2 RIGID COMPOUND SYSTEMS

2.1 General

2.2 isoplus - Single Pipe

2.3 isoplus - Double Pipe

Edition: 16.01.2012

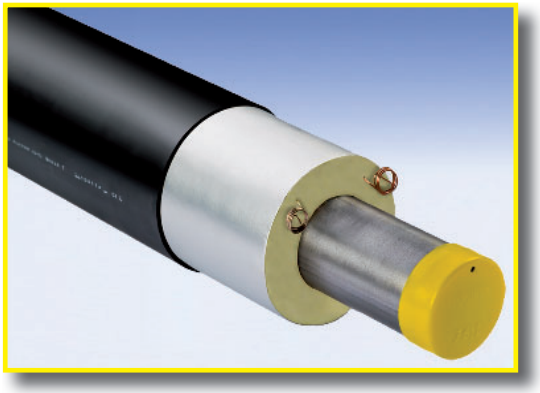
2.1.1 Principle

Single Pipe

isopipe-single is mainly used as energy pipe for effective lasting transportation of district heating and district cooling. Furthermore it will be used for various applications in the production technology from food stuff industry up to the oil-industry.

The **isopipe**-single is produced in classical and continuous method (with diffusion barrier layer).

High quality PUR-hard foam insulation - 100% free of freon, with Cyclopentan as foaming agent, processed on modern machinery equipment - guarantees a permanent excellent insulation characteristic during the duration of application. The outside PEHD-jacket pipe is covering the insulated-system, shock resistant, break-proof and water tight. All factory produced pipes and fittings can be used easily at site as a building brick system.



Data (depending on manufacturing and nominal diameter):

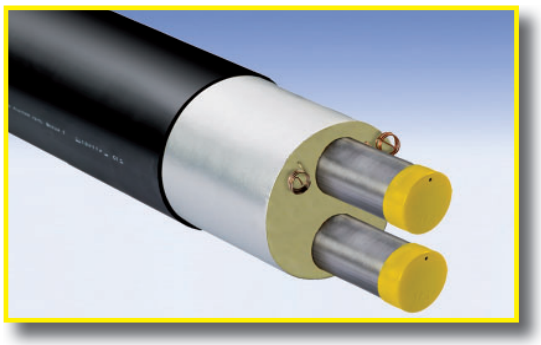
- DN 20 (¾“) up to DN 1000 (40“) in classical discontinuous production
- DN 25 (1") up to DN 200 (8") in continuous production
- Thermal conductivity λ_{50} Disconti = 0,027 W/(m•K) at a PUR-Density of 60 kg/m^3
- Thermal conductivity λ_{50} Conti = 0,024 W/(m•K) at a PUR-Density of 60 kg/m^3
- Standard insulation, 1x or 2x reinforced
- Operating temperature at least according to EN 253 and 25 bar pressure
- Up to 85 °C static calculation temperature infinite in length is possible
- Carrier pipe P235TR1/TR2/GH according to EN 253, DIN EN 10217-1 or -2, DIN EN 10216-2
- Available as 6, 12 or 16 m pipe bar
- **IPS-Cu**, **IPS-NiCr** leak detection, others available

Dimensions see **chapter 2.2.2, 2.2.3**
Technical operation data see **chapter 2.1.3, 2.2.5, 2.2.6**
Material specifications jacket pipe see **chapter 2.1.4**
Material specifications carrier pipe see **chapter 2.2.1**
Material specifications PUR hard foam see **chapter 7.1.7**

Edition: 16.01.2012

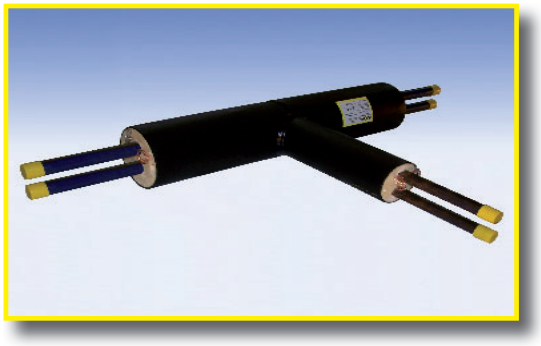
Double Pipe

isopipe-double is an effective supplement to the single pipe and a perfect solution for the transportation of district heating and district cooling with optimized **eco**logical and **eco**nomical customer efficiency.



The **isopipe**-double is produced in classical and continuous method (with diffusion barrier layer).

With the construction-principle of the double pipe an optimum of insulation will be reached as **one** thermal-block, with the advantage that the double pipe will reach the same insulation as a 1x reinforced single pipe. Space- and cost saving by reduced trenches will additionally lower the construction expenses essentially.



Data (depending on manufacturing and nominal diameter):

- DN 20 (¾“) up to DN 200 (8“) in classical discontinuous production
- DN 25 (1") bis DN 100 (4") in continuous production
- Thermal conductivity λ_{50} Disconti = 0,027 W/(m•K) at a PUR-Density of 60 kg/m^3
- Thermal conductivity λ_{50} Conti = 0,024 W/(m•K) at a PUR-Density of 60 kg/m^3
- Standard insulation, 1x reinforced
- Up to 90 K Spread [Δ_T] between flow- and return-line
- **Attention:** Thermal prestressing with electric power is not allowed at isoplus double-pipe!
- Up to 70 °C static average temperature infinite in length is possible
- Carrier pipe P235TR1/TR2/GH according to EN 253, DIN EN 10217-1 or -2
- Available as 6, 12 or 16 m pipe bar
- **IPS-Cu** or **IPS-NiCr** as leak detection

Dimensions see **chapter 2.3.2, 2.3.3**
Technical operation data see **chapter 2.1.3, 2.3.5, 2.3.6**
Material specifications jacket pipe see **chapter 2.1.4**
Material specifications carrier pipe see **chapter 2.3.1**
Material specifications PUR hard foam see **chapter 7.1.7**

2.1.2 Production Procedure / Heat-Insulation / Lambda-Value PUR

Production Procedure - Disconti

During the discontinuous production technique, the carrier pipe is prepared with spacers to which the leak detection wires are attached. The pre-assembled pipe is subsequently inserted into the casing pipe and the annular gap at the pipe ends is closed with foam covers. Afterwards, the foaming table must be set up at exactly the predetermined angle and the polyurethane foam must be sprayed into the lowest end of the pipe with an electronically controlled mixing head .

Following the development of preinsulated pipes, this procedure has become established as the most common production process and is listed as a technical standard in all the applicable specifications and guidelines. In principle, this is the only method that may be used in the production of moulded parts such as elbows, branches, etc.

Production Procedure - Conti

During the first step of the production line, the steel pipe rods will be mechanically coupled together. This string of pipes will then receive the leak detection wires, the polyurethane insulation layer, the diffusion barrier film, and the extruded polyethylene casing pipe in a continuous and CNC-controlled process.

The barrier film made of aluminum is coated with polyurethane treated with Corona on both sides and prevents the diffusion of the polyurethane cell gases through the polyethylene casing pipe. The Corona treatment ensures that the minimum shear strength required in accordance with EN 253 is exceeded and that the basic or composite principle of the frictional construction method for pre-insulated pipes remains intact.

isoplus Conti-Pipes are guiding concerning their mechanical and thermal properties. The innovative production procedure guarantees a constant foam density and thickness of the PEHD-jacket pipe over the total pipe length. This will result in optimal opportunities to keep the energy efficiency of a district heating network high, respectively the heat-loss and CO_2 emission low. The positive effects for the environment as well as for the expenses for network losses during the total lifetime are considerable.

The optimal quality of the PUR-foam will result in the best possible heat insulation of non-aged pipes. The proportion of the cell gases at λ total value is approx. 60 % and is therefore the determining variable. In the case of traditionally manufactured pipes a partial exchange of the cell gases through air occurs during operation, especially with constant use temperatures ≥ 130 °C. Cyclopentan will mainly remain in the foam cells, due to it´s molecular structure. However the λ-value will get more worse because of the exchange of the CO_2 ,the so called aging procedure. In order to avoid this, a diffusion barrier-foil will be installed between PUR-foam and PEHD jacket pipe. Because of this the favorable insulation properties of the pipes will remain nearly constant during the total lifetime. This is an especially important point for smaller to middle pipe dimensions in order to keep the energy efficiency of a pipe grid at its highest level.

Conti-pipes meet all requirements of EN 253 as well as AGFW –paper FW 401- certified by EuHP. When laying pipes, work must be performed with the utmost care (only tested and certified welding personnel) while implementing the carrier pipe welds. The outgoing medium can expand faster depending on the time factor and scope of any carrier pipe leakage occurring. Because of this, it cannot be ruled out that the damage profile is more extensive than for classically manufactured pipes. Naturally, attention must also be paid to a standardized pressure test and speedy start-up of the **IPS-Cu** or **IPS-NiCr** leak detection.

Heat-Insulation

isoplus - Compound Systems are insulated with Polyurethane-hard-foam (PUR) in especially therefore designed prescription tested according to EN 253. Polyurethane-hard foam consists of two components Polyol (component A, bright) and Isocyanat (component B, dark). Foamed continuously in the production street classical and continuous (with diffusion barrier layer) around the carrier pipe, a high quality insulation will be reached, with excellent thermal conductivity λ_{50} = 0,024 (Conti) to max. 0,027 W/(m•K) (Disconti), at low specific weight, due to an exothermical chemical reaction.

isoplus is using generally PUR-foam which is 100 % free of chlorofluorocarbon (CFC). Cyclopentan is exclusively used as foaming agent. That means lowest possible ODP- and GWP-value at extremest heat insulation quality. ODP (ozone-reducing potential) = 0, GWP (greenhouse potential) = < 0,001 !

Edition: 16.01.2012

The EN 253 standard has been modified concerning the foam-density of preinsulated pipes. Now the density of 60 kg/m^3 is no longer strictly required. The **isoplus** Conti-Pipe-Technology offers the possibility to adjust the foam density exact and constant over the total pipe length. By reducing the foam density below 60 kg/m^3 the lambda-value (λ) can be improved. However it has to be exactly considered, that the required shearing and pressure resistance values, as well as the expected lifetime will be kept, in case of preinsulated pipes with a PUR-foam density below 60 kg/m^3.

The thermal conductivity is only marginally affected by reducing the density. However, the strength of the composite system and thus the operating life and durability of the district heating system is significantly reduced.

isoplus is convinced that it cannot be in the interest of the power utility companies or in the overall national economic interest to pay for minimal gains in thermal insulation with a reduction in the shear and compressive strength of the bonded system.

Lambda-Value PUR hard foam

The thermal conductivity (λ) of the polyurethane foam is generally to be determined in conformance with DIN EN ISO 8497 at 50 °C (λ_{50}) average temperature. Compliance with all test parameters is ensured by awarding the audit to independent external laboratories (e.g. FFI, AMPA, etc.).

In addition to these external tests, our in-house testing laboratories are constantly carrying out further investigations into the characteristics required of the polyurethane foam. The significance of the supplementary internal tests increases with repetition, using an identical scope of testing of the same product group for the same issue and submitted for the same QM audit.

Thanks to the on-going expansion of the laboratory, **isoplus** is creating the possibility of significantly extending the frequency of inspection. Amongst other things, this helps us monitoring the continuous and batch production processes in a more consistent manner and improve them still further. This ensures that our stated lambda values are based on a large number of test results, which are then published as an average, using statistical methods.

External testing continues, serving as verification of our own results. This methodology ensures that our customers receive a product that meets the declared thermal conductivity (λ_{50}).

