PP-r

kalde®

First Choice

2013-05/TK ING G

Kalde is the “First Choice” all around the world.

Why Kalde?

Kalde is leading pipes and fittings manufactoring company with over 35 years experience in designing and innovating highest quality products and integrated solutions for its customers globally.

The company is located in Istanbul, Turkey, where two continents, Asia and Europe meet.

Our strategic location with respect to Europe, Asia and Africa gives us unique advantages to serve our business partners and clients with our reliable supply chain capabilities and to compete successfully in global markets. We already export our products to more than 40 countries all around the world including Germany, Hungary, Romania, Austria, Greece, Bulgaria, Russia, Ukraine, Egypt, Syria, Lebanon...

Kalde has 70,000 square meters production area complete with design, product development and quality control facilities.

We manufacture a broad line of products covering PP pipes, PP fittings, Al-pex - PE-rt pipes, screw fittings, press fittings, PE-x pipes, manifolds and radiators. We also have several internationally accredited certifications from respectable master institutes like SKZ-Germany and AENOR-Spain. Furthermore, our management quality is certified by ISO 9001:2008.

We pride ourselves on our high quality products and best business practices...

Our vision is to deliver an expanding range of highest quality products and solutions to our customers through continuous research and innovation. We aim to develop long-term partnerships with our customers and suppliers.
We create integrated solutions through teamwork within the company as well as working closely with customers and partners. Through dedicated, market-focused business teams with 900 professional staff and strong management team, we drive responsive solutions and deliver value to our business partners and customers worldwide.

That's why Kalde is the **"First Choice"** of hundreds of customers globally.

Kalde Value Proposition

Kalde was founded in 1977 by four young engineers who were
dedicated to provide the best service to their customers.
That spirit is still alive today and remains the focus of our missions.

Kalde's Success is a Result of Many Factors.

- **High quality** products.
- Use of **best** practices.
- Products that meet your **unique** requirements.
- Products that are **proven.**
- Total client **satisfaction.**
- **Long-term** successful relationships with each client.
- A **committed team** of 900 people.

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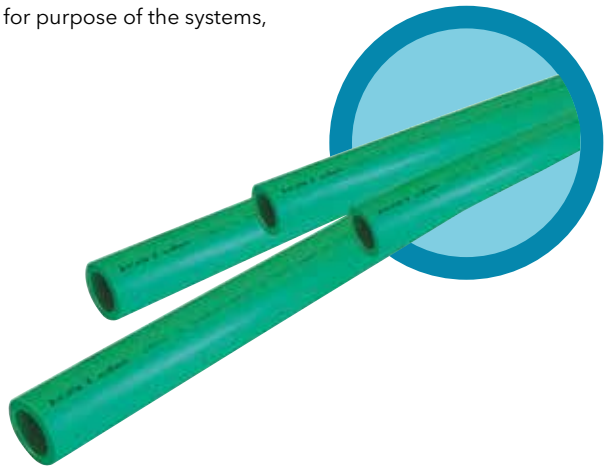
Kalde PP-r Tubes and Fittings for Hot & Cold Water and Heating Installation Systems

• Applied Norms

DIN 8077	Polypropylene (PP) pipes' dimensions
DIN 8078	Polypropylene (PP) pipes' general quality requirements and testing
DIN 16962 (6-9)	Pipe joints and elements for polypropylene (PP) pressure pipelines, types 1 and 2; injection moulded elbows for socket-welding, dimensions
DIN 16962	Pipe joints and components of polypropylene (PP) for pipes under pressure, - Part 5: General quality requirements, testing
DIN 1988	Drinking water line installation
DIN 4109	Sound insulation in building construction
DVS 2207 (11)	Welding regulations for plastic pipes
DVS 2208.1	Machines and devices for welding thermoplastic pipes
DIN 10266-1	Pipe threads where pressure tight joints are made on the thereads – Part 1: Taper external threads and paralel internal threads - Dimension, tolerances and designation
DIN 16928	Pipe connections and components - Pipes of thermoplastic materials; pipe joints, elements for pipes, laying; general directions
EN ISO 15874	Plastics piping systems for hot and cold water installations – polypropylene; Part 1: General, Part 2: Pipe, Part 3: Fittings, Part 5: Fitnes for purpose of the systems, Part 7: Guidance for the assessment of conformity



• Raw Material: Polypropylene Random Copolimer (PP-r)

Polypropylene Random Copolimer (PP-r) is widely used in hot water, floor- and radiator heating systems as well as in industrial liquid distribution systems. Most commonly, this material can be found in drinking water installations.

Kalde pipes are produced using solely PP-r. PP-r has several advantages over other materials: long duration, better flexibility, high resistance to pressure and heat, high molecular weight, low MFR, high acoustic and thermal insulation.

PP-r is suitable for DIN 8078 and EN ISO 15874-1 standards.

The metal inserts used in the polypropylene fittings increase the reliability of the products. Kalde's experience in brass fittings for more than 35 years results in high quality fittings with very reliable metal inserts.

Physical and Thermal Properties

Properties	Testing Methods	Unit	Values
Density, at 23 °C	ISO 1183	g/cm^3	0,9
Melt flow index (MFI) 230 °C/2, 16 kg	ISO 1133	g/10 min	0,3
Thermal conductivity at 23 °C	DIN 52612-1	W/m.K	0,23
Coefficient of linear expansion K^{-1} average between 0 °C up to 110 °C	DIN 53712	K^{-1}	1,5 x10^{-4}
Surface Resistance (ohm)	DIN IEC 60093	Ω	>10^{12}
Deflection temperature under load 1,8 N/mm^2 0,45 N/mm^2	 ISO 75A-1, -2 ISO 75B-1, -2	 °C °C	 49 70
VICAT softening point (1 kg) (5 kg)	 ASTM D 1525 ISO 306 DIN 53460	 °C °C	 130 70
Melting point	DSC	°C	146

Mechanical Properties

Properties	Testing Methods	Unit	Values
Tensile stres at yield (23 °C) At 50 mm/min	ISO 527-1,-2	N/mm^2	25
Tensile strain at yield At 50 mm/min		%	10
Flexural modulus at 23 °C	ISO 527	N/ mm^2	800
Charpy impact strength (notched) at 23 °C at 0 °C	ISO 179/1eA	 kJ/ m^2 kJ/ m^2	 22 4,5
Charpy impact strength (unnotched) (0 C°)	ISO 179	Joule	No break
Hardness (shore D)	ISO 868		60

Pipe Dimension-PN 10 According to DIN 8077

Outer Diameter mm	Diameter Tolerance mm	Wall Thickness, mm S=5 SDR=11 mm	Thickness Tolerance mm	Approx. Weight kg/m
20	+0,3	1,9	+0,3	0,107
25	+0,3	2,3	+0,4	0,158
32	+0,3	2,9	+0,4	0,240
40	+0,4	3,7	+0,5	0,401
50	+0,5	4,6	+0,6	0,605
63	+0,6	5,8	+0,7	0,960
75	+0,7	6,8	+0,8	1,360
90	+0,9	8,2	+1,0	1,960
110	+1,1	10,0	+1,2	3,002

Operating Conditions (S=5 SDR=11) (PN 10)

Temperature (C)	Life (years)	Pressure (bar)
20	50	12,9
40	50	9,2
60	50	6,4
70	50	4,2
80	25	3,2
95	5	2,6

Pipe Dimension-PN 16 According to DIN 8077

Outer Diameter mm	Diameter Tolerance mm	Wall Thickness S=3,2 SDR=7,4 mm	Thickness Tolerance mm	Approx. Weight kg/m
20	+0,3	2,8	+0,4	0,150
25	+0,3	3,5	+0,5	0,215
32	+0,3	4,4	+0,6	0,343
40	+0,4	5,5	+0,7	0,547
50	+0,5	6,9	+0,8	0,854
63	+0,6	8,6	+1,0	1,347
75	+0,7	10,3	+1,2	1,920
90	+0,9	12,3	+1,4	2,755
110	+1,1	15,1	+1,7	4,116

Operating Conditions (S=3,2 SDR=7,4) (PN 16)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	20,4
40	50	14,5
60	50	10,2
70	50	6,7
80	25	5,1
95	5	4,1

Pipe Dimension-PN 20 According to DIN 8077

Outer Diameter mm	Diameter Tolerance mm	Wall Thickness S=2,5 SDR=6 mm	Thickness Tolerance mm	Approx. Weight kg/m
20	+0,3	3,4	+0,5	0,170
25	+0,3	4,2	+0,6	0,258
32	+0,3	5,4	+0,7	0,415
40	+0,4	6,7	+0,8	0,642
50	+0,5	8,3	+1,0	0,992
63	+0,6	10,5	+1,2	1,580
75	+0,7	12,5	+1,4	2,245
90	+0,9	15,0	+1,7	3,227
110	+1,1	18,3	+2,0	4,812

Operating Conditions (S=2,5 SDR=6) (PN 20)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	25,7
40	50	18,3
60	50	12,9
70	50	8,5
80	25	6,5
95	5	5,2

Fitting Dimension-PN25 According to DIN 8078 (S=2, SDR=5)

Nominal Diameter (Ød) mm	Wall Thickness (s) mm	Thickness Tolerance mm
20	4,1	+0,6
25	5,1	+0,7
32	6,5	+0,8
40	8,1	+1,0
50	10,1	+1,2
63	12,7	+1,4
75	15,1	+1,7
90	18,1	+2,0
110	22,1	+2,3

• Thermal Expansion in PP-r Tubes

The polypropylene pipes have an expansion coefficient that is much higher than the metal pipes.

It is critical to take this characteristic 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.

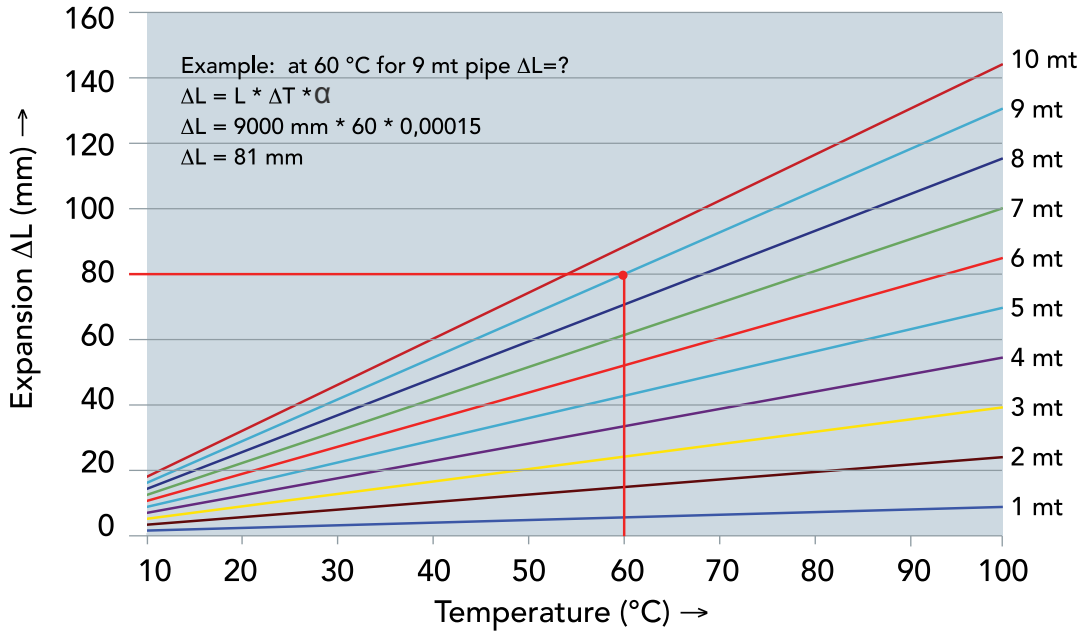
L = Initial length of the pipe in m.

α = Coefficient of linear thermal expansion. The value of α is $1,5 * 10^{-4}$ (K^{-1}) for PP-r tubes.

Pipe length (M)	Temperature variation ΔT in K											
	1	5	10	20	30	40	50	60	70	80	90	100
	Linear expansion ΔL (mm)											
1.0	0.15	0.75	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00
2.0	0.30	1.50	3.00	6.00	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00
3.0	0.45	2.25	4.50	9.00	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00
4.0	0.60	3.00	6.00	12.00	18.00	24.00	30.00	36.00	42.00	48.00	54.00	60.00
5.0	0.75	3.75	7.50	15.00	22.50	30.00	37.50	45.00	52.50	60.00	67.50	75.00
6.0	0.90	4.50	9.00	18.00	27.00	36.00	45.00	54.00	63.00	72.00	81.00	90.00
7.0	1.05	5.25	10.50	21.00	31.50	42.00	52.50	63.00	73.50	84.00	94.50	105.00
8.0	1.20	6.00	12.00	24.00	36.00	48.00	60.00	72.00	84.00	96.00	108.00	120.00
9.0	1.35	6.75	13.50	27.00	40.50	54.00	67.50	81.00	94.50	108.00	121.50	135.00
10.0	1.50	7.50	15.00	30.00	45.00	60.00	75.00	90.00	105.00	120.00	135.00	150.00

Note: When the water temperature circulating in the pipe is higher than the environmental temperature, the result will be an elongation. But if the water temperature circulating in the pipe is lower than the environmental temperature, the result will be a shortage.

