

3 FLEXIBLE COMPOUND SYSTEMS

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3.1 General

3.1.1 Principle / Heat-Insulation / Jacket-Pipe

Principle

The Flexible Compound System of **isoplus** is especially suited for house connections and extension works on. It can be easily being led around obstructions such as buildings, trees or other pipeline systems. It can be also used for complete low-temperature systems in lower dimensions.

Because of the continuous production of **isoplus** flexible pipes a longitudinal water tight compound system will be reached. That means the three basic materials (carrier pipe + insulation + jacket pipe) are connected by axial force with each other. Due to very small bending radius of flexible pipes, it is possible to choose always the direct way around obstructions respectively to the area of the house connection.



Due to the big delivery lengths the pipe laying works can be carried out in a short time, the operational works can be reduced to a minimum. Also the underground construction works can be reduced essentially because of the extremely narrow trenches. For these reasons the flexible pipe system of **isoplus** represents a technically fully developed and **economically** as well as **ecologically** perfect laying method for district heating systems.

Heat-Insulation

Flexible pipes will be insulated with polyurethane-hard-foam (PUR), consisting of component A = Polyol (clear) and component B = Isocyanat (dark), tested acc. to EN 15632-1. During production continuously foamed around the carrier pipe, a high quality heat insulation with an excellent thermal conductivity, $\lambda_{50} = \text{maximum } 0,023 \text{ W/(m}\cdot\text{K)}$, at low specific weight will be reached, due to an exothermal chemical reaction.

isoplus is using generally Cyclopentan driven foam, 100 % free of Freon and therefore environment friendly. That means the very best heat insulation values will be reached at lowest possible ODP- and GWP-values, ODP (Ozone Reducing Potential) = 0, GWP (Green House Potential) = <0,001 !

In order to avoid the exchange of PUR-cell-gas, in all **isoplus** flexible pipes a diffusion barrier is included. This barrier-foil will be implemented between PUR-foam and jacket-pipe during the production procedure. The used barrier-foils are granting the flexible pipes a constant and durable low engery loss during the duration of operation.

For **isoflex** and **isocu** a 100 % diffusion tight aluminium-foil will be used as barrier. In order to keep the compound system, the foil is coated on both sides by corona treated polyethylene. **isopex**- and **isoclima**-pipes are containing a coloured and also corona (electrical surface-cross-linked) treated polyethylene foil, as a direct cell gas barrier.

Jacket-Pipe

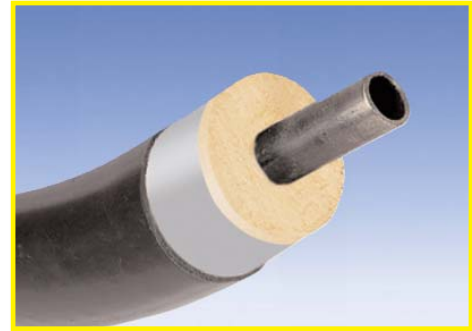
The jacket-pipe of the flexible pipes consists of proved polyethylene with even surface. Polyethylene Low Density is a seamless, tough elastic thermo-plastic material which will be continuously extruded on to the PUR foam during the production procedure. Thermal conductivity $\lambda_{PE} = 0,35 \text{ W/(m}\cdot\text{K)}$.

PE is mentioned in all national and international standards, respectively recommendations, as the only suitable material, due to the resistance against weather conditions and UV-rays, as well as against practically all chemical compounds existing in the soil.

3.2.1 Carrier Pipe / Connection Technology / Operating Conditions

Carrier Pipe

The **isoflex**-carrier pipe consists of a welded, measure rolled precision steel pipe with especial measure-exactness and plain inner surface. Measures and weights acc. to DIN EN 10220, material P195GH+N (annealed regular) No. 1.0348. Technical delivery conditions acc. to option 1 of DIN EN 10305-3, with works certificate (APZ) acc. to EN 10204-3.1.



Connection Technology

The connection of the steel pipe will be made by autogenously-welding or by Wolfram Inert Gas (WIG) welding procedure.

Operating Conditions

Permissible short-term peak temperature T_{max} : 130 °C
 Maximum operating pressure p_B : 25 bar
 Maximum permissible axial-tension σ_{max} : 150 N/mm²
 Leak detecting: Copper wire isolated and twisted as standard
 Possible liquids: Heating water as well as other material resistant liquids

Technical Data P195GH at 20 °C					
Property	Unit	Value	Property	Unit	Value
Volume weight ρ	kg/dm ³	7,85	Elastic modulus E	N/mm ²	211.800
Tensile stress R_m	N/mm ²	320 - 440	Thermal conductivity λ	W/(m•K)	55,2
Yield stress R_e	N/mm ²	195	Specific heat capacity c	kJ/(kg•K)	0,43
Wall roughness k	mm	0,01	Thermal expansion coefficient α	K ⁻¹	11,3 • 10 ⁻⁶

3.2.2 Dimensions resp. Types / Heat Loss and Capacity

Dimensions Steel Pipe P195GH + N			Jacket-Pipe Outside-Ø D_a in mm	Delivery length in 1,00 m steps L in m	Maximum coil-outside-Ø d_R in mm	Minimum bending radius r in m	Weight without water G in kg/m
Type	Outside-Ø d_a in mm	Wall-thickness s in mm					
isoflex - 20	20,0	2,0	75	24 - 100	2220	0,8	1,57
isoflex - 28	28,0	2,0	75	24 - 100	2220	0,8	1,94
isoflex - 28 v	28,0	2,0	90	24 - 100	2300	0,9	2,15
isoflex - 28 + 28	28,0	2,0	110	24 - 100	2440	1,10	3,43

Type	Dimensioning						Heat Loss			
	Water-content v in l/m	Volume-flow V' in m ³ /h	Flow-speed w in m/s	Transmittable capacity P in kW at spread			Coefficient $u_{ER/DR}$ in W/(m•K)	q per pipe meter in W/m at average temperature T_M		
				20 K	30 K	40 K		70 K	60 K	50 K
isoflex - 20	0,201	0,36-0,72	0,5 - 1,0	8 - 17	13 - 25	17 - 34	0,1054	7,377	6,324	5,270
isoflex - 28	0,452	0,81-1,63	0,5 - 1,0	19 - 38	28 - 57	38 - 76	0,1397	9,777	8,380	6,983
isoflex - 28 v	0,452	0,81-1,63	0,5 - 1,0	19 - 38	28 - 57	38 - 76	0,1183	8,278	7,095	5,913
isoflex - 28+28	0,452	0,81-1,63	0,5 - 1,0	19 - 38	28 - 57	38 - 76	0,1952	13,660	11,710	9,760

The mentioned data are based on a medium specific heat capacity [c_m] of the water of 4.187 J/(kg•K), a soil covering height [\dot{U}_H] of 0,60 m (Surface jacket pipe to surface of the area), a heat conductivity of soil [λ_E] of 1,2 W/(m•K), a medium temperature of soil [T_E] of 10° C as well as a carrier pipe distance of 100 mm at single pipes.

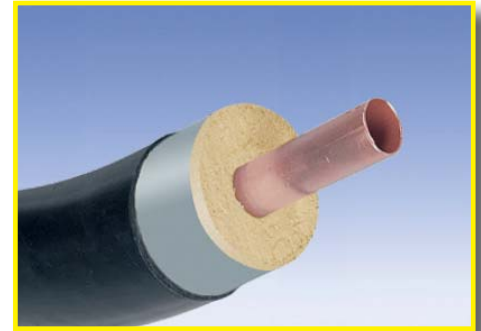
$T_M = (T_{VL} + T_{RL}) : 2 - T_E$; Example: $(90^\circ + 70^\circ) : 2 - 10^\circ = 70$ K average temperature

3.3 isocu

3.3.1 Carrier Pipe / Connection Technology / Operating Conditions

Carrier Pipe

The isocu-pipe consists of a coldfinished soft, seamless drawn copper pipe acc. to EN 1057. Dimension, specification and static data and tolerances acc. to DIN 12449, material Cu-DHP/R 220, No. CW024A, in standard wall thickness, technical delivery conditions acc. to DIN 12735-2.