Edition: 16.01.2012

2.1.3 Capacity / Dimension / Pressure Loss

In essence, the heat that is to be transmitted [kW] and the desired temperature difference [Δ_T] between the flow line and return line determines the pipe size. The sum of all the resistance factors [ζ] of the fittings, such as branches and elbows, should be considered. For all fittings and pipes, the pressure loss is proportional to the square of the flow velocity [w]. The entire district heating system is optimised when a specific pressure drop [$\Delta p/l$] of about 100 Pa/m, determined by cost calculations, can be maintained. Depending on the project, reserves for future users must be included here as well.

The sum [Δp] of the total friction losses within the pipe network and the static pressure loss through the geodetic height differences [H] are decisive in pump design. The calculation of friction losses is made with the pipe friction coefficient [λ], and/or the roughness coefficient [*Re*] or/and the roughness number [k] of the pipe wall.

$$\Delta p = \lambda \bullet \frac{L}{d_i} \bullet \frac{w^2 \bullet \rho}{2} + H \bullet \rho \left[Pa \right] \quad \text{in which} \quad \rho = \frac{\gamma}{g} \left[\gamma \text{ in } N/m^3 \right] \quad \Big| \quad Re = \frac{w \bullet d_i}{\nu} \left[- \right]$$

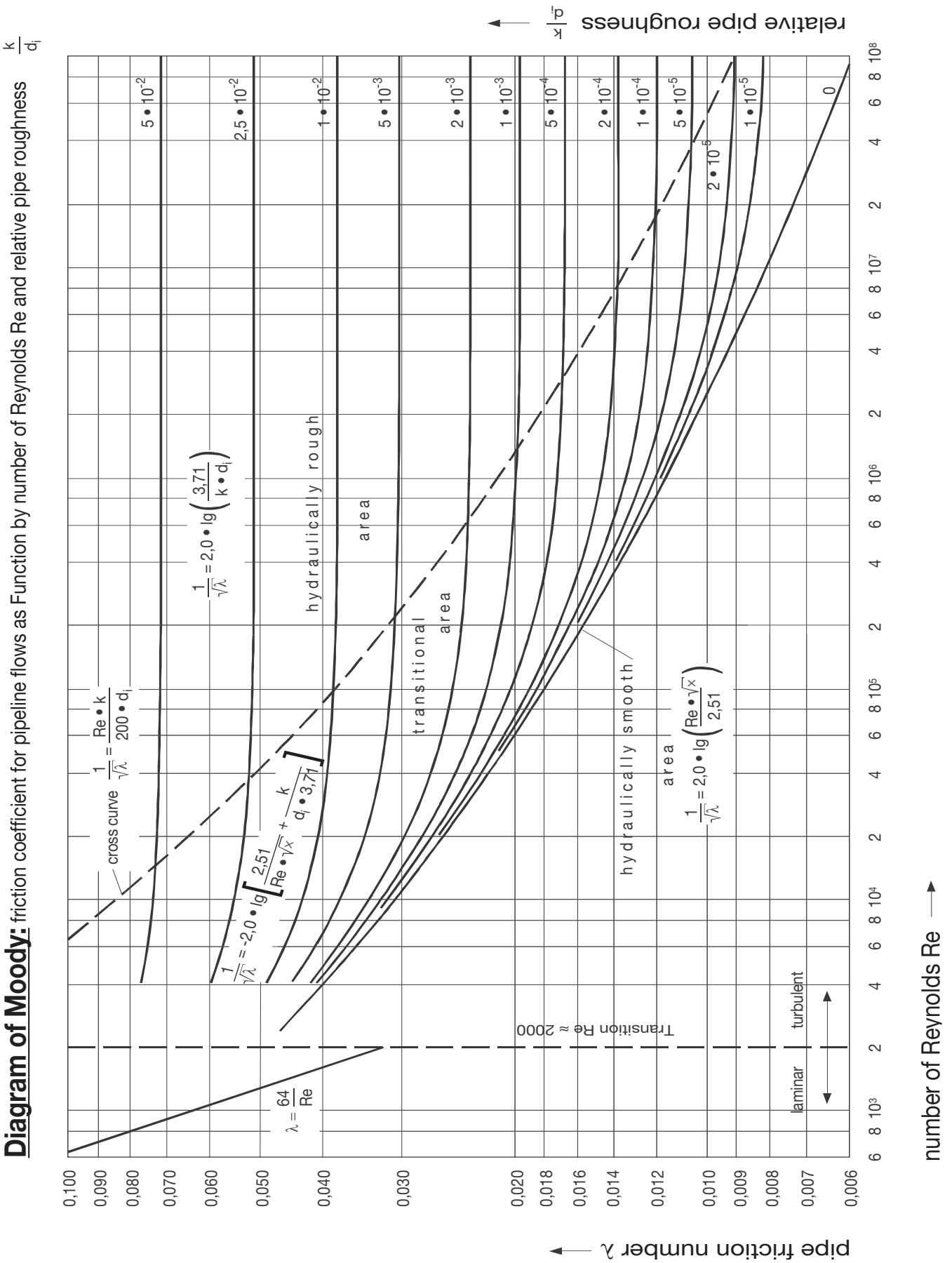
In calculating the effective pipe length [L], a specific pressure drop [$\Delta p/l$] of 60-80 Pa/m is to be expected as a result of increased losses due to the number of fittings. Lower values must be used if there are more fittings. The required flow or mass flow [Φ] follows from the calculated heat or current [$\dot{m}$] demand.

$$\Phi = \dot{m} \bullet c \bullet \left(\vartheta_{VL} - \vartheta_{RL} \right) \left[kW \right] \quad \Big| \quad \dot{m} = \frac{\Phi}{c \bullet \left(\vartheta_{VL} - \vartheta_{RL} \right)} \left[t/h \right]$$

w = Velocity of flow [m/s]
L = Effective pipe length [m]
ϑ_{VL} = Flow line temperature [°C]
d_i = Inside diameter of pipe [m]
ϑ_{RL} = Return line temperature [°C]
H = Geodetic height difference [m]
ρ = Density of the medium [kg/m^3]
γ = Specific gravity of medium [N/m^3]
g = Acceleration due to gravity = 9,81 m/s^2
ν = Kinematic viscosity of the medium [m^2/s]
C = Specific heat capacity of the medium [Wh/(kg•K)]

For an approximate calculation of the pipe diameter, the **following tables** may be used to calculate the dimensions. No warranty claims will be accepted. The precise determination of the nominal sizes is usually made by the engineering or design office responsible for the plumbing and heating in the project or directly by the owner, operator or power utility company.

Edition: 16.01.2012



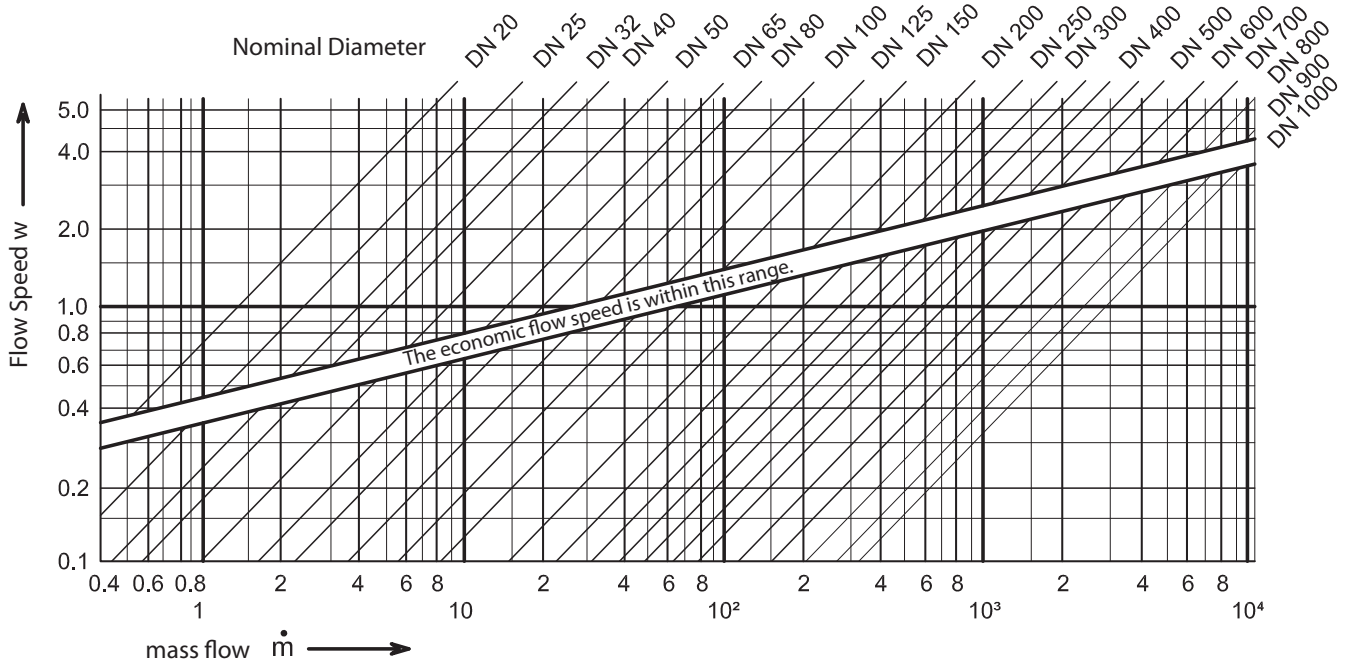
Permissible mass flows with a pressure drop of 60 -8 0 Pa/m pipe length

Dimension in	Wall-thickness s	Inside-Ø d_i	mass flow $\dot{m}$ in t/h		Dimension in	Wall-thickness s	Inside-Ø d_i	mass flow $\dot{m}$ in t/h	
DN	in mm	in mm	from	to	**DN**	in mm	in mm	from	to
20	2,6	21,7	0,4	0,5	**250**	5,0	263,0	300	348
25	3,2	27,3	0,8	1,0	**300**	5,6	312,7	472	547
32	3,2	36,0	1,7	2,0	**350**	5,6	344,4	610	7,05
40	3,2	41,9	2,5	3,0	**400**	6,3	393,8	862	1.000
50	3,2	53,9	4,7	5,5	**450**	6,3	444,6	1.180	1.370
65	3,2	69,7	9,3	11,0	**500**	6,3	495,4	1.570	1.820
80	3,2	82,5	14,5	16,5	**600**	7,1	595,8	2.520	2.920
100	3,6	107,1	28,5	33,0	**700**	8,0	695,0	3.770	4.370
125	3,6	132,5	50,0	58,0	**800**	8,8	795,4	5.390	6.240
150	4,0	160,3	82,0	95,0	**900**	10,0	894,0	7.400	9.500
200	4,5	210,1	167,0	193,0	**1000**	11,0	994,0	from 9.200	

The mass flow specifications take into account the different numbers of fittings and fixtures, with the lower values being associated with a large proportion of such parts. The flow speed [w] is derived using the table.

$$w = \frac{\dot{m}}{\left(\frac{d_i}{2}\right)^2 \cdot \pi \cdot 3600} \quad [m/s]$$

The relationship between the mass flow rate and the flow speed can be taken directly from the following chart.



Edition: 16.01.2012

2.1.4 Jacket Pipe

PEHD

Polyethylene High Density (PEHD) is a seamless extruded highly shock-resistant and break-proof, viscoplastic hard-polyethylene up to -50 °C. General Quality requirements acc. to DIN 8075. Corona treated for optimal compound with PUR-foam, acc. to EN 253.

Dimensions respectively wall thickness at least acc. to EN 253. Test procedure of melt flow index (MFI-Group) acc. to DIN 53735 resp. ISO 1133. PEHD is a proved plastic-material, which is successfully used since many years for PE-jacket-pipes-systems (PJP).

