PINOPLAST

ITALIAN TECHNOLOGY

PPR-C PIPES AND FITTINGS







TECHNICAL CATALOUGE

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PINOPLAST

Multilayer Pipe



PINOPLAST MULTILAYER PIPES

PINOPLAST produce the multilayer pipe with a unique technique, the multilayer pipe has the same specifications as the single layer standard pipe and is produced according to the German standards DIN 8077&DIN 8078 and it confirms compliances with the English standard ISO 21003.

PINOPLAST multilayer piping system is intended to be used for hot and cold water installations inside buildings for the conveyance of water whether (or not) the water is intended for human consumption (domestic systems) or heating systems.

PURPOSES FOR PRODUCING THE MULTILAYER PIPES

ONE IMPORTANT PURPOSE For producing our multilayer pipe is to prove that we use a different technology in producing the pipes different from all the common techniques used in Egypt, and also to prevent copying of our products.

ANOTHER PURPOSE for producing the multilayer pipe is the ability to give the multilayer pipe a color; we produce it in 3 colors as follows:

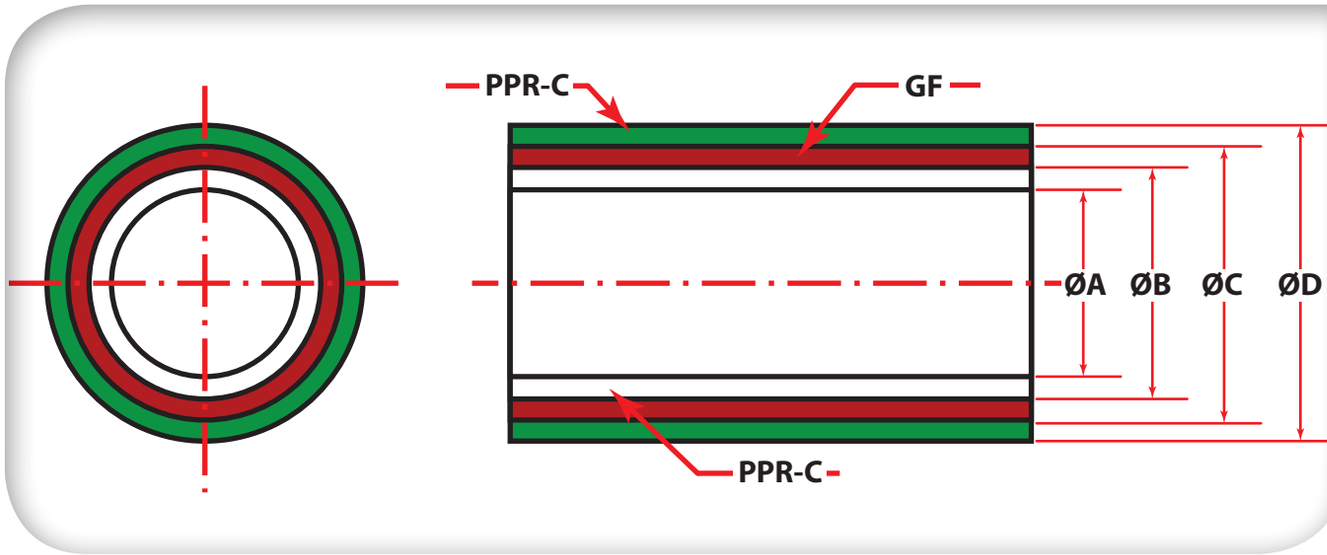
- **The outer layer is green.**
- **The middle layer is white.**
- **The inner layer is green.**

PINOPLAST multilayer pipes are available in 4 thicknesses depending on the pressure the pipe will be exposed to as shown on the products show.

PINOPLAST MULTILAYER PIPES

PINOPLAST GLASS FIBER REINFORCED PIPES

PPR-C GLASS FIBER Reinforced pipe is a multilayer pipe consists of three layers (PPR-C / GF / PPR-C) where the inner and outer layers are produced from PPR-C and the middle layer is produced from the special mixture of PPR-C and Glass fiber raw material of the properties shown on the below table.



