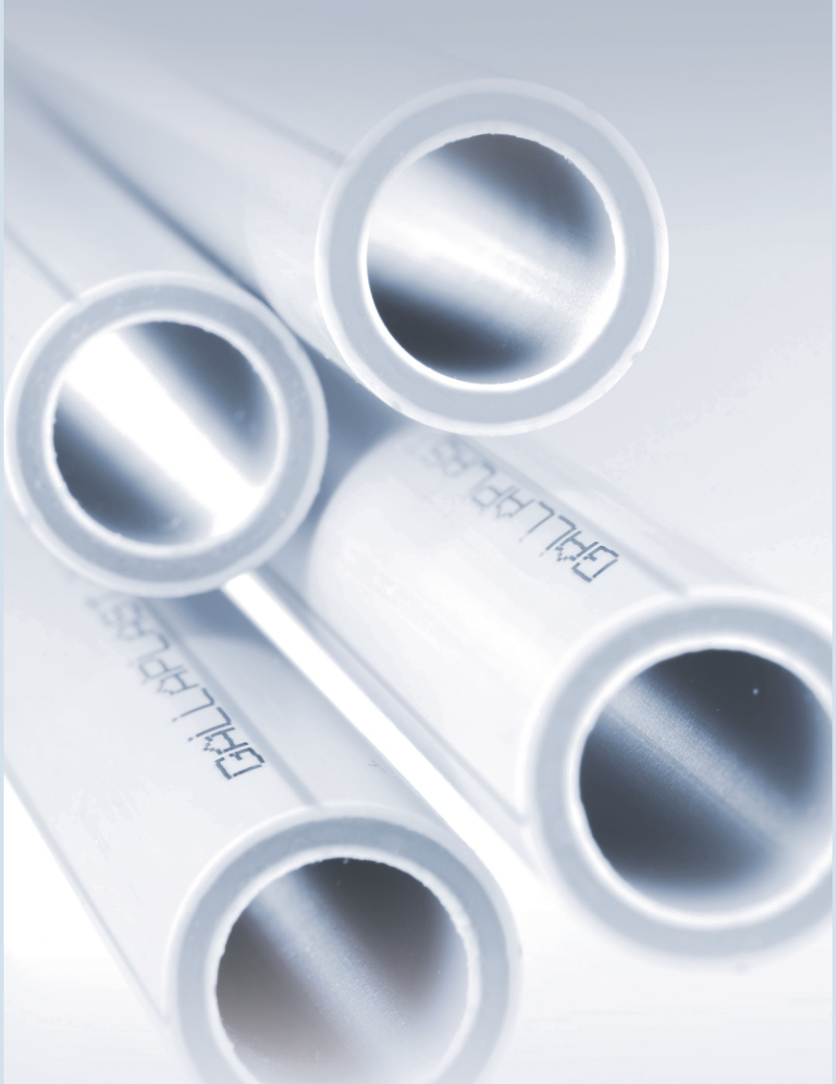
GALLAPLAST

PP-R PIPING SYSTEM

Gallaplast



RELIABLE SYSTEM FOR LONG YEARS

Gallaplast

PP-R PIPING SYSTEM

TECHNICAL INFORMATION

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CONTENT

Features of the system:

- Scope of use
- Advantages of the system
- Strength analysis of PP-R system
- Storage and transportation
- Warranty

Review of the products:

PP-R 100 Pipes (polypropilene type 3- RA130E)

- Gallaplast Standard Pipes Pn10/SDR11/S5
- Gallaplast Standard Pipes Pn16/SDR7,4/S3,2
- Gallaplast Standard Pipes Pn20/SDR6/S2,5
- Gallaplast STABI Pipes SDR7,4
- Gallaplast Fazer Pipes SDR7,4 with fiber-glass layer.

PP-RCT Pipes (thermostabilized polypropilene)

- Gallaplast Beta PPR Pipes SDR9/S4
- Gallaplast Beta PPR Pipes SDR7,4/S3,2
- Gallaplast-Beta Fazer Pipes SDR9/S4 with fiber-glass layer.
- Gallaplast-Beta Fazer Pipes SDR7,4/S3,2 with fiber-glass layer.
- Gallaplast-PPRCT Pipes SDR9/S4 in rolls for underfloor heating systems.
- Gallaplast-PPRCT Pipes SDR7,4/S3, in rolls for underfloor heating systems.

Fittings & Tools.

Welding technology:

- Welding machine preparation for work.
- Preparation of elements for connection.
- Contact socket welding by fusion.

Mounting and installation:

- Open mounting.
- Mounting in shafts and ducts.
- Under plasterwork mounting.
- Fastening technology.
- Calculations of linear expansion.
- Linear expansion compensation.

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INTRODUCTION

Steel pipes were used for internal piping systems of cold, hot water and heating systems. Long experience has shown that because of corrosion their lifespan is limited: only 10-15 years.

Corrosion products degrade water quality and clog the internal cavity tubes, reducing their bandwidth and degrade the valves and automatic control devices.

The company "GALLAPLAST" offers you the pipes and fittings of plastics for cold and hot water supply of buildings, as well as for air-conditioning and heating. Products are not subject to corrosion. Due to hygienic material properties GALLAPLAST pipeline system does not change the properties of water.

5 REASONS TO CHOOSE THE BENEFITS OF GALLAPLAST®

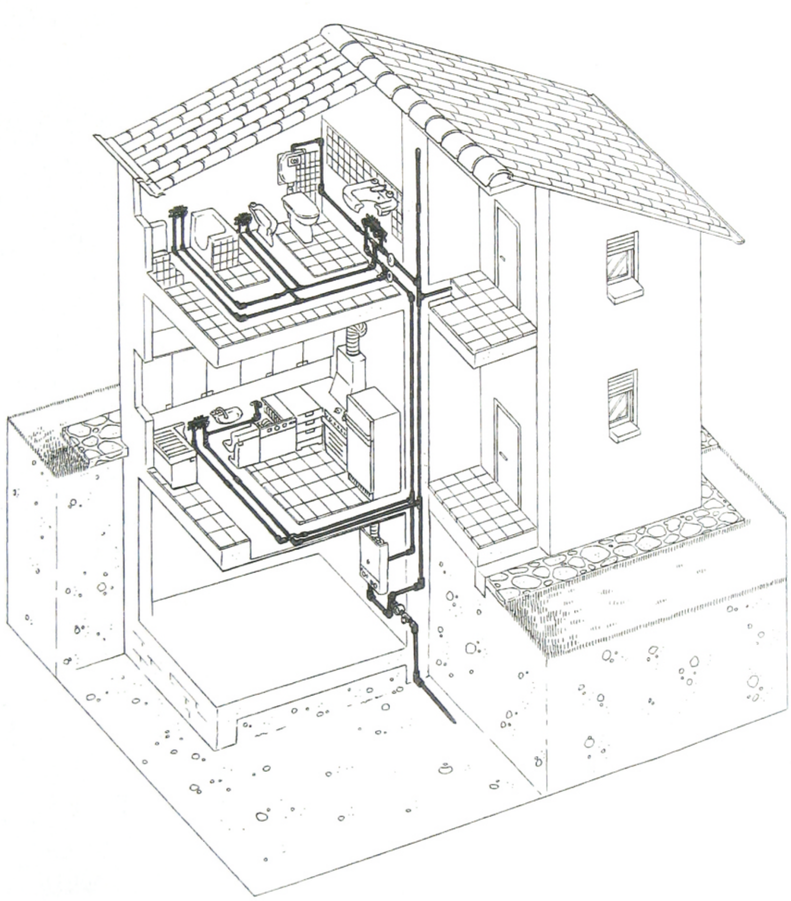
1. Using the latest technology - multilayer extrusion and innovative materials - heat stabilized polypropylene
2. Time for usage at least 50 years.
3. Reliability of the system even at a temperature of 110°C.
4. Guarantee on all products 15 years.
5. Products are insured for 500,000 EUROS.

FEATURES OF THE SYSTEM

SCOPE OF USE

On account of special physical and chemical properties of the materials, pipelines systems of GallaPlast have the most versatile application scope. Pressure pipe systems for water supply and heating are the most commonly used. Due to hygienic properties of the material, GallaPlast pipe systems do not alter potable water properties.

Potable water remains pure and potable!



As the material is able to withstand constant pressure and high temperature, these properties make it possible to widely use GallaPlast pipe system in heating systems.
Under long-duration exposure to constant temperature of 70°C, and depending on preset pressure, the design service life exceeds 50 years. Any peak overloading of temperature up to 110°C due to short-time troubles does not generate problems for GallaPlast pipe systems.

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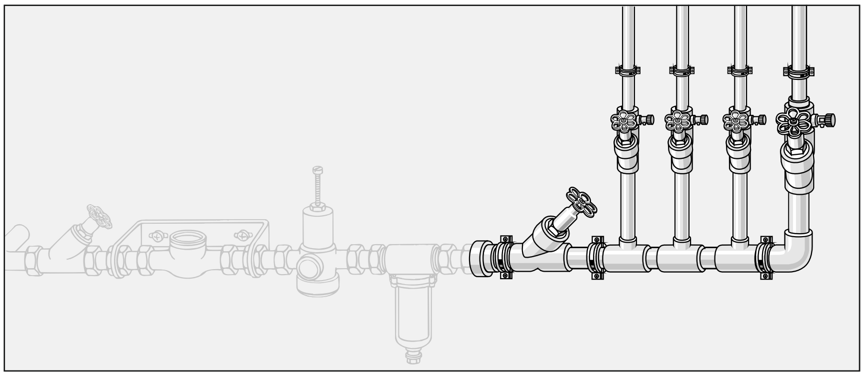
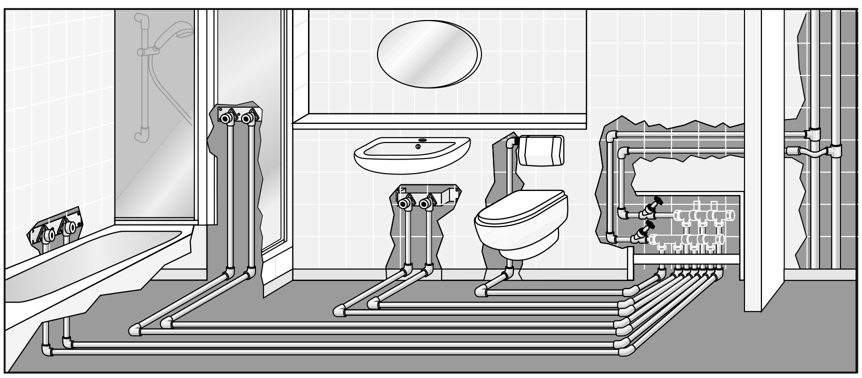
SCOPE OF USE

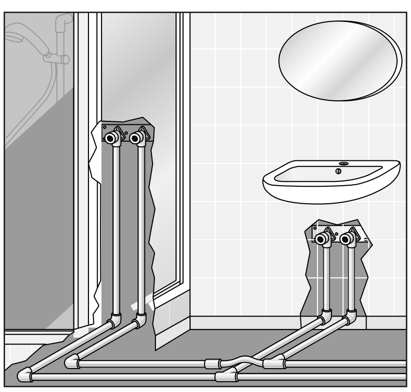
GALLAPLAST PPR piping system is used in construction as pressure pipelines for potable water, cold and hot water supply pipes in office and industrial buildings, schools, hotels, etc.



The system is intended for quick and qualitative installation and construction of cold and hot water supply main lines, as well as connecting to water treatment plants and water supply stations;



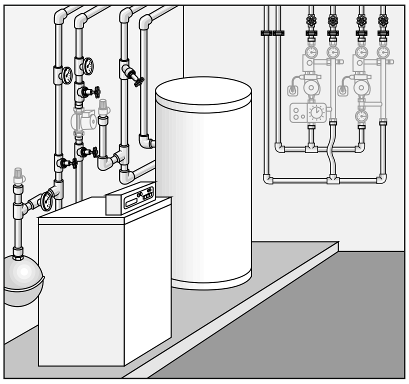
Connecting standpipes and providing floor-by-floor distribution lay-out.



Classical or collector connecting up to the final post to tap water, with laying the system under plaster or upon walls.

SCOPE OF USE

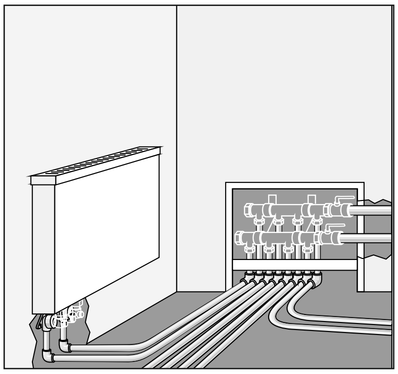
GALLAPLAST PPR piping system is intended for heat supply systems both in multi-storeyed buildings and cottages. It allows carrying out construction of radiator heat systems and ceiling heating, as well as floor heating systems. We recommend using STABI pipes reinforced with aluminium, or pipes reinforced with FAZER glass-filled layer. These types of pipes, due to their reinforced layers, have lower coefficient of thermal linear expansion. This allows increasing distances in-between spans, which saves fastening collars..

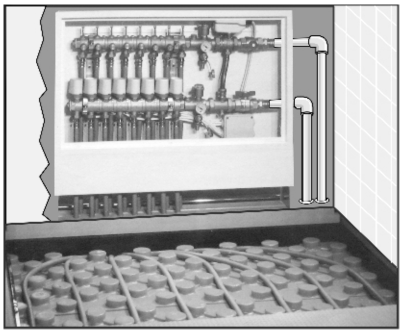


Connecting to the source of heat (heat supply station, separate heat supply unit, heating boiler or heat supply pumping unit).

Thanks to wide range of connection pieces, mounting of heating standpipes and main lines can be quick and reliable, as well as connecting radiators.

Connecting a radiator can be provided both for side or bottom feed.





The range of GALLAPLAST PPR products allows mounting heating circuits of floor heating systems.

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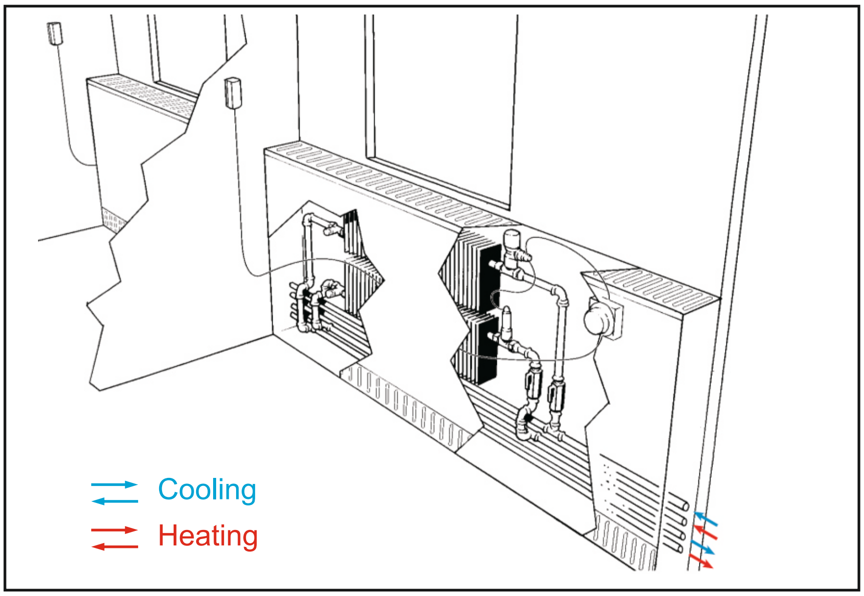
SCOPE OF USE

As to interior climate systems, which use heating and cooling supplied by ventilation units or elements, GALLAPLAST CLIMA pipes made of thermostabilized polypropylene are to be used, complete with GALLAPLAST fittings. .



GALLAPLAST PPR piping system can be used as pneumatic pipe lines, and also, to transport corrosive media, both in liquid and gaseous state. While designing process or industrial pipelines, it is necessary to take into consideration chemical stability, working temperature and pressure.

GallaPlast piping system allows quick, reliable and versatile mounting of pipes. This system can be used at any stage of construction work, for instance, to lay new pipes, to carry out repairs, or to execute rehabilitation or renovation activities. It is suitable for any type of mounting work: cut-and cover method, mounting under plaster, mounting in ducts and shafts, ductless underground laying, etc.

GallaPlast piping system, due to its wide variety of profiled parts, allows simple and reliable connecting to existing systems, which are made of other material.

