2	24.0	30.3	38.1
	100	3.7	4.7	5.9	8.9	14.8	23.4	29.5	37.1
20	1	3.8	4.8	6.0	9.0	15.0	23.8	30.0	37.8
	5	3.5	4.5	5.6	8.5	14.1	22.3	28.1	35.4
	10	3.4	4.3	5.5	8.2	13.7	21.7	27.3	34.4
	25	3.3	4.2	5.3	8.0	13.3	21.1	26.5	33.4
	50	3.2	4.1	5.1	7.8	12.9	20.4	25.7	32.4
	100	3.1	4.0	5.0	7.5	12.5	19.8	24.9	31.4
30	1	3.2	4.0	5.1	7.7	12.8	20.2	25.5	32.1
	5	3.0	3.8	4.8	7.2	12.0	19.0	23.9	30.1
	10	2.9	3.7	4.6	7.0	11.6	18.3	23.1	29.1
	25	2.8	3.5	4.4	6.7	11.2	17.7	22.3	28.1
	50	2.7	3.4	4.3	6.6	10.9	17.3	21.8	27.4
	100	2.7	3.4	4.2	6.4	10.6	16.9	21.2	26.4

Temperature in °C	Years of Service	Pipe Series (S)							
		20	16	12.5	8.3	5	3.2	2.5	2
		Standard Dimention Ratio (SDR)							
		41	33	26	17.6	11	7.4	6	5
		Allowable working Pressure, In bar							
40	1	2.7	3.4	4.3	6.5	10.8	17.1	21.5	27.1
	5	2.5	3.2	4.0	6.1	10.1	16.0	20.2	25.4
	10	2.5	3.1	3.9	5.9	9.8	15.6	19.6	24.7
	25	2.4	3.0	3.8	5.7	9.4	15.0	18.8	23.7
	50	2.3	2.9	3.7	5.5	9.2	14.5	18.3	23.1
	100	2.2	2.8	3.5	5.4	8.9	14.1	17.8	22.4
50	1	2.3	2.9	3.7	5.5	9.2	14.5	18.3	23.1
	5	2.1	2.7	3.4	5.1	8.5	13.5	17.0	21.4
	10	2.1	2.6	3.3	5.0	8.2	13.1	16.5	20.7
	25	2.0	2.5	3.2	4.8	8.0	12.6	15.9	20.0
	50	1.9	2.4	3.1	4.6	7.7	12.2	15.4	19.4
	100	1.9	2.4	3.0	4.5	7.4	11.8	14.9	18.7
60	1	1.9	2.4	3.1	4.6	7.7	12.2	15.4	19.4
	5	1.8	2.3	2.9	4.3	7.2	11.4	14.3	18.0
	10	1.7	2.2	2.8	4.2	6.9	11.0	13.8	17.4
	25	1.7	2.1	2.6	4.0	6.7	10.5	13.3	16.7
	50	1.6	2.0	2.5	3.8	6.4	10.1	12.7	16.0
70	1	1.6	2.1	2.6	3.9	6.5	10.3	13.0	16.4
	5	1.5	1.9	2.4	3.6	6.0	9.5	11.9	15.0
	10	1.5	1.9	2.3	3.5	5.9	9.3	11.7	14.7
	25	1.3	1.6	2.0	3.0	5.1	8.0	10.1	12.7
	50	1.1	1.3	1.7	2.6	4.3	6.7	8.5	10.7
80	1	1.4	1.7	2.2	3.3	5.5	8.6	10.9	13.7
	5	1.2	1.5	1.9	2.9	4.8	7.6	9.6	12.0
	10	1.0	1.3	1.6	2.4	4.0	6.3	8.0	10.0
	25	-	1.0	1.3	1.9	3.2	5.1	6.4	8.0
95	1	1.0	1.2	1.5	2.3	3.9	6.1	7.7	9.7
	5	-	-	1.0	1.5	2.5	4.0	5.0	6.3
	(10)[1])	-	-	-	(1.3)[1])	(2.1)[1])	(3.4)[1])	(4.2)[1])	(5.3)[1])

[1]) The bracketed values apply where testing can be shown to have been carried out for longer than one year at 110 °C

PINOPLAST PPR-C PIPES

ALLOWABLE WORKING PRESSURE

ALLOWABLE WORKING PRESSURE FOR PIPES MADE OF PPR-C TYPE3 AND WITH SAFETY FACTOR 1.25 (SF=1.25)