Connection Technology

The connection of the copper pipe will be made by capillary-soldering-fittings, acc. to DIN 1254 with the same wall thickness than the pipes, or by special suitable press fittings. It is not allowed to enlarge the copper pipes. The recommendations and/or instructions of the manufacturers of the fittings concerning soldering procedure and kind of soldering have to be considered.

Operating Conditions

Permissible short-term peak temperature T_{max} : 130 °C
 Maximum operating pressure p_B : 25 bar
 Maximum permissible axial-tension σ_{max} : 110 N/mm²
 Leak detecting: without
 Possible liquids: All potable and heating water as well as other material resistant liquids

Technical data Cu-DHP/R 220 at 20° C					
Property	Unit	Value	Property	Unit	Value
Volume weight ρ	kg/dm ³	8,94	Elastic modulus E	N/mm ²	132.000
Tensile stress R_m	N/mm ²	220 - 260	Thermal conductivity λ	W/(m•K)	305,00
Yield stress R_e	N/mm ²	65	Specific heat capacity c	kJ/(kg•K)	0,386
Wall roughness k	mm	0,0015	Thermal expansion coefficient α	K ⁻¹	16,8 • 10 ⁻⁶

3.3.2 Dimensions resp. Types / Heat Loss and Capacity

Dimensions Copper Pipe Cu-DHP/R 220			Jacket-Pipe Outside-Ø D_a in mm	Delivery- length in 1m steps L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without Water G in kg/m
Type	Outside- Ø d_a in mm	Wall- thickness s in mm					
isocu - 22	22,0	1,0	65	max. 360	2200	0,8	1,14
isocu - 28	28,0	1,2	75	max. 360	2200	0,8	1,57
isocu - 22+22	2 • 22,0	1,0	90	max. 200	2300	0,9	1,80
isocu - 28+28	2 • 28,0	1,2	90	max. 200	2300	0,9	2,40

Type	Dimensioning						Heat Loss			
	Water- content v in l/m	Volume- flow V' in m ³ /h	Flow- speed w in m/s	Transmittable capacity P in kW at spread			Coefficient $u_{ER/DR}$ in W/(m•K)	q per pipe meter in W/m at average temperature T_M		
				20 K	30 K	40 K		70 K	60 K	50 K
isocu - 22	0,314	0,57-1,13	0,5 - 1,0	13 - 26	20 - 39	26 - 53	0,1282	8,974	7,692	6,410
isocu - 28	0,515	0,93-1,85	0,5 - 1,0	22 - 43	32 - 65	43 - 86	0,1397	9,777	8,381	6,984
isocu - 22+22	0,314	0,57-1,13	0,5 - 1,0	13 - 26	20 - 39	26 - 56	0,1894	13,257	11,365	9,473
isocu - 28+28	0,515	0,93-1,85	0,5 - 1,0	22 - 43	32 - 65	43 - 86	0,2537	17,757	15,222	12,688

Basis of the values see previous page.

3.4.1 Carrier Pipe / Connection Technology / Operating Conditions

Carrier Pipe

The **isopex**-pipe consists of cross-linked (**X**) **PE-Xa**, basic material **PE**, with peroxide (**a**) added during extrusion. General material requirements acc. to DIN 16892, pipe series respectively measures acc. to DIN 16893.

Resistant to aggressive chemicals and water.

PolyEthylene is an organic connection of carbon- and hydrogen molecules. For **PolyEthylene-cross-linked (X)** H-atoms will be removed out of the molecule chains, irreversible carbon-connections will develop, which will form a cross link between the chains. During extrusion of **PE** peroxide (**a**) will be added, the oxygen will bind the hydrogen atoms. The mechanical high resistant, but not weldable material **PE-Xa** comes into being.



Heating pipe: Pipe-range 1; series 5; SDR 11; operating pressure max. 6 bar, PN 12,5; with red coloured organic oxygen diffusion barrier of E/VAL (Ethylvenylalcohol) acc. to DIN 4726. According to AGFW-information FW 420 „District Heating pipelines with plastic-carrier pipes (PMR)“.

Sanitary pipe: Pipe-range 2; series 3,20; SDR 7,40; operating pressure max. 10 bar, PN 20; tested acc. to DVGW- documentation W 531, with DVGW- and ÖVGW-inspection mark.

Connection Technology

The connection of **PE-Xa**-pipes is made in buried sections preferably with press resp. clamp connections- and connection pieces, see **chapter 3.6.5**. Inside of buildings as well as for sanitary installations also screwed connections may be used. Electric welded connections are available on request.

Operating Conditions

Maximum continuous operating temp.: 80 °C acc. to EN 15632-2

Permissible short-term peak temp. T_{max} : 95 °C acc. to EN 15632-2

Maximum operating pressure p_B : 6/10 bar

Leak detecting: without

Possible liquids: potable and heating water, chemicals as well as other material resistant liquids

Pipe systems according to EN 15632-2 are designed with the following temperature profile for a service life of at least 30 years of age:
 29 years at 80 °C + 1 year at 90 °C + 100 hours at 95 °C
 Other temp. / time profiles are applicable to ISO 13760 (Miner's rule).
 The maximum operating temperature must not exceed 95 °C.

Technical data PE-Xa at 20° C					
Property	Unit	Value	Property	Unit	Value
Volume weight ρ	kg/dm ³	0,938	Elastic modulus E	N/mm ²	600
Tensile stress R_m	N/mm ²	≥ 20	Thermal conductivity λ	W/(m•K)	0,38
Yield stress R_e	N/mm ²	17	Specific heat capacity c	kJ/(kg•K)	2,3
Wall roughness k	mm	0,007	Thermal expansion coefficient α	K ⁻¹	15,0 • 10 ⁻⁵

Due to the production principle of **isopex**-pipes a longitudinal water tight compound system comes into being, that means the three materials (**PE-Xa**, PUR-foam, PELD) are connected by axial force with each other. At increasing temperature the E-modulus of the carrier pipe is getting smaller and will cause only very slight tension. Because of soil-embedding the tension will be additionally reduced and in case of a compound system like **isopex**, the axial heat extension will be nearly totally suppressed.

That means, **isopex**-pipes may be designed without expansion components and at building entries without anchors, due to the compound.

3.4 isopex

3.4.2 Dimensions resp. Types

Single Pipe Heating - 6 bar

Dimensions PE-Xa-Pipe			Jacket-Pipe Outside-Ø D_a in mm	Delivery- length in 1,00 m steps L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without water G in kg/m
Type	Outside- Ø d_a in mm	Wall- thickness s in mm					
H - 25 / H - 25 v	25,0	2,3	75 / 90	≤ 360 / 250	2530	0,7 / 0,8	0,82 / 1,03
H - 32 / H - 32 v	32,0	2,9	75 / 90	≤ 360 / 250	2530	0,8 / 0,8	0,90 / 1,10
H - 40 / H - 40 v	40,0	3,7	90 / 110	≤ 250 / 200	2530	0,8 / 0,9	1,22 / 1,62
H - 50 / H - 50 v	50,0	4,6	110 / 125	≤ 250 / 170	2530 / 2550	0,9 / 1,0	1,79 / 2,06
H - 63 / H - 63 v	63,0	5,8	125 / 140	≤ 170 / 150	2550 / 2690	1,0 / 1,1	2,35 / 2,82
H - 75 / H - 75 v	75,0	6,8	140 / 160	≤ 150 / 120	2690 / 2700	1,1 / 1,2	3,14 / 3,58
H - 90 / H - 90 v	90,0	8,2	160 / 180	≤ 120 / 85	2700 / 2800	1,2 / 1,4	4,07 / 4,65
H - 110	110,0	10,0	180	max. 85	2700	1,4	5,43
H - 125	125,0	11,4	180	max. 85	2700	1,4	6,14
H - 125 Stg.	125,0	11,4	225	only as pipe bar		2,2	7,85
H - 160 Stg.	160,0	14,6	250	in 12 m available		3,0	10,78