Because of the resistance against nearly all chemical reactions in the soil, PEHD is excellent suitable as jacket-pipe for direct underground installation. PEHD is mentioned as the only material for jacket-pipes as PE-jacket-pipe-compound-system in all national and international standards respectively guidelines. PEHD is highly resistant against weather conditions and ultraviolet rays. isoplus only uses polyethylene materials that have been treated with light stabilisers. As required by EN 253, the polyethylene pipes are very effectively protected against ultraviolet rays by adding 2,5 ± 0,5 mass % of a special, very fine carbon black.

Due to the excellent welding characteristics of PEHD a maximum of safety and quality will be reached at the welding seams of the fittings. In case of elbow-segments these will be butt-welded by use of a butt-welding-machine. The fillet-welds of the branch-connection-piece will be carried out by use of an extruder-welding-machine.

	Technical characteristics PE 80 at 20° C	Standard	Unit	Value
specific	Raw density ρ	DIN 8074 / DIN EN ISO 1183	kg/dm^3	0,95
	Wall-Roughness *k*	Colebrook & White	mm	0,007
	Melt-Index, MFR-Code T	DIN EN ISO 1133	g/10 min	ca. 0,45
	Melt-Index, MFR-Code V	DIN EN ISO 1133	g/10 min	ca. 10
	MFI-Group	DIN EN ISO 1133	---	T 005
	Material Class / Behaviour in case of fire, normal flamm.	DIN 4102	---	B 2
mechanical	Yield stress (Tensile Strength) R_m	DIN EN ISO 527	N/mm^2	23
	Yield expansion	EN 253 / DIN EN ISO 527	%	10
	Elongation at tear	DIN EN ISO 527	%	> 600
	Modulus of elasticity *E* (Tensile test)	DIN EN ISO 527 / 178	N/mm^2	1000
	Thrust modulation	DIN EN ISO 6721 / ISO R 537	N/mm^2	500 - 600
	Ball-pressure-hardness	DIN EN ISO 2039	N/mm^2	42
thermal	Crystallite-melt-temperature	DIN EN ISO 3146	°C	ca. 130
	Vicat-distortion temperature, VST-B/50	DIN EN ISO 306	°C	ca. 72
	Stability at 200° C	EN 253	min	> 20
	Thermal conductivity λ	DIN EN 12667	W/(m•K)	0,40
	Specific thermal capacity *c*	DIN 4108 / IEC 1006	KJ(kg•K)	1,9
	Longitudinal expansion coefficient α	DIN 53752	K^{-1}	1,8 • 10^{-4}
electrical	Specific volume resistance	DIN/IEC 60093	Ω • cm	> 10^{16}
	Disruptive strength	DIN/IEC 60243	kV/mm	75
	Surface resistance	DIN/IEC 60093	Ω	> 10^{14}

Dimensions see **chapter 2.2.2 resp. 2.3.2**

SPIRO

This casing pipe is made of a galvanized steel spiral-seam pipe acc. to DIN EN 12237 with external seams and is therefore only suitable for overhead pipework inside or outside buildings. In contrast to conventionally insulated overhead pipework, batch-produced SPIROFALZ casing pipe offers significant benefits.

The insulation thickness can be made significantly thinner due to the low thermal conductivity of the rigid polyurethane foam used in **isoplus** (λ_{50} = 0,027 W/(m•K)). This results in considerable savings in supporting structures, because the outer diameter of the pipe is reduced as well as the weight.

According to DIN 4102, the sheet-metal jacket is rated as A1 (not flammable), and the SPIROFALZ - casing pipe classified as material class B2 (flammable). Compared to the standard insulation thicknesses, differences arise when the pipes have to be insulated according to the German federal Energy Saving Regulations (EnEV). According to § 1, the EnEV only applies to service pipework within buildings and not for underground structures.

Dimensions Steel-Pipe				Jacket Pipe outside diameter **D_a** in mm				Weight **G** in kg/m		
Nominal Diameter / Dimension in		Outside-Ø **d_a**	Delivery Length **L**	Insulation Class				Insulation Class		
DN	**Inch**	in mm	in m	**Standard**	**1x reinf.**	*2x reinf. **	**EnEV**	**Standard**	**1x reinf.**	*2x reinf. **
20	¾“	26,9	6	**90**	110	*125*	**90**	3,27	3,79	*4,20*
25	1"	33,7	6	**90**	110	*125*	**90**	4,10	4,61	*5,03*
32	1¼"	42,4	6	**110**	125	*140*	**110**	5,26	5,68	*6,12*
40	1½"	48,3	6	**110**	125	*140*	**110**	5,70	6,11	*6,55*
50	2"	60,3	6	125	**140**	*160*	**140**	6,99	7,43	*8,05*
65	2½"	76,1	6	140	160	***180***	**180**	8,56	9,18	*9,85*
80	3"	88,9	6	160	180	***200***	**200**	10,07	10,74	*11,45*
100	4"	114,3	6	200	225	***250***	**250**	14,23	15,18	*16,20*
125	5"	139,7	6	225	250	***280***	**280**	17,08	18,10	*19,42*
150	6"	168,3	6	250	280	***315***	**315**	21,74	23,06	*26,25*
200	8"	219,1	6	315	355	***400***	**400**	32,78	35,03	*37,78*
250	10"	273,0	6	400	**450**	*500*	**450**	45,55	48,87	*52,45*
300	12"	323,9	6	450	**500**	*560*	**500**	58,11	61,70	*66,37*
350	14"	355,6	6	**500**	*560*	*630*	**500**	64,89	69,56	*78,58*
400	16"	406,4	6	**560**	*630*	-	**560**	81,26	90,28	-
450	18"	457,0	6	**630**	-	-	**630**	95,76	-	-

ATTENTION: Italicised mentioned jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement. All weights given are for steel wall thicknesses of welded pipe according to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, SPIRO = Ø 7,85 kg/dm^3 and without water.

Edition: 16.01.2012

Heat loss comparison overhead pipework

For overhead pipework other heat loss factors apply as shown in **chapter 2.2.5** for preinsulated pipes laid in the earth. To achieve the required insulation values or thermal transmittance or U-values (k-value) in compliance with **EnEV**, the equivalent insulation thicknesses are calculated and determined for **isoplus** pipes. According to **EnEV**, the inner diameter of the pipe is the decisive factor.

Dimensions carrier pipe		**EnEV** λ_{50} insulation = 0,0370 W/(m•K)			**isoplus** SPIRO - Jacket Pipe λ_{50} PUR-insulation = 0,027 W/(m•K)					
Diameter in **DN**	Inside-Ø d_i in mm	insulation-layer s_D in mm	Outside-Ø D_a in mm	u-Value u_{FL} in W/(m•K)	Jacket-Pipe-Outside-diameter D_a in mm			Thermal Transm. Coefficient u_{FL} in W/(m•K)		
					Standard	**1x reinf.**	*2x reinf. **	**Standard**	**1x reinf.**	*2x reinf. **
20	21,7	20	67	0,2460	**90**	110	*125*	0,1285	0,1118	0,1033
25	27,3	30	94	0,2226	**90**	110	*125*	0,1550	0,1313	0,1197
32	36,0	36	115	0,2295	**110**	125	*140*	0,1597	0,1428	0,1306
40	41,9	42	133	0,2265	**110**	125	*140*	0,1820	0,1604	0,1452
50	53,9	54	169	0,2233	125	**140**	*160*	0,2030	0,1792	0,1575
65	69,7	70	217	0,2201	140	160	***180***	0,2376	0,2009	0,1768
80	82,5	83	255	0,2192	160	180	***200***	0,2462	0,2109	0,1870
100	107,1	107	329	0,2190	200	225	***250***	0,2587	0,2201	0,1942
125	132,5	100	340	0,2602	225	250	***280***	0,2976	0,2522	0,2166
150	160,3	100	369	0,2947	250	280	***315***	0,3487	0,2842	0,2388
200	210,1	100	420	0,3555	315	355	***400***	0,3798	0,3012	0,2496
250	263,0	100	473	0,4208	400	**450**	*500*	0,3691	0,2953	0,2505
300	312,7	100	524	0,4807	450	**500**	*560*	0,4204	0,3351	0,2750
350	344,4	100	556	0,5173	**500**	*560*	*630*	0,4108	0,3241	0,2660
400	393,8	100	607	0,5772	**560**	*630*	-	0,4351	0,3365	-
450	444,6	100	658	0,6360	**630**	-	-	0,4390	-	-

Where heat is conducted through preinsulated pipes, the heat flows through different heat-conducting materials: the carrier pipe, the insulation and the casing pipe. Each of these compounds has its own individual thermal conductivity [λ], depending on its chemical and physical properties. In compliance with applicable standards and guidelines, this calculation is to be carried out using a mean annual temperature [T_M] between the medium and ambient temperature of T_M = 50 °C.

A mean heat transfer coefficient [α] of 25 W/(m²•K) is assumed in accordance with VDI Guideline 2055. For the determination of thermal transmittance [u_{FL}], the following corresponding values of thermal conductivity [λ] at T_M = 50 °C were used:

⇒ carrier pipe P235 λ_{ST} = 54,5000 W/(m•K)
⇒ insulation acc. EnEV (1) $\lambda_{DÄ}$ = 0,0370 W/(m•K)
⇒ PUR-insulation acc. **isoplus** λ_{PUR} = 0,0270 W/(m•K)
⇒ SPIROFALZ jacket pipe λ_{ST} = 54,5000 W/(m•K)

(1) The thermal conductivity given by **EnEV**, $\lambda_{DÄ}$ = 0,035 W/(m•K), refers to a mean temperature of T_M = 20 °C. At T_M = 50 °C, a suitable insulating material such as mineral wool increases $\lambda_{DÄ}$ to 0,037 W/(m•K). In other words λ_{PUR} decreases at T_M = 20 °C to 0,0225 W/(m•K).

Edition: 30.12.2016

2.2.1 Carrier Pipe / Connection Technology / Operating Conditions

Carrier pipe, welded

Welded, circular, unalloyed and calmed down steel, description and technical conditions acc. to EN 253, EN 10217-1 and -2.

Materials P235GH (1.0345), P235TR1 (1.0254), P235TR2 (1.0255). All pipes acc. to EN 10204 - 3.1 with acceptance certificate (APZ) approved. Starting from wall thickness > 3,0 mm with welding-seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.

Carrier pipe, seamless

Seamless, circular, unalloyed and calmed down steel, description and technical conditions acc. to EN 253, EN 10216-2.

Materials P235GH (1.0345), with approval certificate (APZ) acc. to EN 10204 - 3.1. Starting from wall thickness > 3,0 mm with welding-seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.

ATTENTION: Seamless carrier pipes only available in traditional production. In continuous production carrier pipes are exclusively welded !

Connection Technology

The joints between the steel pipes can be made using the following methods according to DIN ISO 857-1: manual arc welding, gas welding with oxygen-acetylene flame, tungsten inert gas (TIG) or a combination of processes. The testing and evaluation of the quality of the weld is according to AGFW Worksheet FW 446.

