HEATPEX

Save energy with us

DELTA

DESIGN AND INSTALLATION GUIDE

System Description

Information

An energy-efficient heating system requires top-quality pipes.
Our solution is based on PEX-a or PE100 carrier pipes with PE foam insulation and a corrugated, 2-layer PE-HD casing.
Heatpex Delta PEX and Heatpex Delta PE pipes are intended for heating medium distribution, as well as cooling and plumbing applications. They can be used as part of water supply systems, industrial (process) and geothermal systems.

Whenever used, the pipes offer many notable benefits: they are light, highly flexible, durable, easy to install and bendable for easy rerouting. Supplemented with a system of accessories, they can be installed without the use of specialist tools.

Scope of application

Our complete system of flexible pre-insulated pipes is based on PEX-a pipes and PE foam insulation.
The casing pipe is a corrugated PE-HD pipe, which makes the solution outstandingly flexible and durable.

Heatpex pipes are designed for

- the transfer of heating system water or other media with the maximum working temperature of 95°C and the maximum working pressure of 0.6 MPa;
- the transfer of hot tap water with the maximum working temperature of 95°C and the maximum working pressure of 0.6 MPa and 1 MPa;
- the transfer of cold tap water with the maximum working temperature of 20°C and the maximum working pressure of 1.6 MPa.

Properties of the materials used in the production

HEATING

- SUPPLY OF HEAT TO HOUSES
- INDOOR DISTRIBUTION OF HEAT
- LOW-TEMPERATURE HEAT NETWORKS

SUPPLY OF WATER

- COLD AND HOT TAP WATER NETWORKS

RENEWABLE ENERGY SOURCES

- HEAT PUMPS
- BIOGAS PLANT SYSTEMS
- GEOTHERMAL APPLICATIONS

SPECIAL APPLICATIONS

- PROCESS NETWORKS IN THE CHEMICALS INDUSTRY
- THE FOOD INDUSTRY
- COOLING SYSTEMS
- SWIMMING POOLS

APPLICATION

A COMPLETE SYSTEM OF FLEXIBLE PRE-INSULATED PIPES IS BASED ON A PEX-A PIPE AND PE INSULATION WITH DEZINCIFICATION-RESISTANT BRASS CONNECTORS.

PEX-A Carrier Pipes

PEX-a carrier pipes are made of specially selected plastic. In the process of production the plastic is extruded under high pressure and high temperature, using a chemical catalyst. The pipes are also cross-linked according to the ISO 10147 standard.

The cross-linking process produces an unbreakable 3D system of links. As a result, the pipe becomes a single molecule.

The pipes for the transfer of heating system media are, as an addition, coated with an anti-diffusion EVOH layer according to the DIN 4726 standard.

The cross-linked polyethylene (known as PEX-a) offers many benefits:

- resistance to temperatures ranging from -50 °C to 95 °C
- corrosion resistance
- outstanding mechanical resistance
- unique chemical resistance
- a very low coefficient of friction (C-155) (according to Hazen-Williams)
- resistance to abrasion
- high durability
- resistance to scratches and cracks at elongation or under heavy-duty conditions
- low longitudinal creep
- a smooth internal surface that prevents the accumulation of sediments and scale (encrustation)
- low thermal permeability of the plastic material
- no slow crack growth in the case of cross-linked 3D structures

TABLE 1.1 Properties of PEX-a

Properties	Value	Unit	Standard
Mechanical properties			
Density	938	kg/m^3	DIN 53455
Degree of cross-linking	80	%	ISO 10147
Elongation at break at 20^{0}C	>400	%	ISO 527
Tensile strength at 20^{0}C	>19	N/mm^2	DIN 53455
UV resistance - White pipes are not resistant to sunlight. - Black pipes are resistant to sunlight.	Requirements satisfied: - temperature stability - hydrostatic forces at 95^{0}C - elongation at break	-	ISO 14531-1, Annex C Resistance to weathering
Longitudinal shrinkage	<2.5	%	ISO 2505
Migration stabilisers	>50	%	NCh 2086
Oxidation induction time	> 40 min at 200^{0}C	min	EN 728, ISO TR 10837

Properties	Value	Unit	Standard
Mechanical properties			
Accelerated aging	after 100 hour: 90 % compared to the sample	hour	ATEC
Thermal stability	>10,000	hour	AS 2492, DIN 16892
PENT test: resistance to slow crack growth	>100	hour	ASTM F876
Compression strength	>1,000	hour	ISO 14531
RCP	lc/dn=0.2 at -50°C	-	ISO 14531
Sudden impact at 20°C	no damage	-	ISO 179
Moisture absorption at 20°C	<0.01	mg/4d	DIN 53472
Oxygen permeability for pipes with an oxygen barrier	0.02	gr/m³ x day	DIN 4726
Thermal properties			
Maximum range of working temperatures	-50 / +95	°C	-
Coefficient of linear expansion at 20°C	1.4 x 10-4	m/m*°C	DIN 53752
Coefficient of linear expansion at 100°C	2.05 x 10-4	m/m*°C	DIN 53752
Softening temperature	133	°C	-
Specific heat	2.3	KJ/Kg*°C	DIN 53765
Thermal conductivity coefficient	0.35	W/m*K	DIN 4725
Electrical properties			
Specific resistance at 20°C	1015	Ωm	-
Dielectric constant at 20°C	2,3	-	-
Dielectric loss factor at 20°C / 50Hz	1 x 10-34	-	DIN 53483
Breakdown voltage at 20°C	100	kV/mm	-

PE-HD 100 Carrier Pipe

In accordance with the PN-EN 12202 standard, these pipes are made of high-density polyethylene (HDPE). HDPE pipes are intended for the transfer of potable water, as well as water for technical and industrial use.

They are highly resistant to impact in the process of installation. As the working temperature range is large, they can be installed in any season of the year. They are also highly resistant to most chemical compounds.

What the advantages of the PE100 polyethylene?

- It is resistant to high pressure for applications where high temperatures are not required.
- It is a light and universal material.
- It offers durability at low temperatures.
- It is highly flexible.
- It is recyclable.

TABLE 1.2 Properties of PE 100

Properties	Value	Unit	Standard
Maximum range of working temperatures	-10 / +40	^{0}C	-
Density	950	kg/m^3	ISO 1183
Elastic modulus (short-term value)	1100	MPa	ISO 527-2
Tensile strength at plastic limit	25	MPa	ISO 527-2
Relative elongation at break	> 600%	-	ISO 527-2
Oxidation induction time (200^{0}C)	> 20	min	EN 728
Resistance to slow crack growth (9.2 bar/80^{0}C)	> 1000	h	ISO 13479
Hardness (Shore D)	> 65%	-	ISO 868

Insulating Material

The insulating material is cross-linked closed-cell polyethylene foam, which offers the best insulation properties, allows for offsetting the thermal elongation of the carrier pipe, prevents moisture absorption and makes the pipe highly flexible.

TABLE 1.3 Properties of the insulating material

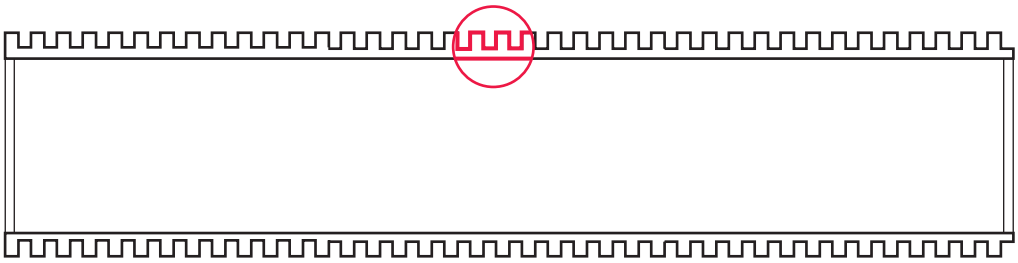
Properties	Normal value	Unit	Standard
Density	30	kg/m^3	DIN 53420
Tensile strength	28	N/cm^2	ISO 1798
Tensile strength	23	N/cm^2	ISO 1798
Elongation	101	%	ISO 1798
Elongation	103	%	ISO 1798
Compressive strength, deflection of 25%	45	kPa	ISO 3386
Compressive strength, deflection of 50%	105	kPa	ISO 3386

Properties	Normal value	Unit	Standard
Water absorption (24h)	< 1.0 of the volume	%	DIN EN 12087
Recommended working temperatures	between -50 and +95	^{0}C	-
Fire resistance	upon request	-	-

PE-HD casing pipes

The casing pipe has a double wall made of PE-HD polyethylene, fully sealed. Also, the insulating material is protected from external damage. As the corrugated surface of the pipe is fully sealed, no water will enter the insulating material of the carrier pipe even if the outer surface is damaged. Also, the protective surface is resistant to **ultraviolet radiation**.

The double wall of the casing pipe is highly durable and resistant to aggressive agents



Do you need more technical details of our pipes?

For assistance with calculating your requirement for materials or if you have any questions, **call +48 (58) 30-90-283**.
Our personnel will be happy to help you.

Scope of Supply

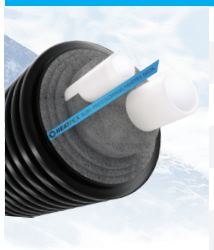
Heatpex Delta PEX-a Pre-Insulated Pipes

DELTA PEX HEAT DUO PN 6/95°C SDR 11 with EVOH anti-diffusion barrier for transporting heat transfer medium (central heating)

Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz1	Wall thickness	Do			
mm	mm	mm	m	kg/m	
25	2.3	125	100	1.26	706 125 025
32	2.9	125	100	1.49	706 125 032
25	2.3	160	100	1.738	706 150 025
32	2.9	160	100	1.861	706 160 032
40	3.7	160	100	2.131	706 160 040
50	4.6	200	100	3.188	706 200 050
63	5.8	200	100	3.786	706 200 063

Double pipes

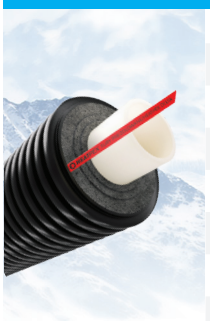
DELTA PEX SANI DUO PN 10/95°C SDR 7,4 for transporting cold or hot tap water



Dimensions					Maximum coil length	Weight without water	Catalogue number
Inner pipe				Casing			
Dz1	Wall thickness	Dz2	Wall thickness	Do			
mm	mm	mm	mm	mm	m	kg/m	
25	3.5	25	3.5	125	100	1.3	710 125 225
32	4.4	20	2.8	125	100	1.47	710 125 032
25	3.5	25	3.5	160	100	1.88	710 160 225
32	4.4	25	3.5	160	100	2.07	710 160 232
40	5.5	25	3.5	160	100	2.1	710 160 040
50	6.9	32	4.4	200	100	2.77	710 165 032
63	8.6	32	4.4	200	100	3.51	710 200 063

Double pipes

DELTA PEX HEAT UNO PN 6/95°C SDR 11 with EVOH anti-diffusion barrier for transporting heat transfer medium (central heating)



Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	m	kg/m	
25	2.3	110	100	0.992	706 110 025
32	2.9	110	100	1.080	706 110 032
40	3.7	110	100	1.219	706 110 040
50	4.6	160	100	2.106	706 160 050
63	5.8	160	100	2.429	706 160 063
75	6.8	160	100	2.784	706 160 075
90	8.2	200	100	4.118	706 200 090
110	10	200	100	5.020	706 200 110
125	11.4	200	100	5.846	706 200 125

Single pipes

DELTA PEX SANI UNO PN 10/95°C SDR 7,4 for transporting cold or hot tap water

Single pipes

Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	m	kg/m	
25	3.5	110	100	1.062	710 110 025
35	4.4	110	100	1.200	710 110 032
40	5.5	110	100	1.389	710 110 040
50	6.9	160	100	2.376	710 160 050
63	8.6	160	100	2.849	710 160 063
75	10.3	160	100	3.414	710 160 075
90	12.3	200	100	4.998	710 200 090
110	15.1	200	100	6.360	710 200 110

Heatpex Delta PE100 Pre-Insulated Pipes

DELTA PE PN16 SDR 11 for water supply and industrial systems

Single pipes

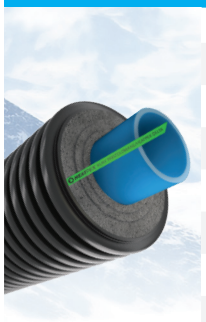
Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	m	kg/m	
25	2.3	110	100	1.01	721 110 025
32	3	110	100	1.02	721 110 025
40	3.7	110	100	1.15	721 110 040
50	4.6	160	100	2.24	721 160 050
63	5.8	160	100	2.59	721 160 063
75	6.8	160	100	2.97	721 160 075
90	8.2	200	100	4.02	721 200 090
110	10	200	100	4.96	721 200 110
125	11.4	200	100	5.82	721 200 125

DELTA PE GEO PN10 SDR17 for geothermal installations

Single pipes

Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz1	Wall thickness	Do			
mm	mm	mm	m	kg/m	
40	2.4	63	100	0.71	722 063 040
50	3	90	100	1	722 090 050

DELTA PE PRO PN16 SDR11 for water supply and industrial systems, equipped with a heating cable.*



Dimensions			Maximum coil length	Weight without water	Catalogue number
Inner pipe		Casing			
Dz1	Wall thickness	Do			
mm	mm	mm	m	kg/m	
25	2.3	110	100	1.11	723 110 025
32	3	110	100	1.12	723 110 032
40	3.7	110	100	1.25	723 110 040
50	4.6	160	100	2.34	723 160 050
63	5.8	160	100	2.69	723 160 063
75	6.8	160	100	3.07	723 160 075
90	8.2	200	100	4.12	723 200 090
110	10	200	100	5.06	723 200 110
125	11.4	200	100	5.92	723 200 125

* The heating system ensures freeze protection of the pipeline or can be used for maintaining the desired temperature of the fluid being conveyed through the system

Connectors for PEX-a and PE100 Pipes

HELA H, PN6 transition coupling

Designation	Pipe diameter $øD_z$ x s [mm]	Thread R [inch]	Marketing unit	Catalogue number
H 20 20-6	20 x 2.0	¾"	1 pc	606 020 001
H 25 25-6	25 x 2.3	1"	1 pc	606 025 001
H 32 25-6	32 x 2.9	1"	1 pc	606 032 001
H 32 32-6	32 x 2.9	1 ¼"	1 pc	606 032 114
H 40 32-6	40 x 3.7	1 ¼"	1 pc	606 040 114
H 50 32-6	50 x 4.6	1 ¼"	1 pc	606 050 114
H 63 50-6	63 x 5.8	2"	1 pc	606 063 002
H 75 65-6	75 x 6.8	2 ½"	1 pc	606 075 002
H 90 80-6	90 x 8.2	3"	1 pc	606 090 003
H 110 100-6	110 x 10.0	4"	1 pc	606 110 004
H 125 100-6	125 x 11.4	4"	1 pc	606 125 005
H 160 150-6	160 x 14.6	6"/5" Rp	1 pc	606 160 006

HELA H, PN10 transition coupling

Designation	Pipe diameter $øD_z$ x s [mm]	Thread R [inch]	Marketing unit	Catalogue number
H 20 20-10	20 x 2.8	¾"	1 pc	610 020 001
H 25 20-10	25 x 3.5	¾"	1 pc	610 025 001
H 32 25-10	32 x 4.4	1"	1 pc	610 032 001
H 32 32-10	32 x 4.4	1 ¼"	1 pc	610 032 114
H 40 32-10	40 x 5.5	1 ¼"	1 pc	610 040 114
H 50 32-10	50 x 6.9	1 ¼"	1 pc	610 050 114
H 63 50-10	63 x 8.6	2"	1 pc	610 063 002
H 75 50-10	75 x 10.3	2"	1 pc	610 075 002
H 90 80-10	90 x 12.3	3"	1 pc	610 090 003
H 110 100-10	110 x 15.1	4"	1 pc	610 110 004

HELA L, PN6 transition coupling with weld ends

Designation	Pipe diameter $øD_z$ x s [mm]	OD/ID [mm]*	Marketing unit	Catalogue number
L 25 26.9 – 6	25 x 2.3	26.9	1 pc	706 025 001
L 32 33.7 – 6	32 x 2.9	33.7	1 pc	706 032 001
L 40 42.4 – 6	40 x 3.7	42.4	1 pc	706 042 001
L 50 48.3 – 6	50 x 4.6	48.3	1 pc	706 048 001
L 63 60.3 – 6	63 x 5.8	60.3	1 pc	706 060 001
L 75 76.1 – 6	75 x 6.8	76.1	1 pc	706 076 001
L 90 88.9 – 6	90 x 8.2	88.9	1 pc	706 089 001
L 110 114.3 – 6	110 x 10.0	114.3	1 pc	706 114 001
L 125 139.7 – 6	125 x 11.4	139.7	1 pc	706 139 001
L 160 168.3-6	160 x 14.6	168.3	1 pc	706 168 001

* OD - outer diameter of weld end / ID - inner diameter of weld end

HELA S, PN 6, straight coupling with with H-type compression couplings in a horizontal run

Designation	Pipe diameter $øD_z$ x s [mm]	Marketing unit	Catalogue number
S 25-6	25 x 2.3	1 pc	626 025 001
S 32-6	32 x 2.9	1 pc	626 032 114
S 40-6	40 x 3.7	1 pc	626 040 114
S 50-6	50 x 4.6	1 pc	626 050 114
S 63-6	63 x 5.8	1 pc	626 063 002
S 75-6	75 x 6.8	1 pc	626 075 002
S 90-6	90 x 8.2	1 pc	626 090 003
S 110-6	110 x 10.0	1 pc	626 110 004
S 125-6	125 x 11.4	1 pc	626 125 005
S 160-6	160 x 14.6	1 pc	626 125 006

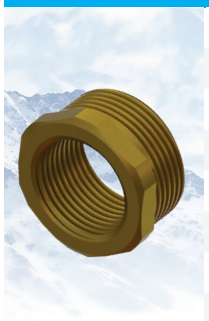
HELA T equal tee piece

Designation	Female thread Rp [inch]	Marketing unit	Catalogue number
T 20	¾″	1 pc	611 020 001
T 25	1″	1 pc	611 025 001
T 32	1 ¼″	1 pc	611 032 114
T 50	2″	1 pc	611 050 002
T 65	2 ½″	1 pc	611 065 003
T 80	3″	1 pc	611 080 003
T 100	4″	1 pc	611 100 004
T 125	5″	1 pc	611 125 005

HELA V right angle elbow

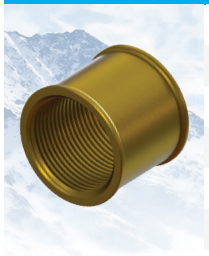
Designation	Female thread Rp [inch]	Marketing unit	Catalogue number
V 20	¾″	1 pc	612 020 001
V 25	1″	1 pc	612 025 001
V 32	1 ¼″	1 pc	612 032 114
V 50	2″	1 pc	612 050 002
V 65	2 ½″	1 pc	612 065 003
V 80	3″	1 pc	612 080 003
V 100	4″	1 pc	612 100 004

HELA B pipe bushing



Designation	Male thread R [inch]	Female thread Rp [inch]	Marketing unit	Catalogue number
B 25 20	1″	¾″	1 pc	613 025 020
B 32 25	1 ¼″	1″	1 pc	613 032 025
B 50 25	2″	1″	1 pc	613 050 025
B 50 32	2″	1 ¼″	1 pc	613 050 032
B 65 50	2 ½″	2″	1 pc	613 065 050
B 80 50	3″	2″	1 pc	613 080 050
B 80 65	3″	2 ½″	1 pc	613 080 065
B 100 50	4″	2 ″	1 pc	613 100 050
B 100 80	4″	3″	1 pc	613 100 080
B 125 80	5″	3″	1 pc	613 125 080
B 125 100	5″	4″	1 pc	613 125 100

HELA M female thread straight coupling



Designation	Female thread Rp [inch]	Marketing unit	Catalogue number
M 20	¾″	1 pc	618 020 020
M 25	1″	1 pc	618 025 025
M 32	1 ¼″	1 pc	618 032 032
M 50	2 ″	1 pc	618 050 050
M 65	2 ½″	1 pc	618 065 065
M 80	3″	1 pc	618 080 080
M 100	4″	1 pc	618 100 100

HELA D pipe bushing

Designation	Male thread R [inch]	Female thread Rp [inch]	Marketing unit	Catalogue number
D 20 20	¾″	¾″	1 pc	614 020 020
D 25 20	1″	¾″	1 pc	614 025 020
D 25 25	1″	1″	1 pc	614 025 025
D 32 25	1 ¼ ″	1″	1 pc	614 032 025
D 32 32	1 ¼ ″	1 ¼″	1 pc	614 032 032
D 50 32	2″	1 ¼″	1 pc	614 050 032
D 50 50	2″	2″	1 pc	614 050 050
D 80 50	3″	2″	1 pc	614 080 050
D 80 80	3″	3″	1 pc	614 080 080
D 100 80	4″	3″	1 pc	614 100 080
D 100 100	4″	4″	1 pc	614 100 100

HELA G female thread tee clamp

Oznaczenie	Pipe diameter $øD_z$ x s [mm]	Branch Rp thread [inch]	Marketing unit	Catalogue number
G 63 32	63	1 ¼″	1 pc	620 063 032 1)
G 63 50	63	2″	1 pc	620 063 050 1)
G 75 50	75	2″	1 pc	620 075 050 1)
G 90 50	90	2″	1 pc	620 090 050 1)
G 110 50	110	2″	1 pc	620 110 050 1)

* item available on request

HELA P Fixed Point for use inside the building as a fixing of the pipeline to the PEX-a carrier pipe

Designation	Male thread R [inch]	Female thread Rp [inch]	Marketing unit	Catalogue number
P 20 20	¾''	¾''	1 pc	806 020 020
P 25 25	1″	1″	1 pc	806 025 025
P 32 32	1 ¼″	1 ¼″	1 pc	806 032 032
P 50 50	2″	2″	1 pc	806 050 050
P 65 65	2 ½″	2 ½″	1 pc	806 065 065
P 80 80	3″	3″	1 pc	806 080 080
P 100 100	4″	4″	1 pc	806 100 100

Accessories

Rubber end cap for double pipes

Designation	Pex-a pipe diameter DZ1 [mm]	Pex-a pipe diameter DZ2 [mm]	Casing diameter [mm]	Catalogue number
ECD 125/2	20	20	110	707 000 110
	25	25		
	32	32		
ECD 160/2	25	25	160	707 100 160
	32	32		
	40	40		
	50	50		
	32	32		
	40	40		
	50	50		
	63	63		
ECD 200/2	32	32	200	707 000 200
	40	40		
	50	50		
	63	63		

* prevents water from penetrating the pipe's insulation between the protective jacket and the carrier pipe.