ADVANTAGES OF THE SYSTEM

GallaPlast PPR piping system comprises all components which are required for mounting pipelines from main inlet gates or water meter to final post of tapping, and also, from heat supply unit to final radiator or heating elements.

GallaPlast PPR piping system, due to its wide variety of profiled parts, allows quick, simple and reliable connecting to existing systems, which are made of other material.

Mounting the system is simple and reliable. It does not require considerable labour and power costs. Technology of connecting is contact socket fusion or welding by means of special tools, and welded parts act as single pieces. This technology of welding the system parts ensures reliability, which allows carrying out pressure tests and putting lines into operation directly after welding.

Further to text marking, pipes have colour marking, to avoid confusing with pressure classes or range of application of pipes. Moreover, this essentially facilitates mounting.

GALLAPLAST PPR piping systems are not corrodible.

As compared with metal conduits or pipelines, GALLAPLAST PPR systems are less noisy in operation during water flowing.

GALLAPLAST PPR piping system saves heat energy. Thermal conductivity of this system comes to 0.24 W/mK, as compared to the same of steel coming to 74.4W/mK. Heat losses of GALLAPLAST PPR system are 310 times less as compared to steel pipelines.

GALLAPLAST PPR systems stop light, and therefore, there are no hazards for algae formation and encrustation.

Thanks to the combined use of GallaPlast Fazer and GallaPlast Stabi pipes, the system has additional advantages in relation to normal polypropylene pipes:

- reducing linear thermal expansion by 75%;
- throughput capacity is 20% higher due to reduced thickness of pipe walls under the same load capacity.

GALLAPLAST PPR piping systems contribute to better environment. The systems are made of material which is friendly to environment. Neither the manufacturing, nor recycling waste produces any matters which are harmful to environment. .

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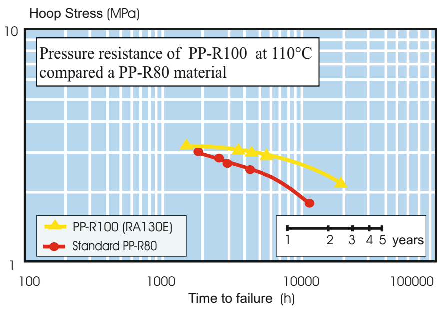
ADVANTAGES OF THE SYSTEM

Pipes GALLAPLAST STANDARD - Pn10; Pn16; Pn20; STABI, FAZER, and fittings are manufactured from a material PP-R 100, which according to its strength characteristics is superior to standard polypropylene PP-R 80.



PP-R 100

	Borealis RA130E MPa	Ref. curve DIN 8078 MPa	Ref. curve prEN ISO 15874-2 MPa
20°C - 50 years	10.10	9.71	9.71
70°C - 51 years	3.25	3.20	3.20
95°C - 3 years	2.73	2.22	2.22
110°C - 1 year	2.25	1.90	1.90

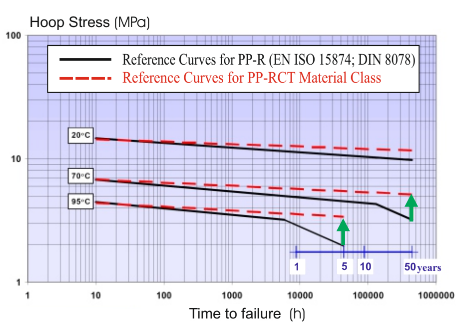
Table 1: Extrapolated strength values of Borealis RA130E according to Bodycote Polymer´s extrapolation analysis

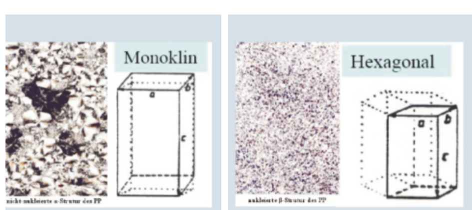
Material PP-R100 is characterized by higher values of the maximum operating pressure in the temperature range from 20 to 110 °C. This means that the pipeline system GALLAPLAST ® which is made of this material will be more durable than the pipeline system made of standard polypropylene PP-R80.

When operating at high temperatures of 95 °C - 110 °C, the lifetime of the pipeline system GALLAPLAST ®, will be 25-30 % longer than that of a similar system, made of standard polypropylene PP-R 80.

Using advanced technology and innovative multilayer extrusion material company GALLAPLAST has since 2009 launched a multi-layer pipes Beta PP-R and Beta FAZER of heat stabilized polypropylene PP-RCT.

Due to the unique physical and mechanical properties of the new material products have high thermal stability and high throughput. High thermal stability of the material PP-RCT is achieved thanks to a new crystal lattice - Hexagonal (b-structure), which has additional molecular bond, it can enable the material - heat stabilized polypropylene maintain their strength under the influence of constant pressure and temperature for the entire period of operation.





P-R crystallizes in the monoclinic form (α-structure)

•PP-RCT crystallizes predominantly in the hexagonal form (β-structure)

STRENGTH ANALYSIS OF PP-R SYSTEM

For comparison, we perform the calculation of the operating pressures for pipes SDR 7, 4 of materials:

a) heat stabilized polypropylene PP-RCT
b) the standard polypropylene PP-R

To perform this calculation to determine the S-series of tubes.

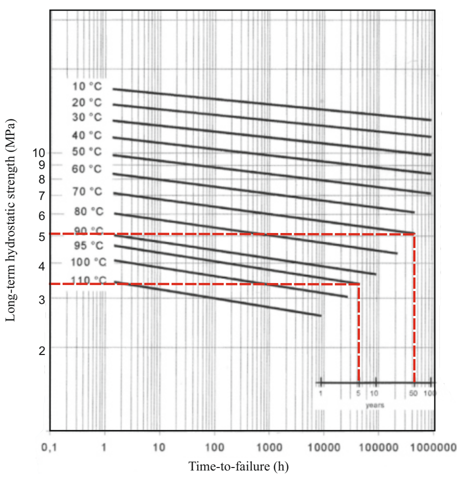
$$S = \frac{d_n - e_n}{2e_n}$$

where: d_n - nominal outside diameter, in millimeters
e_n - nominal wall thickness, in millimeters

For example, we calculate the S-series of pipe with diameter D32, wall thickness 4.4 mm.

$$S = \frac{32 - 4{,}4}{2*4{,}4} = 3{,}2$$

We define the long-term hydrostatic strength for pipe S3, 2



For material PPRCT (heat stabilized polypropylene)

Operating temperature: 70°C
Period of usage: 50 years
Hydrostatic strenght in the pipe wall: 5, 1 Mpa
Operating pressure:

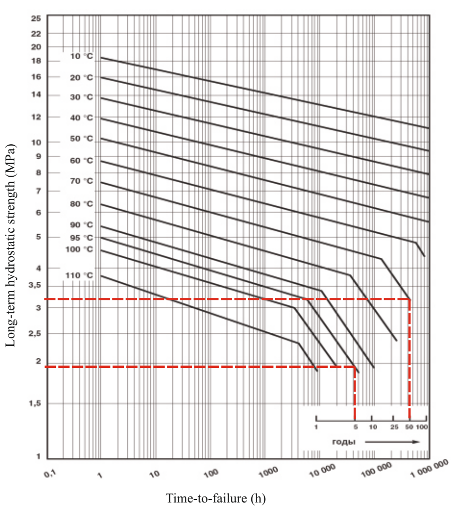
$$P_0 = \frac{\text{HYDROSTATIC STRENGTH}}{\text{S - PIPE SERIES}} = \frac{5{,}1 \text{ Mpa}}{3{,}2} = 1{,}59\,\text{Mpa} = 15{,}9\,\text{Bar}$$

$P_{oper.(with\ safety\ factor\ -1.3)} = 15{,}9 / 1{,}3 = 12$ Bar

Operating temperature: 95°C
Period of usage: 5 years
Hydrostatic strenght in the pipe wall: 3,4 Mpa
Operating pressure:

$$P_0 = \frac{\text{HYDROSTATIC STRENGTH}}{\text{S - PIPE SERIES}} = \frac{3{,}4 \text{ Mpa}}{3{,}2} = 1{,}06\,\text{Mpa} = 10{,}6\,\text{Bar}$$

$P_{oper.(with\ safety\ factor\ -1.3)} = 10{,}6 / 1{,}3 = 8$ Bar



For material PP-R (standard polypropylene)

Operating temperature: 70°C
Period of usage: 50 years
Hydrostatic strenght in the pipe wall: 3,15 Mpa
Operating pressure:

$$P_0 = \frac{\text{HYDROSTATIC STRENGTH}}{\text{S - PIPE SERIES}} = \frac{3{,}15 \text{ Mpa}}{3{,}2} = 0{,}98\,\text{Mpa} = 9{,}8\,\text{Bar}$$

$P_{oper.(with\ safety\ factor\ -1.3)} = 9{,}8 / 1{,}3 = 7$ Bar

Operating temperature: 95°C
Period of usage: 5 years
Hydrostatic strenght in the pipe wall: 1,9 Mpa
Operating pressure:

$$P_0 = \frac{\text{HYDROSTATIC STRENGTH}}{\text{S - PIPE SERIES}} = \frac{1{,}9 \text{ Mpa}}{3{,}2} = 0{,}59\,\text{Mpa} = 5{,}9\,\text{Bar}$$

$P_{oper.(with\ safety\ factor\ -1.3)} = 5{,}9 / 1{,}3 = 4{,}5$ Bar

Seen from the calculations - pipes SDR7, 4/S3, 2 of heat stabilized polypropylene at an operating temperature of 70 °C to 95 °C is 1.7 times stronger than similar pipes from standard polypropylene.

STRENGTH ANALYSIS OF PP-R SYSTEM

SYSTEM LIFE PERIOD, OPERATING TEMPERATURE AND PRESSURE LIMITS, ACCORDING TO ISO 15874 APPLICATION CLASS.

ISO 15874 standard classifies, according to different conditions, all the water and heating systems to following classes:

Application class	Design temperature $T_{(oper.)}$ C°	Time at $T_{(oper.)}$ years	$T_{(max.)}$ C°	Time at $T_{(max.)}$ years	$T_{(mal.)}$ C°	Time at $T_{(mal.)}$ h	*Typical field of application*
1	60	49	80	1	95	100	Hot water supply (60°C)
2	70	49	80	1	95	100	Hot water supply (70°C)
3	30 40	20 25	50	4,5	65	100	Low Underfloor Heating
4	20 40 60	2,5 20 25	70	2,5	100	100	High Underfloor Heating and Low Temperature Radiators
5	20 60 80	14 25 10	90	1	100	100	High Temperature Radiators
XB	20	50	--	--	--	--	Cool water supply

Table 1

As shown in Table 1, the standard identified six main conditions:

Application class 1 - the condition of pipelines in hot water at a constant operating temperature of 60 °C (*Toper.*). For this class of service provided by the annual increase in the operating temperature of 80 °C (*Tmax.*) for a period of 175 hours for the rehabilitation of water supply system, and also allow a short-term increase in operating temperature up to 95 °C (*T mal.*) for up to 100 hours in case of emergency
Total lifetime *Toper.+Tmax.+Tmal.* - 50 years.

Application class 2 - the condition of pipelines in hot water at a constant operating temperature of 70 °C (*Toper.*). For this class of service provided by the annual increase in the operating temperature of 80 °C (*Tmax.*) for a period of 175 hours for the rehabilitation of water supply system, and also allow a short-term increase in operating temperature up to 95 °C (*T mal.*) for up to 100 hours in case of emergency
Total lifetime *Toper.+Tmax.+Tmal.* - 50 years.

Application class 3 - the condition of pipelines in low temperature floor heating systems. In this class the application of polypropylene piping is not recommended due to the low thermal conductivity of the material.

Application class 4 - the condition of pipelines in high-temperature floor heating systems or low-temperature radiator heating. In this class the heating system operates in a temperature range where the maximum flow temperature up to 70 °C (*Tmax.*). Short-term increase of the working temperature to 100 °C (*T mal.*) is possible for up to 100 hours in case of emergency.
Total lifetime *Toper.+Tmax.+Tmal.* - 50 years.

STRENGTH ANALYSIS OF PP-R SYSTEM

Application class 5 - the condition of pipelines in high-temperature radiator heating systems. In this class the heating system operates in a temperature range where the maximum flow temperature of 90 °C (*Tmax*). Short-term increase of the working temperature to 100 °C (*Tmal*) is possible for up to 100 hours in case of emergency.
Total lifetime *Toper.*+*Tmax.*+*Tmal.* - 50 years.

Application class XB - the condition of pipelines in cold water. Period is 50 years.

MAXIMALLY ALLOWED WORKING PRESSURE FOR EACH CLASS OF OPERATION DEPENDING ON THE TYPE OF THE PIPELINE FROM POLYPROPYLENE PP-R (Type 3)

During operation tension will appear due to external pressure in the walls and fittings of pipes. In connection with this standard introduced the concept - S series, which allows you to quickly select the right type of pipe, depending on the operating pressure and operating conditions.
For single-walled tubes S series is calculated by the following formula:

$$S= \frac{d_n - e_n}{2e_n}$$

d_n - nominal outside diameter, in millimeters
e_n - nominal wall thickness, in millimeters
For multilayer composite pipes (STABI and FAZER) this formula does not apply.

Pipes GALLAPLAST® of material PP-R (Type3) have the following series of S:

STANDARD PIPE Pn10 / SDR11	-	series S 5
STANDARD PIPE Pn16 / SDR7,4	-	series S 3,2
STANDARD PIPE Pn20 / SDR6	-	series S 2,5
Combined PIPE STABI SDR7,4	-	match the series S 2,5
Combined PIPE FAZER SDR7,4	-	match the series S 3,2

Using Table 2, you can quickly determine the type of pipe for a given pressure and class exploitation. To do this, meet the following conditions:

Series **S pipe** ≤ calculated pipe value series **S max**, shown in Table 2.

The working pressure Bar	Application Classes				Cold Water Supply
	Class 1	Class 2	Class 4	Class 5	
	calculated pipe value series **S max**				
4	6,9	5,3	6,9	4,8	6,9
6	5,2	3,6	5,5	3,2	
8	3,9	2,7	4,1	2,4	
10	3,1	2,1	3,3	1,9	

Table 2.

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STRENGTH ANALYSIS OF PP-R SYSTEM

MAXIMALLY ALLOWED WORKING PRESSURE FOR EACH CLASS OF OPERATION DEPENDING ON THE TYPE OF THE PIPELINE FROM HEAT STABILIZED POLYPROPYLENE PP-RST

Pipe GALLAPLAST® of material PP-RCT have the following series of S:

Beta PPR PIPE SDR9 - series S 4
Beta PPR PIPE SDR7,4 - series S 3,2
Combined PIPE Beta FAZER SDR9 - series S 4
Combined PIPE Beta FAZER SDR7,4 - series S 3,2

Using Table 3, you can quickly determine the type of pipe for a given pressure and class exploitation. To do this, meet the following conditions:

Series **S pipe** ≤ calculated pipe value series **S max**, shown in Table 3.

The working pressure Bar	Application Classes				Cold Water Supply
	Class 1	Class 2	Class 4	Class 5	
	calculated pipe value series **S max**				
4	8,2	8,2	8,2	7,3	8,2
6	6,1	5,7	6,1	4,8	
8	4,5	4,3	4,5	3,6	
10	3,6	3,4	3,7	2,9	

Table № 3.

EXAMPLE:

The task: You have to choose the type of pipeline for hot water system in apartment building.

Specifications:

1. The service life of the pipeline at least 50 years.
2. Operating class 1 - hot water at a constant operating temperature of 60°C (see Table 1)
3. Operating Pressure - 8 Bar.

a) If the building is made of tubes made of the material PP-R (Type3), then according to Table 2 we choose a series S max for class of exploitation 2 with pressure 8 Bar. (S max = 3, 9)

Choose the type of pipe that meets the following condition:
series **S pipe** ≤ calculated pipe value series **S max:**

These requirements meet the pipe grades:
- STANDARD PIPE Pn20 / SDR6/S 2,5
- Combined pipe STABI SDR7,4/S 2,5
- Combined pipe FAZER SDR7,4/ S 3,2

All of the above tubes correspond to the condition: S series Pipe ≤ 3,9

b) If the building is made of tubes made of the material PP-RCT, then according to Table 3 we choose the series S max for class of exploitation 1 with pressure 8 Bar. (S max = 4, 5)

These requirements meet the pipe grades:
- Beta PPR PIPE SDR9/S 4
- Beta PPR PIPE SDR7,4/S 3,2
- Combined pipe Beta FAZER SDR9/ S 4
- Combined pipe Beta FAZER SDR7,4/ S 3,2

All of the above tubes correspond to the condition: S series Pipe ≤ 4,5

STRENGTH ANALYSIS OF PP-R SYSTEM

CALCULATION THE LIFETIME OF THE PIPELINE, IF THE OPERATING PRESSURE DIFFERS FROM THE STANDARD REQUIREMENTS WHEN CHOOSING THE PIPELINE.