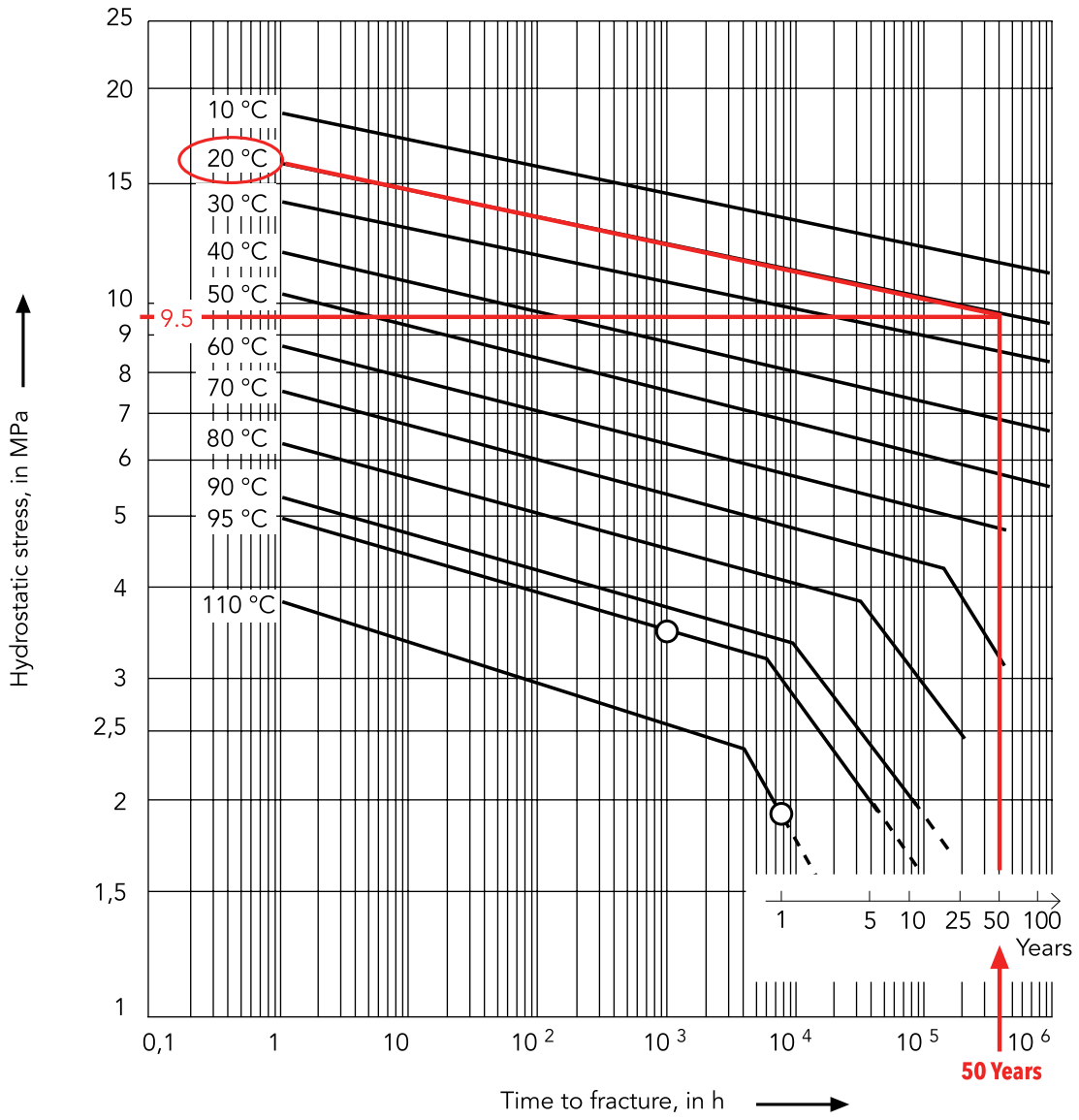
Thermal Expansion of the Kalde PP-r Pipe



Operating Life According to DIN 8077 (SF=1.5 PP-r 80)

Temperature °C	Operation Life	Series (S)							
		20	16	12,5	8,3	5	3,2	2,5	2
		Standard Dimension Rate (SDR)							
		41 PN2,5	33 PN3,2	26 PN4	17,6 PN6	11 PN10	7,4 PN16	6 PN20	5 PN25
		pressure (bar)							
20	1	3,7	4,7	5,9	9,0	15,0	23,7	29,9	37,7
	5	3,5	4,4	5,6	8,4	14,1	22,3	28,1	35,4
	10	3,4	4,3	5,4	8,2	13,7	21,7	27,4	34,5
	25	3,3	4,1	5,2	7,9	13,2	21,0	26,4	33,3
	50	3,2	4,0	5,1	7,7	12,9	20,4	25,7	32,4
	100	3,1	3,9	5,0	7,5	12,5	19,9	25,0	31,5
30	1	3,2	4,0	5,0	7,6	12,7	20,2	25,4	32,0
	5	3,0	3,7	4,7	7,2	11,9	18,9	23,8	30,0
	10	2,9	3,6	4,6	7,0	11,6	18,4	23,2	29,2
	25	2,8	3,5	4,4	6,7	11,2	17,7	22,3	28,1
	50	2,7	3,4	4,3	6,5	10,9	17,2	21,7	27,4
	100	2,6	3,3	4,2	6,3	10,6	16,8	21,1	26,6
40	1	2,7	3,4	4,3	6,5	10,8	17,1	21,6	27,2
	5	2,5	3,2	4,0	6,0	10,1	16,0	20,2	25,4
	10	2,4	3,1	3,9	5,9	9,8	15,5	19,6	24,7
	25	2,3	2,9	3,7	5,6	9,4	15,0	18,8	23,7
	50	2,3	2,9	3,6	5,5	9,2	14,5	18,3	23,1
	100	2,2	2,8	3,5	5,3	8,9	14,1	17,8	22,4
50	1	2,3	2,8	3,6	5,5	9,1	14,5	18,2	23,0
	5	2,1	2,7	3,4	5,1	8,5	13,5	17,0	21,4
	10	2,0	2,6	3,3	4,9	8,2	13,1	16,5	20,8
	25	2,0	2,5	3,1	4,7	7,9	12,6	15,9	20,0
	50	1,9	2,4	3,0	4,6	7,7	12,2	15,4	19,4
	100	1,8	2,3	2,9	4,5	7,5	11,8	14,9	18,8
60	1	1,9	2,4	3,0	4,6	7,7	12,2	15,4	19,4
	5	1,8	2,2	2,8	4,3	7,1	11,3	14,3	18,0
	10	1,7	2,2	2,7	4,1	6,9	11,0	13,9	17,5
	25	1,6	2,1	2,6	4,0	6,6	10,5	13,3	16,7
	50	1,6	2,0	2,5	3,8	6,4	10,2	12,9	16,2
70	1	1,6	2,0	2,5	3,9	6,5	10,3	12,9	16,3
	5	1,5	1,9	2,4	3,6	6,0	9,5	12,0	15,1
	10	1,4	1,8	2,3	3,5	5,8	9,2	11,6	14,6
	25	1,2	1,5	2,0	3,0	5,0	8,0	10,0	12,7
	50	1,0	1,3	1,7	2,5	4,2	6,7	8,5	10,7
80	1	1,3	1,7	2,1	3,2	5,4	8,6	10,8	13,7
	5	1,2	1,5	1,9	2,9	4,8	7,6	9,6	12,1
	10	1,0	1,2	1,6	2,4	4,0	6,4	8,1	10,2
	25	0,8	1,0	1,2	1,9	3,2	5,1	6,5	8,1
95	1	0,9	1,2	1,5	2,3	3,8	6,1	7,6	9,6
	5	0,6	0,8	1,0	1,5	2,6	4,1	5,2	6,5
	(10)1	(0,5)	(0,6)	(0,8)	(1,3)	(2,2)	(3,4)	(4,3)	(5,5)

• Hydrostatic Pressure Performance



Hydrostatic pressure is calculated according to the below formula:

$$P = \frac{2 * e_{min} * \sigma}{d_e - e_{min}}$$

P = Internal pressure, MPa.
d_e = Outside diameter of the pipe, mm.
e_{min} = Minimum wall thickness of the pipe, mm.
σ = Hydrostatic stress, MPa.
1MPa = 10 bar = 14.5 Psi.

Sample:

Usage time of the pipe : 50 years

Operating temperature : 20°C

Outside diameter of pipe : ø32

Wall thickness of pipe : 5,4 mm

Hydrostatic stress : 9.5 MPa

Maksimum operating pressure
P = (20 x 5,4 x 9,5) / (32 - 5,4)
P = 1026 / 26,6
P = 38,57 bar

This result shows the maximum resistance in a certain time, in order to find the maximum pressure,
the value the maximum resistance should be divided by safety factor (for example, Kalde pipe safety factor is SF:1,5)

Pmax = Pmax / SF
Pmax = 38,57 / 1.5
Pmax = 25,7 bar (*see page 9*)

Classification of Service Conditions

Application class	Design temperature, TD °C	Time at TD years	Tmax °C	Time at Tmax years	Tmal °C	Time at Tmal 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)

• Chemical Resistance

Polypropylene has a very high chemical resistance as a polymer.

The following table lists the chemical resistance of PP-r pipe and fittings according to ISO 10358.
Since chemical resistance depends on factors such as chemical composition, concentration and
temperature, the table below gives chemical resistance for three different temperatures and
different concentrations.

The below abbreviations are used in the table:

W.s. water solution

S.s. saturated solution

R resistant

L limited resistant

NR nonresistant

- insufficient information

Compatibilities reported on the table are valid for PP-r not submitted to mechanical stresses.

Chemical Resistance of Polypropylene, at 20, 60 and 100°C (ISO 10358)

Chemical or Product	Concentration	Temperature °C		
		20	60	100
Acetic acid	Up to 40 %	R	R	-
Acetic acid	50 %	R	R	L
Acetic acid, glacial	> 96 %	S	L	NR
Acetic anhydride	100 %	R	-	-
Acetone	100 %	R	R	-
Aceptophenone	100 %	R	L	-
Acrylonitrile	100 %	R	-	-
Air		R	R	R
Allyl alcohol	100 %	R	R	-
Almond oil		R	-	-
Alum	W.s	R	R	-
Ammonia, aqueous	S.s	R	R	-
Ammonia, dry gas	100 %	R	-	-
Ammonia, liquid	100 %	R	-	-
Ammonium acetate	S.s	R	R	-
Ammonium chloride	S.s	R	R	-
Ammonium fluoride	Up to 20%	R	R	-
Ammonium hydrogen carbonate	S.s	R	R	-
Ammonium metaphosphate	S.s	R	R	R
Ammonium nitrate	S.s	R	R	R
Ammonium persulphate	S.s	R	R	-
Ammonium phosphate	S.s	R	-	-
Ammonium sulphate	S.s	R	R	R
Ammonium sulphide	S.s	R	R	-
Amyl acetate	100 %	L	-	-
Amyl alcohol	100 %	R	R	R
Aniline	100 %	R	R	-
Apple juice		R	-	-
Aqua regia	HCl/HNO3=3/1	NR	NR	NR
Barium bromide	S.s	R	R	R
Barium carbonate	S.s	R	R	R
Barium chloride	S.s	R	R	R
Barium hydroxide	S.s	R	R	R
Barium sulphide	S.s	R	R	R
Beer		R	R	-
Benzene	100 %	L	NR	NR
Benzoic acid	S.s	R	R	-
Benzyl alcohol	100 %	R	L	-
Borax	W.s	R	R	-
Boric acid	S.s	R	-	-
Boron trifluoride	S.s	R	-	-
Bormine, gas	100 %	NR	NR	NR
Bromine, liquid	100 %	NR	NR	NR
Butane, gas	100 %	R	-	-
Butyl acetate	100 %	L	NR	NR
Butyl glycol	100 %	R	-	-
Butyl phenols	S.s	R	-	-
Butyl phthalate	100 %	R	L	L
Calcium carbonate	S.s	R	R	R
Calcium chlorate	S.s	R	R	-
Calcium chloride	S.s	R	R	R
Calcium hydroxide	S.s	R	R	R
Calcium hypochlorite	W.s	R	-	-
Calcium nitrate	S.s	R	R	-
Camphor oil		NR	NR	NR
Carbon dioxide, dry gas		R	R	-
Carbon dioxide, wet gas		R	R	-
Carbon disulphide	100 %	R	NR	NR
Carbon monoxide, gas		R	R	-
Carbon tetrachloride	100 %	NR	NR	NR
Caustic soda	Up to 50%	R	L	L
Chlorine, aqueous	S.s	R	L	-
Chlorine, dry gas	100 %	NR	NR	NR

Chemical or Product	Concentration	Temperature °C		
		20	60	100
Chloroacetic acid	W.s	R	-	-
Chloroform	100%	L	NR	NR
Chlorosulphonic acid	100%	NR	NR	NR
Chrome alum	W.s	R	R	-
Chromic acid	Up to 40%	R	L	NS
Citric acid	S.s	R	R	R
Coconut oil		R	-	-
Copper (II) chloride	S.s	R	R	-
Copper (II) nitrate	S.s	R	R	R
Copper (II)	S.s	R	R	-
Corn oil		R	L	-
Cottonseed oil		R	R	-
Cresol	Greater than 90%	R	-	-
Cyclohexane	100%	R	-	-
Cyclohexanol	100%	R	L	-
Cyclohexanone	100%	L	NR	NR
Decalin (decahydronaphthalene)	100%	NR	NR	NR
Dextrin	W.s	R	R	-
Dextrose	W.s	R	R	R
Dibutyl phthalate	100%	R	L	NR
Dichloroacetic acid	100%	L	-	-
Dichloroethylene (A and B)	100%	L	-	-
Diethanolamine	100%	R	-	-
Diethyl ether	100%	R	L	-
Diethylene glycol	100%	R	R	-
Diglycolic acid	S.s	R	-	-
Diisooctyl	100%	R	L	-
Dimethyl amine, gas		R	-	-
Dimethyl formamide	100%	R	R	-
Dioctyl phthalate	100%	L	L	-
Dioxane	100%	L	L	-
Distilled water	100%	R	R	R
Ethanolamine	100%	R	-	-
Ethyl acetate	100%	L	NR	NR
Ferric chloride	S.s	R	R	R
Formaldehyde	40 %	R	-	-
Formic acid	10 %	R	R	L
Formic acid	85 %	R	NR	NR
Formic acid, anhydrous	100 %	R	L	L
Fructose	W.s	R	R	R
Fruit juice		R	R	R
Gasoline, petrol (aliphatic hydrocarbons)		NR	NR	NR
Gelatine		R	R	-
Glucose	20 %	R	R	R
Glycerine	100 %	R	R	R
Glycolic acid	30 %	R	-	-
Heptane	100 %	L	NR	NR
Hexane	100 %	R	L	-
Hydrobromic acid	Up to 48 %	R	L	NR
Hydrochloric acid	Up to 20 %	R	R	R
Hydrochloric acid	30 %	R	L	L
Hydrofluoric acid	w.s	R	-	-
Hydrofluoric acid	40 %	R	-	-
Hydrogen	100 %	R	-	-
Hydrogen chloride, dry gas	100 %	R	R	-
Hydrogen peroxide	Up to 10 %	R	-	-
Hydrogen peroxide	Up to 30 %	R	L	-
Hydrogen sulphide, dry gas	100 %	R	R	-
Iodine, in alcohol		R	-	-

