## Tubería Polipropileno Random (PP-R)

Pipe and fittings are produced using PP Random Copolimer ( PP-R). PP Random Copolimer is commonly used in drinking water installations, hot water, floor and radiator heating systems and every kind of industrial liquid distribution systems.

PP-R has a lot of advantages over other plastics such as; long life duration, high resistance to pressure and heat, better flexibility, high acoustic and thermal insulaton, high molecular weight, low MFI.

PP-R confirms the requirements of ASTM F 2389, DIN 8077, DIN 8078 ,EN ISO 15874 standards.

## Technical Specifications

| Characteristics | | Unit | Test Method | Values |
|---|---|---|---|---|
| Density | +23°C | g/cm3 | ISO 1183 | 0,909 |
| Melt Flow Index (MFI) | 190 °C /5 kg | g/10 min | ISO 1133 | 0,4-0,6 |
| | 230°C /2,16 kg | g/10 min | ISO 1133 | 0,2-0,5 |
| | 230°C /5 kg | g/10 min | ISO 1133 | 0,8-1,3 |
| Tensile Stress at yield (23°C) | (50 mm/min) | MPa | ISO 527 | 25 |
| Tensile Strain at Yield | (50 mm/min) | % | ISO 527 | 10 |
| Flexural Modules | +23°C | N/mm² | ISO 527 | 800 |
| Charpy Impact Strength (notched) | +23°C | kJ/m² | ISO 179 | >15 |
| | 0°C | kJ/m² | ISO 179 | >5 |
| Charpy Impact Strength (unnotched) | 0°C | kJ/m² | ISO 179 | No break |
| Vicat Softening Point | (1 kg) | °C | ASTM D 1525<br>ISO 306<br>DIN 53460 | 130 |
| | (5 kg) | °C | | 60 |
| Melting Range | | °C | Polarizing Microscope | 140-150 |
| Linear Thermal Expansion Co-efficient | | 1/K | DIN 53752 | 1,5x10-4 |
| Thermal Conductivity | | W/mK | DIN 52612 | 0,24 |
| Hardness (Shore D) | (3 sec value) | | ISO 868 | 65 |
| Pipe Friction Factor | | | | 0,007 |
| | | | | |

## Mechanical characteristics of tubular test pieces made of PPR by injection moulding ( TS EN ISO 15874-3)

| Characteristic | Requirement | Test parameters for the individual tests PPR | | | | | Test method |
|---|---|---|---|---|---|---|---|
| | | Hydrostatic Stress (Mpa) | Test Temp. ( C° ) | Test Period ( h ) | Number of test pieces | Test Pressure (Bar) | |
| Resistance to İnternal pressure | No failure during the test period | 16,0 | 20 | 1 | 3 | 53,1 | ISO 1167-1 ISO 1167-3 |
| | | 3,5 | 95 | 1000 | 3 | 11,6 | |

## Mechanical characteristics of pipes ( TS EN ISO 15874-2)

| Characteristic | Requirement | Test parameters for the individual tests PPR | | | | | Test method |
|---|---|---|---|---|---|---|---|
| | | Hydrostatic Stress (Mpa) | Test Temp. ( C° ) | Test Period ( h ) | Number of test pieces | Test Pressure (Bar) | |
| Resistance to İnternal pressure | No failure during the test period | 16,0 | 20 | 1 | 3 | 64 | ISO 1167-1 ISO 1167-2 |
| | | 4,3 | 95 | 22 | 3 | 17,2 | |
| | | 3.8 | 95 | 165 | 3 | 15,2 | |
| | | 3,5 | 95 | 1000 | 3 | 14 | |

## Physical and chemical characteristics of pipes ( TS EN ISO 15874-2)

| Characteristic | Requirement | Test parameters | | Test method |
|---|---|---|---|---|
| | | Parameter | Value | |
| Longitudinal reversion | ≤ %2 | Test temperature<br>PPR<br>Duration of exprosure for:<br>en ≤ 8 mm<br>8mm ≤ en≤ 16mm<br>en > 16mm<br>Number of test pieces | 135 °C<br><br><br>1 h<br>2 h<br>4 h<br>3 | Method B of ISO 2505 (oven test) |
| Thermal stability by hydrostatic pressure testing | No bursting during the test period | Test temperature<br>Hydrostatic stress<br>Test period<br>Number of test pieces | 110 °C<br>1,9 MPa<br>8760 h<br>1 | ISO 1167-1<br>ISO 1167-2 |
| Impact resistance | ≤ %10 | Test temperature<br>Number of test pieces | 0 °C<br>10 | ISO 9854-1<br>ISO 9854-2 |
| MFI (Raw material) | ≤ 0,5g /10 min | Test temperature<br>Mass<br>Number of test pieces | 230 °C<br>2,16 kg<br>3 | ISO 1133-1 |
| MFI (Pipe) | %30 maximum difference compared with compound from the same batch | Test temperature<br>Mass<br>Number of test pieces | 230 °C<br>2,16 kg<br>3 | |

## Pipe Dimension and Tolerances According to DIN 8077

### SDR 11 ( PN10 )

| Outside Ø mm. | Tolerance mm. | Thickness mm. | Tolerance mm. | Inside Ø mm. | In” inches |
|---|---|---|---|---|---|
| 20 | +0.3/-0 | 1.9 | +0.3/-0 | 16.20 | 1/2” |
| 25 | +0.3/-0 | 2.3 | +0.4/-0 | 20.40 | 3/4” |
| 32 | +0.3/-0 | 2.9 | +0.4/-0 | 26.20 | 1” |
| 40 | +0.4/-0 | 3.7 | +0.5/-0 | 32.60 | 1 1/4” |
| 50 | +0.5/-0 | 4.6 | +0.6/-0 | 40.80 | 1 1/2” |
| 63 | +0.6/-0 | 5.8 | +0.7/-0 | 51.40 | 2” |
| 75 | +0.7/-0 | 6.8 | +0.8/-0 | 61.40 | 2 1/2” |
| 90 | +0.9/-0 | 8.2 | +1.0/-0 | 73.60 | 3” |
| 110 | +1.0/-0 | 10.0 | +1.1/-0 | 90.00 | 4” |
| 125 | +1.2/-0 | 11.4 | +1.3/-0 | 102.20 | 5” |