Rubber End Cap for single pipes

Designation	Pex-a pipe diameter DZ1 [mm]	Casing diameter [mm]	Catalogue number
ECP 110/1	25	110	707 000 110
	32		
	40		
ECP 160/1	50	160	707 000 160
	63		
	75		
ECP 200/1	90	200	707 000 200
	110		
	125		

* prevents water from penetrating the pipe's insulation between the protective jacket and the carrier pipe.

Reduction ring for use in a casing insulating an elbow connector, a T-pipe connector and a straight connector

Designation	Casing outer diameter [mm]	Catalogue number
PR 110	110	708 000 110
PR 125	125	708 000 125
PR 160	160	708 000 160
PR 200	200	708 000 200
PR 000	-	708 000 000

* it is possible to make a ring to order for other outer diameters of casings.

PE sleeve to make connections without changing the pipeline diameter

Designation	Casing outer diameter [mm]	Catalogue number
NPE 110	110	702 000 110
NPE 125	125	702 000 125
NPE 160	160	702 000 160
NPE 200	200	702 000 200

* the set consists of 1 rigid protective bushing, an insulation mat, 2 heat-shrinkable sleeves and fixing clips.

Heatpex Delta set for T-piece insulation

Designation	Casing outer diameter [mm]	Catalogue number
TPR 1	110/125/160/200	703 000 000

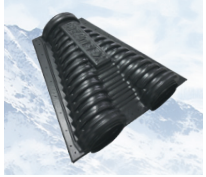
* guarantees full insulation and sealing between the passage of the T-piece and the perpendicular branch. The kit consists of a two-piece casing, a liquid gasket, connection screws of stainless steel and installation instructions. End-Caps and reduction rings are sold separately.

Heatpex Delta set for H-type insulation

Designation	Casing outer diameter [mm]	Catalogue number
HPR 1	110/125/160/200	707 000 000

* guarantees full insulation and sealing between the connected elements. The kit consists of a two-piece casing, a liquid gasket, connection screws of stainless steel and installation instructions. End-Caps and reduction rings are sold separately.

Heatpex Delta set for Y-type insulation



Designation	Casing outer diameter [mm]	Catalogue number
YPR 1	110/125/160/200	706 000 000

* guarantees full insulation and sealing between the connected elements. The kit consists of a two-piece casing, a liquid gasket, connection screws of stainless steel and installation instructions. End-Caps and reduction rings are sold separately.

Heatpex Delta set for insulation of straight connection

Designation	Casing outer diameter [mm]	Catalogue number
PPR 1	110/125/160/200	704 000 000

* guarantees full insulation and sealing between the connected elements of the network. The set contains a two-piece casing, a liquid gasket, connection screws of stainless steel and installation instructions. End-Caps and reduction rings are sold separately.

Heatpex Delta set for insulation of elbow connection

	Designation	Casing outer diameter [mm]	Catalogue number
	KPR 1	110/125/160/200	705 000 000

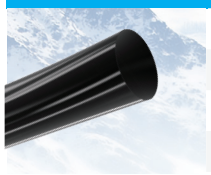
* guarantees full insulation and sealing between the connected elements of the network. The set contains a two-piece casing, a liquid gasket, connection screws of stainless steel and installation instructions. End-Caps and reduction rings are sold separately.

NOTE

Apart from pre-insulated couplings, a set of reduction rings and rubber End-Caps should be ordered as well

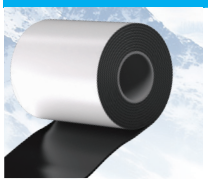
	Reduction ring	End-Cap
T-pipe	3 sets	3 pcs
Elbow	2 sets	2 pcs
Straight connector	2 sets	2 pcs
H type connector	5 sets	5 pcs
Y type connector	3 sets	3 pcs

Heatpex Delta heat-shrinkable sealing & repair sleeve

	Designation	Pipe outside diameter [mm]	Length [mm]	Catalogue number
	RN 120/40	110	60	705 110 060
	RN 140/50	125	60	705 125 060
	RN 180/66	160	60	705 160 060
	RN 235/70	200	60	705 200 060

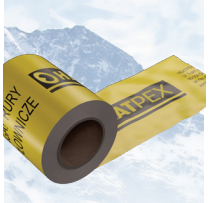
* used for spot repair of the pipe casing

Heatpex heat-shrinkable tape with adhesive

	Designation	Tape width [mm]	Roll length [m]	Marketing unit [m]	Catalogue number
	TN 50	50	15	1	705 010 020

* used for spot repair of the damage of the casing pipe

Warning tape

	Designation	Length [m]	Catalogue number
	T -150	100	920 000 000

* to be laid in an excavation above the pipeline

Wall feed-throughs

Designation	Casing outer diameter [mm]	Catalogue number
PL110	110	711 000 110
PL125	125	711 000 125
PL160	160	711 000 160
PL200	200	711 000 200

* non-pressure protection of the wall penetration. Protects against moisture penetration into the building, provided it is not exposed to water under pressure

Assembly kit for heating system

Designation	Catalogue number
ZM-1	701 000 100

* consists of connection elements to connect the power cable with the self-regulating heating cable

Thermostat with temperature sensor for heating system

Designation	Catalogue number
TC-1	701 000 200

Products available on request:

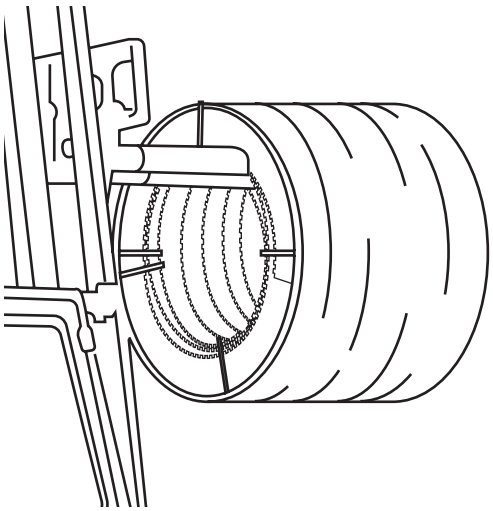
preinsulated T-pipe or elbow

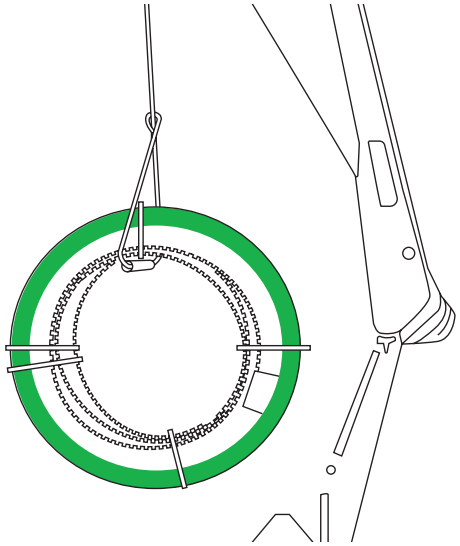
Basic information

Transport and storage

Heatpex pipes are delivered to the installation site in coils. The maximum length of the pipe on a coil is 100 m. Both ends of the pipe are covered with plastic sleeves for protection against moisture and dirt. These sleeves should stay on the pipes at all times during the transport and storage of the pipes.

The use of construction equipment for lifting operations is recommended for unloading the coils and moving them to the place of storage or installation. If a forklift truck is used, the forks should be protected, for example with plastic pipes. The coils must not be pulled on the ground and should be lifted when positioned vertically.





When in storage, all carrier pipes (e.g. PEX-a) must be protected against exposure to sunlight.
Do not remove the protective plastic sleeves from the pipes, unless it is necessary. Heatpex Delta flexible pre-insulated pipes must be placed on a smooth surface while in storage.

Please note that low temperatures may naturally make the pipes less flexible.

Protective film

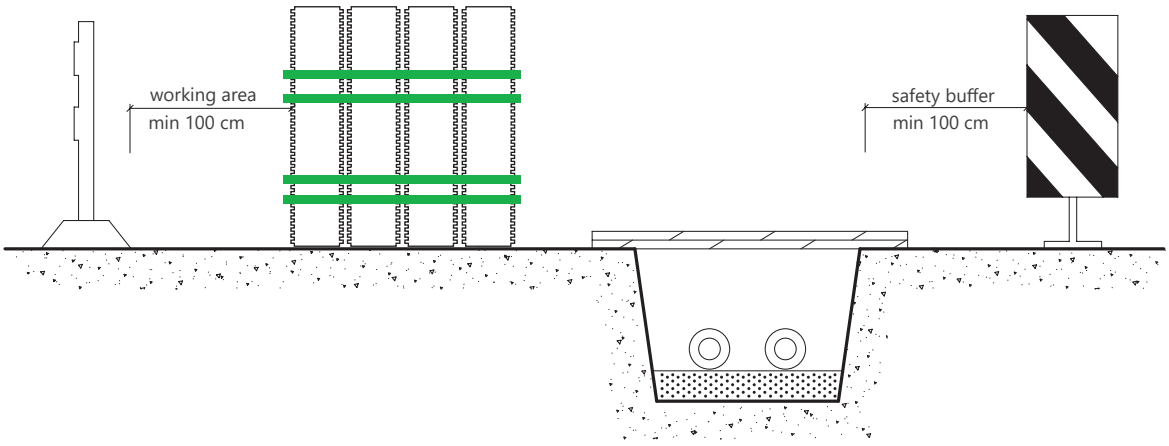
Pipe cutting instructions

Heatpex Delta can be cut with simple hand tools or electromechanical equipment. While cutting, keep a straight angle in relation to the axis of the pipe. Clean the pipe ends thoroughly before fixing a connector. If any cuttings are left inside or on the pipe, the connector may not be properly sealed or other components of the pre-insulated pipe network may be obstructed.
See section 4 for Hela connector installation instructions.

Excavation work

All excavation, auxiliary and preparatory work connected with measurements, site organisation etc. must be carried out in accordance with the general conditions specified in Volume I of WTWiO (Code of Practice for Execution and Acceptance of Works). The protective systems for excavations must comply with the applicable OHS regulations and established excavation work standards. The excavation and placing of bedding (haunch) material must comply with the design documentation.
Figure 1 shows the cross-section of a typical excavation, working and transport areas and a safety buffer.

Figure 01 (reference drawing)

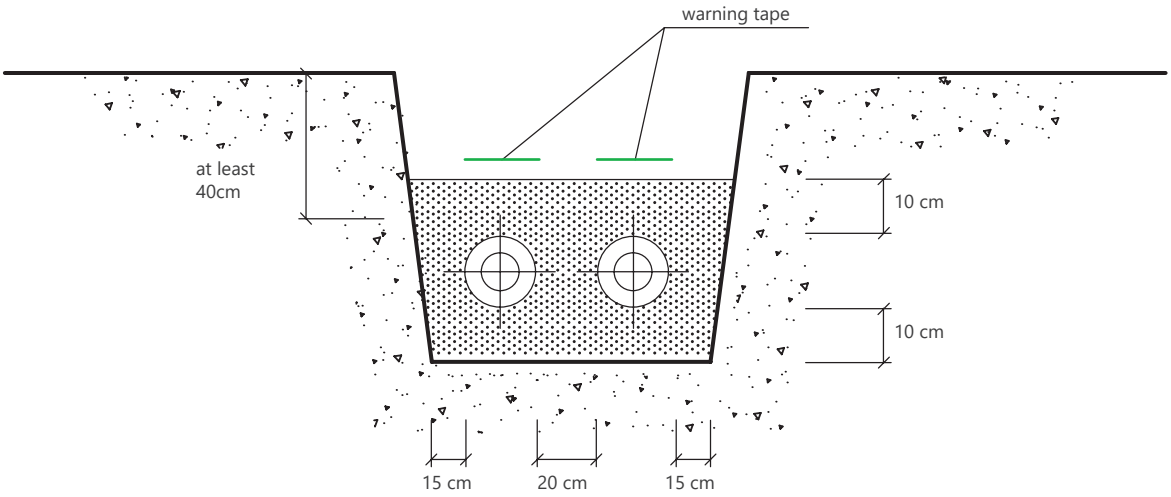


The depth of the excavation should allow for a backfill layer of at least 40 cm and a levelling and haunch layer under and over the pipe (pre-insulated pipeline) of at least 10 cm.

TABLE 3.1 recommended excavation dimensions

Outer diameter of shoring [mm]	Minimum width [m]	Minimum depth [m]
110	0.7	0.65
125	1.0	0.80
160	0.8	0.70
200	0.9	0.75

Figure 02 (reference drawing)



The width of the bottom of the excavation should provide a distance of at least 15 cm between two pipelines and at least 15 cm between each pipeline and either wall of the excavation. For pipelines of above 200 mm in diameter, the distance between two pipelines should be at least 20 cm.

At the points of connecting pre-insulated pipes and pipe junctions, the necessary width and depth of the excavation must be ensured. The bottom of the excavation should be smooth and sloped as specified in the designs. The tolerance for the invert level of the excavation should not exceed +3 cm (No negative tolerance is permitted). Each excavation work should be carried out so as to prevent damage to the surface of roads, to buildings, other structures or buried utilities.

Any hardened surface must be removed at such a distance from the excavation as to prevent damage to the surface. All excavation work near any foundations should be carried out above the line marked in the drawing. Alternatively, formwork can be used in accordance with the designs.

Figure 03 (reference drawing)

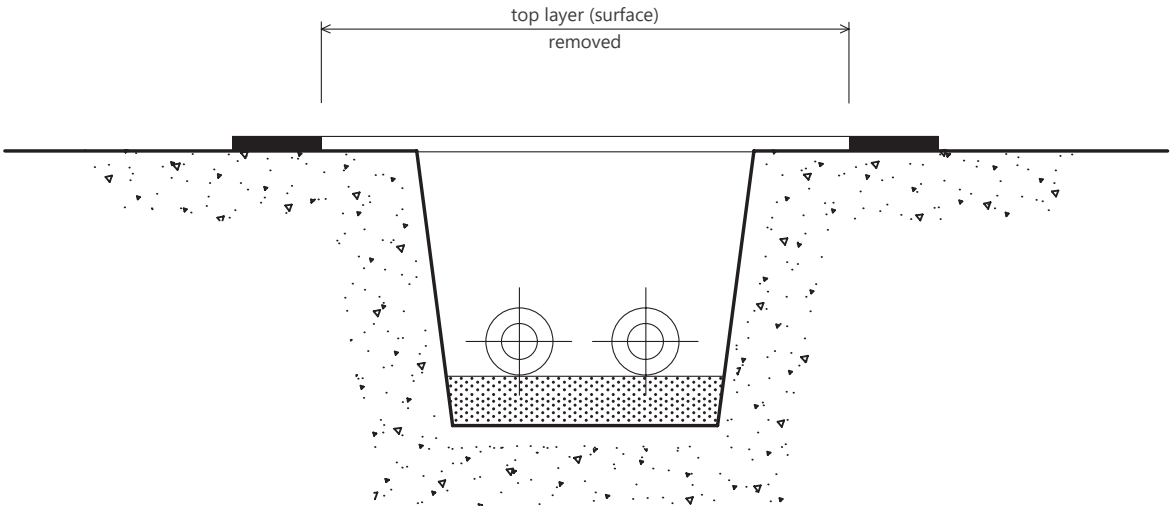
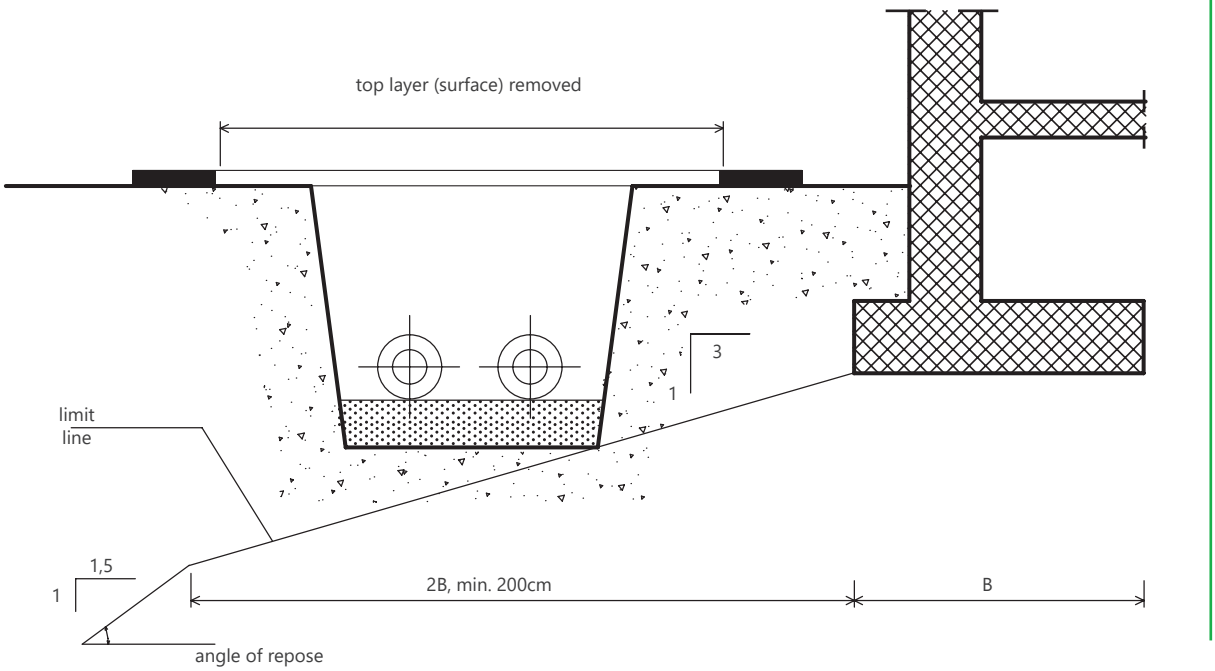


Figure 04 (reference drawing)



All buried utilities uncovered during the excavation work should be protected to prevent their damage, breakage etc. Before proceeding with the actual installation work, check that all auxiliary and associated work has been completed in accordance with the designs and these instructions.

The excavation and the protection of any pipes or cables found near the excavation must be checked.

TABLE 3.2 Basic distances between underground heat distribution networks and terrain objects.

No	Types of terrain objects	Terrain object clearance outline	Basic distance [m]
1	Buildings - a heat distribution network with a pipeline diameter of up to DN150 - a heat distribution network with a pipeline diameter ranging from DN200 to DN500 - a heat distribution network with a pipeline diameter above DN500	maximum layout (plan of the structure)	2,0 3,0 5,0
2	Water supply and sewage conduits	pipe, duct, sewer, manhole or chamber clearance	2,0

No	Types of terrain objects	Terrain object clearance outline	Basic distance [m]
3	Gas networks - low-pressure gas pipes with a diameter of up to 100 mm - low-pressure gas pipes with a diameter above 100 mm - medium-pressure gas pipes with a diameter of up to 100 mm - medium-pressure gas pipes with a diameter above 100 mm	pipe clearance	 1,5 2,0 1,5 2,0
4	Underground power cables	cable clearance	1.0
5	Overhead power lines with an input voltage of up to 1kV - above 1 kV and up to 20 kV - above 30 kV and up to 110 kV - above 100kV	the plan of the outermost power cable	0,5 4,0 8,0 15,0
6	Cables, communication conduits	cable, duct, manhole or chamber clearance	1.0
7	Utility poles with a voltage of up to 1 kV., telecommunications and tramway line poles and other supports	plan of the foundation of the pole or support	1,0
8	Tramway tracks	track clearance	1,0
9	Trees	the plan of the crown	2,0

NOTES

1. The distances shown in the table are valid until they are replaced by new regulations.
2. Distances other than shown in the table are acceptable if they are approved by the owner of the buried utilities.

Pipeline installation rules

All installation work should be carried out by trained and qualified personnel and supervised by the designer of the network and technical inspectors.