This method allows to calculate the service life of a pipeline, if the conditions are violated, where a series of tubes S > Account series S max, specified in the standard.

Task 1: You need to calculate the service life of the pipeline material PP-R brand Standard Pn20 / SDR6, 0 - Series S 2,5 for Class 2 operation (hot water at a constant temperature of 70 C), with an operating pressure - 10 Bar or 1MPa:

1. According to Table 1 of this class of operation established the following temperature conditions during 50 years:
Toper. = T_1 = 70 °C - 49 years, i.e. the effect of the temperature during the all years is ***a_1 = 98 %***;
Tmax. = T_2 = 80 °C - 1 year, i.e. ***a_2 = 2 %***;
Tmal. = T_3 = 95 °C - 100 hours, i.e. ***a_3 = 0,0228 %***

2. Determine the calculated stress in the pipe wall from the following expression:
δ_0 = Poperating pressure (MPa) x S (series of pipe) = 1,0 x 2,5 = 2,5 MPa

3. The factor of safety at temperatures *Toper., Tmax., Tmal.,* according to this standard : C_1 = 1,5; C_2 = 1,3; C_3 = 1

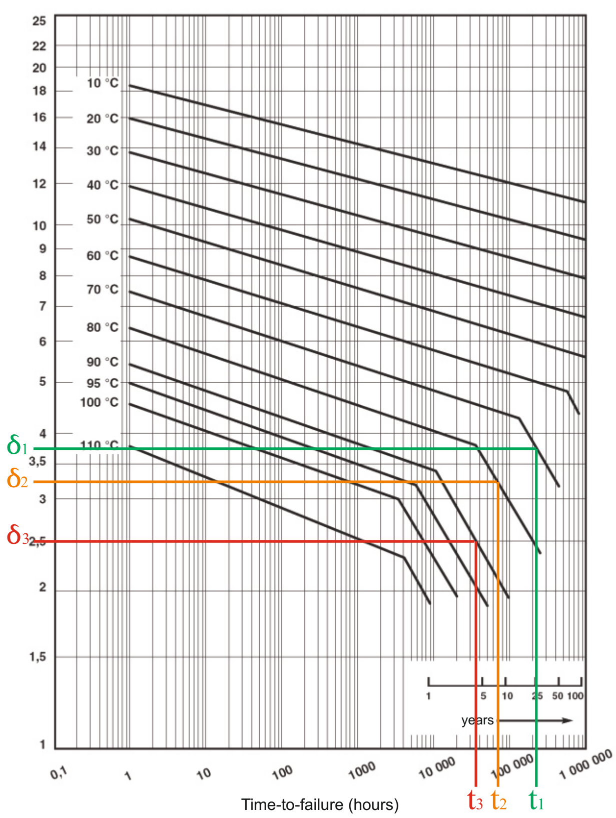
4. Determine the calculated stress in the pipe wall with the action the safety factor.

$$\delta_1 = C_1 \times \delta_0 = 1{,}5 \times 2{,}5 = 3{,}75 \text{ MPa}$$
$$\delta_2 = C_4 \times \delta_0 = 1{,}3 \times 2{,}5 = 3{,}25 \text{ MPa}$$
$$\delta_3 = C_5 \times \delta_0 = 1{,}0 \times 2{,}5 = 2{,}5 \text{ MPa}$$

5. Using the graph of the isotherm for the material strength PP-R determine the time t_1, t_2, t_3, where the pipe can withstand without collapsing under the continuous action of each of the individual temperatures and stress in the wall of $\delta_1, \delta_2, \delta_3$.
t_1 = 230 000 hours, t_2 = 75 000 hours, t_3 = 46 000 hours

6. Further, it comes from the rule of Miner that if the time to failure of the pipe is t_l (years) under the continuous action of temperature T_1, then the ratio $1/t_1$ – this is a "level of damages" attributable to a year in continuous operation under this temperature. If the action of the temperature throughout the year is continuous and reaches a_1, the "share of annual damage" is a_1/t_1.

Long-term hydrostatic strength of PP-R



δ_0 Mpa	δ_1 Mpa	t_1 hours	a_1 %	a_1/t_1 %/hours	δ_2 Mpa	t_2 hours	a_2 %	a_2/t_2 %/hours	δ_3 Mpa	t_3 hours	a_3 %	a_3/t_3 %/hours	$\Sigma a_i/t_i$ %/hours
2,5	3,75	$2{,}3 \cdot 10^5$	97,98	$4{,}26 \cdot 10^{-4}$	3,25	$7{,}5 \cdot 10^4$	2	$2{,}66 \cdot 10^{-5}$	2,5	$4{,}6 \cdot 10^4$	0,0228	$4{,}96 \cdot 10^{-7}$	$4{,}53 \cdot 10^{-4}$

The total damage TYD (%) is defined with formula:

$$TYD = \Sigma\, a_i/t_i$$

The service life of the pipeline in the given conditions of use *Tx*, is the inverse of TYD and it makes in hours:

$$Tx = 100/TYD = 100 / 4{,}53 \cdot 10^{-4} = 220\,671 \text{ hours} = 25.2 \text{ years}$$

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STRENGTH ANALYSIS OF PP-R SYSTEM

CALCULATION THE LIFETIME OF THE PIPELINE, IF THE OPERATING PRESSURE DIFFERS FROM THE STANDARD REQUIREMENTS WHEN CHOOSING THE PIPELINE.

Task 2: You need to calculate the service life of the pipeline material PP-RST brand Beta FAZER SDR7, 4 - Series S 3,2 for class range 5 (high heat) with a working pressure - 9 Bar or 0,9MPa.

1. According to Table 1 of this class of operation established the following temperature conditions during 50 years:

$T_{oper1} = T_1 = 20$ °C - 14 years, i.e. the effect of the temperature during the years is $\boldsymbol{a_1 = 28}$ ***%***;
$T_{oper2} = T_2 = 60$ °C - 25 years, i.e. $\boldsymbol{a_2 = 50}$ ***%***;
$T_{oper3} = T_3 = 80$ °C - 10 years, i.e. $\boldsymbol{a_3 = 20}$ ***%***;
$T_{max.} = T_4 = 90$ °C - 1 year, i.e. $\boldsymbol{a_4 = 2}$ ***%***;
$T_{mal.} = T_5 = 100$ °C - 100 hours, i.e. $\boldsymbol{a_5 = 0{,}0228}$ ***%***

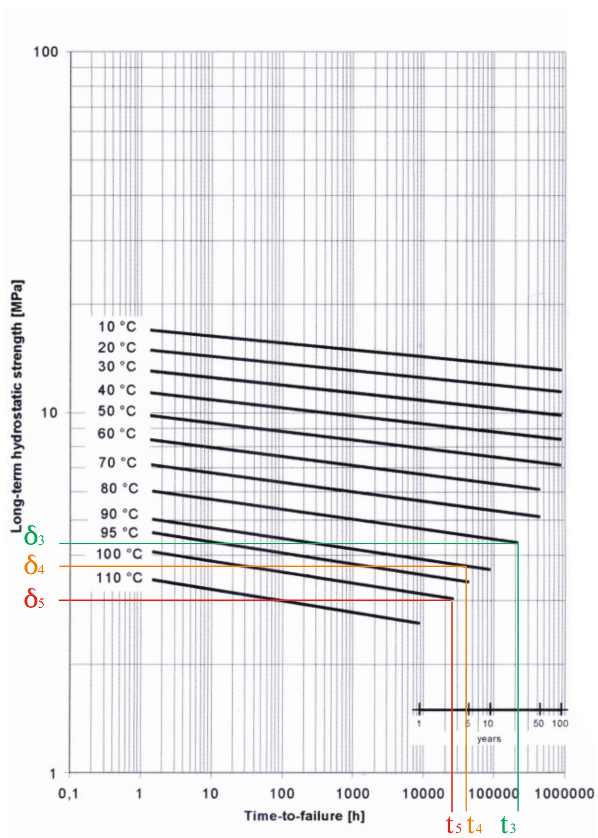
2. Determine the calculated stress in the pipe wall from the following expression:
$\delta_0 =$ P$_{\text{operating pressure (MPa)}}$ x S $_{\text{(series of pipe)}}$ = 0,9 x 3,2 = 2,88 MPa

3. The factor of safety at temperatures *Toper., Tmax., Tmal.,* according to this standard: $C_{1\text{-}3} = 1{,}5$; $C_4 = 1{,}3$; $C_5 = 1$

4. Determine the calculated stress in the pipe wall with the action the safety factor.

$$\delta_{1\text{-}3} = C_{1\text{-}3} \times \delta_0 = 1{,}5 \times 2{,}88 = 4{,}32 \text{ MPa}$$
$$\delta_4 = C_4 \times \delta_0 = 1{,}3 \times 2{,}88 = 3{,}74 \text{ MPa}$$
$$\delta_5 = C_5 \times \delta_0 = 1{,}0 \times 2{,}88 = 2{,}88 \text{ MPa}$$

5. Using the graph of the isotherm for the material strength PP-RST determine the time t_1, t_2, t_3, t_4, t_5, where the pipe can withstand without collapsing under the continuous action of each of the individual temperatures and stress in the wall of $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5$. t_1>10000000 hours, t_2>10000000 (h.), t_3=210000 (h.), t_4=40000 (h), t_5=25000 (h).



6. Further, it comes from the rule of Miner that if the time to failure of the pipe is t_l (years) under the continuous action of temperature T_l, then the ratio $1/t_1$ - this is a "level of damages" attributable to a year in continuous operation under this temperature. If the action of the temperature throughout the year is continuous and reaches a_1, the "share of annual damage" is a_1/t_1.

t_1 hours	a_1 %	a_1/t_1 %/hours	t_2 hours	a_2 %	a_2/t_2 %/hours	t_3 hours	a_3 %	a_3/t_3 %/hours	t_4 hours	a_4 %	a_4/t_4 %/hours	t_5 hours	a_5 %	a_5/t_5 %/hours	$\Sigma a_i/t_i$ %/hours
$1*10^6$	28	$2{,}8*10^{-5}$	$1*10^6$	50	$5*10^{-5}$	$2{,}1*10^5$	20	$9{,}5*10^{-5}$	$4*10^4$	2	$5*10^{-5}$	$25*10^3$	0,0228	$9*10^{-7}$	$22{,}4*10^{-5}$

The total damage TYD (%) is defined with formula :

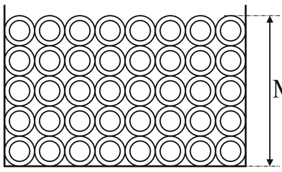
$$\text{TYD} = \Sigma\, a_i/t_i$$

The service life of the pipeline in the given conditions of use *Tx*, is the inverse of TYD and it makes in hours:

$$Tx = 100/\,TYD = 100 \,/\, 22{,}4*10^{-5} = 446129 \text{ hours} = 51 \text{ years}$$

STORAGE AND TRANSPORTATION

GALLAPLAST pipes may be stored at any ambient outside temperature. Places for storing are to be chosen so that pipes can be placed the full length of these pipes. Pipes shall not be placed with uneven loading on one side. Prevent bending the pipes. Pipes shall not be placed on sharp supports during their storing or transportation.



Maximum height of stacking the pipes shall not exceed ONE metre. However, when special pallet racks are used, the above limitation is not valid.

At sub-zero temperatures, hazards of damages may arise due to heavy shocks. Therefore, the material shall be handled with care at ambient low temperatures.

Plastic profiled parts shall be stored in plastic bags, on pallets, or in bulk in cardboard boxes, containers or baskets, etc.

During handling or transportation, it is prohibited to drag pipes on ground or deck surface of transport vehicle.
It is prohibited to drop a load of pipes off the deck surface onto ground.

While handling and carrying pipes to a construction site, it is necessary to protect pipes from any mechanical damage. At the site, pipes are to be placed on proper base; pipes are to be safeguarded against any contamination, or solvents, as well as direct impacts of heat or mechanical damages.

All GALLAPLAST items are supplied in protective polyethylene packing..

WARRANTY

GALLAPLAST piping system is covered by 15-year warranty. The warranty is valid under conditions of proper operation, compliance with proper rules of engineering, installation, storage and transportation.

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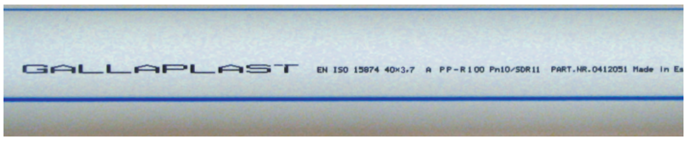
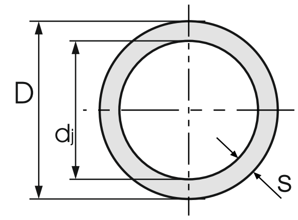
GALLAPLAST ® STANDARD PIPE Pn10/ SDR11/ S5





Characteristic of pipes:

material	:	PP-R100 (TYP-3)
pressure class	:	Pn 10
series	:	SDR11 / S5
standard	:	EN ISO 15874
colour	:	light-grey, green, white
colour marking	:	four (4) blue stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold potable water;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for water supply to swimming pools;
- pipeline networks for water basins;
- pipelines for agricultural and garden purposes;

Working pressure at 50 years of operation:

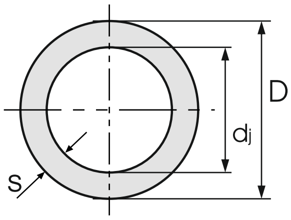
The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	–	+
6	+	–	+	–	
8	–	–	–	–	
10	–	–	–	–	

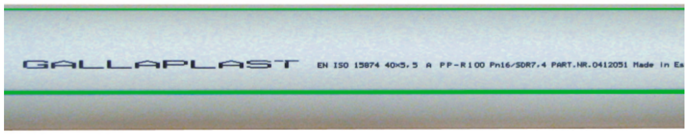
(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
01020	20	1,9	16,2	100	0,107	15
01025	25	2,3	20,4	100	0,163	20
01032	32	2,9	26,2	60	0,259	25
01040	40	3,7	32,6	40	0,412	32
01050	50	4,6	40,8	24	0,639	40
01063	63	5,8	51,4	16	1,010	50
01075	75	6,8	61,4	12	1,410	50
01090	90	8,2	73,6	8	2,022	65
01110	110	10,0	90,0	4	3,000	80

GALLAPLAST ® STANDARD PIPE Pn16/ SDR7,4/ S3,2





Characteristic of pipes:

material	:	PP-R100 (TYP-3)
pressure class	:	Pn 16
series	:	SDR7.4 / S3.2
standard	:	EN ISO 15874
colour	:	light-grey, green, white
colour marking	:	four (4) green stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- pipeline networks for water supply to swimming pools

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	–	+	–	
10	–	–	+	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
02016	16	2,2	11,6	200	0,095	12
02020	20	2,8	14,4	100	0,148	15
02025	25	3,5	18,0	100	0,231	20
02032	32	4,4	23,2	60	0,371	25
02040	40	5,5	29,0	40	0,578	
02050	50	6,9	36,2	24	0,901	32
02063	63	8,6	45,8	16	1,417	40
02075	75	10,3	54,4	12	2,018	50
02090	90	12,3	65,4	8	2,863	65
02110	110	15,1	79,8	4	4,288	80

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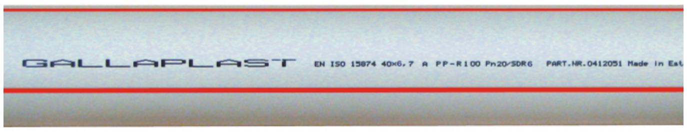
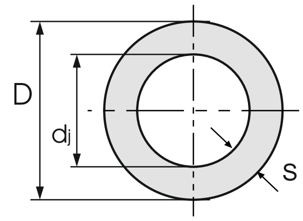
GALLAPLAST ® STANDARD PIPE Pn20/ SDR6/ S2,5





Characteristic of pipes:

material	:	PP-R100 (TYP-3)
pressure class	:	Pn 20
series	:	SDR6 / S2,5
standard	:	EN ISO 15874
colour	:	light-grey, green, white
colour marking	:	four (4) red stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

Working pressure at 50 years of operation:

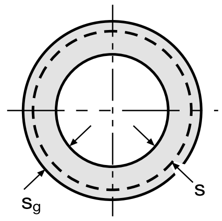
The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	–	
10	+	–	+	–	

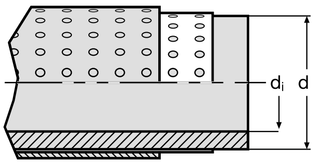
(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
03016	16	2,7	10,6	200	0,110	10
03020	20	3,4	13,2	100	0,173	12
03025	25	4,2	16,6	100	0,267	15
03032	32	5,4	21,2	60	0,436	20
03040	40	6,7	26,6	40	0,675	25
03050	50	8,3	33,4	24	1,048	32
03063	63	10,5	42,0	16	1,663	40
03075	75	12,5	50,0	12	2,330	50
03090	90	15,0	60,0	8	3,353	
03110	110	18,3	73,4	4	5,004	65

GALLAPLAST STABI PIPE SDR7,4





Characteristic of pipes:

Pipes with low coefficient of linear expansion.

material	:	PP-R100/AL/PP-R100
series	:	SDR7.4
standard	:	EN ISO 15874
colour	:	light-grey, green, white
colour marking	:	without any stripes
pipe length	:	4 m

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	–	
10	+	–	+	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL Nominal S (mm)	Total Sq (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
04020	20	2,8	3,6	14,4	100	0,219	15
04025	25	3,5	4,4	18,0	100	0,322	20
04032	32	4,5	5,4	23,0	60	0,499	25
04040	40	5,6	6,6	28,8	40	0,739	25
04050	50	6,9	7,9	36,2	24	1,095	32
04063	63	8,7	9,7	45,6	16	1,677	40
04075	75	10,4	11,4	54,2	12	2,320	50

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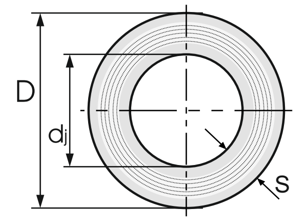
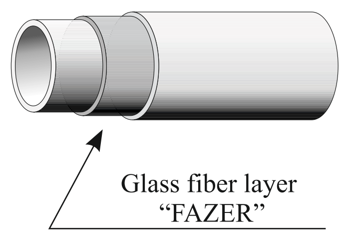
GALLAPLAST® FAZER PIPE SDR7,4



Characteristic of pipes:

Pipes with low coefficient of linear expansion - thanks to the fiberglass reinforced middle layer.

material	:	PP-R100/PPR-GF/PP-R100
series	:	SDR7.4
standard	:	EN ISO 15874
colour	:	light-grey, green, white
colour marking	:	four (4) dark-grey stripes
pipe length	:	4 m
bar code	:	yes



Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

ADVANTAGES:

PROFITABLE PRICE

QUICK INSTALLATION
(do not require cleaning cover layer)

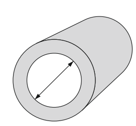
LOW EXPANSION

standard pipe	- 0,15 mm/mC°
FAZER pipe	- 0,04 mm/mC°
STABI pipe	- 0,03 mm/mC°

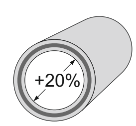
HIGH STABILITY

INCREASED FLOW

(By reducing the wall thickness of the pipe, the capacity of flow is 20% while maintaining the same load capacity)



STANDARD PIPE Pn20



GALLAPLAST FAZER PIPE

Working pressure at 50 years of operation:

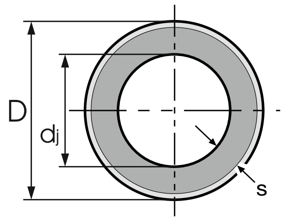
The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	–	
10	+	–	+	–	

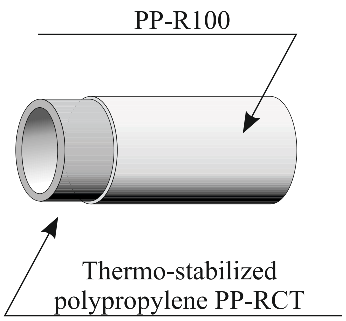
(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER d_j (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
06020	20	2,8	14,4	100	0,148	15
06025	25	3,5	18,0	100	0,230	20
06032	32	4,4	23,2	60	0,380	25
06040	40	5,5	29,0	40	0,582	25
06050	50	6,9	36,2	24	0,896	32
06063	63	8,6	45,8	16	1,430	40
06075	75	10,3	54,4	12	2,045	50
06090	90	12,3	65,4	8	2,920	65

GALLAPLAST ® BetaPPR PIPE SDR 9/ S4





Characteristic of pipes:

Thermo-stabilized polypropylene pipes with high capacity.

material	:	PP-RCT/PP-R100
series	:	SDR9/S4
standard	:	EN ISO 15874, SKZ HR3.34
colour	:	light-grey, green, white
colour marking	:	four (4) black stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

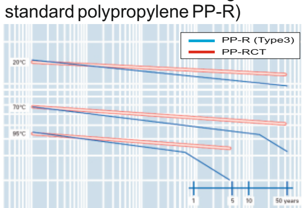
ADVANTAGES:

✓ **PROFITABLE PRICE**

✓ **LIGHT WEIGHT**

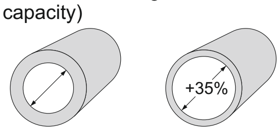
✓ **INCREASED RESISTANCE TO PRESSURE AND HIGH THERMAL STABILITY**

(through the use of innovative technologies, the new material, thermo-stabilized polypropylene PP-RCT is 1.7 times stronger than standard polypropylene PP-R)



✓ **INCREASED FLOW**

(By reducing the wall thickness of the pipe, the capacity of flow is 35% while maintaining the same load capacity)



STANDARD PIPE Pn20 — GALLAPLAST Beta PPR SDR9

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	–	
10	–	–	–	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
03120	20	2,3	15,4	100	0,129	15
03125	25	2,8	19,2	100	0,193	20
03132	32	3,6	24,6	60	0,317	25
03140	40	4,5	31,0	40	0,494	32
03150	50	5,6	38,6	24	0,765	40
03163	63	7,1	48,8	16	1,220	50
03175	75	8,4	58,2	12	1,700	50
03190	90	10,1	69,8	8	2,450	65

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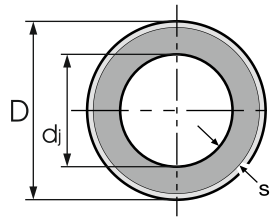
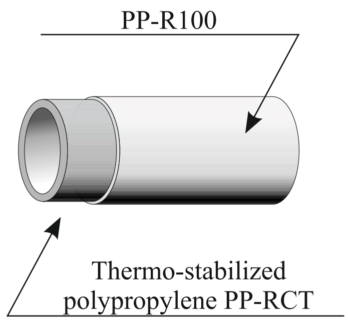
GALLAPLAST ® Beta PPR PIPE SDR 7,4/ S3,2





Characteristic of pipes:

Thermo-stabilized polypropylene pipes with high capacity.

material	:	PP-RCT/PP-R100
series	:	SDR7,4/S3,2
standard	:	EN ISO 15874, SKZ HR3.34
colour	:	light-grey, green, white
colour marking	:	without any stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	+	
10	+	+	+	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

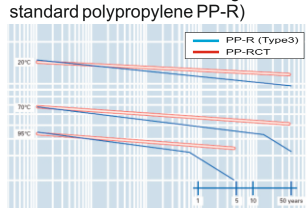
ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
07016	16	2,2	11,6	200	0,098	12
07020	20	2,8	14,4	100	0,152	15
07025	25	3,5	18,0	100	0,237	20
07032	32	4,4	23,2	60	0,380	25
07040	40	5,5	29,0	40	0,590	32
07050	50	6,9	36,2	24	0,919	32
07063	63	8,6	45,8	16	1,443	40
07075	75	10,3	54,4	12	2,020	50
07090	90	12,3	65,4	8	2,900	65

ADVANTAGES:

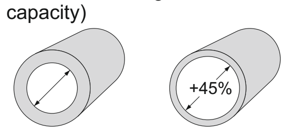
PROFITABLE PRICE

LIGHT WEIGHT

INCREASED RESISTANCE TO PRESSURE AND HIGH THERMAL STABILITY
(through the use of innovative technologies, the new material, thermo-stabilized polypropylene PP-RCT is 1.7 times stronger than standard polypropylene PP-R)

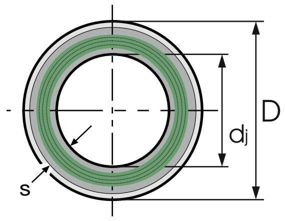


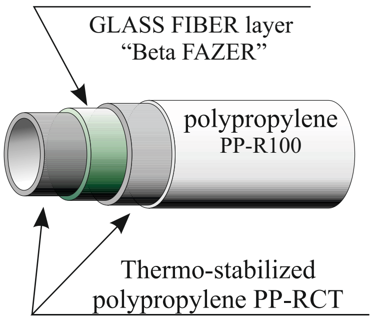
INCREASED FLOW
(By reducing the wall thickness of the pipe, the capacity of flow is 45% while maintaining the same load capacity)



STANDARD PIPE Pn25 | GALLAPLAST Beta PPR SDR7,4

GALLAPLAST ® Beta FAZER PIPE SDR 9/ S4





Characteristic of pipes:

Thermo-stabilized polypropylene pipes with high capacity and low coefficient of linear expansion.

material	:	PP-RCT/ PPRCTGF/ PP-RCT/ PP-R100
series	:	SDR9/S4
standard	:	EN ISO 15874, SKZ HR3.34
colour	:	light-grey, green, white
colour marking	:	without any stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

ADVANTAGES:

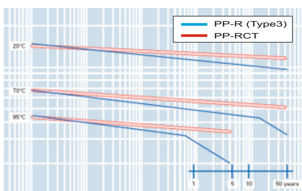
✔ **PROFITABLE PRICE**

✔ **QUICK INSTALLATION**
(do not require cleaning cover layer)

✔ **LOW EXPANSION**

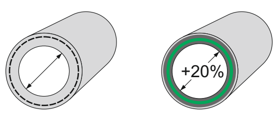
standard pipe	- 0,15 mm/mC°
Beta FAZER	- 0,04 mm/mC°
STABI pipe	- 0,03 mm/mC°

✔ **INCREASED RESISTANCE TO PRESSURE AND HIGH THERMAL STABILITY**
(through the use of innovative technologies, the new material, thermo-stabilized polypropylene PP-RCT is 1.7 times stronger than standard polypropylene PP-R)



✔ **INCREASED FLOW**

(By reducing the wall thickness of the pipe, the capacity of flow is 20% while maintaining the same load capacity)



STABI PIPE
FAZER PIPE

GALLAPLAST
Beta FAZER SDR9

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	–	
10	–	–	–	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER d_j (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
09020	20	2,3	15,4	100	0,133	15
09025	25	2,8	19,2	100	0,200	20
09032	32	3,6	24,6	60	0,320	25
09040	40	4,5	31,0	40	0,490	32
09050	50	5,6	38,6	24	0,765	40
09063	63	7,1	48,8	16	1,197	50
09075	75	8,4	58,2	12	1,767	50
09090	90	10,1	69,8	8	2,548	65

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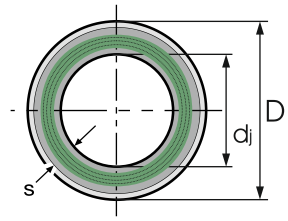
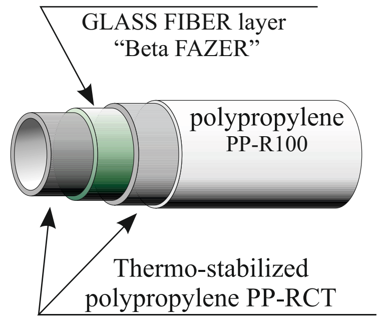
GALLAPLAST ® Beta FAZER PIPE SDR 7,4/ S3,2





Characteristic of pipes:

Thermo-stabilized polypropylene pipes with high capacity and low coefficient of linear expansion.

material	:	PP-RCT/ PPRCTGF/ PP-RCT/ PP-R100
series	:	SDR7,4/S3,2
standard	:	EN ISO 15874, SKZ HR3.34
colour	:	light-grey, green, white
colour marking	:	without any stripes
pipe length	:	4 m
bar code	:	yes

Scope:

- pressure pipelines for cold and hot potable water;
- low and high-temperature radiator heating;
- process industrial pipelines for corrosive media, for chemical resistance and required operating temperature and pressure;
- pipeline networks for connection to heat pumps;
- connections to heating stations and distribution units

Working pressure at 50 years of operation:

The working pressure Bar	Application Classes				
	Hot Water Supply		Radiator heating		Cold Water Supply
	Class 1(60°C)	Class 2(70°C)	Class 4	Class 5	
4	+	+	+	+	+
6	+	+	+	+	
8	+	+	+	+	
10	+	+	+	–	

(+) applied
(–) not recommended or required a recalculation of life cycle

Pipe technical specifications :

ITEM. № 4M	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER dj (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
10020	20	2,8	14,4	100	0,155	15
10025	25	3,5	18,0	100	0,237	20
10032	32	4,4	23,2	60	0,375	25
10040	40	5,5	29,0	40	0,574	32
10050	50	6,9	36,2	24	0,890	40
10063	63	8,6	45,8	16	1,390	40
10075	75	10,3	54,4	12	2,070	50
10090	90	12,3	65,4	8	3,050	65

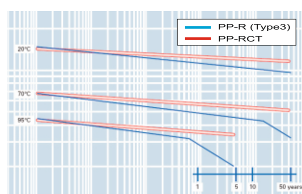
ADVANTAGES:

PROFITABLE PRICE

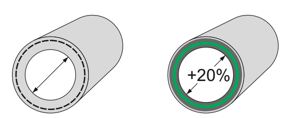
QUICK INSTALLATION
(do not require cleaning cover layer)

LOW EXPANSION
standard pipe - 0,15 mm/mC°
Beta FAZER - 0,04 mm/mC°
STABI pipe - 0,03 mm/mC°

INCREASED RESISTANCE TO PRESSURE AND HIGH THERMAL STABILITY
(through the use of innovative technologies, the new material, thermo-stabilized polypropylene PP-RCT is 1.7 times stronger than standard polypropylene PP-R)



INCREASED FLOW
(By reducing the wall thickness of the pipe, the capacity of flow is 20% while maintaining the same load capacity)



STABI PIPE Pn25 — GALLAPLAST Beta FAZER SDR7,4

REVIEW OF PRODUCTS

PIPES IN ROLLS

GALLAPLAST ® Beta PPR PIPE SDR 11/ S5

Thermo-stabilized polypropylene pipes with high capacity.

material : PP-RCT
series : SDR7,4/S3,2
standard : EN ISO 15874, SKZ HR3.34
colour : dark-grey

Scope:

- for underfloor heating and low temperature radiators heat systems class application 4 ($T_{oper.max}$ = 70°C, T_{mal} = 100°C, $P_{oper.max}$ = 7Bar);
- for high-temperature radiator heating systems class application 5 ($T_{oper.max}$ = 90°C, T_{mal} = 100°C, $P_{oper.max}$ = 5.8Bar);
- pressure pipelines for cold potable water (10Bar) and hot potable water ($T_{oper.max}$ = 70°C, $P_{oper.max}$ = 6Bar).
  connections of traditional type, and also, header piping lay-out.

Pipe technical specifications :

ITEM. №	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER d_j (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
11016	16	1,8	12,0	100	0,080	12
11017	16	1,8	12,0	200	0,080	12
11020	20	1,8	16,0	100	0,105	15
11021	20	1,8	16,0	200	0,105	15

GALLAPLAST ® Beta PPR PIPE SDR 7,4/ S3,2

Thermo-stabilized polypropylene pipes with high capacity.

material : PP-RCT
series : DR7,4 / S3,2
standard : EN ISO 15874, SKZ 3.34, Гост Р 52134
colour : dark-grey

Scope::

- pressure pipelines for cold potable water (10Bar) and hot potable water ($T_{oper.max}$ = 70°C, $P_{oper.max}$ = 10Bar).
- for radiator heating systems (flow pipes to radiators) ($T_{oper.max}$ = 90°C, $P_{oper.max}$ = 8Bar; T_{mal} = 110°C)
- connections of traditional type, and also, header piping lay-out.