### SDR 7,4 ( PN16 )

| Outside Ø mm. | Tolerance mm. | Thickness mm. | Tolerance mm. | Inside Ø mm. | In” inches |
|---|---|---|---|---|---|
| 20 | +0.3/-0 | 2.8 | +0.4/-0 | 14.00 | 1/2” |
| 25 | +0.3/-0 | 3.5 | +0.5/-0 | 18.00 | 3/4” |
| 32 | +0.3/-0 | 4.4 | +0.6/-0 | 23.20 | 1” |
| 40 | +0.4/-0 | 5.5 | +0.7/-0 | 29.00 | 1 1/4” |
| 50 | +0.5/-0 | 6.9 | +0.8/-0 | 36.20 | 1 1/2” |
| 63 | +0.6/-0 | 8.6 | +1.0/-0 | 45.80 | 2” |
| 75 | +0.7/-0 | 10.3 | +1.2/-0 | 54.40 | 2 1/2” |
| 90 | +0.9/-0 | 12.3 | +1.4/-0 | 65.40 | 3” |
| 110 | +1.0/-0 | 15.1 | +1.7/-0 | 79.80 | 4” |
| 125 | +1.2/-0 | 17.1 | +1.9/-0 | 90.80 | 5” |

### SDR 6 ( PN20 )

| Outside Ø mm. | Tolerance mm. | Thickness mm. | Tolerance mm. | Inside Ø mm. | In” inches |
|---|---|---|---|---|---|
| 20 | +0.3/-0 | 3.4 | +0.5/-0 | 13.20 | 1/2” |
| 25 | +0.3/-0 | 4.2 | +0.6/-0 | 16.60 | 3/4” |
| 32 | +0.3/-0 | 5.4 | +0.7/-0 | 21.20 | 1” |
| 40 | +0.4/-0 | 6.7 | +0.8/-0 | 26.60 | 1 1/4” |
| 50 | +0.5/-0 | 8.3 | +1.0/-0 | 33.40 | 1 1/2” |
| 63 | +0.6/-0 | 10.5 | +1.2/-0 | 42.00 | 2” |
| 75 | +0.7/-0 | 12.5 | +1.4/-0 | 50.00 | 2 1/2” |
| 90 | +0.9/-0 | 15.0 | +1.7/-0 | 60.00 | 3” |
| 110 | +1.0/-0 | 18.3 | +2.0/-0 | 73.40 | 4” |
| 125 | +1.2/-0 | 20.8 | +2.2/-0 | 83.40 | 5” |

## Operating life According to DIN 8077 (SF=1,5)

| Temperature (C°) | Years of Service | PN10 | PN16 | PN20 |
|---|---|---|---|---|
| | | Pipe Series ( S ) | | |
| | | 5 | 3,2 | 2,5 |
| | | Standart Dimension Ratio ( SDR ) | | |
| | | 11 | 7,4 | 6 |
| | | Allowable Operating Pressure ( Bar ) | | |
| 10 | 1 | 17,5 | 27,8 | 35,1 |
| | 5 | 16,5 | 26,2 | 33,0 |
| | 10 | 16,1 | 25,6 | 32,2 |
| | 25 | 15,6 | 24,7 | 31,1 |
| | 50 | 15,2 | 24,1 | 30,3 |
| 20 | 1 | 15,0 | 23,7 | 29,9 |
| | 5 | 14,1 | 22,3 | 28,1 |
| | 10 | 13,7 | 21,7 | 27,4 |
| | 25 | 13,2 | 21,0 | 26,4 |
| | 50 | 12,9 | 20,4 | 25,7 |
| 30 | 1 | 12,7 | 20,2 | 25,4 |
| | 5 | 11,9 | 18,9 | 23,8 |
| | 10 | 11,6 | 18,4 | 23,2 |
| | 25 | 11,2 | 17,7 | 22,3 |
| | 50 | 10,9 | 17,2 | 21,7 |
| 40 | 1 | 10,8 | 17,1 | 21,6 |
| | 5 | 10,1 | 16,0 | 20,2 |
| | 10 | 9,8 | 15,5 | 19,6 |
| | 25 | 9,4 | 15,0 | 18,8 |
| | 50 | 9,2 | 14,5 | 18,3 |
| 50 | 1 | 9,1 | 14,5 | 18,2 |
| | 5 | 8,5 | 13,5 | 17,0 |
| | 10 | 8,2 | 13,1 | 16,5 |
| | 25 | 7,9 | 12,6 | 15,9 |
| | 50 | 7,7 | 12,2 | 15,4 |
| 60 | 1 | 7,7 | 12,2 | 15,4 |
| | 5 | 7,1 | 11,3 | 14,3 |
| | 10 | 6,9 | 11,0 | 13,9 |
| | 25 | 6,6 | 10,5 | 13,3 |
| | 50 | 6,4 | 10,2 | 12,9 |
| 70 | 1 | 6,5 | 10,3 | 12,9 |
| | 5 | 6,0 | 9,5 | 12,0 |
| | 10 | 5,8 | 9,2 | 11,6 |
| | 25 | 5,0 | 8,0 | 10,0 |
| | 50 | 4,2 | 6,7 | 8,5 |
| 80 | 1 | 5,4 | 8,6 | 10,8 |
| | 5 | 4,8 | 7,6 | 9,6 |
| | 10 | 4,0 | 6,4 | 8,1 |
| | 25 | 3,2 | 5,1 | 6,5 |
| 95 | 1 | 3,8 | 6,1 | 7,6 |
| | 5 | 2,6 | 4,1 | 5,2 |

## Thermal Expansion in PPR Pipes

PPR pipes have an expansion coefficient that is much higher than the metal pipes. So, this characteristic should be taken into consideration during installations.