General pipeline installation rules

- Pre-insulated pipelines must be placed on a levelling layer of material of at least 10 cm thick (coarse or medium sand) on transverse heaps of sand.
- While dropping a pipe into the excavation, take care not to damage the casing pipe.
- The minimum distance between two pre-insulated pipelines placed in the excavation must be 15 cm.
- The minimum distance between a pre-insulated pipeline placed in the excavation and each wall of the excavation must be 15 cm.
- Each pipeline must be placed at such a slope as to allow for water drainage from the pipeline. The minimum slope must be 3‰.
- The difference between the level of a pipeline placed in the excavation and the level specified in the design must not exceed +3cm

Pipeline Installation Instructions

- Pre-insulated pipelines must be installed directly in the excavation.
- Before any pre-insulated pipes and other parts are placed in the excavation, place a rubber end cap onto each end of the pipes.
- The maximum allowed non-alignment tolerance for pipes at connection points is 3^0.
- Heatpex Delta pre-insulated elbow connectors should be used whenever pipeline rerouting is necessary (and the bending radius is insufficient). The minimum bending radius values for the pipes (see tables 5.3 - 5.8) must never be exceeded.
- All junctions must be prepared using the Heatpex Delta tee insulation sets.
- When all connections are complete and a tightness test has been performed, the connector assembly cover must be installed (sealed).

Backfilling pre-insulated pipelines

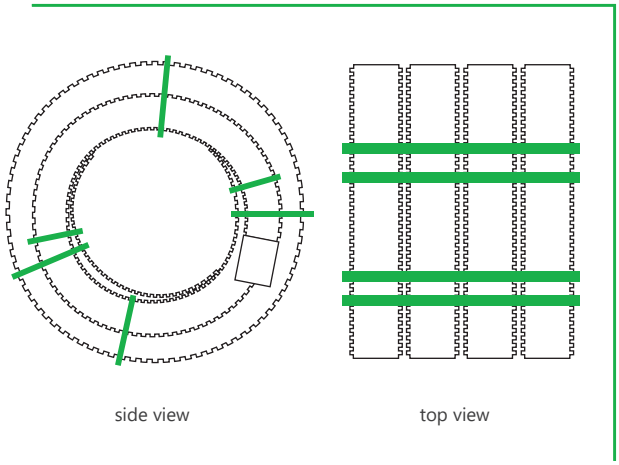
- Coarse or medium sand or fine gravel free from clay, slit or stones should be used as the backfill material for excavations with pre-insulated pipelines.
- An excavation with pre-insulated pipelines must be backfilled in layers. The first step is to haunch the pipelines with sand. If compacted manually, the cover layer should not be thicker than 15 cm.
- The haunch material must be placed in two layers. The first layer should be as high as the axes of the pipelines, filling the spaces first between the pipelines and then between each pipeline and the excavation. This layer must be compacted.
- The second layer should be placed and compacted in the same way as the first one, up to 10 cm above the edge of the pipeline. For compacting, the ID (or density index) should be between 1.0 and 0.68.
- With the haunch layer in place, the excavation should be backfilled with the excavated material (free from stones, roots, clay or loam lumps or other foreign matter) in layers of 30 cm thick each, and compacted mechanically.

Placing pipes in an excavation

It is recommended that the pipes should be stored and carried to the place of installation (the excavation) in their original packaging. The coils should be unwound next to or in the excavation.

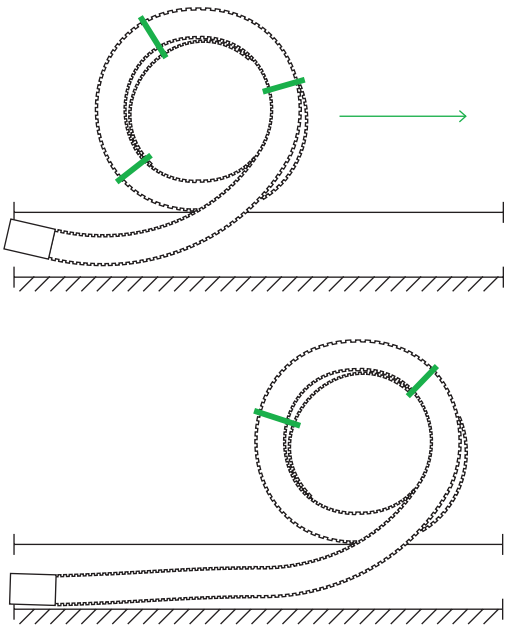
Heatpex Delta pipes are fastened with protective tape layer by layer. For this reason, unwind the pipes layer by layer, cutting the protective tape only for the layer to be unwound.

Only place Heatpex Delta pipes in excavations if the ambient temperature is higher than 5^0C.



Unwinding the pipes

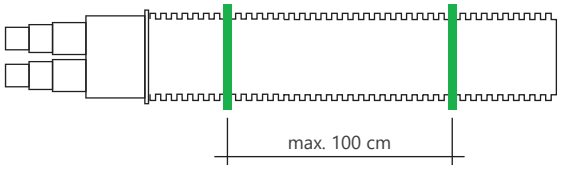
Remove the packaging, cut the nylon tape and remove the end cap (do not remove the protective sleeves). Place a section of the pipe in the excavation, fix it in place and unwind the pipe from the coil until you reach the next fastening tape. Repeat these steps as shown in the drawing.



Note

When placing the pipe in the excavation, prevent the pipe from rubbing against the bed of the excavation as far as possible, particularly against sharp-edged items. Otherwise the pipe may be damaged. If the casing pipe is damaged, repair it immediately using the available accessories, e.g. heat-shrink tape.

All pre-insulated pipes delivered to the place of installation should be inspected visually before they are installed.



Installing the pipes under ceilings or on walls

As the pipes are flexible, use clamping bands to fix them in place. Fixing points on the ceiling or wall should be located not more than 1 metre from the pipeline.

As the PEX-A material is flexible, it is possible to bend the pipes to avoid obstacles or to reroute the pipeline. Never exceed the maximum bending radius of the pipe, depending on its diameter (see tables 5.3 - 5.8).

Wall penetrations

For each wall penetration, use appropriate accessories. Useful tips:

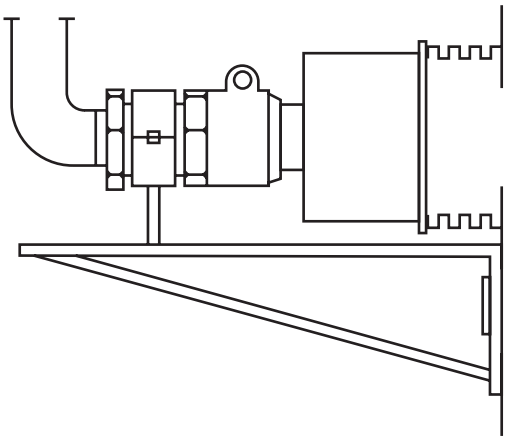
- The size of the hole to be drilled must appropriate for the type of sealing to be used for the penetration.
- Follow the installation instructions strictly.
- Prepare the pipe to pass it through the wall: cut all the nylon tapes and place the pipe loosely. Make sure that the pipe is passed smoothly, without jerking it or causing temporary stress on the pipe.

Never turn or twist the pipe so as to avoid exerting torsion forces on the carrier pipe or the casing.

Pipe protection

In most cases, the end piece of the pipeline will usually be located inside a building as a connection to a source of heat or to the end user's network inside the building. In either case, the rubber end caps must be used to protect the insulation of the pipe (see drawing).

To prevent end-cap stress, use a clamping band on the fixed coupling. Use an appropriate Hela adapter (a fixed point), such as P 2020.



The system will work properly only if the end piece of the pipeline is fixed properly.

Connectors

The system will work properly only with dezincification-resistant brass connectors are used. Such connectors are available in two types for different pressure levels.

- SDR7.4 (PN10)
- SDR11 (PN6)

The connector system is a modular system that consists of two types of parts:

- an adapter for preparing an end piece of the pipe, with an external thread, and
- fittings: tees, elbows, couplings, flanges and internally threaded bushings.

The connector is easy to fix, with no specialist tools required. The steps are as follows:

- prepare all the parts of the connector, the necessary adapters and fittings;
- assemble the connector; and
- fix the connector.

Please refer to the Heatpex catalogue available on the **www.heatpex.pl** website to prepare the different parts of the connector. Begin with choosing the necessary adapters (type H), depending on the diameters of the pipes to be connected and the PN pressure value. Subsequently, choose the required internally thread fitting for the largest adapter.

The last step is to choose an appropriate type B bushing (if the pipes to be connected have different diameters).

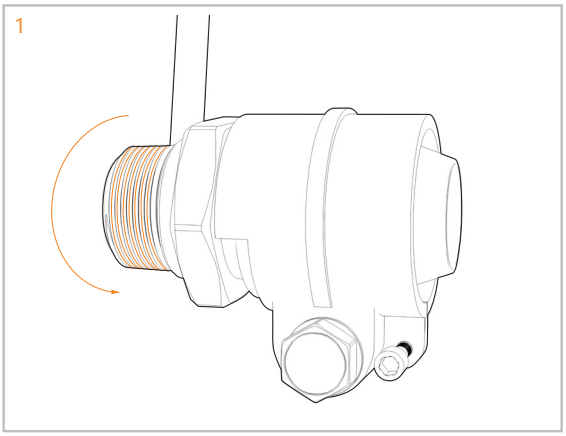
For detailed instructions refer to section 4.

Installation Instructions

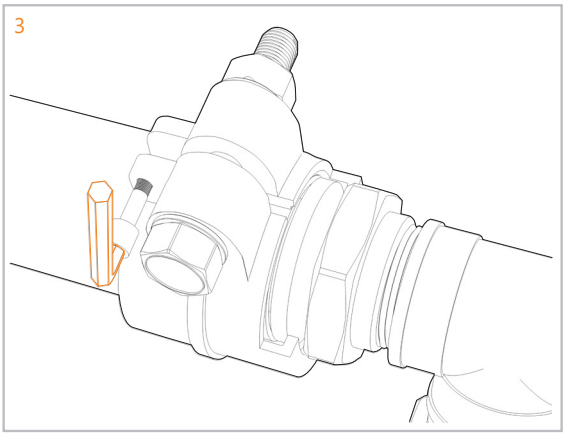
Connectors for PEX and PE pipes

Assembly of fittings

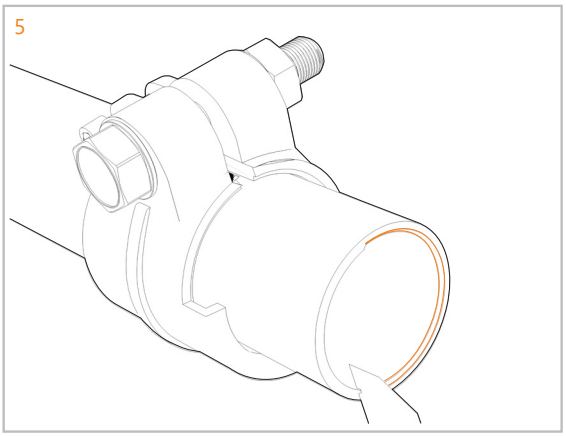
- Wind Teflon tape onto the thread joint (caulking tow with sealing paste may also be applied), in the opposite direction to the direction of screwing. (1)



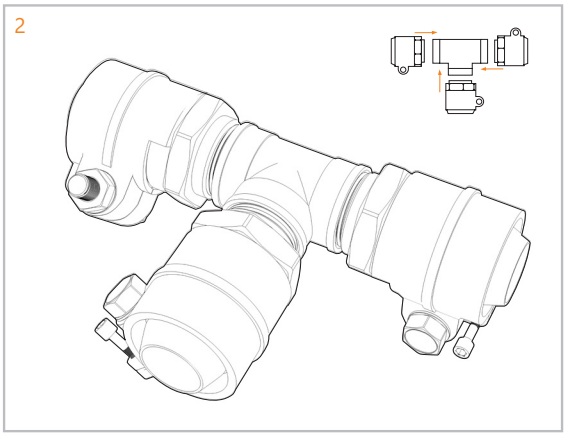
- Loosen the nuts on the clamping ring and screw in the expansion bolt (with hexagonal socket), to open out the clamping ring and take it off the body. (3)



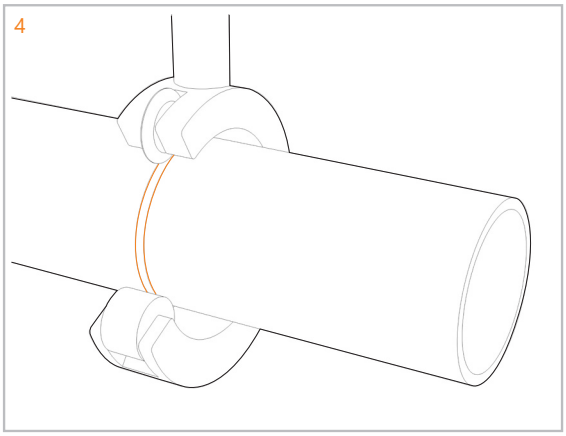
- Slide the clamping ring of the connector onto the pipe and bevel the internal pipe edge (cutter). (5)



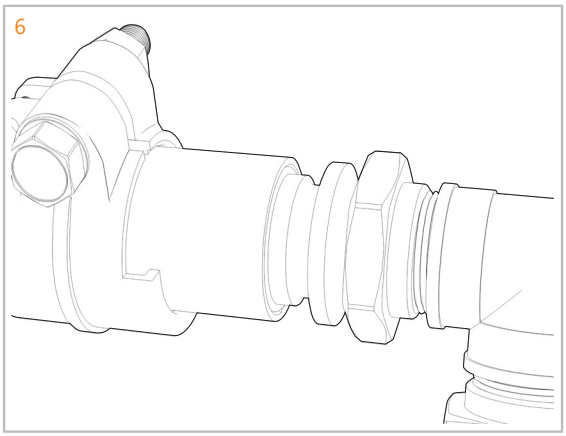
- Screw all joints into the transition coupling to the limit (two plumber wrenches will be needed) (2)



- Cut the pipe perpendicularly to the pipe axis (wheel pipe cutter). (4)

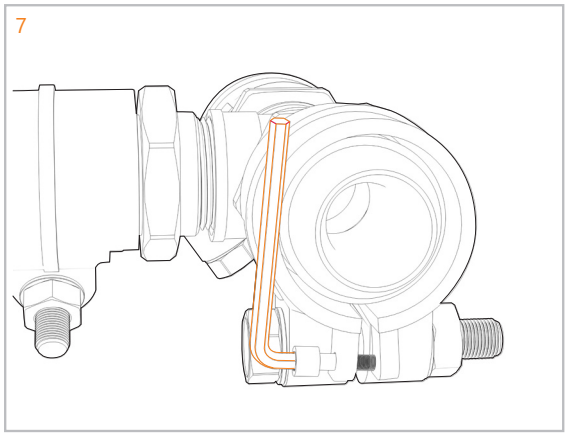


- Lubricate the stub pipe of the connector body with soap solution and slide it onto the pipe. (6)



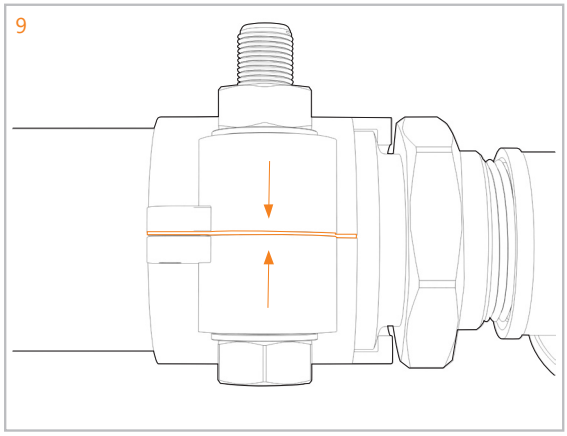
- Slide the clamping ring up to the retaining surface of the joint body and screw the expansion bolt (with hexagonal socket) completely out. (7)

7



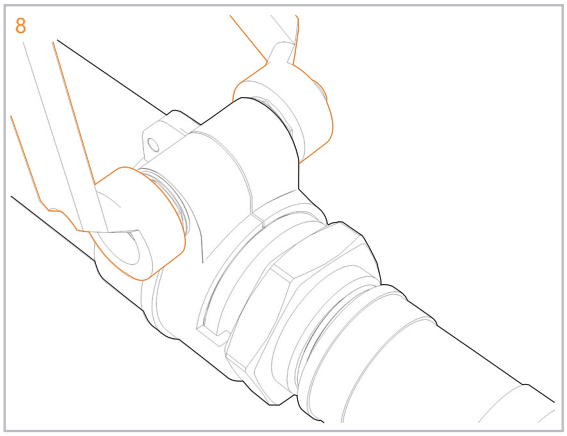
- The clamping bolt should be tightened until the clamping ring edges come together. (9)

9



- Tighten the clamping ring with the bolt (two box spanners will be needed). (8)

8



If resistance during tightening is too high, repeat the operation after about 20 minutes.

Assembly technique for HELA connectors

Connector type with nut

1. Cut off the pipe perpendicularly to the pipe axis using a wheel pipe cutter or a saw.
2. Slide the clamping ring (A) onto the pipe.
3. Slide the pipe onto the stub pipe as far as it will go. To make it easier, the pipe end can be heated with a blower up to 50-80°C or the pipe end can be lubricated with soap solution.
4. Manually turn the ring (B), then make approx. 2.5 turns using a spanner until resistance is encountered.

Connector type with mounting screw

1. . Cut off the pipe perpendicularly to the pipe axis using a wheel pipe cutter or a saw and bevel the internal edge pipe edge with a cutter.
2. Loosen the nut on the clamping ring and by unscrewing the expansion bolt, open it and then remove the clamping ring. Use an Allen key.

3. Slide the clamping ring onto the pipe as shown in the drawing.

4. Lubricate the stub pipe and the o-ring with soap solution, then slide the pipe onto the stub as far as it will go. To make it easier the pipe end can be heated with a blower up to 50-80°C.

5. Slide the clamping ring up to the retaining surface of the body as shown in the drawing.

6. Gradually tighten the ring with the screw, allow the pipe to fit.

7. Make sure the pipe did not slip out during tightening.

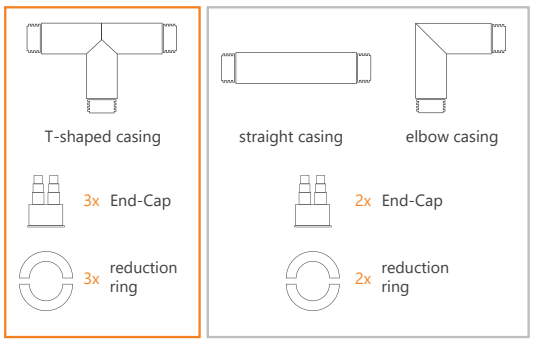
8. Tighten the screw until the edges of the clamping ring come together. For fittings having a diameter of more than 63 mm - allow time for the pipe to fit during tightening (wait approx. 20-30 min.).

9. Remember to rinse the system and carry out pressure and leak tests.

Insulating tee connector

Insulation joint

ⓘ **These instructions show how to assemble a double pipe in a T-shaped insulating casing.** An elbow-shaped casing and a straight casing should be assembled in a similar way.



ⓘ When assembling the insulating casing, **you should buy End-Caps and reduction rings** (sold separately depending on the pipeline diameter).

ⓘ In the case of double pipes it is recommended to lay the line pipes vertically, to make further installation easier, for example of Hela connectors.

ⓘ The assembly temperature should be at least +5 °C to ensure the sealing of the casing is properly completed. +5°C

ⓘ The casing is designed to provide an insulating joint on **casing pipes with the following outside diameters: 110 mm, 125 mm, 160 mm and 200 mm.**

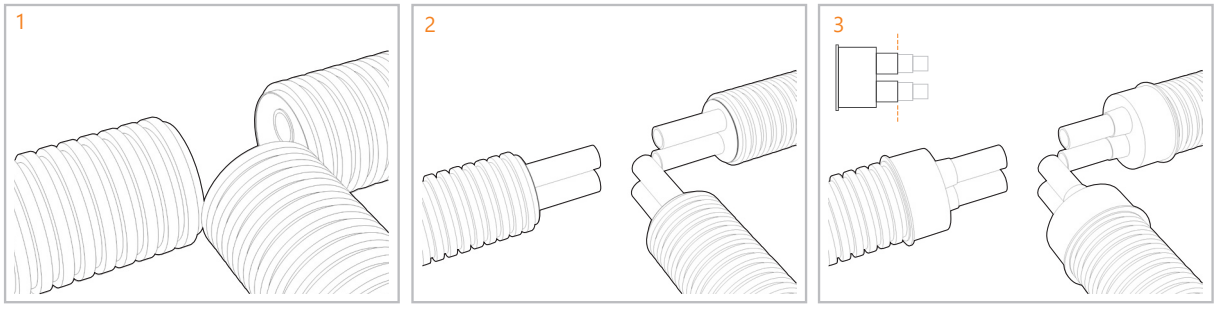
Both parts of the casing are fitted with factory-made openings for assembly bolts. There are also marked places, where liquid sealant (supplied with the bolts) should be applied.

Preparation and cutting of end-caps and sliding them onto pipes*

- Prepare a pipe section of appropriate length. (1)
- Cut off the protective tubing, including its thermal insulation (2)
  Make sure the assembly site is dry and clean.
- Place the rubber End-Cap in place by fitting it to the diameter of the carrier pipe by cutting it off. (3)

ⓘ The rubber End-Cap will ensure the correct distance between the pipes and it will facilitate the assembly of Hela connectors.

* Correct preparation of pipeline ends by means of rubber End-Caps is required to maintain the manufacturer's guarantee.

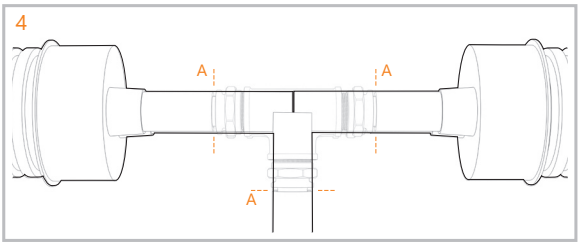


Adjustment of pipe length and assembly of connectors

- Make sure carrier pipes are properly positioned. (4)
- Adjust the length of the carrier pipe to the joint used. (A)
- Prepare the joint according to the assembly instructions for connectors. (5)

Carry out a leak-tightness test of joints under pressure.