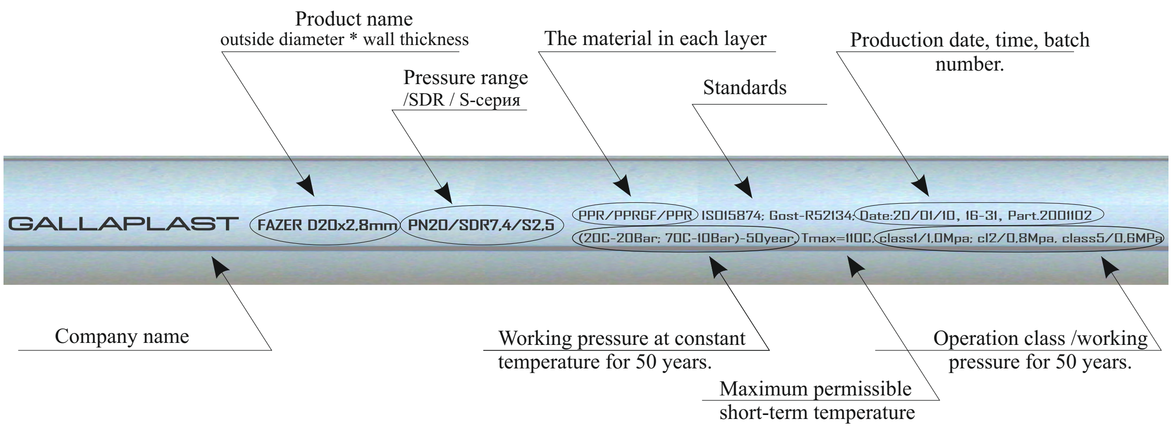
Pipe technical specifications:

ITEM. №	SIZE D (mm)	PIPE WALL S (mm)	INSIDE DIAMETER d_j (mm)	PACKING (meters)	WEIGHT (kg/m)	DN
12016	16	2,2	11,6	100	0,092	12
12017	16	2,2	11,6	200	0,092	12
12020	20	2,8	14,4	100	0,144	15
12021	20	2,8	14,4	200	0,144	15

GALLAPLAST® pipes comparative chart

Product name	Pipes of material PP-R 100					Thermo-stabilized polypropylene pipes PP-RCT					
	STANDARD Pn10/SDR11/S5	STANDARD Pn16/SDR7,4/S3,2	STANDARD Pn20/SDR6/S2,5	FAZER SDR7,4/S3,2	STABI SDR7,4/S2,5	Beta PPR SDR9/ S4	Beta PPR SDR7,4/ S3,2	Beta FAZER SDR9/ S4	Beta FAZER SDR7,4/ S3,2	Beta PPR SDR11/ S5 (in rolls)	Beta PPR SDR7,4/ S3,2 (in rolls)
Maximum permitted pressure (Bar) with strength reserve factor K = 1.25											
Constant temperature (20 ° C) for 50 years	16	25	32	25	30	**23**	**28**	**23**	**28**	**18**	**28**
Constant temperature (70 ° C) for 50 years	5	8	10	8	10	**10**	**12,7**	**10**	**12,7**	**8**	**12,7**
Maximum permitted pressure (Bar) for different operation classes											
Hot water supply (60°C) application class - 1 life period 50 years	6	9,5	12	10	12	**9**	**11**	**9**	**11**	**7**	**11**
Hot water supply (70°C) application class - 2 life period 50 years	4	6,5	8,5	6,5	8,5	**8,5**	**10**	**8,5**	**10**	**6,8**	**10**
High Underfloor Heating application class - 4 life period 50 years	6,5	10	13	10	13	**9**	**11**	**9**	**11**	**7**	**11**
High Temperature Radiators application class - 5 life period 50 years	3,8	5	7	5	7	**7**	**9**	**7**	**9**	**5**	**9**
Basic parameters											
Coefficient of Thermal Expansion (mm/mC°)	0,15	0,15	0,15	0,04	0,03	**0,15**	**0,15**	**0,04**	**0,04**	**0,15**	**0,15**
Installation conditions											

Pipes marking:



GALLAPLAST ® FITTINGS

COMPENSATION PIECE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
16016	16	10	0,09
16020	20	10	0,12
16025	25	10	0,25
16032	32	10	0,47
16040	40	5	0,89

OVERBRINGE-BOW

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
17016	16	50	0,04
17020	20	50	0,06
17025	25	50	0,09
17032	32	20	0,17
17040	40	10	0,25

90° ELBOW

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
18016	16	200	0,01
18020	20	200	0,02
18025	25	100	0,02
18032	32	50	0,05
18040	40	25	0,08
18050	50	10	0,14
18063	63	5	0,29
18075	75	5	0,44
18090	90	2	0,78
18110	110	1	1,41

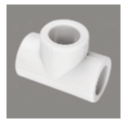
45° ELBOW

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
19016	16	200	0,01
19020	20	200	0,02
19025	25	100	0,02
19032	32	50	0,03
19040	40	25	0,05
19050	50	10	0,10
19063	63	5	0,22
19075	75	5	0,34
19090	90	2	0,56
19110	110	1	1,00

90° ELBOW MALE-FEMALE

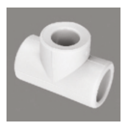
ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
20016	16	200	0,01
20020	20	200	0,02
20025	25	100	0,03
20032	32	50	0,05

TE PIECE



ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
22016	16	200	0,01
22020	20	100	0,02
22025	25	100	0,03
22032	32	50	0,06
22040	40	25	0,08
22050	50	10	0,17
22063	63	5	0,35
22075	75	5	0,50
22090	90	2	1,00
22110	110	1	1,72

INEQUAL TE PIECE



ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
232016	20-16-20	200	0,02
232516	25-16-25	100	0,04
232520	25-20-25	100	0,04
233216	32-16-32	100	0,04
233220	32-20-32	50	0,05
233225	32-25-32	50	0,07
234020	40-20-40	25	0,08
234025	40-25-40	25	0,08
234032	40-32-40	25	0,09
235020	50-20-50	10	0,14
235025	50-25-50	10	0,13
235032	50-32-50	10	0,15
235040	50-40-50	10	0,14
236320	63-20-63	5	0,33
236325	63-25-63	5	0,33
236332	63-32-63	5	0,32
236340	63-40-63	5	0,35
236350	63-50-63	5	0,39
237525	75-25-75	5	0,39
237532	75-32-75	5	0,40
237540	75-40-75	5	0,43
237550	75-50-75	5	0,41
237563	75-63-75	5	0,44
239050	90-50-90	2	0,70
239063	90-63-90	2	0,79
239075	90-75-90	2	0,85
239163	110-63-110	1	1,67
239175	110-75-110	1	1,63
239190	110-90-110	1	1,65

45° ELBOW MALE-FEMALE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
21016	16	200	0,01
21020	20	200	0,02
21025	25	100	0,02
21032	32	50	0,03

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GALLAPLAST ® FITTINGS

SOCKET

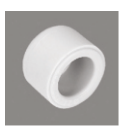
ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
24016	16	200	0,01
24020	20	200	0,02
24025	25	100	0,02
24032	32	50	0,03
24040	40	25	0,04
24050	50	10	0,08
24063	63	5	0,15
24075	75	5	0,21
24090	90	2	0,32
24110	110	2	0,59

REDUCER

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
252016	20-16	200	0,01
252516	25-16	200	0,01
252520	25-20	200	0,01
253220	32-20	50	0,02
253225	32-25	50	0,02
254020	40-20	25	0,02
254025	40-25	25	0,02
254032	40-32	25	0,03
255032	50-32	10	0,04
255040	50-40	10	0,05
256340	63-40	5	0,08
256350	63-50	5	0,11
257540	75-40	5	0,10
257550	75-50	5	0,11
257563	75-63	5	0,15
259050	90-50	5	0,17
259063	90-63	2	0,16
259075	90-75	2	0,19
259110	110-90	1	0,21

BLANKING CAP

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
26016	16	200	0,01
26020	20	200	0,01
26025	25	100	0,01
26032	32	50	0,02
26040	40	25	0,04
26050	50	10	0,06
26063	63	5	0,12
26075	75	5	0,17
26090	90	2	0,32



MALE THREATED END PLUG

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
4401	½" red	200	0,007
4402	½" blue	200	0,007
4403	½" grey	200	0,006
44004	¾" grey	200	0,01

FEMALE THREATED ADAPTOR

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
27016	16 × ½"	50	0,04
270201	20 × ½"	50	0,05
270202	20 × ¾"	50	0,07
270251	25 × ½"	50	0,05
270252	25 × ¾"	50	0,08
270321	32 × ¾"	25	0,14
270322	32 × 1"	25	0,12
27040	40 × 1¼"	15	0,21
27050	50 × 1½"	10	0,45
27063	63 × 2"	5	0,78
27075	75 × 2½"	5	1,22
27090	90 × 3"	2	1,98

MALE THREATED ADAPTOR

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
28016	16 × ½"	50	0,06
280201	20 × ½"	50	0,05
280202	20 × ¾"	50	0,09
280251	25 × ½"	50	0,06
280252	25 × ¾"	50	0,09
280253	25 × 1"	50	0,12
280321	32 × ¾"	25	0,18
280322	32 × 1"	25	0,15
28040	40 × 1¼"	15	0,21
28050	50 × 1½"	10	0,46
28063	63 × 2"	5	0,69
28075	75 × 2½"	5	1,02
28090	90 × 3"	2	1,53

FEMALE THREATED ELBOW 90° TE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
29016	16 × ½"	50	0,06
290201	20 × ½"	50	0,05
290202	20 × ¾"	50	0,10
290251	25 × ½"	50	0,06
290252	25 × ¾"	50	0,10
290321	32 × ¾"	50	0,09

MALE THREATED ELBOW 90° TE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
30016	16 × ½"	50	0,07
300201	20 × ½"	50	0,07
300202	20 × ¾"	50	0,08
300251	25 × ½"	50	0,08
300252	25 × ¾"	50	0,09
300321	32 × ¾"	50	0,11
300322	32 × 1"	50	0,14

GALLAPLAST ® FITTINGS

MALE THREATED TE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
31016	16 × ½" × 16	50	0,07
310201	20 × ½" × 20	50	0,07
310202	20 × ¾" × 20	50	0,08
310251	25 × ½" × 25	50	0,08
310252	25 × ¾" × 25	50	0,09
310321	32 × ¾" × 32	50	0,11
310322	32 × 1" × 32	50	0,14

FEMALE THREATED TE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
32016	16 × ½" × 16	50	0,07
320201	20 × ½" × 20	50	0,07
320202	20 × ¾" × 20	50	0,08
320251	25 × ½" × 25	50	0,08
320252	25 × ¾" × 25	50	0,09
320321	32 × ¾" × 32	50	0,11
320322	32 × 1" × 32	50	0,14

TAB CONNECTING

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
33016	16 × ½"	50	0,07
330201	20 × ½"	50	0,06
330251	25 × ½"	50	0,07
330252	25 × ¾"	50	0,10

WALL COMPLET

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
34020	20 × ½"	1	0,23

MALE THREATED ADAPTOR WITH NUT

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
35020	**20 × ½"**	**50**	**0,09**
35025	**25 × ¾"**	**50**	**0,14**
35032	**32 × 1"**	**25**	**0,24**

FEMALE THREATED ADAPTOR WITH NUT

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
36020	20 × ½"	50	0,06
36025	25 × ¾"	50	0,11
36032	32 × 1"	25	0,24

SOCKET WITH NUT

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
37016	16 × ½"	100	0,02
37017	16 × ¾"	100	0,03
37020	20 × ¾"	100	0,04
37025	25 × 1"	100	0,06
37032	32 × 1¼"	25	0,08

COUPLING JOINT ADAPTER

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
380161	16 × ½"	50	0,03
380162	16 × ¾"	50	0,04
380201	20 × ½"	50	0,04
380202	20 × ¾"	25	0,05
380251	25 × ¾"	25	0,06
380252	25 × 1"	25	0,08
380321	32 × 1"	25	0,11
380322	32 × 1¼"	25	0,11

REMOVABLE JOINT

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
39020	20	50	0,06
39025	25	50	0,10
39032	32	50	0,21

SHUT OFF VALVE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
40020	20	30	0,16
40025	25	30	0,22
40032	32	30	0,40
40040	40	10	0,57
40050	50	5	0,78
40063	63	5	1,43

BALL VALVE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
41020	20	30	0,14
41025	25	30	0,19
41032	32	30	0,32
41040	40	10	0,58
41050	50	5	0,89
41063	63	5	1,32

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GALLAPLAST ® FITTINGS

FILTER

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
42020	20	25	0,11
42025	25	25	0,10
42032	32	10	0,12

PIPEWORK FOR HEATER

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
43016	16	1	0,07
43020	20	1	0,01

HANGER

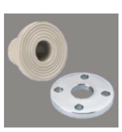
ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
45016	16	200	0,004
45020	20	200	0,005
45025	25	100	0,006
45032	32	100	0,008
450216	2×16	100	0,013
450220	2×20	100	0,018
450225	2×25	50	0,023
450232	2×32	50	0,028
45040	40	50	0,019
45050	50	50	0,025
45063	63	25	0,050
45075	75	25	0,104
45090	90	10	0,125
45110	110	10	0,151

CROSSPOINT ITEM

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
46020	D20	50	0,025
46025	D25	50	0,044
46032	D32	25	0,066
46040	D40	25	0,104

FLANGE CONNECTION

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
STEEL FLANGE			
48063	63 / Dn50	1	2,400
48075	75 / Dn65	1	2,860
48090	90 / Dn80	1	3,520
48110	110 / Dn100	1	3,875
PP-R WELDED BUSH			
48064	D63	1	0,165
48076	D75	1	0,275
48091	D90	1	0,440
48111	D110	1	0,644



WELD IN SADDLE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
47630	63-32	10	0,040
47750	75-32	10	0,040
47900	90-32	10	0,040

FEMALE WELD IN SADDLE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
47631	63 × ¾"	10	0,100
47751	75 × ¾"	10	0,100
47901	90 × ¾"	10	0,100

MALE WELD IN SADDLE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
47631	63 × ¾"	10	0,135
47751	75 × ¾"	10	0,135
47901	90 × ¾"	10	0,135

STEEL CLAMP WITH RUBBER SEAL

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
49016	15-19	150	0,048
49020	20-23	100	0,063
49025	25-28	150	0,085
49032	32-35	75	0,118
49040	40-43	50	0,125
49050	44-50	50	0,138
49063	57-63	50	0,143
49075	74-80	50	0,155
49090	83-91	50	0,178
49110	108-114	25	0,254

HEATING SYSTEM COLLECTOR

ITEM. №	SIZE D (mm)	OUTPUTS	PACKING (pcs)
67002	1" × ¾"	2	1
67003	1" × ¾"	3	1
67004	1" × ¾"	4	1
67005	1" × ¾"	5	1
67006	1" × ¾"	6	1
67007	1" × ¾"	7	1
67008	1" × ¾"	8	1
67009	1" × ¾"	9	1
67010	1" × ¾"	10	1
67011	1" × ¾"	11	1
67012	1" × ¾"	12	1

GALLAPLAST ® FITTINGS

REVIEW OF PRODUCTS

CORRUGATED HOUSING

ITEM. №	SIZE D (mm)	COLOR	PACKING (meter)
62001	⌀21	blue	50
62002	⌀25	blue	25
62003	⌀21	red	50
62004	⌀25	red	25

CONNECTORS FOR PPR-CT PIPES PIPE IN ROLL

ITEM. №	SIZE D (mm)	for pipes (mm)	PACKING (pcs)
63001	16 × ½"	16 × 2,0	60
63002	16 × ¾"	16 × 2,0	60
63003	20 × ½"	20 × 2,0	60
63004	20 × ¾"	20 × 2,0	60
63005	18*	16 × 2,2	25
63006	18*	20 × 2,8	25
63007	22*	25 × 3,5	25

MALE THREATED ADAPTOR

ITEM. №	SIZE D (mm)	for connection	PACKING (pcs)
64001	18 × ½"	63005	50
64002	18 × ¾"	63006	25
64004	22 × ¾"	63007	25
64004	22 × 1"		25

FEMALE THREATED ADAPTOR

ITEM. №	SIZE D (mm)	for connection	PACKING (pcs)
65001	18 × ½"	63005	50
65002	18 × ¾"	63006	25
65004	22 × ¾"	63007	25
65004	22 × 1"		25

DISTRIBUTIVE COLLECTOR

ITEM. №	SIZE D (mm)	OUTPUTS	PACKING (pcs)
66001	¾" × ½"	2	14
66002	¾" × ½"	3	9
66003	¾" × ½"	4	7
66004	1" × ½"	2	14
66005	1" × ½"	3	9
66006	1" × ½"	4	7

TOOLS

WELDING UNIT 1400W

ITEM. №		WEIGHT (kg/pcs)
50001	Welding unit 1400w double heads 16, 20, 25, 32, 40 6mm wrench.	7,500

HEAD FOR WELDING UNIT

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
51016	16	1	0,07
51020	20	1	0,09
51025	25	1	0,13
51032	32	1	0,20
51040	40	1	0,30
51050	50	1	0,42
51063	63	1	0,64
51075	75	1	1,06

CONDITIONING DEVICE FOR STABI PIPES

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
52001	16-20	1	0,15
52002	20-25	1	0,19
52003	25-32	1	0,23
52004	32-40	1	0,31
52005	50	1	0,46
52006	63	1	0,51
52007	75	1	0,64

WELDING SADDLE CAP

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
53063	63/32	1	0,300
53075	75/32	1	0,300
53090	90/32	1	0,300

MILLING CUTTER FOR SADDLE

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
54001	32	1	0,152

SCISSORS

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
55001	16-40	1	0,353

PIPE CUTTER

ITEM. №	SIZE D (mm)	PACKING (pcs)	WEIGHT (kg/pcs)
56001	50-110	1	1,190

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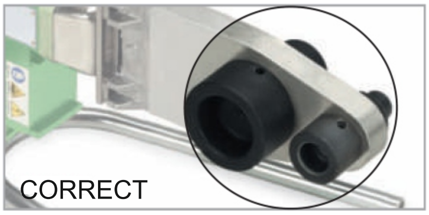
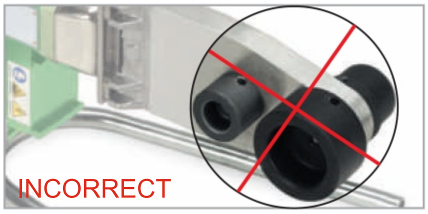
WELDING MACHINE PREPARATION FOR WORK

Reliable connections of GallaPlast piping systems require using the original welding equipment and tools, as offered by GallaPlast Company.

