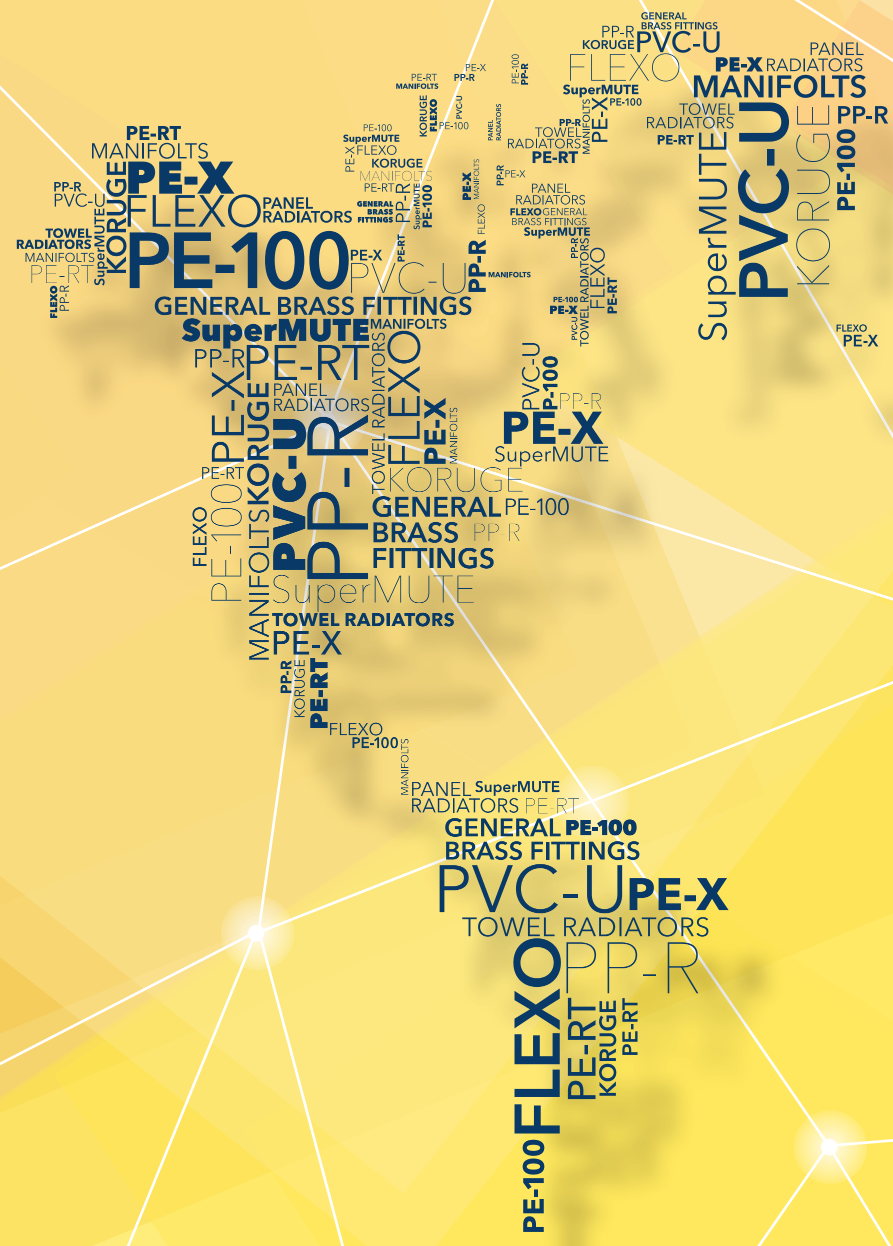
01.08.2020

Floor Heating Systems

kalde®

First Choice



K-Yerden-Isıtma-ENG-01.08.2020 v.01

Kalde is the "First Choice" all around the world.

Why Kalde?

Kalde produces high quality products, designs and develops integrated solutions for customers worldwide.

It is among the leading companies in production of pipes and fittings with its knowledge and expertise of more then 40 years.

The headquarters of the company is located in Istanbul where the continents of Asia and Europe meet.

Our strategical location at the junction of Europe, Asia and Africa together with a reliable supply chain give us unique advantages in providing our business partners and customers with high quality service as well as the competition in the global markets. Currently, our products are exported to more than 40 countries worldwide including Germany, Hungary, Romania, Austria, Greece, Bulgaria, Russia, Ukraine, Egypt, Syria, Lebanon, etc.

Kalde has product design, development and quality control facilities in 300.000 m^2.

Kalde produces a wide range of products including PP-R pipes, PP-R fittings, PP-R and brass valves, Al-pex & PE-RT pipes, screw fittings, press fittings, PE-X pipes and collectors. Kalde has internationally accredited certificates from respected organisations such as DVGW SKZ (Germany), CSTB (France) and AENOR (Spain). Furthermore, our management system has been certified by ISO.
We are proud of our high quality products and experiences...

Our vision is providing our customers with an increasingly wide portfolio of high quality products and solutions with continuous research and development.

Our goal is to develop long term partnerships with our customers and suppliers.

We create integrated solutions by team work as well as collaboration with our customers and partners.

Having market-focused teams of around 1500 professionals supported by a strong management, we offer our business partners and customers worldwide with value-adding solutions.

As result of these reasons, kalde® Kalde is the "First Choice" of the users worldwide

Kalde Value Commitment.

Kalde was established by four young engineers dedicated to provide customers with the best service in 1977.

This spirit is still alive and is the essence of our mission statement.

The Success Of Kalde Is The Result Of Various Factors.

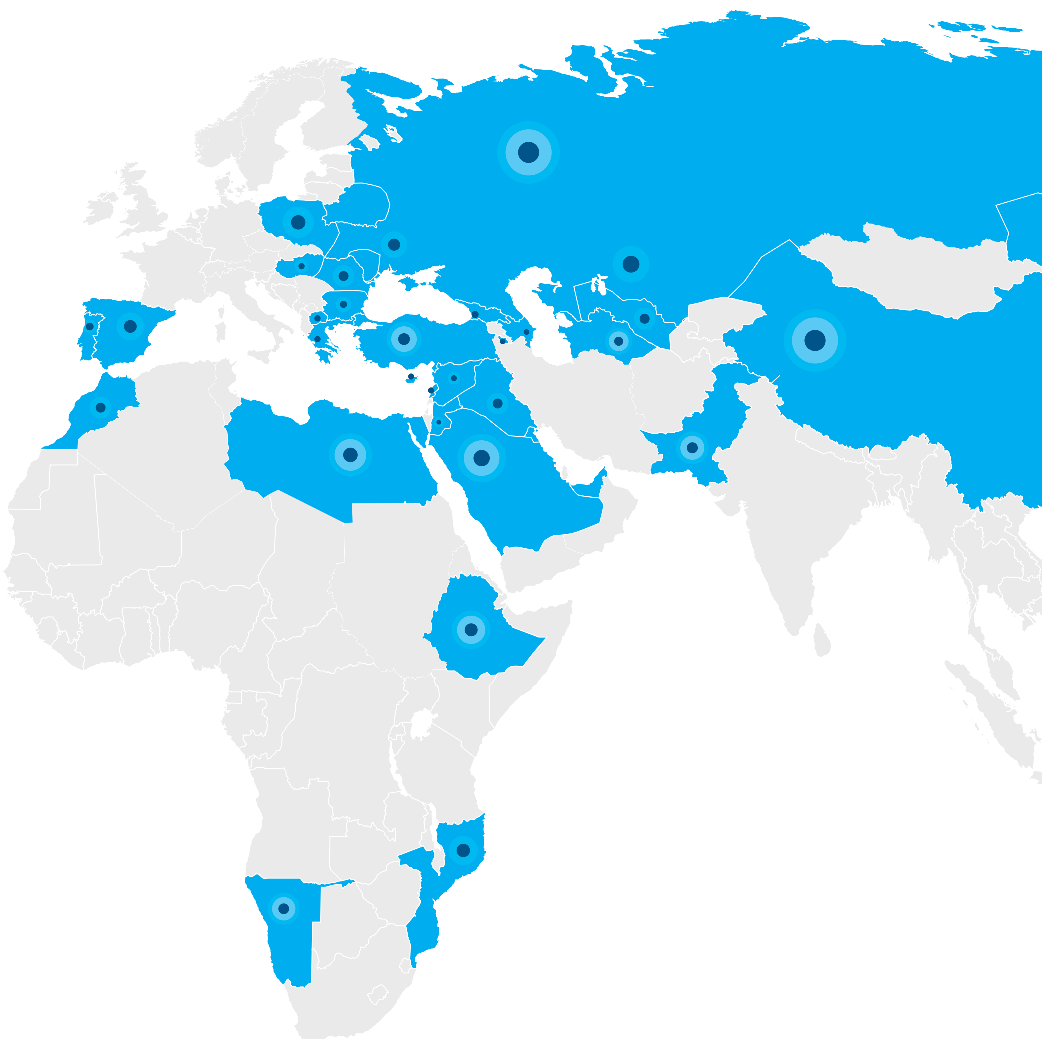
- **High quality** products.
- Utilization of best **practices.**
- Products meeting your **unique** requirements.
- **Proven** products.
- **Total** customer satisfaction.
- **Long term** relationships with each customer.
- A **dedicated** team of around 1500 professionals.

Why Kalde?

Export Markets

The proximity of our Istanbul head office to Europe, Asia and Africa allows us to easily reach our customers in more than 60 countries.

- Algeria
- Angola
- Azerbaijan
- Belarus
- Bulgaria
- Cyprus
- Ethiopia
- Egypt
- Georgia
- Greece
- Hungary
- Iran
- Iraq
- Jordan
- Kazakhstan
- Kuwait
- Lebanon
- Libya
- Macedonia
- Moldova
- Mongolia
- Morocco
- Mozambique
- Pakistan
- People's Republic of China
- Poland
- Portugal
- Romania
- Russia
- Saudi Arabia
- Spain
- Syria
- Turkmenistan
- Ukraine
- United Arab Emirates
- Uzbekistan
- ...



kalde

Why Kalde?

Innovation

It's unimaginable for a premier manufacturer to maintain its success without constant innovation and development. Of course, the key to Kalde's success is innovation.

Yes, we are an installation systems manufacturer, but we define ourselves also as a technology provider.

We brainstorm and exchange ideas with our customers on a regular basis; we inform our R&D department and design engineers about the demands of all our partners, plumbers and project offices; and we come up with outstanding solutions that are specifically designed to expedite the application processes and reduce the risks.

As we raise the bar for our sector, naturally we ensure to obtain patents and certificates for all our new products that are invented in-house.

We Offer the Best Quality

Our four-staged Kalde Quality Control Mechanism, besides regular control of production, includes follow-ups on shipments and the application process of the products.

Since all our products are validated by our own control processes, naturally they have also been certified by world's most prestigious institutions of quality control. Some of these quality certifications include: Turkey, Turkish Standards Institute, ISO 9001 Quality Management System; Germany, DVGW and SKZ; Spain, AENOR; Russia, Gost and etc.

The quality of our products are examined periodically by the independent certification institutions, so that at each stage of production the principle of excellency is maintained.

In addition, all products of Kalde are covered by product liability insurance up to 2.000.000 Euro per year.