Chemical Resistance of Polypropylene, at 20, 60 and 100°C (ISO 10358)

Chemical or Product	Concentration	Temperature °C		
		20	60	100
Isopropyl alcohol	100 %	R	R	R
Isopropyl ether	100 %	L	-	-
Lanoline		R	L	-
Linseed oil		R	R	R
Magnesium carbonate	S.s	R	R	R
Magmesium cloride	S.s	R	R	-
Magnesium hydroxide	S.s	R	R	-
Magnesium sulphate	S.s	R	R	-
Maleic acid	S.s	R	R	-
Mercury (II) chloride	S.s	R	R	-
Mercury (II) cyanide	S.s	R	R	-
Mercury (I) nitrate	W.s	R	R	-
Mercury	100 %	R	R	-
Methyl acetate	100 %	R	R	-
Methyl alcohol	5 %	R	L	L
Methyl amine	Up to 32 %	R	-	-
Methyl bromide	100 %	NR		NR
Methyl ethyl ketone	100 %	R	-	-
Methylene chloride	100 %	L	NR	NR
Milk		R	R	R
Monochloroacetic acid	>85 %	R	R	-
Naphtha		R	NR	NR
Nickel chloride	S.s	R	R	-
Nickel nitrate	S.s	R	R	-
Nickel sulphate	S.s	R	R	-
Nitric acid	Up to 30 %	R	NR	NR
Nitric acid	From 40 to 50 %	L	NR	NR
Nitric acid, fujming (with nitrogen dioxide)		NR	NR	NR
Nitrobenzene	100%	R	L	_
Oleic acid	100 %	R	L	-
Oleum (sulphuric acid with 60 % of SO3)		R	L	-
Olive oil		R	R	L
Oxalic acid	w.s	R	L	NR
Paraffin oil (FL65)		R	L	NR
Peanut oil		R	R	-
Peppermint oil		R	-	-
Perchloric acid	(2N) 20%	R	-	-
Petroleum ether (ligroin)		L	L	-
Phenol	5%	R	R	-
Phenol	90%	R	-	-
Phosphine, gas		R	R	-
Phosphoric acid	Up.to 85%	R	R	R
Phosphorus oxychloride	100%	L	-	-
Picric acid	S.s	R	-	-
Potassium borate	S.s	R	R	-
Potassium fluride	S.s	R	R	-
Potassium hydroxide	Up to 50%	R	R	R
Ptassium iodide	S.s	R	-	-
Potassium nitrate	S.s	R	R	-
Potassium pechlorate	10%	R	R	-
Potassium permanganate	(2 N) 30%	R	-	-
Potassium persulphate	S.s	R	R	-
Potassium sulphate	S.s	R	R	-
Propane, gas	100%	R	-	-
Propionic acid	>50%	R	-	-
Pyridine	100%	L	-	-
Seaweter		R	R	R
Silicon oil		R	R	R
Silver nitrate	S.s	R	R	L

Chemical or Product	Concentration	Temperature °C		
		20	60	100
Sodium benzoate	35%	R	L	-
Sodium bicarbonate	S.s	R	R	R
Sodium carbonate	Up to 50%	R	R	L
Sodium chlorate	S.s	R	R	-
Sodium chloride	S.s	R	R	-
Sodium chlorite	2%	R	L	NR
Sodium chlorite	20%	R	L	NR
Sodium dichromate	S.s	R	R	R
Sodium hydrogen carbonate	S.s	R	R	R
Sodium hydrogen sulphate	S.s	R	R	-
Sodium hydrogen sulphite	S.s	R	-	-
Sodium hydroxide	1%	R	R	R
Sodium hydroxide	From 10 to 60 %	R	R	R
Sodium hypochlorite	5%	R	R	-
Sodium hypochlorite	10%-15%	R	-	-
Sodium hypochlorite	20%	R	L	-
Sodium metaphosphate	W.s	R	-	-
Sodium nitrate	S.s	R	R	-
Sodium perorate	S.s	R	R	-
Sodium phisohate (neutral)		R	R	R
Sodium silicate	W.s	R	R	-
Sodium sulphate	S.s	R	R	-
Sodium sulphide	S.s	R	-	-
Sodium sulphite	40%	R	R	R
Sodium thiosulphate (hypo)	S.s	R	-	-
Soybean oil		R	L	-
Succinic acid	S.s	R	R	-
Sulphuric acid	Up to 10%	R	R	R
Sulphuric dioxide, dry or wet	10%	R	R	-
Sulphur acid	From 10 to 30 %	R	R	-
Sulphuric acid	50 %	R	L	L
Sulphuric acid	96 %	R	L	NR
Sulphuric acid	98 %	L	NR	NR
Sulphurous acid	Up to 30 %	R	-	-
Tartaric acid	S.s	R	R	-
Tetrahydrofuran	100 %	L	NR	NR
Tetralin	100 %	NR	NR	NR
Thiophene	100 %	R	L	-
Tin(IV) chloride	W.s	R	R	-
Tin (II) chloride	S.s	R	R	-
Toluene	100 %	L	NR	NR
Trichloroacetic acid	Up to 50 %	R	R	-
Trichloroethylene	100 %	NR	NR	NR
Triethanolamine	W.s	R	-	-
Turpentine		NR	NR	NR
Urea	S.s	R	R	-
Vinegar		R	R	-
Water brackish, mineral, potable		R	R	R
Whiskey		R	R	-
Wines		R	R	-
Xylene	100%	NR	NR	NR
Yeast	W.s	R	R	R
Zinc chloride	Sat.w.s	R	R	-
Zinc chloride	S.s	R	R	-

• Polypropylene Tubes with Aluminum Foil

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

Characteristics

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

• Oxygen Impermeability

Oxygen penetration reduces the system life by corroding the radiator and the heater device. Oxygen diffusion from the air is one of the most common ways of oxygen penetrating into the system. Plastic pipes do not prevent this diffusion. The aluminum foil increases the life of the radiator and the heater by acting as a barrier.

Technical Properties, Pipe Dimensions (S=2,5 SDR=6) (PN 20)

Inner Pipe		Aluminum	Outer Pipe	Outside layer
Outer Diameter, mm	Wall Thickness, mm	Thickness (micron)	Outer Diameter, mm	Thickness, mm
20	2,8	150	21,8	0,5
25	3,5	150	26,8	0,5
32	4,4	150	33,8	0,5
40	5,5	150	41,8	0,5
50	6,9	150	51,8	0,5
63	8,6	150	64,8	0,5
75	10,3	150	76,8	0,5
90	12,3	150	91,8	0,5
110	15,1	150	111,8	0,5

Operating Conditions (S=2,5 SDR=6) (PN 20)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	25,7
40	50	18,3
60	50	12,9
70	50	8,5
80	25	6,5
95	5	5,2

Technical Properties, Pipe Dimensions (S=2 SDR=5) (PN 25)

Inner Pipe		Aluminum	Outer Pipe	Outside layer
Outer Diameter, mm	Wall Thickness, mm	Thickness (micron)	Outer Diameter, mm	Thickness, mm
20	3,4	150	21,8	0,5
25	4,2	150	26,8	0,5
32	5,4	150	33,8	0,5
40	6,7	150	41,8	0,5
50	8,3	150	51,8	0,5
63	10,5	150	64,8	0,5
75	12,5	150	76,8	0,5
90	15,0	150	91,8	0,5
110	18,3	150	111,8	0,5

Operating Conditions (S=2 SDR=5) (PN 25)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	32,4
40	50	23,1
60	50	16,2
70	50	10,7
80	25	8,1
95	5	6,5

• Thermal Expansion in PP-r Tubes with Aluminum Foil

Polypropylene pipes with aluminum foil have lower expansion coeficients.

The expansion is calculated 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.

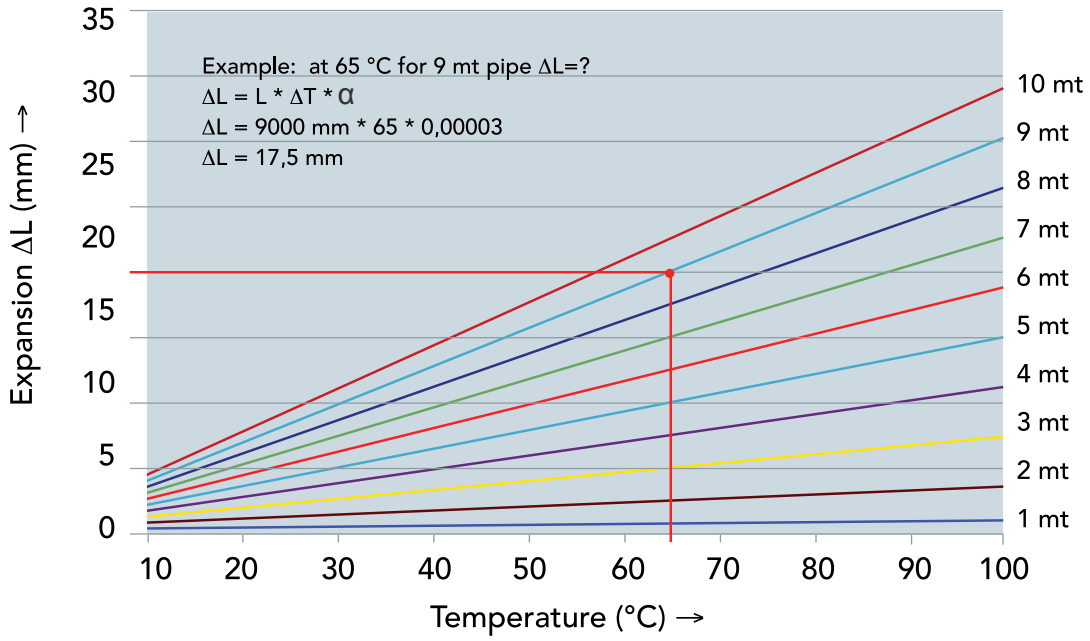
L = Initial length of the pipe in m.

α = Coefficient of linear thermal expansion. The value for α in PP-r tubes with alu foil is 0,3 $*10^{-4}$ (K^{-1}).

Pipe length (m)	Temperature variation ΔT in K											
	1	5	10	20	30	40	50	60	70	80	90	100
	Linear expansion ΔL (mm)											
1.0	0,03	0,15	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00
2.0	0,06	0,30	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00
3.0	0,09	0,45	0.90	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00
4.0	0,12	0,60	1.20	2.40	3.60	4.80	6.00	7.20	8.40	9.60	10.80	12.00
5.0	0,15	0,75	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00
6.0	0,18	0,90	1.80	3.60	5.40	7.20	9.00	10.80	12.80	14.40	16.20	18.00
7.0	0,21	1,05	2.10	4.20	6.43	8.40	10.50	12.60	14.70	16.80	18.90	21.00
8.0	0,24	1,20	2.40	4.80	7.20	9.60	12.00	14.40	16.80	19.20	21.60	24.00
9.0	0,27	1,35	2.70	5.40	8.10	10.80	13.50	16.20	18.90	21.60	24.30	27.00
10.0	0,30	1,50	3.00	6.00	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00

Note: When the water temperature circulating in the pipe is higher than the environmental temperature, the pipe will elongate. But if the water temperature circulating in the pipe is lower than the environmental temperature, the result will be a shortage.

Thermal Expansion of the Kalde PP-r Pipe



• Polypropylene Pipes with Fiberglass

This pipe consists of three layers: the pipe and the coat are made of PP-r with a fiberglas-mixed PP-r inbetween.

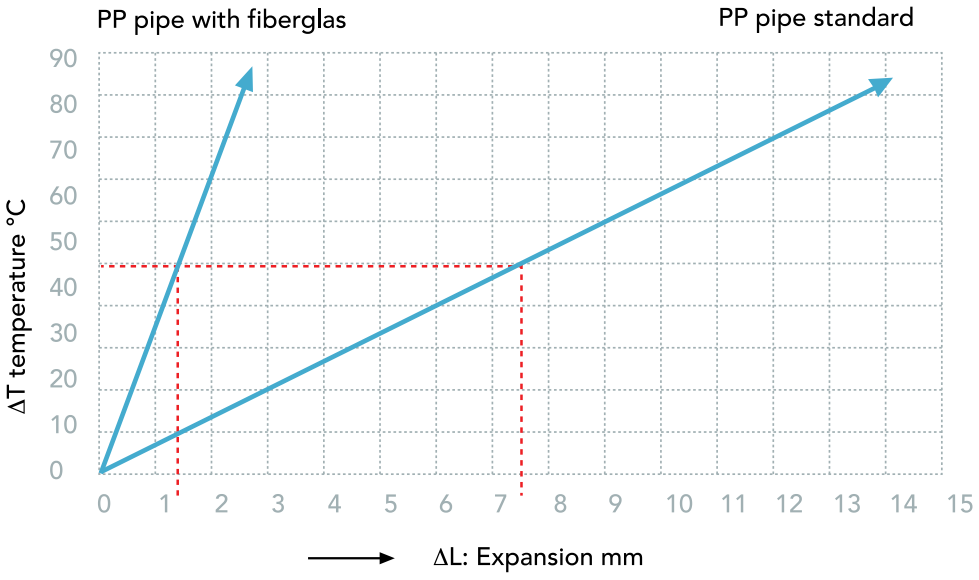
Characteristics

- Hygenic.
- Resistance to chemicals.
- High resistance to pressure and heat.
- Low heat loss.
- Low pressure loss due to the smoothness.
- Low thermal expansion.
- Expansion: 0.035 mm/mK.
- Lighter than standard PP-r pipes.
- The heat conductivity is less than alu-foiled PP-r pipes and same as PP-r standard pipes.
- Higher discharge related to the bigger inner diameter.