Temperature in °C	Years of Service	Pipe Series (S)							
		20	16	12.5	8.3	5	3.2	2.5	2
		Standard Dimention Ratio (SDR)							
		41	33	26	17.6	11	7.4	6	5
		Allowable working Pressure, In bar							
10	1	5.3	6.7	8.4	12.7	21.1	33.4	42.0	52.9
	5	5.0	6.3	7.9	12.0	20.0	31.6	39.8	50.1
	10	4.9	6.1	7.7	11.6	19.3	30.6	38.5	48.5
	25	4.7	5.9	7.4	11.2	18.7	29.6	37.3	46.9
	50	4.6	5.8	7.2	10.9	18.2	28.8	36.3	45.7
	100	4.5	5.6	7.1	10.7	17.7	28.1	35.4	44.5
20	1	4.5	5.7	7.2	10.8	18.0	28.6	36.0	45.3
	5	4.2	5.4	6.7	10.2	16.9	26.8	33.8	42.5
	10	4.1	5.2	6.5	9.9	16.4	26.1	32.8	41.3
	25	4.0	5.0	6.4	9.6	16.0	25.3	31.8	40.1
	50	3.9	4.9	6.2	9.3	15.5	24.5	30.9	38.9
	100	3.8	4.7	6.0	9.0	15.0	23.8	29.9	37.7
30	1	3.8	4.8	6.1	9.2	15.3	24.3	30.6	38.5
	5	3.6	4.5	5.7	8.6	14.4	22.8	28.7	36.1
	10	3.5	4.4	5.5	8.4	13.9	22.0	27.7	34.9
	25	3.4	4.2	5.3	8.1	13.4	21.3	26.8	33.7
	50	3.3	4.1	5.2	7.9	13.1	20.7	26.1	32.9
	100	3.2	4.0	5.1	7.7	12.8	20.2	25.5	32.1

Temperature in °C	Years of Service	Pipe Series (S)							
		20	16	12.5	8.3	5	3.2	2.5	2
		Standard Dimention Ratio (SDR)							
		41	33	26	17.6	11	7.4	6	5
		Allowable working Pressure, In bar							
40	1	3.2	4.1	5.1	7.8	12.9	20.5	25.8	32.5
	5	3.0	3.8	4.8	7.3	12.1	19.2	24.2	30.5
	10	3.0	3.7	4.7	7.1	11.8	18.7	23.5	29.7
	25	2.8	3.6	4.5	6.8	11.3	18.0	23.6	28.5
	50	2.8	3.5	4.4	6.6	11.0	17.5	22.0	27.7
	100	2.7	3.4	4.3	6.4	10.7	16.9	21.3	26.9
50	1	2.8	3.5	4.4	6.6	11.0	17.5	22.0	27.7
	5	2.6	3.2	4.1	6.1	10.2	16.2	20.4	25.7
	10	2.5	3.1	3.9	6.0	9.9	15.7	19.7	24.9
	25	2.4	3.0	3.8	5.8	9.6	15.2	19.1	24.1
	50	2.3	2.9	3.7	5.6	9.3	14.7	18.5	23.3
	100	2.2	2.8	3.6	5.4	8.9	14.2	17.8	22.5
60	1	2.3	2.9	3.7	5.6	9.3	14.7	18.5	23.3
	5	2.2	2.7	3.4	5.2	8.6	13.7	17.2	21.7
	10	2.1	2.6	3.3	5.0	8.3	13.2	16.6	20.8
	25	2.0	2.5	3.2	4.8	8.0	12.6	15.9	20.0
	50	1.9	2.4	3.1	4.6	7.7	12.1	15.3	19.2
70	1	2.0	2.5	3.1	4.7	7.8	12.4	15.6	19.6
	5	1.8	2.3	2.9	4.3	7.2	11.4	14.3	18.0
	10	1.8	2.2	2.8	4.2	7.0	11.1	14.0	17.6
	25	1.5	1.9	2.4	3.6	6.1	9.6	12.1	15.2
	50	1.3	1.6	2.0	3.1	5.1	8.1	10.2	12.8
80	1	1.6	2.1	2.6	3.9	6.5	10.4	13.1	16.4
	5	1.4	1.8	2.3	3.5	5.7	9.1	11.5	14.4
	10	1.2	1.5	1.9	2.9	4.8	7.6	9.6	12.0
	25	1.0	1.2	1.5	2.3	3.8	6.1	7.6	9.6
95	1	1.2	1.5	1.8	2.8	4.6	7.3	9.2	11.6
	5	-	1.0	1.2	1.8	3.0	4.8	6.1	7.6
	(10)[1])	-	-	(1.0)[1])	(1.5)[1])	(2.6)[1])	(4.0)[1])	(5.1)[1])	(6.4)[1])