PHYSICAL PROPERTIES

Property	Test method	Units	Mean value
Density at 23^{0}C	ISO 1183	g/cm^3	1.05
Melt mass flow rate MFR at 190^{0}C/ 5Kg	ISO 1133	g/10min.	0.9
Melt mass flow rate MFR at 230^{0}C/ 2.16Kg	ISO 1133	g/10min.	0.7
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 at 20^{0}C	Adiabatic calorim-eter	KJ/Kg.K	1.4
Heat deflection temperature at 0.45Mpa (HDT/B)	ISO 75-1,-2	^{0}C	135
Heat deflection temperature at 1.8Mpa (HDT/A)	ISO 75-1,-2	^{0}C	113
Vicat softening point, A120	ISO 306	^{0}C	141
Vicat softening point, B120	ISO 306	^{0}C	104
Coefficient of linear expansion, at 20^{0}C	VDE 0304	m/mk (k^{-1})	$0.5x10^{-4}$

MECHANICAL PROPERTIES

Property	Test method	Units	Mean value
Tensile modulus (1 mm/min.)	ISO 527-1,-2	M Pa	4000
Tensile stress at Yield (50 mm/min.)	ISO 527-1,-2	MPa	62
Tensile strain at yield (50 mm/min.)	ISO 527-1,-2	%	5
Tensile stress at break (50 mm/min.)	ISO 527-1,-2	MPa	60
Tensile strain at break (50 mm/min.)	ISO 527-1,-2	%	7
Charpy impact strength at 23^{0}C	ISO 179/1eU	KJ/m2	NB
Charpy impact strength at -20^{0}C	ISO 179/1eU	KJ/m2	70
Charpy impact strength notched at 23^{0}C	ISO 179/1eA	KJ/m2	17,5
Charpy impact strength notched at -20^{0}C	ISO 179/1eA	KJ/m2	9
Flexural modulus (2mm/min.)	ISO 178	MPa	3700
Hardness	ISO 2039-2	R scale	90

PINOPLAST *choose to produce pipes reinforced with glass fiber over to produce Aluminum foiled pipes because of the following reasons:*

1. **PINO**PLAST glassfiber reinforced pipes are Easier and faster in installation

2. **PINO**PLAST glassfiber reinforced pipe does not require peeling before welding operation so the welding time is less than welding aluminum foiled pipes as shown in the below comparison:

WELDING TIME COMPARISON:

- Comparison between the welding time of a Ø20mm PPR-C Glassfiber Reinforced Pipe and a Ø20mm Aluminium Foiled PP-R Pipe.
- Comparison was performed in a laboratorial environment.
- Calculations were based on 300 weldings made in an installation process of the plumbing system for a single apartment.
- Welding time of PPR-C Glassfiber Reinforced Pipe: 20.8 sec.
- Welding time of Aluminum Foiled PPR-C Pipe: 30.3 sec.
- Welding time advantage of **PINO**PLAST glassfiber reinforced pipe: 9.5 sec.
- Total time advantage for 300 weldings 2850 sec (47.5 min.).

3. **PINO**PLAST glassfiber reinforced pipes have a linear expansion coefficient which is close to those of Aluminum foiled pipes, they can be used in the same areas where aluminum foiled pipes are used.
   - Coefficient of **PINO**PLAST glassfiber reinforced pipe is: 0.05 mm/mk
   - Coefficient of PPR-C Aluminum Foil Pipe is: 0.030mm/mk

   Besides it is 75% less linear expansion than the standard PPR-C pipe

4. **PINO**PLAST glassfiber reinforced pipes have a lower heat transfer coefficient than those of Aluminum foiled pipes so thermal loss caused by Aluminum in foiled pipes does not occur in **PINO**PLAST glassfiber reinforced pipes.
   - heat transfer coefficient of **PINO**PLAST glassfiber reinforced pipes is: 1,10 W/MK
   - heat transfer coefficient of Aluminum foiled pipes is: 190 W/MK

5. Due to the difference in material properties between PPR-C and Aluminum, cracks might be occurring so the Aluminum foiled pipes can be broken faster.