Advantages

- %75 less expansion than standard PP-r pipes.
- No need to shave the pipe for welding.
- Lower costs, you use less brackets due to less expansion.
- More resistance despite smaller wall thickness.
- %20 more flow than standard pipes.
- Same or lower heat conductivity in comparison to standard PP-r and aluminum foiled pipes.
- Easy welding and mounting.

Expansion Comparison Between PP Pipes with Fiberglass and Standard Pipe



Technical Properties, Pipe Dimensions (S=3,2 SDR=7,4) PN 20

Outer Diameter mm	Diameter Tolerance mm	Wall thickness mm	Thickness Tolerance mm	APP-rox Weight Kg/m
20	+0,3	2,8	+0,4	0,155
25	+0,3	3,5	+0,5	0,230
32	+0,3	4,4	+0,6	0,380
40	+0,4	5.5	+0,7	0,607
50	+0,5	6.9	+0,8	0,910
63	+0,6	8.6	+1,0	1,440
75	+0,7	10.3	+1,2	2,040
90	+0,9	12.3	+1,4	2,905
110	+1,1	15.1	+1,7	4,380

Operating Life According to DIN 8078 (PN 20)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	25,7
40	50	18,3
60	50	12,9
70	50	8,5
80	25	6,5
95	5	5,2

Technical Properties, Pipe Dimensions (S=2,5 SDR=6) PN 25

Outer Diameter mm	Diameter Tolerance mm	Wall thickness mm	Thickness Tolerance mm	APP-rox Weight Kg/m
20	+0,3	3,4	+0,5	0,180
25	+0,3	4,2	+0,6	0.270
32	+0,3	5,4	+0,7	0.415
40	+0,4	6,7	+0,8	0,665
50	+0,5	8,3	+1,0	1,030
63	+0,6	10,5	+1,2	1,620
75	+0,7	12,5	+1,4	2,310
90	+0,9	15,0	+1,6	3,326
110	+1,1	18,3	+2,0	4,950

Operating Life According to DIN 8078 (PN 25)

Temperature (°C)	Life (years)	Pressure (bar)
20	50	32,4
40	50	23,1
60	50	16,2
70	50	10,7
80	25	8,1
95	5	6,5

• Thermal Expansion in Polypropylene Pipes with Fiberglass

Polypropylene pipes with fiberglass have an expansion coefficient that is much higher than metal pipes. It is critical to take this characteristic 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.

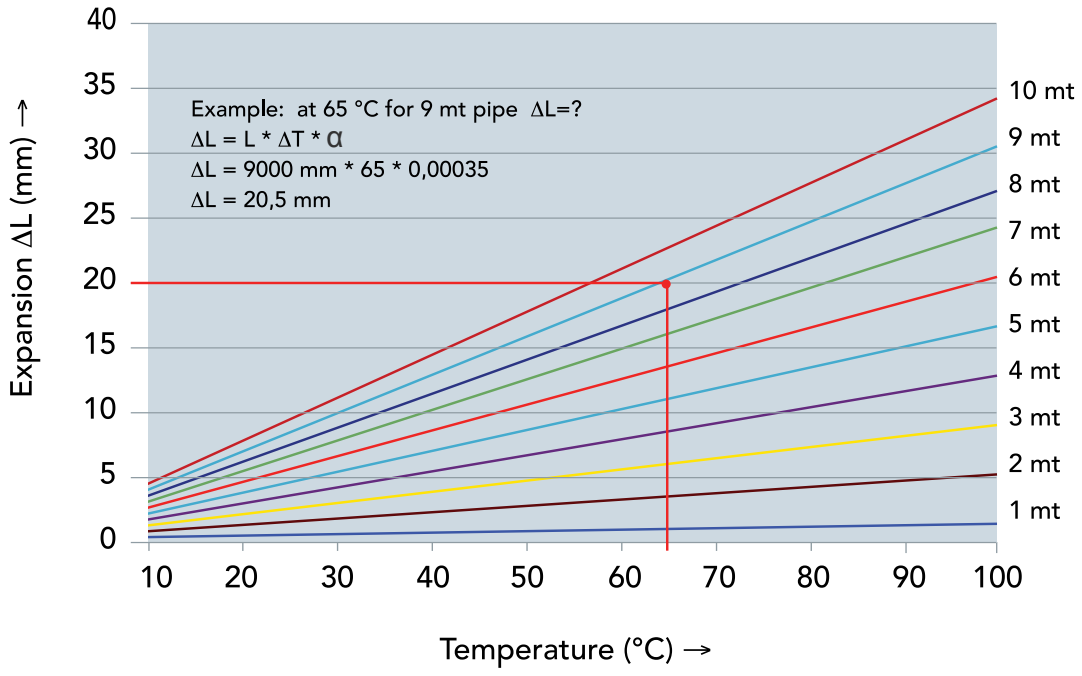
L = Initial length of the pipe in m.

α = Coefficient of linear thermal expansion. The value of α is $0.35 * 10^{-4}$ (K^{-1}) for fiber pipes.

Pipe length (m)	Temperature variation ΔT in K											
	1	5	10	20	30	40	50	60	70	80	90	100
	Linear expansion ΔL (mm)											
1.0	0,035	0,17	0,35	0,70	1,05	1,40	1,75	2,10	2,45	2,80	3,15	3,50
2.0	0,070	0,35	0,70	1,40	2,10	2,80	3,50	4,20	4,90	5,60	6,30	7,00
3.0	0,105	0,52	1,05	2,10	3,15	4,20	5,25	6,30	7,35	8,40	9,45	10,50
4.0	0,140	0,70	1,40	2,80	4,20	5,60	7,00	8,40	9,80	11,20	12,60	14,00
5.0	0,175	0,87	1,75	3,50	5,25	7,00	8,75	10,50	12,25	14,00	15,75	17,50
6.0	0,210	1,05	2,10	4,20	6,30	8,40	10,50	12,60	14,70	16,80	18,90	21,00
7.0	0,245	1,22	2,45	4,90	7,35	9,80	12,25	14,70	17,15	19,60	22,05	24,50
8.0	0,280	1,40	2,80	5,60	8,40	11,20	14,00	16,80	19,60	22,40	25,20	28,00
9.0	0,315	1,57	3,15	6,30	9,45	12,60	15,75	18,90	22,05	25,20	28,35	31,50
10.0	0,350	1,75	3,50	7,00	10,50	14,00	17,50	21,00	24,50	28,00	31,50	35,00

Note: When the water temperature circulating in the pipe is higher than the environmental temperature, the result will be an elongation. But if the water temperature circulating in the pipe is lower than the environmental temperature, the result will be a shortage.

Thermal Expansion of the Kalde PP-r Fiber-glass Pipe



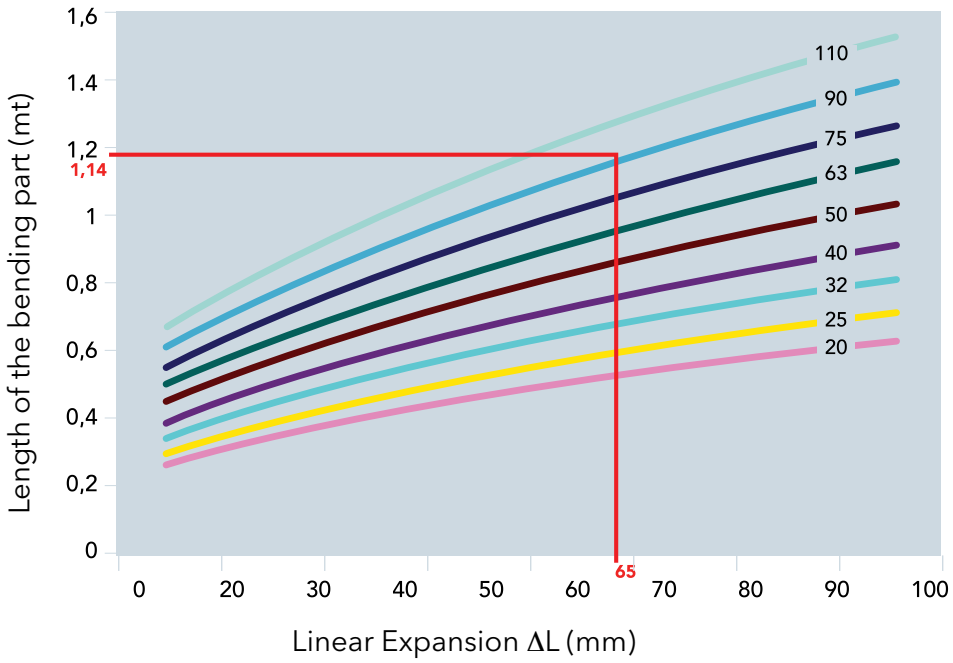
• Mounting and Installation

Thermal Tensions

Piping systems are used to convey gas and fluids in a broad area with various pressure and temperatures. Piping materials go through size changes due to changes in temperature, external forces, time-dependent effects (fatigue and relaxation), changes in internal structure, humidity value and some other reasons. When considering pipe systems, the most important elements that require taking measures are temperature and external forces as well as the weight of pipe itself, weight of fluid being conveyed, operating temperature, and internal and external pressure.

Thermal tensions result from static points blocking the pipe motion in all directions and preventing pipe's angular movement, and the sliding support that hinders the same in two directions.

A piping system should be designed so as to have the longest service life against its intended use, the lowest business and investment cost, and to work in the safest way. This can be ensured by making a thermal tension analysis of the installation. Therefore, thermal tensions must be taken into the same consideration from the basic household installation to those with the highest pressure and temperature values. Amount of thermal tension in piping is determined upon temperature difference in the pipeline, pipe length and material characteristics. Amount of thermal tension of PP-r pipe can be determined using the thermal expansion diagram below.



• Removing Expansions from Installation

Omega and (U) Elements

Omega and U parts designed for use in hot pipes. As an alternative, metal (belows) compansation also can used instead of the omega and U parts.. these parts, are used to get extensions in straight pipelines. these components, application forms and calculations of the system are given below.

Use some shape:

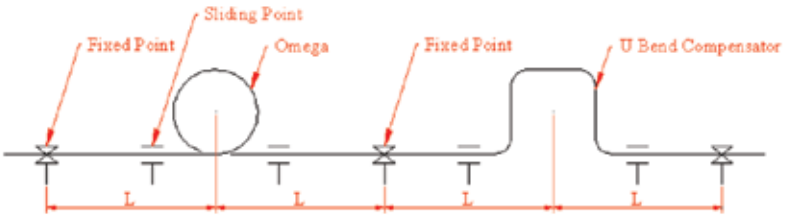


Figure - 1 Omega and U part

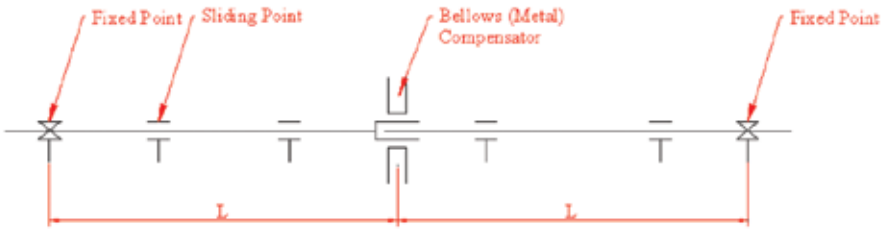


Figure - 2 Metal compansator

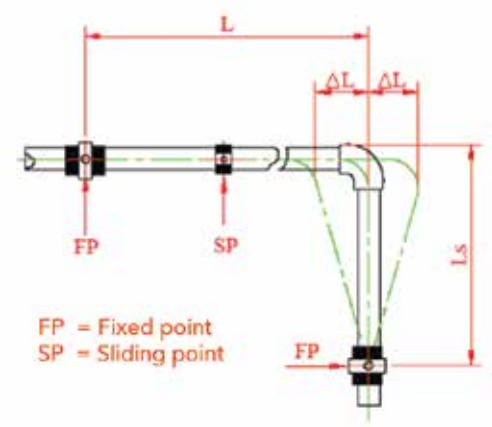


Figure - 3 U part (calculation distance of bending part)

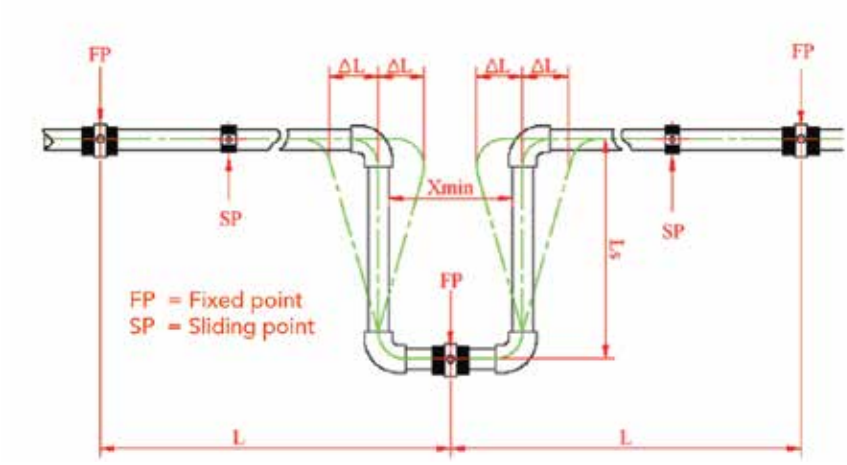


Figure - 4 Calculation distance of bending part

• Calculation of Elongation

Length of the bending part is calculated with the following formula.

Ls = c x $\sqrt{d \times \Delta L}$.