Prior to starting welding operations, mount replaceable welding heads. It is admissible to mount not more than two welding heads at a time.

Whenever mounting welding heads, take measures so that the surfaces of welding heads would not be outside the edge of heating element of the welding unit.





Welding heads shall be clean, therefore check the heads before mounting. If necessary, use some soft cloth wetted with alcohol to clean the heads.

It should be remembered that welding units are covered with special Teflon layer, which shall not be damaged. Any damaged welding heads are to be immediately replaced.

Switch on the welding unit and check whether the green indicator of power supply is on. At the same time, the red indicator of ambient temperature lights up. Depending on ambient temperature, heating the welding unit lasts from 10 to 30 minutes. Once the heating of the welding unit is completed, the red indicator of temperature goes off. The welding unit is ready for operation. From now on, the welding unit automatically maintains temperature level needful for welding.

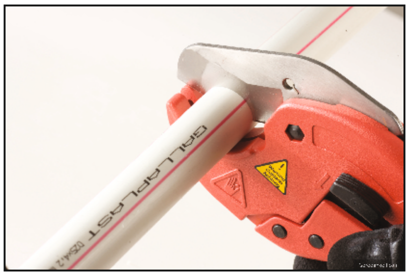
Attention! The very first welding, and also, any welding after replacement of welding heads shall be started only five minutes after reaching the temperature needful for welding.

The temperature needful for welding is 260°C.

While operating the welding unit, safety precautions and relevant rules shall be observed.

PREPARATION OF ELEMENTS FOR CONNECTION

Cut off a pipe at the right angle to its axis.
If required, remove burrs or any swarf and chips formed during the cutting.



Before welding GallaPlast Stabi combination pipes, it is needful to completely remove the aluminium layer. For this purpose, the end of Stabi combination pipe is to be inserted into the guide of conditioning device. The aluminium layer is to be cleaned off together with the upper layer of polypropylene, up to the stop position of the conditioning device. The depth of conditioning up to the stop position determines depth of fusion during the welding.

Any presence of aluminium particles or residual portions of aluminium layer in places to be welded is INADMISSIBLE.

GallaPlast Fazer combination pipes do not require any conditioning.

Only conditioning devices with faultless knives shall be used. Blunt knives are to be replaced by stand-by knives. Further, trial conditioning is required to check proper setting of knives. The knife shall cut off only the outer layer of polypropylene and aluminium layer. Thickness of the inner polypropylene layer shall remain without any changes, which warrants reliable fusion.

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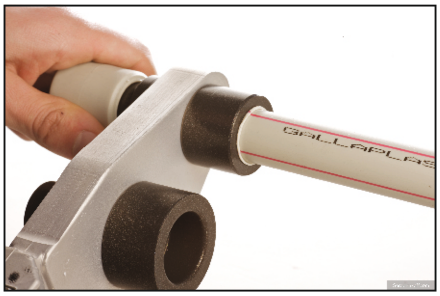
CONTACT SOCKET WELDING BY FUSION

The end of a pipe, without any rotating, is to be inserted into the welding head quill, up to the depth of welding, as given in the table and, at the same time, without any rotating, a profiled part is be fit over the opposite side of the welding mandrel, up to the stop position/ until bumping.



Complete the heating according to time shown in the Table. When heating pipes of bigger diameter, it is recommended to fit both the pipe and profiled part onto welding mandrels in slow motions, without applying any considerable force and according to heating progress.

MAJOR DATA OF FUSION				
Outside Diameter of pipe (mm)	Depth of Fusion (mm)	Heating Time (seconds)	Process pause (seconds)	Cooling Time (minutes)
16	13,0	5	4	2
20	14,0	6	4	2
25	15,0	7	4	2
32	16,5	8	6	4
40	18,0	12	6	4
50	20,0	18	6	4
63	24,0	24	8	6
75	26,0	30	8	8
90	29,0	40	8	8
110	32,5	50	10	8

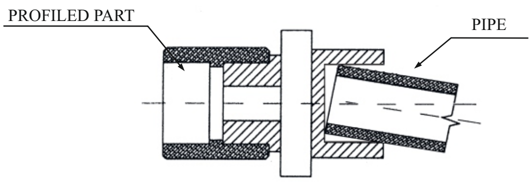
Table 4.

Heating time shown in the Table is valid at ambient temperature not lower than +5°C. If welding is performed at temperatures lower than +5°C, the time for process heating shall be increased by 50%.

Contact socket connection welding of GallaPlast piping elements is admissible at ambient temperatures not lower than 0°C. The place of fusion is to be protected against any rainfall and dust.

CONTACT SOCKET WELDING BY FUSION

While performing the process of heating, any angular misalignment between the pipe axial line and the heating device axial line exceeding five degrees (5°) is not admissible.



On completing the heating according to its specified time, quickly remove both the pipe and profiled part off the welding elements, and without their rotating, immediately connect them so that the depth of fusion would be covered by the forming overlap / collar. For ease in mounting, that is, for quick orientation of required position of particular profiled part relative to its pipe, it is possible to use the auxiliary reference marking on the profiled part and colour marking line on the pipe.

During the process pause, the position of profiled part relative to its pipe can be adjusted. This adjustment is limited by their alignment only. Any rotating the elements is not admissible. On completing the time of process pause, the fused contact connection shall not be subjected to any alignment.

The process pause is followed by the cooling phase.
Cooling parameters are given in Table 4.
During the cooling phase, it is prohibited to perform any mechanical attack or impact on the pipe or connected part.

On completing the time of cooling, fused integrated elements can be subjected to its rated loading.

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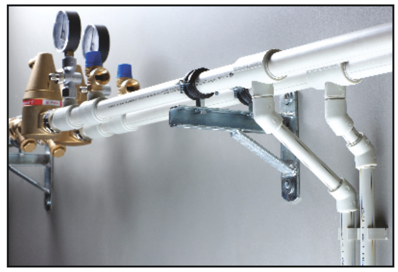
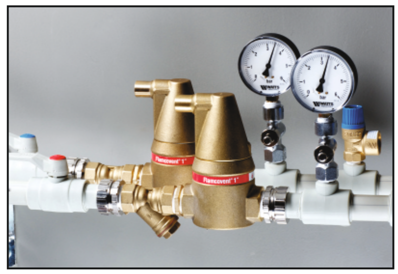
OPEN MOUNTING OF PIPES

Open laying is one of the most frequently used types of mounting. However, as pipelines installed both in cellar or living premises remain visible at all times, they shall meet especially high requirements as to their external appearance and stability of shapes.

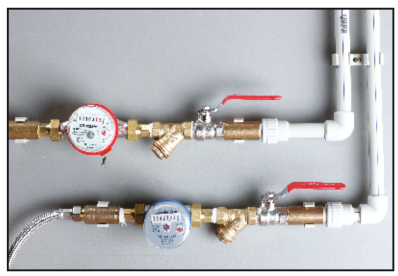


Stability of shapes depends on properly chosen temperature compensation required for thermal expansion during operation of pipelines, and also, properly installed fasteners, both rigid and slidably mounted ones, as well as proper distance between fasteners.

Due to low thermal linear expansion factor, GallaPlast-Stabi combination pipes, i.e. pipes stabilized with its aluminium layer, and also, GallaPlast-Fazer pipes, i.e. pipes stabilized with glass-filled layer, are intended for mounting both main pipelines and standpipes for heating or hot water supply. Using the combination pipes, standpipes can be installed rigidly, without any thermal compensation (refer Laying in Shafts and Ducts).



Mounting hot water supply mains requires both combination pipes and pipes without any stabilized layer. Therefore, measures aimed at compensation of thermal expansion for combination pipes are needful, when unsupported length of the pipeline section exceeds 40 m. As to other pipes, calculations are to be performed, and pipe expansion pieces are to be installed.



Mounting cold water supply mains and standpipes requires normal pipes without any stabilized layer, as linear thermal expansion is not observed in such pipelines.

As to practical determination of linear thermal expansion and methods of compensation, refer the section on Calculations of Linear Thermal Expansion

MOUNTING IN SHAFTS AND DUCTS

Laying pipes in shafts of buildings is intended, as a rule, to apply different design concepts. Selection of particular design concept depends on selection of pipes to be used. As branch pipes are located in shafts, floor by floor, as well as vertical standpipes, it is necessary to foresee their possible thermal expansion.

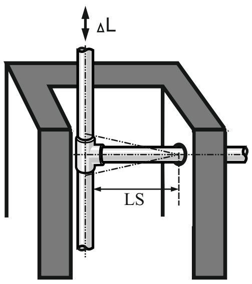


Figure 1

Pipes without stabilized layer in mounting standpipes .
While using pipes without stabilized layer in mounting standpipes, it is necessary to provide sufficient space, which is to be available for elastic bend (LS distance as shown in Figures 1, 2 and 3) for each branch pipe, due to thermal expansion of standpipe (ΔL elongation) under exposure to high temperatures of hot water supply. This can be provided by means of optimal arrangement of standpipe in shaft (refer Figure 1).

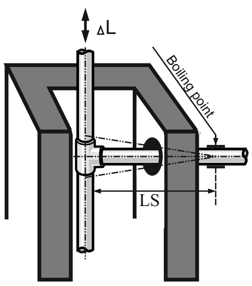


Figure 2

In the event when the sizes of a shaft are not sufficient for optimal arrangement of the standpipe, the standpipe can be installed as shown in Figure 2 or Figure 3. The particular feature of standpipe mounting according to Figure 2 is availability of increased diameter of through passage in the shaft. Diameter of passage shall be selected so that not to obstruct mounting and performance of branch pipes, floor by floor. Providing an elastic bend can be by means of spring elastic compensator (refer Figure 3). Calculations of ΔL and LS values are given in the section on Calculations of Linear Thermal Expansion..

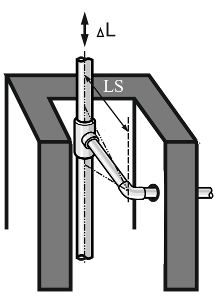


Figure 3

Using GallaPlast-Stabi and GallaPlast-Frazer combination pipes for installation of standpipes.
As a rule, when laying the combination pipes for standpipes, these can be installed without taking thermal expansion into consideration. If floor structures are rigid supports for particular standpipe and the distance between them does not exceed 3.0 m, and an additional fastening device is installed before connection with each branch pipe, thermal linear expansion may be neglected. In this case, ΔL value is insignificant. Moreover, it is applicable to the pipe section between the points of rigid supports, where it does not have any practical influence on the standpipe, and therefore, the value of LS loses its significance.

If the water temperature is above 70 °C it is necessary to provide for a small compensator on one of the floors. The size of the compensator should be calculated according to the method written in the "Calculation of linear expansion".

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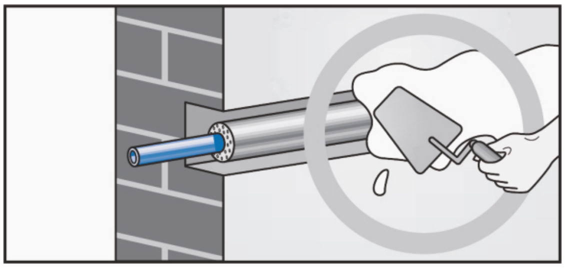
UNDER PLASTERWORK MOUNTING

While laying the piping under plasterwork, thermal expansion of GALLAPLAST PPRCT pipes is not taken into consideration.

To lay the piping under any plaster, pipes made of PPRCT thermal stabilized polypropylene, in coils, are to be used. These pipes are intended both for standard parallel and series connecting, and for piping from the header. Laying the distributing pipeline is provided in its duct in walls, or in wall chases.



If a pipeline is to be insulated according to the existing local norms and standards, or technical requirements towards heating systems, such insulation absorbs linear thermal expansion of the pipes. It is recommended to use insulation made of foam polyethylene, or foam polyurethane. In absence of requirements as to pipeline insulation, it is recommended to lay the pipe into convoluted tube prior its mounting, and the size of the tube as compared to the pipeline is to be bigger by an order. Before plastering the chases, the pipeline shall be fixed by means of plastic or metallic clips, or by plaster applied.

When such pipeline is fixed appropriately, as described above, linear thermal expansion due to thermal loads does not reach any critical values, as it is absorbed by construction material.

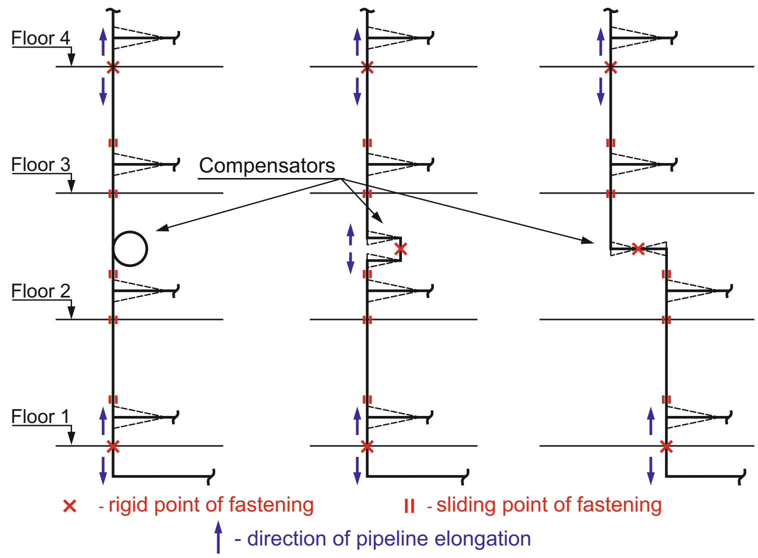
FASTENING TECHNOLOGY

When mounting the piping system, it is needful to take into account thermal expansion of material, i.e. elongation or contraction of pipelines due to exposure to temperatures of water supply. Therefore, the principles of fastening pipes foresee two types of fasteners:

- points for rigid and fixed fasteners;
- sliding points of fasteners, which let motions of a pipeline along its axis, without any damages.

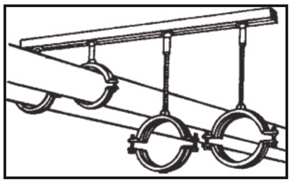
Proper selection between these types of supports guarantees faultless external appearance of pipelines.

Rigid points of fasteners.
The points of rigid fastening divide a pipeline into sections. Thus, direction of elongation is provided due to thermal expansion. Proceeding from calculated data of elongation, size and location of compensator is to be determined.



Rigid fasteners are also provided in places of mounting valves, on the both sides, to avoid exposure of pipeline to mechanical impacts, for operation of valves. Rigid fasteners are to be sufficiently fixed to withstand exposures to forces. Moreover, when selecting material for fastening, measures are to be taken up to prevent any mechanical damage of pipe surfaces.