Raw Material Control ➤ **Manufacturing Control** ➤ **Quality Control** ➤ **Absoulte Customer Satisfaction**

Contents

Floor Heating Systems

Multilayer PE-RT Pipes

Pipe design

- Internal pipe PE-RT Type II, DIN 16833
- Adhesive layer
- Butt-welded aluminium layer
- Adhesive layer
- External layer PE-RT Type II or heat-resistant PE

Standards / Approvals

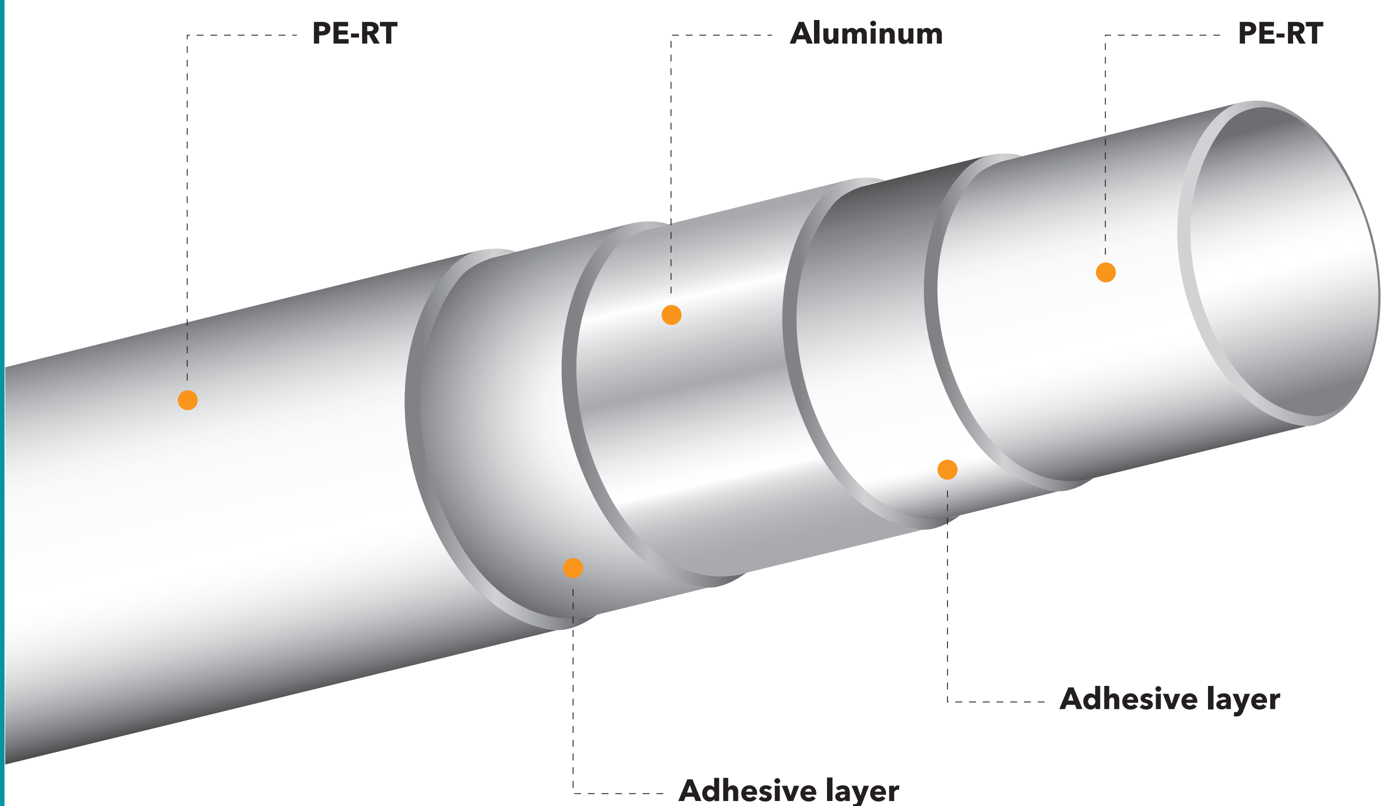
- SKZ Guideline HR 3.12
- DVGW W 542 (certificate no. DW-8236 BN 0125)
- EN ISO 21003 for the pipe (approvals of customised systems when combined with certified connectors)
- EN ISO 22391 series (for the basic pipe)
- DIN 16833/16834 general quality requirements and PE-RT inspections

Range of available products

- Additional specifications on request of the customer
- Dimensions: DN 12 mm to DN 63 mm
- Lengths: rolls a 100 m, 200 m; bars a 5 m
- Pipe color: Standard color white
- Labelling: Standard color black
- Rolls packaged in cardboard boxes; bars in plastic sleeves
- Pipe insulated red/blue
- Insulation thicknesses 6 mm to 20 mm according to size
- Pipe in pipe: Drawn in corrugated protective pipe (red blue, black)

Advantages

- Suitable for drinking water
- Absolute gastight
- Corrosion-free
- Chemical-resistant
- Light weight
- Deposit-free
- Low longitudinal expansion
- Simple laying
- Very flexible
- Dimensionally stable



Kalde Press Fittings

Raw Material, Technical Specifications and Standards

- Material: CuZn36Pb2As (CW602N) (EN 12164)
- Ø20 – 40mm
- EN 1254 – 3: Copper and copper alloy plumbing fittings - part:3: fittings with compression ends for use with plastics pipes
- Dezincification resistance: CR/DRA (the largest Dezincification depth <200 μm, EN ISO 6509)
- Coupling part type: Type A (EN 1254–3, Figure A–5)
- Used in heating and cooling systems, potable water, radiator systems, under-floor heating, chiller water, fan-coil systems
- Type A press-type coupling parts are suitable for use with different type plastic pipes. Type A coupling parts with internal support are recommended for use only in polyethylene pipe materials.
- Maximum temperature and pressure comply with the pipe material performance specified in the applicable pipe standards relating to temperature and pressure for coupling after mounting (Table–5 of DIN 16834 - Polyethylene pipes with enhanced thermal resistance)
- The basic reason for using Kalde press fitting materials with arsenic is its higher corrosion resistance than that of other copper alloy materials.
- Kalde press fitting material's hardness is 100–112 HB. Also, all materials are tempered for eliminating tension (EN ISO 196).
- Kalde press fittings' chemical composition is seen in Table –1.

Table 1

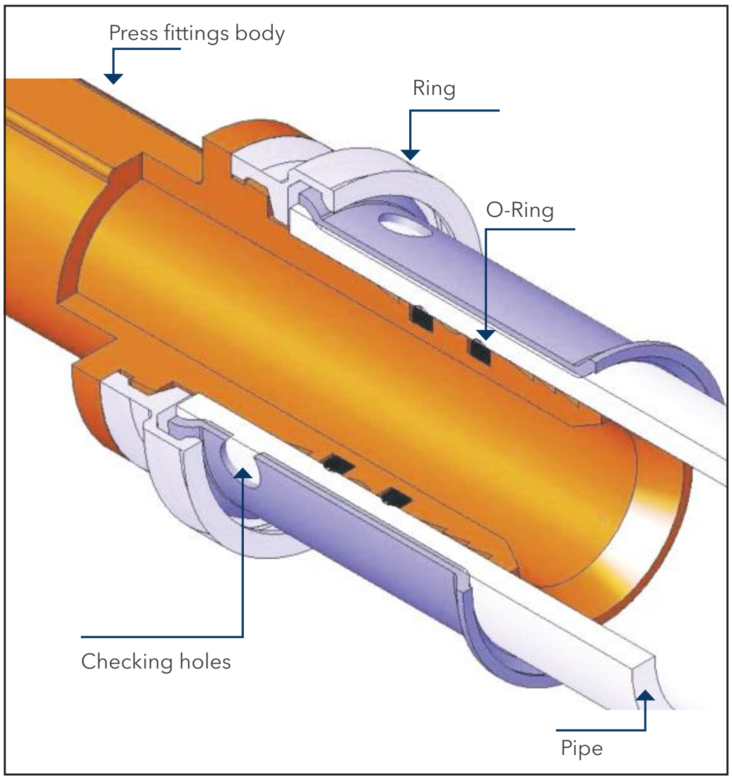
Chemical Composition % (Min) (EN 12164)													
Symbol	**Number**	**Element**	**Cu**	**Al**	**As**	**Fe**	**Mn**	**Ni**	**Pb**	**Sn**	**Zn**	**Others total**	**Density g/cm³**
CuZn36Pb2As	CW602N	Min	61	-	0.02	-	-	-	1.7	-	The rest	-	8.4
		max	63	0.05	0.15	0.1	0.1	0.3	2.2	0.1	-	0.2	

Table-5 of DIN 16834 bearable working pressure for pipes canveying other water, with SF = 1,6

Temparature °C	Years of Service	Pipe Series (S)					
		6.3	5	4	3.2	2.5	2
		Standard Dimension Rate (SDR)					
		13.6	11	9	7.4	6	5
		Allowable Working Pressure, in Bar					
20	1	9.4	11.8	14.7	18.4	23.6	29.5
	5	9.3	11.7	14.6	18.2	23.3	29.2
	10	9.2	11.6	14.5	18.2	23.2	29.1
	25	9.2	11.6	14.4	18.1	23.1	28.9
	50	9.1	11.5	14.4	18	23	28.8
	100	9	11.3	14.1	17.6	22.6	28.2
40	1	7.2	9	11.3	14.1	18	22.5
	5	7.1	8.9	11.1	13.9	17.8	22.3
	10	7	8.9	11.1	13.9	17.7	22.2
	25	7	8.8	11	13.8	17.6	22
	50	7	8.8	11	13.7	17.5	21.9
	100	6.9	8.7	10.9	13.6	17.5	21.8
60	1	5.5	6.9	8.6	10.8	13.8	17.2
	5	5.4	6.8	8.5	10.6	13.6	17
	10	5.4	6.8	8.5	10.6	13.5	16.9
	25	4.9	6.2	7.7	9.6	12.3	15.4
	50	4.3	5.4	6.8	8.5	10.9	13.6
70	1	4.8	6	7.5	9.4	12	15
	5	4.7	5.9	7.4	9.3	11.9	14.9
	10	4.3	5.4	6.7	8.4	10.7	13.4
	25	3.6	4.5	5.7	7.1	9	11.3
	50	3.3	4.1	5.2	6.4	8.3	10.3
80	1	4.2	5.3	6.6	8.2	10.5	13.1
	5	3.6	4.5	5.6	7.1	9	11.3
	10	3.1	4	4.9	6.2	7.9	9.9
	25	2.1	2.7	3.4	4.2	5.4	6.8
95	1	3.1	4	5	6.2	7.9	9.9
	5	2.3	2.9	3.6	4.5	5.8	7.2
	(10)1)	(2,0)1)	(2,5)1)	(3,1)1)	(3,9)1)	(5,0)1)	(6,3)1)

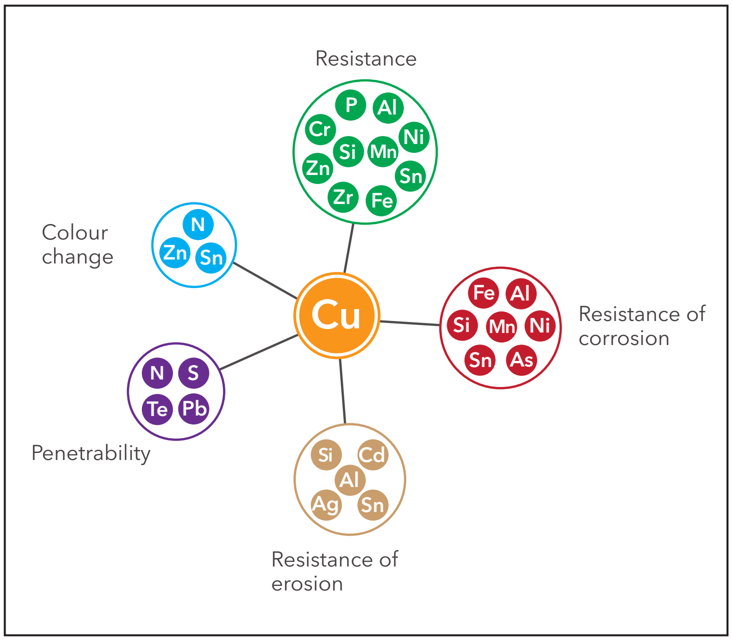
Floor Heating Systems

Shema - 1: Section Appearence of Press Fittings



Shema - 2: Effect of Alloy Elements

The effects of the chemical composition of the material used for Kalde press fittings on the material are as follows:



Floor Heating Systems

Resistance Increasing of Alloy Elements

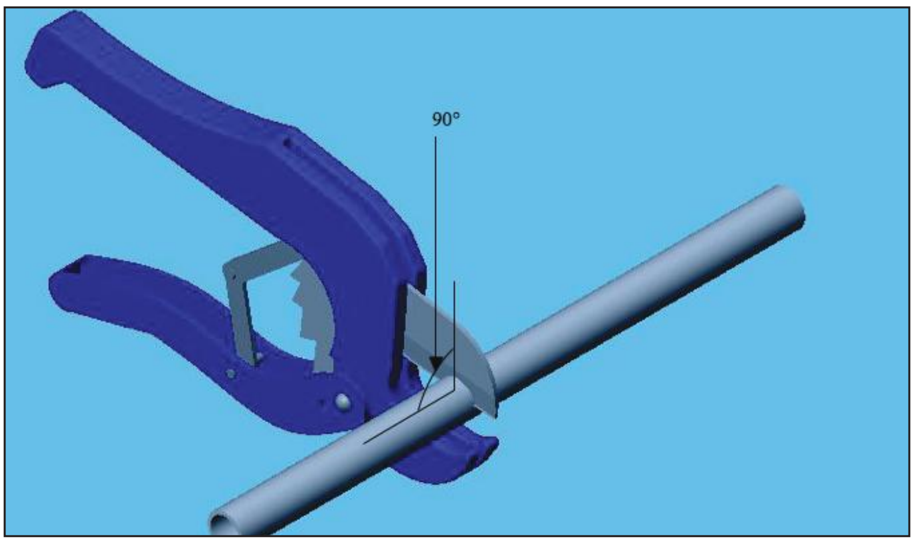
- Chrome (Cr)
- Aluminium (Al)
- Phosphorus (P)
- İron (Fe)
- Silicon (Si)
- Manganese (Mn)
- Zinc (Zn)
- Zirkonium (Zr)
- Tin (Sn)
- Nickel (Ni)
- Beryllium (Be)
- Cobalt (Co)

Resistance Corrosion Increasing of Alloy Elements

- Nickel (Ni)
- Aluminium (Al)
- Tin (Sn)
- Manganese (Mn)
- Arsenic (As)
- İron (Fe)
- Silicon (Si)

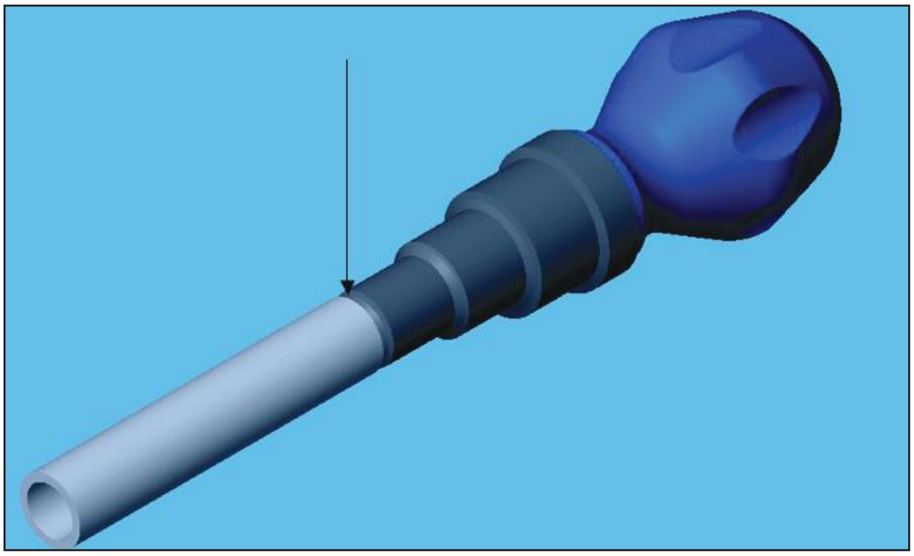
Kalde Press Fittings Assembling Instructions

1- The pipe must be cut perpendicularly with a 90° angle with appropriate scissors.

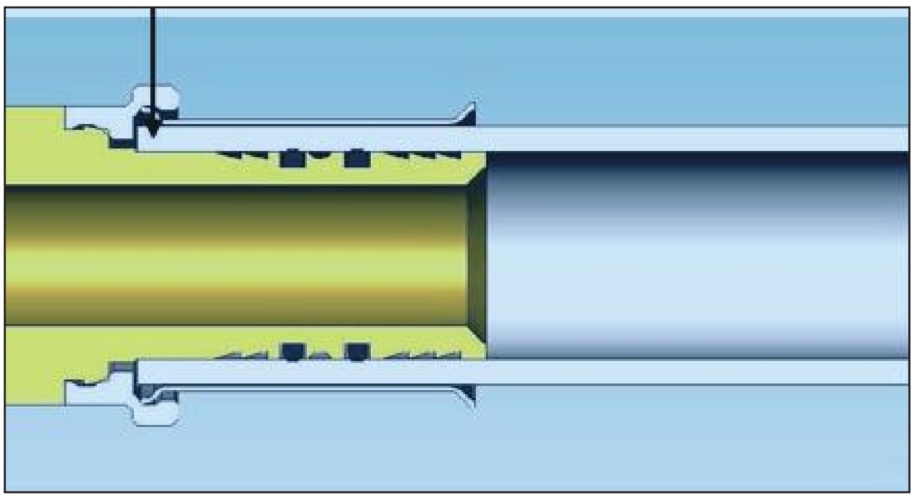


Floor Heating Systems

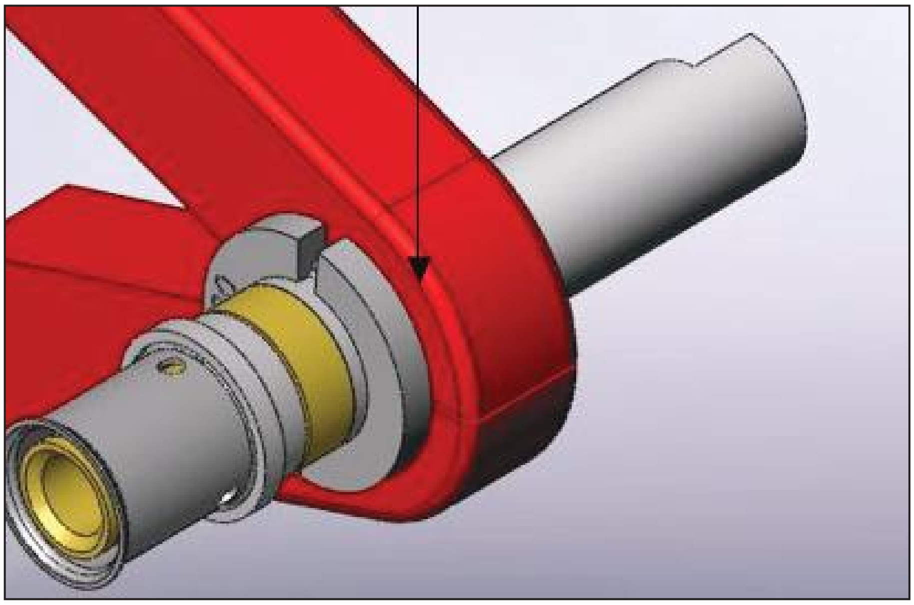
2– Before connecting the pipe with the fitting the pipe must be calibrated. It is very important to stepping the pipe. There should be no rest (dirt and waste) at the end of the pipe.



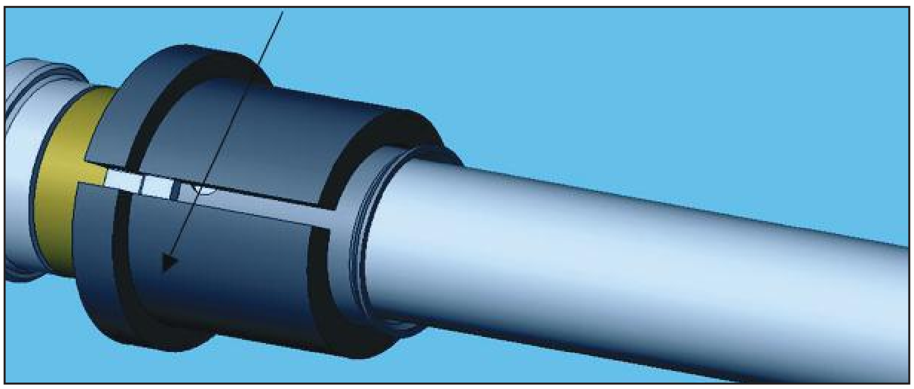
3– After calibrating the pipe, the fitting is placed into the pipe. The pipe is pushed until the transparent plastic edge. It has to be checked wheather the pipe is properly placed or not through the 3 holes in the press sleeve.



4– The press sleeve is pushed into the transparent plastic ring. The press tool is placed on the pressing sleeve in order to press it.



Note: In order to do the pressing correctly, it is very important to place the connection into the pressing aparat's jaw.



Checks:

- The circular pressing marks left on the sleeve should be the same.
- The position of the pipe in the fitting should again be checked through the 3 holes on the sleeve. DIN 1988 should be cared for assembling
- After finishing the installation the whole system must be tested during 24 h with air & water pressure.

Floor Heating Systems

Pipe Design

Characteristic	Unit	Composite Pipe	
		Pert	Pex
Design	[-]	5-layer	5-layer
Diffusion barier	[-]	Butt-welded alu	Butt-welded alu
Oxygen diffusion	mg/l d	<0.005	<0.006
Application		Heating/Sanitary	Heating/Sanitary

Mechanical Characteristics

Characteristic	Unit	Composite Pipe	
		Pert	Pex
Surface rougness (Prandtl-Colebrook)	mm	0.007	0.007
Bending radius at 23°C	mm	5 DN	5 DN

Kalde PE-RT Heating Pipe (5 layer)

Dimension mm	Wall thickness mm	Weigh kg/m	Water content l / m	Roll length m	Pallet length m
8.0	1.00	0.023	0.028	2000	6000
10.0	1.30	0.039	0.043	200 / 600	3200 / 10800
12.0	1.30	0.045	0.069	200 / 600	3200 / 4800
14.0	2.00	0.080	0.079	200	3600
16.0	2.00	0.090	0.113	200 / 600	3600 / 3600
17.0	2.00	0.100	0.133	200	2400
18.0	2.00	0.104	0.154	200 / 400	2400 / 2000
20.0	2.00	0.120	0.201	200	1600
26.0	3.00	0.220	0.314	100	1100

Floor Heating Systems

Multilayer PE-RT Pipes

PE-RT Pipe

Code	Size	Pcs.
3522-prt-160000	16 x 2	200
3522-prt-200000	20 x 2	100
3522-prt-260000	26 x 3	50
3522-prt-320000	32 x 3	50

PE-RT Pipe

Code	Size	Pcs.
3522-prt-320001	32 x 3	50
3522-prt-400001	40 x 3,5	35

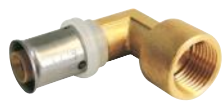
Press Fittings

Elbow 90°

Code	Size	Pcs.
3461-elb-160000	16 x 16 x 2	150
3461-elb-200000	20 x 20 x 2	80
3461-elb-260000	26 x 26 x 3	50
3461-elb-320000	32 x 32 x 3	30
3461-elb-400000	40 x 40 x 3,5	30