Ls = Lenght of the bending part mm.

d = Outer dimater of the Kalde pipe mm.

ΔL = Variation of length mm.

C = 15 (material based constant of Kalde pipe).

FP = Fixed Point.

MP = Moving Point.

Kalde Length of the Bending Part

Pipe out diamter, mm	Linear Expansion ΔL (mm)								
	20	30	40	50	60	70	80	90	100
	Length of the bending part in (m)								
Ø20	0.30	0.36	0.42	0.47	0.51	0.56	0.60	0.63	0.67
Ø25	0.33	0.41	0.47	0.53	0.58	0.62	0.67	0.71	0.75
Ø32	0.37	0.46	0.53	0.60	0.65	0.70	0.75	0.80	0.84
Ø40	0.42	0.52	0.60	0.67	0.73	0.79	0.84	0.90	0.94
Ø50	0.47	0.58	0.67	0.75	0.82	0.88	0.94	1.00	1.06
Ø63	0.53	0.65	0.75	0.84	0.90	0.99	1.06	1.12	1.19
Ø75	0.58	0.71	0.82	0.91	1.00	1.08	1.16	1.23	1.29
Ø90	0.63	0.78	0.90	1.00	1.10	1.19	1.27	1.35	1.42
Ø110	0.70	0.86	0.99	1.11	1.21	1.31	1.40	1.49	1.57

Example

1.Calculation of elongation

Temperature difference between cold water and environment

Input

α = 0.15 mm/m-K

L = 12 meter

ΔT = 40 °C

Required

ΔL = λ x ΔT x L

ΔL = 0.15 x 40 x 12 = 72 mm

2. The calculation of the bending length

d = 63 mm

ΔL = 72 mm

C = 15

Ls = c x $\sqrt{d \times \Delta L}$

Ls = 15 x $\sqrt{63 \times 72}$ = 1010 mm

• Support Intervals

Kalde PP-r Pipe SDR:6 – SDR:7.4 (PN20 – PN16)

Temperature ΔT (K)	Pipe diameter d (mm)								
	20	**25**	**32**	**40**	**50**	**63**	**75**	**90**	**110**
	Support intervals in cm								
20	60	70	90	100	120	140	150	160	180
30	60	70	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	50	60	70	80	100	110	120	140	160
70	50	60	70	80	90	100	110	120	140

Kalde Foil Pipe SDR:6 – SDR:7.4 (PN25 – PN20)

Temperature ΔT (K)	Pipe diameter d (mm)								
	20	25	32	40	50	63	75	90	110
	Support intervals in cm								
20	110	120	140	160	180	200	210	220	240
30	110	120	140	160	180	200	210	220	230
40	110	120	130	150	170	190	200	210	220
50	110	120	130	150	170	190	200	210	210
60	100	110	120	140	160	180	190	200	200
70	90	100	110	130	150	170	180	190	200

Kalde PP-r Pipe SDR:11 (PN10) (Temperature of Medium:20°C)

Temperature ΔT (K)	Pipe diameter d (mm)								
	20	25	32	40	50	63	75	90	110
	Support intervals in cm								
20	60	70	90	100	120	140	150	160	180

Kalde Fiberglas Pipe SDR:6 – SDR:7.4 (PN25 – PN20)

Temperature ΔT	Pipe diameter d (mm)								
	20	25	32	40	50	63	75	90	110
	Support intervals in cm								
20	90	100	110	120	140	160	170	180	200
30	90	100	110	120	140	160	170	180	200
40	80	90	100	110	130	150	160	170	180
50	80	90	100	110	130	150	160	170	180
60	70	80	90	100	120	140	150	160	170
70	70	80	90	100	120	120	140	150	160

• Welding Technique

Welding takes only a few seconds. The quality of an installation depends on the tightness, stability and lifetime of its connections. When the welded joint cools down, it can be fully loaded.

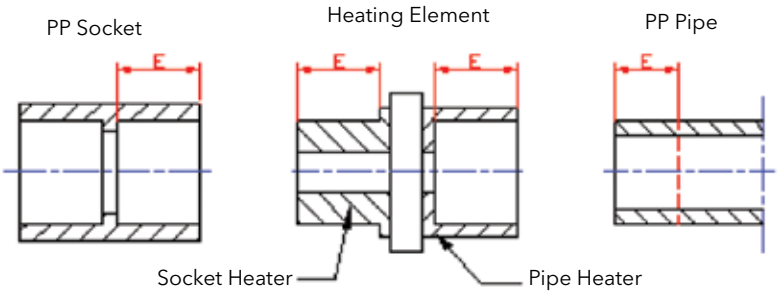
PPR pipes and fittings, combined with socket welding. This operation is done with welding machines. Surfaces to be welded must be clean.

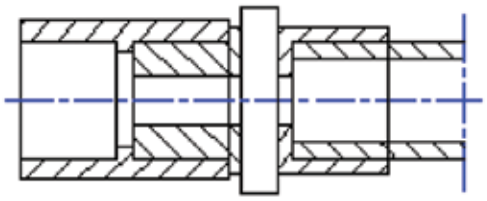
Welding sequence:

- According to the size of pipes and fittings welding part (Teflon coated) mounted welding machine, welding parts is heated until it reaches the temperature (260 ° C ± 10).
- To be welded pipe, pipe cutting scissors cut perpendicular to the axis of the pipe, (outer foil pipes, after cutting proses the on surface of the pipe aluminum foil must shaved with shave aparatus.)
- Pipe welding distance is marked. (see Chart of welding)
- Pipes and fittings, gently inserted into welding parts.
- A certain period of the welding machine the heated pipe and fitting, getting out from welding parts, and are combined with each other. (see Chart of welding)

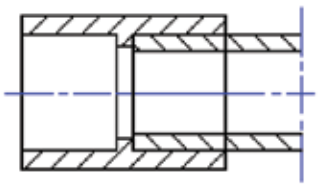
Outer Diameter (mm)	Heating Secs	Joining Secs	Cooling Time (minutes)	Welding length mm
20	7	4	2	16
25	7	4	3	18
32	8	6	4	20
40	12	6	4	22
50	18	6	5	26
63	24	8	6	29
75	30	10	8	32
90	40	11	8	38
110	50	12	8	42

Diameter (Ø), mm	E, mm
20	15
25	17
32	19
40	22
50	24
63	28
75	32
90	38
110	42





heating the socket and pipe-end



joining the socket and pipe

• Insulation of Pipes

PP-r tubes require less insulation compared to other types of pipes under the same conditions. Nevertheless, in cold and hot climates some insulation is required against freezing and heat loss over heating. These are caused by factors such as sun light, rain, snow when the pipes are laid outside. Another advantage of the insulation layer is the protection it provides against impacts.

General

Pipe insulation shall be designed to meet the following requirements.

a) Legal and other obligations shall complied with.

b) Insulation material shall be adequately protected against moisture.

c) The insulation materials shall ensure that the water is maintained at the designed operating temperature.

The insulating effect is mainly a function of the thickness of the insulation and its thermal conductivity, and increases in direct proportion to the temperature. The performance of insulating materials is impaired if they are moist. Opencell and fibrous insulating materials shall be provided with a vapour barrier bonded to the outher surface of the insulation.

Condensation can form on any insulating material if the cold water pipes are inadequately lagged. If unsuitable materials this may lead to the moisture penetrating to the pipe. Thus, closed-cell materials with a high moisture resistance should be used to insulate cold water pipes. All but joints, cuts, seams and ends shall be sealed.

If pipes are located in areas where frost damage is likely, even insulation cannot always prevent freezing if the system is not in service. The pipes should, therefore, be drained or otherwise protected.

Protection of cold water system against warmth and condensation.

Cold water pipework shall be adequately protected against heat sources and condensation, if necessary.

Cold water pipe shall be installed sufficiently clear of heat sources (e.g. hot pipes, chimneys, boilers). Where this is not possible, the pipes shall be insulated so that the water quality is not impaired by warmth.

For residential applications, the insulation thickness specified in the following table shall be used, assuming normal service conditions. insulation will not provide permanent protection of the water against warmth.

The specifications of the table are also applicable where the protection against condensation on the outer surface of the insulation is concerned, assuming a water temperature of 10°C.

Protection against condensation is not required if the pipe is provided with a suitable sheathing (e.g. ducted pipe).

Recommended Minimum Thickness of Insulation for Cold Water Pipes

Location of pipe	Insulation Thickness λ = 0,040 W/mK *)
Exposed pipes, in unheated room (e.g. cellar)	4 mm
Exposed pipes, in heated room	9 mm
Ducted pipes, (cold water only)	4 mm
Ducted pipes, (cold and hot water)	13 mm
Chased pipes, risers	4 mm
Pipes in wall recess, next to hot pipes	13 mm
Pipes on concrete floor	4 mm
*) for other values of λ, the thickness is to be obtained by conversion, on the basis of a pipe diameter of 20 mm.	

• Protection of Hot Water Pipes Against Heat Loss

The minimum requirements specified in the Heizungsanlagen-Verordnung (heating system regulation) shall be complied with for restricting the heat loss of hot pipes, including circulation pipes.

• Thermal Insulation of Warm Water Pipes

The decree for energy saving thermal protection and energy saving technique for buildings shall be considered.

Decree for energy saving (EnEV-in Germany) regulates the thermal insulation of pipes and fittings.

Minimum Thickness of Insulation Warm Water Pipes

Line	Type of Pipe / Fitting	Minimum Thickness of insulation refered to thermal conductivity of λ=0.035 W/mK
1	Inner diameter up to 22 mm	20 mm
2	Inner diameter more than 22 mm up to 35 mm	30 mm
3	Inner diameter more than 35 mm up to 100 mm	Same as inner diameter
4	Inner diameter more than 100 mm	100 mm

Insulation Thickness

Pipe Outer Diameter	Available Thickness Acc.to 2 HAVO λ = 0.035 W/mK	Insulation Thickness in Kalde Pipes λ = 0.035 W/mK
20x3,4 mm	20 mm	20 mm
25x4,2 mm	20 mm	20 mm
32x5,4 mm	20 mm	20 mm
40x6,7 mm	30 mm	30 mm
50x8,3 mm	30 mm	30 mm
63x10,5 mm	42 mm	42 mm
75x12,5 mm	50 mm	50 mm
90x15,0mm	60 mm	60 mm
110x18,3mm	73,4 mm	73,4 mm

• Pipe Laying

Pipes in the ground should be isolated against thermal insulation and corrosion.

Penetration of moisture and water through the pipes underground and insulation material should be avoided.

Water in buried service pipes may be polluted by waste water. Thus, where the distance between drinking and waste water pipes does not exceed 1 m, the former shall not be laid deeper than the latter. The minimum clear distance between drinking water pipes and other pipes shall be 0.2 m. Where this distance cannot be maintained, protective measures (e.g. enclosing pipe in a duct) shall be taken.

Pipes embedded in a building element (e.g. wall or floor) shall be suitably wrapped or coated so as to ensure that the pipe and building element are not in direct contact.

• Test Procedure (DIN 1988-2)

The finished installation shall be filtered and vacuumed in order to be filled with water to start testing.

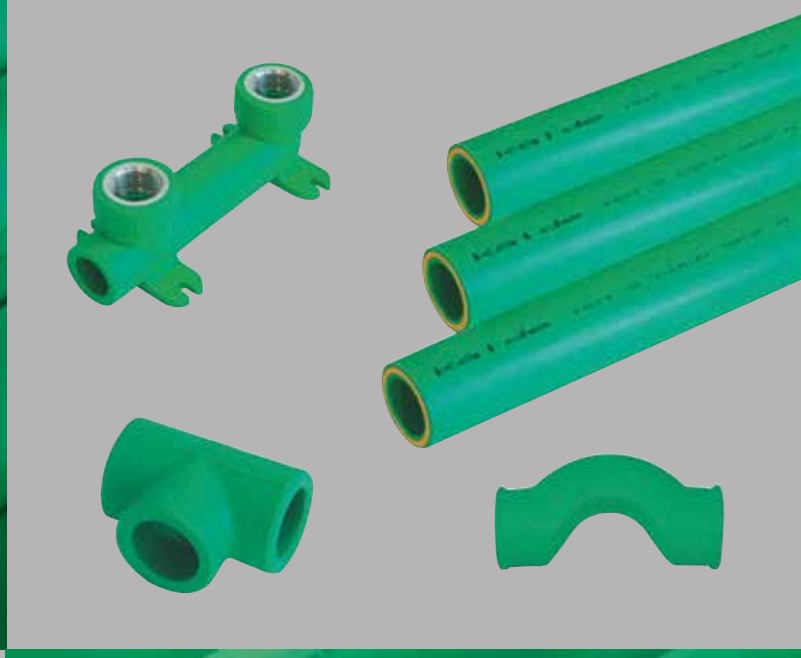
Pressure testing shall be carried out in two stages, the first stage being sufficient for smaller sections of the system (e.g. for testing supply and branch pipes in wet rooms).

a) 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 (with a rate of 0.1 bar per minute) and leakage has occurred.

b) The second stage shall follow the first stage without interval and shall last two 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.