4



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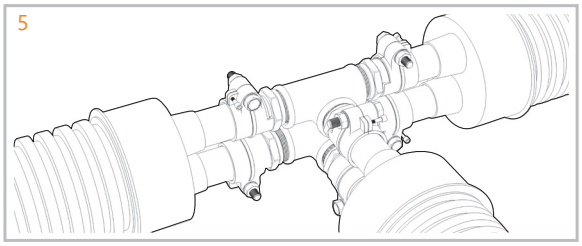


Sealing of the casing

- Seal the casing with the supplied tube with liquid sealant. (B)
- Apply about 6 mm thick strips along the indicated guiding lines. (6)
- Apply a reduction ring appropriate to the outside diameter of the pipe casing. (C)

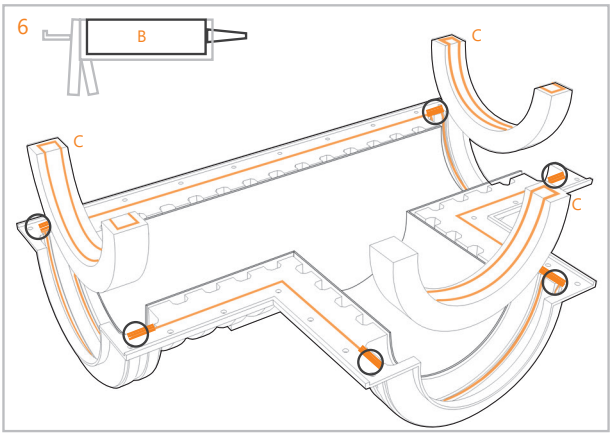
Remember to thoroughly fill in the joint between the casing and the reduction ring.

- Lay the joined pipes on the bottom part of the casing (marked with a sticker). (7)
- Apply the liquid sealant to the end of the End-Cap. (D)

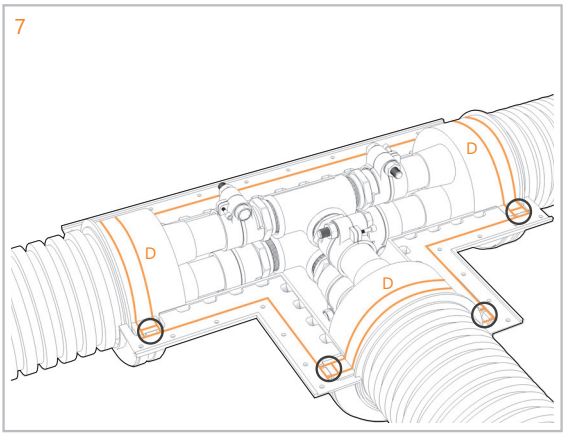
Seal the top part of the casing in exactly the same manner as you did the bottom part.

Application of two symmetrical sealant strips onto the rubber End-Cap increases leak-tightness of the insulation joints.

6



7



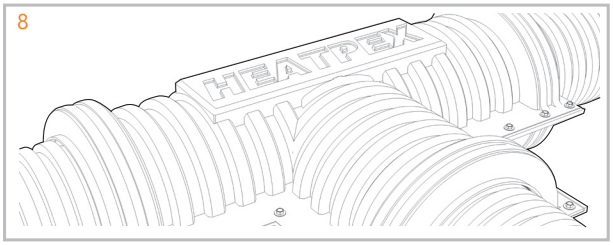
Apply abundantly an additional amount of the liquid sealant onto the place where the casing joins the ring.

Joining the bottom part of the casing to the top part

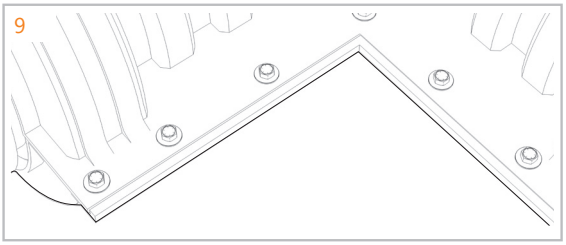
- Be careful to make sure both parts of the casing are put together to fit precisely. (8)
- Secure with the supplied bolts with washers. (9)

If the sealant has been properly applied, some sealant should flow out at the ends of the casing, near the reduction ring.

8



9

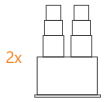


PE sleeve - joint without changing the pipeline diameter.

PE Sleeves

The instruction shows how to assemble a joint without modifying the pipeline diameter.

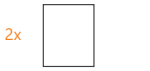
You should additionally acquire two rubber End-Caps (sold separately depending on the pipeline diameter).



End-Cap

The set consists of 1 of rigid protective bush, 2 heat-shrinkable sleeves and an insulation mat.


protective bush



heat-shrinkable sleeve


insulation mat

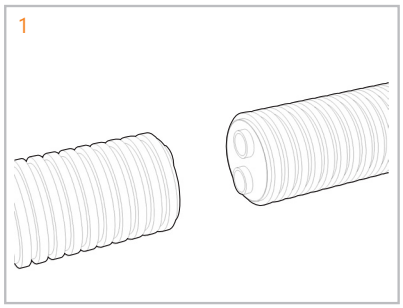

tie-wrap

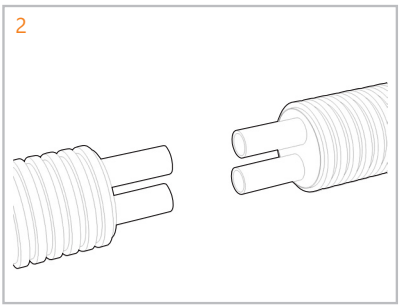
Preparation and cutting of an END-CAP and sliding it onto pipes*

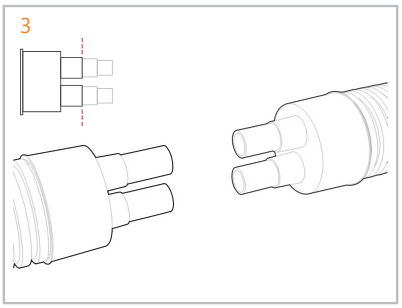
- Prepare a pipe section of appropriate length. (1)
- Cut off the jacket pipe, including thermal insulation. (2)

  Make sure the assembly site is dry and clean.
- Place the rubber End-Cap in place cutting it to fit the diameter of the carrier pipe. (3)

* Correct preparation of pipeline ends by means of rubber End-Caps is required to maintain the manufacturer's guarantee.

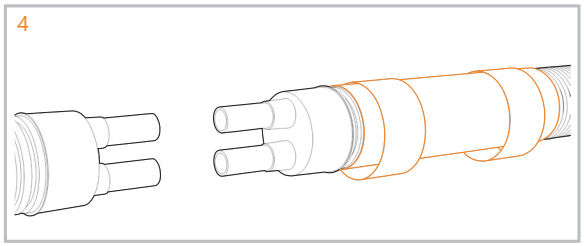


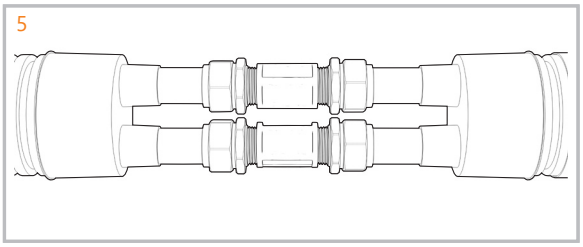




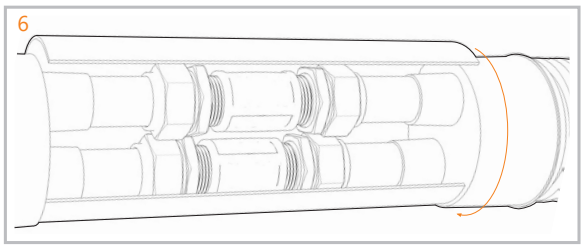
Joint preparation and insulation

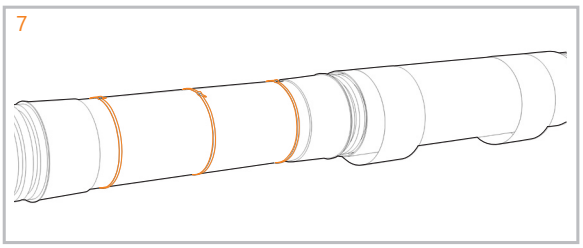
- Slide the protective bush with two sleeves onto one section of the pipeline. (4)
- Fix HELA connectors and prepare the joint according to the assembly instructions for connectors. (5)



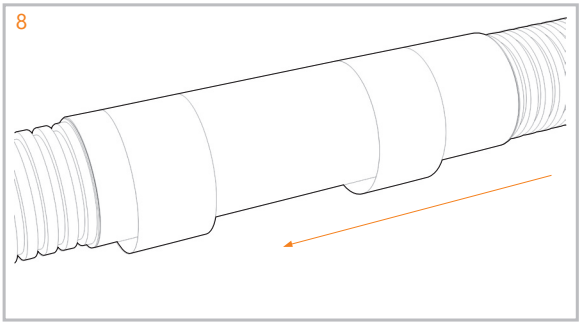


- Insulate the carrier pipe and the joint with the supplied mat. (6)
- Secure the mat firmly using the supplied tie-wraps. (7)

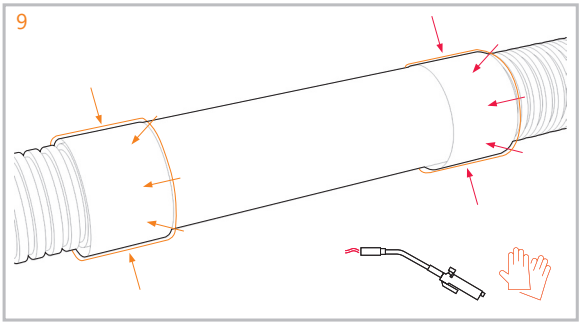




- Slide the protective bush with two heat-shrinking sleeves onto the joint. (8)

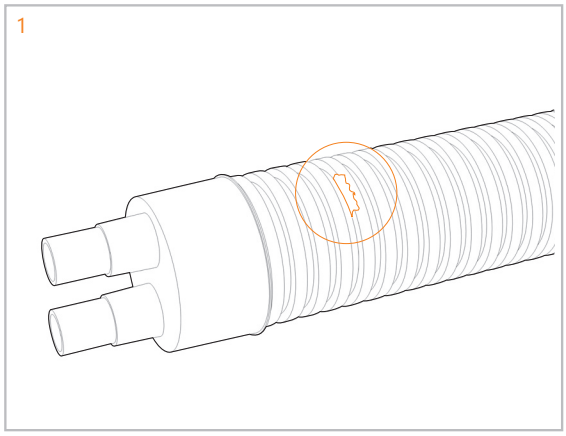


- Shrink the sleeves in a steady and uniform manner around the protective bush and the pipeline with a mild burner flame. Wear protective gloves (risk of burns, hot surface), and press the sleeves to the entire surface of the pipeline. (9)

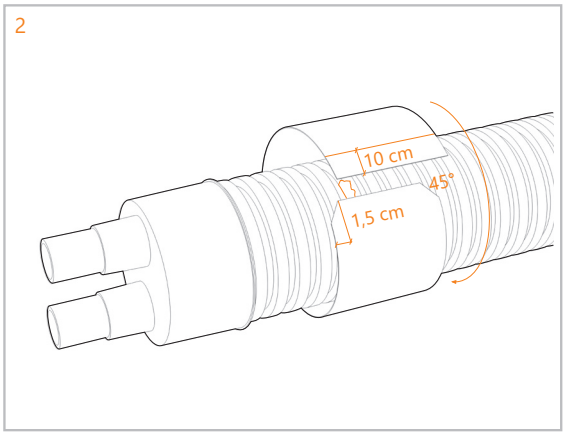


Repair Tape

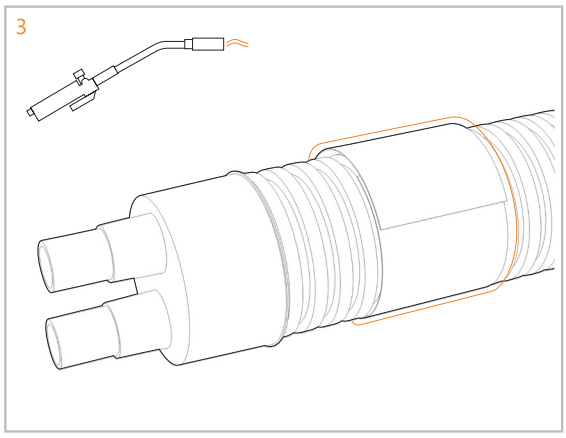
- Make sure the spot to be repaired is dry and clean. (1)



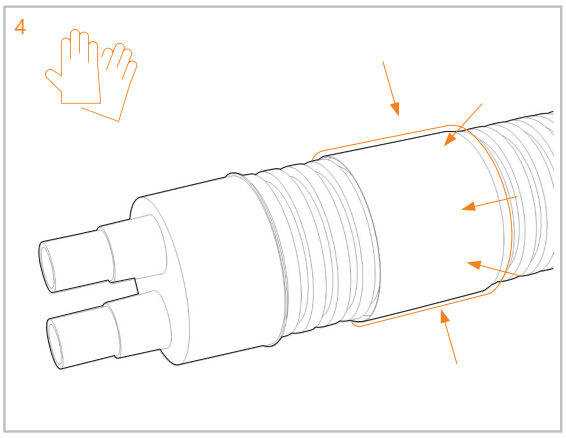
- Cut corners of the tape at the angle of 25 degrees, then wrap the damaged place with tape, with a 10 cm overlap over the undamaged part. The repair tape is 5 cm wide. (2)



- Heat it up with a mild burner flame to make the tape shrink around the pipe. (3)



- Wear protective gloves (risk of burns) – press the tape against the casing over the entire surface. (4)



Design Information

Design Instructions for PEX-a pre-insulated pipes

For the production of flexible pre-insulated pipes we use a PEX-a carrier pipe. It is a cross-linked pipe made of high density polyethylene. It is produced in accordance with PN-EN 15875 -2 and DIN 16892/93 standards' requirements. It has an external anti-diffusion coating (EVOH) made according to DIN 4726 standard. Cross-linking takes place during the production process when durable, irreversible chemical bonds between neighbouring polyethylene chains are created.

Cross-linked polyethylene is a thermoelastic material with a spatial molecular structure and is characterized by very high dimensional stability when exposed to high temperatures.

The thermal, mechanical and electrical properties are described in Chapter 1.

Physical properties of PEX-a pressure pipes:

- maximum range of working temperatures -50 /+95 °C
- density - 938 kg/m
- tensile strength at 20 °C -> 19 N/ mm^2
- elongation at break at 20 °C -> 400%
- thermal conductivity coefficient 0.35 W/(m*K)
- specific heat 2.3 KJ/kg*°C

Design Instructions for PE pre-insulated pipes

For the production of PE pre-insulated pipes we use PE SDR 11 and SDR 17 carrier pipes, for water supply networks and for pressure storm and foul water drainage systems in accordance with the PN-EN 12201 standard.

Physical properties of PE 100 pressure pipes:

- maximum range of working temperatures -10 / +40 °C density - 960 kg/m
- melt flow rate MFR (190°C; 5.0 kg) - 0.40 g/10 min
- coefficient of linear thermal expansion a - 0.13 mm/m°C
- specific heat cp - 1.9 kJ/kg°C
- thermal conductivity coefficient at 20°C - 0.38 W/(m*K)
- tensile strength at yield point – 23 MPa
- relative elongation at break – >600%
- hardness - 59 Shore D

Heat losses

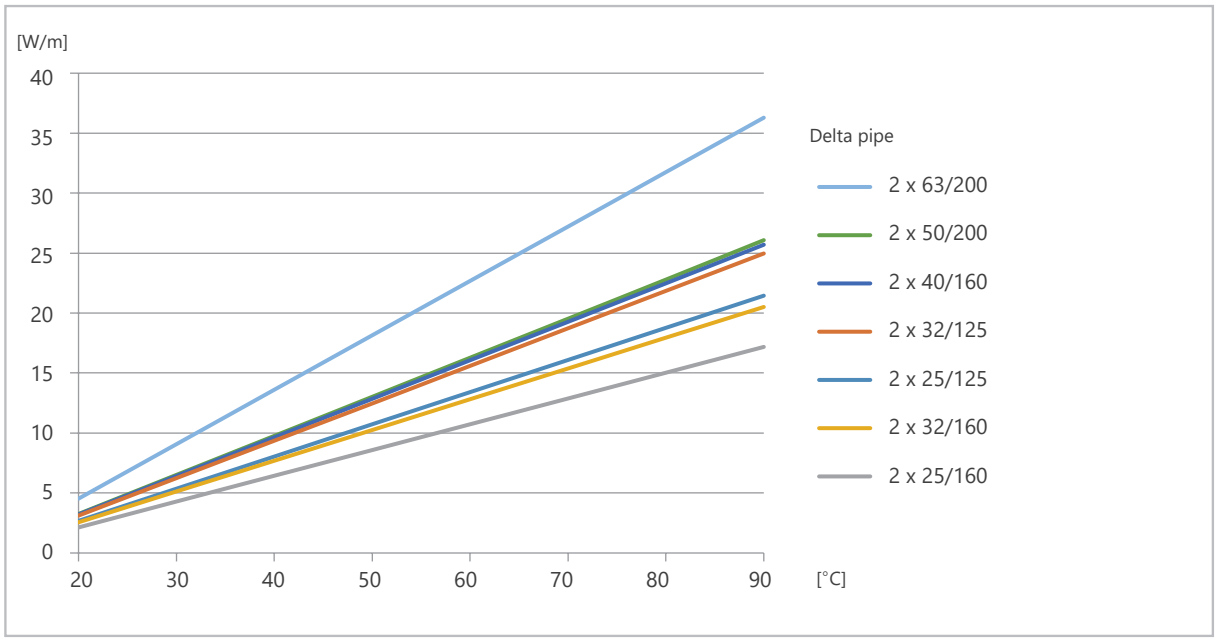
Drawn up on the basis of research work of the Building Research Institute in Warsaw No. NZF-02187/16/Z00NZF and NZF-02981/16/Z00NZF

The following calculation assumptions have been used:

- soil thermal conductivity coefficient λ = 1.0 W/(m -K)
- soil temperature ΘSE = 10°C
- pipeline burial depth h = 0.8 m
- specific heat cp - 1.9 kJ/kg°C
- average operating temperature for a single pipe from 20°C to 90°C
- average operating temperature for a double pipe as the difference between feed and return flow Δt from 20°C to 90°C

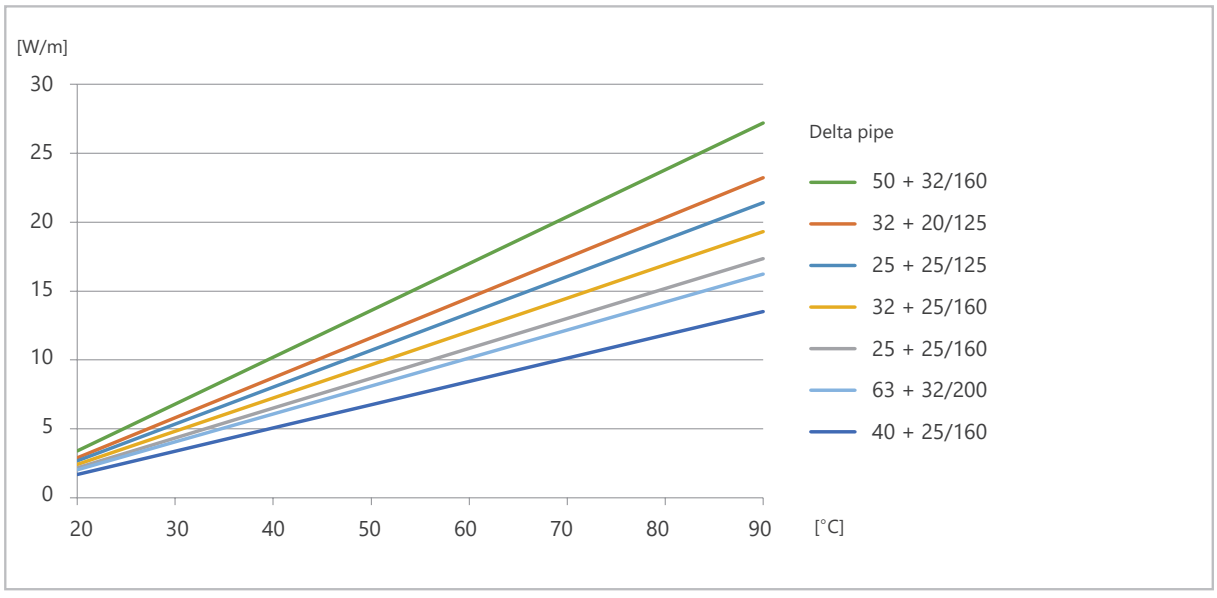
DELTA PEX HEAT DUO PN 6/95°C SDR 11 double pipe

with EVOH anti-diffusion barrier for distribution of heating medium (central heating)