Double Pipe Heating - 6 bar

Dimensions PE-Xa-Pipe			Jacket-Pipe Outside-Ø D_a in mm	Delivery- length in 1,00 m steps L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without water G in kg/m
Type	Outside- Ø d_a in mm	Wall- thickness s in mm					
H - 20 + 20	2 • 20,0	2,0	75	max. 360	2500	0,9	0,71
H - 25 + 25 / H - 25 + 25 v	2 • 25,0	2,3	90 / 110	250 / 200	2500 / 2530	0,9 / 0,9	0,92 / 1,19
H - 32 + 32 / H - 32 + 32 v	2 • 32,0	2,9	110 / 125	200 / 150	2500 / 2550	0,9 / 1,0	1,34 / 1,50
H - 40 + 40 / H - 40 + 40 v	2 • 40,0	3,7	125 / 140	150 / 120	2500 / 2700	1,0 / 1,1	1,74 / 2,10
H - 50 + 50 / H - 50 + 50 v	2 • 50,0	4,6	160 / 180	120 / 85	2800 / 2800	1,2 / 1,4	2,71 / 3,08
H - 63 + 63	2 • 63,0	5,8	180	max. 85	2800	1,4	3,67

Single Pipe Sanitary - 10 bar

Dimensions PE-Xa-Pipe			Jacket-Pipe Outside-Ø D_a in mm	Delivery- length in 1,00 m steps L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without water G in kg/m
Type	Outside- Ø d_a in mm	Wall- thickness s in mm					
S - 25	25,0	3,5	75	24 - 360	2530	0,7	0,89
S - 32	32,0	4,4	75	24 - 360	2530	0,8	1,01
S - 40	40,0	5,5	90	24 - 250	2530	0,8	1,39
S - 50	50,0	6,9	110	24 - 200	2530	0,9	2,05
S - 63	63,0	8,7	125	24 - 150	2550	1,0	2,77

Single pipe heating - 6 bar may be used for dimensions > S - 63, providing that operation pressure will be maximum 6 bar. Admissible operating pressure p_B see chapter 3.4.3.

Double Pipe Sanitary - 10 bar

Dimensions PE-Xa-Pipe			Jacket-Pipe Outside-Ø D_a in mm	Delivery- length in 1,00 m steps L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without water G in kg/m
Type	Outside- Ø d_a in mm	Wall- thickness s in mm					
S - 25 + 20	25,0 / 20,0	3,5 / 2,8	90	24 - 250	2530	0,9	0,98
S - 32 + 20	32,0 / 20,0	4,4 / 2,8	110	24 - 200	2530	0,9	1,37
S - 40 + 25	40,0 / 25,0	5,5 / 3,5	125	24 - 150	2550	1,0	1,78
S - 50 + 32	50,0 / 32,0	6,9 / 4,4	140	24 - 140	2690	1,1	2,53
S - 63 + 32	63,0 / 32,0	8,7 / 4,4	160	24 - 120	2700	1,2	3,23

3.4.3 Heat Loss and Capacity (Dimensions)

Single Pipe Heating - 6 bar

Type	Dimensioning						Heat Loss			
	Water-content v in l/m	Volume-flow V' in m ³ /h	Flow-speed w in m/s	Transmittable capacity P in kW at spread			Coefficient u_{ER} in W/(m ² ·K)	q per pipe meter in W/m at average temperature T_M		
				20 K	30 K	40 K		70 K	60 K	50 K
H - 25	0,327	0,59 - 1,18	0,5 - 1,0	14 - 27	21 - 41	27 - 55	0,1246	8,719	7,473	6,228
H - 32	0,539	1,17 - 2,33	0,6 - 1,2	27 - 54	41 - 81	54 - 108	0,1582	11,077	9,495	7,912
H - 40	0,835	1,80 - 3,61	0,6 - 1,2	42 - 84	63 - 126	84 - 168	0,1646	11,525	9,879	8,232
H - 50	1,307	3,30 - 6,59	0,7 - 1,4	77 - 153	115 - 230	153 - 307	0,1693	11,854	10,160	8,467
H - 63	2,075	5,23 - 10,5	0,7 - 1,4	122 - 243	182 - 365	243 - 487	0,1921	13,449	11,528	9,607
H - 75	2,961	8,53 - 17,1	0,8 - 1,6	198 - 397	298 - 595	397 - 793	0,2109	14,764	12,655	10,546
H - 90	4,254	12,3 - 24,5	0,8 - 1,6	285 - 570	428 - 855	570 - 1140	0,2264	15,851	13,587	11,322
H - 110	6,362	20,6 - 41,2	0,9 - 1,8	479 - 959	719 - 1438	959 - 1918	0,2608	18,257	15,649	13,041
H - 125	8,203	26,6 - 53,2	0,9 - 1,8	618 - 1237	927 - 1855	1237 - 2473	0,3390	23,730	20,340	16,950
H - 125 Stg.	8,203	26,6 - 53,2	0,9 - 1,8	618 - 1237	927 - 1855	1237 - 2473	0,2245	15,717	13,472	11,226
H - 160 Stg.	13,437	48,4 - 96,7	1,0 - 2,0	1125 - 2250	1688 - 3376	2250 - 4501	0,2883	20,179	17,296	14,413
H - 25 v	0,327	0,59 - 1,18	0,5 - 1,0	14 - 27	21 - 41	27 - 55	0,1072	7,506	6,434	5,362
H - 32 v	0,539	1,17 - 2,33	0,6 - 1,2	27 - 54	41 - 81	54 - 108	0,1313	9,191	7,878	6,565
H - 40 v	0,835	1,80 - 3,61	0,6 - 1,2	42 - 84	63 - 126	84 - 168	0,1342	9,396	8,054	6,711
H - 50 v	1,307	3,30 - 6,59	0,7 - 1,4	77 - 153	115 - 230	153 - 307	0,1470	10,288	8,819	7,349
H - 63 v	2,075	5,23 - 10,5	0,7 - 1,4	122 - 243	182 - 365	243 - 487	0,1681	11,766	10,085	8,404
H - 75 v	2,961	8,53 - 17,1	0,8 - 1,6	198 - 397	298 - 595	397 - 793	0,1761	12,330	10,568	8,807
H - 90 v	4,254	12,3 - 24,5	0,8 - 1,6	285 - 570	428 - 855	570 - 1140	0,1915	13,402	11,488	9,573

Double Pipe Heating - 6 bar

Type	Dimensioning						Heat Loss			
	Water-content v in l/m	Volume-Flow V' in m ³ /h	Flow-speed w in m/s	Transmittable Capacity P in kW at spread			Coefficient u_{DR} in W/(m ² ·K)	q per Pipe Meter in W/m at average Temperature T_M		
				20 K	30 K	40 K		70 K	60 K	50 K
H - 20 + 20	0,201	0,36 - 0,72	0,5 - 1,0	8 - 17	13 - 25	17 - 34	0,2107	14,743	12,639	10,535
H - 25 + 25	0,327	0,59 - 1,18	0,5 - 1,0	14 - 27	21 - 41	27 - 55	0,2148	15,033	12,887	10,742
H - 32 + 32	0,539	1,17 - 2,33	0,6 - 1,2	27 - 54	41 - 81	54 - 108	0,2346	16,419	14,076	11,732
H - 40 + 40	0,835	1,80 - 3,61	0,6 - 1,2	42 - 84	63 - 126	84 - 168	0,2638	18,462	15,827	13,192
H - 50 + 50	1,307	3,30 - 6,59	0,7 - 1,4	77 - 153	115 - 230	153 - 307	0,2464	17,243	14,783	12,322
H - 63 + 63	2,075	5,23 - 10,5	0,7 - 1,4	122 - 243	182 - 365	243 - 487	0,2935	20,542	17,610	14,678
H - 25 + 25 v	0,327	0,59 - 1,18	0,5 - 1,0	14 - 27	21 - 41	27 - 55	0,1744	12,206	10,464	8,721
H - 32 + 32 v	0,539	1,17 - 2,33	0,6 - 1,2	27 - 54	41 - 81	54 - 108	0,1975	13,823	11,850	9,877
H - 40 + 40 v	0,835	1,80 - 3,61	0,6 - 1,2	42 - 84	63 - 126	84 - 168	0,2223	15,557	13,337	11,116
H - 50 + 50 v	1,307	3,30 - 6,59	0,7 - 1,4	77 - 153	115 - 230	153 - 307	0,2103	14,717	12,617	10,517

Admissible Operating Pressure p_B in bar

Duration	Permanent Operating Temperature T_B in °C									
	10°	20°	30°	40°	50°	60°	70°	80°	90°	95°
1 year	17,9	15,8	14,0	12,5	11,1	9,9	8,9	8,0	7,2	6,8
5 years	17,5	15,5	13,8	12,2	10,9	9,7	8,7	7,8	7,0	6,6
10 years	17,4	15,4	13,7	12,1	10,8	9,7	8,6	7,7	6,9	---
25 years	17,2	15,2	13,5	12,0	10,7	9,5	8,5	7,6	---	---
50 years	17,1	15,1	13,4	11,9	10,6	9,5	8,5	---	---	---

The mentioned data are corresponding to DIN 16893 for flow medium water with a safety factor of $S_D = 1,25$.