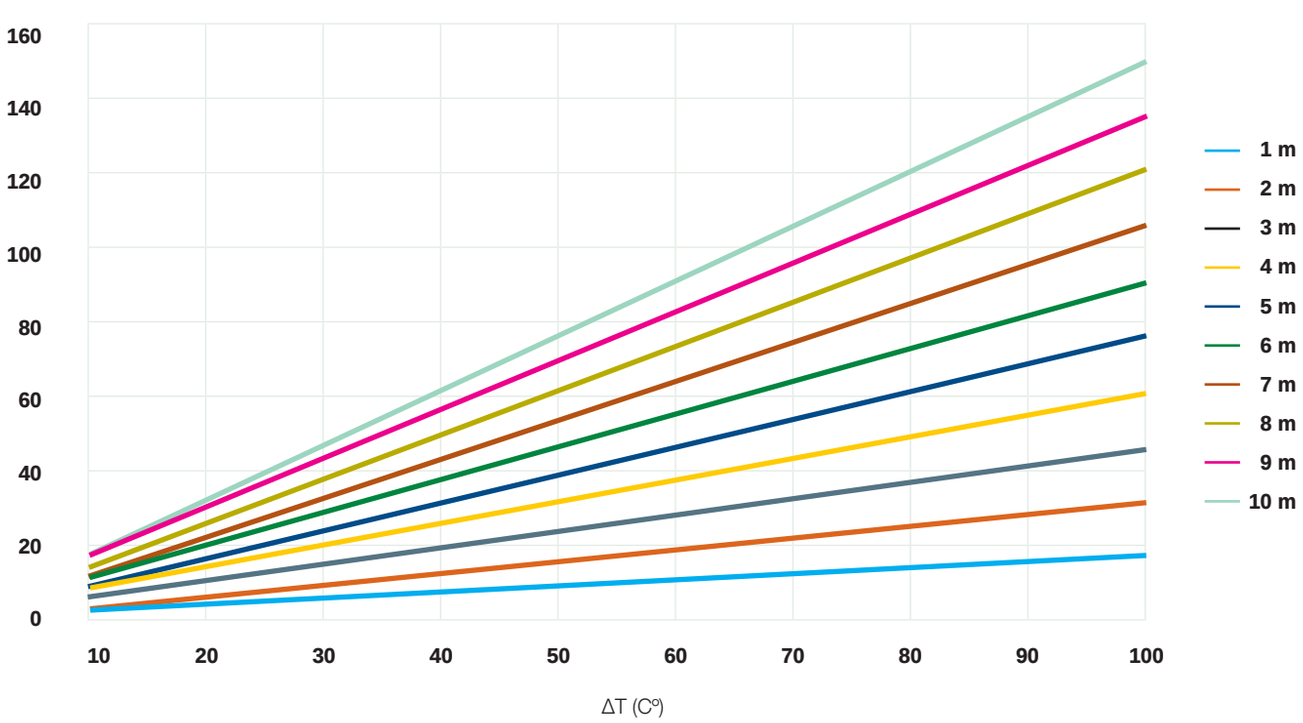
Calculation of thermal expansion is as follows:

$\Delta L = L * \Delta T * \alpha$

where
ΔT = The difference between environmental temperature and water temperature in Kelvin degrees (K) or Celsius (°C).
ΔL = Variation of length in mm.
L = Initial length of the pipe in m.
α = Coefficient of linear thermal expansion. The value of α is 1,5 * 10-4 (K-1) for PPR pipes.

| Pipe Length L ( m. ) | Linear Expansion ΔL ( mm. ) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Temperature Difference ΔL ( °C ) | | | | | | | | | |
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 1 | 1.5 | 3 | 4.5 | 6 | 7.5 | 8 | 10.5 | 12 | 13.5 | 15 |
| 2 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 |
| 3 | 4.5 | 9 | 13.5 | 18 | 22.5 | 27 | 21..5 | 36 | 40.5 | 45 |
| 4 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 5 | 7 | 15 | 22.5 | 30 | 37.5 | 45 | 52.5 | 60 | 67.5 | 75 |
| 6 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| 7 | 10.5 | 21 | 31.5 | 42 | 52.5 | 63 | 73.5 | 84 | 94.5 | 105 |
| 8 | 12.5 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 |
| 9 | 13.5 | 27 | 40 | 54 | 67.5 | 81 | 94.5 | 108 | 121.5 | 135 |
| 10 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 |

## Thermal Expansion of the Standart PP-R Pipe



Example; at 70 °C for 8m PPR pipe, ΔL=?
ΔL = L * ΔT * α
ΔL=8000 mm*70*0,00015
ΔL=84 mm

## PPR Glassfiber Reinforced Pipe

PP-R Glassfiber Reinforced Pipe (PP-R/GF/PP-R) consist of three layers where the inner and outer layers are produced of PP-R and the middle layer is produced of the special mixture of PP-R and Glassfiber raw material.

## Main Advantages of the PP-R Glassfiber Reinforced Pipe

1) Easier and faster installation since it does not require peeling before the welding operation.
2) It has 75 % less linear expansion than the standart PP-R pipe.
3) Higher stiffness than standart PP-R pipe.
4) Glassfiber PP-R pipes have thermal expansion co-efficient close to foil pipes, they can conveniently be used in the areas where foil pipes are used. Expansion co-efficient:
   For Glassfiber Reinforced PP-R pipe: 0,035 mm/mK
   For Aluminium Foil Reinforced PP-R Pipe: 0,030 mm/mK
   For Standart PP-R Pipe: 0,15 mm/mK
5) Lighter than standart PP-R pipes.