Female Elbow

Code	Size	Pcs.
3461-efo-160b00	16 x 1/2" x 2	120
3461-efo-200b00	20 x 1/2" x 2	100
3461-efo-200c00	20 x 3/4" x 2	50
3461-efo-260c00	26 x 3/4" x 3	50
3461-efo-321000	32 x 1" x 3	30
3461-efo-401a00	40 x 1 1/4" x 3,5	30



Floor Heating Systems

Female Elbow

Code	Size	Pcs.
3461-emo-160b00	16 x 1/2" x 2	150
3461-emo-200b00	20 x 1/2" x 2	120
3461-emo-200c00	20 x 3/4" x 2	100
3461-emo-260c00	26 x 3/4" x 3	50
3461-emo-321000	32 x 1" x 3	30
3461-emo-401a00	40 x 1 1/4" x 3,5	30

Wall Plate Elbow

Code	Size	Pcs.
3461-ewo-160b01	16 x 1/2" x 2	50
3461-ewo-200b01	20 x 1/2" x 2	50
3461-ewo-200c01	20 x 3/4" x 2	50
3461-ewo-260c01	26 x 3/4" x 3	50

Double Wall Plate Elbow

Code	Size	Pcs.
3461-ewd-160b01	16 x 1/2" x 2	40
3461-ewd-200b01	20 x 1/2" x 2	40

Nippel

Code	Size	Pcs.
3461-ndb-160000	16 x 16 x 2	200
3461-ndb-200000	20 x 20 x 2	150
3461-ndb-260000	26 x 26 x 3	100
3461-ndb-320000	32 x 32 x 3	50
3461-ndb-400000	40 x 40 x 3,5	50

Floor Heating Systems

Female Nippel

Code	Size	Pcs.
3461-nfo-160b00	16 x 1/2" x 2	150
3461-nfo-200b00	20 x 1/2" x 2	150
3461-nfo-200c00	20 x 3/4" x 2	100
3461-nfo-260c00	26 x 3/4" x 3	100
3461-nfo-261000	26 x 1" x 3	70
3461-nfo-321000	32 x 1" x 3	50
3461-nfo-321a00	32 x 1 1/4" x 3,5	50
3461-nfo-401000	40 x 1" x 3,5	30
3461-nfo-401a00	40 x 1 1/4" x 3,5	30

Male Nippel

Code	Size	Pcs.
3461-nmo-160b00	16 x 1/2" x 2	150
3461-nmo-200b00	20 x 1/2" x 2	150
3461-nmo-200c00	20 x 3/4" x 2	150
3461-nmo-260c00	26 x 3/4" x 3	100
3461-nmo-261000	26 x 1" x 3	80
3461-nmo-321000	32 x 1" x 3	70
3461-nmo-321a00	32 x 1 1/4" x 3,5	50
3461-nmo-401000	40 x 1" x 3,5	30
3461-nmo-401a00	40 x 1 1/4" x 3,5	30

Reduction Nippel

Code	Size	Pcs.
3461-rdn-201600	20 x 2 / 16 x 2	150
3461-rdn-261600	26 x 3 / 16 x 2	100
3461-rdn-262000	26 x 3 / 20 x 2	100
3461-rdn-321600	32 x 3 / 16 x 2	70
3461-rdn-322000	32 x 3 / 20 x 2	70
3461-rdn-322600	32 x 3 / 26 x 3	70
3461-rdn-403200	40 x 3,5 / 32 x 3	50

Floor Heating Systems

Tee

Code	Size	Pcs.
3461-tee-160000	16 x 16 x 16 x 2	60
3461-tee-200000	20 x 20 x 20 x 2	50
3461-tee-260000	26 x 26 x 26 x 3	30
3461-tee-320000	32 x 32 x 32 x 3	25

Reduction Tee

Code	Size	Pcs.
3461-rte-201616	20 x 16 x 16 x 2	50
3461-rte-202016	20 x 20 x 16 x 2	50
3461-rte-261620	26 x 3 / 16 x 2 / 20 x 2	30
3461-rte-261621	26 x 3 / 16 x 2 / 20 x 2,5	30
3461-rte-262016	26 x 3 / 20 x 2 / 16 x 2	30
3461-rte-262020	26 x 3 / 20 x 2 / 20 x 2	30
3461-rte-262616	26 x 3 / 26 x 3 / 16 x 2	30
3461-rte-262620	26 x 3 / 26 x 3 / 20 x 2	30
3461-rte-322026	32 x 3 / 20 x 2 / 26 x 3	30
3461-rte-322626	32 x 3 / 26 x 3/ 26 x 3	30
3461-rte-323220	32 x 3 / 32 x 3 / 20 x 2	30
3461-rte-323226	32 x 3 / 32 x 3 / 26 x 3	30

Inegal Tee

Code	Size	Pcs.
3461-tio-162016	16 x 20 x 16 x 2	50
3461-tio-201620	20 x 16 x 20 x 2	50
3461-tio-202620	20 x 2 / 26 x 3 / 20 x 2	30
3461-tio-261626	26 x 3 / 16 x 2 / 26 x 3	30
3461-tio-262026	26 x 3 / 20 x 2 / 26 x 3	30
3461-tio-263226	26 x 3 / 32 x 3 / 26 x 3	30
3461-tio-321632	32 x 3 / 16 x 2 / 32 x 3	30
3461-tio-322032	32 x 3 / 20 x 2 / 32 x 3	30
3461-tio-322632	32 x 3 / 26 x 3 / 32 x 3	30

Female Tee

Code	Size	Pcs.
3461-tfo-160b16	16 x 1/2" x 16 x 2	60
3461-tfo-200b20	20 x 1/2" x 20 x 2	50
3461-tfo-200c20	20 x 3/4" x 20 x 2	50
3461-tfo-260b26	26 x 1/2" x 26 x 3	30
3461-tfo-260c26	26 x 3/4" x 26 x 3	30
3461-tfo-320b32	32 x 1/2" x 32 x 3	30
3461-tfo-320c32	32 x 3/4" x 32 x 3	30
3461-tfo-321032	32 x 1" x 32 x 3	30

Male Tee

Code	Size	Pcs.
3461-tmo-160b16	16 x 1/2" x 16 x 2	60
3461-tmo-200b20	20 x 1/2" x 20 x 2	50
3461-tmo-200c20	20 x 3/4" x 20 x 2	50
3461-tmo-260b26	26 x 1/2" x 26 x 3	30
3461-tmo-260c26	26 x 3/4" x 26 x 3	30
3461-tmo-320c32	32 x 3/4" x 32 x 3	30
3461-tmo-321032	32 x 1" x 32 x 3	25

Nipple with Loose Nut

Code	Size	Pcs.
3461-npt-160c00	16 x 3/4" x 2	150
3461-npt-200c00	20 x 3/4" x 2	150
3461-npt-201000	20 x 1" x 2	100
3461-npt-261000	26 x 1" x 3	80
3461-npt-261a00	26 x 1 1/4" x 3	80
3461-npt-321a00	32 x 1 1/4 x 3	50
3461-npt-321b00	32 x 1 1/2" x 3	40

Stoppend

Code	Size	Pcs.
3461-ste-160000	16 x 2	200
3461-ste-200000	20 x 2	200
3461-ste-260000	26 x 3	100
3461-ste-320000	32 x 3	70

Floor Heating Systems

PE-X Pipes

Applied Norms

- EN 578 - Plastics piping systems - plastics pipes and fitting- Determination of the opacity
- EN 579 - Plastics piping systems – cross linked polyethylene (PE-X) pipes – Determination of degree of cross linking by solvent extraction
- EN ISO 2505 – Plastic and duction systems – Thermoplactics pipes – Determination of the longitudinal reversion
- EN ISO 1167- 1 - Plastic piping systems - Thermoplactics pipes, fitting and assemblies for the conveyonce of fluids – Determination of the resistance to internal pressure – part 1: general method
- EN ISO 1167- 2 - Plastic piping systems - Thermoplactics pipes, fitting and assemblies for the conveyonce of fluids – Determination of the resistance to internal pressure – part 2: Preparation of pipe test pieces.
- EN ISO 15875 -1 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 1: General
- EN ISO 15875 -2 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 2: Pipes
- EN ISO 15875 -3 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 3: Fittings
- EN ISO 15875-5 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 5: Fitness for purpose of the system
- DIN 16892 Crosslinked high-density polyethylene (PE-X) pipes – General quality requirements and testing
- DIN 16893 Crosslinked high-density polyethylene (PE-X) pipes - Dimension

Raw Material: Cross Linked Polyethylene (PE-X)

PE-X results from chemically joining individual polyethylene molecules in order to improve the performance of the original base resin in higher temperatures. The primary reason for cross-linking polyethylene (PE) is to raise the thermal stability of the material under load.

For high performance polyethylene applications, requiring higher temperature, creep, abrasion and chemical resistances, cross-linking is a must.

There are three different ways for crosslinking:

1- The peroxide method employs a special extruder with a plunger action where peroxide is added to the base resin and through a combination of pressure and high temperature the cross-linking takes place as the tubing is produced.
2- The “Silane” method of PE-X production involves grafting a reactive silane molecule to the backbone of the polyethylene. The tubing is produced by blending this grafted compound with a catalyst which can be done using either the Sioplas method or by using a special extruder it can be done using the Monosil method. After extrusion the tubing is exposed to either steam or hot water to induce the final cross-linking reaction in the tubing.
3- Electron Beam crosslinking takes place when very high energy radiation is used to initiate molecular cross-linking in high density polyethylene. This product is extruded like normal HDPE then taken to an E-beam facility and routed under a beam or ray in the accelerator where it is dosed with a specific amount of radiation to release the hydrogen atoms and cause polymer cahins to bond or link to the open carbon sites.

In European standards these three methods are referred to as PE-X_a, PE-X_b and PE-X_c.

PE-X_a - the Peroxide method
PE-X_b - the Silane
PE-X_c - Electron beam crosslinking

Kalde PE-X pipes are cross-linked using silane.