3.4 isopex

Single Pipe Sanitary - 10 bar

Type	Dimensioning							Heat Loss			
	Water-content v in l/m	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Coefficient u_{ER} in W/(m•K)	q per Pipe Meter in W/m at average Temperature T_M		
	60 K	50 K	40 K								
S - 25	0,254	1,099	1,2	1,191	1,3	1,283	1,4	0,1237	7,425	6,187	4,950
S - 32	0,423	1,826	1,2	1,978	1,3	2,131	1,4	0,1570	9,419	7,849	6,279
S - 40	0,661	2,853	1,2	3,091	1,3	3,329	1,4	0,1633	9,780	8,166	6,533
S - 50	1,029	4,446	1,2	4,817	1,3	5,187	1,4	0,1679	10,075	8,396	6,717
S - 63	1,633	7,055	1,2	7,643	1,3	8,231	1,4	0,1903	11,418	9,515	7,612

Double Pipe Sanitary - 10 bar

Type	Dimensioning							Heat Loss			
	Water-content v in l/m	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Volume-Flow V' in m ³ /h	Flow-Speed w in m/s	Coefficient u_{DR} in W/(m•K)	q per Pipe Meter in W/m at average Temperature T_M		
	60 K	50 K	40 K								
S-25+20	0,254	1,374	1,5	1,466	1,6	1,557	1,7	0,1930	11,578	9,674	7,769
S-32+20	0,423	2,283	1,5	2,435	1,6	2,587	1,7	0,1893	11,356	9,510	7,664
S-40+25	0,661	3,567	1,5	3,805	1,6	4,042	1,7	0,2053	12,319	10,319	8,319
S-50+32	1,029	5,558	1,5	5,928	1,6	6,299	1,7	0,2348	14,086	11,800	9,514
S-63+32	1,633	8,819	1,5	9,407	1,6	9,995	1,7	0,2765	16,588	13,928	11,267

The mentioned data are based on a medium specific thermal capacity [c_m] of the water of 4187 J/(kg•K), a soil covering height [\ddot{U}_H] of 0,60 m, a thermal conductivity of the soil [λ_E] of 1,2 W/(m•K), a medium soil temperature [T_E] of 10 °C and for single pipes on a carrier pipe distance of 100 mm. The flow speed [w] has to be determined specifically.

$T_M = (T_{VL} + T_{RL}) : 2 - T_E$; Example: $(80^\circ + 60^\circ) : 2 - 10^\circ = 60$ K average temperature.

Admissible Operating Pressure p_B in bar - Sanitary

Duration	Permanent Operating Temperature T_B in °C									
	10°	20°	30°	40°	50°	60°	70°	80°	90°	95°
1 year	28,3	25,1	22,3	19,8	17,7	15,8	14,1	12,7	11,4	10,8
5 years	27,8	24,6	21,9	19,4	17,3	15,5	13,8	12,4	11,1	---
10 years	27,6	24,4	21,7	19,3	17,2	15,3	13,7	12,3	11,0	---
25 years	27,3	24,2	21,4	19,1	17,0	15,2	13,6	12,1	---	---
50 years	27,1	24,0	21,3	18,9	16,8	15,0	13,4	---	---	---

The mentioned data are corresponding to DIN 16893 for flow medium water with a safety factor of $S_D = 1,25$.

3.5.1 Carrier Pipe / Connection Technology / Operating Conditions

Carrier Pipe

The **isoclima** pipe consists of a seamless extruded, impact- and shatter-resistant, ductile and stable high-density polyurethane known as polyethylene 100. General quality requirements, pipe series, and measurements according to DIN 8075, DIN 8074 / DIN EN 12201-2. Polyethylene 100 pipes are tested for drinking water suitability and tested in accordance with DVGW Directive W270.



Connection Technology

The connection of the **isoclima** pipe occurs in underground sections, preferably using weldable PE-HD joints; butt welds and screw-type connections are also options. A wide range of connection components is available.

Operating Conditions

Maximum operating temperature T_{max} :	+30 °C
Minimum operating temperature T_{min} :	-20 °C
Maximum operating pressure p_B :	16 bar
Leak detecting:	without

3.5.2 Dimensions resp. Types / Energy Loss and Capacity

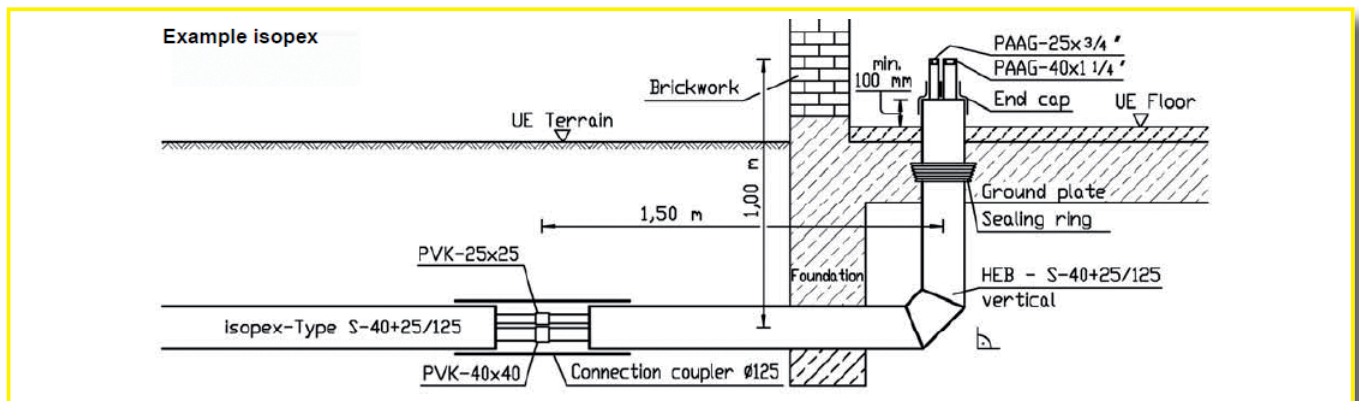
Series 1								
Dimensions PE100-Pipe			Jacket-Pipe Outside-Ø D_a in mm	Maximum Delivery length L in m	Maximum coil- outside-Ø d_R in mm	Minimum- bending radius r in m	Weight without Water G in kg/m	Heat- Loss coefficient u-Value in W/(m•K)
Type	Outside- Ø d_a in mm	Wall- thickness s in mm						
isoclima-20	20,0	2,0	65	250	2500	0,8	0,66	0,1115
isoclima-25	25,0	2,3	75	250	2500	0,8	0,82	0,1188
isoclima-32	32,0	2,9	75	250	2500	0,9	0,90	0,1511
isoclima-40	40,0	3,7	90	200	2500	0,9	1,23	0,1573
isoclima-50	50,0	4,6	110	200	2500	1,0	1,80	0,1617
isoclima-63	63,0	5,8	125	150	2500	1,1	2,37	0,1836
isoclima-75	75,0	6,8	140	140	2700	1,2	3,15	0,2017
isoclima-90	90,0	8,2	160	120	2700	1,4	4,10	0,2166
isoclima-110	110,0	10,0	160	85	2700	1,4	4,89	0,3173
isoclima-110	110,0	10,0	180	85	2700	1,4	5,47	0,2498

3.6 Flexible pipe preformed parts

3.6.1 General

Depending on the application form parts such as elbows, branches will be delivered on request as well as custom molded parts from the PJP program if required.