Sliding points of fastening.
Sliding points of fastening shall be provided so that to allow motions of pipeline in axial direction, without any damages to the pipes.



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FASTENING TECHNOLOGY

Recommendations for the installation of hard, sliding attachment points and finding the right place for compensators.

It should be remembered that hard attachment points determine the direction and magnitude of lengthening the pipeline and determine a site on which to set the compensator.

1. First rigid attachment point to establish places of branching pipelines extending from heating stations where pipe diameters are the greatest.

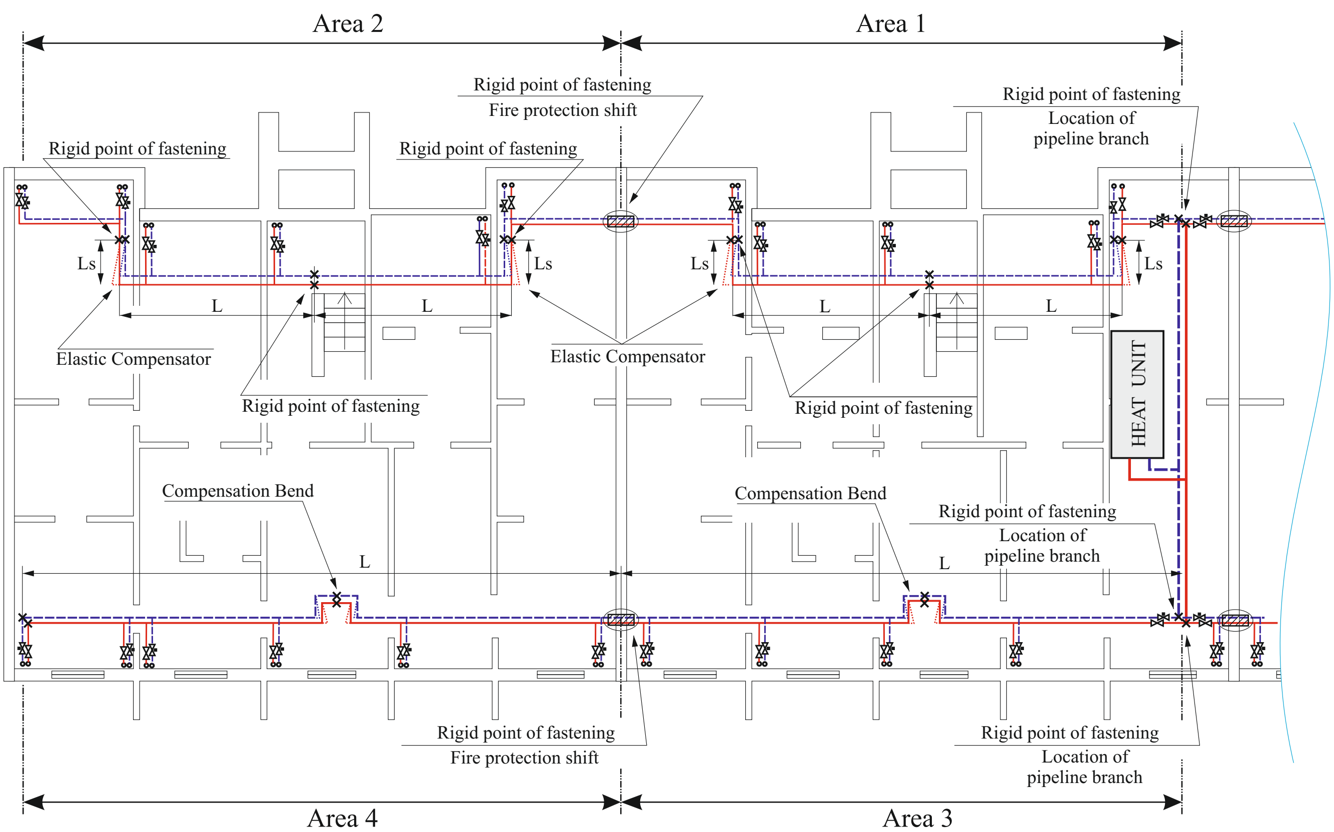
2. Next, the following rigid attachment point is set in the place of installation of fire hits on the border of fire sections.

3. Define sections of pipelines and, depending on their location in the building is determined by the installation location and type of expansion joints (flexible or compensator compensator-wear knee). Compensator size calculated from the value of the linear expansion of the pipeline, located at a specific site.

4. After that, the rate of the selected compensator arranges remaining hard mounting points.

5. Also, remember that hard mounting points are set before and after the valves and fittings to avoid mechanical stress on the pipeline in service.

6. Sliding mounting points installed at providing no slack line. Step is calculated depending on the operating temperature and the type of pipe.

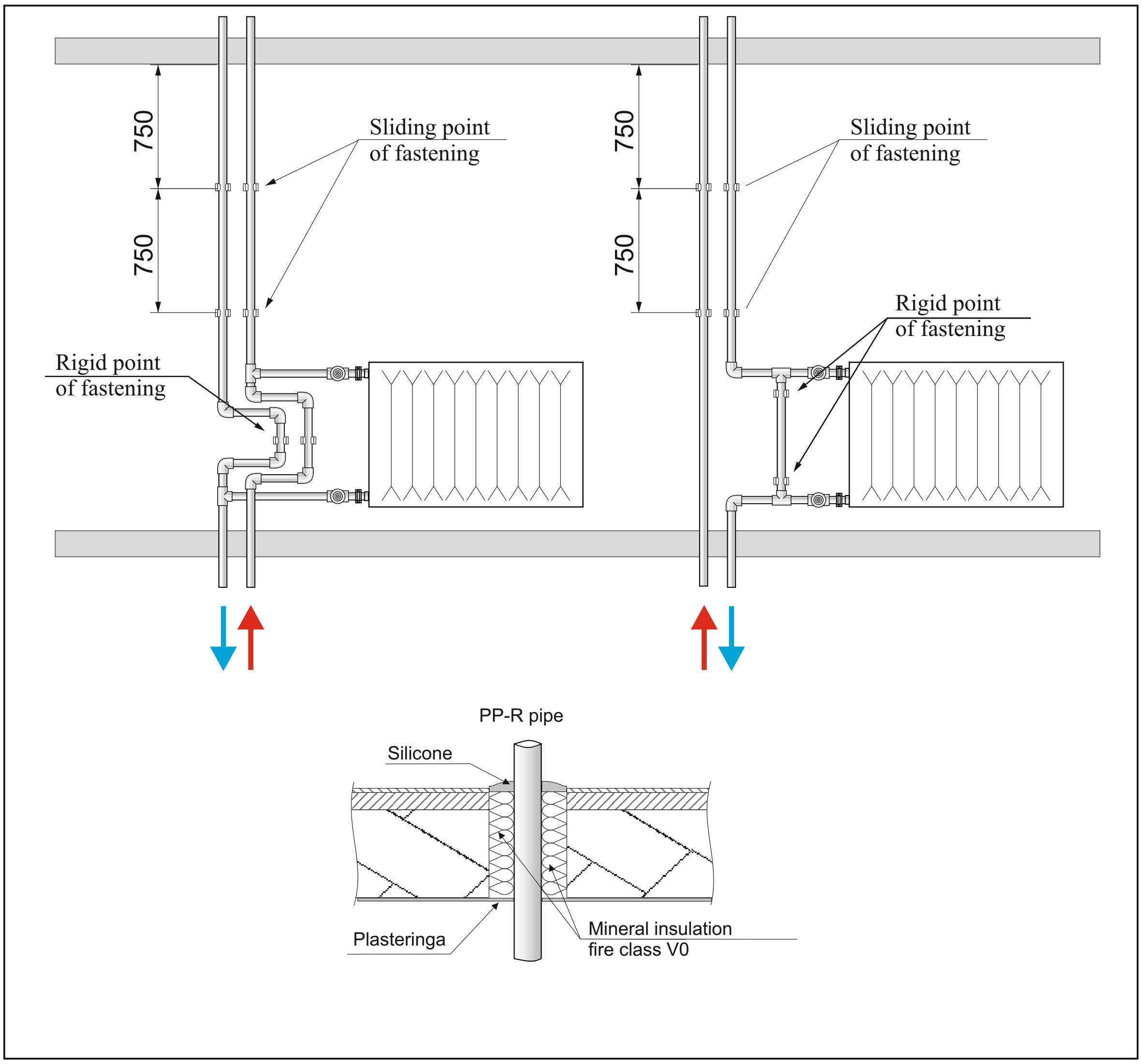


FASTENING TECHNOLOGY

Installation recommendations for rigid, sliding mounting points and designated compensators while constructing the stand pipe.

During the construction of the water supply or heating risers must be considered in storey building. Depending on the number of floors, operating conditions and type of the selected pipeline extension of the pipeline must be determined. Depending on the result determine the need for the installation of expansion joints.

Some examples for installation of compensators:



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CALCULATIONS OF LINEAR EXPANSION

Difference of temperatures during the mounting work and operation of pipelines results in arising of linear thermal expansion or contraction of pipelines. For practical purposes and determination of linear thermal expansion, the formulae and tables given in this section may be used.

The basic values to calculate linear thermal expansion are as follows:

- linear expansion coefficient for pipes to be installed;
- length of pipeline / distance value between rigid points of fastening;
- difference between operation temperature and temperature of mounting.

An example of calculations of linear thermal expansion:

Unit symbol	Name	Value	Measurement unit
α_1	Coefficient of linear expansion of combination pipe GALLAPLAST-STABI stabilized with aluminium layer.	0,03	mm/mC°
α_2	Coefficient of linear expansion of combination pipe GALLAPLAST-FAZER and BETA FAZER stabilized with glass-fiber layer.	0,04	mm/mC°
α_3	Coefficient of linear expansion of combination pipe GALLAPLAST STANDARD and GALLAPLAST BETA PPR without stabilized layer.	0,15	mm/mC°
L	Length of pipeline (distance between rigid points of fastening)	20	m
t_p	Operating temperature (temperature of pipeline operation)	60	C°
t_m	Temperature during mounting	20	C°
Δt	Difference between operating temperature and temperature during mounting	40	C°

Linear expansion ΔL is calculated according to the following equation:

$$\boxed{\Delta L = \alpha \times L \times \Delta t}$$

Linear expansion ΔL for combination pipe GallaPlast-FAZER stabilized with glass-fiber layer, where $\alpha = 0.04$ mm/ mC°, is determined as follows

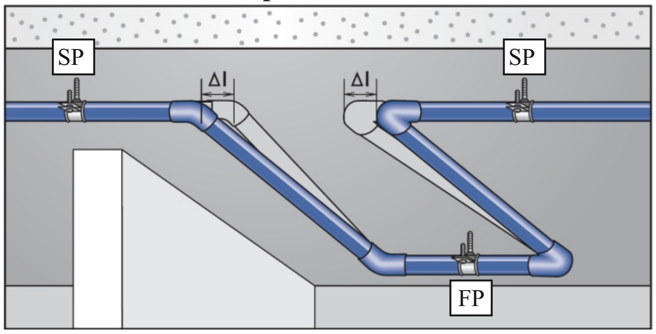
$$\boxed{\Delta L = 0{,}04\,\text{мм/мC°} \times 20\,\text{м} \times 40\,\text{C°}}$$

$$\boxed{\Delta L = 32{,}0\ \text{мм}}$$

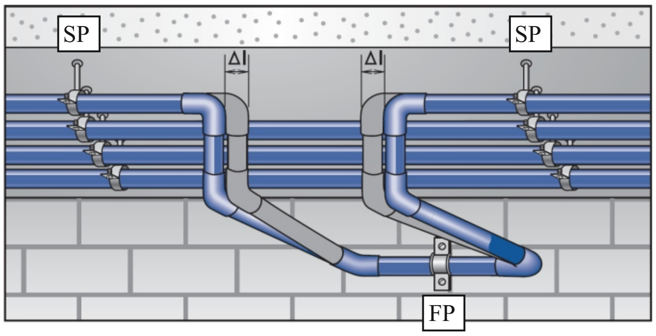
LINEAR EXPANSION COMPENSATION

A number of options are available to compensate linear expansion:

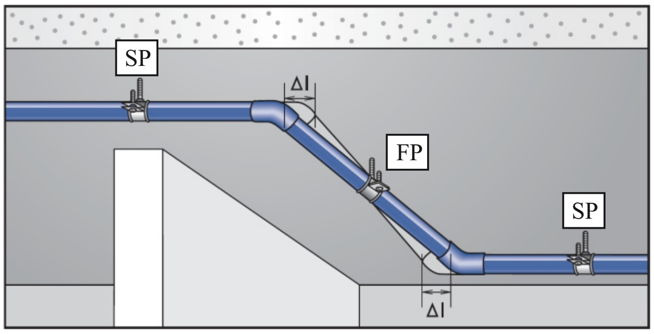
Compensation Bend



Compensation Bend



Elastic Compensator



SP - sliding point
FP - rigid fastening point

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ELASTIC COMPENSATOR

Length of elastic compensator is determined on the basis of the following calculations:

An example of calculations of elastic compensator:

Given values and unknown value:

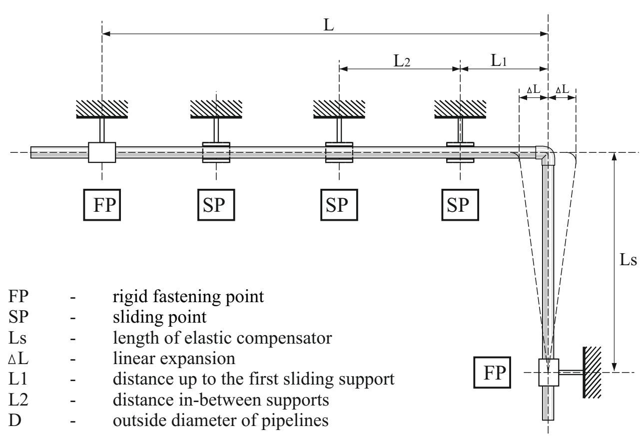
Unit symbol	Name	Value	Measurement unit
Ls	Length of elastic compensator	?	mm
K	Material specific constant	15	mm/mC°
D	Outside Diameter of pipeline	40	mm
Δl	Linear expansion	32	mm

Length of an elastic compensator is calculated according to the equations:

$$Ls = K \times \sqrt{D \times \Delta l}$$

$$Ls = 15 \times \sqrt{40\,\mathrm{MM} \times 32\,\mathrm{MM}}$$

$$Ls = 537\,\mathrm{MM}$$



FP - rigid fastening point
SP - sliding point
Ls - length of elastic compensator
ΔL - linear expansion
L1 - distance up to the first sliding support
L2 - distance in-between supports
D - outside diameter of pipelines

COMPENSATOR - COMPENSATOR BEND

An example of calculations of compensator:

Given values and unknown values

Unit symbol	Name	Value	Measurement unit
Ls	Length of elastic compensator	?	mm
K	Material specific constant	15	mm/mC°
D	Outside Diameter of pipeline	40	mm
Δl	Linear expansion	32	mm
Amin	Width of compensation bend	?	mm
SA	Safe distance	150	mm

Length of compensation bend is calculated as follows:

$$Ls = K \times \sqrt{D \times \Delta l / 2}$$

$$Ls = 15 \times \sqrt{40\,\text{MM} \times 16\,\text{MM}}$$

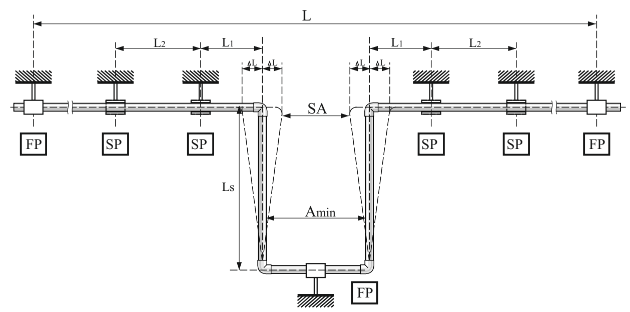
$$Ls = 329\,\text{MM}$$

Width of compensation bend is calculated as follows:

$$A_{min} = 2 \times \Delta l + SA$$

$$A_{min} = 2 \times 32\,\text{MM} + 150\,\text{MM}$$

$$A_{min} = 214\,\text{MM}$$



FP - rigid fastening point
SP - sliding point
Ls - length of elastic compensator
ΔL - linear expansion
L1 - distance up to the first sliding support
L2 - distance in-between supports
D - outside diameter of pipelines

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TABLE: LINEAR EXPANSION

Linear expansion of GALLAPLAST pipes

Grades Pn10; Pn16; Pn20; Beta PPR SDR9 ; Beta PPR SDR7.4

($\alpha = 0{,}15$ mm/mC°)

Linear expansion							
Length of pipeline L (m)	Difference in temperatures Δt (C°)						
	10	20	30	40	50	60	70
0,5	0,8	1,5	2,3	3,0	3,8	4,5	5,3
0,6	0,9	1,8	2,7	3,6	4,5	5,4	6,3
0,7	1,1	2,1	3,2	4,2	5,3	6,3	7,4
0,8	1,2	2,4	3,6	4,8	6,0	7,2	8,4
0,9	1,4	2,7	4,1	5,4	6,8	8,1	9,5
1	1,5	3,0	4,5	6,0	7,5	9,0	10,5
2	3,0	6,0	9,0	12,0	15,0	18,0	21,0
3	4,5	9,0	13,5	18,0	22,5	27,0	31,5
4	6,0	12,0	18,0	24,0	30,0	36,0	42,0
5	7,5	15,0	22,5	30,0	37,5	45,0	52,5
6	9,0	18,0	27,0	36,0	45,0	54,0	63,0
7	10,5	21,0	31,5	42,0	52,5	63,0	73,5
8	12,0	24,0	36,0	48,0	60,0	72,0	84,0
9	13,5	27,0	40,5	54,0	67,5	81,0	94,5
10	15,0	30,0	45,0	60,0	75,0	90,0	105,0
11	16,5	33,0	49,5	66,0	82,5	99,0	115,5
12	18,0	36,0	54,0	72,0	90,0	108,0	126,0
13	19,5	39,0	58,5	78,0	97,5	117,0	136,5
14	21,0	42,0	63,0	84,0	105,0	126,0	147,0
15	22,5	45,0	67,5	90,0	112,5	135,0	157,5
16	24,0	48,0	72,0	96,0	120,0	144,0	168,0
17	25,5	51,0	76,5	102,0	127,5	153,0	178,5
18	27,0	54,0	81,0	108,0	135,0	162,0	189,0
19	28,5	57,0	85,5	114,0	142,5	171,0	199,5
20	30,0	60,0	90,0	120,0	150,0	180,0	210,0

Linear expansion ΔL in mm

TABLE: LINEAR EXPANSION

Linear expansion of GALLAPLAST-STABI combination pipes.