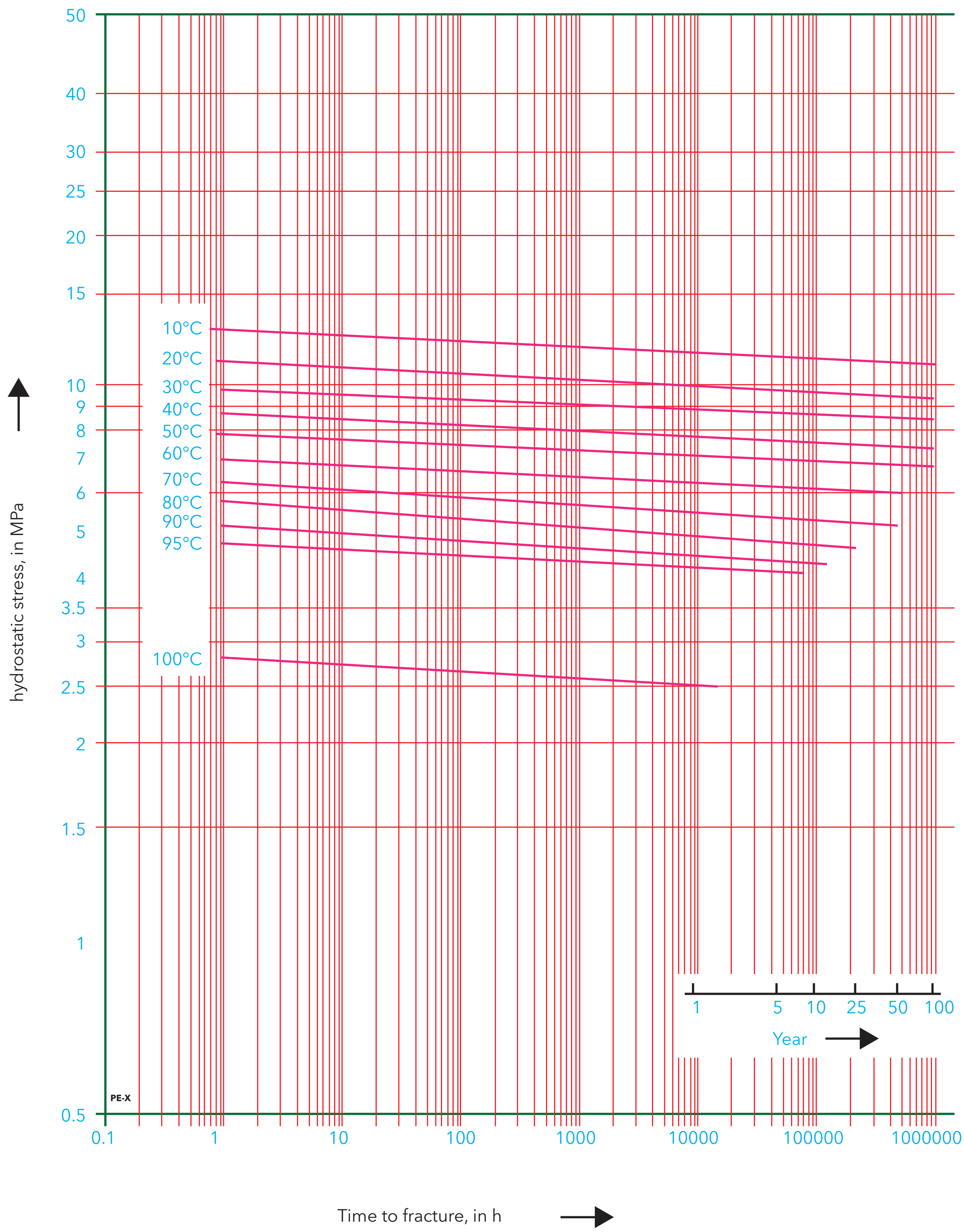
Physical, Thermal and Mechanical Properties

Table 1

Properties	Specification	Value	Unit	Test Method
Density	0,94 - 0,95	0.94	g/cm³	DIN 53497
Melt Flow Rate	0,7 – 1,9	0.96	(190°C , 5kg)	ISO 1133
Degree of Crosslinking	≥65	68	%	EN 579
Tensile Strength	at 20°C	19-26	N/mm²	EN ISO 527
	at 100°C	Sep-13		
Elongation at Break	at 20°C	350-500	%	EN ISO 527
	at 100°C	500-700		
Impact Strength	at 20°C	No failure	KJ/m²	ISO 179
Moisture Absorbtion	at 22°C	0.01	Mg/4d	
Pipe Roughness		$5{,}10^{-4}$	mm	
Minimum Bending Radius	at 20°C	5xØd	mm	
Softening Point	>122	130	°C	ASTM D1525
Min. laying Temperature	-	-15	°C	
Max. Operating Temperature	-	95	°C	BS7291-3
Thermal Conductivity at 23C°	≥0,41	0.41	W/mK	DIN 52612
Flexural Modulus at 23C°	>600	600	N/mm²	DIN EN ISI 178
Coefficient of linear Expansion		$2{,}10^{-4}$	K^{-1}	DIN 53752
Resistance of Faces		10^{12}	Ω	DIN 53482

Reference Curves for Expected Strength of Cross Linked Polyethylene

Table 2



Floor Heating Systems

Pipe Dimension - PN 20 According to EN ISO 15875-2, DIN 16893

Table 3

Outer Diameter (mm)	Diameter Tolerance (mm)	Wall Thickness S 3,2 -SDR 7,4 (mm)	Thickness Tolerance (mm)	Approx. Weight (kg/m)
16	0.3	2.2	0.4	0.94
20	0.3	2.8	0.4	0.148
25	0.3	3.5	0.5	0.23
32	0.3	4.4	0.6	0.368

Operating Conditions (S=3,2 SDR=7,4) (PN 20) DIN16893

Table 4

Temperature (°C)	Life (years)	Pressure (bar)
20	50	20
40	50	15.7
60	50	12.5
70	50	11.2
80	25	10.1
95	5	8.8

Pipe Dimension-PN 12,5 According to EN ISO 15875-2, DIN 16893

Table 5

Outer Diameter (mm)	Diameter Tolerance (mm)	Wall Thickness S 5 - SDR11 (mm)	Thickness Tolerance (mm)	Approx. Weight (kg/m)
16	0.3	1.8	0.4	0.84
20	0.3	1.9	0.4	0.11
25	0.3	2.3	0.5	0.156
32	0.3	2.9	0.5	0.251

Operating Conditions (S 5 – SDR 11) (PN 12,5) DIN 16893

Table 6

Temperature (°C)	Life (years)	Pressure (bar)
20	50	12.6
40	50	9.9
60	50	7.9
70	50	7.1
80	25	6.4
95	5	5.5

Classification of Service Conditions DIN 16893

Table 7

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)

Floor Heating Systems

PE-X Pipe Permissible Working Pressure DIN 16893

Table 8

Temperature (°C)	Operating Life (years)	Series (S)			
		6.3	5	4	3.2
		Standart Dimension Ratio (SDR)			
		13.6	11	9	7.4
		Nominal Working Pressure			
		PN 10	PN 12,5	PN 16	PN 20
		Allowable Working Pressure (Bar)			
20	1	10.5	13.2	16.6	20.9
	5	10.3	12.9	16.3	20.5
	10	10.2	12.8	16.2	20.4
	25	10.1	12.7	16	20.1
	50	10	12.6	15.9	20
40	1	8.2	10.4	13.1	16.5
	5	8.1	10.2	12.8	16.2
	10	8	10.1	12.7	16.1
	25	7.9	10	12.6	15.9
	50	7.9	9.9	12.5	15.7
50	1	7.3	9.3	11.7	14.7
	5	7.2	9.1	11.4	14.4
	10	7.1	9	11.3	14.3
	25	7.1	8.9	11.2	14.1
	50	7	8.8	11.1	14
60	1	6.6	8.3	10.4	13.1
	5	6.4	8.1	10.2	12.9
	10	6.4	8	10.1	12.8
	25	6.3	7.9	10	12.6
	50	6.2	7.9	9.9	12.5
70	1	5.9	7.4	9.3	11.8
	5	5.7	7.3	9.1	11.5
	10	5.7	7.2	9.1	11.4
	25	5.6	7.1	9	11.3
	50	5.6	7	8.9	11.2
80	1	5.3	6.6	8.4	10.5
	5	5.2	6.5	8.2	10.3
	10	5.1	6.4	8.1	10.2
	25	5	6.4	8	10.1
90	1	4.7	6	7.5	9.5
	5	4.6	5.8	7.4	9.3
	10	4.6	5.8	7.3	9.2
95	1	4.5	5.7	7.1	9
	5	4.4	5.5	7	8.8
	10	4.3	5.5	6.9	8.7

Thermal Expansion in Polyethylene (PE-X) Pipes

The polyethylene 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 = variation of working 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 $2 * 10^{-4}$ (K^{-1}) for pex tubes.

Table 9

Pipe length (m)	Temperature variation ΔT in K									
	10	20	30	40	50	60	70	80	90	100
	Linear expansion ΔL (mm)									
1	2	4	6	8	10	12	14	16	18	20
2	4	8	12	16	20	24	28	32	36	40
3	6	12	18	24	30	36	42	48	54	60
4	8	16	24	32	40	48	56	64	72	80
5	10	20	30	40	50	60	70	80	90	100
6	12	24	36	48	60	72	84	96	108	120
7	14	28	42	56	70	84	98	112	126	140
8	16	32	48	64	80	96	112	128	144	160
9	18	36	54	72	90	108	126	144	162	180
10	20	40	60	80	100	120	140	160	180	200

Kalde - PE-X Pipes

Kalde - PE-X is tested in accordance with the most respected standards such as EN ISO15875-2 and DIN 16892/93. All the test and quality controls required by these norms are performed in a modern and well-equipped laboratory. Production range consists of diameters from 16 mm up to 32 mm. The tables 3 and 5 show the details of Kalde - PE-X.

Floor Heating Systems

Kalde - PE-X Pipes are

- Flexible for faster and easier installation
- Corrosion free and high resistance to chemicals
- Replaceable pipe-in conduit
- Very good performance at high temperatures and high pressure
- Easy to cut and join
- Pipe laying can be carried out during the construction of building
- No electricity or heat is necessary for installation
- Allows high water speeds,
- Installed with fewer fittings, long runs without joints
- Quiet, does not transmit noise like metal pipes
- Long service life

Kalde - PE-X Pipes have

- excellent resistance to corrosion
- freeze damage resistance
- noise and water hammer resistance
- no odor, impurities or any other harmful chemicals.
- less condensation than the copper and metallic pipes.
- These properties of kalde-pex make it the ideal choice for sanitary piping systems.

Installation

Kalde - PE-X is ideally suited for potable water plumbing applications. The excellent properties of Kalde - PE-X make it perfect for plumping applications. Kalde is proud of the reliable and proven performance of its pex systems under the harshest conditions.

It is flexible, making it easy to install and service. PE-X is able to withstand the high and low temperatures found in plumbing and heating applications and is highly resistant to chemicals found in the plumbing environment.

Flexible systems are more quiet than rigid piping. The smooth interior will not corrode which can affect other materials long term pipe flow characteristics. PE-X is also very freeze- break resistant. PE-X systems have fewer joints and are easier to install providing a lower cost installation over traditional plumbing materials.

Floor Heating Systems

PE-RT Pipes

Applied Norms

- EN 578 - Plastics piping systems - plastics pipes and fitting- Determination of the opacity
- EN 579 - Plastics piping systems – cross linked polyethylene (PE-RT) pipes – Determination of degree of cross linking by solvent extraction
- EN ISO 2505 – Plastic and duction systems – Thermoplactics pipes – Determination of the longitudinal reversion
- EN ISO 1167- 1 - Plastic piping systems - Thermoplactics pipes, fitting and assemblies for the conveyonce of fluids – Determination of the resistance to internal pressure – part 1: general method
- EN ISO 1167- 2 - Plastic piping systems - Thermoplactics pipes, fitting and assemblies for the conveyonce of fluids – Determination of the resistance to internal pressure – part 2: Preparation of pipe test pieces.
- EN ISO 15875 -1 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 1: General
- EN ISO 15875 -2 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 2: Pipes
- EN ISO 15875 -3 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 3: Fittings
- EN ISO 15875-5 Plastics piping systems for hot and cold water installations – cross linked polyethylene (PE-X); Part 5: Fitness for purpose of the system
- DIN 16892 Crosslinked high-density polyethylene (PE-X) pipes – General quality requirements and testing
- DIN 16893 Crosslinked high-density polyethylene (PE-X) pipes - Dimension

Raw Material: Temperature Resistance Raised Polyethylene (PE-RT)

PE-RT pipe is made of polyethylene (PE-RT) material, whose mechanical resistance is increased to high temperature.