Operating Conditions

Maximum operating temperature T_{max}:	at least acc. to EN 253
Maximum operating pressure p_B:	25 bar
Maximum permissible axial-tension σ_{max}:	190 N/mm^2
Leak detecting:	**IPS-Cu**, **IPS-NiCr** and others, at continuous production only **IPS-Cu**
Possible liquids: Heating water as well as other material resistant liquids	

Technical Data P235TR1/TR2/GH at 20° C					
Property	**Unit**	**Value**	**Property**	**Unit**	**Value**
Volume weight p	kg/dm^3	7,85	Elastic modulus *E*	N/mm^2	211.800
Tensile stress R_m	N/mm^2	360 - 500	Thermal conductivity λ	W/(m•K)	55,2
Yield stress R_e	N/mm^2	235	Specific heat capacity c_m	kJ/(kg•K)	0,46
Wall roughness *k*	mm	0,02	Thermal expansion coeff. α	K^{-1}	11,3 • 10^{-6}

Carrier pipe wall thickness see **chapter 2.2.2** resp. **chapter 2.2.3**

Edition: 16.01.2012

2.2.2 Dimensions resp. Types — straight pipe bar - Disconti

Discontinuous production - Carrier pipe, welded

Dimensions Carrier Pipe P235TR1 / TR2 / GH						Dimensions Jacket Pipe PEHD												Weight without water **G** in kg/m (**s** acc. to **isoplus**)		
Type	Nominal diameter in		Outside-Ø d_a	Wall-thick. acc. to **isoplus** **s**	Wall-thick. acc. to EN 253 **s**	PEHD-Jacket Pipe Outside-Ø x Wall Thickness D_a x **s** in mm												Insulation Class		
						Insulation Class / Delivery Length **L** in m														
	DN	Inch	in mm	in mm	in mm	Standard	6	12	16	1x reinforced	6	12	16	2x reinf.	6	12	16	Stand.	1x reinf.	2x reinf.
DRE-20	**20**	¾“	26,9	2,6	2,0	90 • 3,0	√	-	-	110 • 3,0	√	-	-	*125 • 3,0*	√	-	-	2,68	3,08	*3,41*
DRE-25	**25**	1“	33,7	3,2	2,3	90 • 3,0	√	-	-	110 • 3,0	√	√	-	*125 • 3,0*	√	√	-	3,54	3,96	*4,30*
DRE-32	**32**	1¼“	42,4	3,2	2,6	110 • 3,0	√	√	-	125 • 3,0	√	√	-	*140 • 3,0*	√	√	-	4,60	4,95	*5,32*
DRE-40	**40**	1½“	48,3	3,2	2,6	110 • 3,0	√	√	-	125 • 3,0	√	√	-	*140 • 3,0*	√	√	-	5,04	5,38	*5,76*
DRE-50	**50**	2“	60,3	3,2	2,9	125 • 3,0	√	√	-	140 • 3,0	√	√	-	*160 • 3,0*	√	√	-	6,25	6,62	*7,16*
DRE-65	**65**	2½“	76,1	3,2	2,9	140 • 3,0	√	√	-	160 • 3,0	√	√	-	*180 • 3,0*	√	√	-	7,73	8,28	*8,87*
DRE-80	**80**	3“	88,9	3,2	3,2	160 • 3,0	√	√	-	180 • 3,0	√	√	-	*200 • 3,2*	√	√	-	9,15	9,75	*10,49*
DRE-100	**100**	4“	114,3	3,6	3,6	200 • 3,2	√	√	√	225 • 3,4	√	√	√	*250 • 3,6*	√	√	√	13,23	14,24	*15,35*
DRE-125	**125**	5“	139,7	3,6	3,6	225 • 3,4	√	√	√	250 • 3,6	√	√	√	*280 • 3,9*	√	√	√	16,09	17,20	*18,72*
DRE-150	**150**	6“	168,3	4,0	4,0	250 • 3,6	√	√	√	280 • 3,9	√	√	√	*315 • 4,1*	√	√	√	20,77	22,29	*24,15*
DRE-175*	***175***	*7“*	*193,7*	*4,5*	-	*280 • 3,9*	√	√	√	*315 • 4,1*	√	√	√	*355 • 4,5*	√	√	√	*26,22*	*27,91*	*30,22*
DRE-200	**200**	8“	219,1	4,5	4,5	315 • 4,1	√	√	√	355 • 4,5	√	√	√	*400 • 4,8*	√	√	√	30,51	33,02	*36,05*
DRE-225*	***225***	*9“*	*244,5*	*5,0*	-	*355 • 4,5*	√	√	√	*400 • 4,8*	√	√	√	*450 • 5,2*	√	√	√	*37,53*	*40,29*	*43,77*
DRE-250	**250**	10“	273,0	5,0	5,0	400 • 4,8	√	√	√	450 • 5,2	√	√	√	*500 • 5,6*	√	√	√	43,59	47,42	*51,66*
DRE-300	**300**	12“	323,9	5,6	5,6	450 • 5,2	√	√	√	500 • 5,6	√	√	√	*560 • 6,0*	√	√	√	56,40	60,65	*66,19*
DRE-350	**350**	14“	355,6	5,6	5,6	500 • 5,6	√	√	√	560 • 6,0	√	√	√	*630 • 6,6*	√	√	√	63,65	69,20	*76,62*
DRE-400	**400**	16“	406,4	6,3	6,3	560 • 6,0	√	√	√	630 • 6,6	√	√	√	*710 • 6,9*	√	√	√	80,57	88,00	*92,55*
DRE-450	**450**	18“	457,0	6,3	6,3	630 • 6,6	√	√	√	710 • 6,9	√	√	√	*800 • 7,2*	√	√	√	93,07	97,62	*102,44*
DRE-500	**500**	20“	508,0	6,3	6,3	710 • 6,9	√	√	√	800 • 7,2	√	√	√	*900 • 7,9*	√	√	√	102,40	107,22	*119,09*
DRE-550*	***550***	*22“*	*558,8*	*6,3*	-	*710 • 7,2*	√	√	√	*800 • 7,9*	√	√	√	*900 • 8,7*	√	√	√	*110,38*	*121,16*	*134,64*
DRE-600	**600**	24“	610,0	7,1	7,1	800 • 7,9	√	√	√	900 • 8,7	√	√	√	*1000 • 9,4*	√	√	√	139,45	154,30	*170,59*
DRE-650*	***650***	*26“*	*660,0*	*7,1*	-	*900 • 8,7*	√	√	√	*1000 • 9,4*	√	√	√	-	-	-	-	*156,34*	*171,09*	-
DRE-700	**700**	28“	711,0	8,0	8,0	900 • 8,7	√	√	√	1000 • 9,4	√	√	√	-	-	-	-	178,93	195,23	-
DRE-750*	***750***	*30“*	*762,0*	*8,0*	-	*1000 • 9,4*	√	√	√	*1100 • 10,2*	√	√	√	-	-	-	-	*197,56*	*214,09*	-
DRE-800	**800**	32“	813,0	8,8	8,8	1000 • 9,4	√	√	√	1100 • 10,2	√	√	√	-	-	-	-	221,15	239,38	-
DRE-850*	***850***	*34“*	*864,0*	*8,8*	-	*1100 • 10,2*	√	√	√	*1200 • 11,0*	√	√	√	-	-	-	-	*241,81*	*259,88*	-
DRE-900	**900**	36“	914,0	10,0	10,0	1100 • 10,2	√	√	√	1200 • 11,0	√	√	√	-	-	-	-	276,70	296,63	-
DRE-1000	**1000**	40“	1016,0	11,0	11,0	1200 • 11,0	√	√	√	1300 • 12,5	√	√	√	-	-	-	-	333,79	357,76	-

ATTENTION: Italicised mentioned dimensions (*) and jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement.

For nominal diameters DN 25 to DN 65 isoplus provides only steel pipes and fittings with wall thickness of 3,2 mm! This is also to observe in comparison with competitors just as the differing standard insulation class respectively series from nominal diameter DN 250!

Length of bare steel pipe ends: 220 mm ± 10 mm. Wall thickness jacket pipe **isoplus** acc. to EN 253, Wall thickness carrier pipe **isoplus** acc. to AGFW FW 401. The mentioned steel wall thicknesses are corresponding with the standard wall thicknesses of **isoplus**, which are generally calculated against inside pressure [p] acc. to DIN 2413. The mentioned weights are valid for steel wall thicknesses acc. to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, PEHD = Ø 0,95 kg/dm^3.

Specification carrier pipe see **chapter 2.2.1**

Edition: 25.03.2020

Discontinuous production - Carrier pipe, seamless

Dimensions carrier pipe P235GH						Dimensions jacket pipe PEHD													Weight without water **G** in kg/m (**s** acc. to **isoplus**)		
Type	Nominal Diameter / Dimension in		Outside-Ø d_a	Wall-thickn. acc. to **isoplus** **s**	Wall-thickn. acc. to EN 253 **s**	PEHD-Jacket-Pipe Outside-Ø x Wallthickness D_a x **s** in mm													Insulation Class		
						Insulation Class / Delivery Length **L** in m															
	DN	**Inch**	in mm	in mm	in mm	**Standard**	6	12	16	**1x reinforced**	6	12	16	**2x reinf.**	6	12	16		**Stand.**	**1x reinf.**	**2x reinf.**
DRE-20	**20**	¾“	26,9	2,6	2,0	90 • 3,0	√	-	-	110 • 3,0	√	-	-	*125 • 3,0*	√	-	-		2,68	3,08	*3,41*
DRE-25	**25**	1“	33,7	3,2	2,3	90 • 3,0	√	-	-	110 • 3,0	√	√	-	*125 • 3,0*	√	√	-		3,54	3,96	*4,30*
DRE-32	**32**	1¼“	42,4	3,2	2,6	110 • 3,0	√	√	-	125 • 3,0	√	√	-	*140 • 3,0*	√	√	-		4,60	4,95	*5,32*
DRE-40	**40**	1½“	48,3	3,2	2,6	110 • 3,0	√	√	-	125 • 3,0	√	√	-	*140 • 3,0*	√	√	-		5,04	5,38	*5,76*
DRE-50	**50**	2“	60,3	3,2	2,9	125 • 3,0	√	√	-	140 • 3,0	√	√	-	*160 • 3,0*	√	√	-		6,25	6,62	*7,16*
DRE-65	**65**	2½“	76,1	3,2	2,9	140 • 3,0	√	√	-	160 • 3,0	√	√	-	*180 • 3,0*	√	√	-		7,73	8,28	*8,87*
DRE-80	**80**	3“	88,9	3,2	3,2	160 • 3,0	√	√	-	180 • 3,0	√	√	-	*200 • 3,2*	√	√	-		9,15	9,75	*10,49*
DRE-100	**100**	4“	114,3	3,6	3,6	200 • 3,2	√	√	-	225 • 3,4	√	√	-	*250 • 3,6*	√	√	-		13,23	14,24	*15,35*
DRE-125	**125**	5“	139,7	4,0	3,6	225 • 3,4	√	√	-	250 • 3,6	√	√	-	*280 • 3,9*	√	√	-		17,39	18,51	*20,03*
DRE-150	**150**	6“	168,3	4,5	4,0	250 • 3,6	√	√	-	280 • 3,9	√	√	-	*315 • 4,1*	√	√	-		22,74	24,26	*26,12*
DRE-200	**200**	8“	219,1	6,3	4,5	315 • 4,1	√	√	-	355 • 4,5	√	√	-	*400 • 4,8*	√	√	-		39,78	42,29	*45,32*
DRE-250	**250**	10“	273,0	6,3	5,0	400 • 4,8	√	√	-	450 • 5,2	√	√	-	*500 • 5,6*	√	√	-		52,01	55,83	*60,08*
DRE-300	**300**	12“	323,9	7,1	5,6	450 • 5,2	√	√	-	500 • 5,6	√	√	-	*560 • 6,0*	√	√	-		67,94	72,19	*77,74*
DRE-350	**350**	14“	355,6	8,0	5,6	500 • 5,6	√	√	-	560 • 6,0	√	√	-	*630 • 6,6*	√	√	-		83,95	89,49	*96,92*
DRE-400	**400**	16“	406,4	8,8	6,3	560 • 6,0	√	√	-	630 • 6,6	√	√	-	*710 • 6,9*	√	√	-		104,76	112,18	*116,73*
DRE-450	**450**	18“	457,0	10,0	6,3	630 • 6,6	√	√	-	710 • 6,9	√	√	-	*800 • 7,2*	√	√	-		133,38	137,93	*142,75*
DRE-500	**500**	20“	508,0	11,0	6,3	710 • 6,9	√	√	-	800 • 7,2	√	√	-	*900 • 7,9*	√	√	-		159,42	164,24	*176,11*
DRE-600	**600**	24“	610,0	12,5	7,1	800 • 7,9	√	√	-	900 • 8,7	√	√	-	*1000 • 9,4*	√	√	-		218,27	233,12	*249,42*

ATTENTION: Italicised mentioned dimensions (*) and jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement.