PP-r Products

PP-r Products

• Polypropylene Tubes

PN-20 | Polypropylene Tube

Code	D (mm)	m/bundle
3201-tbe- 200000	ø20	100
3201-tbe- 250000	ø25	80
3201-tbe- 320000	ø32	40
3201-tbe- 400000	ø40	32
3201-tbe- 500000	ø50	20
3201-tbe- 630000	ø63	16
3201-tbe- 750000	ø75	12
3201-tbe- 900000	ø90	8
3201-tbe- 110000	ø110	4
3201-tbe- 125000	ø125	4

PN-16 | Polypropylene Tube

Code	D (mm)	m/bundle
3201-tbe- 200016	ø20	100
3201-tbe- 250016	ø25	80
3201-tbe- 320016	ø32	40
3201-tbe- 400016	ø40	32
3201-tbe- 500016	ø50	20
3201-tbe- 630016	ø63	16
3201-tbe- 750016	ø75	12
3201-tbe- 900016	ø90	8
3201-tbe- 110016	ø110	4
3201-tbe- 125016	ø125	4

PN-10 | Polypropylene Tube

Code	D (mm)	m/bundle
3201-tbe- 200010	ø20	100
3201-tbe- 250010	ø25	80
3201-tbe- 320010	ø32	40
3201-tbe- 400010	ø40	32
3201-tbe- 500010	ø50	20
3201-tbe- 630010	ø63	16
3201-tbe- 750010	ø75	12
3201-tbe- 900010	ø90	8
3201-tbe- 110010	ø110	4
3201-tbe- 125010	ø125	4

PN-25 | Polypropylene Tube with Alu-foil - Supperpipe

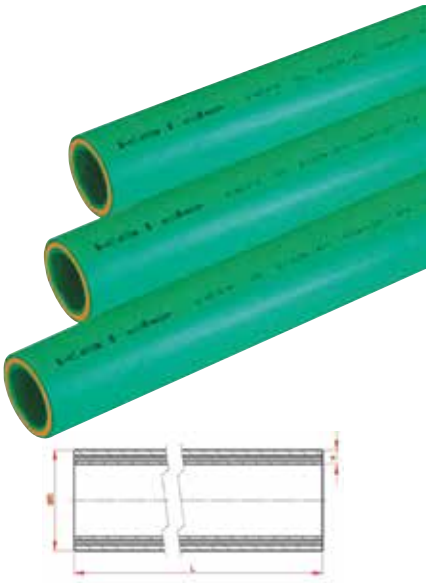
Code	D (mm)	m/bundle
3201-tmf- 200000	ø20	100
3201-tmf- 250000	ø25	80
3201-tmf- 320000	ø32	40
3201-tmf- 400000	ø40	32
3201-tmf- 500000	ø50	20
3201-tmf- 630000	ø63	16
3201-tmf- 750000	ø75	12
3201-tmf- 900000	ø90	8
3201-tmf- 110000	ø110	4

PN-25 | Polypropylene Tube with Alu Oxi - Supperpipe

Code	D (mm)	m/bundle
3201-tox- 200000	ø20	100
3201-tox- 250000	ø25	80
3201-tox- 320000	ø32	40
3201-tox- 400000	ø40	32
3201-tox- 500000	ø50	20
3201-tox- 630000	ø63	16
3201-tox- 750000	ø75	12
3201-tox- 900000	ø90	8
3201-tox- 110000	ø110	4

PN-16 | Polypropylene Tube with Fiberglass - Orangepipe

Code	D (mm)	m/bundle
3201 -tfr- 200016	ø20	100
3201 -tfr- 250016	ø25	80
3201 -tfr- 320016	ø32	40
3201 -tfr- 400016	ø40	32
3201 -tfr- 500016	ø50	20
3201 -tfr- 630016	ø63	16
3201 -tfr- 750016	ø75	12
3201 -tfr- 900016	ø90	8
3201 -tfr- 110016	ø110	4
3201 -tfr- 125016	ø125	4



PN-20 | Polypropylene Tube with Fiberglass - Orangepipe

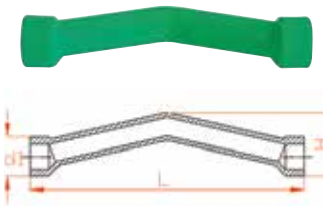
Code	D (mm)	m/bundle
3201-tfr- 200020	ø20	100
3201-tfr- 250020	ø25	80
3201-tfr- 320020	ø32	40
3201-tfr- 400020	ø40	32
3201-tfr- 500020	ø50	20
3201-tfr- 630020	ø63	16
3201-tfr- 750020	ø75	12
3201-tfr- 900020	ø90	8
3201-tfr- 110020	ø110	4
3201-tfr- 125020	ø125	4

PN-25 | Polypropylene Tube with Fiberglass - Orangepipe

Code	D (mm)	m/bundle
3201-tfr- 200000	ø20	100
3201-tfr- 250000	ø25	80
3201-tfr- 320000	ø32	40
3201-tfr- 400000	ø40	32
3201-tfr- 500000	ø50	20
3201-tfr- 630000	ø63	16
3201-tfr- 750000	ø75	12
3201-tfr- 900000	ø90	8
3201-tfr- 110000	ø110	4
3201-tfr- 125000	ø125	4

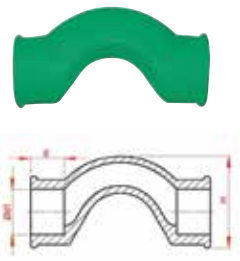
PP Bridge

Code	D (mm)	H (mm)	Pcs/Box
3201-twc- 200000	ø20	40	100/40
3201-twc- 250000	ø25	50	50/40
3201-twc- 320000	ø32	64	20/40
3201-twc- 400000	ø40	80	25/40



PP C-Bridge

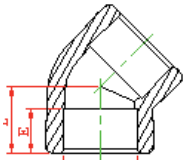
Code	D (mm)	H (mm)	Pcs/Box
3201-twc- 200001	ø20	38	200
3201-twc- 250001	ø25	51	100
3201-twc- 320001	ø32	66	60



• Polypropylene Fittings

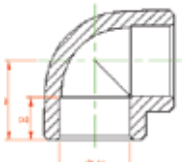
Elbow 45°

Code	Size	Ød1	E	L	Pcs/Box
3211-elb- 200045	ø20	19	15	20	400
3211-elb- 250045	ø25	24	17	23	200
3211-elb- 320045	ø32	31	19	27	100
3211-elb- 400045	ø40	39	22	31	60
3211-elb- 500045	ø50	48,5	24	36	40
3211-elb- 630045	ø63	61,5	28	42	20
3211-elb- 750045	ø75	73,5	32	50	12
3211-elb- 900045	ø90	88,5	38	59	10
3211-elb- 110045	ø110	108,5	42	66	4



Elbow 90°

Code	Size	Ød1	E	L	Pcs/Box
3211-elb- 200000	ø20	19	15	26	400
3211-elb- 250000	ø25	24	17	30	200
3211-elb- 320000	ø32	31	19	36	100
3211-elb- 400000	ø40	39	22	43	60
3211-elb- 500000	ø50	48,5	24	50,5	30
3211-elb- 630000	ø63	61,5	28	62	16
3211-elb- 750000	ø75	73,5	32	70	16
3211-elb- 900000	ø90	88,5	38	80	4
3211-elb- 110000	ø110	108,5	42	94	2

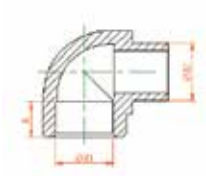


Tail Elbow 45°

Code	Size	Ød1	Ød2	E	Pcs/Box
3211-elt- 200045	ø20	19	20,5	15	300
3211-elt- 250045	ø25	24	25,5	17	200

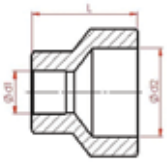
Tail Elbow 90°

Code	Size	Ød1	Ød2	E	Pcs/Box
3211-elt- 200000	ø20	19	20,5	15	300
3211-elt- 250000	ø25	24	25,5	17	200



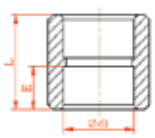
Reducing Female Coupling

Code	Size	Ød1	E	L	Pcs/Box
3211-rdf- 252000	ø25/20	24	17	33	300
3211-rdf- 322000	ø32/20	31	19	37	200
3211-rdf- 322500	ø32/25	31	19	42	200
3211-rdf- 402000	ø40/20	39	22	42	150
3211-rdf- 402500	ø40/25	39	22	53	150



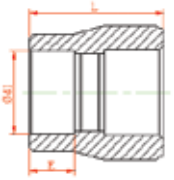
Coupling

Code	Size	Ød1	E	L	Pcs/Box
3211-muf- 200000	ø20	19	15	33	500
3211-muf- 250000	ø25	24	17	37	300
3211-muf- 320000	ø32	31	19	42	150
3211-muf- 400000	ø40	39	22	46	100
3211-muf- 500000	ø50	48,5	24	53	50
3211-muf- 630000	ø63	61,5	28	62	25
3211-muf- 750000	ø75	73,5	32	69	24
3211-muf- 900000	ø90	88,5	38	79	16
3211-muf- 110000	ø110	108,5	42	86	6



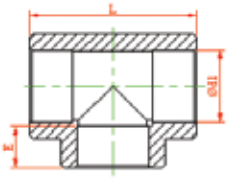
Reducing Coupling

Code	Size	Ød1	E	L	Pcs/Box
3211-rdc- 252000	ø25/20	19	15	40	500
3211-rdc- 322000	ø32/20	19	15	40	400
3211-rdc- 322500	ø32/25	24	17	45	300
3211-rdc- 402000	ø40/20	19	15	45	200
3211-rdc- 402500	ø40/25	24	17	49	200
3211-rdc- 403200	ø40/32	31	19	52	150
3211-rdc- 502000	ø50/20	19	15	56	100
3211-rdc- 502500	ø50/25	24	17	56	100
3211-rdc- 503200	ø50/32	31	19	56	100
3211-rdc- 504000	ø50/40	39	22	60	80
3211-rdc- 632000	ø63/20	19	15	95	80
3211-rdc- 632500	ø63/25	24	17	95	80
3211-rdc- 633200	ø63/32	31	19	95	60
3211-rdc- 634000	ø63/40	39	22	63	60
3211-rdc- 635000	ø63/50	48,5	24	67	50
3211-rdc- 752000	ø75/20	19	15	95	60
3211-rdc- 752500	ø75/25	24	17	95	50
3211-rdc- 753200	ø75/32	31	19	95	50
3211-rdc- 754000	ø75/40	39	22	95	50
3211-rdc- 755000	ø75/50	48,5	24	75	40
3211-rdc- 756300	ø75/63	61,5	28	75	30
3211-rdc- 905000	ø90/50	48,5	24	85	20
3211-rdc- 906300	ø90/63	61,5	28	85	20
3211-rdc- 907500	ø90/75	73,5	32	85	16
3211-rdc- 110630	ø110/63	61,5	28	92	16
3211-rdc- 110750	ø110/75	73,5	32	95	16
3211-rdc- 110900	ø110/90	88,5	38	95	12



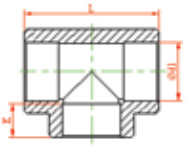
Inegal Tee

Code	Size	Ød1	Ød2	Ød3	Pcs/Box
3211-tio- 202520	ø20x25x20	19	24	19	150
3211-tio- 252020	ø25x20x20	24	19	19	200
3211-tio- 252025	ø25x20x25	24	19	24	200
3211-tio- 252520	ø25x25x20	24	24	19	150
3211-tio- 322020	ø32x20x20	31	19	19	100
3211-tio- 322025	ø32x20x25	31	19	24	100
3211-tio- 322032	ø32x20x32	31	19	31	80
3211-tio- 322520	ø32x25x20	31	24	19	100
3211-tio- 322525	ø32x25x25	31	24	24	100
3211-tio- 322532	ø32x25x32	31	24	31	80
3211-tio- 402040	ø40x20x40	39	19	39	60
3211-tio- 402540	ø40x25x40	39	24	39	50
3211-tio- 403240	ø40x32x40	39	31	39	50
3211-tio- 502050	ø50x20x50	48,5	19	48,5	40
3211-tio- 502550	ø50x25x50	48,5	24	48,5	40
3211-tio- 503250	ø50x32x50	48,5	31	48,5	30
3211-tio- 504050	ø50x40x50	48,5	39	48,5	30
3211-tio- 632063	ø63x20x63	61,5	19	61,5	20
3211-tio- 632563	ø63x25x63	61,5	24	61,5	20
3211-tio- 633263	ø63x32x63	61,5	31	61,5	20
3211-tio- 634063	ø63x40x63	61,5	39	61,5	16
3211-tio- 635063	ø63x50x63	61,5	48,5	61,5	16
3211-tio- 752075	ø75x20x75	73,5	19	73,5	10
3211-tio- 752575	ø75x25x75	73,5	24	73,5	10
3211-tio- 753275	ø75x32x75	73,5	31	73,5	10
3211-tio- 754075	ø75x40x75	73,5	39	73,5	10
3211-tio- 755075	ø75x50x75	73,5	48,5	73,5	10
3211-tio- 756375	ø75x63x75	73,5	61,5	73,5	10
3211-tio- 905090	ø90x50x90	88,5	48,5	88,5	4
3211-tio- 906390	ø90x63x90	88,5	61,5	88,5	4
3211-tio- 115011	ø110x50x110	108,5	48,5	108,5	3
3211-tio- 116311	ø110x63x110	108,5	61,5	108,5	2



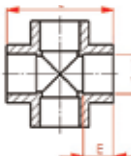
Tee

Code	Size	Ød1	E	L	Pcs/Box
3211-teo- 200000	ø20	19	15	52	250
3211-teo- 250000	ø25	24	17	60	150
3211-teo- 320000	ø32	31	19	72	80
3211-teo- 400000	ø40	39	22	86	40
3211-teo- 500000	ø50	48,5	24	101	20
3211-teo- 630000	ø63	61,5	28	124	14
3211-teo- 750000	ø75	73,5	32	140	10
3211-teo- 900000	ø90	88,5	38	160	4
3211-teo- 110000	ø110	108,5	42	188	2



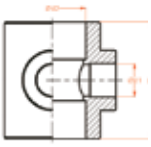
Cross

Code	Size	Ød1	E	L	Pcs/Box
3211-crs- 200000	ø20	19	15	53	200
3211-crs- 250000	ø25	24	17	64	100
3211-crs- 320000	ø32	31	19	74	60



Cross Tee

Code	Size	Ød1	Ød2	L	Pcs/Box
3211-cdl- 322000	ø32/20	19	31	61	80
3211-cdl- 322500	ø32/25	24	31	61	80
3211-cdl- 402000	ø40/20	19	39	68	60
3211-cdl- 402500	ø40/25	24	39	68	60