6. Higher stiffness than the standard PPR-C pipe.

7. Does not sag when used for hot water transport so the number of fixed support points is reduced, thereby reducing the total cost of the project.

PINOPLAST **MULTILAYER PIPES**

PINOPLAST GLASSFIBER REINFORCED PIPE DIMENTIONS AT PN25

Nominal diameter		Average diameter		Wall thickness	Weight (kg/m)
(MM)	(INCH)	Min.	Max.		
20	1/2"	20	20.3	3.4	0.190
25	3/4"	25	25.3	4.2	0.294
32	1"	32	32.3	5.4	0.484
40	1.1/4"	40	40.4	6.7	0.751
50	1.1/2"	50	50.5	8.3	1.163
63	2"	63	63.6	10.5	1.858
75	2.1/2"	75	75.7	12.5	2.628
90	3"	90	90.9	15.0	3.792
110	4"	110	111	18.3	5.656

APPLICATION AREAS

- All kinds of hot and cold water installations.
- Industry.
- Compressed Air networks.
- Heating systems, radiator systems and air conditioning connections.
- Petrochemicals transportations.

LINEAR EXPANSION CALCULATION OF PINOPLAST REINFORCED PIPES

The coefficient of linear expansion for PPR-C REINFORCED PIPE is lower than that of the standard PPR-C pipe 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: 0.05MM/MK

Example:

For a pipe have Ø32mm, L_0=4m, **Δt** =50°C so **Δl** = 4 x 50 x 0.05 **Δl = 10mm**

LINEAR EXPANSION TABLE FOR PINOPLAST PPR-C REINFORCED PIPES

Pipe Length	Temprature Difference (°C)									
L(m)	10	20	30	40	50	60	70	80	90	100
1.0	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
3.0	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00
4.0	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00
5.0	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
6.0	3.00	6.00	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00
7.0	3.50	7.00	10.50	14.00	17.50	21.00	24.50	28.00	31.50	35.00
8.0	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00
9.0	4.50	9.00	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00
10.0	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
11.0	5.50	11.00	16.50	22.00	27.50	33.00	38.50	44.00	49.50	55.00
12.0	6.00	12.00	18.00	24.00	30.00	36.00	42.00	48.00	54.00	60.00
13.0	6.50	13.00	19.50	26.00	32.50	39.00	45.50	52.00	58.50	65.00
14.0	7.00	14.00	21.00	28.00	35.00	42.00	49.00	56.00	63.00	70.00

linear expansion (Δl) in mm

FREE EXPANSION CALCULATION IN PINOPLAST PPR-C REINFORCED PIPES

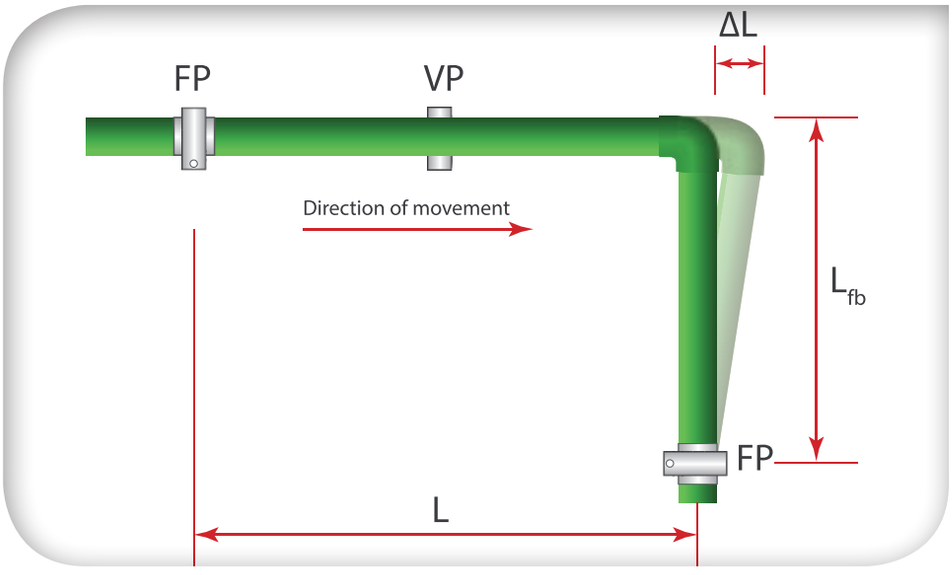
Linear expansion of PINOPLAST PPR-C reinforced pipe can be compensated by a change in direction so; free expansion parts are formed in order to prevent the installation from linear expansion which may arise in the pipes due to temperature variations.