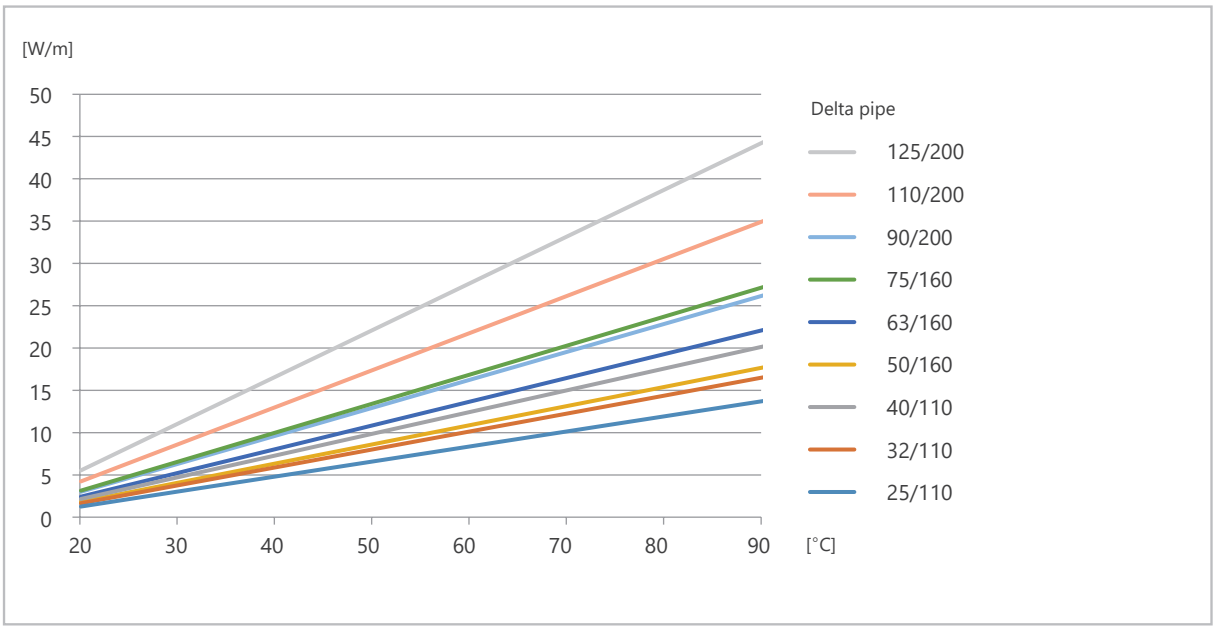
DELTA PEX SANI DUO PN 10/95°C SDR 7.4 double pipe

for distribution of cold or warm tap water



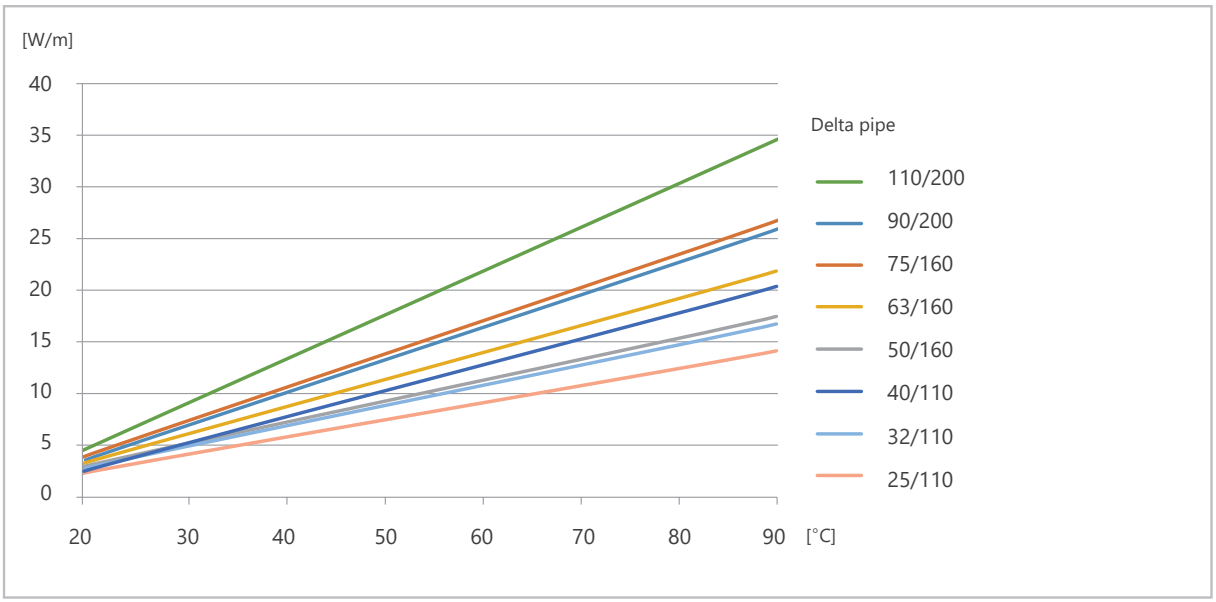
DELTA PEX HEAT UNO PN 6/95°C SDR 11 single pipe

with EVOH anti-diffusion barrier for distribution of heating medium (central heating)



DELTA PEX SANI UNO PN 10/95°C SDR 7.4 single pipe

for distribution of cold or warm tap water



Head losses

NOTE: Δ T = 20°C

TABLE 5.1 Pressure (head) losses for DELTA PEX HEAT PN6/95°C SDR11 pipe

Volume flow			Thermal power	DN20 25x2,3	DN25 32x2,9	DN32 40x3,7	DN40 50x4,6	DN50 63x5,8	DN65 75x6,8	DN80 90x8,2	DN100 110x10	DN 125x11,4
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
0,10	6,00	0,36	8,38	0,31 43,05	0,19 11,80	0,12 3,82	0,08 1,20	0,05 0,36	0,03 0,15	0,02 0,06	0,02 0,02	0,01 0,01
0,20	12,00	0,72	16,76	0,61 172,20	0,37 47,22	0,24 15,26	0,15 4,79	0,10 1,45	0,07 0,58	0,05 0,23	0,03 0,08	0,02 0,04
0,30	18,00	1,08	25,14	0,92 387,44	0,56 106,24	0,36 34,34	0,23 10,78	0,14 3,27	0,10 1,31	0,07 0,51	0,05 0,18	0,04 0,09
0,40	24,00	1,44	33,52	1,22 688,78	0,74 188,88	0,48 61,05	0,31 19,16	0,19 5,82	0,14 2,33	0,09 0,91	0,06 0,32	0,05 0,17
0,50	30,00	1,80	41,90	1,53 1076,23	0,93 295,12	0,60 95,40	0,38 29,94	0,24 9,09	0,17 3,63	0,12 1,43	0,08 0,51	0,06 0,26
0,60	36,00	2,16	50,28	1,84 1549,76	1,11 424,97	0,72 137,37	0,46 43,12	0,29 13,09	0,20 5,23	0,14 2,06	0,09 0,73	0,07 0,38
0,70	42,00	2,52	58,66	2,14 2109,40	1,30 578,43	0,84 186,98	0,54 58,69	0,34 17,82	0,24 7,12	0,16 2,80	0,11 0,99	0,09 0,52
0,80	48,00	2,88	67,04	2,45 2755,14	1,48 755,50	0,96 244,21	0,61 76,66	0,39 23,27	0,27 9,30	0,19 3,65	0,13 1,30	0,10 0,67
0,90	54,00	3,24	75,42	2,75 3486,97	1,67 956,18	1,08 309,08	0,69 97,02	0,43 29,45	0,30 11,77	0,21 4,62	0,14 1,64	0,11 0,85
1,00	60,00	3,60	83,80	3,06 4304,90	1,86 1180,47	1,20 381,58	0,77 119,77	0,48 36,36	0,34 14,53	0,24 5,71	0,16 2,02	0,12 1,05
1,10	66,00	3,96	92,18	3,37 5208,93	2,04 1428,37	1,32 461,72	0,84 144,93	0,53 44,00	0,37 17,59	0,26 6,91	0,17 2,45	0,13 1,27
1,20	72,00	4,32	100,56	3,67 6199,06	2,23 1699,88	1,44 549,48	0,92 172,48	0,58 52,36	0,41 20,93	0,28 8,22	0,19 2,91	0,15 1,51
1,30	78,00	4,68	108,94	3,98 7275,28	2,41 1995,00	1,56 644,88	0,99 202,42	0,63 61,46	0,44 24,56	0,31 9,65	0,20 3,42	0,16 1,78
1,40	84,00	5,04	117,32	4,29 8437,61	2,60 2313,73	1,68 747,90	1,07 234,76	0,68 71,27	0,47 28,49	0,33 11,19	0,22 3,97	0,17 2,06
1,50	90,00	5,40	125,70	4,59 9686,03	2,78 2656,07	1,80 858,56	1,15 269,49	0,72 81,82	0,51 32,70	0,35 12,84	0,24 4,55	0,18 2,37
1,60	96,00	5,76	134,08	4,90 11020,55	2,97 3022,01	1,92 976,85	1,22 306,62	0,77 93,09	0,54 37,21	0,38 14,61	0,25 5,18	0,20 2,69
1,70	102,00	6,12	142,46	5,20 12441,17	3,15 3411,57	2,04 1102,78	1,30 346,15	0,82 105,09	0,57 42,00	0,40 16,50	0,27 5,85	0,21 3,04
1,80	108,00	6,48	150,84	5,51 13947,88	3,34 3824,73	2,16 1236,33	1,38 388,07	0,87 117,82	0,61 47,09	0,42 18,50	0,28 6,56	0,22 3,41

Volume flow			Thermal power	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100	DN
				25x2,3	32x2,9	40x3,7	50x4,6	63x5,8	75x6,8	90x8,2	110x10	125x11,4
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
1,90	114,00	6,84	159,22	5,82 15540,70	3,53 4261,51	2,28 1377,52	1,45 432,39	0,92 131,27	0,64 52,47	0,45 20,61	0,30 7,31	0,23 3,80
2,00	120,00	7,20	167,60	6,12 17219,61	3,71 4721,89	2,40 1526,33	1,53 479,10	0,96 145,46	0,68 58,14	0,47 22,83	0,31 8,10	0,24 4,21
2,10	126,00	7,56	175,98	6,43 18984,62	3,90 5205,89	2,52 1682,78	1,61 528,21	1,01 160,37	0,71 64,10	0,49 25,18	0,33 8,93	0,26 4,64
2,20	132,00	7,92	184,36	6,73 20835,72	4,08 5713,49	2,64 1846,86	1,68 579,71	1,06 176,00	0,74 70,35	0,52 27,63	0,35 9,80	0,27 5,09
2,30	138,00	8,28	192,74	7,04 22772,93	4,27 6244,70	2,76 2018,58	1,76 633,61	1,11 192,37	0,78 76,89	0,54 30,20	0,36 10,71	0,28 5,56
2,40	144,00	8,64	201,12	7,35 24796,23	4,45 6799,53	2,88 2197,92	1,84 689,90	1,16 209,46	0,81 83,72	0,56 32,88	0,38 11,66	0,29 6,06
2,50	150,00	9,00	209,50	7,65 26905,64	4,64 7377,96	3,00 2384,90	1,91 748,59	1,21 227,27	0,84 90,84	0,59 35,68	0,39 12,65	0,30 6,57
2,60	156,00	9,36	217,88	7,96 29101,14	4,83 7980,00	3,12 2579,50	1,99 809,68	1,25 245,82	0,88 98,25	0,61 38,59	0,41 13,68	0,32 7,11
2,70	162,00	9,72	226,26	8,26 31382,73	5,01 8605,65	3,24 2781,74	2,07 873,16	1,30 265,09	0,91 105,96	0,63 41,62	0,42 14,76	0,33 7,67
2,80	168,00	10,08	234,64	8,57 33750,43	5,20 9254,91	3,36 2991,61	2,14 939,03	1,35 285,09	0,95 113,95	0,66 44,76	0,44 15,87	0,34 8,24
3,00	180,00	10,80	251,40	9,18 38744,12	5,57 10624,26	3,60 3434,25	2,30 1077,97	1,45 327,28	1,01 130,81	0,71 51,38	0,47 18,22	0,37 9,46
3,50	210,00	12,60	293,30	10,71 52735,05	6,50 14460,80	4,20 4674,39	2,68 1467,24	1,69 445,46	1,18 178,05	0,82 69,93	0,55 24,80	0,43 12,88
4,00	240,00	14,40	335,20	12,24 68878,43	7,42 18887,57	4,79 6105,33	3,06 1916,40	1,93 581,82	1,35 232,55	0,94 91,34	0,63 32,39	0,49 16,82
4,50	270,00	16,20	377,10	13,77 87174,26	8,35 23904,59	5,39 7727,06	3,44 2425,44	2,17 736,37	1,52 294,32	1,06 115,60	0,71 40,99	0,55 21,29
5,00	300,00	18,00	419,00	15,31 107622,55	9,28 29511,84	5,99 9539,58	3,83 2994,37	2,41 909,10	1,69 363,36	1,18 142,72	0,79 50,60	0,61 26,29
5,50	330,00	19,80	460,90	16,84 130223,28	10,21 35709,32	6,59 11542,89	4,21 3623,18	2,65 1100,01	1,86 439,66	1,29 172,69	0,86 61,23	0,67 31,81
6,00	360,00	21,60	502,80	18,37 154976,47	11,13 42497,04	7,19 13737,00	4,59 4311,89	2,89 1309,10	2,03 523,23	1,41 205,51	0,94 72,87	0,73 37,85
6,50	390,00	23,40	544,70	19,90 181882,10	12,06 49875,00	7,79 16121,89	4,97 5060,48	3,13 1536,38	2,20 614,07	1,53 241,19	1,02 85,52	0,79 44,42
7,00	420,00	25,20	586,60	21,43 210940,19	12,99 57843,20	8,39 18697,58	5,36 5868,96	3,38 1781,84	2,37 712,18	1,65 279,72	1,10 99,18	0,85 51,52
7,50	450,00	27,00	628,50	22,96 242150,73	13,92 66401,63	8,99 21464,06	5,74 6737,33	3,62 2045,47	2,53 817,55	1,76 321,11	1,18 113,86	0,91 59,15
8,00	480,00	28,80	670,40	24,49 275513,72	14,85 75550,30	9,59 24421,33	6,12 7665,58	3,86 2327,29	2,70 930,19	1,88 365,35	1,26 129,55	0,98 67,29
8,50	510,00	30,60	712,30	26,02 311029,16	15,77 85289,20	10,19 27569,39	6,50 8653,72	4,10 2627,30	2,87 1050,10	2,00 412,45	1,34 146,24	1,04 75,97

Volume flow			Thermal power	DN20 25x2,3	DN25 32x2,9	DN32 40x3,7	DN40 50x4,6	DN50 63x5,8	DN65 75x6,8	DN80 90x8,2	DN100 110x10	DN 125x11,4
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
9,00	540,00	32,40	754,20	27,55 348697,05	16,70 95618,35	10,79 30908,24	6,89 9701,75	4,34 2945,48	3,04 1177,28	2,12 462,40	1,42 163,96	1,10 85,17
9,50	570,00	34,20	796,10	29,08 388517,39	17,63 106537,73	11,39 34437,89	7,27 10809,67	4,58 3281,85	3,21 1311,72	2,23 515,20	1,49 182,68	1,16 94,89
10,00	600,00	36,00	838,00	30,61 430490,18	18,56 118047,34	11,99 38158,33	7,65 11977,47	4,82 3636,40	3,38 1453,43	2,35 570,86	1,57 202,41	1,22 105,15
15,00	900,00	54,00	1257,00	45,92 968602,92	27,84 265606,52	17,98 85856,23	11,48 26949,31	7,23 8181,90	5,07 3270,22	3,53 1284,44	2,36 455,43	1,83 236,58
20,00	1200,00	72,00	1676,00	61,22 1721960,74	37,12 472189,37	23,97 152633,30	15,31 47909,88	9,64 14545,59	6,76 5813,72	4,70 2283,45	3,15 809,66	2,44 420,59
25,00	1500,00	90,00	2095,00	76,53 2690563,65	46,39 737795,88	29,97 238489,54	19,13 74859,18	12,05 22727,49	8,45 9083,94	5,88 3567,90	3,93 1265,09	3,05 657,17
30,00	1800,00	108,00	2514,00	91,83 3874411,66	55,67 1062426,07	35,96 343424,93	22,96 107797,22	14,47 32727,58	10,14 13080,87	7,05 5137,77	4,72 1821,73	3,66 946,32

NOTE: T = 50°C

TABLE 5.2 Pressure (head) losses for DELTA PEX SANI PN10/95°C SDR7.4 pipe

Volume flow			Thermal power	DN20 25x3,5	DN25 32x4,4	DN32 40x5,5	DN40 50x6,9	DN50 63x8,6	DN65 75x10,3	DN80 90x12,3	DN100 110x15,1
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
0,10	6,00	0,36	8,38	0,39 82,26	0,24 22,14	0,15 6,98	0,10 2,22	0,06 0,66	0,04 0,27	0,03 0,10	0,02 0,04
0,20	12,00	0,72	16,76	0,79 329,03	0,47 88,54	0,30 27,94	0,19 8,89	0,12 2,64	0,09 1,09	0,06 0,42	0,04 0,15
0,30	18,00	1,08	25,14	1,18 740,33	0,71 199,22	0,45 62,86	0,29 19,99	0,18 5,94	0,13 2,44	0,09 0,94	0,06 0,34
0,40	24,00	1,44	33,52	1,57 1316,14	0,95 354,17	0,61 111,76	0,39 35,54	0,24 10,55	0,17 4,34	0,12 1,68	0,08 0,60
0,50	30,00	1,80	41,90	1,97 2056,47	1,18 553,39	0,76 174,62	0,49 55,53	0,30 16,49	0,22 6,78	0,15 2,62	0,10 0,94
0,60	36,00	2,16	50,28	2,36 2961,31	1,42 796,88	0,91 251,45	0,58 79,97	0,36 23,74	0,26 9,77	0,18 3,78	0,12 1,35
0,70	42,00	2,52	58,66	2,75 4030,68	1,66 1084,64	1,06 342,26	0,68 108,85	0,43 32,31	0,30 13,30	0,21 5,14	0,14 1,84
0,80	48,00	2,88	67,04	3,15 5264,56	1,89 1416,67	1,21 447,03	0,78 142,17	0,49 42,21	0,34 17,37	0,24 6,72	0,16 2,41
0,90	54,00	3,24	75,42	3,54 6662,96	2,13 1792,97	1,36 565,77	0,87 179,93	0,55 53,42	0,39 21,98	0,27 8,50	0,18 3,05
1,00	60,00	3,60	83,80	3,93 8225,87	2,37 2213,55	1,51 698,48	0,97 222,14	0,61 65,95	0,43 27,14	0,30 10,50	0,20 3,76

Volume flow			Thermal power	DN20 25x3,5	DN25 32x4,4	DN32 40x5,5	DN40 50x6,9	DN50 63x8,6	DN65 75x10,3	DN80 90x12,3	DN100 110x15,1
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
1,10	66,00	3,96	92,18	4,32 9953,30	2,60 2678,39	1,67 845,17	1,07 268,79	0,67 79,80	0,47 32,84	0,33 12,70	0,22 4,55
1,20	72,00	4,32	100,56	4,72 11845,25	2,84 3187,51	1,82 1005,82	1,17 319,88	0,73 94,97	0,52 39,08	0,36 15,11	0,24 5,42
1,30	78,00	4,68	108,94	5,11 13901,72	3,08 3740,90	1,97 1180,44	1,26 375,41	0,79 111,45	0,56 45,86	0,39 17,74	0,26 6,36
1,40	84,00	5,04	117,32	5,50 16122,71	3,31 4338,56	2,12 1369,03	1,36 435,39	0,85 129,26	0,60 53,19	0,42 20,57	0,28 7,37
1,50	90,00	5,40	125,70	5,90 18508,21	3,55 4980,48	2,27 1571,59	1,46 499,81	0,91 148,38	0,65 61,06	0,45 23,62	0,30 8,47
1,60	96,00	5,76	134,08	6,29 21058,23	3,79 5666,69	2,42 1788,12	1,56 568,67	0,97 168,83	0,69 69,47	0,48 26,87	0,32 9,63
1,70	102,00	6,12	142,46	6,68 23772,77	4,02 6397,16	2,58 2018,62	1,65 641,98	1,03 190,59	0,73 78,43	0,51 30,33	0,34 10,87
1,80	108,00	6,48	150,84	7,08 26651,82	4,26 7171,90	2,73 2263,09	1,75 719,73	1,09 213,67	0,77 87,92	0,54 34,01	0,36 12,19
1,90	114,00	6,84	159,22	7,47 29695,39	4,50 7990,91	2,88 2521,53	1,85 801,92	1,15 238,07	0,82 97,97	0,57 37,89	0,38 13,58
2,00	120,00	7,20	167,60	7,86 32903,48	4,73 8854,20	3,03 2793,94	1,94 888,55	1,21 263,79	0,86 108,55	0,60 41,99	0,40 15,05
2,10	126,00	7,56	175,98	8,26 36276,09	4,97 9761,75	3,18 3080,31	2,04 979,63	1,28 290,83	0,90 119,67	0,63 46,29	0,42 16,59
2,20	132,00	7,92	184,36	8,65 39813,21	5,21 10713,58	3,33 3380,66	2,14 1075,15	1,34 319,19	0,95 131,34	0,66 50,80	0,44 18,21
2,30	138,00	8,28	192,74	9,04 43514,85	5,44 11709,67	3,48 3694,98	2,24 1175,11	1,40 348,87	0,99 143,56	0,69 55,53	0,46 19,90
2,40	144,00	8,64	201,12	9,44 47381,01	5,68 12750,04	3,64 4023,27	2,33 1279,51	1,46 379,86	1,03 156,31	0,71 60,46	0,48 21,67
2,50	150,00	9,00	209,50	9,83 51411,69	5,92 13834,68	3,79 4365,52	2,43 1388,36	1,52 412,18	1,08 169,61	0,74 65,60	0,50 23,52
2,60	156,00	9,36	217,88	10,22 55606,88	6,15 14963,59	3,94 4721,75	2,53 1501,65	1,58 445,81	1,12 183,45	0,77 70,96	0,52 25,43
2,70	162,00	9,72	226,26	10,62 59966,60	6,39 16136,77	4,09 5091,95	2,62 1619,39	1,64 480,76	1,16 197,83	0,80 76,52	0,54 27,43
2,80	168,00	10,08	234,64	11,01 64490,82	6,63 17354,22	4,24 5476,11	2,72 1741,56	1,70 517,03	1,21 212,76	0,83 82,29	0,56 29,50
3,00	180,00	10,80	251,40	11,80 74032,83	7,10 19921,94	4,54 6286,36	2,92 1999,24	1,82 593,53	1,29 244,23	0,89 94,47	0,60 33,86
3,50	210,00	12,60	293,30	13,76 100766,91	8,28 27115,97	5,30 8556,43	3,40 2721,19	2,13 807,86	1,51 332,43	1,04 128,58	0,70 46,09
4,00	240,00	14,40	335,20	15,73 131613,93	9,47 35416,78	6,06 11175,74	3,89 3554,21	2,43 1055,17	1,72 434,19	1,19 167,94	0,80 60,20
4,50	270,00	16,20	377,10	17,69 166573,88	10,65 44824,36	6,82 14144,30	4,37 4498,29	2,73 1335,45	1,94 549,53	1,34 212,55	0,90 76,19