[1]) The bracketed values apply where testing can be shown to have been carried out for longer than one year at 110 °C

LINEAR EXPANSION CALCULATION OF PINOPLAST PPR-C PIPES

As the PPR-C Pipe has lower coefficient of linear expansion over other plastics so it has a lower elongation and this can be obtained from the following calculations:

$$\Delta l = L_0 \times \Delta t \times \alpha$$

Where:

Δl : linear expansion (elongation) in mm

L_0 : pipe length in m

Δt : Temperature difference in °C between the operating temperature and the installation temperature,

α : coefficient of linear expansion which is: 0.11MM/MK

Example:

For a pipe have Ø32mm, L_0=4m, Δt =50°C so Δl = 4 x 50 x 0.11 ∴ Δl = 22mm

LINEAR EXPANSION TABLE FOR PINOPLAST PPR-C PIPES

pipe Length	Temprature Difference (°C)									
L(m)	10	20	30	40	50	60	70	80	90	100
1.0	1.10	2.20	3.30	4.40	5.50	6.60	7.70	8.80	9.90	11.00
2.0	2.20	4.40	6.60	8.80	11.00	13.20	15.40	17.60	19.80	22.00
3.0	3.30	6.60	9.90	13.20	16.50	19.80	23.10	26.40	29.70	33.00
4.0	4.40	8.80	13.20	17.60	22.00	26.40	30.80	35.20	39.60	44.00
5.0	5.50	11.00	16.50	22.00	27.50	33.00	38.50	44.00	49.50	55.00
6.0	6.60	13.20	19.80	26.40	33.00	39.60	46.20	52.80	59.40	66.00
7.0	7.70	15.40	23.10	30.80	38.50	46.20	53.90	61.60	69.30	77.00
8.0	8.80	17.60	26.40	35.20	44.00	52.80	61.60	70.40	79.20	88.00
9.0	9.90	19.80	29.70	39.60	49.50	59.40	69.30	79.20	89.10	99.00
10.0	11.00	22.00	33.00	44.00	55.00	66.00	77.00	88.00	99.00	110.00
11.0	12.10	24.20	36.30	48.40	60.50	72.60	84.70	96.80	108.90	121.00
12.0	13.20	26.40	39.60	52.80	66.00	79.20	92.40	105.60	118.80	132.00
13.0	14.30	28.60	42.90	57.20	71.50	85.80	100.10	114.40	128.70	143.00
14.0	15.40	30.80	46.20	61.60	77.00	92.40	107.80	123.20	138.60	154.00