For nominal diameters DN 25 to DN 65 isoplus provides only steel pipes and fittings with wall thickness of 3,2 mm! This is also to observe in comparison with competitors just as the differing standard insulation class respectively series from nominal diameter DN 250!

Length of bare steel pipe ends: 220 mm ± 10 mm. Wall thickness jacket pipe **isoplus** acc. to EN 253, Wall thickness carrier pipe **isoplus** acc. to AGFW FW 401. The mentioned steel wall thicknesses are corresponding with the standard wall thicknesses of **isoplus**, which are generally calculated against inside pressure [p] acc. to DIN 2413. The mentioned weights are valid for steel wall thickness acc. to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, PEHD = Ø 0,95 kg/dm^3.

Edition: 25.03.2020

2.2.3 Dimensions resp. Types — straight pipe bar - Conti

Continuous production - Carrier pipe, welded

Dimensions Carrier Pipe P235TR1 / TR2 / GH						Dimensions Jacket pipe PEHD												Weight without water **G** in kg/m (**s** acc. to **isoplus**)		
Type	Nominal Diameter / Dimension in		Outside Ø d_a in mm	Wall-thick. acc. to **isoplus** **s** in mm	Wall-thick. acc. to EN 253 **s** in mm	PEHD-Jacket-Pipe Outside-Ø x Wall thickness D_a x **s** in mm												Insulation Class		
						Insulation Class / Delivery Length **L** in m														
	DN	**Inch**				**Standard**	6	12	16	**1x reinforced**	6	12	16	**2x reinf.**	6	12	16	**Stand.**	**1x reinf.**	**2x reinf.**
KRE-25	**25**	1“	33,7	3,2	2,3	-	-	-	-	110 • 3,0	-	√	-	*125 • 3,0*	-	√	-	-	3,86	*4,19*
KRE-32	**32**	1¼“	42,4	3,2	2,6	110 • 3,0	-	√	-	125 • 3,0	-	√	-	*140 • 3,0*	-	√	-	4,49	4,83	*5,18*
KRE-40	**40**	1½“	48,3	3,2	2,6	110 • 3,0	-	√	-	125 • 3,0	-	√	-	*140 • 3,0*	-	√	-	4,91	5,24	*5,61*
KRE-50	**50**	2“	60,3	3,2	2,9	125 • 3,0	-	√	-	140 • 3,0	-	√	-	*160 • 3,0*	-	√	-	4,98	6,45	*6,97*
KRE-65	**65**	2½“	76,1	3,2	2,9	140 • 3,0	-	√	-	160 • 3,0	-	√	-	*180 • 3,0*	-	√	-	7,53	8,06	*8,63*
KRE-80	**80**	3“	88,9	3,2	3,2	160 • 3,0	-	√	-	180 • 3,0	-	√	-	*200 • 3,2*	-	√	-	8,91	9,49	*10,62*
KRE-100	**100**	4“	114,3	3,6	3,6	200 • 3,2	-	√	√	225 • 3,4	-	√	√	*250 • 3,6*	-	√	√	13,29	14,20	*15,32*
KRE-125	**125**	5“	139,7	3,6	3,6	225 • 3,4	-	√	√	250 • 3,6	-	√	√	*280 • 3,9*	-	√	√	16,00	17,13	*18,57*
KRE-150	**150**	6“	168,3	4,0	4,0	250 • 3,6	-	√	√	280 • 3,9	-	√	√	*315 • 4,1*	-	√	√	20,60	22,05	*24,14*
KRE-200	**200**	8“	219,1	4,5	4,5	315 • 4,1	-	√	√	355 • 4,5	-	√	√	-	-	-	-	30,34	33,14	-

ATTENTION: Italicised mentioned dimensions (*) and jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement.

For nominal diameters DN 25 to DN 65 isoplus provides only steel pipes and fittings with wall thickness of 3,2 mm! This is also to observe in comparison with competitors just as the differing standard insulation class respectively series from nominal diameter DN 250!

Length of bare steel pipe ends: 220 mm ± 10 mm. Wall thickness jacket pipe **isoplus** acc. to EN 253, Wall thickness carrier pipe **isoplus** acc. to AGFW FW 401. The mentioned steel wall thicknesses are corresponding with the standard wall thicknesses of **isoplus**, which are generally calculated against inside pressure [p] acc. to DIN 2413. The mentioned weights are valid for steel wall thickness acc. to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, PEHD = Ø 0,95 kg/dm^3.

Specification carrier pipe see **chapter 2.2.1**

Edition: 16.01.2012

2.2.4 Dimensions resp. Types — Bowed Pipe

Discontinuous and continuous production

Dimensions Carrier pipe		Maximum permissible bow-angle α_{max} in °	Minimum bending-radius $r_{F\,min}$ in m	Circle segment at $r_{F\,min}$ and 12,00 m		
Nominal-Diameter in **DN**	Outside-Ø **d_a** in mm			Secant-length s_L in m	Production secant-length s_{hF} in m	Tangent-length t_L in m
100	114,3	28,0	16,78	11,78	0,97	6,07
125	139,7	28,0	16,78	11,78	0,97	6,07
150	168,3	25,0	18,80	11,83	0,87	6,06
200	219,1	22,5	20,88	11,86	0,78	6,05
250	273,0	20,0	23,49	11,89	0,70	6,04
300	323,9	18,0	26,10	11,91	0,63	6,03
350	355,6	12,0	28,65	11,96	0,42	6,01
400	406,4	6,5	52,89	11,99	0,23	6,00
450	457,0	5,0	68,75	11,99	0,17	6,00
500	508,0	4,0	85,94	12,00	0,16	6,00

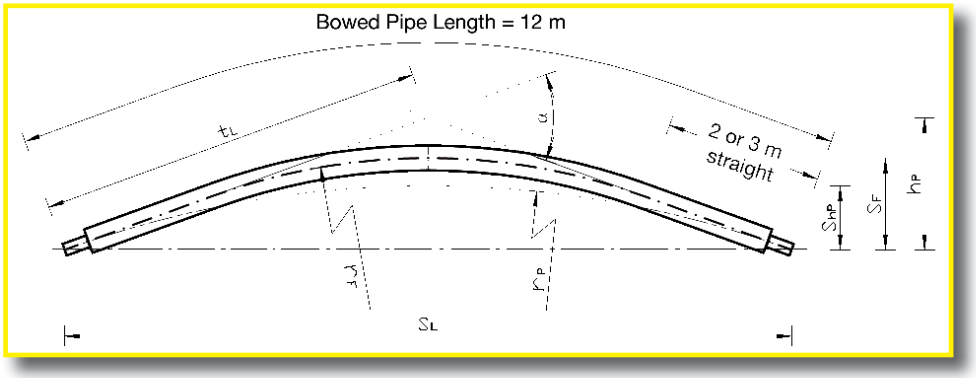
Smaller dimensions available on request!

The single pipe / bowed pipe production used at the factory is only possible with a high density polyethylene jacket in 12 m lengths and only above a nominal diameter of DN 100. The values given in the table are valid regardless of the PEHD casing pipe diameter (standard, 1x or 2x reinforced). For nominal diameters DN 20 to DN 80, it is usually sufficient to compensate for pipe elbows with on-site bending (elastic distortion of a pipe length).

Due to production constraints, bowed pipes of up to PEHD casing pipe diameters $\mathbf{D_a} \leq 450$ mm have 2,0 m long straight pipe ends, while from $\mathbf{D_a} \geq 500$ these ends are approximately 3,0 m long. For this reason, the production bending radius [$\mathbf{r_F}$] is also different from the design radius [$\mathbf{r_P}$].

Bowed pipes are bent mechanically according to the route of the pipeline and the permitted production bending radius, according to local management instructions (bending angle and design radius). When ordering, the angle, design radius and bending direction, left or right (depending on the route of the network monitoring) should be given. If necessary, these parameters are determined by **isoplus**.

Edition: 16.01.2012



Context between project planning radius [r_P] and production bending radius [r_F]

General parameter			Project planning parameter			2 m pipe end straight		3 m pipe end straight	
Angle α in °	Segment s_L in m	Tangent t_L in m	Height h_P in m	Radius r_P in m	Segment s_{hP} in m	Radius r_{F2} in m	Segment s_{hF2} in m	Radius r_{F3} in m	Segment s_{hF3} in m
40	11,56	6,15	2,10	16,90	1,02	11,40	1,37	8,65	1,55
39	11,58	6,14	2,05	17,34	0,99	11,70	1,34	8,87	1,51
38	11,60	6,13	2,00	17,82	0,97	12,01	1,31	9,10	1,47
37	11,62	6,13	1,94	18,31	0,95	12,33	1,27	9,35	1,43
36	11,64	6,12	1,89	18,84	0,92	12,68	1,24	9,60	1,40
35	11,66	6,11	1,84	19,39	0,90	13,04	1,21	9,87	1,36
34	11,68	6,11	1,79	19,97	0,87	13,43	1,17	10,16	1,32
33	11,70	6,10	1,73	20,59	0,85	13,84	1,14	10,47	1,28
32	11,72	6,09	1,68	21,25	0,82	14,28	1,10	10,79	1,24
31	11,73	6,09	1,63	21,95	0,80	14,74	1,07	11,13	1,21
30	11,75	6,08	1,57	22,70	0,77	15,24	1,04	11,50	1,17
29	11,77	6,08	1,52	23,50	0,75	15,76	1,00	11,90	1,13
28	11,78	6,07	1,47	24,35	0,72	16,33	0,97	12,32	1,09
27	11,80	6,07	1,42	25,27	0,70	16,94	0,93	12,77	1,05
26	11,81	6,06	1,36	26,25	0,67	17,59	0,90	13,26	1,01
25	11,83	6,06	1,31	27,32	0,65	18,30	0,87	13,79	0,98
24	11,84	6,05	1,26	28,47	0,62	19,06	0,83	14,36	0,94
23	11,85	6,05	1,21	29,73	0,60	19,90	0,80	14,98	0,90
22,5	11,86	6,05	1,18	30,39	0,58	20,34	0,78	15,31	0,88
22	11,87	6,04	1,15	31,09	0,57	20,80	0,76	15,66	0,86
21	11,88	6,04	1,10	32,59	0,55	21,80	0,73	16,40	0,82
20	11,89	6,04	1,05	34,23	0,52	22,89	0,70	17,22	0,78
19	11,90	6,03	1,00	36,05	0,49	24,10	0,66	18,12	0,74
18	11,91	6,03	0,94	38,07	0,47	25,44	0,63	19,12	0,70
17	11,92	6,03	0,89	40,32	0,44	26,94	0,59	20,25	0,67
16	11,93	6,02	0,84	42,86	0,42	28,62	0,56	21,51	0,63
15	11,94	6,02	0,79	45,73	0,39	30,54	0,52	22,94	0,59
14	11,95	6,02	0,73	49,01	0,37	32,72	0,49	24,58	0,55
13	11,95	6,02	0,68	52,79	0,34	35,24	0,45	26,46	0,51
12	11,96	6,01	0,63	57,21	0,31	38,18	0,42	28,67	0,47
11	11,97	6,01	0,58	62,42	0,29	41,65	0,38	31,27	0,43
10	11,97	6,01	0,52	68,68	0,26	45,82	0,35	34,39	0,39
9	11,98	6,01	0,47	76,33	0,24	50,92	0,31	38,21	0,35
8	11,98	6,01	0,42	85,89	0,21	57,28	0,28	42,98	0,31
7	11,99	6,00	0,37	98,17	0,18	65,47	0,24	49,12	0,27
6,5	11,99	6,00	0,34	105,73	0,17	70,51	0,23	52,90	0,26
6	11,99	6,00	0,31	114,55	0,16	76,39	0,21	57,30	0,24
5	11,99	6,00	0,26	137,47	0,13	91,67	0,17	68,76	0,20
4	12,00	6,00	0,21	171,86	0,10	114,59	0,14	85,95	0,16