Volume flow			Thermal power	DN20 25x3,5	DN25 32x4,4	DN32 40x5,5	DN40 50x6,9	DN50 63x8,6	DN65 75x10,3	DN80 90x12,3	DN100 110x15,1
l/s	l/min	m³/h	Q [kW]	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m	m/s Pa/m
5,00	300,00	18,00	419,00	19,66 205646,76	11,83 55338,72	7,57 17462,10	4,86 5553,45	3,04 1648,70	2,15 678,43	1,49 262,41	1,00 94,06
5,50	330,00	19,80	460,90	21,62 248832,58	13,02 66959,85	8,33 21129,14	5,35 6719,67	3,34 1994,93	2,37 820,90	1,64 317,52	1,10 113,81
6,00	360,00	21,60	502,80	23,59 296131,33	14,20 79687,76	9,09 25145,42	5,83 7996,97	3,64 2374,13	2,58 976,94	1,79 377,87	1,20 135,45
6,50	390,00	23,40	544,70	25,56 347543,02	15,38 93522,44	9,85 29510,95	6,32 9385,33	3,95 2786,31	2,80 1146,55	1,94 443,47	1,30 158,96
7,00	420,00	25,20	586,60	27,52 403067,65	16,57 108463,89	10,60 34225,71	6,80 10884,76	4,25 3231,46	3,01 1329,72	2,08 514,32	1,40 184,36
7,50	450,00	27,00	628,50	29,49 462705,21	17,75 124512,12	11,36 39289,72	7,29 12495,26	4,55 3709,58	3,23 1526,47	2,23 590,42	1,50 211,64
8,00	480,00	28,80	670,40	31,45 526455,71	18,93 141667,13	12,12 44702,97	7,78 14216,83	4,86 4220,68	3,44 1736,78	2,38 671,77	1,60 240,79
8,50	510,00	30,60	712,30	33,42 594319,14	20,12 159928,90	12,88 50465,47	8,26 16049,47	5,16 4764,75	3,66 1960,66	2,53 758,36	1,70 271,83
9,00	540,00	32,40	754,20	35,39 666295,50	21,30 179297,46	13,63 56577,20	8,75 17993,17	5,47 5341,80	3,87 2198,11	2,68 850,21	1,80 304,76
9,50	570,00	34,20	796,10	37,35 742384,80	22,48 199772,78	14,39 63038,18	9,23 20047,95	5,77 5951,82	4,09 2449,13	2,83 947,30	1,90 339,56
10,00	600,00	36,00	838,00	39,32 822587,04	23,67 221354,88	15,15 69848,39	9,72 22213,80	6,07 6594,82	4,30 2713,72	2,98 1049,64	2,00 376,24
15,00	900,00	54,00	1257,00	58,98 1850820,84	35,50 498048,49	22,72 157158,89	14,58 49981,04	9,11 14838,34	6,46 6105,86	4,47 2361,68	3,00 846,54
20,00	1200,00	72,00	1676,00	78,63 3290348,16	47,34 885419,54	30,29 279393,58	19,44 88855,19	12,15 26379,26	8,61 10854,87	5,96 4198,55	4,00 1504,97
25,00	1500,00	90,00	2095,00	98,29 5141169,01	59,17 1383468,03	37,87 436552,47	24,30 138836,23	15,18 41217,60	10,76 16960,73	7,45 6560,23	5,00 2351,51

Technical data: bending radius, carrier pipe volume

In order to be able to change the direction of HEATPEX pipes placed inside excavations, above the ground or on multi-span bridges, the pipes must be properly bent, as shown in the table.

The design of a suitable pipeline type that takes advantage of the natural flexibility of the plastic used to produce the pipes can lead to a significant reduction in the number of necessary supports, joints and reduction of flow losses. As far as possible, the largest possible bending radius should be designed to facilitate on-site bending of the pipe by minimising the forces required to bend the pipe properly.

NOTE! THE MINIMUM BENDING RADIUS DEPENDS ON THE AMBIENT TEMPERATURE.

When ordering a pipe of a specified length, always add some extra length of the pipe to make bends, e.g. as part of the connection to a building.

TABLE 5.3

DELTA PEX HEAT UNO PN 6/95°C SDR 11 with EVOH anti-diffusion barrier for distribution of heating medium (central heating)

Single pipes

Dimensions			Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	l/m	m	
25	2.3	110	0.327	0.25	706 110 025
32	2.9	110	0.539	0.32	706 110 032
40	3.7	110	0.835	0.40	706 110 040
50	4.6	160	1.307	0.5	706 160 050
63	5.8	160	2.075	0.63	706 160 063
75	6.8	160	2.961	0.75	706 160 075
90	8.2	200	4.254	0.90	706 200 090
110	10	200	6.362	1.10	706 200 110
125	11.4	200	8.230	1.25	706 200 125

TABLE 5.4

DELTA PEX SANI UNO PN 10/95°C SDR 7,4 for distribution of cold or hot tap water

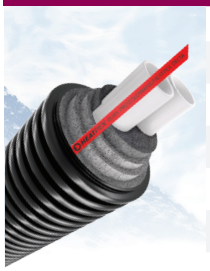
Single pipes

Dimensions			Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	l/m	m	
25	3,5	110	0,254	0,26	710 110 025
32	4,4	110	0,423	0,34	710 110 032
40	5,5	110	0,661	0,42	710 110 040
50	6,9	160	1,029	0,53	710 160 050
63	8,6	160	1,647	0,66	710 160 063
75	10,3	160	2,324	0,79	710 160 075
90	12,3	200	3,359	0,95	710 200 090
110	15,1	200	5,001	1,16	710 200 110

TABLE 5.5

DELTA PEX HEAT DUO PN 6/95°C SDR 11 with EVOH anti-diffusion barrier for distribution of heating medium (central heating)

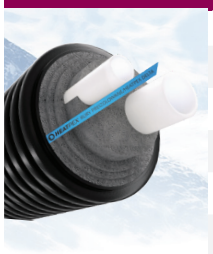
Rury podwójne



Dimensions			Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe		Casing			
Dz1	Wall thickness	Do			
mm	mm	mm	l/m	m	
25	2,3	125	0,654	0,50	706 125 025
32	2,9	125	1,078	0,64	706 125 032
25	2,3	160	0,654	0,50	706 160 025
32	2,9	160	1,078	0,64	706 160 032
40	3,7	160	1,669	0,80	706 160 040
50	4,6	200	2,615	1,00	706 200 050
63	5,8	200	4,150	1,26	706 200 063

TABLE 5.6

DELTA PEX SANI DUO PN 10/95°C SDR 7,4 for distribution of cold or hot tap water

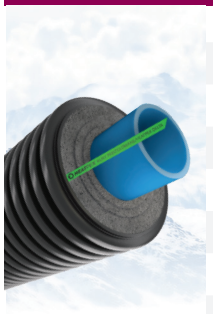


Dimensions					Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe				Casing			
Dz1	Wall thickness	Dz2	Wall thickness	Do			
mm	mm	mm	mm	mm	l/m	m	
25	3,5	25	3,5	125	0,509	0,53	710 125 225
32	4,4	20	2,8	125	0,586	0,55	710 125 032
25	3,5	25	3,5	160	0,509	0,47	710 160 225
32	4,4	25	3,5	160	0,677	0,53	710 160 232
40	5,5	25	3,5	160	0,915	0,55	710 160 040
50	6,9	32	4,4	200	1,452	0,60	710 165 032
63	8,6	32	4,4	200	2,070	0,68	710 200 063

Double pipes

TABLE 5.7

DELTA PE PN16 SDR11 for water supply and industrial systems

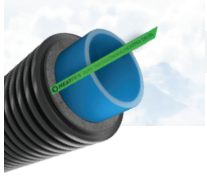


Dimensions			Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	l/m	m	
25	2,3	110	0,327	0,25	721 110 025
32	2,9	110	0,539	0,32	721 110 025
40	3,7	110	0,835	0,40	721 110 040
50	4,6	160	1,307	0,5	721 160 050
63	5,8	160	2,075	0,63	721 160 063
75	6,8	160	2,961	0,75	721 160 075
90	8,2	200	4,254	0,90	721 200 090
110	10	200	6,362	1,10	721 200 110
125	11,4	200	8,230	1,25	721 200 125

Single pipes

TABLE 5.8

DELTA PE GEO PN10 SDR17 for water supply and industrial systems



Dimensions			Carrier pipe volume	Minimum bending radius	Catalogue number
Carrier pipe		Casing			
Dz	Wall thickness	Do			
mm	mm	mm	l/m	m	
40	2,4	63	0,973	0,40	722 063 040
50	3,0	90	1,521	0,50	722 090 050

Single pipes

Selecting the diameter of the carrier pipe

The diameter of the district heating system pipeline is determined on the basis of the design stream of the district heating water flowing through a given length of the pipe.

The district heating water stream is determined on the basis of the heating demand of such consumers as:
heating, domestic hot water, process heat

When selecting the diameter of the carrier pipe, the optimum velocity and the permissible pressure drop must be maintained.
Due to the characteristics of the flows in the pipelines, we suggest to select the pipes as follows:

- for outside diameters up to 50 mm: R=100-500 Pa/m, v=0.6-1.3 m/s
- in the higher diameter range: R=100-500 Pa/m, v=0.6-1.5 m/s

Finally, after checking the total head loss in the critical branch, the circulating pump should be selected and it should be decided, based on the engine size of the selected equipment, whether to modify the pipeline diameters in order to reduce the head loss.

Specifying possibly the shortest route for the pipeline

When determining the routes for the pipelines, the flexibility of the pre DELTA-insulated pipes (no elbows, gentle bends) and the self-compensation of linear elongations (no compensation on the branches and along the entire length of the pipe) should be taken advantage of.

Determination of the level of pipeline foundation

The minimum burial depth for the pipes should be 40 cm. In the places where the pipeline crosses roads with a normative dynamic load, the burial depth should amount to 90 cm. The depth of frost penetration should be taken into consideration for the local conditions.

Specifications for pre-insulated pipes, connector sets and accessories

The pre-insulated pipes are supplied in any lengths not exceeding the maximum marketed lengths specified in the technical data. This allows to prevent the need to join pipe sections in most cases. Every branch/joint in the ground must be insulated using an appropriate joining set, protecting also the joining fittings from corrosion and soiling.

Example of how to select DELTA pre-insulated pipe

The first step in selecting the pipeline is to determine the flow rate of the medium to be flown through a given length of the pipeline. In the case of pipelines transporting hot or cold domestic water, the flow is determined directly on the basis of the wear and tear of individual fittings, taking into account coincidence factors. In the case of pipelines transporting a heating medium or a cooling medium, the flow rate will depend on the amount of heat energy that is to be transferred. Therefore, we start with the heating demand balance of a building.

Example: During the heating season an institutional facility needs 100 kW of power at a design temperature to cover losses caused by penetration of the building envelope elements and to prepare fresh air. The calculation of the demand is based on the PN-EN 12831:2006 standard.

Then we determine the pressure at which the pipelines will operate. Pressures higher than 6 bar are not permitted for indoor installations. That means that the pre-insulated pipe sections from a local district heating plant or a boiler plant in a housing estate will operate at this maximum pressure and that is why it is possible to use the SDR11 pipe.

In the case of external systems or domestic hot water systems, the operating pressure may exceed 6 bar, so it is necessary to use the SDR7.4 pipe.

After determining the demand, we make a preliminary delineation of the pre-insulated pipeline route in the field, paying attention to the principles mentioned earlier in Chapter 3, ground and water conditions, possible collisions with existing facilities and the ownership status of the land.

The flow is related to heating capacity by the following formula:

$$G = \frac{Q_{rad}}{c \cdot (t_{in} - t_{out})}, \text{kg/s}$$

where:

G – design water stream in kg/s

Q_{rad} – design heat output of the radiator without taking into account heat gains [W],

c – water specific heat capacity 4186 [J/(kg ×K)],

t_{in} – design temperature of the water feeding the system [°C],

t_{out}– design temperature of the water returning from the system [°C].

> then the mass flow should be converted into volume flow rate by dividing the mass flow by ρ - water density for the average temperature of the medium [kg/m³].
>
> We obtain the value given in m³/s, which should be converted into m³/h or dm³/s respectively, depending on the units in which the tables with head loss in pipes are available.
>
> Conversion factors for the volume flow rate: 1 m³/h = 0.00028 m³/s = 16.667 dm³/min = 0.28 l/s = 1000 l/h
>
> Example: On the 100 m route, 100 kW is to be transmitted. The system temperature difference between the feed and the return is 20 K. This gives a flow of 4.23 m³/h, calculated using the procedure above.

The determination of the pressure drop over a given pipeline length is calculated using nomographs or tables that are the result of the following formulas:

$$\Delta h = \lambda \cdot \frac{l}{d} \cdot \frac{v^2}{2g}$$

where:

Δh - amount of piezometric head loss; [m H2O],

λ - coefficient of linear resistance (linear frictional resistance); [-], l - pipe length; [m],

d - inner diameter of pipe; [m],

l - pipe length

v - average liquid flow velocity in the cross-section; [m/s],

g - gravitational acceleration; 9.81 [m/s²].

The linear loss coefficient λ depends on two parameters: the Reynolds number Re and the relative roughness of the pipe e, which is a dimensionless parameter. The relative roughness is defined as:

$$e = \frac{k}{d}$$

k - roughness (equivalent sand grain roughness); [m].

The roughness k is associated with the average height of irregularities on the internal surface of the pipe. To be more precise it should be defined as a measure of the actual "surface condition" of the pipe which results not only from the size but also from the distribution of irregularities resulting from the pipe material, accumulated sediments, but also from the inaccuracy in the circular shape of the pipe, local losses at pipe joints being the result of assembly techniques, etc. This parameter is given by the pipeline manufacturer. This information is given in this guide for specific pipe types in Chapter 1.

Reynolds number:

$$Re = \frac{\mathrm{v} \cdot d}{v}$$

where ν is the kinematic viscosity coefficient; [m^2/s].

All these parameters are given in the relevant literature, but their interrelationship is so complicated that it is most convenient to use the parameters given by us in Tables 5.1 and 5.2, which have been prepared by us according to the formulas given above. The head loss to be taken into account when calculating the delivery head:

$$Rt = I \cdot Rm + nRI$$

where:

Rt - total head loss [Pa]

l - given length of pipe

Rm - unit loss per 1 m of the length of pipeline

nRl - sum of local losses [Pa]

the amounts of local losses are available in the literature in a tabular form including coefficients of local losses, which are converted to the piezometric head of energy loss:

$$\Delta h = \zeta \frac{v^2}{2g}$$

where:

Δh - amount of mechanical energy losses; [m],

ζ - local loss coefficient, calculated for the velocity behind the location of the local loss; [dimensionless parameter];

v - average flow velocity in the pipe; [m/s]

For the sake of simplicity, it can be assumed that the sum of local losses along the pipelines' route is statistically one third of the length loss, and finally we assume that the sum of losses along the pipelines' route will be 133% of friction losses against the pipeline's walls.

Due to the characteristics of the flow in pipelines, we suggest to choose pipes according to the following formula:

a. for outside diameters up to 50 mm: R=100-500 Pa/m, v=0.6-1.3 m/s

b. in the higher diameter range: R=100-500 Pa/m, v=0.6-1.5 m/s

Finally, after checking the total head loss in the critical branch, the circulating pump should be selected and it should be decided, based on the engine size of the selected equipment, whether to modify the pipeline diameters in order to reduce the head loss.

Taking into account the physical quantities conversion factors, which for the sake of simplicity assume a specific water density of 1000 kg/m^3, we get the following dependence:

1m H2O = 10 kPa = 10 000 Pa = 0,01 MPa = 1 bar

Example:

The pipe should be sized so that its diameter is as small as possible, however the appropriate pressure drop should not exceed 200 - 250 Pa/m (under current conditions, in extreme cases, it is recommended not to exceed 400 Pa/m and 1.5 m/s over short distances). Selected diameter 50 x 4.6 (appropriate pressure drop is 167 Pa/m)

3. Determining the pressure drop for SDR11 pipe:

The total length of the pipes in the straight section of the 100 m heat pipeline is 200 m, so the total head loss will be 2*100*167 = 33,400 Pa. or 33.4 KPa (3.3 mH2O).

TABLE 5.9 Pex-a chemical resistance

The PEX-a Pipe Chemical Resistance List is based on information included in the professional literature. The list is only intended as a guide. Changes in the composition of the medium or special working conditions could lead to deviations.

Classification:

A - Resistant: can be used within the working pressures, according to table 11.2 or 12.1 (safety factor of 1.25).

B - Conditionally resistant: restrictions of 70% to 90% must be made regarding the working pressures according to table 11.2 or 12.1.

C - Conditionally resistant: can be used within pressures up to 60% of the working pressures.

D - Conditionally resistant: can be used within pressures up to 20% of the working pressures.

U - Not recommended.

Note! In case of any doubts, please contact us.