linear expansion (Δl) in mm

FREE EXPANSION CALCULATION IN PINOPLAST PPR-C PIPES

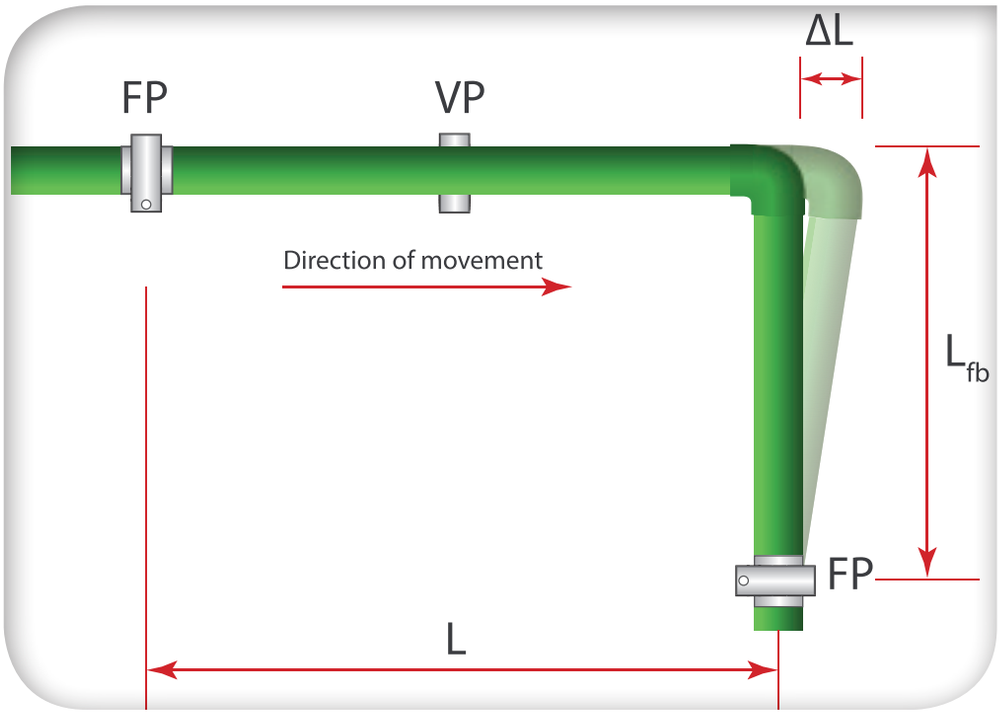
Linear expansion of a pipe can be compensated by a change in direction so; free expansion parts are formed in order to prevent the installation from linear expansion which may arise in the pipes due to temperature variations.

The length of free bending part is calculated from the following formula:

$$L_{fb} = A \times \sqrt{\Delta l \times d}$$

Where:

L_{fb}: length of free bending part in mm
A = specific constant of PPR-C material A=20
Δl : longitudinal elongation in mm
L : pipe length in m
d : pipe outer diameter in mm
FP : fixed point
VP : varying point



FREE EXPANSION CALCULATION IN PINOPLAST PPR-C PIPES

Example:

Consider a corner installation consists of a **PINO**PLAST standard pipe and have the following specifications:

Pipe diameter =Ø32mm

Pipe length L_0=4m

Max. working temperature=60^{0}C

ambient temperature=20^{0}C

then **Δt** =60-20=40^{0}C

First step:

we need to calculate the linear expansion amount that going to be happened in the main pipe by using the following formula:

$$\Delta l = L_0 \times \Delta t \times \alpha$$

As for **PINO**PLAST standard pipe **α**= 0.11MM/MK

Δl = 4 x 40 x 0.11 = 17.6mm

Second step:

we use the following formula to calculate the length of free bending part:

$$L_{fb} = A \times \sqrt{\Delta l \times d}$$

So,

$$L_{fb} = 20 \times \sqrt{17.6 \times 32}$$

L_{fb} = 474.64mm

LINEAR EXPANSION CURVE FOR PINOPLAST PPR-C PIPES

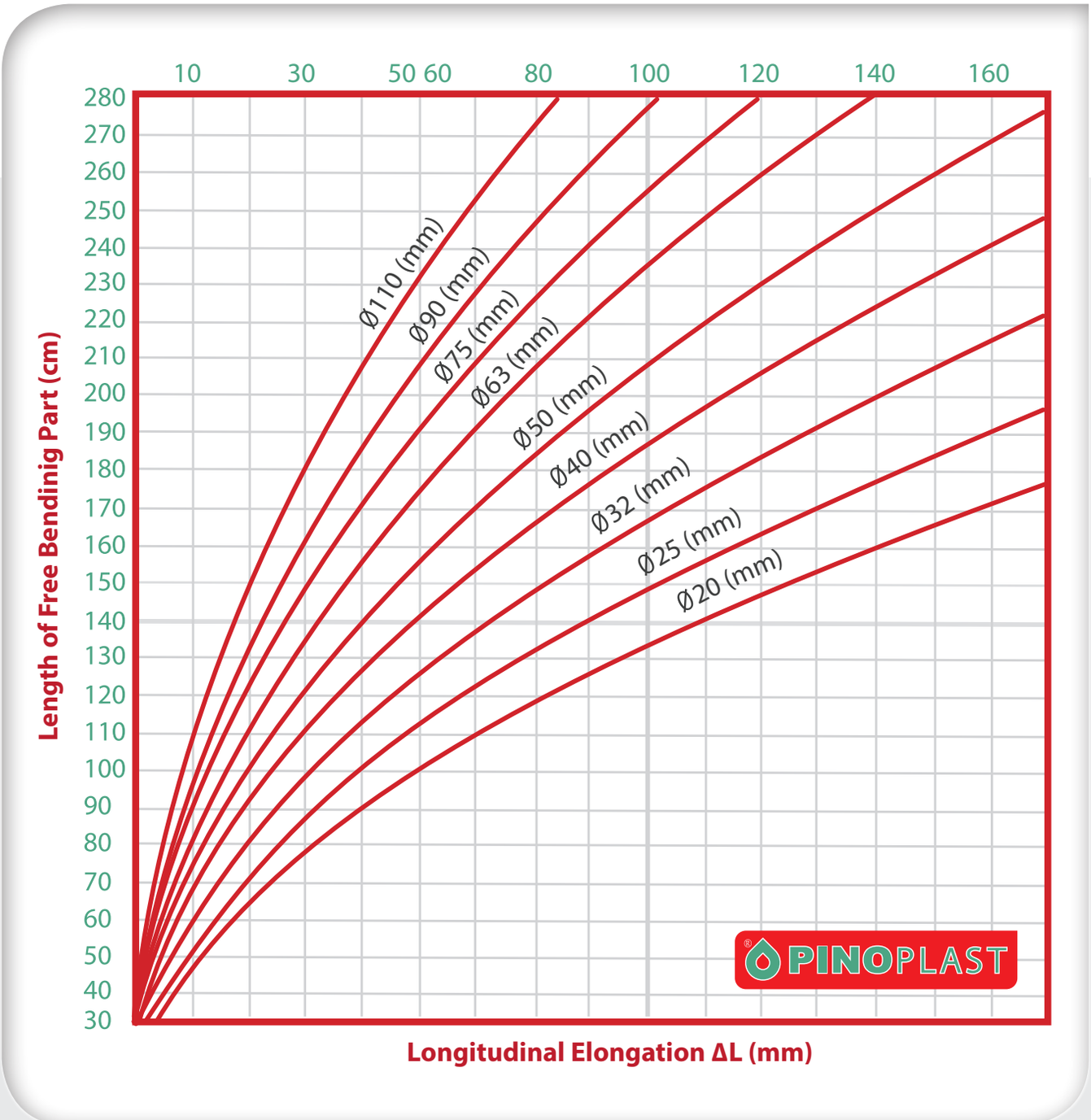


FIGURE (02)

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EXPANSION CHAMBERS IN PINOPLAST PPR-C PIPES

If the linear expansion can not be removed by changing the direction, an expansion chamber must be designed as the below shape

MINIMUM WIDTH OF EXPANSION CHAMBER CALCULATION:

$$W_{min.} = (2 \times \Delta L) + SM$$

Where:

Wmin : minimum width of expansion chamber in mm

SM : safety margin 150mm

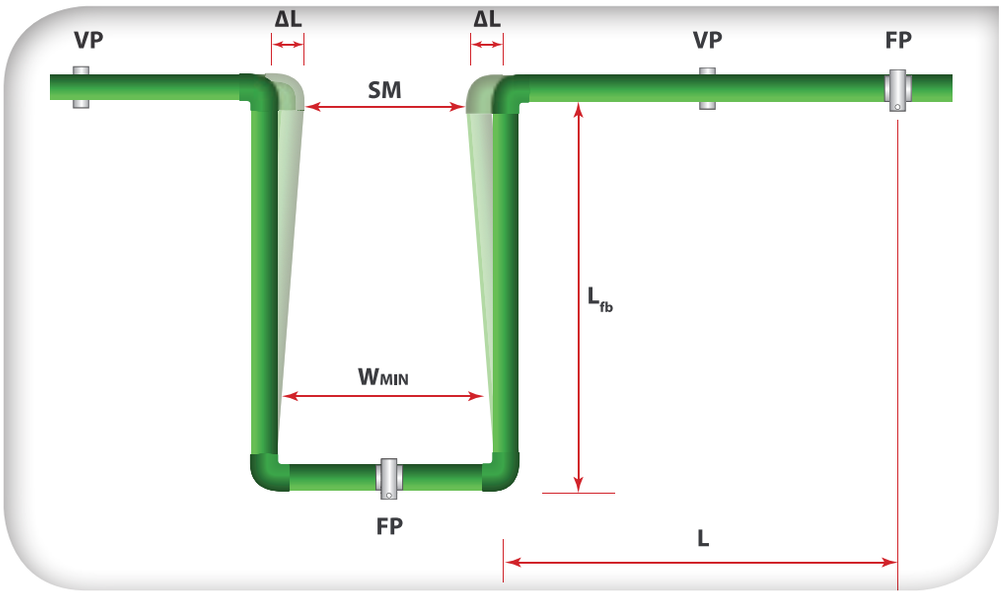
L_{fb} : length of free bending part in mm