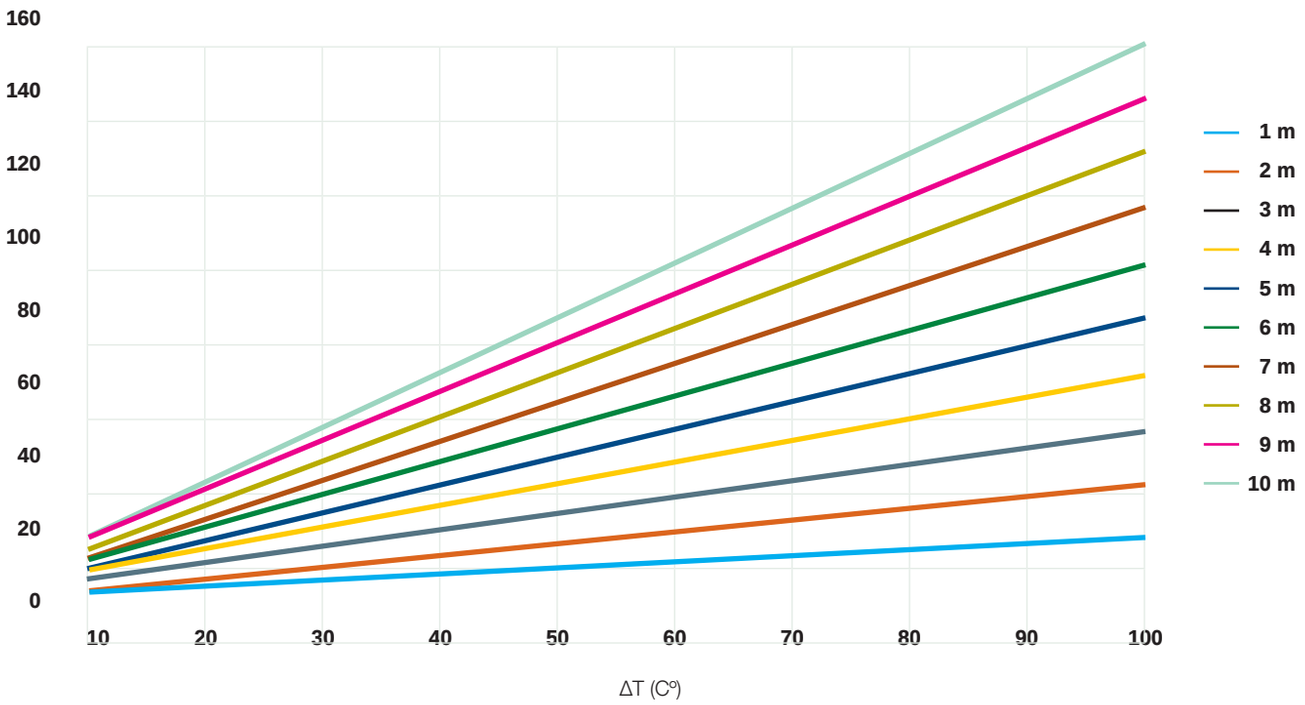
**Application Areas:**

1) All kinds of hot and cold water installations.
2) Air pressure installations.
3) Heating installations and radiator connections.
4) Industry.

## Thermal Expansion in Glassfiber Reinforced PP-R pipe

Calculation of Glassfiber Reinfprced PP-R pipe thermal expansion is as follows:
ΔL = L * ΔT * β
where
ΔT = The difference between environmental temperature and water temperature in Kelvin degrees (K) or Celsius (°C).
ΔL = Variation of length in mm.
L = Initial length of the pipe in m.
ΔT = The difference between environmental temperature and water temperature in Kelvin degrees (K) or Celsius (°C).
β = Coefficient of linear thermal expansion. The value of β is 0,35 * 10-4 (K-1) for Glassfiber Reinforced PPR pipes.

## Thermal Expansion of the Glassfiber Reinforced PP-R Pipe



Example; at 70 °C for 8m Glassfiber Reinforced PP-R pipe, ΔL=?
ΔL = L * ΔT * β
ΔL=8000 mm*70*0,000035
ΔL=19,6 mm

## PPR Aluminium Foil Reinforced Pipe

This pipe consists of three layers: the pipe and the coat are made of PP-R with aluminium foil inbetween. The Aluminium foil is attached with wrapping welding and by using a special PP coating film to establish the mechanical connection between the aluminium foil and the PP-R layer.

## Characteristics

- Low thermal expansion
- Oxygen impermeability
- Low heat loss
- High resistance to pressure and heat
- Easy forming, installation and application
- Hygenic
- Resistance to chemicals
- Low pressure loss due to the smoothness

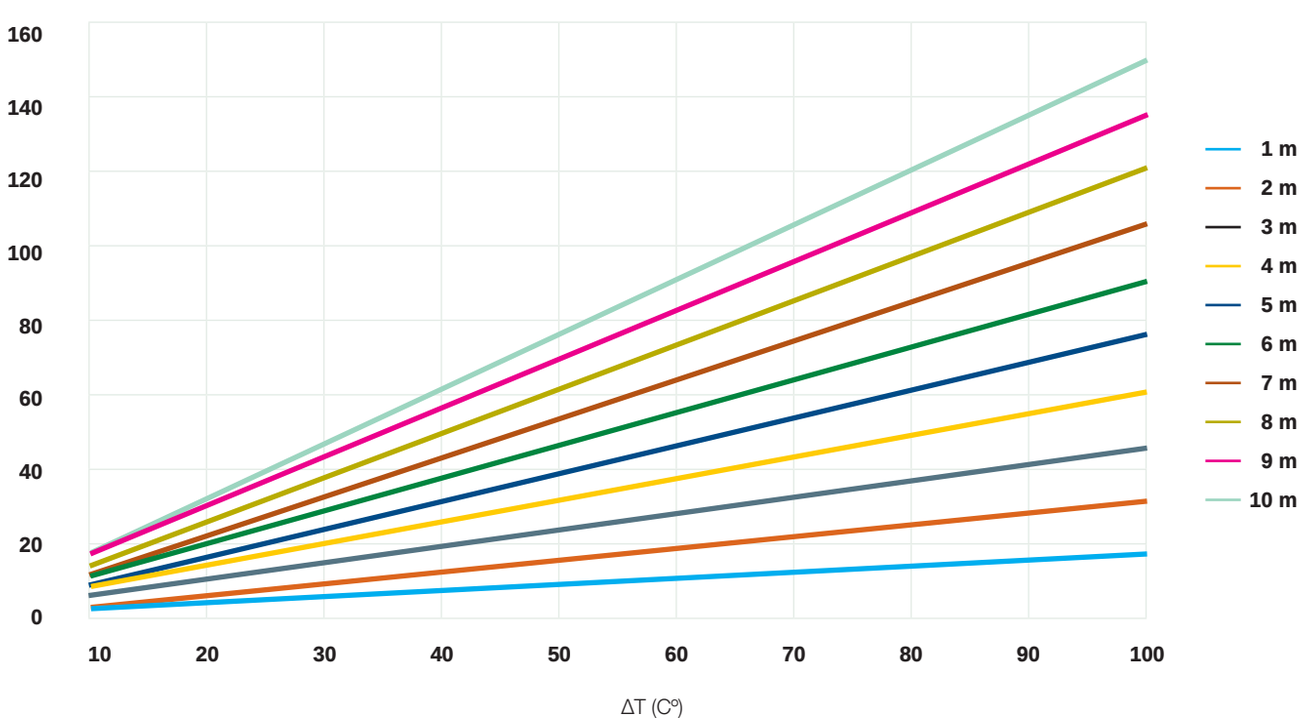
## Oxygen Impermeability

Oxygen penetration reduces the operating life by corroding the radiator and heater device. Oxygen diffusion from the atmospheric air is one of the most common ways of oxygen penetration into the system. Plastic pipes do not prevent this penetration. The aluminium layer increases the life of the radiator and the heater device by preventing.

## Thermal Expansion in Aluminium Foil Reinforced PP-R Pipe

Calculation of Aluminium Foil Reinforced PP-R pipe thermal expansion is as follows:
ΔL = L * ΔT * Φ
where
ΔT = The difference between environmental temperature and water temperature in Kelvin degrees (K) or Celsius (°C).
ΔL = Variation of length in mm.
L = Initial length of the pipe in m.
ΔT = The difference between environmental temperature and water temperature in Kelvin degrees (K) or Celsius (°C).
Φ = Coefficient of linear thermal expansion. The value of Φ is 0,30 * 10-4 (K-1) for Aluminium Foil Reinforced PPR pipes.