Reduction Elbow

Code	Size	Ød1	Ød2	L	Pcs/Box
3211-elr- 252000	ø25/20	24	19	37	200

TE Branch

Code	Size	Ød1	E	L	Pcs/Box
3211-byp- 202000	ø20/20	19	15	59	100
3211-byp- 252500	ø25/25	24	17	63	60
3211-byp- 252000	ø25/20	24	17	63	60

Wallplate Elbow Double

Code	Size	Ød1	E	L	Pcs/Box
3221-btt- 200b00	ø20x1/2"	19	15	91	20
3221-btt- 250b00	ø25x1/2"	24	17	91	20

Special Wallplate Elbow - Double

Code	Size	Ød1	E	L	Pcs/Box
3221-bat- 200b04	ø20x1/2"	19	15	150	40
3221-bat- 250b04	ø25x1/2"	24	17	150	20

Special Wallplate Elbow - Double Grilled

Code	Size	Ød1	E	L	Pcs/Box
3221 -bat- 200b05	ø20x1/2"	19	15	183	40
3221 -bat- 250b05	ø25x1/2"	24	17	183	20

Wallplate Elbow Female

Code	Size	Ød1	E	L	Pcs/Box
3221-bat- 200b01	ø20x1/2"	19	15	34	60
3221-bat- 250b01	ø25x1/2"	24	17	37	40
3221-bat- 250c01	ø25x3/4"	24	17	37	50

Wallplate Elbow - Male

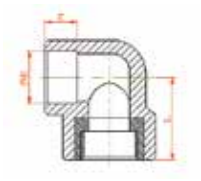
Code	Size	Ød1	E	L	Pcs/Box
3221-btm- 200b00	ø20x1/2"	19	15	78	100

Wallplate Elbow - Female - Long

Code	Size	Ød1	E	L	Pcs/Box
3221-btl- 200b00	ø20x1/2"	19	15	78	45

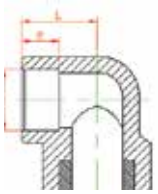
Female Elbow

Code	Size	Ød1	E	L	Pcs/Box
3221-efo- 200b00	ø20x1/2"	19	15	35	100
3221-efo- 200c00	ø20x3/4"	19	15	37	60
3221-efo- 250b00	ø25x1/2"	24	17	37	60
3221-efo- 250c00	ø25x3/4"	24	17	37	60
3221-efo- 320b00	ø32x1/2"	31	19	49	40
3221-efo- 320c00	ø32x3/4"	31	19	49	30
3221-efo- 321000	ø32x1"	31	19	49	30
3221-efo- 401a06	ø40x1 1/4"	39	22	49	16



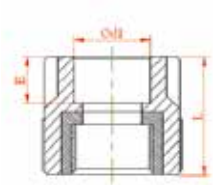
Male Elbow

Code	Size	Ød1	E	L	Pcs/Box
3221-emo- 200b00	ø20x1/2"	19	15	50	80
3221-emo- 200c00	ø20x3/4"	19	15	50	50
3221-emo- 250b00	ø25x1/2"	24	17	50	50
3221-emo- 250c00	ø25x3/4"	24	17	53	50
3221-emo-320b00	ø32x1/2"	31	19	64	40
3221-emo- 320c00	ø32x3/4"	31	19	64	30
3221-emo- 321000	ø32x1"	31	19	64	30
3221-emo- 401a06	ø40x1 1/4"	39	22	64	16



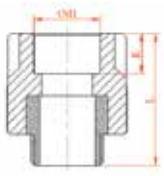
Female Nipple

Code	Size	Ød1	E	L	Pcs/Box
3221-nfo- 200b00	ø20x1/2"	19	15	45	100
3221-nfo- 200c00	ø20x3/4"	19	15	45	100
3221-nfo- 250b00	ø25x1/2"	24	17	49	100
3221-nfo- 250c00	ø25x3/4"	24	17	49	100
3221-nfo- 320b00	ø32x1/2"	31	19	55	60
3221-nfo- 320c00	ø32x3/4"	31	19	55	60
3221-nfo- 321000	ø32x1"	31	19	55	40



Male Nipple

Code	Size	Ød1	E	L	Pcs/Box
3221-nmo- 200b00	ø20x1/2"	19	15	41	100
3221-nmo- 200c00	ø20x3/4"	19	15	41	100
3221-nmo- 250b00	ø25x1/2"	24	17	47	100
3221-nmo- 250c00	ø25x3/4"	24	17	47	100
3221-nmo- 320b00	ø32x1/2"	31	19	47	50
3221-nmo- 320c00	ø32x3/4"	31	19	47	50
3221-nmo- 321000	ø32x1"	31	19	47	40



Female Nipple - Octa

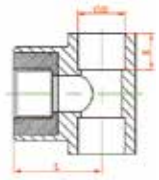
Code	Size	Ød1	E	L	Pcs/Box
3221-nfo- 321006	ø32x1"	31	19	55	40
3221-nfo- 401a06	ø40x1 1/4"	39	22	65	20
3221-nfo- 501b06	ø50x1 1x2"	48,5	24	71	12
3221-nfo- 632006	ø63x2"	61,5	28	78	8
3221-nfo- 752b06	ø75x 1/2"	73,5	32	85	6
3221-nfo- 903006	ø90x3"	88,5	38	110,5	4
3221-nfo- 110406	ø110x4"	108,5	42	112,5	2

Male Nipple - Octa

Code	Size	Ød1	E	L	Pcs/Box
3221-nmo- 321006	ø32x1"	31	19	76	30
3221-nmo- 401a06	ø40x1 1/4"	39	22	86	16
3221-nmo- 501b06	ø50x1 1/2"	48,5	24	91	12
3221-nmo- 632006	ø63x2"	61,5	28	101	8
3221-nmo- 752b06	ø75x2 1/2"	73,5	32	103	6
3221-nmo- 903006	ø90x3"	88,5	38	132,7	8
3221-nmo- 110406	ø110x4"	108,5	42	146,5	3

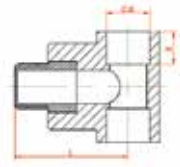
Female Tee

Code	Size	Ød1	E	L	Pcs/Box
3221-tfo- 200b20	ø20x1/2"x20	19	15	36	75
3221-tfo- 200c20	ø20x3/4"x20	19	15	36	40
3221-tfo- 250b25	ø25x1/2"x25	24	17	38	60
3221-tfo- 250c25	ø25x3/4"x25	24	17	38	40
3221-tfo- 320b32	ø32x1/2"x32	31	19	49	30
3221-tfo- 320c32	ø32x3/4"x32	31	19	49	30
3221-tfo- 321032	ø32x1"x32	31	19	49	20
3221-tfo- 401a40	ø40x1 1/4"x40	39	22	49	20



Male Tee

Code	Size	Ød1	E	L	Pcs/Box
3221-tmo- 200b20	ø20x1/2x20"	19	15	50	60
3221-tmo- 200c20	ø20x3/4x20"	19	15	55	40
3221-tmo- 250b25	ø25x1/2x25"	24	17	57	40
3221-tmo- 250c25	ø25x3/4x25"	24	17	57	40
3221-tmo- 320c32	ø32x3/4x32"	31	19	65	20
3221-tmo- 321032	ø32x1"x32"	31	19	65	20
3221-tmo- 401a40	ø40x1 1/4x40"	39	22	65	20



Male Tail Nipple

Code	Size	Ød1	E	L	Pcs/Box
3221-nmo- 200b01	ø20x1/2"	20,5	15	65	100
3221-nmo- 250c01	ø25x3/4"	25,5	17	68	80

Female Nipple for PE-X Connection

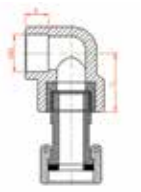
Code	Size	Ød1	E	L	Pcs/Box
3221-nfo- 200b16	ø20x1/2"	19	15	60	120

Male Nipple for PE-X Connection

Code	Size	Ød1	E	L	Pcs/Box
3221 -nmt- 200b16	ø20x1/2"	20,5	15	68	200

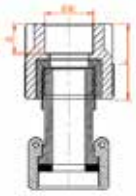
Elbow with Loose Nut

Code	Size	Ød1	E	L	Pcs/Box
3221-tue- 200b00	ø20x1/2"	19	15	35	120
3221-tue- 200c00	ø20x3/4"	19	15	37	70
3221-tue- 250c00	ø25x3/4"	24	17	37	70
3221-tue- 251000	ø25x1"	24	17	37	50
3221-tue- 321000	ø32x1"	31	19	49	30
3221-tue- 321a00	ø32x1 1/4"	31	19	49	30



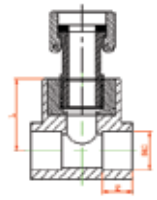
Nipple with Loose Nut

Code	Size	Ød1	E	L	Pcs/Box
3221-tun- 200b00	ø20x1/2"	19	15	45	150
3221-tun- 200c00	ø20x3/4"	19	15	45	150
3221-tun- 250c00	ø25x3/4"	24	17	49	100
3221-tun- 251000	ø25x1"	24	17	49	60
3221-tun- 321000	ø32x1"	31	19	55	40
3221-tun- 321a00	ø32x1 1/4"	31	19	55	40



Tee with Loose Nut

Code	Size	Ød1	E	L	Pcs/Box
3221-tut- 200b00	ø20x1/2"	19	15	36	100
3221-tut- 200c00	ø20x3/4"	19	15	36	50
3221-tut- 250c00	ø25x3/4"	24	17	38	50
3221-tut- 251000	ø25x1"	24	17	38	40
3221-tut- 321a00	ø32x1" 1/4"	31	19	49	20

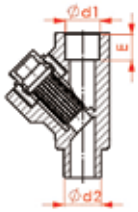


Filter - Female/Female

Code	Size	Ød1	E	L	Pcs/Box
3221-flt- 200001	ø20	19	15	80,3	60
3221-flt- 250001	ø25	24	17	100,3	40
3221-flt- 320001	ø32	31	19	107,8	25

Filter - Male/Female

Code	Size	Ød1	E	L	Pcs/Box
3221-flt- 200000	ø20	19	15	80.3	60
3221-flt- 250000	ø25	24	17	100.3	40
3221-flt- 320000	ø32	31	19	107.8	25



Sealed Filter - Female/Female

Code	Size	Ød1	E	L	Pcs/Box
3221-fls- 200001	ø20	19	15	80,3	60
3221-fls- 250001	ø25	24	17	100,3	40
3221-fls- 320001	ø32	31	19	107,8	25

Sealed Filter - Male/Female

Code	Size	Ød1	E	L	Pcs/Box
3221-fls- 200000	ø20	19	15	80.3	60
3221-fls- 250000	ø25	24	17	100.3	40
3221-fls- 320000	ø32	31	19	107.8	25

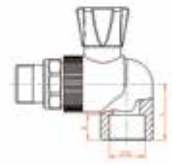
Ball Valve for Radiator - Straight

Code	Size	Ød1	E	L	Pcs/Box
3241-vlr- 200b00	ø20x1/2"	19	15	89	50
3241-vlr- 250c00	ø25x3/4"	24	17	95	40

Ball Valve for Radiator - Elbow

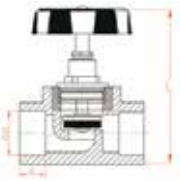
Only by kalde

Code	Size	Ød1	E	L	Pcs/Box
3241-vre- 200b00	ø20x1/2"	19	15	33	50
3241-vre- 250c00	ø25x3/4"	24	17	38	30



Valve

Code	Size	Ød1	E	L	Pcs/Box
3241-vlf- 200000	ø20	19	15	81	35
3241-vlf- 250000	ø25	24	17	86	25
3241-vlf- 320000	ø32	31	19	104	15



Check Valve

New by kalde

Code	Size	Ød1	E	L	Pcs/Box
3221 -cvl- 0b0000	20	19	15	58	100
3221 -cvl- 0c0000	25	24	17	61	100

Elbow with Transition Union for Radiator

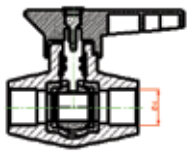
Code	Size	Ød1	E	L	Pcs/Box
3221-tre- 200b00	ø20x1/2"	19	15	67,5	80
3221-tre- 250c00	ø25x3/4"	24	17	71,5	50

Ball Valve - Long

Code	Size	Ød1	E	L	Pcs/Box
3241-vlb- 200002	ø20	19	15		35
3241-vlb- 250002	ø25	24	17		30

Ball Valve

Code	Size	Ød1	E	L	Pcs/Box
3241-vlb- 200003	ø20	19	15		40
3241-vlb- 250003	ø25	24	17		35
3241-vlb- 320003	ø32	31	19		20
3241-vlb- 400003	ø40	39	22		15
3241-vlb- 500003	ø50	48,5	24		6
3241-vlb- 630003	ø63	61,5	28		5
3241-vlb- 750003	ø75	73,5	32		5



Ball Valve with Female Nipple

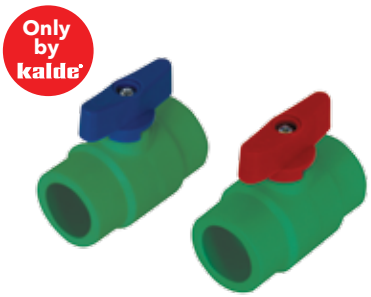
Code	Size	Ød1	E	L	Pcs/Box
3241-vlb- 200b04	ø20x1/2"	19	15		40
3241-vlb- 250c04	ø25x3/4"	24	17		35

Ball Valve with Male Nipple

Code	Size	Ød1	E	L	Pcs/Box
3242 -vlb- 200b05	ø20x1/2"	19	15	68	40
3242 -vlb- 250c05	ø25x3/4"	24	17	79	35

Mini Ball Valve

Code	Size / Color	Ød1	E	L	Pcs/Box
3241-vlm- 200001	ø20 ●	19	15	59,5	80
3241-vlm- 200002	ø20 ●	19	15	59,5	80
3241-vlm- 250001	ø25 ●	24	17	65	80
3241-vlm- 250002	ø25 ●	24	17	65	80
3241-vlm- 320001	ø32 ●	31	19	74	35
3241-vlm- 320002	ø32 ●	31	19	74	35