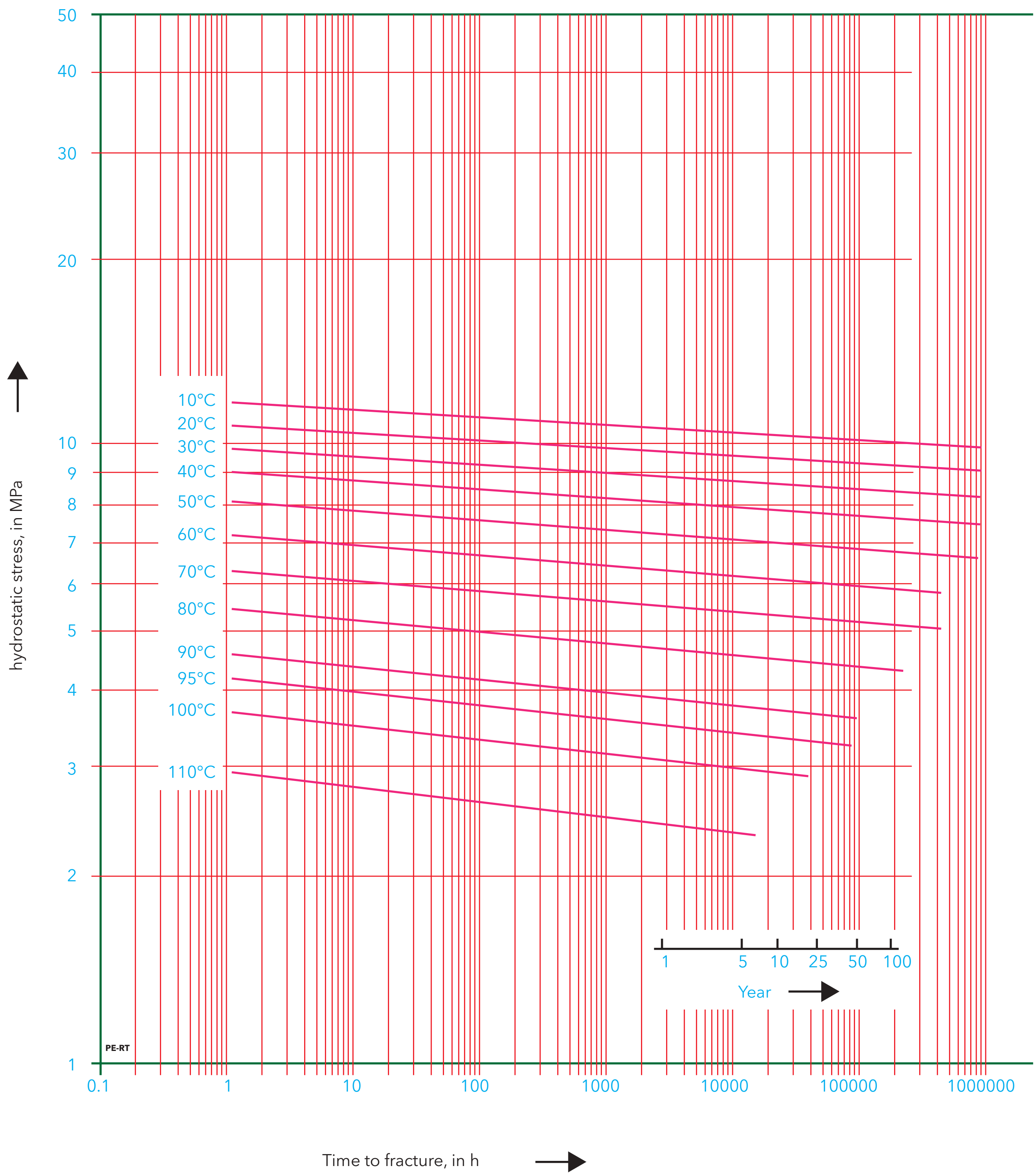
Physical, Thermal and Mechanical Properties

Table 1

Properties	Specification	Value	Unit	Test Method
Density	0,94 - 0,95	0.94	g/cm^3	DIN 53497
Melt Flow Rate	0,7 – 1,9	0.96	(190°C , 5kg)	ISO 1133
Degree of Crosslinking	≥65	68	%	EN 579
Tensile Strength	at 20°C	19-26	N/mm^2	EN ISO 527
	at 100°C	9-13		
Elongation at Break	at 20°C	350-500	%	EN ISO 527
	at 100°C	500-700		
Impact Strength	at 20°C	No failure	KJ/m^2	ISO 179
Moisture Absorbtion	at 22°C	0.01	Mg/4d	
Pipe Roughness		$5{,}10^{-4}$	mm	
Minimum Bending Radius	at 20°C	5xØd	mm	
Softening Point	>122	130	°C	ASTM D1525
Min. laying Temperature	-	-15	°C	
Max. Operating Temperature	-	95	°C	BS7291-3
Thermal Conductivity at 23C°	≥0,41	0.41	W/mK	DIN 52612
Flexural Modulus at 23C°	>600	600	N/mm^2	DIN EN ISI 178
Coefficient of linear Expansion		$2{,}10^{-4}$	K^{-1}	DIN 53752
Resistance of Faces		10^{12}	Ω	DIN 53482

Reference Curves for Expected Strength of Cross Linked Polyethylene

Table 2



Pipe Dimension - TS EN ISO 22391-2, DIN 16893

Table 3

Outer Diameter (mm)	Diameter Tolerance (mm)	Wall Thickness S 3,2 -SDR 7,4 (mm)	Thickness Tolerance (mm)	Approx. Weight (kg/m)
16	0.3	1.8	0.3	0.82
20	0.3	2.0	0.4	0.110

Operating Conditions (S=3,2 SDR=7,4) (PN 20) DIN16893

Table 4

Temperature (°C)	Life (years)	Pressure (PN12,5) (bar)
20	1	11.8
	5	11.7
	10	11.6
	50	11.5
50	1	7.9
	5	7.8
	10	7.8
	50	7.4
70	1	6.0
	5	5.9
	10	5.4
	50	4.1
95	1	4.0
	5	2.9

Thermal Expansion in Polyethylene (PE-RT) Pipes

The polyethylene 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 = variation of working 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 $2 * 10^{-4}$ (K^{-1}) for pe-rt tubes.

Table 9

Pipe length (m)	Temperature variation ΔT in K								
	10	20	30	40	50	60	70	80	90
	Linear expansion ΔL (mm)								
1	2	4	6	8	10	12	14	16	18
4	8	16	24	32	40	48	56	64	72
8	16	32	48	64	80	96	112	128	144
10	20	40	60	80	100	120	140	160	180

Floor Heating Systems

Kalde - PE-RT Pipes

Kalde PE-RT pipe is produced in accordance with TS EN ISO 22391-2 and DIN 16833/34 standards and performs its tests and controls in its modern and advanced laboratories according to the quality requirements of all these standards.

Kalde - PE-RT Pipes are

- Flexible for quick and easy installation
- It is stainless and resistant to chemicals.
- It performs very well at high temperatures and high pressures.
- Easy to cut and join.
- No electricity or heater is required for the installation.
- It is silent and does not transmit sound like metal pipes.
- It has a long service life.
- It is odorless and does not contain dirt or other harmful chemicals.
- It makes less concentration than copper and metal pipes.

Kalde - PE-RT Pipes with Oxygen Barrier

Corrosion in metal and metal components in heating systems is caused by the presence of free oxygen in the water. Oxygen can be found in every system, and it can enter into the system from certain points. It is found in any system where it can also enter gas-permeable materials (pipes etc.), such as open-head tanks, valves, threaded connections and pumps connections.

In closed circuit heating systems that are not fed with continuous hot water, minimizing oxygen inflow from the pipe wall will significantly reduce corrosion. For this reason, oxygen barrier pert pipes have been developed. Oxygen barrier pipes consist of 3 basic layers; Kalde oxygen barrier Pert pipes, inner base layer, adhesive (adhesive) and outer layer (ethylene vinyl alcohol copolymer (EVOH)). the middle layer is an adhesive material that is compatible with both inner and outer layer materials to form an integrated structure. EVOH is an oxygen barrier material with very low oxygen permeability properties.

Datasheet Typical Properties of EVAL™ Resin

EVAL™ FP104B

Test Method		Unit	Value
Ethylene Content	Kuraray Method	mol %	32
Oxygen Transmission Rate	ISO 14663-2 annexC 20°C 0%RH	$cm^3.20\mu m/m^2.day.atm$	0.2
	ISO 14663-2 annexC 20°C 35%RH	$cm^3.20\mu m/m^2.day.atm$	0.3
	ISO 14663-2 annexC 20°C 50%RH	$cm^3.20\mu m/m^2.day.atm$	
	ISO 14663-2 annexC 20°C 65%RH	$cm^3.20\mu m/m^2.day.atm$	0.4
	ISO 14663-2 annexC 20°C 85%RH	$cm^3.20\mu m/m^2.day.atm$	1.5
	ISO 14663-2 annexC 20°C 90%RH	$cm^3.20\mu m/m^2.day.atm$	3
	ISO 14663-2 annexC 20°C 100%RH	$cm^3.20\mu m/m^2.day.atm$	19

Installation

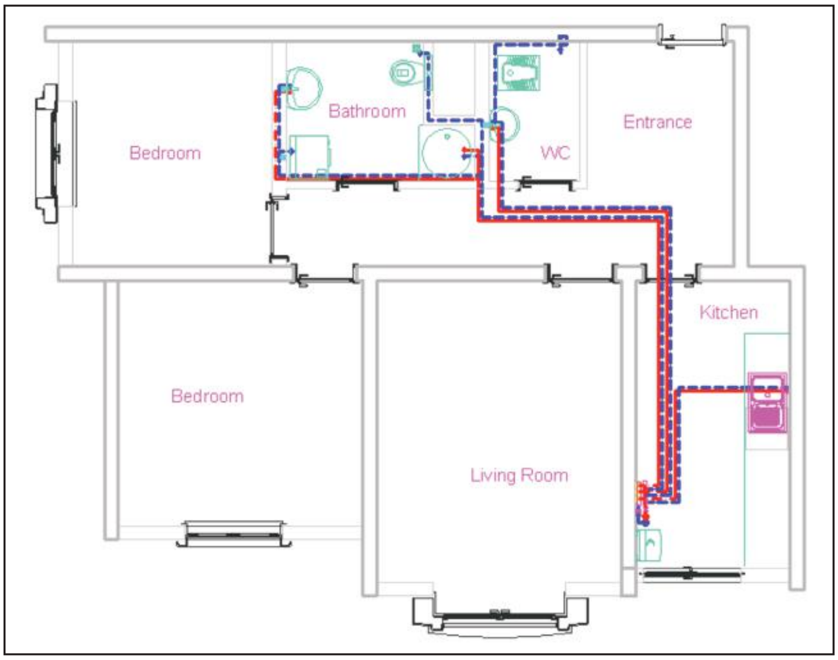
Kalde – PE-RT is ideally suited for potable water plumbing applications. The excellent properties of Kalde – PE-RT make it perfect for plumping applications. Kalde is proud of the reliable and proven performance of its PE-RT systems under the harshest conditions.
It is flexible, making it easy to install and service. PE-RT is able to withstand the high and low temperatures found in plumbing and heating applications, and is highly resistant to chemicals found in the plumbing environment.

Flexible systems are more quiet than rigid piping. The smooth interior will not corrode which can affect other materials long term pipe flow characteristics. PE-RT is also very freeze- break resistant. PE-RT systems have fewer joints and are easier to install providing a lower cost installation over traditional plumbing materials.