The length of free bending part is calculated using the same manner used for **PINO**PLAST PPR-C standard pipe as follows noting that the only difference is that the amount of linear expansion in **PINO**PLAST reinforced pipe is much lower than that of the **PINO**PLAST PPR-C standard pipe:

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

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 REINFORCED PIPES

Example:

Consider a corner installation consists of a **PINO**PLAST PPR-C reinforced 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:

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

As for **PINO**PLAST reinforced pipe **α**= 0.05MM/MK

Δl = 4 x 40 x 0.05 = 8 mm

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,

$$L_{fb} = 20 \times \sqrt{8 \times 32}$$

L_{fb}= 320mm

LINEAR EXPANSION CURVE FOR PINOPLAST REINFORCED PIPES

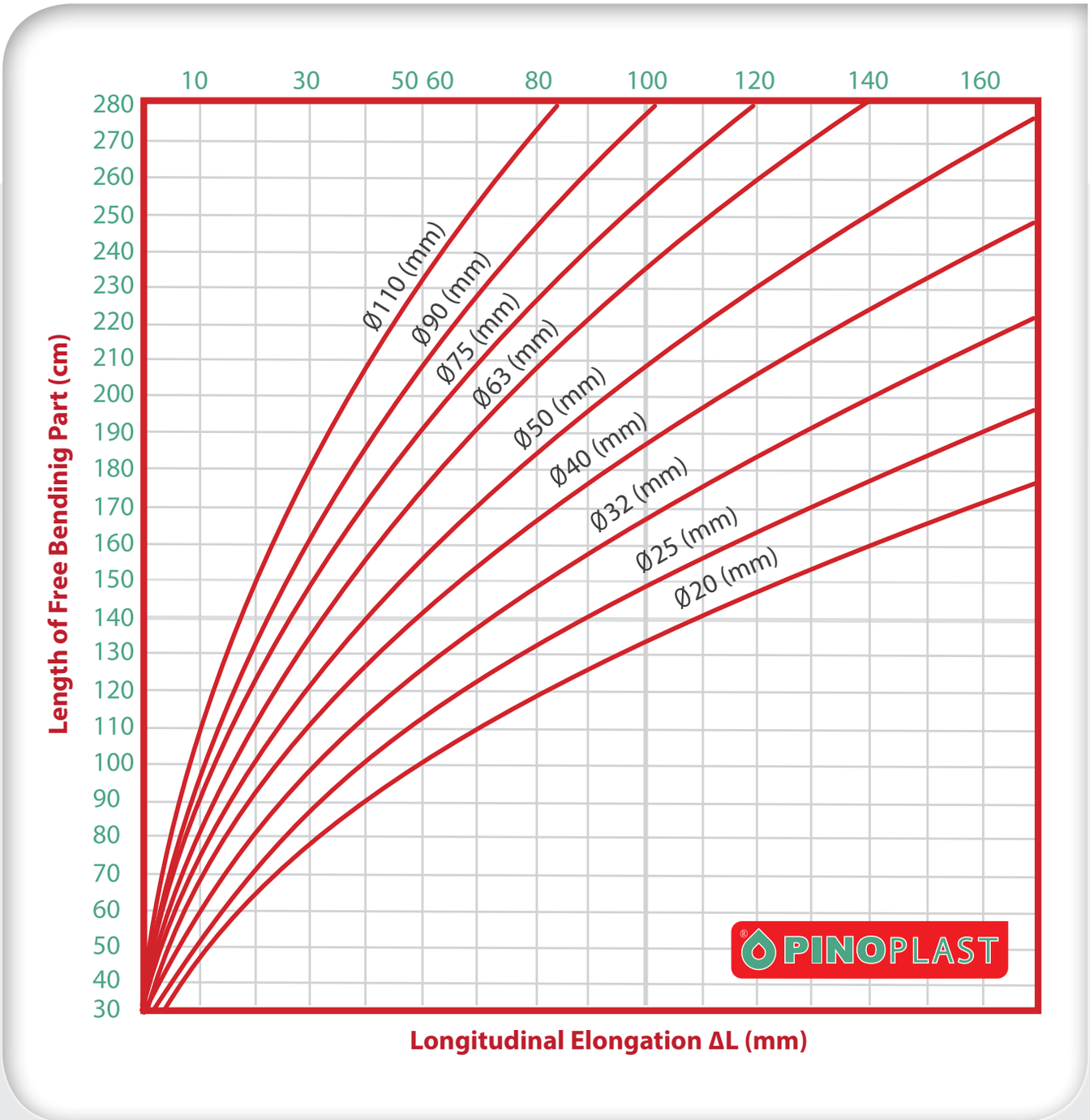


FIGURE (03)

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EXPANSION CHAMBERS IN PINOPLAST PPR-C REINFORCED PIPES