(α = 0,03 мм/мС°)

Linear expansion							
Length of pipeline L (m)	Difference in temperatures Δt (C°)						
	10	20	30	40	50	60	70
0,5	0,2	0,3	0,5	0,6	0,8	0,9	1,1
0,6	0,2	0,4	0,5	0,7	0,9	1,1	1,3
0,7	0,2	0,4	0,6	0,8	1,1	1,3	1,5
0,8	0,2	0,5	0,7	1,0	1,2	1,4	1,7
0,9	0,3	0,5	0,8	1,1	1,4	1,6	1,9
1	0,3	0,6	0,9	1,2	1,5	1,8	2,1
2	0,6	1,2	1,8	2,4	3,0	3,6	4,2
3	0,9	1,8	2,7	3,6	4,5	5,4	6,3
4	1,2	2,4	3,6	4,8	6,0	7,2	8,4
5	1,5	3,0	4,5	6,0	7,5	9,0	10,5
6	1,8	3,6	5,4	7,2	9,0	10,8	12,6
7	2,1	4,2	6,3	8,4	10,5	12,6	14,7
8	2,4	4,8	7,2	9,6	12,0	14,4	16,8
9	2,7	5,4	8,1	10,8	13,5	16,2	18,9
10	3,0	6,0	9,0	12,0	15,0	18,0	21,0
11	3,3	6,6	9,9	13,2	16,5	19,8	23,1
12	3,6	7,2	10,8	14,4	18,0	21,6	25,2
13	3,9	7,8	11,7	15,6	19,5	23,4	27,3
14	4,2	8,4	12,6	16,8	21,0	25,2	29,4
15	4,5	9,0	13,5	18,0	22,5	27,0	31,5
16	4,8	9,6	14,4	19,2	24,0	28,8	33,6
17	5,1	10,2	15,3	20,4	25,5	30,6	35,7
18	5,4	10,8	16,2	21,6	27,0	32,4	37,8
19	5,7	11,4	17,1	22,8	28,5	34,2	39,9
20	6,0	12,0	18,0	24,0	30,0	36,0	42,0

Linear expansion ΔL in mm

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TABLE: LINEAR EXPANSION

Linear expansion of GALLAPLAST-FAZER and GALLAPLAST BetaFAZER combination pipes.

($\alpha = 0{,}04$ mm/mC°)

Linear expansion							
Length of pipeline L (m)	Difference in temperatures Δt (C°)						
	10	20	30	40	50	60	70
0,5	0,2	0,4	0,6	0,8	1,0	1,2	1,4
0,6	0,2	0,5	0,7	1,0	1,2	1,4	1,7
0,7	0,3	0,6	0,8	1,1	1,4	1,7	2,0
0,8	0,3	0,6	1,0	1,3	1,6	1,9	2,2
0,9	0,4	0,7	1,1	1,4	1,8	2,2	2,5
1	0,4	0,8	1,2	1,6	2,0	2,4	2,8
2	0,8	1,6	2,4	3,2	4,0	4,8	5,6
3	1,2	2,4	3,6	4,8	6,0	7,2	8,4
4	1,6	3,2	4,8	6,4	8,0	9,6	11,2
5	2,0	4,0	6,0	8,0	10,0	12,0	14,0
6	2,4	4,8	7,2	9,6	12,0	14,4	16,8
7	2,8	5,6	8,4	11,2	14,0	16,8	19,6
8	3,2	6,4	9,6	12,8	16,0	19,2	22,4
9	3,6	7,2	10,8	14,4	18,0	21,6	25,2
10	4,0	8,0	12,0	16,0	20,0	24,0	28,0
11	4,4	8,8	13,2	17,6	22,0	26,4	30,8
12	4,8	9,6	14,4	19,2	24,0	28,8	33,6
13	5,2	10,4	15,6	20,8	26,0	31,2	36,4
14	5,6	11,2	16,8	22,4	28,0	33,6	39,2
15	6,0	12,0	18,0	24,0	30,0	36,0	42,0
16	6,4	12,8	19,2	25,6	32,0	38,4	44,8
17	6,8	13,6	20,4	27,2	34,0	40,8	47,6
18	7,2	14,4	21,6	28,8	36,0	43,2	50,4
19	7,6	15,2	22,8	30,4	38,0	45,6	53,2
20	8,0	16,0	24,0	32,0	40,0	48,0	56,0

Linear expansion ΔL in mm

DISTANCE BETWEEN SUPPORTS

GALLAPLAST-STABI combination pipe.

The table down below is intended for determination distance between supports of a horizontal pipeline made of GallaPlast-Stabi combination pipes, depending on temperature and diameter of pipeline. Parameter of Δt is determined by a difference between operating temperature and temperature during mounting.

Temperature Difference Δt°C	PIPELINE DIAMETER D (mm)						
	20	25	32	40	50	63	75
	DISTANCE BETWEEN SUPPORTS (cm)						
0	155	170	195	220	245	270	285
20	120	130	150	170	190	210	220
30	120	130	150	170	190	210	220
40	110	120	140	160	180	200	210
50	110	120	140	160	180	200	210
60	100	110	130	150	170	190	200
70	90	100	120	140	160	180	190

GALLAPLAST-FAZER and BetaFAZER combination pipe.

The table down below is intended for determination distance between supports of a horizontal pipeline made of multilayer pipes with fiberglass layer, depending on temperature and diameter of pipeline.

Temperature Difference Δt°C	PIPELINE DIAMETER D (mm)								
	20	25	32	40	50	63	75	90	110
	DISTANCE BETWEEN SUPPORTS (cm)								
0	120	140	160	180	205	230	245	260	290
20	90	105	120	135	155	175	185	195	215
30	90	105	120	135	155	175	185	195	210
40	85	95	110	125	145	165	175	185	200
50	85	95	110	125	145	165	175	185	190
60	80	90	105	120	135	155	165	175	180
70	70	80	95	110	130	145	155	165	170

GALLAPLAST STANDARD Pn16/SDR7,4 and Pn20/SDR6,0
GALLAPLAST Beta PP-R SDR9/S4 and Beta PP-R SDR7.4/S3.2

Temperature Difference Δt°C	PIPELINE DIAMETER D (mm)								
	20	25	32	40	50	63	75	90	110
	DISTANCE BETWEEN SUPPORTS (cm)								
0	85	105	125	140	165	190	205	220	250
20	60	75	90	100	120	140	150	160	180
30	60	75	90	100	120	140	150	160	180
40	60	70	80	90	110	130	140	150	170
50	60	70	80	90	110	130	140	150	170
60	55	65	75	85	100	115	125	140	160
70	50	60	75	80	95	105	115	125	140

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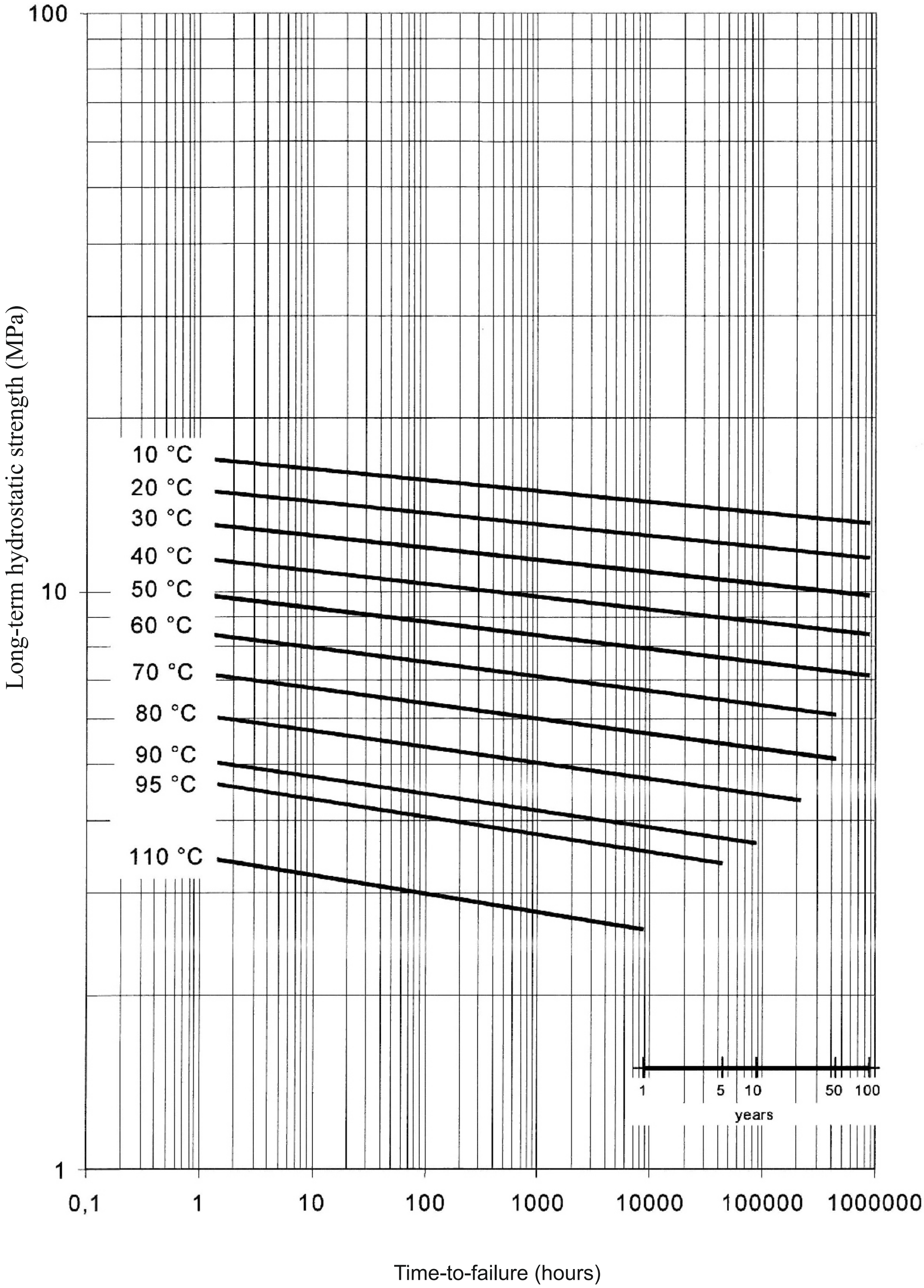
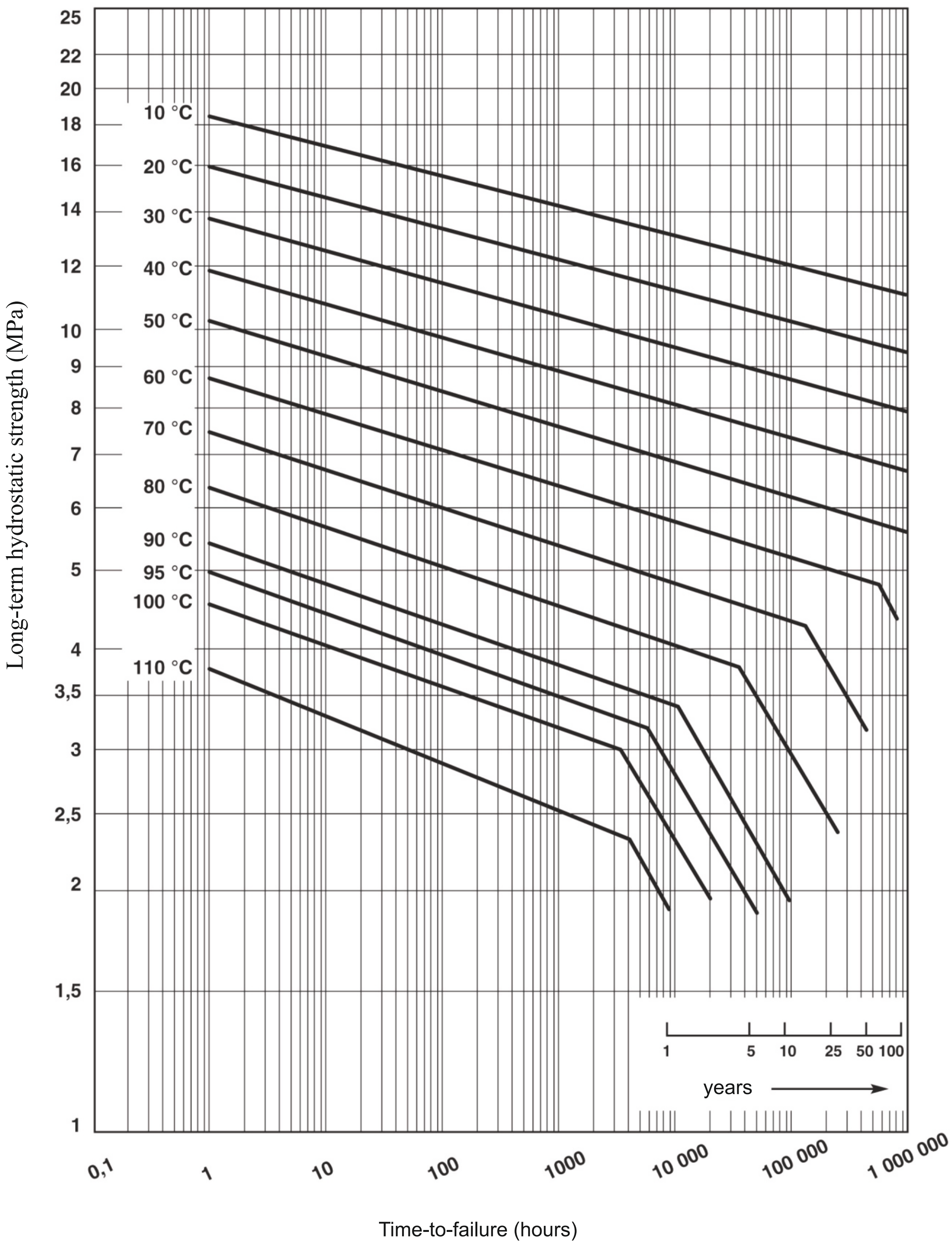
CURVES OF THE LON-TERM HYDROSTATIC STRENGTH OF PP-RCT



CURVES OF THE LON-TERM HYDROSTATIC STRENGTH OF PP-R



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