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Accumulator Acid	A	A	A	
Acetaldehyde 40%	A	A		B
Acetaldehyde 100%	U			
Acetamide	A	A	A	
Acetic Acid 05%	A	A		
Acetic Acid 10%	A	A		
Acetic Acid 20%	A	A		
Acetic Acid 50%	A	A		
Acetic Acid 60%	A	A		
Acetic Acid 80%	A	A		
Acetic Acid Ethyl Ester	A	A		
Acetic Anhydride	A	D		
Acetoacetic Acid	A			
Acetone	C			
Acetophenone			B	
Acetyl Bromide	U			
Acetyl Chloride			B	
Acetylene	A	A	A	
Acetylene Dichloride	see Dichloroethylene			
Acid mixture H2SO4-HNO3-H2O	U			
Acid mixture H2SO4-H3PO4-H2O		B		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Acrylic emulsions	A			
Acroline dispersion	A			
Acroline solution	B			
Acronal	C			
AcryloN itritle	A	A	A	
Acrylic Acid	A	A		
Adipic Acid	A	A	A	
Air	A	A	A	
Aktivin	A	A		
Alcohol	see Ethylalcohol			
Aliphatic Esters	A	A	A	
Allyl Acetate	A	C		
Allyl Alcohol 7%	A	A	A	
Allyl Alcohol 95%	A			
Allyl Aldehyde	see Acroline			
Allyl Chloride	C	U		
Alum	A	A	A	B
Aluminium Acetate	A	A	A	
Aluminium Chloride	A	A	A	
Aluminium Fluoride	A	A	A	
Aluminium Hydroxide	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Aluminium Metaphosphate	A	A		
Aluminium Nitrate sol.	A	A	A	
Aluminium Phosphate	A	A	A	
Aluminium Potassium Phosphate	A	A	A	
Aluminium Potassium Sulphate	A	A	A	A
Aluminium Sodium Sulphate sol.	A	A	A	
Aluminium Sulphate	A	A	A	
Amino Acids	A	A		B
Aminoacetic Acid	B	B		
Ammonia Aqueous	A	A	A	
Ammonia, dry gas	A	A	A	
Ammoniacal Liquor	A	A		
Ammonium Acetate	A	A	A	
Ammonium Aluminium Sulphate	A	A		
Ammonium Bromide	B	B		
Ammonium Carbonate	A	A	A	
Ammonium Chloride	A	A	A	
Ammonium Fluoride 20%	A	A	A	
Ammonium Hydrogen Carbonate	A	A	A	
Ammonium Hydrogen Sulphide	A	A	A	
Ammonium Hydroxide	A	A	A	
Ammonium Metaphosphate	A	A	A	
Ammonium Molybdate	A		B	
Ammonium Nitrate	A	A	A	
Ammonium Persulphate	A	A	A	
Ammonium Phosphate	A	A	A	
Ammonium Sulfide	A	A	A	
Ammonium Sulphate	A	A	A	
Ammonium Sulphocyanide	A			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Ammonium Thiocyanate	A	A	A	
Amyl Acetate	A	A		
Amyl Alcohol	A	A	A	
Amyl Chloride	U			
Amyl Methyl Carbinol	B			
Amyl Naphthaline	B			
Amyl Phthalate	A	B		
Aniline Hydrochloride	D			
Aniline Sulphate	U			
Aniline, coloured	see Aniline			
Aniline, pure	A	A		
Aniline, water soluble	B			
Animal Fats	A	A	A	
Animal Oils	B	B	B	
Anis Oil	B			
Aniseed Oil	C	U		
Anisole	see Cyclohexanone			
Antifreeze solution	A	A	A	
Antimony Pentachloride	A	A	A	
Antimony Trichloride	A	A	A	
Antrhoquinone Sulphonic Acid	A	A		
Aqua regia	U			
Aromatic Acids	A	A	A	
Aromatic Hydrocarbons	U			
Arsenic	B	B		
Arsenic Acid 80%	A	A	A	
Arsenic Acid Anhydride	A	A		
Arsenic Salts	A			
Arsenic Trichloride	U			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Ascorbic Acid	A			
Asphalt	A	C		
ASTM Oil no. 1	A	A	A	
ASTM Oil no. 2	A	A	A	
ASTM Oil no. 3	A	A	A	
Atropine Sulphate	A			
Barium Carbonate	A	A	A	
Barium Chloride	A	A	A	
Barium Hydrosulphide, Bone Oil			B	
Barium Hydroxide	A	A	A	
Barium Salts	A	A		
Barium Sulphate	A	A	A	
Barium Sulphide	A	A	A	
Battery Acid	A	B		
Beater Glues	A			
Beer Colours	A	A	A	
Beer, trading quality	A			
Beet Juice	A	A		
Benzaldehyde 0.1%			C	
Benzaldehyde 100%	A	C		
Benzaldehyde Oxime 2%	A			
Benzaldoxime	see Benzaldehyde Oxime			
Benzene (Benzole)	D	U		
Benzene Carbonic Acid	see Bensoic Acid			
Benzene Dicarbonic Acid	see Phthalic Acid			
Bezene Sulphonic Acid	A		B	
Benzoic Acid	A	A	B	
Benzole Carbon Acid	see Bensoic Acid			
Benzole Dicarbon Acid	see Phthalic Acid			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Benzole Sulphonic Acid	U			
Benzyl Acetate	B			
Benzyl Alcohol	A	A	B	
Benzyl Benzoate		B		
Benzyl Chloride	A			
Bichromate Sulfuric Acid	B	U		
Bismuth Carbonate	A	A	A	
Bisulfite	see Sodium Bisulfite			
Bitumen	A	C		
Black Liquor	B	B		
Bleach	D	U		
Bleach Lye 10%	B	B		
Bloodstream Salt, red	see Potassium Ferricyanide			
Bloodstream Salt, yellow	see Potassium Ferricyanid			
Bone Oil	A	A		
Bonewax	A		U	
Borax	see Sodium Tetraborate			
Boric Acid	A	A	A	
Boric Acid Methyl Ester	B	U		
Boric Copper Sulphate	A			
Boric Trifluoride	A			
BoronTrifluoride	A	D		
Brake Fluids	A	A	A	
Brandy	A			
Brines, saturated	A	A	A	A
Brom Oil	A		B	
Bromate Solution	A	A		
Bromoethane	U			
Bromic Acid	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Bromine Vapours, low conc.	B			
Bromine Water	U			
Bromine, Liquid	U			
Bromochloromethane	U			
Butadiene 50%	A	A	A	
Butadiene 100%		B		
Butane (gas)	U			
Butanediol up to 10%	A	A	A	
Butanediol up to 100%	B			
Butanetriol	A	A		
Butanol 100%	A	A	A	
Butanone	A	U		
Butene	U			
Butoxy I	A	C		
Butter	A		B	
Butter Acid	C			
Butter Acid in water, conc.	C			
Butter Acid in water, sol. 20%	C			
Butyl Acetate	A	B	C	
Butyl Acrylate	A	B		
Butyl Alcohol	see Butanol			
Butyl Aldehyde	A		B	
Butyl Benzyl Phtalate	A	A		
Butyl Carbinol			B	
Butyl Cellulose solution	U			
Butyl Phenol	U			
Butyl Stearate	A	A	A	
Butylene	see Butene			
Butylene Glycol	see Butanediol			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Butyric Acid	C	D		
Cadmium Salts	A			
Caffeine Citrate	B	B		
Calcium Acetate	A	A	A	
Calcium Bisulphide	A	B		
Calcium Bisulphite	A	A	A	
Calcium Bromide 50%	A	A		
Calcium Bromide 80%	A			
Calcium Carbide	A	A		
Calcium Carbonate (Soda)	A	A	A	
Calcium Chlorate	A	A	A	
Calcium Chloride	A	A	A	B
Calcium Hydrosulphite containing SO2	B	B		
Calcium Hydroxide	A	A	A	
Calcium Hypochlorite	A	A	A	
Calcium Nitrate	A	A	A	
Calcium Oxide	A			
Calcium Phosphate	A			
Calcium Sulphate	A	A	A	
Calcium Sulphide			B	
Calcium Water	A			
Camphor	C			
Cane Sugar	A			
Cane Sugar Juice	A	A	A	
Carbamide 33%	A	A	A	
Carbazole	A	A		
Carbolic Acid	A	B		
Carbolic Acid (Phenol)	A	A		
Carbolineum	A	C		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Carbon Bisulfide	U			
Carbon Dioxide	A	A	A	
Carbon Dioxide damp	A	A	A	
Carbon Dioxide dry	A	A	A	A
Carbon Disulphide		D	U	
Carbon Monoxide - lamp gas	A	A	A	
Carbon Tetrachloride		D	U	
Carbonic Acid H2CO3	A	A		
Carnbevox	A			
Carrot Juice	A	A		
Castor Oil	A	B		
Caustic Potash	A	A		
Caustic Soda	see Sodium Hydroxide			
Cedar Leaf Oil	D			
Cedar Wood Oil	D			
Cellulose dissolver	See Ethylene Glycol Monoethyl Ether			
Cetyl Alcohol	A	A	B	
Chalk	A	A	A	
Cheese Enzyme	A	A	A	
Chloral Hydrate	A	A	A	
Chloramine	A	A	A	
Chloramine T	see Paratoulene Sulpho- Chlor			
Chloride Acid	see Hydrochloric Acid			
Chlorine water 10 PPM	A	A		
Chlorine water sturated	A		B	
Chlorine, damp gas	C	U		
Chlorine, dry gas	B		U	
Chlorine, liquid	U			
Chloro Acetic Acid Ethyl Ester	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Chloro Acetic Acid Methyl	A	A		
Chloro Carbonic Acid	A	C		
Chloroacetic Acid 85%	B	B		
Chloroacetic Acid 98%	B			
Chloroacetic Acid 100%		B		U
Chlorobenzene	D	U		
Chlorocalcium (in H2O)	A	A	A	
Chloroethane	see Ethyl Chloride			
Chloroethanol	A	A	A	
Chloroethyl Alcohol	see Chloroethanol			
Chloroethyl Phosphate	A	A		
Chloroform	D	U		
Chloromethane	see Methyl Chloride			
Chloropicrin	U			
Chloropropane	see Glycerine Chlorhydrin			
Chlorosulfonic Acid	U			
Chrome Alum	A	A	A	
Chrome Anode Mud	A	A		
Chrome Mercury	B			
Chromic Acid 50%	A	A	A	
Chromic Acid 80%	A		B	
Chromic Acid Anhydride	see Chromium Trioxide			
Chromium Oxide	see Chromium Trioxide			
Chromium Salts	A			
Chromium Trioxide 20%	A	A	A	
Chromium Trioxide 50%	A		B	
Chromium Trioxide 80%				
Chromo Sulfuric Acid	A	U		
Cider	A	B		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Cinnamon	B	C		
Cinnamon Oil	D			
Cis - Oxime	see Benzaldehyde Oxime			
Citric Acid	A			
Citronella	B	D		
Citrus Juices	A	A		
Cloves	C	C		
Coal Tar	D	U		
Cobalt Chloride	A	A	A	
Coca Cola	A	A		
Coca Cola Syrup	A	B		
Cocanut Oil Alcohols	B	C		
Cocoa Fat	A	A	A	
Cocoa Fat Alcohol	A	A	A	
Coconut Oil	A	B		
Cod Liver Oil	B	C		
Coffee	A			
Cognac	A			
Colanut, concentrated	A	A	A	
Cooking Salt	see Sodium Chloride			
Copper Acetate			B	
Copper Chloride (cupric)	A	A	A	
Copper Chloride (cuprous)	A	A	A	
Copper Cyanide	A	A	A	
Copper Fluoride	A	A	A	
Copper Nitrate	A	A	A	
Copper Salts	A	A		
Copper Sulphate	A	A	A	
Corn Oil	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Corn Syrup	A	A		
Cotton d Oil	A	B	C	
Coumarone Resins	A	A		
Cranberry Sauce	B	B		
Creosote	A	B		
Cresol 100%	A	C		
Cresol diluted	A	C		
Crop Protection Agent	A	A		
Croton Aldehyde	A	C		
Crude Oil	A	B	C	D
Cupric Salts Cuprous Chloride,	A			
saturated	B	B		
Cupprous Oxide	B	B		
Cyanides	A	A	A	
Cyclanone	A	A		
Cyclohexane	C	D		
Cyclohexanol	A			
Cyclohexanone	D	U		
Cyclohexyl Alcohol	A	B		
DDT	A	A		
Decahydro Naphthalene	B	C		
Decalin	A	C		
Defoamer	A	C		
Denatured Spirit	see Methyl Alcohol			
Deodorants	A	A		
Detergents	A	B		
Dextrine	A	A	A	
Dextrose	A	A	A	A
Diacetone	A	A	A	
Diacetone Alcohol	A			
Diammonium Salts	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Diazo Salts	A	A		
Dibenzyl Ether			B	
Dibromoethane	D	U		
Dibutyl Ether	B	D		
Dibutyl Phthalate	B	C		
Dibutyl Sebacate	A	B	B	
Dichloracetic Acid	A	A	A	
Dichloracetic Acid Methylester	A	A	A	
Dichlorobenzene	C	U		
Dichloroethane	see Ethyl Chloride			
Dichloroethylene	U			
Dichloromethane	see Methyl Chloride			
Dicyclohexamine			B	
Diesel Fuel	A	U		
Diesel Oil	A	U		
Diethlene Glycol Monobutylene	A			
Diethyl Benzene				B
Diethyl Ether	see Ethyl Ether			
Diethyl Ketone	B	C		
Diethyl Phthalate	A			
Diethylamine			B	
Diethylene Dioxide	see Dioxane			
Diethylene Glycol	A	A		
Diglycolic Acid	A	A	A	
Dihexyl Phthalate	A	A	A	
Diisobutylene			B	
Diisopropyl Ether	B	U		
Diisopropyl Ketone	A	A	A	
Dimethyl Amine	C	U		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Dimethyl Aniline			B	
Dimethyl Benzole	see Xylol			
Dimethyl Formamide	A	B		
Dimethyl Ketone	see Acetone			
Dimethyl Phthalate	A	A	A	
Dimethyl Sulphoxide	A	A		
Dioctyl Phthalate	B	C		
Dioctyl Sebacate			B	
Dioxalane			B	
Dioxane	A	B	C	
Dioxyethyl Ether	see Diethylene Glycol			
Diphenyl			B	
Diphenyl Amine	A	C		
Diphenyl Oxide	B	C		
Dishwash Detergents	A	A	B	
Disodium Phosphate	A	A		
Disodium Sulphate	A	A		
Dispersions	A			
Dodecylbenzene Sulfonic Acid	A	C		
Dop (Diethylhexyl Phthalate)	A	C		
Edible Oil	A			
Electrolyte 10%	A	A	A	
Elementine normal cone.	A	A	A	A
Emulsions, Photographic	A	A	A	
Engine Oils	A	C		
Ephetin	A	A		
Epichlorohydrin	A	A	B	
Epoxy Ethane	see Ethylene Oxide			
Epsom Salts	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Essential Oils	C	U		
Esteric Oils	B	B	B	
Ethanal	see Acetaldehyde			
Ethandiol	see Ethylene Glycol			
Ethane	A	A		
Ethane Diamine	see Ethylene Diamine			
Ethanol	see Ethyl Alcohol			
Ethanolamine	A	A	B	
Ethers	C	D	U	
Ethoxyethane	see Ethyl Ether			
Ethyl Acetate	A	B	C	
Ethyl Alcohol	A	A	A	B
Denaturated with 2% Toluol	A			
plus Acetic Acid, quality use	A			
Ethyl Benzene	D	U		
Ethyl Benzoate	B			
Ethyl Carbitol			B	
Ethyl Cellulose			B	
Ethyl Chloride	C	U		
Ethyl Dibromide	C	U		
Ethyl Ether	C	D	U	
Ethyl Formate			B	
Ethyl Glycol			B	
Ethyl Methyl Ketone	see Butanone			
Ethyl Oxalate	A	A	A	
Ethyl Pentachloro Benzene	U			
Ethyl Salicylate	B			
Ethyl Silicate	A	A	A	
Ethyl Valeriate	A			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Ethylamine	A	A	A	
Ethylene	A	B		
Ethylene Chlorhydrin	U			
Ethylene Chloride	U			
Ethylene Diamine	A	A		
Ethylene Diamine Tetra-acetic Acid	A	A		
Ethylene Dichloride	D	U		
Ethylene Glycol 100% trading quality	A	A	A	B
Ethylene Glycol\ Monoethyl Ether	A			
Ethylene Oxide, gaseous	A	A		
Ethylene Oxide, liquid	U			
Ethylene Trichloride	D			
Ethylhexyl Alcohol	A	B		
"Eugenol"	B			
Euron B	B	B		
Euron G	A	A		
Fatty Acid	A	B	C	
Fatty Acid Amides	A	C		
Fatty Alcohols	A	C		
Fatty Oils	A	c		
Ferric Chloride	see Iron Chloride			
Ferric Nitrate	see Iron Nitrate			
Ferrous Ammonium Citrate	A	B		
Ferrous Chloride	A	B		
Ferrous Sulphate Fe SO4	A	A		
Fertilizer Salts	A	A	A	B
Fir Wool Oil	A	C		
Fish Oil	A	A	A	
Fish Solubles	B			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Fluoboric Acid	A	B		
Fluorbenzene	U			
Fluorides	A	A	A	
Fluorine, liquid	C			
Fluorine (solution)	U			
Fluosilicic Acid 25%	A	C		
Formaldehyde 40%	A	A		
Formaldehyde, diluted	A	A	A	
Formamide	A	A	A	
Formic Acid	A	A	B	
Freon 12	C	U		
Freon 13	A	A	A	
Freon 21	U			
Freon 22	A	A	A	
Freon 113	A			
Freon 114	A	A	A	
Frigen	C	U		
Fructose	A	A		
Fruit Juice	A	A	A	
Fruit Mass (fruit pulp)	A	A	A	
Fruit Sugar	A			
Fuel Oils	A	D		
Fuming Sulphuric Acid	see Oleum			
Furan	D			
Furfural	A	C	U	
Furfural Alcohol	A	B		
Gallic Acid	A	A		
Gas Liquor	A	A		
Gas, Natural	see Natural Gas			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Gases, containing Carbon Dioxide, Carbon Acid	A	A	A	A
Gases containing Chlorine	A	A	A	B
Gases, containing Fluorine traces	A	A	A	
Gases, containing Nitrious Oxide traces	A	A	A	
Gases, containing Oleum, low conc.	U			
Gases, containing Sulphur Dioxide 50%	A	A		
Gases, containing Sulphur Dioxide, low conc.	A	A	A	B
Gases, containing Sulphuric Acid	A	A	A	
Gasoline-Benzene mixture 80/20	B		C	
Gasoline, Leaded	A			
Gasoline, pure, 100 Octane	B	C		
Gasoline, Sour	A			
Gasoline, Unleaded	A			
Gelatine	A	A	A	
Genantin	A	A		
Gin	A	A		
Glaubers Salt	A	A		
Glucose	see Dextrose			
Glycerine Chlorhydrin	A	A	A	
Glycerine, Glycerol	A	A	A	
Glycerol Chloro Hydrin	A	A		
Glycine	see Glycol			
Glycois	A	A		
Glycol	A	A		
Glycol Dichloride	see Ethylene Chloride			
Glycol Ester	A	A	A	
Glycolic Acid 37%	A	B		
Glycolic Acid Butyl Ester	A	A		
Glysantin	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Grape Juice	A	A		
Grape Sugar	A	A		
Grapefruit Juice	A	A		
Grease	A			
Grisiron 8302	B	B		
Grisiron 8702	A	A		
Hair Oil/Tonic Oil	A	A		
Halothane	C	D		
Hand Lotions	A	A		
Heating Oil, Barrel Oil	A			
Heavy Emulsion	see Barium Carbonate			
Heavy Oil			B	
Heptane	B	D		
Hexachlorobenzene	A	B		
Hexadecylalcohol	A	A		
Hexane	C	D		
Hexane Triol	A	A		
Hexyl Alcohol	D			
Honey	A			
Household Cleaners	A	B		
Hydrobromic Acid 20%	A	A		
Hydrobromic Acid 50%	A	A		
Hydrochloric Acid 10%	A	A	A	
Hydrochloric Acid 20%	A	A	A	
Hydrochloric Acid < 30%	A	A	A	
Hydrochloric Acid > 30%	A	A	B	
Hydrochloric dry gas	A			
Hydrocyanic Acid	see Hydrogen Cyanide			
Hydrocyanic Acid 10%	A	C		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Hydrofluoric Acid 20%	A	C		
Hydrofluoric Acid 50%	A	C		
Hydrofluoric Acid 75%, HF	A	C		
Hydrofluosilicic Acid	A	A		
Hydrogen	A	A	A	
Hydrogen Bromide	A	A	A	
Hydrogen Chloride gas dry and moist	A	A	A	
Hydrogen Cyanide	A	A	A	
Hydrogen Fluoride 40%	A	A		
Hydrogen Fluoride 70%	A			
Hydrogen Peroxide 30%	A	A	A	
Hydrogen Peroxide 50%	B			
Hydrogen Peroxide 90%	C			
Hydrogen Peroxide 100%	A			
Hydrogen Phosphide	A			
Hydrogen Sulphide, H2S	A	A	A	B
Hydrogen Sulphide (Aq. Sol.)	A	A	A	B
Hydrogen Sulphide, dry	A	A	A	
Hydroquinone	A	A		
Hydrosulphite	A	A		
Hydroxylamine Sulphate	A	A		
Hypochlorous Acid	A	A		
Hyraulic Fluids	A	B		
Hyrazine Hydrate	A	A		
Igepal	A	A	A	
Ink	A	A	A	
Iodine	A			
Iodine, alcoholic sol.	B			
Iodine ink	A			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Iodine-Potassium Iodide, 3%	A	A		
Iodine Solution	U			
Iodine, Tincture of	A	C		
Iron (II) Chloride	A	A	A	
Iron (II) Sulphate	A	A	A	
Iron (III) Chloride	A	A	A	A
Iron (III) Nitrate	A	A	A	
Iron (III) Sulphate	A	A	A	
Isobutyl Alcohol	A	A		
Isooctane	A	B		
Isopropanol	A	A		
Isopropyl Acetate	A	C		
Isopropyl Ether	D	U		
Jams	A	A		
Kerosene	B	C		
Kerosine	B	C		
Ketones	B	D		
Labarraques Solution	D	U		
Lacquer	U			
Lactic Acid 90%	A	A	A	
Lactose	A	A		
Lanolin	A	A	A	
Latex	A			
Lauryl Alcohol	B			
Lavender Oil			B	
Lead Acetate	A	A	A	B
Lead Arsenate	A			
Lead Nitrate	A	A	A	
Lead Sulphamate	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Lemon Juice	A	A		
Lemon Oil	B	U		
Lime	A	A		
Lime Chloride	A	A		
Lime Juice	B	B		
Lime Water	A	A		
Lind Oil	A	B	C	
Liquor, Trading Quality	C	U		
Lithium Bromide	A	A		
LPG	A	A		
Lubricating Oils	A	C		
Machine Oils	A	B		
Magnesium Carbonate	A	A	A	
Magnesium Chloride	A	A	A	
Magnesium Fluosilicate	A	A		
Magnesium Hydroxide	A	A	A	
Magnesium Iodine	A	A		
Magnesium Nitrate	A	A	A	
Magnesium Salts	A	A		
Magnesium Sulphate	A	A	A	A
Maleic Acid	A	A	A	A
Malic Acid	A	A		
Manganese Sulphate	A	A	A	
Manure, liquid	A	A		
Margarine	B	C		
Marmelade	A	A	A	
Masa	A	A		
Mascara	A	A	A	
Mash	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Mayonnaise	A			
Melase spices, industrial cone.	A	A	A	
Melase, industrial cone.	A	A	A	A
Menthanol	see Menthol			
Menthol	A	C		
Mercuric Chloride	A	B		
Mercuric Cyanide	B	B		
Mercurochrome	A	A		
Mercurous Nitrate	B	B		
Mercury	A	A	A	
Mercury Salts	A	A	A	
Mesityl Oxide				B
Metallic Mordants	A	A		
Methacrylate	A	A		
Methacrylic Acid	A	A		
Methane			B	
Methane Amide	see Formamide			
Methanol	see Methyl Alcohol			
Methoxy Butanol	A	A	A	
Methoxybutyl Alcohol	A	B		
Methyl-2-Pentanone (4-)	A	A		
Methyl Acetate			B	
Methyl Alcohol	A	A	A	
Methyl Amine, 32%	A			
Methyl Bromide	see Bromethane			
Methyl Butyl Ketone	A	A	A	
Methyl Cellulose Solvent	A			
Methyl Chloride	D	U		
Methyl Ethyl Ketone	B	D		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Methyl Formate			B	
Methyl Glycol	A	A	A	
Methyl Isobutyl Ketone	A	C		
Methyl Methacrylate	A	A	B	
Methyl n-Propyl Ketone	A	B		
Methyl Oleate	A	A	A	
Methyl Phenol	see Cresol			
Methyl Pyrrolidone	A	A		
Methyl Salicate	B			
Methyl Salicylate	A	B		
Methyl Sulphate	A	A		
Methyl Sulphuric Acid up to 50%	B	B		
Methylbenzene	D	U		
Methylcyclohexane	C	D		
Methylene Chloride	C	U		
Milk	A	A	A	
Mineral Oils	B	U		
Mineral Spirits	A	C		
Mineral Water	A	A	A	
Molasses	A	A		
Mold Release	A	A		
Monochloride Acetic Acid	A	A	A	
Monochloride Acetic Acid Ethylester	A	A	A	
Monochloride Acetic Acid Methylester	A	A	A	
Monochloro Benzene	D			
Monoethanolamine	A			
Monoethyl Ether	A	A	A	
Monomethyl Aniline	A	A	A	
Morpholine	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Motor Oil			C	
Mowilth	A	A		
Mustard	A	B		
Nafta	B	U		
Naphthalene, Naphthaline	A	C		
Natural gas	A	A		
Nickel	A			
Nickel Chloride	A	B		
Nickel Nitrate	A	B		
Nickel Salts	A	A		
Nickel Sulphate	A	B		
Nicotine	A	A		
Nicotine Acid	B	B		
Nitric Acid 30%	A	A		
Nitric Acid 30-50%	B	C		
Nitric Acid 40%	B			
Nitric Acid 70%	C			
Nitric Acid 98%			U	
Nitrobenzene (Oil of Mirbane)	C	U		
Nitrocellulose	A			
Nitroethane	A		U	
Nitrogen	A	A	A	
Nitroglycerin	B	D		
Nitromethane	A		U	
Nitrotoluene	A	B		
Nitrous gases, conc.	A		U	
Nonyl Alcohol	A	A		
Octane	A	B		
Octyl Alcohol	A		B	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Octyl Cresol	B	U		
Oil	C	C		
Oil Acid			C	
Oleic Acid	A	C		
Oleic Acid (Red Oil)	U			
Oleum	U			
Oleum vapeur (SO3)	B			
Olive Oil	A	A	A	
Optical Brighteners	A	A		
Orange Extract	A	A		
Ortho-Boric Acid	see Boric Acid			
Oxalic Acid	A	B		
Oxyacetic Acid	see Glycolic Acid			
Oxybensole	see Phenol			
Oxydiethanole	see Diethylene Glycol			
Oxygen	A	A		
Oxypropionic Acid	see Lactic Acid			
Oxyrane	see Ethylene Oxide			
l-Oxytoluol	see Benzyl Alcohol			
m-Oxytoluol	see Cresol			
Ozone	C		U	
Painting Turpentine	see Thinner			
Palm Kernal Oil	A	A		
Palm Oil	B	B		
Palmatic Acid	A	A	B	
Palmityl Alcohol	A	A		
Palmolive Oil	A			
Paraffin	A	B	C	
Paraffin emulsion, trading qual.		B		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Paraffin Oil	A	A	A	
Paraformaldehyde	A	A		
Paratoluene Sulpho Chloramide Sodium 1%	A			
Peanut Butter	B	B		
Pentanol	see Amyl Alcohol			
Pentanol Acetate	see Amyl Acetate			
Pepper	B	B		
Peppermint Oil	B	D		
Perchloric Acid 10%	A	A		
Perchloric Acid 20%	A	A	A	
Perchloric Acid 50%	A	B	C	
Perchloric Acid 70%	A	D		
Perchloro Ethylene	U			
Perfumes	C	U		
Petroleum	A	B	C	
Petroleum Ether	A	D		
Petroleum Jelly	B	B		
Petroleum Spirits	C	D		
Phenol up to 90%	A	A		U
Phenolic Resins	A	A		
Phenols 100% (Carbolic Acid)	D			
Phenyl Alcohol	see Benzyl Alcohol			
Phenyl Ethane	see Ethyl Benzene			
Phenyl Ethyl Alcohol	A	A		
Phenyl Hydrazine	C	D		
Phenyl Hydrazine Hydrochloride	A	U		
Phenyl Methane	see Toluol			
Phenyl Methyl Ether	see Cyclohexanone			
Phenyl Sulfonate	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Phosgene, gas	U			
Phosphates	A	A	A	
Phosphoric Acid 80%	A	A	A	A
Phosphoric Acid 90%	A	A	A	A
Phosphoric Acid 95%	A	A		
Phosphorus Oxychloride	A	B	B	
Phosphorus Pentoxide	A	A	A	
Phosphorus Trichloride	A	B		
Phosphorus Yellow	A			
Photographic Developer	A	A		
Photographic solution. Fixer	A	A	A	
Phthalic Acid 50%	A	A	A	
Phtalic Acid Ester	A	C		
Phtalic Anhydride	B	B		
Pickling Baths	B	C		
Picric Acid 1%	A		B	
Pine Oil	B	D		
Pineapple Juice	A	A		
Pinene			B	
Plasticizers of Polyester	A	B		
Plating Solutions, Brass	A	B		
Plating Solutions, Cadmium	A	B		
Plating Solutions, Copper	A	B		
Plating Solutions, Gold	A	B		
Plating Solutions, Indium	A	B		
Plating Solutions, Iron	A	B		
Plating Solutions, Lead	A	B		
Plating Solutions, Nickel	A	B		
Plating Solutions, Rhodium	A	B		
Plating Solutions, Silver	A	B		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Plating Solutions, Tin	A	B		
Plating Solutions, Zinc	A	B		
Polyesters (Resins)	C	U		
Polyglycols	A	A		
Polysolvan O	A	A		
Potash Alum	A	A		
Potassium Acetate			B	
Potassium Bicarbonate	A	B		
Potassium Bichromate 40%	see Potassium Dichromate			
Potassium Bisolphate	A	A		
Potassium Borate 1%	A	A	A	
Potassium Bromate	A	A	A	
Potassium Bromide	A	A	A	
Potassium Carbonate	A	A	A	
Potassium Chlorate	A	A	A	
Potassium Chloride	A	A	A	A
Potassium Chromate	A	A	A	
Potassium Chromium Sulphate	A	A	A	B
Potassium Cupro Cyanide	A	A	A	
Potassium Cyanide	A	A	A	
Potassium Dichromate 40%	A	A	A	
Potassium Ferricyanide	A	A	A	B
Potassium Ferrocyanide	A	B		
Potassium Fluoride	A	A	A	
Potassium Hydrogen Carbonate	A	A	A	
Potassium Hydrogen Sulphate	A	A	A	
Potassium Hydrogen Sulphite solution	A	A	A	
Potassium Hydroxide 50%	A	A	A	
Potassium Hydroxide 60%	A	A	B	
Potassium Hypochlorite, solution	A		B	
Potassium Iodide, cold saturated	A	A	A	
Potassium Nitrate	A	A	A	
Potassium Orthophosphate	A	A	A	
Potassium Perborate	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Potassium Perchlorate 1%	A	A	A	A
Potassium Perchlorate 10%	A			
Potassium Permanganate 18%	A	A	A	
Potassium Persulfate	A			
Potassium Phophate	A	A	A	
Potassium Salts	A			
Potassium Sulphate	A	A	A	
Potassium Sulphate, cold saturated	A	A	A	
Potassium Sulphide	A	A	A	
Potassium Sulphite	A	A		
Potassium Supersulphate	A	A	A	
Potassium Tetracyao Cuprate	A	A		
Potassium Thiosulphate	A	A		
Propargyl Alcohol	A			
Propane Acid	see Propionic Acid			
Propane Diol	see Propylene Glycol			
Propane Triol	see Glycerine			
Propane, gas	A	B		
Propane, liquid	B			
Propanol	A	A	A	
Propanone	see Acetone			
Propargyl Alcohol	A	B		
Propene	A	A	A	
Propionic Acid	A	A	A	
Propyl Acetate			B	
Propyl Alcohol	see Propanol			
Propylene Dichloriole	U			
Propylene Glycol	A	A	A	
Propylene Oxide	A	A		
Prune Juice	A			
Pseudo Cumol/ Pseudo Cumene	B	B		
Pyridine	A	B	C	
Pyrol			B	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Quinine	A	A		
Rayon Coagulating Bath	A	B		
Resorcinol	A	B		
Ricine Oil	A		B	
Rinser Loosener	A	A	A	
Road Tar	U			
Roasting Gases	A	A		
Rouge	A	A		
Rubbers Dispersions/Latex	A	A		
Sagrotan	A	B		
Salicylic Acid	A	A	A	
Salicylic Acid Methyl Ester	A	B		
Sauerkraut	A	A		
Sea Water	A	A	A	A
Selenie Acid	A	A		
Shampoos, Shaving Lotion	A	A		
Shortening	A	B		
Silicic Acid	A	A		
Silicone Fats	A	A	A	
Silicone Oils	A	A	A	
Silver Nitrate <80%	A	A	A	B
Silver Salts, cold saturated	A	A	A	
Soap	A	A	A	
Soap Loosener	A	A	A	
Soap Solution	A	A	A	
Soda	see Sodium Carbonate			
Sodium Acetate	A	A	A	
Sodium Aluminate	A	A	A	
Sodium Aluminium Sulphate	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Sodium Benzoate	A	A	A	
Sodium Benzoate to 36%	A	A	A	
Sodium Bicarbonate	A	A	A	
Sodium Bisulphate	A	A	A	
Sodium Bisulphite	A	A	A	A
Sodium Borate	A	A	A	
Sodium Bromide	A	A	A	
Sodium Carbonate	A	A	A	
Sodium Chlorate	A	A	A	
Sodium Chloride	A	A	A	A
Sodium Chloride 50%	A	A	A	A
Sodium and Bleach	A		B	
Sodium Chloride and Water	A	A	A	A
Sodium Chromate	A	A		
Sodium Cyanide	A	A	A	
Sodium Dichromate	A	A		
Sodium Dodecylbenzene Sulfonate	A	A		
Sodium Ferricyanide	A	A	A	
Sodium Ferrocyanide	A	A	A	
Sodium Fluoride	A	A	A	
Sodium Hexacyano Ferrate	A	A		
Sodium Hexametaphos-phate	A			
Sodium Hydrogen Carbonate	A	A	A	
Sodium Hydrogen Phosphate	A	A	A	
Sodium Hydrogen Sulphite sol.	A	A	A	
Sodium Hydrosulphite 15%	A	A		
Sodium Hydrosulphite 20%	A	A		
Sodium Hydrosulphite 30%	A	A		
Sodium Hydrosulphite 50%	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Sodium Hydrosulphite 70%	A	A		
Sodium Hydroxide Conc. (Caustic soda)	A	A		
Sodium Hypochlorite 12%	B	D		
Sodium Hypochlorite Solution	B			
Solution Metaphosphate	A	A	A	
Sodium Nitrate	A	A	A	
Sodium Nitrite	A	A	A	
Sodium Perborate	A	C		
Sodium Perchlorate	A	A		
Sodium Peroxide 10%	A	A	A	
Sodium Phosphate	A	A	A	
Sodium Polyacrylate (GR 894)	A	A	A	
Sodium Silicate	A	A	A	
Sodium Sulphate	A	A	A	
Sodium Sulphide	A	A	A	
Sodium Sulphite	A	A	A	
Sodium Tetraborate	A	A	A	
Sodium Thiosulphate	A	A	A	
Soya Oil	A	B		
Spermaceti	A	B		
Spindle Oil	C	D		
Spinning Oil	A		B	
Spinning-Bath Oil containing Carbon Disulphide 0.01%	A	A		
Spinning-Bath Oil containing Carbon Disulphide 0.07%	A	A		
Spot Solvents	A	A	A	
Stain Removers	C	D		
Stannic Salts	A			
Stannous Chloride	A	A		
Starch	A	A	A	A
Starch Syrup	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Steam	A	A	A	
Stearic Acid	A	A	B	
Styrene	C	U		
Succinic Acid	A	A		
Sucrose Solution	A	A	A	
Sugar	A	A		
Sulphates	A	A		
Sulphur	A	A	A	
Sulphur Dioxid, dry	A	A	A	B
wet, in water solution	A	A	A	
Sulphur Solution	A			
Sulphur Trioxide	U			
Sulphuric Acid 10%	A	A	A	A
Sulphuric Acid lower than 50%	A	A	A	
Sulphuric Acid 70%	A		C	
Sulphuric Acid 80-90%	A	C		
Sulphuric Acid 96%	A	C		
Sulphuric Acid 98%	C			
Sulphuric Ether	B	C		
Sulphurous Acid	A	A		
Sulphuryl Chloride	B			
Superchloric Acid	see Perchloric Acid			
Synthetic Washing Powder, home quality	A	A	A	
Tallow	A	B		
Tannic Acid	A	A		
Tannin	see Ascorbic Acid			
Tar	U			
Tartaric Acid (Dihydrxy Succinic Acid)	A	A		
Tea	B	B		
Tertiary Butyl Alcohol	A	A	A	
Tetrabromo Ethane	D	U		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Tetrachloro Ethane	D	U		
Tetraethyl Lead	A			
Tetrahydro Furane	U			
Tetrahydro Furfuryl Alcohol	A			
Tetrahydro Naphtalene	B	U		
Tetraline	see Tetrahydro Naphtalene			
Tetramethylene Oxide	see Tetrahydro Furane			
Tin Chloride	A	A		
Tin Salts	A	A	A	
Thinner	D			
Thioglycolic Acid	A	A		
Thionyl Chloride	D	U		
Thiophene	D	U		
Titanium Tetrachloride	U			
Toluene	D	U		
Tomato Juice	A	A		
Transformer Oils	A	C	D	
Tributile Phosphate	A	A		
Tributro Ethyl Phosphate			B	
Trichloro Acetic Acid	A		B	
Trichloro Acetic Acid 50%	A	C		
Trichloro Benzene	U			
Trichloro Ethane	C		U	
Trichloro Ethylene (Tri)	U			
Trichloro Methane	see Chloroform			
Tricresyl Phosphate	A	A		
Triethanolamine	A	B		
Triethylene Glycol	A	A		
Trifluoroacetic acid (TFA)	A			
Trilom, trade quality	A	A	A	
Trimethyl Borate	U			