3.6.2 House Entry Elbow 90°



House-entry-elbows are useful for connecting buildings without cellars by passing the concrete ground-plate of the house. They will be produced generally in standard lengths of 1,00 x 1,50 m. Depending from kind of flexible pipe with steel, copper, PE-Xa or PE100-carrier pipe. For post insulation of the connection spot in the soil a jacket pipe connecting coupler will be required, see Design-Manual, **chapter 6**.

In case of **isopex**-pipes the connection with the continuing pipe will be made inside of the building by using connection couplers with welding ends or outside threads, see **chapter 3.6.5**.

Orders of house-entry-elbows should clearly indicate all carrier- and jacket pipe dimensions respectively -type and operating pressure. In case of double pipes additionally the position of the bend, vertical (s), horizontal (w) or falling (f) should be mentioned. In case of different carrier pipe diameters, the position of the smaller carrier pipe diameter will be generally in 12:00 o'clock position.

Example of order:

House-Entry-Elbow (HEB) isoflex:

Single: HEB - 28 / 75
for isoflex - Standard

House-Entry-Elbow (HEB) isocu:

Double: HEB-s - 2 x 28 / 90
for isocu - Double 28 + 28

House-Entry-Elbow isopex-Heating:

Single: HEB - 40 / 90, 6 bar
for isopex-Heating Type H-40

Double: HEB-s - 63 + 63 / 180, 6 bar
for isopex-Heating Type H-63+63

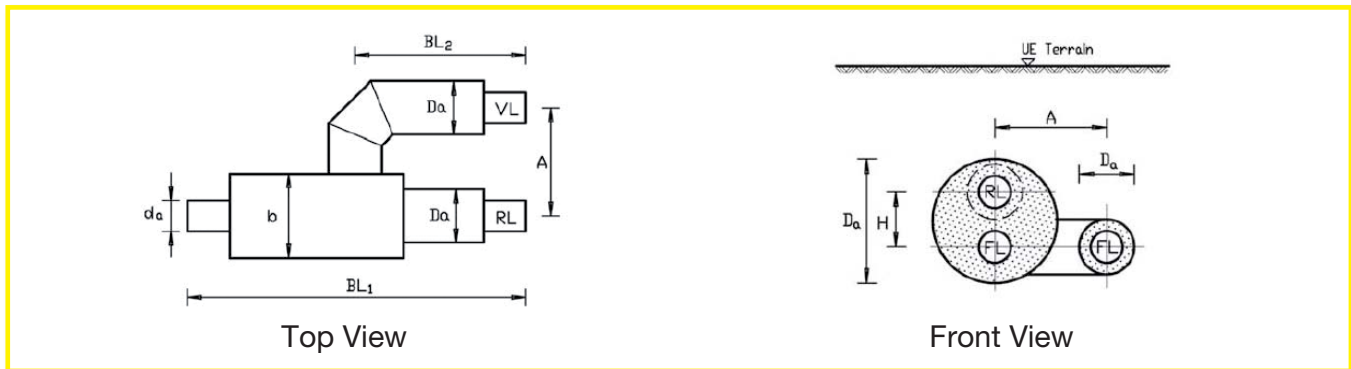
House-Entry-Elbow isopex-Sanitary:

Single: HEB - 32 / 75, 10 bar
for isopex-Sanitary Type S-32

Double: HEB-s - 50 + 32 / 140, 10 bar
for isopex-Sanitary Type S-50+32

Carrier- and jacket-pipe dimensions **isoflex** see **chapter 3.2.2**, **isocu** see **chapter 3.3.2** and **isopex** see **chapter 3.4.2**. All connection couplings, protection- and end caps as well as jacket-pipe couplers are not included within the delivery of the elbow. **isoclima**-preformed parts available on request.

3.6.3 Bifurcated Pipe



Bifurcated pipes are used for transition of two single pipes to one double pipe and are produced generally with the same dimensions. For **isoflex**-applications, bifurcated pipes will consist of steel carrier pipe, for **isopex**-Heating and **isopex**-Sanitary of crosslinked PE-Xa. In relation with **isocu** they will consist of copper pipes according to DIN 1754/17671.

For post insulation of the connection spots in the soil, corresponding connection couplers will be required, according to the jacket-pipe dimensions, see Design-Manual, **chapter 6**. The connection has to be ensured to the requirements of the advanced systems.

Orders of bifurcated pipes should clearly indicate **all** carrier- and jacket-pipe dimensions respectively kind and operating pressure. In case of double pipes the position of the smaller dimension will be generally in 12:00- o'clock position.

Example of order:

Bifurcated Pipe (HR-I) isoflex:

HR-I for **isoflex**, 2 x Single 28 / 75
to 1 x Double **28 + 28 / 110**

Bifurcated Pipe (HR-I) isocu:

HR-I for **isocu**, 2 x Single 22 / 65
to 1 x Double **22 + 22 / 90**

Bifurcated Pipe (HR-I) isopex-Heating:

HR-I for **isopex**-Heating, 6 bar
2 x Single **H - 63 / 125**
to 1 x Double **H - 63 + 63 / 180**

Bifurcated Pipe (HR-I) isopex-Sanitary:

HR-I for **isopex**-Sanitary, 10 bar
2 x Single **S - 50 / 110** and **S - 32/75**
to 1 x Double **S - 50 + 32 / 140**

Carrier- and jacket-pipe dimensions **isoflex** see **chapter 3.2.2**, **isocu** see **chapter 3.3.2** and **isopex** **chapter 3.4.2**. All connection couplings as well as jacket-pipe couplers are not included within the delivery of a bifurcated pipe. Due to manufacturing reasons the jacket-pipe dimensions may differ partly from the PELD-dimensions of the flexible pipes. Available dimensions and measures on request.

During assembling the correct position of single- and double pipes, respectively the position of the bifurcated pipe as well as the axial measures A and H has to be considered. The condition for expansion compensation (L-, Z, or U-elbow) has to be provided at the transitions of the single-pipe system before the bifurcated pipe, because bifurcated pipes have to be installed generally at pipe-static neutral pipeline spots. In case of changing of the system within an exit-pipe of a branch, between branch and bifurcated pipe a rigid fitting part of at least 2,50 m lengths has to be installed for compensation of lateral expansion.

3 FLEXIBLE COMPOUND SYSTEMS



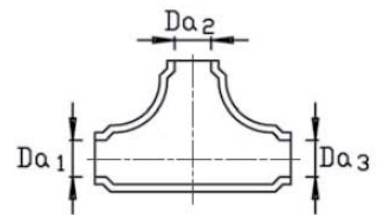
3.6 Flexible pipe preformed parts

3.6.4 GFK-Assembling Fittings

GFK-Assembling-Branch 90°

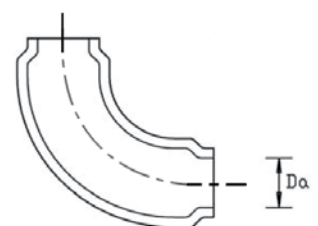


Passage in mm		Branch resp. Exit D_{a2} in mm							
D_{a1}	D_{a3}	65	75	90	110	125	140	160	180
65	65	✓							
75	65	✓	✓						
75	75	✓	✓						
90	65	✓	✓	✓					
90	75	✓	✓	✓					
90	90	✓	✓	✓					
110	65	✓	✓	✓	✓				
110	75	✓	✓	✓	✓				
110	90	✓	✓	✓	✓				
110	110	✓	✓	✓	✓				
125	75	✓	✓	✓	✓	✓			
125	90	✓	✓	✓	✓	✓			
125	110	✓	✓	✓	✓	✓			
125	125	✓	✓	✓	✓	✓			
140	90	✓	✓	✓	✓	✓	✓		
140	110	✓	✓	✓	✓	✓	✓		
140	125	✓	✓	✓	✓	✓	✓		
140	140	✓	✓	✓	✓	✓	✓		
160	110	--	✓	✓	✓	✓	✓	✓	
160	125	--	✓	✓	✓	✓	✓	✓	
160	140	--	✓	✓	✓	✓	✓	✓	
160	160	--	✓	✓	✓	✓	✓	✓	
180	125	--	--	✓	✓	✓	✓	✓	✓
180	140	--	--	✓	✓	✓	✓	✓	✓
180	160	--	--	✓	✓	✓	✓	✓	✓
180	180	--	--	✓	✓	✓	✓	✓	✓



GFK-Assembling-Elbow 90°

D_a in mm	Elbow
65	--
75	✓
90	✓
110	✓
125	✓
140	✓
160	✓
180	✓



GFK-Assembling-Branch 90° / GFK-Assembling-Elbow 90°

Orders for GFK-fittings should clearly indicate the corresponding jacket pipe dimensions [D_a] or/and the flexible pipe types. All half shells consist of a break proof fibre glass polyester (GFK). The delivery includes the two shells and the required quantity of stainless-hexagon-screws M8 x 40, sealing stripes made of butyl-rubber, eventually required reducing rings, brass threaded-valve including closing cap for the PUR-foam filling-hole, as well as the corresponding quantity of ready-made foam portion.