Floor Heating Systems

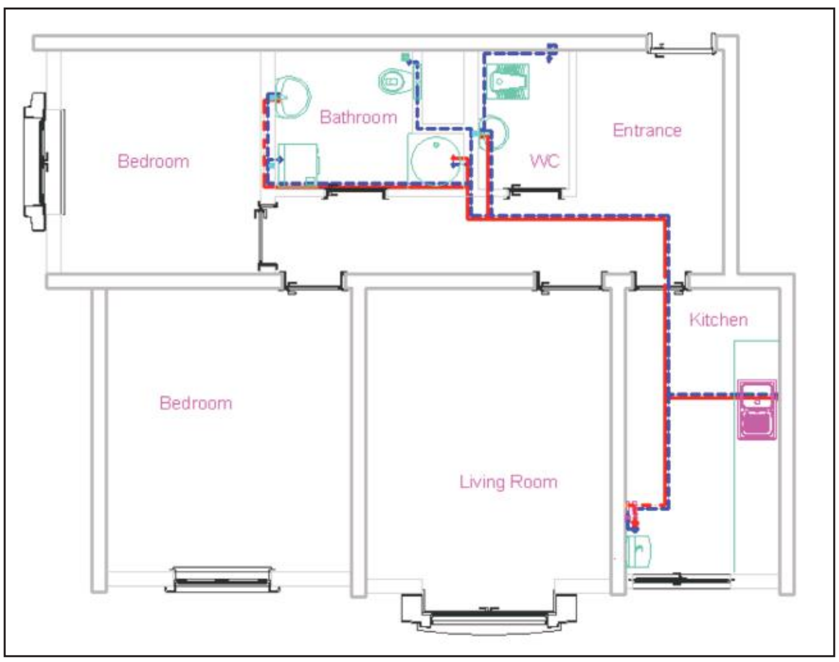
A - Flooring with Manifolds

This installation method allows the pipes to directly reach the consumption points from the manifold. The components needed for installation are minimized also resulting in time and labor savings.



B - Flooring without Manifolds

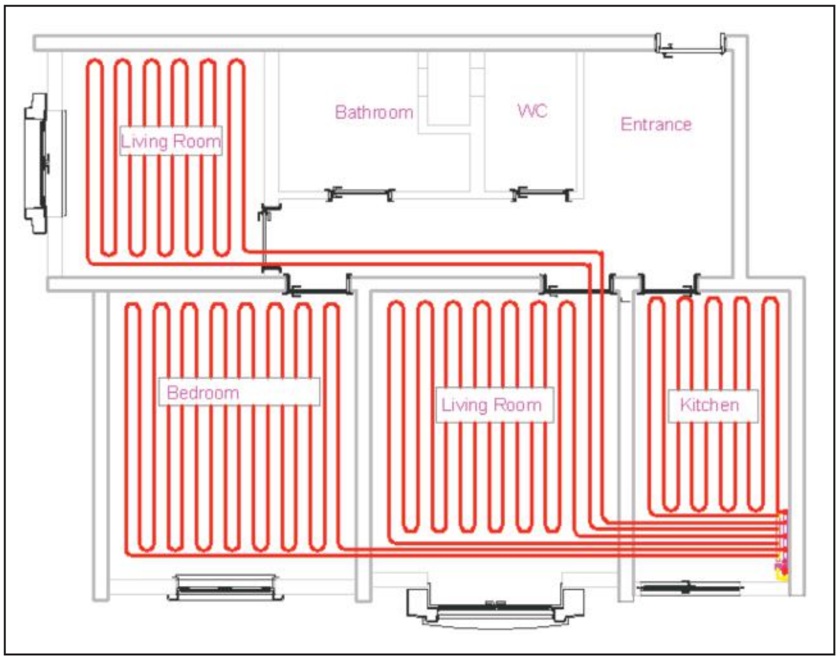
This installation approach is preferred for gaining space by not using a manifold. T-elements are used at junctions, the installed pipe lenghts are minimized.



Floor Heating Systems

C- Under-Floor Heating

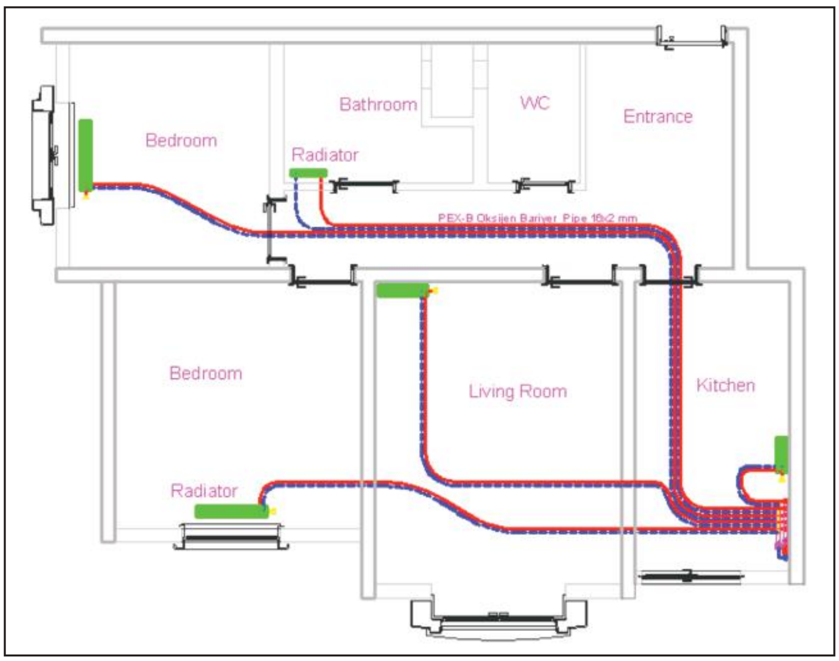
The ideal heat distribution pattern is to have the warmest temperatures at floor level and cooler temperatures at head and ceiling levels. This can be achieved by installing Kalde - PE-X piping system under the floor surface. This is a definite advantage of Kalde - PE-X over some other main heating systems such as radiators where the heat is trapped at the ceiling level.



D– Radiator Connection

The water temperatures in a radiator heating system are around 70 - 90°C. Water at high temperatures is corrosive, especially when it contains added chemicals such as chlorine and acids. The oxygen dissolved in the water reacts with metal components of a heating system causing corrosion, or depositing scale.

Kalde - PE-X pipes overcome these complications with their superior properties at high temperatures. Furthermore, since the pipes are also protected with a corrugated pipe, if the inner pipe gets demaged it can easily be replaced without any damage to the floor or the wall.



kalde®

General Instructions

1. Do not install the pipe if the temperature is below 0°C. If needed, store the pipe and the accessories in a warm room before installation.

2. Although the pipe is rather flexible, the minimum bending radius of the pipe is r min=5*d outer. The minimum bending radius at room temperature (20°C) is given in the following table.

Pipe Outer Diameter (mm)	Minimum Pipe Bending radius r (cm)	Bending Diameter R (cm)
16	8.0	16.0
20	10.0	20.0
25	12.5	25.0
32	16.0	32.0

3. As the thermal expansion of the pipes is approximately 42 mm per 10°C for every 25 m pipe length, do not pull tubing tight during installation but allow about 10mm longitudinal clearance per meter of run to accommodate thermal expansion.

4. Pipe cutting should be done with pipe cutters. The pipe cut should be straight, and perpendicular to the tubing. Cutting the pipe on an angle may result in an improper fitting assembly. Extra care should be taken when cutting the corrugated pipe not to damage the inner pipe.

5. Leave some extra pipe at the beginning and end of runs to simplify the connection to manifolds and fittings.

6. When entering or exiting the slab, a 90°C angle pipe guide or metal bend supports should be used.

7. Installed tubing should be protected from possible damage. Tubing runs should be safeguarded with suitable steel plate protectors during construction since they can be pierced by screws, nails, etc.

8. Manifold locations should be chosen so that they are accessible for future use. This provides convenient access to all fixtures, permits easy connections to the supply mains and provides adequate protection from freezing.

9. Each exit of the distributing manifolds should have a shut-off valve so that it can be isolated as necessary.

10. The system must be tested pressure testing before use and concrete is discarded. During the pressure test, ensure that the pressure is stable and that all joints are leak-free.

11. Use teflon for sealing when assembling threaded parts and do not overload to screw it. If linen is used as sealing material; care should be taken not to over wrap, In case of excessive use, brass inserts or other brass parts may cause fatigue cracking or breakage over time and separation of plastic and metal from each other.

12. Before installation, the products to be used must be visually checked, if there are cracks, broken etc. defects should be returned to our company for replacement without using the product.

13. After the installation is finished, the products in the system should be tested for leakage. If there are leaking products those should be returned to our company to be replaced with a new one.

Note: Products that have not been checked and tested before and after installation are excluded from the warranty. Any damages arising from this reason are the responsibility of the implementing company.

Test Procedures (DIN 1988-2)
finished installation, filtered and vacuum to be filled completely with water.

Pressure testing should be carried out in two stages. The first stage is surfficient for smaller sections of the system, e.g. for testing supply pipes and branch pipes in wet rooms.

a) For the first stage, a test pressure equal to the permissible working pressure plus 5 bars should 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 (at the rate of 0,1 bar per minute) and leakage has occurred.

b) The second stage should immediately follow the first stage and should last two hours with no breaks. Then, one checked whether the pressure has dropped by more than 0,2 bar and the pipework shows any signs of leakage.

Floor Heating Systems

PE-X Tube and Fittings

PE-X and Spiral Pipes

Code	Size	Pcs.
3512-pxb-162016	PE-X ø16 x 2	160
3518-pxs-162010	PE-X ø16 x 2 S ●	100
3517-pxs-162010	PE-X ø16 x 2 S ●	100
3512-pxo-162016	PE-X ø16 x 2 O	160
3518-pos-162010	PE-X ø16 x 2 S+O ●	100
3517-pos-162010	PE-X ø16 x 2 S+O ●	100
3512-spb-190010	Spiral ø19 ●	100
3512-spr-190010	Spiral ø19 ●	100

S= Spiral covered O= Oksygen barriered

PE-RT and Spiral Pipes

Code	Size	Pcs.
3858-prs-162010	PE-RT 16 x 2 S ●	100
3857-prs-162010	PE-RT 16 x 2 S ●	100
3852-pro-162016	PE-RT 16 x 2 O	160
3858-pos-162010	PE-RT 16 x 2 S+O ●	100
3857-pos-162010	PE-RT 16 x 2 S+O ●	100

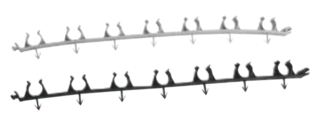
S= Spiral covered O= Oksygen barriered

Pipe Fixture for PE-X

Code	Size	Pcs.
3592-pfp-000000	for ø16 PE-X	5000
3595-pfp-250000	for Spiral	5000

Pipe Fixture

Code	Size	Pcs.
3592-pft-350000	ø35	400



Angle Pipe Guide

Code	Size	Pcs.
3595-ccr-000000	ø16	250

Floor Heating Systems

By-Pass

Code	Size	Pcs.
3411-byp-160b00	ø16 x 1/2"	20

Taps Terminal Elbow

Code	Size	Pcs.
3411-elc-0b0100	1/2" x 105° Kısa	75
3411-elc-0b0105	1/2" x 105° Uzun	75

Connection Tube Upper Coupling

Code	Size	Pcs.
3411-cnt-150b00	ø15 x 1/2"	200

Connection Tube Lower Coupling

Code	Size	Pcs.
3411-cnt-151600	ø15 / 16 x 2	125

Connection Tube Upper Elbow

Code	Size	Pcs.
3411-cne-150b00	ø15 x 1/2"	150

Wall Plate Elbow

Code	Size	Pcs.
3411-ewf-160b00	ø16 x 1/2"	75

Bracket

Code	Size	Pcs.
3391-bck-0c0000	3/4"	75
3391-bck-100000	1"	100
3391-bck-100001	1" Light	100
3391-bck-1a0000	1 1/4"	60