Same as in PINO PLAST PPR-C standard 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

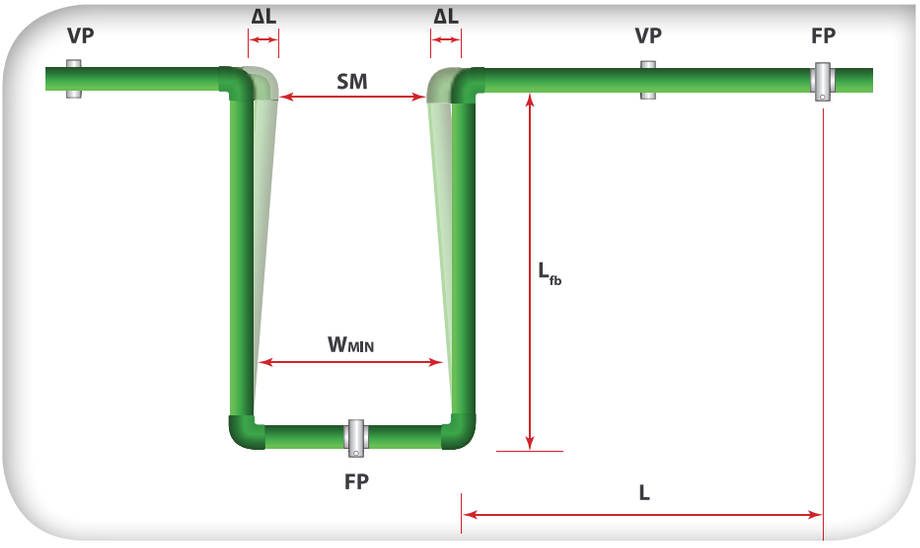
L_{fb} : length of free bending part in mm

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**= 20mm, then the minimum width of expansion chamber will be calculated as follows:

Wmin.= (2 x 20) + 150

Wmin.= 190mm

PINOPLAST PPR-C REINFORCED PIPES CLAMP SPACING

One advantage of PINO PLAST PPR-C reinforced pipe is that the linear expansion occurs in it is lower than that of the standard pipe so the number of fixed support points is consequently reduced as shown on the below table:

Temperature Difference (°C)	Pipe Diameter (mm)									
	16	20	25	32	40	50	63	75	90	110
0	110	115	130	150	135	185	215	240	280	280
20	80	90	100	115	130	145	165	185	200	215
30	80	90	100	115	130	145	165	185	200	210
40	70	80	90	105	120	135	155	175	190	200

NOTE:

- The values of clamp spacing listed in the previous table are for PN25.

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