## Thermal Expansion of the Aluminium Foil Reinforced PP-R Pipe




Example; at 70 °C for 8m Aluminium Foil Reinforced PP-R pipe, ΔL=?
ΔL = L * ΔT * Φ
ΔL=8000 mm*70*0,000030
ΔL=16,8 mm

## Expansion Comparison Among Standard Pipe,Glassfiber Pipe and Aluminium Foil Reinforced PPR Pipe

As for seen from the examples above , at 70 °C for 8m of pipe expansion is;

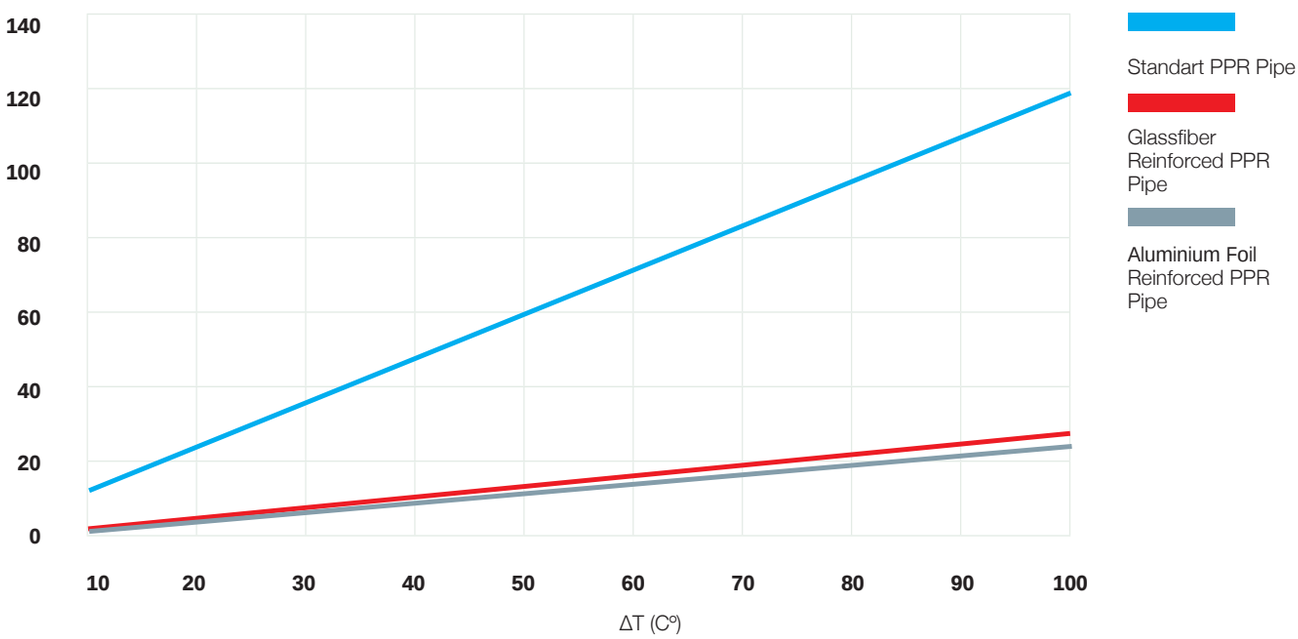
ΔL ( Standart PPR Pipe) = 84 mm

ΔL ( Glassfiber Reinforced PPR Pipe) = 19,6 mm

ΔL ( Aluminium Foil Reinforced PPR Pipe) = 16,8 mm

In conclusion we can say Glassfiber and Aluminium Foil Reinforced PPR pipes have very closer expansion values. Therefore Glassfiber Reinforced PPR Pipe might be used easily instead of Aluminium Foil Reinforced PPR pipe.

## Expansion Comparison Among Standard Pipe,Glassfiber Pipe and Aluminium Foil Reinforced PPR Pipe




## Welding Technique

The quality of an installation depends on the tightness, stability and lifetime of its connections. Fusion welding technique is safe because parts made of polypropylene create a homogenous connection within the process. When the welded joint cools down, it can be fully loaded. The resulting joints are very reliable, and they are as strong as the pipe itself. The pipe may even break before the socket welded joint under tension.

Welding takes only a few seconds. After cutting the pipe perpendicularly to its axis, both the pipes and the fittings ( these must be clean if not please clean it with a cloth or alcohol-water solution) are heated with the welding machine ( generally up to 260 °C +/- 10 °C ) and they are joined wtihout twisting. For proper connections please follow the table given below.

| Outer Diameter (mm) | Heating Time (Secs) | Joining Time ( Secs) | Cooling Time (Minutes) | Welding Depth (mm) |
|---|---|---|---|---|
| 20 | 5 | 4 | 2 | 14,5 |
| 25 | 7 | 4 | 3 | 16 |
| 32 | 8 | 6 | 4 | 18 |
| 40 | 12 | 6 | 4 | 20,5 |
| 50 | 18 | 6 | 5 | 23,5 |
| 63 | 24 | 8 | 6 | 27,5 |
| 75 | 30 | 8 | 8 | 31 |
| 90 | 40 | 8 | 8 | 35,5 |
| 110 | 50 | 10 | 8 | 41,5 |
| 125 | 60 | 10 | 8 | 46,5 |

## After Assembling Test Procedure

After assembling to start the test procedure system should be checked please see the steps below.

- Whole valves in the system must be turned off.
- While filling the system, first main valve is opened slightly.
- In order to avoid strong pressure impacts, pipe lines must be reduced air pressure from the utilization points at the highest and farthest sections.
- Separate tests are made by opening the valves of every zone.

When finishing the assembly of the installation, quality control of the system must be made by following below test procedure. Pressure testing shall be carried out in two stages.

1) For the first stage, a test pressure equal to the permissible working pressure plus 5 bar shall be produced twice within 30 minutes at 10 minute intervals. Than it shall be checked whether, over a further period of 30 minutes, the pressure has dropped by more than 0,6 bar and leakage has occurred.
2) The second stage shall follow the first stage without interval and shall last 2 hours. Then, it shall be checked whether the pressure has dropped by more than 0.2 bar and the pipework shows any signs of leakage.

Finally, If pressure drops more than the values given above in the manometer where test is observed, then leakage occurs. Leaking pipe line must be controlled and replaced or re-tightened.

## Installation and Expansion Compensation

Pipes can be installed under or above the floor. The installation is very easy and quick. However, one has to pay attention to the following simple points when installing polypropylene pipes.
Pipes have to discharge the radial and axial extensions; compensation may be done by using Omega and U parts. As an alternative, metal compansation also can used instead
of the omega and U parts.