Δl : longitudinal elongation in mm.

l : pipe length in m

FP : fixed point

VP : varying point



Example:

Consider we have an expansion chamber have **Δl**= 44mm, then the minimum width of expansion chamber will be calculated as follows:

Wmin.= (2 x 44) + 150

Wmin.= 238mm

CLAMP SPACING IN PINOPLAST PPR-C PIPES

Fixed clamp spacing at horizontally and vertically installed PPR-C pipes can be obtained from the below table.

Fixed points prevent non controllable movements in the installation and separate entire installation into expansion sections. Elongation amount, weight of pipe and the fluid inside the pipe play role in determination of the places of fixed points.

Fixed points should be stronger than the repulsive force of the free bending part and should be placed at appropriate distances for availability to expansion.

PPR-C PIPE CLAMP SPACING

Temperature Difference (°C)	Pipe Diameter (mm)									
	16	20	25	32	40	50	63	75	90	110
0	85	90	110	130	145	170	195	210	225	255
20	80	65	80	95	105	125	145	155	165	185
30	75	65	80	95	105	125	145	155	165	185
40	75	65	75	85	95	115	135	145	155	175
50	70	65	75	85	95	115	135	145	155	175
60	70	60	70	80	90	105	120	130	145	165
70	65	55	65	75	85	100	110	110	130	145

Clamp Spacing (cm)

NOTES

- The values of clamp spacing listed in the previous table are for PN16, PN20 & PN25.
- For cold water applications @PN10: when the temperature of medium is 20°C, you are supposed to use the following spacing:

Pipe Diameter in mm									
16	20	25	32	40	50	63	75	90	110
Clamp spacing in cm									
80	65	80	95	105	125	145	155	165	185

SERVICE LIVES OF PPR-C PIPES

FOR PIPES USED IN WATER INSTALLATION AND ACCORDING TO DIN2000

Temperature (°C)	Service Life (Year)	Operating Pressure (Bar)
20	1	30.0
	5	28.1
	10	27.3
	25	28.5
	50	25.7
30	1	25.5
	5	23.9
	10	23.2
	25	22.3
	50	21.8
40	1	21.5
	5	20.2
	10	19.6
	25	18.8
	50	18.3

Temperature (°C)	Service Life (Year)	Operating Pressure (Bar)
50	1	18.3
	5	17.0
	10	16.5
	25	15.9
	50	15.4
60	1	15.4
	5	14.3
	10	13.8
	25	13.3
	50	12.7
65	1	14.6
	5	13.6
	10	13.1
	25	12.6
	50	11.1
70	1	13.0
	5	11.9
	10	11.7
	25	10.1
	30	8.8
	50	8.5

Cold Water

Hot water

FOR PIPES USED IN HEATING SYSTEMS AND ACCORDING TO DIN2000

Usage Period	Temperature (°C)	Service Life (Year)	Operating Pressure (Bar)
30 days/year	75	5	17.27
		10	13.79
		25	11.74
		45	10.18
	80	5	13.50
		10	13.80
		25	11.14
		42.5	9.79
	85	5	12.42
		10	11.87
		25	10.14
		37.5	9.18
	90	5	11.39
		10	10.94
		25	8.86
		35	8.16
60 days/year	75	5	14.11
		10	13.57
		25	11.59
		45	10.05
	80	5	13.12
		10	12.54
		25	10.56
		40	9.41
	85	5	12.03
		10	11.52
		25	9.22
		35	8.48
	90	5	11.04
		10	9.76
		25	7.81
		30	7.46

Usage Period	Temperature (°C)	Service Life (Year)	Operating Pressure (Bar)
90 days/year	75	5	14.02
		10	13.38
		25	11.33
		45	9.82
	80	5	12.80
		10	12.35
		25	10.05
		37.5	9.08
	85	5	11.81
		10	10.72
		25	8.58
		32.5	8.03
	90	5	10.59
		10	8.96
		25	7.17



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