Ball Valve with Double Transtion Union

Code	Size	R"	Ød1	Ød2	Pcs/Box
3241-vlb- 200005	ø20"	1/2"	19	19	30
3241-vlb- 250005	ø25"	3/4"	24	24	25
3241-vlb- 320005	ø32"	1"	31	31	15
3241-vlb- 400005	ø40"	1 1/4"	39	39	10
3241-vlb- 500005	ø50"	1 1/2"	48,5	48,5	5
3241-vlb- 630005	ø63"	2"	61,5	61,5	4

Ball Valve with Single Transtion Union

Code	Size	R"	Ød1	Ød2	Pcs/Box
3241-vlb- 200006	ø20"	1/2"	19	19	35
3241-vlb- 250006	ø25"	3/4"	24	24	25
3241-vlb- 320006	ø32"	1"	31	31	15

Valve for Radiator - Elbow

Code	Size	Ød1	E	L	Pcs/Box
3241-vse- 200b00	ø20"x1/2"	19	15	52	50

Valve for Radiator - Straight

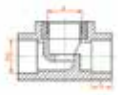
Code	Size	Ød1	E	L	Pcs/Box
3241-vsr- 200b00	ø20x1/2"	19	15	50,5	50

Chrome-Plated Valve - Hidden

Code	Size	R	L	Ød2	Pcs/Box
3241-vle- 200000	20	1/2"	97,5	19	30
3241-vle- 250000	25	3/4"	102	24	25
3241-vle- 320000	32	1"	111,5	31	20

Chrome-Plated Valve

Code	Size	R	L	Ød2	Pcs/Box
3241-vlk- 200000	20	1/2"	113	19	20
3241-vlk- 250000	25	3/4"	113	24	20
3241-vlk- 320000	32	1"	113	31	15



Chrome-Plated Valve - Trefoil

Code	Size	R	L	Ød2	Pcs/Box
3241-vlk- 200002	20	1/2"	113	19	20
3241-vlk- 250002	25	3/4"	113	24	20

Chrome-Plated Ball Valve - Trefoil

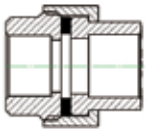
Code	Size	R	L	Ød2	Pcs/Box
3241-vlg- 250003	25	3/4"	113	24	20

Valve - Laundry

Code	Size	R"			Pcs/Box
3243 -vlc- 0b0c00	20	1/2"			35

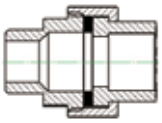
Only by kalde

Transition Union - Female



Code	Size	Ød1	E		Pcs/Box
3271 -tuf- 200b00	ø20x1/2"	19	15		200
3271 -tuf- 250c00	ø25x3/4"	24	17		100
3271 -tuf- 321000	ø32x1"	31	19		75
3271 -tuf- 401a 00	ø40x1 1/4"	39	22		45
3251 -tuf- 501b00	ø50x1 1/2"	48,5	24		25
3251 -tuf- 632000	ø63x2"	61,5	28		12
3251 -tuf- 752b00	ø75x2 1/2"	73,5	32		6
3251 -tuf- 903000	ø90x3"	88,5	38		3
3251 -tuf- 110400	ø110x4 1/2"	108,5	42		2
3251 -tuf- 200c00	ø20x3/4"	19	15		120
3251 -tuf- 250b00	ø25x1/2"	24	17		100
3251 -tuf- 251000	ø25x1"	24	17		80
3251 -tuf- 320c00	ø32x3/4"	31	19		70

Transition Union - Male



Code	Size	Ød1	E		Pcs/Box
3271 -tum- 200b00	ø20x1/2"	19	15		150
3271 -tum- 250c00	ø25x3/4"	24	17		100
3271 -tum- 321000	ø32x1"	31	19		60
3271 -tum- 401a00	ø40x1 1/4"	39	22		40
3251 -tum- 501b00	ø50x1 1/2"	48,5	24		25
3251 -tum- 632000	ø63x2"	61,5	28		12
3251 -tum- 752b00	ø75x2 1/2"	73,5	32		6
3251 -tum- 903000	ø90x3"	88,5	38		3
3251 -tum- 110400	ø110x4 1/2"	108,5	42		2
3251 -tum- 200c00	ø20x3/4"	19	15		120
3251 -tum- 250b00	ø25x1/2"	24	17		80
3251 -tum- 251000	ø25x1"	24	17		70
3251 -tum- 320c00	ø32x3/4"	31	19		60

Coupling with Loose Nut

Code	Size	Ød1	E	L	Pcs/Box
3251 -mft- 200000	ø20	19	15	46	100
3251 -mft- 250000	ø25	24	17	49	70
3251 -mft- 320000	ø32	31	19	53	45

PP Manifold

Code	Size		Pcs/Box
3261 -mnb- 400220	2 ways	●	25
3261 -mnr- 400220	2 ways	●	25
3261 -mnb- 400320	3 ways	●	20
3261 -mnr- 400320	3 ways	●	20
3261 -mnb- 400420	4 ways	●	15
3261 -mnr- 400420	4 ways	●	15
3261 -mnb- 400520	5 ways	●	10
3261 -mnr- 400520	5 ways	●	10
3261 -mnb- 400620	6 ways	●	10
3261 -mnr- 400620	6 ways	●	10
3261 -mnb- 400720	7 ways	●	9
3261 -mnr- 400720	7 ways	●	9
3261 -mnb- 400820	8 ways	●	9
3261 -mnr- 400820	8 ways	●	9

Transition Nipple - Female

Code	Size	Ød1	E	L	Pcs/Box
3251 -tnf- 200c00	ø20x3/4"	20,2	15	52,5	150
3251 -tnf- 251000	ø25x1"	25,2	17	58	150
3251 -tnf- 321a00	ø32x1 1/4"	32,2	19	70	100

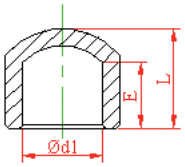
Transition Nipple - Male

Code	Size	Ød1	E	L	Pcs/Box
3251 -tnm- 200c00	ø20x3/4"	20,2	15	38,5	200
3251 -tnm- 251000	ø25x1"	25,2	17	43	150
3251 -tnm- 321a00	ø32x1 1/4"	32,2	19	70	100

• Accessories

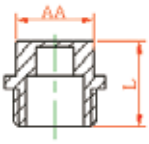
Stopend

Code	Size	Ød1	E	L	Pcs/Box
3291 -ste- 200000	ø20	19	15	27	500
3291 -ste- 250000	ø25	24	17	30	500
3291 -ste- 320000	ø32	31	19	34	250
3291 -ste- 400000	ø40	39	22	47	150
3291 -ste- 500000	ø50	48,5	24	47	80
3291 -ste- 630000	ø63	61,5	28	54	50
3291 -ste- 750000	ø75	73,5	32	60	32
3291 -ste- 900000	ø90	88,5	38	65	18
3291 -ste- 110000	ø110	108,5	42	70	9



Stopend

Code	Size	AA	L		Pcs/Box
3291 -ste- 200b00	ø20x1/2"	22	37,5		500
3291 -ste- 250c00	ø25x3/4"	24	35		600
3291 -ste- 321000	ø32x1"	27	38		300



Stopend

Code	Size	AA	L		Pcs/Box
3291 -stu- 200000	ø20x1/2"	30	73		200

Single Bracket

Code	Size	Ød1			Pcs/Box
3591 -bck- 160001	ø16	16,0			250/5000
3591 -bck- 202201	ø20	20,5			250/5000
3591 -bck- 252701	ø25	25,5			100/5000
3591 -bck- 323401	ø32	32,5			100/2000
3591 -bck- 404201	ø40	40,5			100/2000
3591 -bck- 505201	ø50	50,5			50/1500

Double Bracket

Code	Size	Ød1			Pcs/Box
3591 -bck- 160000	ø16	16			200/3000
3591 -bck- 202200	ø20-22	20,5			100/2500
3591 -bck- 252700	ø25-27	25,5			50/2000
3591 -bck- 323400	ø32-34	32,5			50/1000

Welding Machine

Code	Size	Pcs/Box
3292 -wmh- 000000	800 W + 700 W (up to 75 mm)	5
3292 -wmh- 000002	700 W + 700 W (up to 63 mm)	5
3292 -wmh- 000003	1600 W (up to 125 mm)	5

Welding Apparatus

Code	Size	Pcs/Box
3291 -die- 200000	20	1
3291 -die- 250000	25	1
3291 -die- 320000	32	1
3291 -die- 400000	40	1
3291 -die- 500000	50	1
3291 -die- 630000	63	1
3291 -die- 750000	75	1
3291 -die- 900000	90	1
3291 -die- 110000	110	1
3291 -die- 125000	125	1

Tube Sharpener

Code	Size	Pcs/Box
3291 -shv- 202500	20x25	1
3291 -shv- 324000	32x40	1
3291 -shv- 506300	50x63	1
3291 -shv- 759000	75x90	1
3291 -shv- 901100	90x110	1

Scissors

Code	Size	Pcs/Box
3591 -sss- 000000	ø16-ø42	100
3591 -sss- 000001	ø16-ø42 Automatic	100

• Points to Pay Attention to When Installing Polypropylene Pipes and Fittings

- Do not expose the pipes and fittings to the sun. Protect the pipes against hard and sharp objects. Do not use accidentally damaged pipes for installation.
- Bend the pipes with hot air. Never use fire when heating the pipes.
- The pipes and the fittings to be installed should be clean.
- Cut the pipes, perpendicular to the axis of pipe with a proper scissor, do not use other sharp objects that can cause impurity in the pipes.
- Mark the welding length on the pipe before welding.
- Information about the welding process (heating time, standby time, cooling time, etc.) In the manufacturer's catalog.
- Protect polypropylene pipe and fittings where water may freeze. Expansion due to freezing water inside the pipe may damage it.
- After shaving the aluminum layer make sure that there is no aluminum parts on the welding surface, otherwise it will cause leakage.
- Cold weather weakens the resistance of polypropylene against hit and it becomes fragile. Protect the pipes against hit when there is a risk of freezing.
- To prevent leaks in your installation use teflon tapes with the threaded fittings.

- All PP fittings and pipes are available in white/grey/green.
- Nominal pressure: PN25 for fittings.
- Packaging quantities are subject to change without notice.

WARRANTY

For KaldeWater Installation Systems with
PPR pipes and fittings (‘Product’ or ‘Products’)

Kalde Klima Orta Basinc ve Valf Sanayii A.S.’s (“Kalde”) Products are manufactured according to international standards and they particularly conform to the DIN norms. This Limited Warranty provides that, subject to the following limitations, each Kalde Product will be free from defects in material and workmanship and will conform to Kalde's specification for the particular Product. Your exclusive remedy for any defective Product is limited to the repair or replacement of the defective Product within fifty (50) years from the date of purchase. If Kalde is unable to repair or replace, as applicable, a defective Product which is covered by this Limited Warranty, Kalde shall, within a reasonable time refund the purchase price of the Product.

This Limited Warranty covers only those defects that arise as a result of normal use, Kalde shall not be liable for any defects that are caused by the neglect, abuse, misuse or mistreatment by anyone or any entity other than Kalde, including but not limited to, improper installation or testing, user’s flawed designs or specifications, unsatisfactory applications, use in conjunction with incompatible materials, contact with aggressive chemical agents, freezing or overheating of liquids in the product and any other neglect or misuse. This Limited Warranty shall be void if the Product fails to function properly as a result of any force majeure (i.e. earthquakes, flood, fire etc.) This Limited Warranty also specifically excludes failure or damage caused by fire stopping materials, tread sealants, plasticized vinyl products or damage caused by the fault or negligence of anyone other than Kalde, or defects that are caused by any Products that have been altered or modified in any way by a person or entity other than Kalde. Products must be used in accordance with standards, regulations and the applicable standards, failure to adhere to these standards shall void this Limited Warranty. Kalde shall have sole and absolute authority to decide whether the Product is covered under the Limited Warranty.

Kalde shall have a reasonable time to repair or replace a defective Product, after determining that a defective Product exists. Kalde's replacement Product under its Limited Warranty will be manufactured from new and serviceable used parts. Kalde's warranty applies to repaired or replaced Products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced Product, whichever is longer. For warranty application the end-user must present the purchase invoice.

Kalde's entire liability for any defective Product shall in no event exceed the purchase price for the defective Product. There are no warranties which extend beyond the face of Kalde’s Limited Warranty. Kalde specifically disclaims all other warranties, express or implied, regarding the Products, including any implied warranties of merchantability, fitness for a particular purpose or satisfactory quality. In no event shall Kade or its third party suppliers be liable for direct, indirect, special, collateral, punitive, incidental or consequential damages, No claim or suit or action shall be brought against Kalde more than one year after the related cause of action has occurred. The foregoing liability limitations are essential elements of this Limited Warranty. No course of dealing or trade usage or course of performance shall be relevant to explain or supplement any term in this Limited Warranty. No addition to or modification of any provision of This Limited Warranty shall be binding upon Kalde unless made in writing and signed by Kalde Klima Orta Basınç ve Valf Sanayii A.Ş. This Limited Warranty shall be governed by and construed under the law of Republic of Turkey, without regard to the conflict of law principles thereof. All disputes arising out of or relating to this Limited Warranty shall be adjudicated at Istanbul Merkez Mahkemeleri, Turkey. Kalde doesn’t provide any warranty to Products sold to U.S. and Canada.

NOTE: Kalde carries a Products Liability Insurance Policy from ERGO AŞ. that provides for EURO 2,000,000 per year to cover any third-party legal liability. For insurance application the internationally approved procedures are required. This Products Liability Insurance Policy does not include the damage claims made in connection with the (direct or indirect) sales made to countries that have been placed an embargo by USA or EU countries (including the OFAC countries). Kalde keeps the right to ask for any supplementary document necessary to approve damage indemnity.

TSE DVGW SKZ Internationally accredited Добровольная сертификация PG TZW certif AENOR

We go where our vision is, come with us...

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