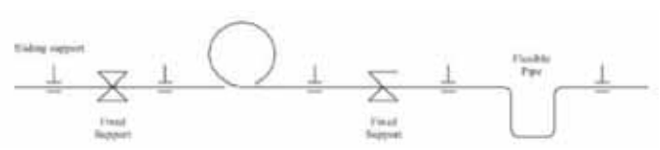


Figure 1- Omega and U part

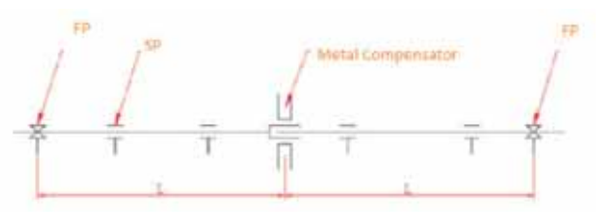



Figure 2- Metal Compensator

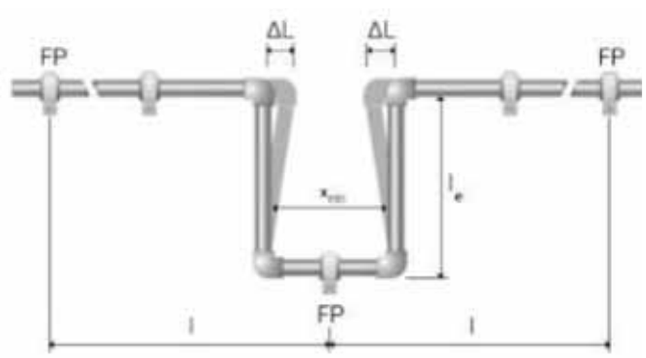



Figure 3-Distance of bending part

Length of the bending part is calculated by following equation.
**Le=k * d * ΔL**

Le = Lenght of the bending part ( U part, mm)
d = Outside diameter of the pipe (mm)
ΔL = Variation of length (mm)
k = Material dependent constant (15 for PP)
FP: Fixing point, support point, SP: Sliding point, support point.

## Clamps Interfaces
## Clamps interface of standart PPR pipes (mm)

| Temperature Difference ΔT (°C) | Standart PPR Pipe Diameter (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 25 | 32 | 40 | 50 | 63 | 75 | 90 | 110 | 125 |
| 0 | 85 | 105 | 125 | 140 | 165 | 190 | 205 | 220 | 250 | 270 |
| 20 | 60 | 75 | 90 | 100 | 120 | 140 | 150 | 160 | 180 | 195 |
| 30 | 60 | 75 | 90 | 100 | 120 | 140 | 150 | 160 | 180 | 195 |
| 40 | 60 | 70 | 80 | 90 | 110 | 130 | 140 | 150 | 170 | 185 |
| 50 | 60 | 70 | 80 | 90 | 110 | 130 | 140 | 150 | 170 | 185 |
| 60 | 55 | 65 | 75 | 85 | 100 | 115 | 125 | 140 | 160 | 175 |
| 70 | 50 | 60 | 75 | 80 | 95 | 105 | 115 | 125 | 140 | 150 |

## Clamps interface of Glassfiber Reinforced PPR pipes (mm)

| Temperature Difference ΔT (ºC) | Glassfiber Reinforced PPR Pipe Diameter (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 25 | 32 | 40 | 50 | 63 | 75 | 90 | 110 | 125 |
| 0 | 115 | 130 | 150 | 165 | 185 | 215 | 240 | 260 | 280 | 295 |
| 20 | 90 | 100 | 115 | 130 | 145 | 165 | 185 | 200 | 215 | 225 |
| 30 | 90 | 100 | 115 | 130 | 145 | 165 | 185 | 200 | 210 | 220 |
| 40 | 80 | 90 | 105 | 120 | 135 | 155 | 175 | 190 | 200 | 210 |
| 50 | 80 | 90 | 105 | 120 | 135 | 155 | 175 | 190 | 180 | 190 |
| 60 | 70 | 80 | 100 | 115 | 130 | 145 | 165 | 180 | 175 | 180 |
| 70 | 65 | 75 | 90 | 105 | 120 | 135 | 155 | 175 | 175 | 180 |

## Clamps interface of Aluminium Foil Reinforced PPR pipes (mm)

| Temperature Difference ΔT (ºC) | Aluminium Foil Reinforced PPR Pipe Diameter (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 25 | 32 | 40 | 50 | 63 | 75 | 90 | 110 | 125 |
| 0 | 155 | 170 | 195 | 220 | 245 | 270 | 285 | 300 | 325 | 345 |
| 20 | 120 | 130 | 150 | 170 | 190 | 210 | 220 | 230 | 250 | 265 |
| 30 | 120 | 130 | 150 | 170 | 190 | 210 | 220 | 230 | 240 | 250 |
| 40 | 110 | 120 | 140 | 160 | 180 | 200 | 210 | 220 | 210 | 220 |
| 50 | 110 | 120 | 140 | 160 | 180 | 200 | 210 | 220 | 210 | 220 |
| 60 | 100 | 110 | 130 | 150 | 170 | 190 | 200 | 210 | 200 | 210 |
| 70 | 90 | 100 | 120 | 140 | 160 | 180 | 190 | 200 | 200 | 200 |

## CHEMICAL RESISTANCE

Polypropylene is a polymer with very high chemical resistance. Chemical resistance varies on factors such as composition, quality condition, time of affection, concentration and temperature. The tables shown below give chemical resistance in different temperature and concentrations.

The Symbols used in the table are:
S : Saturated solution
f : Resistant
p : Partially resistant
n : Nonresistant

| Products | Concentration | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Accumulator acid | | f | f | |
| Acetic glacial acid | 100 | f | p | n |
| Acetic acid | 50 | f | f | |
| Acetic acid | 10 | f | f | |
| Acetic anhydride | 100 | f | | |
| Acetone | 100 | f | p | n |
| Acrylonitrile | 100 | p | | |
| Alum | All | f | f | |
| Ammonia | High | f | f | |