Example of order:**GFK-Assembling-Branch, passage x branch x passage (D_{a1} x D_{a2} x D_{a3}):**

isopex: **GFK-T - 140 x 110 x 125**
for isopex, Type **H-75 to H-50 to H-63**

isocu: **GFK-T - 75 x 65 x 75**
for isocu, Type **28 to 22 to 28**

GFK-Assembling-Elbow:

isopex: **GFK-B - 180**
for isopex, Type **H-63+63**

isoflex: **GFK-B - 90**
for isoflex, Type **28 v**

Further information see **chapter 11.3.11.**

3 FLEXIBLE COMPOUND SYSTEMS

3.6 Flexible pipe preformed parts

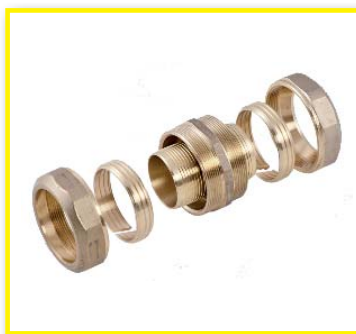
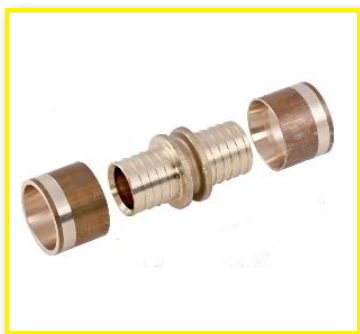
3.6.5 Components Carrier Pipe isopex

Connecting- and Elbow-Coupling

Dimensions PE-Xa-Pipe	Heating - 6 bar						Sanitary - 10 bar					
	Press		Screw		Clamp		Press		Screw		Clamp	
	Conn.	Elbow	Conn.	Elbow	Conn.	Elbow	Conn.	Elbow	Conn.	Elbow	Conn.	Elbow
	PVK	PBK	SVK	SBK	KVK	KBK	PVK	PBK	SVK	SBK	KVK	KBK
20 x 20	--	--	--	--	✓	✓	✓	✓	✓	✓	✓	✓
25 x 25	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
32 x 32	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
40 x 40	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
50 x 50	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
63 x 63	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
75 x 75	✓	✓	✓	✓	--	--	--	--	--	--	--	--
90 x 90	✓	✓	✓	✓	--	--	--	--	--	--	--	--
110 x 110	✓	✓	✓	✓	--	--	--	--	--	--	--	--
125 x 125	✓	✓	✓	✓	--	--	--	--	--	--	--	--
160 x 160	✓	✓	✓	✓	--	--	--	--	--	--	--	--

Conn. = Connecting-Coupling

Elbow = Elbow-Coupling



Orders for connecting- or/and elbow-couplings (90° bends) should bear the exact description, operating pressure and kind of connection to the **isopex**-pipe ends, for which press fittings, screwable or clampable connections can be used.

For buried sections as well as for heating installations (6 bar) generally press fittings or clamp fittings should be used. Inside of buildings in manholes as well as for sanitary applications (10 bar) also screwed connections can be used.

Example of order:**Press-Connection-Coupling (PVK):**

Heating: PVK - 110 x 110, 6 bar,
with press fittings
for **isopex-Heating Type H-110**

Sanitary: PVK - 25 x 25, 10 bar,
with press fittings
for **isopex-Sanitary Type S-25**

Press-Elbow-Coupling (PBK):

Heating: PBK - 90 x 90, 6 bar,
with press fittings
for **isopex-Heating Type H-90**

Sanitary: PBK - 63 x 63, 10 bar,
with press fittings
for **isopex-Sanitary Type S-63**

Screw-Connection-Coupling (SVK):

Heating: SVK - 32 x 32, 6 bar,
with screw fittings
for **isopex-Heating Type H-32**

Sanitary: SVK - 50 x 50, 10 bar,
with screw fittings
for **isopex-Sanitary Type S-50**

Screw-Elbow-Coupling (SBK):

Heating: SBK - 75 x 75, 6 bar,
with screw fittings
for **isopex-Heating Type H-75**

Sanitary: SBK - 40 x 40, 10 bar,
with screw fittings
for **isopex-Sanitary Type S-40**

Clamp-Connection-Coupling (KVK):

Heating: KVK - 63 x 63, 6 bar,
with clamp fittings
for **isopex-Heating Type H-63**

Sanitary: KVK - 25 x 25, 10 bar,
with clamp fittings
for **isopex-Sanitary Type S-25**

Clamp-Elbow-Coupling (KBK):

Heating: KBK - 50 x 50, 6 bar,
with clamp fittings
for **isopex-Heating Type H-50**

Sanitary: KBK - 40 x 40, 10 bar,
with clamp fittings
for **isopex-Sanitary Type S-40**

According to type and dimension, press-connection-couplings and clamp-connection-couplings determined from **isoplus**, may consist of steel 435 GH or dezincification resistant brass MS58/M560 or red cast iron RG 7. Screw-connection-couplings generally acc. to DIN 8076 in heavy brass quality.

3 FLEXIBLE COMPOUND SYSTEMS

3.6 Flexible pipe preformed parts

Reducing-Coupling

Dimensions PE-Xa-Pipe	Heating - 6 bar			Sanitary - 10 bar		
	Press	Screw	Clamp	Press	Screw	Clamp
	Reduction	Reduction	Reduction	Reduction	Reduction	Reduction
	PRK	SRK	KRK	PRK	SRK	KRK
25 x 20	✓	✓	✓	✓	✓	✓
32 x 20	✓	✓	✓	✓	✓	✓
32 x 25	✓	✓	✓	✓	✓	✓
40 x 25	✓	✓	✓	✓	✓	✓
40 x 32	✓	✓	✓	✓	✓	✓
50 x 32	✓	✓	✓	✓	✓	✓
50 x 40	✓	✓	✓	✓	✓	✓
63 x 40	✓	✓	✓	✓	✓	✓
63 x 50	✓	✓	✓	✓	✓	✓
75 x 50	✓	✓	✓	--	--	--
75 x 63	✓	✓	✓	--	--	--
90 x 63	✓	✓	✓	--	--	--
90 x 75	✓	✓	✓	--	--	--
110 x 75	✓	✓	✓	--	--	--
110 x 90	✓	✓	✓	--	--	--
125 x 90	✓	--	✓	--	--	--
125 x 110	✓	--	✓	--	--	--
160 x 110	✓	--	✓	--	--	--
160 x 125	✓	--	✓	--	--	--



Orders for reducing-couplings should bear the exact description, operating pressure and kind of connection to **isopex**-pipe ends, for which press fittings, screwable or clampable connections can be used.

For buried sections as well as for heating installations (6 bar) generally press fittings or clamp fittings should be used. Inside of buildings in manholes as well as for sanitary applications (10 bar) also screwable connections can be used.