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Trimethylbenzene	see Pseudocumol			
Trimethylol Propane	A	A		
Trinitro Phenol	see Picric Acid			
Tri nitro Toluene	U			
Trioctyl Phosphate	A	B		
Trisodium Phosphate	A	B	C	
Trybutyl Phosphate	A	A	A	
Turbine Oil			B	
Turpentine	D	U		
Tutogen U	A	A		
Tween 20	B	U		
Tween 80	B	U		
Urea	A	B		
Uric Acid	A	A		
Uric Compounds	see Carbamide			
Urine	A	A		
Urine, normal cone.	A	A	A	
Vanille Extract	A	B		
Vaseline	A	B	C	
Vaseline Oil	A		B	
Vegetable Dyes	A	A		
Vegetable Oils	B	B	B	
Vinegar	A	A	A	
Vinegar Acid Anhydride	A	A	B	U
Vinegar Acid Butyl Ester	see Butyl Acetate			
Vinegar Acid Ethyl Ester	see Ethyl Acetate			
Vinegar Ester	see Ethyl Acetate			
Vinegar, trading quality	A	A	A	
Vinyl Acetate	A	A		

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Vinyl Chloride	A	A	A	
Vinyl Cyanide	see AcryloNitritle			
Viscose Spinning Solution	A	A		
Vitamine C	A	A		
Walnut Oil	A	B		
Wastegases with Acid	A	A		
Wastegases with Carbon Monoxide	A	A		
Wastegases with HCL	A	A		
Wastegases with H2SO4	A	A		
Wastegases with low sodium Dioxide	A	A		
Wastegases with traces of Hydrogen Fluoride	A	A		
Wastegases with traces of Nitrosyl Sulfuric Acid	A	A		
Water	A	A	A	A
Water Acid Mine	A			
Water Deionized	A			
Water Distilled	A			
Waterglass	A			
Waxes	A	C		
Wetting Agents	A	B		
Whey	A	A		
Whisky	see Ethyl Alcohol			
Whitener	see Sodium Hypochlorite			
Wine Vinegar	see Vinegar			
Wine, red and white	A	A	A	
Wohlstone Acid	A	A	A	

Compound	Chemical Resistance			
	40°C	60°C	80°C	100°C
Wood Glue, type Polyvinyl Acetate	B			
Wood Stains	A	C		
Wool Fat	see Lanolin			
Xylol	C		U	
Yeast	A	A	A	
Zinc Bromide	A	A		
Zinc (II) Chloride	A	A	A	B
Zinc Carbonate	A	A	A	
Zinc Hydrate	A	A	A	
Zinc Oxide	A	A	A	
Zinc Salts	A			
Zinc Sludge	A	A		
Zinc Stearate	A	A		
Zinc Sulphate	A	A	A	

Tightness Test

The tightness of pre-insulated pipelines should be checked using water from the water main at a test pressure determined by the following formula:

$$p_p = 1{,}5 \times p_r$$

where:

p_p – the hydraulic test pressure

p_r – the operating pressure in the pre-insulated pipeline

Note.

Polish national standards (PN-B-10405 and PN-92/M-34031) require the use of water for the tightness test.

The PN-EN 13941 European standard, which has the status of a Polish National Standard, allows the use of air at 0.2 bar (high pressure) or 0.65 bar (vacuum pressure) below the atmospheric pressure level, with the use of appropriate liquids for the detection of leaks.

The use of air for a tightness test as an initial test is recommended.

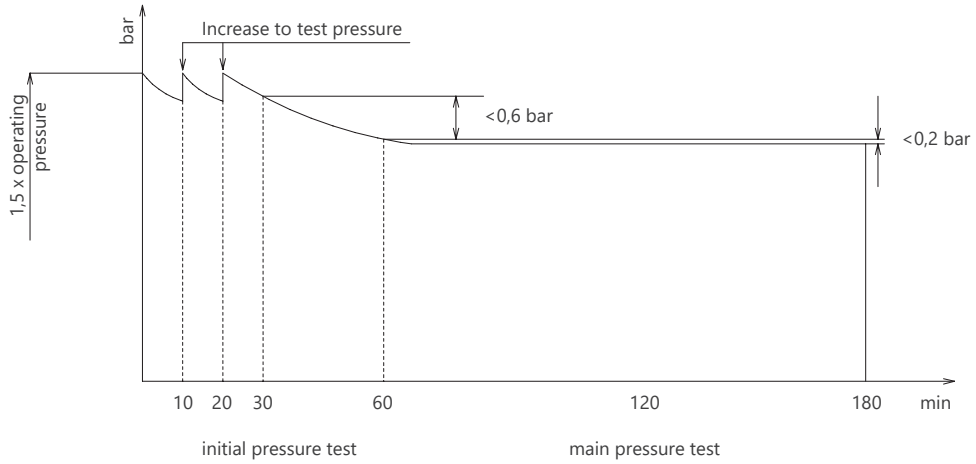
Each pipeline MUST be tested for leaks. Each tightness test must be documented by a written record.

Tightness tests with the use of water must be conducted in respect of the longest possible sections of the pipeline where installation work has been completed. Tightness tests with the use of water for pipelines with the fittings installed must be conducted with the shut-off value fully open.

The duration of the tightness test should be agreed upon with the owner of the heat distribution network. An example of a hydraulic pressure test is described below. Each pipeline must be tested for tightness section by section, using water from the water main. The pipeline must be filled up with water for 24 hours before the test and thoroughly vented. The test pressure must be maintained in the pipeline for at least 30 minutes. Subsequently, the pressure level must be reduced to the operating pressure level, and a thorough visual inspection of the surface of all parts and all connections must be carried out. The test pressure level should be reduced to the operating pressure level, and the operating pressure level increased to the test pressure level, gradually and slowly, i.e. at the maximum rate of 0.1 Mpa per minute.

No defect repair work is allowed on the pipeline while the pipeline is pressurised.

When the tightness test has been completed, no part or connection of the pipeline may show any breakage, deformation, hairline scratches, cracks, leaks or signs or condensation.



RECORD NO. . . . .
(TIGHTNESS TEST)

Name of the facility / location

. . . . . .

. . . . . .

Water temperature: . . . . . °C

Ambient temperature: . . . . . °C

Permissible operating pressure: . . . . . bar

☐ The water to be used to fill up the system has been filtered and the system has been vented.

Initial pressure test:

- Operating pressure x 1,5 . . . . . bar
- after 10 min. (record the reading) . . . . . bar

(and restore the previous pressure level)

- after 20 min. (record the reading) . . . . . bar (and restore the previous pressure level)
- after 30 min. (record the reading) . . . . . bar
- after 60 min. (record the reading) . . . . . bar (max. pressure drop: 0.6 bar)

☐ No leak has been found.

Main pressure test:

- Start of the test . . . . . bar
- after 120 min. (record the reading) . . . . . bar (max. pressure drop: 0.2 bar)

☐ No leak has been found.

Project Owner's representative

. . . . . .

(full name, position, signature)

Contractor's Representative

. . . . . .

(full name, position, signature)

Pipeline Operator's representative

. . . . . .

(full name, position, signature)

If you want to know more about our products or other services, please do not hesitate to contact us.

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