Ball Valve with Thermocouple

Code	Size	Pcs.
3391-bvt-100000	1"	30

Stopend

Code	Size	Pcs.
3391-ste-0c0000	3/4"	300
3391-ste-100000	1"	200
3391-ste-1a0000	1 1/4"	125

PE-X Stopend / AL PE-X Stopend

Code	Size	Pcs.
3391-ste-160000	ø16 x 2 PE-X	400
3391-ste-160001	ø16 x 2 AL PE-X	250

Tee

Code	Size	Pcs.
3391-tep-100000	1"	75
3391-tep-1a0000	1 1/4"	75

Floor Heating Systems

Air Vent

Code	Size	Pcs.
3391-pur-0e0000	1/8"	750
3391-pur-0a0000	1/4"	500
3391-pur-0d0000	3/8"	500
3391-pur-0b0000	1/2"	400

Air Vent Mechanic

Code	Size	Pcs.
3391-pur-0a0001	1/4"	500
3391-pur-0e0002	1/8"	500

Spiral PE-X Stopend

Code	Size	Pcs.
3592-pxs-160000	ø16	1000

Cabinet

Code	Size	L2	L1	L	Pcs.
3392-cab-400000	40 x 70 x 11				1
3392-cab-600000	60 x 70 x 11				1
3392-cab-800000	80 x 70 x 11				1

Floor Heating Systems

Screw Fittings - Attached Type

Elbow

Code	Size	Pcs.
3421-ela-161600	ø16-16	80
3421-ela-181800	ø18-18	75
3421-ela-202000	ø20-20	60
3421-ela-262600	ø26-26	25

Female Elbow

Code	Size	Pcs.
3421-efa-160b00	ø16x1/2"	100
3421-efa-180b00	ø18x1/2"	90
3421-efa-180c00	ø18x3/4"	75
3421-efa-200b00	ø20x1/2"	75
3421-efa-200c00	ø20x3/4"	70
3421-efa-260c00	ø26x3/4"	40
3421-efa-261000	ø26x1"	30

Male Elbow

Code	Size	Pcs.
3421-ema-160b00	ø16x1/2"	125
3421-ema-180b00	ø18x1/2"	100
3421-ema-180c00	ø18x3/4"	100
3421-ema-200b00	ø20x1/2"	85
3421-ema-200c00	ø20x3/4"	75
3421-ema-260c00	ø26x3/4"	45
3421-ema-261000	ø26x1"	30

Wallplate Elbow

Code	Size	Pcs.
3421-ewa-160b00	ø16x1/2"	65
3421-ewa-200b00	ø20x1/2"	50

Nipple

Code	Size	Pcs.
3421-npa-161600	ø16-16	100
3421-npa-181800	ø18-18	80
3421-npa-202000	ø20-20	75
3421-npa-262600	ø26-26	40

Female Nipple

Code	Size	Pcs.
3421-nfa-160d00	ø16x3/8	150
3421-nfa-160b00	ø16x1/2"	150
3421-nfa-160c00	ø16x3/4"	100
3421-nfa-180b00	ø18x1/2"	125
3421-nfa-180c00	ø18x3/4"	100
3421-nfa-200b00	ø20x1/2"	125
3421-nfa-200c00	ø20x3/4"	100
3421-nfa-260c00	ø26x3/4"	50
3421-nfa-261000	ø26x1"	50

Male Nipple

Code	Size	Pcs.
3421-nma-160d00	ø16x3/8	175
3421-nma-160b00	ø16x1/2"	150
3421-nma-160c00	ø16x3/4"	125
3421-nma-180b00	ø18x1/2"	125
3421-nma-180c00	ø18x3/4"	125
3421-nma-200b00	ø20x1/2"	100
3421-nma-200c00	ø20x3/4"	100
3421-nma-260c00	ø26x3/4"	50
3421-nma-261000	ø26x1"	50

Reducing Nipple

Code	Size	Pcs.
3421-nia-181600	ø18-16	100
3421-nia-201600	ø20-16	75
3421-nia-201800	ø20-18	75

Floor Heating Systems

Tee

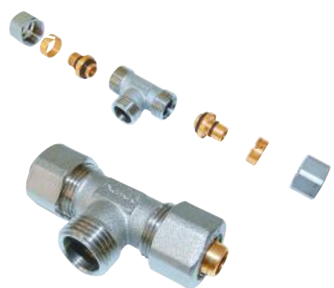
Code	Size	Pcs.
3421-toa-161616	ø16x16x16	50
3421-toa-181818	ø18x18x18	40
3421-toa-202020	ø20x20x20	35
3421-toa-262626	ø26x26x26	15

Female Tee

Code	Size	Pcs.
3421-tfa-160b16	ø16x1/2"x16	60
3421-tfa-160c16	ø16x3/4"x16	50
3421-tfa-180b18	ø18x1/2"x18	50
3421-tfa-180c18	ø18x3/4"x18	45
3421-tfa-200b20	ø20x1/2"x20	40
3421-tfa-200c20	ø20x3/4"x20	40
3421-tfa-260c26	ø26x3/4"x26	20
3421-tfa-261026	ø26x1"x26	20

Male Tee

Code	Size	Pcs.
3421-tma-160b16	ø16x1/2"x16	60
3421-tma-160c16	ø16x3/4"x16	50
3421-tma-180b18	ø18x1/2"x18	50
3421-tma-180c18	ø18x3/4"x18	45
3421-tma-200b20	ø20x1/2"x20	40
3421-tma-200c20	ø20x3/4"x20	40
3421-tma-260c26	ø26x3/4"x26	20
3421-tma-261026	ø26x1"x26	20



Inegal Tee

Code	Size	Pcs.
3421-tia-162016	ø16x20x16	45
3421-tia-181618	ø18x16x18	45
3421-tia-201616	ø20x16x16	40
3421-tia-201620	ø20x16x20	40
3421-tia-201820	ø20x18x20	40
3421-tia-202016	ø20x20x16	40

Floor Heating Systems

Screw Fittings - Fixed Type

Elbow

Code	Size	Pcs.
3431-elf-161600	ø16-16	100
3431-elf-181800	ø18-18	80
3431-elf-202000	ø20-20	70
3431-elf-262600	ø26-26	35
3431-elf-323200	ø32-32	20

Female Elbow

Code	Size	Pcs.
3431-eff-160b00	ø16x1/2"	100
3431-eff-160c00	ø16x3/4"	80
3431-eff-180b00	ø18x1/2"	90
3431-eff-180c00	ø18x3/4"	75
3431-eff-200b00	ø20x1/2"	80
3431-eff-200c00	ø20x3/4"	70
3431-eff-260c00	ø26x3/4"	45
3431-eff-261000	ø26x1"	35
3431-eff-321000	ø32x1	30

Male Elbow

Code	Size	Pcs.
3431-emf-160b00	ø16x1/2"	150
3431-emf-160c00	ø16x3/4"	100
3431-emf-180b00	ø18x1/2"	100
3431-emf-180c00	ø18x3/4"	100
3431-emf-200b00	ø20x1/2"	100
3431-emf-200c00	ø20x3/4"	80
3431-emf-260c00	ø26x3/4"	50
3431-emf-261000	ø26x1"	40
3431-emf-321000	ø32x1	35

Floor Heating Systems

Wallplate Elbow

Code	Size	Pcs.
3431-ewf-160b00	ø16x1/2"	75
3431-ewf-160c00	ø16x3/4"	60
3431-ewf-180b00	ø18x1/2"	65
3431-ewf-180c00	ø18x3/4"	60
3431-ewf-200b00	ø20x1/2"	60
3431-ewf-200c00	ø20x3/4"	50

Nipple

Code	Size	Pcs.
3431-npf-161600	ø16-16	140
3431-npf-181800	ø18-18	100
3431-npf-202000	ø20-20	80
3431-npf-262600	ø26-26	40
3431-npf-323200	ø32-32	30

Female Nipple

Code	Size	Pcs.
3431-nff-160b00	ø16x1/2"	175
3431-nff-160c00	ø16x3/4"	125
3431-nff-180b00	ø18x1/2"	125
3431-nff-180c00	ø18x3/4"	125
3431-nff-200b00	ø20x1/2"	125
3431-nff-200c00	ø20x3/4"	100
3431-nff-260c00	ø26x3/4"	65
3431-nff-261000	ø26x1"	60
3431-nff-321000	ø32x1	40

Male Nipple

Code	Size	Pcs.
3431-nmf-160b00	ø16x1/2"	175
3431-nmf-160c00	ø16x3/4"	125
3431-nmf-180b00	ø18x1/2"	150
3431-nmf-180c00	ø18x3/4"	125
3431-nmf-200b00	ø20x1/2"	125
3431-nmf-200c00	ø20x3/4"	100
3431-nmf-260c00	ø26x3/4"	65
3431-nmf-261000	ø26x1"	60
3431-nmf-321000	ø32x1	40

Reducing Nipple

Code	Size	Pcs.
3431-nif-181600	ø18-16	100
3431-nif-201600	ø20-16	100
3431-nif-201800	ø20-18	100

Tee

Code	Size	Pcs.
3431-tof-161616	ø16x16x16	60
3431-tof-181818	ø18x18x18	50
3431-tof-202020	ø20x20x20	40
3431-tof-262626	ø26x26x26	20
3431-tof-323232	ø32x32x32	15

Female Tee

Code	Size	Pcs.
3431-tff-160b16	ø16x1/2"x16	65
3431-tff-160c16	ø16x3/4"x16	50
3431-tff-180b18	ø18x1/2"x18	55
3431-tff-180c18	ø18x3/4"x18	50
3431-tff-200b20	ø20x1/2"x20	45
3431-tff-200c20	ø20x3/4"x20	40
3431-tff-260c26	ø26x3/4"x26	25
3431-tff-261026	ø26x1"x26	20
3431-tff-321032	ø32x1x32	15

Male Tee

Code	Size	Pcs.
3431-tmf-160b16	ø16x1/2"x16	75
3431-tmf-160c16	ø16x3/4"x16	60
3431-tmf-180b18	ø18x1/2"x18	60
3431-tmf-180c18	ø18x3/4"x18	55
3431-tmf-200b20	ø20x1/2"x20	50
3431-tmf-200c20	ø20x3/4"x20	50
3431-tmf-260c26	ø26x3/4"x26	25
3431-tmf-261026	ø26x1"x26	20
3431-tmf-321032	ø32x1x32	15

Inegal Tee

Code	Size	Pcs.
3431-tif-162016	ø16x20x16	45
3431-tif-181618	ø18x16x18	50
3431-tif-201616	ø20x16x16	45
3431-tif-201620	ø20x16x20	45
3431-tif-201820	ø20x18x20	45
3431-tif-202016	ø20x20x16	45
3431-tif-262026	ø26x20x26	20

Nut

Code	Size	Pcs.
2421-som-160000	ø16	100
2421-som-180000	ø18	75
2421-som-200000	ø20	75
2421-som-260000	ø26	50
2421-som-320000	ø32	40

Insert

Code	Size	Pcs.
2421-uch-160000	ø16	100
2421-uch-180000	ø18	75
2421-uch-200000	ø20	75
2421-uch-260000	ø26	50
2421-uch-320000	ø32	40

Compression Ring

Code	Size	Pcs.
2421-yks-160000	ø16	100
2421-yks-180000	ø18	75
2421-yks-200000	ø20	75
2421-yks-260000	ø26	50
2421-yks-320000	ø32	40

+90 212 876 43 43 +90 212 876 76 49 Kalde Klima A.Ş. İstanbul / Türkiye info@kaldeklima.com www.kalde.com