Example of order:**Press-Reducing-Coupling (PRK):**

Heating: PRK - 110 x 75, 6 bar,
with press fittings
for **isopex-Heating Type H-110 to H-75**

Sanitary: PRK - 25 x 20, 10 bar,
with press fittings
for **isopex-Sanitary Type S-25 to S-20**

Screw-Reducing-Coupling (SRK):

Heating: SRK - 32 x 25, 6 bar,
with screw fittings
for **isopex-Heating Type H-32 to H-25**

Sanitary: SRK - 50 x 32, 10 bar,
with screw fittings
for **isopex-Sanitary Type S-50 to S-32**

Clamp-Reducing-Coupling (KRK):

Heating: KRK - 40 x 32, 6 bar,
with clamp fittings
for **isopex-Heating Type H-40 to H-32**

Sanitary: KRK - 25 x 20, 10 bar,
with clamp fittings
for **isopex-Sanitary Type S-25 to S-20**

According to type and dimension, press-reducing-couplings and clamp-reducing-couplings determined from **isoplus**, may consist of steel 435 GH or dezincification resistant brass MS58/M560 or red cast iron RG 7. Screw-reducing-couplings generally acc. to DIN 8076 in heavy brass quality.

3 FLEXIBLE COMPOUND SYSTEMS

3.6 Flexible pipe preformed parts

Alignment-Coupling inside of building with Welding-End or Outside-Thread

Dimensions PE-Xa- Pipe	Heating - 6 bar						Sanitary - 10 bar					
	Press		Screw		Clamp		Press		Screw		Clamp	
	SE	AG	SE	AG	SE	AG	SE	AG	SE	AG	SE	AG
	PASE	PAAG	SASE	SAAG	KASE	KAAG	PASE	PAAG	SASE	SAAG	KASE	KAAG
20 x 1/2"	--	--	--	--	--	--	--	✓	--	✓	--	✓
25 x 3/4"	✓	✓	✓	✓	✓	✓	--	✓	--	✓	--	✓
32 x 1"	✓	✓	✓	✓	✓	✓	--	✓	--	✓	--	✓
40 x 1 1/4"	✓	✓	✓	✓	✓	✓	--	✓	--	✓	--	✓
50 x 1 1/2"	✓	✓	✓	✓	✓	✓	--	✓	--	✓	--	✓
63 x 2"	✓	✓	✓	✓	✓	✓	--	✓	--	✓	--	✓
75 x 2 1/2"	✓	✓	✓	✓	✓	✓	--	--	--	--	--	--
90 x 3"	✓	✓	✓	✓	✓	✓	--	--	--	--	--	--
110 x 4"	✓	✓	✓	✓	✓	✓	--	--	--	--	--	--
125 x 5"	✓	✓	--	--	✓	✓	--	--	--	--	--	--
160 x 6"	✓	✓	--	--	✓	✓	--	--	--	--	--	--

SE = Welding-End AG = Outside-Thread

All alignment-couplings with outside-thread (AG) acc. to DIN EN 10226 for connection of the following pipe line. The corresponding thread coupler acc. to DIN EN 10241 should be provided at site.



Orders for alignment-couplings should bear the exact description, operating pressure and kind of connection to **isopex**-pipe ends, for which press fittings, screwable or clampable connections can be used.

For buried sections as well as for heating installations (6 bar) generally press fittings or clamp fittings should be used. Inside of buildings in manholes as well as for sanitary applications (10 bar) also screwable connections can be used.

Example of Order:**Press-Alignment with Welding-End (PASE):**

Heating: PASE - 110 x 4", 6 bar,
with press fittings
for **isopex-Heating Type H-110**

Press-Alignment with Outside-Thread (PAAG):

Heating: PAAG - 90 x 3", 6 bar,
with press fittings
for **isopex-Heating Type H-90**

Sanitary: PAAG - 40 x 1", 10 bar,
with press fitting
for **isopex-Sanitary Type S-40**

Screw-Alignment with Welding-End (SASE):

Heating: SASE - 32 x 1", 6 bar,
with screw fittings
for **isopex-Heating Type H-32**

Screw-Alignment with Outside-Thread (SAAG):

Heating: SAAG - 25 x 3/4", 6 bar,
with screw fittings
for **isopex-Heating Type H-75**

Sanitary: SAAG - 63 x 2", 10 bar,
with screw fittings
for **isopex-Sanitary Type S-63**

Clamp-Alignment with Welding-End (KASE):

Heating: KASE - 63 x 2", 6 bar,
with clamp fittings
for **isopex-Heating Type H-63**

Clamp-Alignment with Outside-Thread (KAAG):

Heating: KASE - 32 x 1", 6 bar,
with clamp fittings
for **isopex-Heating Type H-32**

Sanitary: KASE - 63 x 2", 10 bar,
with clamp fittings
for **isopex-Sanitary Type S-63**

According to type and dimension, press-alignments and clamp-alignments determined from **isoplus**, may consist of steel 435 GH or dezincification resistant brass MS58/M560 or red cast iron RG 7. Screw-alignments generally acc. to DIN 8076 in heavy brass quality.

3 FLEXIBLE COMPOUND SYSTEMS

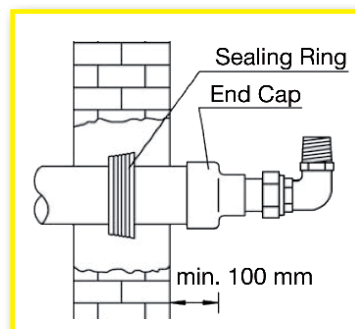


3.6 Flexible pipe preformed parts

Alignment-Angle 90° inside of building with one Outside-Thread

Dimensions PE-Xa-Pipe	Heating - 6 bar		Sanitary - 10 bar	
	Screw-Angle with Outside-Thread SWAG	Clamp-Angle with Outside-Thread KWAG	Screw-Angle with Outside-Thread SWAG	Clamp-Angle with Outside-Thread KWAG
20 x 1/2"	--	✓	✓	✓
25 x 3/4"	✓	✓	✓	✓
32 x 1"	✓	✓	✓	✓
40 x 1 1/4"	✓	✓	✓	✓
50 x 1 1/2"	✓	✓	✓	✓
63 x 2"	✓	✓	✓	✓
75 x 2 1/2"	✓	--	--	--
90 x 3"	✓	--	--	--
110 x 4"	✓	--	--	--
125 x 5"	✓	--	--	--
160 x 6"	✓	--	--	--

All 90°-alignment-angles with outside thread (AG) acc. to DIN 10226 for connection with the following pipe line. The corresponding thread coupler acc. to DIN 10241 should be provided at site.



Orders for alignment-angles should bear the exact description and operating pressure. The connection to the **isopex** pipe end is carried out as a screw or clamp connection, whereby the screw connections are only used at accessible material transitions in buildings or shafts.

Example of order:

Screw-Angle with Outside-Thread (SWAG):

Heating: SWAG - 90 x 3", 6 bar,
with screw fittings
for **isopex-Heating Type H-90**

Sanitary: SWAG - 63 x 2", 10 bar,
with screw fittings
for **isopex-Sanitary Type S-63**

Clamp-Angle with Outside-Thread (KWAG):

Heating: KWAG - 32 x 1", 6 bar,
with clamp fittings
for **isopex-Heating Type H-32**

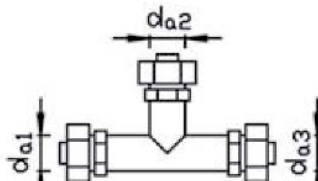
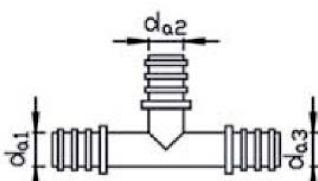
Sanitary: KASE - 63 x 2", 10 bar,
with clamped fittings
for **isopex-Sanitary Type S-63**

According to type and dimension, alignments-angles determined from **isoplus**, may consist of steel 435 GH or dezincification resistant brass MS58/M560 or red cast iron RG 7. Screw-angles generally acc. to DIN 8076 in heavy brass quality.