| Products | Concentra-tion | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Ammonia | 10 | f | f | |
| Ammonia | 100 | f | f | |
| Ammonium acetate | All | f | f | f |
| Ammonium carbonate | All | f | f | |
| Ammonium chloride | All | f | f | f |
| Ammonium nitrate | All | f | f | f |
| Ammonium metaphosphate | S | p | p | p |
| Ammonium phosphate | All | f | f | f |
| Ammonium sulphate | S | p | p | p |
| Ammonium bicarbonate | S | p | p | |
| Animal cooking oil | | f | p | |
| Anti-frreze car | | f | f | |
| Aqua regia | | f | n | |
| Barrium chloride | All | f | f | f |
| Beer | | f | | |
| Benzaldhehyde | | f | f | |
| Benzaldhehyde | S | f | f | f |
| Benzene | | p | n | |
| Benzoic acid | S | f | f | p |
| Benzoyl chloride | 100 | n | | |
| Bitter almonds fragrance | | f | | |
| Bleach | 12.50% | p | p | |
| Borax | | | | |
| Boric acid | 100 | f | f | |
| Boric acid | S | f | f | |
| Brandy | | f | | |
| Bromine | 100 | n | | |
| Bromine | High | n | n | |
| Bromine | Low | n | n | |
| Butane | 100 | f | | |
| Butane (P) | 100 | f | f | |
| Butter | | f | f | |
| Butyol alcohol | 100 | f | f | |
| Calcium nitrate | S | f | f | |
| Camphor | | f | | |
| Carvon tetracloride | 100 | p | n | |
| Chlorine | 100 | n | | |
| Chlorine (dry) | 100 | n | n | n |
| Chlorine (wet) | 10 | p | n | n |
| Chlorosulphonic | 100 | n | n | |

| Products | Concentra-tion | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Chromic acid | S | f | n | |
| Chroomium (3) salts | | | | |
| Chroomium (6) salts | | | | |
| Citric acid | S | f | f | f |
| Cocoa | | f | f | p |
| Cod liver oil | | f | | |
| Cresol | 100 | f | p | |
| Cresol | S | f | p | |
| Cresol oil | | f | | |
| Cyclohexane | 100 | f | | |
| Cycloexanol | 100 | f | p | |
| Cycloexanon | 100 | f | n | |
| Decahydronaphtlene | 100 | p | n | n |
| Dioxan | 100 | f | p | n |
| Distilled water | 100 | f | f | n |
| Engine oil | | f | p | |
| Ethyl alcohol | 100 | f | | |
| Ethyl alcohol | 96 | f | f | |
| Ethyl alcohol | 50 | f | f | |
| Ethers | 100 | f | p | |
| Ethyl alcohol (denatured) | 10 | f | f | |
| Ethyl clorides | 100 | n | | |
| Ethylene chlorides | 100 | p | p | |
| Ethylene tetracloride | 100 | p | n | |
| Formaldehyde | 40 | f | f | |
| Formaldehyde | 30 | f | f | |
| Formaldehyde | 10 | f | f | |
| Formic acid | 98 | f | p | |
| Formic acid | 90 | f | | |
| Formic acid | 50 | f | f | |
| Formic acid | 10 | f | f | f |
| Fruit-juice | | f | f | |
| Fumic sulfurric acid | | n | n | n |
| Galvanic solutions | | f | f | |
| Glycerol | 100 | f | f | |
| Glycerol | High | f | f | |
| Glycerol | Low | f | f | f |
| Glycol | 100 | f | f | |
| Glycol | High | f | f | |
| Glycol | Low | f | f | f |

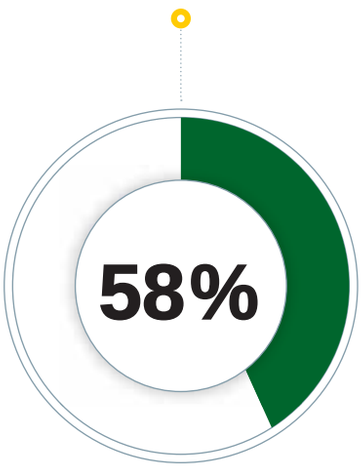
| Products | Concentra-tion | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Heptan | 100 | f | p | |
| Hexan | 100 | f | p | |
| Honey | | f | f | |
| Hydrobromic acid | 10 | f | f | |
| Hydrofluoric acid | 40 | f | f | |
| Hydrogen peroxide water | 30 | f | p | |
| Hydrobromic acid | High | f | f | |
| Hydrogen peroxide water | 10 | f | f | |
| Hydrogen peroxide water | 3 | f | f | f |
| Ink | | f | f | |
| Isooctane | 100 | f | p | |
| Lactic acid | 90 | f | f | |
| Lactic acid | 50 | f | f | |
| Lactic acid | 10 | f | f | f |
| Lacual water | 100 | f | f | f |
| Limestone | | f | f | f |
| Linseed oil | | f | f | |
| Mercury | | f | f | |
| Mercury salts | 100 | | | |
| Methyl alcohol | 50 | f | f | |
| Methyl alcohol | 100 | f | f | |
| Methyl chloride | 100 | p | | |
| Methym ethyl ketone | 100 | f | p | |
| Methylene diformammyde | | f | | |
| Milk | | f | f | p |
| Mineral water | | f | f | f |
| Naphtha | | f | p | |
| Naphthalene | 100 | f | | |
| Nitro benzene | 100 | p | p | |
| Normal gasoline | | p | n | |
| Oil | | n | n | |
| Oleic acid | 100 | f | | |
| Olive oil | | f | f | |
| Nitric acid | 50 | p | n | |
| Nitric acid | 25 | f | f | |
| Nitric acid | 10 | f | f | |
| Oxalic acid | S | f | f | f |
| Ozone | <0.5 ppm | p | p | |
| Paraffine | 100 | f | f | n |
| Petroleum | 100 | f | p | |

| Products | Concentra-tion | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Phenylamine | | f | p | |
| Phenylmethylketone | 100 | p | p | |
| Phosphoric acid | S | f | p | |
| Phosphoric acid | 50 | f | f | |
| Phosphoric acid | 10 | f | f | f |
| Potassium carbonate | S | f | f | |
| Potassium chlorate | S | f | f | |
| Potassium chloride X | S | f | f | f |
| Potassium dichromate | S | f | f | f |
| Potassium hydroxide | 50 | f | f | |
| Potassium hydroxide | 25 | f | f | |
| Potassium hydroxide | 10 | f | f | |
| Potassium hypochlorite | 5 | f | | |
| Potassium iodide | S | f | f | |
| Potassium nitrate | S | f | f | |
| | | | | |
| Sea water | | f | f | f |
| Shampoo | | f | f | |
| Silicone oil | | f | p | |
| Soap solution | S | f | f | |
| Soap solution | 10 | f | f | f |
| Sodium bicarbonate | S | f | f | f |
| Potassium sluphate | S | f | f | f |
| Propane ® | 100 | f | f | f |
| Propane | 100 | f | f | f |
| Pyridine | 100 | f | p | |
| Sodium carbonate | S | f | f | |
| Sodium carbonate | 10 | f | f | f |
| Sodium chlorate | 5 | f | | |
| Sodium chlorite | 25 | f | f | |
| Sodium chloride | S | f | f | f |
| Sodium disulphite | S | f | f | f |
| Sodium hidroxide | 100 | f | f | |
| Sodium hydroxide | 50 | f | f | |
| Sodium hydroxide | 25 | f | f | |
| Sodium hidroxide | 10 | f | f | |
| Sodium nitrate | S | f | f | |
| Sodium nitrite (P) | S | f | | |
| Sodium perborate | S | f | f | f |
| Sodium phosphate | S | f | f | f |