2.2.5 Energy Loss isoplus - Single Pipe Disconti

Thermal Transmission Coefficient [U_{DRE}]

The mentioned values are based on an average specific thermal capacity [c_m] of the water of 4.187 J/(kg•K), a soil covering [$Ü_H$] of 0,80 m (upper edge jacket-pipe to upper edge of the terrain), a thermal conductivity of the soil [λ_E] of 1,0 W/(m•K), an average soil temperature [T_E] of 10 °C, an average clearance pipe distance according to the table as well as on welded pipe wall thicknesses, see **chapter 2.2.2** and **2.2.3.**

Average temperature:
$T_M = (T_{VL} + T_{RL}) : 2$ [°C]

Example:
T_M = (90 °C + 70 °C) : 2 = 80 °C

Type	Jacket-Pipe Outside-Diameter D_a in mm			Thermal Transm. Coefficient u_{DRE} in W/(m•K)		
	Insulation Class			Insulation Class		
	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.
DRE-20	90 / 150	110 / 150	125 / 150	0,1295	0,1114	0,1028
DRE-25	90 / 150	110 / 150	125 / 150	0,1564	0,1308	0,1191
DRE-32	110 / 150	125 / 150	140 / 150	0,1589	0,1420	0,1290
DRE-40	110 / 150	125 / 150	140 / 150	0,1810	0,1593	0,1432
DRE-50	125 / 150	140 / 150	160 / 200	0,2013	0,1763	0,1557
DRE-65	140 / 150	160 / 200	180 / 200	0,2325	0,1980	0,1744
DRE-80	160 / 200	180 / 200	200 / 200	0,2418	0,2076	0,1847
DRE-100	200 / 200	225 / 200	250 / 200	0,2543	0,2148	0,1905
DRE-125	225 / 200	250 / 200	280 / 300	0,2880	0,2459	0,2138
DRE-150	250 / 200	280 / 300	315 / 300	0,3369	0,2794	0,2343
DRE-200	315 / 300	355 / 300	400 / 400	0,3686	0,2953	0,2472
DRE-250	400 / 400	450 / 400	500 / 400	0,3637	0,2914	0,2468
DRE-300	450 / 400	500 / 400	560 / 500	0,4126	0,3284	0,2698
DRE-350	500 / 400	560 / 500	630 / 500	0,4009	0,3169	0,2605
DRE-400	560 / 500	630 / 500	710 / 600	0,4222	0,3277	0,2684
DRE-450	630 / 500	710 / 600	800 / 700	0,4242	0,3299	0,2703
DRE-500	710 / 600	800 / 700	900 / 700	0,4149	0,3249	0,2669
DRE-600	800 / 700	900 / 700	1000 / 800	0,5002	0,3748	0,3065
DRE-700	900 / 700	1000 / 800	-	0,5665	0,4238	-
DRE-800	1000 / 800	1100 / 800	-	0,6372	0,4732	-
DRE-900	1100 / 800	1200 / 900	-	0,7027	0,5221	-
DRE-1000	1200 / 900	1300 / 900	-	0,7742	0,5733	-

Energy Loss [q] at T_M in W/Pipe Meter

Type	Heat Loss **q** at average temperature T_M = 100 °C in W/m			Heat Loss **q** at average temperature T_M = 80 °C in W/m			Heat Loss **q** at average temperature T_M = 60 °C in W/m		
	Insulation Class			Insulation Class			Insulation Class		
	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.
DRE-20	11,656	10,028	9,253	9,066	7,799	7,197	6,476	5,571	5,141
DRE-25	14,078	11,770	10,717	10,950	9,154	8,335	7,821	6,539	5,954
DRE-32	14,302	12,777	11,614	11,124	9,937	9,033	7,946	7,098	6,452
DRE-40	16,290	14,340	12,892	12,670	11,153	10,027	9,050	7,967	7,162
DRE-50	18,116	15,865	14,011	14,090	12,339	10,898	10,064	8,814	7,784
DRE-65	20,925	17,816	15,698	16,275	13,857	12,209	11,625	9,898	8,721
DRE-80	21,765	18,684	16,623	16,928	14,532	12,929	12,092	10,380	9,235
DRE-100	22,884	19,335	17,145	17,799	15,039	13,335	12,713	10,742	9,525
DRE-125	25,923	22,132	19,246	20,163	17,214	14,969	14,402	12,296	10,692
DRE-150	30,318	25,150	21,089	23,580	19,561	16,402	16,843	13,972	11,716
DRE-200	33,176	26,575	22,245	25,804	20,670	17,302	18,431	14,764	12,358
DRE-250	32,736	26,228	22,208	25,461	20,399	17,273	18,186	14,571	12,338
DRE-300	37,133	29,558	24,285	28,881	22,989	18,889	20,630	16,421	13,492
DRE-350	36,080	28,521	23,446	28,062	22,183	18,236	20,044	15,845	13,025
DRE-400	38,000	29,493	24,157	29,556	22,939	18,789	21,111	16,385	13,421
DRE-450	38,180	29,690	24,331	29,696	23,093	18,924	21,211	16,495	13,517
DRE-500	37,341	29,241	24,020	29,043	22,743	18,682	20,745	16,245	13,344
DRE-600	45,016	33,729	27,584	35,012	26,234	21,454	25,009	18,738	15,324
DRE-700	50,986	38,141	-	39,656	29,665	-	28,326	21,189	-
DRE-800	57,345	42,586	-	44,602	33,123	-	31,858	23,659	-
DRE-900	63,242	46,990	-	49,189	36,548	-	35,135	26,106	-
DRE-1000	69,679	51,601	-	54,195	40,134	-	38,710	28,667	-

Edition: 25.03.2020

2.2.6 Energy Loss isoplus - Single Pipe Conti

Thermal Transmission Coefficient [U_{KRE}]

The mentioned values are based on an average specific thermal capacity [c_m] of the water of 4.187 J/(kg•K), a soil covering [$Ü_H$] of 0,80 m (upper edge jacket-pipe to upper edge of the terrain), a thermal conductivity of the soil [λ_E] of 1,0 W/(m•K), an average soil temperature [T_E] of 10 °C, an average clearance pipe distance according to the table as well as on welded pipe wall thicknesses, see **chapter 2.2.2** and **2.2.3.**

Type	Jacket-Pipe Outside-Diameter D_a in mm			Thermal Transm. Coefficient U_{KRE} in W/(m•K)		
	Insulation Class			Insulation Class		
	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.
KRE-25	-	110 / 150	125 / 150	-	0,1178	0,1071
KRE-32	110 / 150	125 / 150	140 / 150	0,1435	0,1279	0,1161
KRE-40	110 / 150	125 / 150	140 / 150	0,1638	0,1438	0,1290
KRE-50	125 / 150	140 / 150	160 / 200	0,1824	0,1593	0,1403
KRE-65	140 / 150	160 / 200	180 / 200	0,2112	0,1790	0,1574
KRE-80	160 / 200	180 / 200	200 / 200	0,2196	0,1878	0,1667
KRE-100	200 / 200	225 / 200	250 / 200	0,2308	0,1943	0,1718
KRE-125	225 / 200	250 / 200	280 / 300	0,2620	0,2228	0,1930
KRE-150	250 / 200	280 / 300	315 / 300	0,3074	0,2534	0,2117
KRE-200	315 / 300	355 / 300	-	0,3361	0,2677	-

Average temperature:
$T_M = (T_{VL} + T_{RL}) : 2$ [°C]

Example:
T_M = (90 °C + 70 °C) : 2 = 80 °C

Energy Loss [q] at T_M in W/Pipe Meter

Type	Heat Loss **q** at average temperature T_M = 100 °C in W/m			Heat Loss **q** at average temperature T_M = 80 °C in W/m			Heat Loss **q** at average temperature T_M = 60 °C in W/m		
	Insulation Class			Insulation Class			Insulation Class		
	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.	Standard	1x reinf.	2x reinf.
KRE-25	-	10,600	9,636	-	8,244	7,495	-	5,889	5,353
KRE-32	12,916	11,514	10,449	10,046	8,955	8,127	7,176	6,396	5,805
KRE-40	14,745	12,944	11,614	11,468	10,068	9,033	8,192	7,191	6,452
KRE-50	16,420	14,337	12,625	12,771	11,151	9,820	9,122	7,965	7,014
KRE-65	19,010	16,114	14,162	14,786	12,533	11,015	10,561	8,952	7,868
KRE-80	19,762	16,904	15,002	15,371	13,147	11,668	10,979	9,391	8,335
KRE-100	20,773	17,483	15,465	16,157	13,598	12,028	11,541	9,713	8,592
KRE-125	23,579	20,050	17,370	18,339	15,595	13,510	13,099	11,139	9,650
KRE-150	27,662	22,807	19,050	21,515	17,739	14,817	15,368	12,671	10,583
KRE-200	30,251	24,090	-	23,528	18,737	-	16,806	13,384	-

Edition: 30.12.2016

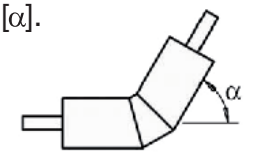
2.2.7 Elbow 90°

All carrier pipe elbows at least bent according to DIN EN 10220 in one piece or in accordance with DIN EN 10253-2 and welded pipe fittings, depending on dimension. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.

Dimensions Carrier Pipe			Carrier Pipe Elbow		Jacket-Pipe-Outside-diameter D_a in mm			Length of Angle L • L 1 in mm	
Nominal Diameter / Dimension in		Outside-Ø d_a in mm	Wall thickness s in mm	Radius r in mm	Insulation Class				
DN	Inch				Standard	1x reinf.	*2x reinf. **		
20	¾“	26,9	2,6	110,0	90	110	*125*	1000 · 1000	
25	1“	33,7	3,2	110,0	90	110	*125*	1000 · 1000	
32	1¼“	42,4	3,2	110,0	110	125	*140*	1000 · 1000	
40	1½“	48,3	3,2	110,0	110	125	*140*	1000 · 1000	
50	2“	60,3	3,2	135,0	125	140	*160*	1000 · 1000	
65	2½“	76,1	3,2	175,0	140	160	*180*	1000 · 1000	
80	3“	88,9	3,2	205,0	160	180	*200*	1000 · 1000	
100	4“	114,3	3,6	270,0	200	225	*250*	1000 · 1000	
125	5“	139,7	3,6	330,0	225	250	*280*	1000 · 1000	1000 · 1500
150	6“	168,3	4,0	390,0	250	280	*315*	1000 · 1000	1000 · 1500
200	8“	219,1	4,5	510,0	315	355	*400*	1000 · 1000	1000 · 1500
250	10“	273,0	5,0	381,0	400	450	*500*	1000 · 1000	1000 · 1500
300	12“	323,9	5,6	457,0	450	500	*560*	1000 · 1000	1000 · 1500
350	14“	355,6	5,6	533,0	500	560	*630*	1000 · 1000	1000 · 1500
400	16“	406,4	6,3	610,0	560	630	*710*	1000 · 1000	1000 · 1500
450	18“	457,0	6,3	686,0	630	710	*800*	1100 · 1100	1100 · 1500
500	20“	508,0	6,3	762,0	710	800	*900*	1200 · 1200	1200 · 1500
600	24“	610,0	7,1	914,0	800	900	*1000*	*1250 · 1250 **	
700	28“	711,0	8,0	1067,0	900	1000	-	*1400 · 1400 **	
800	32“	813,0	8,8	1219,0	1000	1100	-	*1600 · 1600 **	
900	36“	914,0	10,0	1372,0	1100	1200	-	*1900 · 1900 **	
1000	40“	1016,0	11,0	1524,0	1200	1300	-	*2000 · 2000 **	

ATTENTION: Italicised mentioned jacket-pipe dimensions (*) and length of angles (*) are special products resp. minimum length. Please check availability in case of requirement. This also applies to complementary angles [α] < 90°. Elbows with an angle length of 1,5 m are used in applications where preformed part is welded to preformed part and sliding up a coupler is otherwise not possible. It´s also possible to use as house entry elbow.