T-Piece - Heating, 6 bar

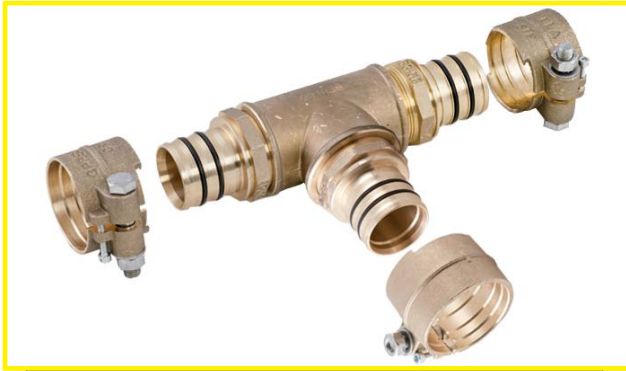


Passage		Press-T-Piece (PT)										Screw-T-Piece (ST)											
		Branch resp. soil pipe d_{a2}										Branch resp. soil pipe d_{a2}											
d_{a1}	d_{a3}	25	32	40	50	63	75	90	110	125	160	25	32	40	50	63	75	90	110	125	160		
25	25	✓										✓											
32	25	✓	✓									✓	✓										
32	32	✓	✓									✓	✓										
40	25	✓	✓	✓								✓	✓	✓									
40	32	✓	✓	✓	✓							✓	✓	✓	✓								
40	40	✓	✓	✓	✓							✓	✓	✓	✓								
50	25	✓	✓	--	✓							✓	✓	✓	✓	✓							
50	32	--	✓	✓	✓	✓						✓	✓	✓	✓	✓	✓						
50	40	✓	✓	✓	✓	--						✓	✓	✓	✓	✓	✓	✓					
50	50	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓				
63	32	--	--	--	--	✓						✓	✓	✓	✓	✓	✓						
63	40	--	--	✓	✓	--						✓	✓	✓	✓	✓	✓	✓					
63	50	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓				
63	63	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			
75	40	--	--	--	--	--	--					✓	✓	✓	✓	✓	✓	✓	✓				
75	50	--	--	--	--	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓			
75	63	✓	✓	✓	✓	✓	✓	--				✓	✓	✓	✓	✓	✓	✓	✓	✓			
75	75	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
90	50	--	--	--	--	--	--	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			
90	63	--	--	--	--	✓	✓	--				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
90	75	--	✓	✓	✓	--	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
90	90	--	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
110	75	--	--	--	✓	--	--	--	--			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
110	90	--	--	--	--	✓	--	--	--			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
110	110	--	--	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
125	90	on request										--	--	--	--	--	--	--	--	--	--	--	
125	110	on request										--	--	--	--	--	--	--	--	--	--	--	--
125	125	on request										--	--	--	--	--	--	--	--	--	--	--	--
160	110	on request										--	--	--	--	--	--	--	--	--	--	--	--
160	125	on request										--	--	--	--	--	--	--	--	--	--	--	--
160	160	on request										--	--	--	--	--	--	--	--	--	--	--	--



3 FLEXIBLE COMPOUND SYSTEMS

3.6 Flexible pipe preformed parts



Passage		Clamp-T-piece (KT)				
		Branch resp. soil pipe d_{a2}				
d_{a1}	d_{a3}	25	32	40	50	63
25	25	✓				
32	25	✓	✓			
32	32	✓	✓			
40	25	✓	✓	✓		
40	32	✓	✓	✓		
40	40	✓	✓	✓		
50	25	✓	✓	✓	✓	
50	32	✓	✓	✓	✓	
50	40	✓	✓	✓	✓	
50	50	✓	✓	✓	✓	
63	32	✓	✓	✓	✓	✓
63	40	✓	✓	✓	✓	✓
63	50	✓	✓	✓	✓	✓
63	63	✓	✓	✓	✓	✓

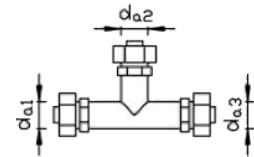
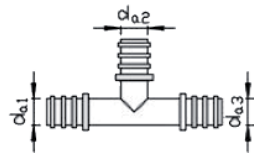


Orders for T-pieces should bear the three dimensions of the t-piece [d_{a1-3}], operating pressure and kind of connection to **isopex**-pipe ends, for which press fittings, screwable or clampable connections can be used.

For buried sections as well as for heating installations (6 bar) generally press fittings or clamp fittings should be used. Inside of buildings in manholes as well as for sanitary applications (10 bar) also screwed connections can be used. Other dimensions on request.

T-Piece - Sanitary, 10 bar

Passage		Press-T-Piece (PT)						Screw-T-Piece (ST)					
		Branch resp. soil pipe d_{a2}						Branch resp. soil pipe d_{a2}					
d_{a1}	d_{a3}	20	25	32	40	50	63	20	25	32	40	50	63
20	20	✓						✓					
25	20	✓	✓					✓	✓				
25	25	✓	✓					✓	✓				
32	20	✓	✓	✓				✓	✓	✓			
32	25	✓	✓	✓				✓	✓	✓			
32	32	✓	✓	✓				✓	✓	✓			
40	20	--	--	--	--			✓	✓	✓	✓		
40	25	--	--	--	--			✓	✓	✓	✓		
40	32	--	--	✓	--			✓	✓	✓	✓		
40	40	--	✓	✓	✓			✓	✓	✓	✓		
50	25	--	--	--	--	--		✓	✓	✓	✓	✓	
50	32	--	--	--	--	--		✓	✓	✓	✓	✓	
50	40	--	--	✓	--	--		✓	✓	✓	✓	✓	
50	50	--	--	✓	--	✓		✓	✓	✓	✓	✓	
63	32	--	--	--	--	--	--	✓	✓	✓	✓	✓	✓
63	40	--	--	--	--	--	--	✓	✓	✓	✓	✓	✓
63	50	--	--	✓	--	--	--	✓	✓	✓	✓	✓	✓
63	63	--	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Passage		Clamp-T-Piece (KT)					
		Branch resp. soil pipe d_{a2}					
d_{a1}	d_{a3}	20	25	32	40	50	63
20	20	✓					
25	20	✓	✓				
25	25	✓	✓				
32	20	✓	✓	✓			
32	25	✓	✓	✓			
32	32	✓	✓	✓			
40	20	✓	✓	✓	✓		
40	25	✓	✓	✓	✓		
40	32	✓	✓	✓	✓		
40	40	✓	✓	✓	✓		
50	25	✓	✓	✓	✓	✓	
50	32	✓	✓	✓	✓	✓	
50	40	✓	✓	✓	✓	✓	
50	50	✓	✓	✓	✓	✓	
63	32	✓	✓	✓	✓	✓	✓
63	40	✓	✓	✓	✓	✓	✓
63	50	✓	✓	✓	✓	✓	✓
63	63	✓	✓	✓	✓	✓	✓



Orders for T-pieces should bear the three dimensions of the t-piece [d_{a1-3}], operating pressure and kind of connection to **isopex**-pipe ends, for which press fittings, screwable or clampable connections can be used.

For buried sections as well as for heating installations (6 bar) generally press fittings or clamp fittings should be used. Inside of buildings in manholes as well as for sanitary applications (10 bar) also screwable connections can be used. Other dimensions on request.

3.6 Flexible pipe preformed parts

Example of order: passage x branch x passage (da_1 x da_2 x da_3):

Press-T-Piece (PT):

Heating: PT - 110 x 50 x 75, 6 bar,
with press fittings
for **isopex**-Heating Type **H-110** to **H-50** to **H-75**

Sanitary: PT - 40 x 32 x 32, 10 bar,
with press fittings
for **isopex**-Sanitary Type **S-25** to **S-32** to **S-32**

Screw-T-Piece (ST):

Heating: ST - 63 x 40 x 50, 6 bar,
with screw fittings
for **isopex**-Heating Type **H-32** to **H-40** to **H-50**

Sanitary: ST - 50 x 32 x 40, 10 bar,
screw fittings
for **isopex**-Sanitary Type **S-50** auf **S-32** auf **S-40**

Clamp-T-Piece (KT):

Heating: KT - 40 x 32 x 40, 6 bar,
with clamp fittings
for **isopex**-Heating Type **H-40** to **H-32** to **H-40**

Sanitary: KT - 25 x 20 x 20, 10 bar,
with clamp fittings
for **isopex**-Sanitary Type **S-25** to **S-20** to **S-20**

According to type and dimension, Press-T-Pieces and Clamp-T-Pieces determined from **isoplus**, may consist of steel 435 GH or dezincification resistant brass MS58/M560 or red cast iron RG 7. Screw-T-Pieces generally acc. to DIN 8076 in heavy brass quality.