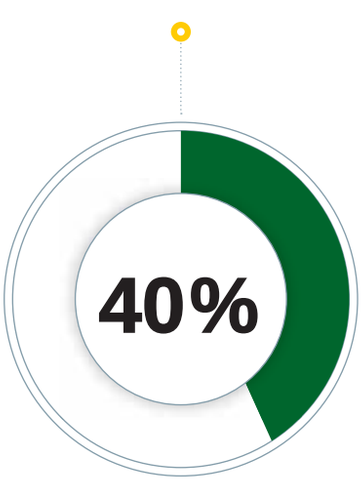
| Products | Concentration | Temperature | | |
|---|---|---|---|---|
| | % | 20 C° | 60 C° | 100 C° |
| Sodium sulphate | S | f | f | f |
| Sodium sulphite | S | f | f | |
| Soluble coffee | | f | f | f |
| Say-bean oil | | f | p | |
| Sulphocromic acid | | n | n | |
| Sulphur | 100 | f | f | f |
| Sulphuric acid | 96 | f | p | |
| Sulphuric acid | 50 | f | f | |
| Sulphuric acid | 25 | f | f | |
| Sulphuric acid | 10 | f | f | f |
| Sulphurous anhydride | Low | f | f | |
| Spirits | | f | | |
| Stannus chloride | S | f | f | |
| Starch | All | f | f | |
| Stearic acid | 100 | f | | |
| Succinic acid | 100 | f | f | |
| Super gasoline | | p | n | |
| Syntetic detersive | | f | f | f |
| Tar | | f | p | |
| Tartaric acid | S | f | f | |
| Tartaric acid | 10 | p | p | |
| Tetrahydrofurane | 100 | p | n | |
| Tetrahydronaphtalene | 100 | p | n | |
| Thea | | f | f | p |
| Thiophene | 100 | p | n | |
| Tlouen | 100 | p | n | |
| Tomatoes-juice | | f | f | |
| Tooth paste | | f | f | |
| Trichlorcethylene | 100 | p | p | |
| Turpentine | | n | n | n |
| Turpentine oil | | p | n | |
| Two stroke engine oil | | p | p | |
| Typewriter oil | | f | p | |
| Urea | S | f | f | |
| Vaselina | | f | p | |
| Vegetable cooking oil | | f | p | |
| Water | 100 | f | f | f |
| Whipped cream | | f | | |
| Whisky | 40 | f | | |
| Xylene or xylol | 100 | p | n | |

Metal Insert Used For The Fittings Are BRASS MS 58
Which Means

**Copper**

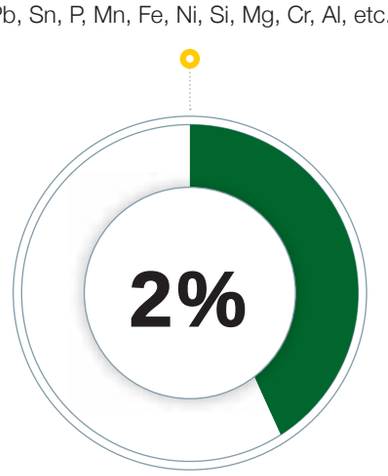



**Zinc**




**Others**

Pb, Sn, P, Mn, Fe, Ni, Si, Mg, Cr, Al, etc.



## Norms in Use

**TS-DIN I988**
Drinking water line installation.

**TS-DIN 2999**
Whitworth pipe threads tor tubes and Fittings.

**TS-DIN 4109**
Sound insulation in building construction.

**TS-DIN 8077**
Polypropylene (PP-R) pipes dimensions.

**TS-DIN 8078**
Polypropylene (PP-R) pipes general quality requirements and testing.

**TS-DIN 16928**
Pipe connections and components - Pipes of thermoplastic materials; pipe joints, elements for pipes, laying; general directions.

**TS-DIN 16962 (6-9)**
Pipe joints and elements for polypropylene (PP-R) pressure pipelines, types 1 and 2; injection moulded elbows tor socket-welding, dimension.

**TS-DIN 16962.5**
Pipe joints and components of polypropylene (PP-R) For pipes under pressure, Part 5: General quality requirements, testing.

**TS-DVS 2207.11**
Welding regulations for plastic pipes.

**TS-DVS 2208.1**
Machines and devices for welding thermoplastic pipes.

**TS-EN ISO 15874 -2-3**
Plastics piping systems for hot and cold water installations polypropylene (PP-R)

**TSE K 28**
Multi-layer glass Fiber pipes From Polypropylene (PP) - pressure pipes used for hot and cold water systems.

**TS 9937**
Plastic Pipes trom Polypropylene (PP) - general purpose.

## Transport & Storage | Транспортировка и хранение | ا لنقل و ا لتخزين

• Store the pipe and fittings sheltered from sun and rain. Do not expose the UV radiation for a long time.

• Хранить трубы и фитинги в защищенном от солнца и дождя месте. Не подвергайте УВ излужению в течении длительного времени.

• خزن الأنابيب وملحقاتها بعيداً عن اشعة الشمس والمطر لا تعرضها للأشعة فوق البنفسجية لفترة طويلة

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• Do not store at temperatures below 0°C. Impacts can form cracks on pipes.

• Не храните при температуре ниже 0°C. Есть вероятность оброзования трещин на трубах.

• لا تخزن فى درجة حرارة اقل من 0 درجة مئوية التاثيرات: قد تسبب تشقق في الأنابيب

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• Protect the impact of hard and sharp objects.

• Защищайте от воздействия твердых и острых предметов.

• الأجسام الحاده والصلهه قد تسهب التلف

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• Although it is quite durable please do not throw of during loading and unloading.

• Не бросайте во время погрузки и разгрузки.

• الرجاء عدو رمي خلال التحميل والتفريغ

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• Please move carefully and stacked.

• Передвигайте и складывайте осторожно.

• الرجاء نقل بعناية وترتيب