The mentioned steel wall thicknesses are corresponding to the minimum requirements acc. to the standard respectively to the norm wall thicknesses of **isoplus**. These are generally calculated against inside pressure [p] acc. to DIN 2413. Length of bare steel pipe ends: 220 mm ± 10 mm. Orders of special degree elbows should generally indicate the complementary angle [α].



Material specifications jacket pipe see **chapter 2.1.4**
Material specifications carrier pipe see **chapter 2.2.1**
Material specifications PUR hard foam see **chapter 7.1.7**

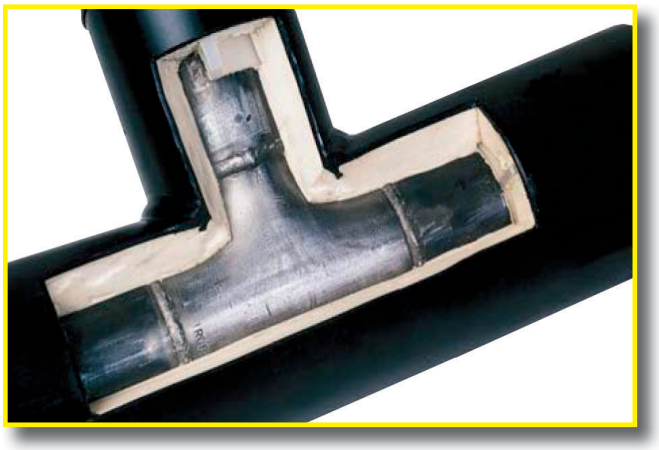
2.2.8 45°-T-Branch / Parallel-Branch / 90°-Vertical-Branch

45° T-Branch

Parallel-Branch

Vertical-Branch

T-Piece acc. to DIN EN 10253-2



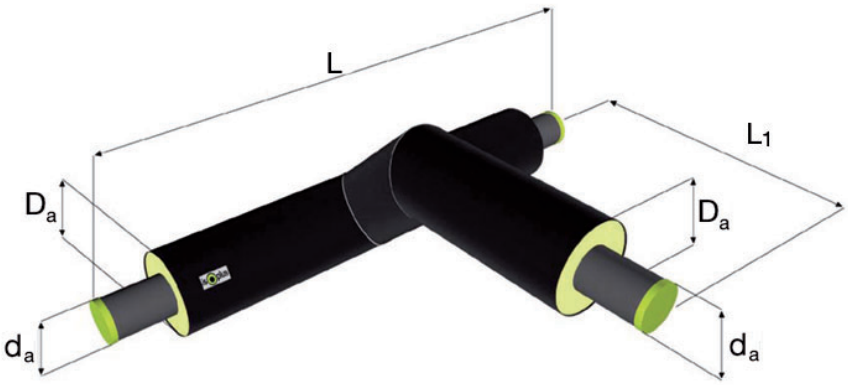
Carrier pipe inside diameter and exit with appropriate wall thickness according to the pipe bars. Pipe elbows 45°- respectively 90° at branch depending on dimension at least acc. to DIN EN 10220 bowed in one piece or with pipe elbow acc. to DIN 10253-2 and welded pipe socket. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends: 220 mm ± 10 mm.

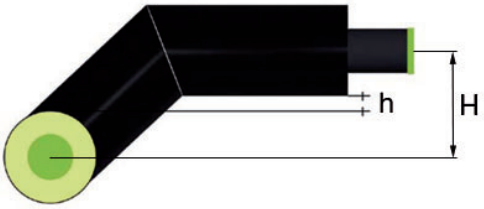
Depending on the nominal diameter, all branches are flared in the ground or with welded T-joints in compliance with DIN EN 10253-2, with appropriate wall thickness according to the pipe bars. The subsequent elbow or pipe cylinder is welded with a lap seam, which can be irradiated. Cylindrical tubes are seamless or welded steel depending on dimension.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.2.1**
Material specification PUR-hard foam see **chapter 7.1.7**

Edition: 16.01.2012

45°-T-Branch / Insulation Class Standard





Dimensions Insulation Class Standard

Branch Exit			Transmission respectively main pipe dimensions																			
DN			20		25		32		40		50		65		80		100		125		150	
Inch			¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
d_a			26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
s			2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		90		90		110		110		125		140		160		200		225		250	
20	L	L_1	1100	695	1100	695	1100	705	1100	705	1100	710	1100	720	1100	730	1100	750	1100	760	1100	775
	h	H	70	160	70	160	70	170	70	170	70	180	70	185	70	195	70	215	70	230	70	240
25	L	L_1			1100	695	1100	705	1100	705	1100	710	1100	720	1100	730	1100	750	1100	760	1100	775
	h	H			70	160	70	170	70	170	70	180	70	185	70	195	70	215	70	230	70	240
32	L	L_1					1100	715	1100	715	1100	720	1100	730	1100	740	1100	760	1100	770	1100	785
	h	H					70	180	70	180	70	190	70	195	70	205	70	225	70	240	70	250
40	L	L_1							1100	715	1100	720	1100	730	1100	740	1100	760	1100	770	1100	785
	h	H							70	180	70	190	70	195	70	205	70	225	70	240	70	250
50	L	L_1									1100	730	1100	735	1100	745	1100	765	1100	780	1100	790
	h	H									70	195	70	205	70	215	70	235	70	245	70	260
65	L	L_1											1100	745	1100	745	1100	775	1100	785	1100	800
	h	H											70	210	70	220	70	240	70	255	70	265
80	L	L_1													1200	800	1200	800	1200	800	1200	800
	h	H													70	230	70	250	70	265	70	275
100	L	L_1															1200	800	1200	800	1200	800
	h	H															70	270	70	285	70	295
125	L	L_1																	1300	850	1300	850
	h	H																	70	295	70	310
150	L	L_1																			1300	850
	h	H																			70	320

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

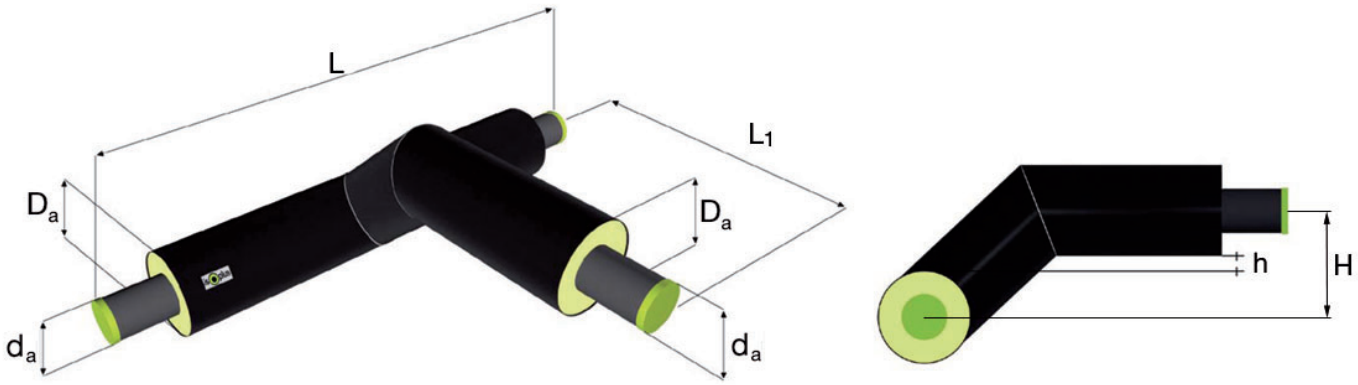
45°-T-Branch / Insulation Class Standard

Dimensions Insulation Class Standard

Branch Exit			Transmission respectively main pipe dimensions																			
DN			200		250		300		350		400		450		500		600		700		800	
Zoll			8“		10“		12“		14“		16“		18“		20“		24“		28“		32“	
d_a			219,1		273,0		323,9		355,6		406,4		457,0		508,0		610,0		711,0		813,0	
s			4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1		8,0		8,8	
DN	D_a		315		400		450		500		560		630		710		800		900		1000	
20	L	L_1	1100	805	1100	850	1100	875	1100	900	1100	930	1100	965	1100	985	1100	1050	1100	1100	1100	1150
	h	H	70	275	70	315	70	340	70	365	70	395	70	430	70	450	70	515	70	565	70	615
25	L	L_1	1100	805	1100	850	1100	875	1100	900	1100	930	1100	965	1100	985	1100	1050	1100	1100	1100	1150
	h	H	70	275	70	315	70	340	70	365	70	395	70	430	70	450	70	515	70	565	70	615
32	L	L_1	1100	815	1100	860	1100	885	1100	910	1100	940	1100	975	1100	995	1100	1060	1100	1110	1100	1160
	h	H	70	285	70	325	70	350	70	375	70	405	70	440	70	460	70	525	70	575	70	625
40	L	L_1	1100	815	1100	860	1100	885	1100	910	1100	940	1100	975	1100	995	1100	1060	1100	1110	1100	1160
	h	H	70	285	70	325	70	350	70	375	70	405	70	440	70	460	70	525	70	575	70	625
50	L	L_1	1100	825	1100	865	1100	890	1100	915	1100	945	1100	980	1100	1000	1100	1065	1100	1115	1100	1165
	h	H	70	290	70	335	70	360	70	385	70	415	70	450	70	470	70	535	70	585	70	635
65	L	L_1	1100	830	1100	875	1100	900	1100	925	1100	955	1100	990	1100	1000	1100	1075	1100	1125	1100	1175
	h	H	70	300	70	340	70	365	70	390	70	420	70	455	70	455	70	540	70	590	70	640
80	L	L_1	1200	850	1200	900	1200	900	1200	950	1200	950	1200	1000	1200	1000	1200	1050	1200	1150	1200	1150
	h	H	70	310	70	350	70	375	70	400	70	430	70	465	70	485	70	550	70	600	70	650
100	L	L_1	1200	850	1200	900	1200	950	1200	950	1200	1000	1200	1000	1200	1050	1200	1100	1200	1150	1200	1200
	h	H	70	330	70	370	70	495	70	420	70	450	70	485	70	505	70	570	70	620	70	670
125	L	L_1	1300	850	1300	900	1300	950	1300	950	1300	1000	1300	1050	1300	1050	1300	1100	1300	1150	1300	1200
	h	H	70	340	70	385	70	410	70	435	70	465	70	500	70	520	70	585	70	635	70	685
150	L	L_1	1300	850	1300	950	1300	950	1300	1000	1300	1000	1300	1050	1300	1100	1300	1150	1300	1200	1300	1200
	h	H	70	355	70	395	70	420	70	445	70	475	70	510	70	530	70	595	70	645	70	695
200	L	L_1	1400	950	1400	1000	1400	1000	1400	1050	1400	1050	1400	1100	1400	1150	1400	1200	1400	1250	1400	1250
	h	H	70	385	70	430	70	455	70	480	70	510	70	545	70	565	70	630	70	680	70	730
250	L	L_1			1500	1050	1500	1050	1500	1100	1500	1100	1500	1150	1500	1200	1500	1250	1500	1300	1500	1300
	h	H			70	470	70	495	70	520	70	550	70	585	70	605	70	670	70	720	70	770
300	L	L_1					1600	1100	1600	1150	1600	1150	1600	1200	1600	1250	1600	1300	1600	1350	1600	1340
	h	H					70	520	70	545	70	575	70	510	70	630	70	695	70	745	70	795
350	L	L_1							1700	1200	1700	1200	1700	1250	1700	1250	1700	1300	1700	1350	1700	1400
	h	H							70	570	70	600	70	635	70	655	70	720	70	770	70	820
400	L	L_1									1700	1250	1700	1300	1700	1300	1700	1350	1700	1400	1700	1450
	h	H									70	630	70	665	70	685	70	750	70	800	70	850
450	L	L_1											1800	1350	1800	1350	1800	1400	1800	1450	1800	1500
	h	H											70	700	70	720	70	785	70	835	70	885
500	L	L_1													1800	1500	1800	1600	1800	1700	1800	1700
	h	H													70	740	70	805	70	875	70	905
600	L	L_1															2000	1700	2000	1800	2000	1800
	h	H															70	870	70	920	70	970
700	L	L_1																	2100	1900	2100	1900
	h	H																	70	970	70	1020
800	L	L_1																			2200	2000
	h	H																			70	1070

Legend, information and explanation see **previous page**

45°-T-Branch / Insulation Class 1x reinforced



Dimensions Insulation Class 1x reinforced

Branch Exit			Transmission respectively main pipe dimensions																			
	DN		20		25		32		40		50		65		80		100		125		150	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
	s		2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		110		110		125		125		140		160		180		225		250		280	
20	L	L_1	1100	715	1100	715	1100	720	1100	720	1100	730	1100	740	1100	750	1100	770	1100	785	1100	800
	h	H	70	180	70	180	70	190	70	190	70	195	70	205	70	215	70	240	70	250	70	265
25	L	L_1			1100	715	1100	720	1100	720	1100	730	1100	740	1100	750	1100	770	1100	785	1100	800
	h	H			70	180	70	190	70	190	70	195	70	205	70	215	70	240	70	250	70	265
32	L	L_1					1100	730	1100	730	1100	735	1100	745	1100	755	1100	780	1100	790	1100	805
	h	H					70	195	70	195	70	205	70	215	70	225	70	245	70	260	70	275
40	L	L_1							1100	730	1100	735	1100	745	1100	755	1100	780	1100	790	1100	805
	h	H							70	195	70	205	70	215	70	225	70	245	70	260	70	275
50	L	L_1									1100	745	1100	755	1100	765	1100	785	1100	800	1100	815
	h	H									70	210	70	220	70	230	70	255	70	265	70	280
65	L	L_1											1100	765	1100	775	1100	795	1100	810	1100	825
	h	H											70	230	70	240	70	265	70	275	70	290
80	L	L_1													1200	800	1200	800	1200	800	1200	850
	h	H													70	250	70	275	70	285	70	300
100	L	L_1															1200	850	1200	850	1200	850
	h	H															70	295	70	310	70	325
125	L	L_1																	1300	850	1300	850
	h	H																	70	320	70	335
150	L	L_1																			1300	900
	h	H																			70	350

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 04.10.2012

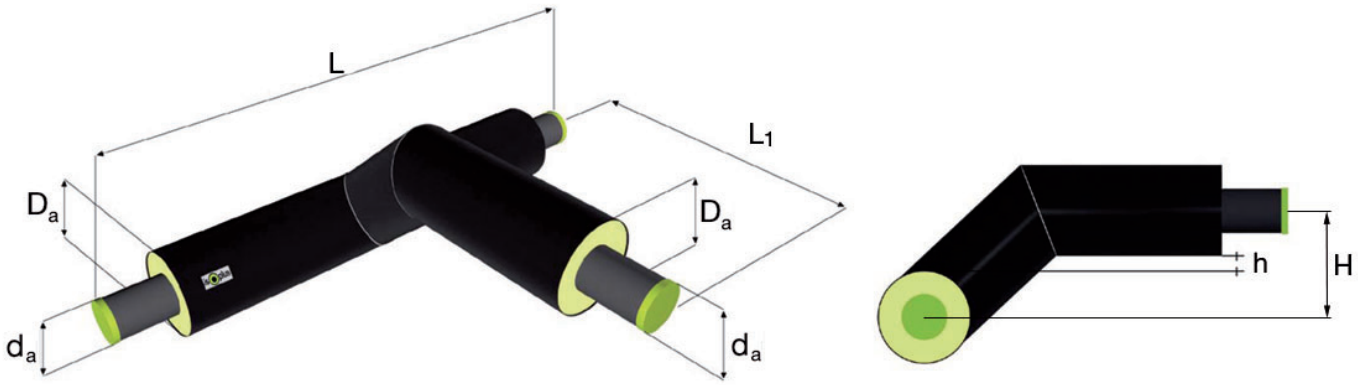
45°-T-Branch / Insulation Class 1x reinforced

Dimensions Insulation Class 1x reinforced

Branch Exit			Transmission respectively main pipe dimensions																			
DN			200		250		300		350		400		450		500		600		700		800	
Inch			8“		10“		12“		14“		16“		18“		20“		24“		28“		32“	
d_a			219,1		273,0		323,9		355,6		406,4		457,0		508,0		610,0		711,0		813,0	
s			4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1		8,0		8,8	
DN	D_a		355		450		500		560		630		710		800		900		1000		1100	
20	L	L_1	1100	835	1100	885	1100	910	1100	940	1100	975	1100	995	1100	1015	1100	1110	1100	1160	1100	1210
	h	H	70	305	70	350	70	375	70	405	70	440	70	460	70	480	70	575	70	625	70	675
25	L	L_1	1100	835	1100	885	1100	910	1100	940	1100	975	1100	995	1100	1015	1100	1110	1100	1160	1100	1210
	h	H	70	305	70	350	70	375	70	405	70	440	70	460	70	480	70	575	70	625	70	675
32	L	L_1	1100	845	1100	890	1100	915	1100	945	1100	980	1100	1000	1100	1020	1100	1115	1100	1165	1100	1215
	h	H	70	310	70	360	70	385	70	415	70	450	70	470	70	490	70	585	70	635	70	685
40	L	L_1	1100	845	1100	890	1100	915	1100	945	1100	980	1100	1000	1100	1020	1100	1115	1100	1165	1100	1215
	h	H	70	310	70	360	70	385	70	415	70	450	70	470	70	490	70	585	70	635	70	685
50	L	L_1	1100	850	1100	900	1100	925	1100	955	1100	990	1100	1010	1100	1030	1100	1125	1100	1175	1100	1225
	h	H	70	320	70	365	70	390	70	420	70	455	70	475	70	495	70	590	70	640	70	690
65	L	L_1	1100	860	1100	910	1100	935	1100	965	1100	1000	1100	1020	1100	1040	1100	1135	1100	1185	1100	1235
	h	H	70	330	70	375	70	400	70	430	70	465	70	485	70	505	70	600	70	650	70	700
80	L	L_1	1200	850	1200	900	1200	950	1200	950	1200	1000	1200	1050	1200	1100	1200	1150	1200	1200	1200	1200
	h	H	70	340	70	385	70	410	70	440	70	475	70	495	70	515	70	610	70	660	70	710
100	L	L_1	1200	900	1200	950	1200	950	1200	1000	1200	1050	1200	1050	1200	1100	1200	1200	1200	1250	1200	1250
	h	H	70	360	70	410	70	435	70	465	70	500	70	520	70	540	70	635	70	685	70	735
125	L	L_1	1300	900	1300	950	1300	1000	1300	1000	1300	1050	1300	1050	1300	1100	1300	1200	1300	1250	1300	1250
	h	H	70	375	70	420	70	445	70	475	70	510	70	530	70	550	70	645	70	695	70	745
150	L	L_1	1300	950	1300	1000	1300	1000	1300	1050	1300	1100	1300	1100	1300	1100	1300	1250	1300	1300	1300	1300
	h	H	70	390	70	435	70	460	70	490	70	525	70	545	70	565	70	660	70	710	70	760
200	L	L_1	1400	1000	1400	1050	1400	1050	1400	1100	1400	1150	1400	1150	1400	1150	1400	1300	1400	1350	1400	1350
	h	H	70	425	70	475	70	500	70	530	70	565	70	585	70	605	70	700	70	750	70	800
250	L	L_1			1500	1100	1500	1100	1500	1150	1500	1200	1500	1200	1500	1250	1500	1350	1500	1400	1500	1400
	h	H			70	520	70	545	70	575	70	610	70	630	70	650	70	745	70	795	70	845
300	L	L_1					1600	1150	1600	1200	1600	1250	1600	1250	1600	1250	1600	1400	1600	1450	1600	1450
	h	H					70	575	70	600	70	635	70	655	70	675	70	770	70	820	70	870
350	L	L_1							1700	1250	1700	1300	1700	1300	1700	1350	1700	1450	1700	1500	1700	1500
	h	H							70	630	70	665	70	685	70	705	70	800	70	850	70	900
400	L	L_1									1700	1350	1700	1350	1700	1350	1700	1500	1700	1550	1700	1550
	h	H									70	700	70	720	70	740	70	835	70	885	70	935
450	L	L_1											1800	1400	1800	1400	1800	1500	1800	1550	1800	1550
	h	H											70	740	70	760	70	855	70	905	70	955
500	L	L_1													1800	1500	1800	1600	1800	1700	1800	1700
	h	H													70	780	70	875	70	925	70	975
600	L	L_1															2000	1700	2000	1800	2000	1800
	h	H															70	970	70	1020	70	1070
700	L	L_1																	2100	1900	2100	1900
	h	H																	70	1070	70	1120
800	L	L_1																			2200	2100
	h	H																			70	1170

Legend, information and explanation see **previous page**

45°-T-Branch / Insulation Class 2x reinforced



Dimensions Insulation Class 2x reinforced

Branch Exit	Transmission respectively main pipe dimensions																					
DN			20		25		32		40		50		65		80		100		125		150	
Inch			¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
d_a			26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
s			2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		125		125		140		140		160		180		200		250		280		315	
20	L	L_1	1100	730	1100	730	1100	735	1100	735	1100	745	1100	755	1100	765	1100	790	1100	805	1100	825
	h	H	70	195	70	195	70	205	70	205	70	215	70	225	70	235	70	260	70	275	70	290
25	L	L_1			1100	730	1100	735	1100	735	1100	745	1100	755	1100	765	1100	790	1100	805	1100	825
	h	H			70	195	70	205	70	205	70	215	70	225	70	235	70	260	70	275	70	290
32	L	L_1					1100	745	1100	745	1100	755	1100	765	1100	775	1100	800	1100	815	1100	830
	h	H					70	210	70	210	70	220	70	230	70	240	70	265	70	280	70	300
40	L	L_1							1100	745	1100	755	1100	765	1100	775	1100	800	1100	815	1100	830
	h	H							70	210	70	220	70	230	70	240	70	265	70	280	70	300
50	L	L_1									1100	765	1100	775	1100	785	1100	810	1100	825	1100	840
	h	H									70	230	70	240	70	250	70	275	70	290	70	310
65	L	L_1											1100	785	1100	795	1100	820	1100	835	1100	850
	h	H											70	250	70	260	70	285	70	300	70	320
80	L	L_1													1200	800	1200	850	1200	850	1200	850
	h	H													70	270	70	295	70	310	70	330
100	L	L_1															1200	850	1200	900	1200	900
	h	H															70	320	70	335	70	355
125	L	L_1																	1300	900	1300	950
	h	H																	70	350	70	370
150	L	L_1																			1300	950
	h	H																			70	385

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 04.10.2012

45°-T-Branch / Insulation Class 2x reinforced

Dimensions Insulation Class 2x reinforced

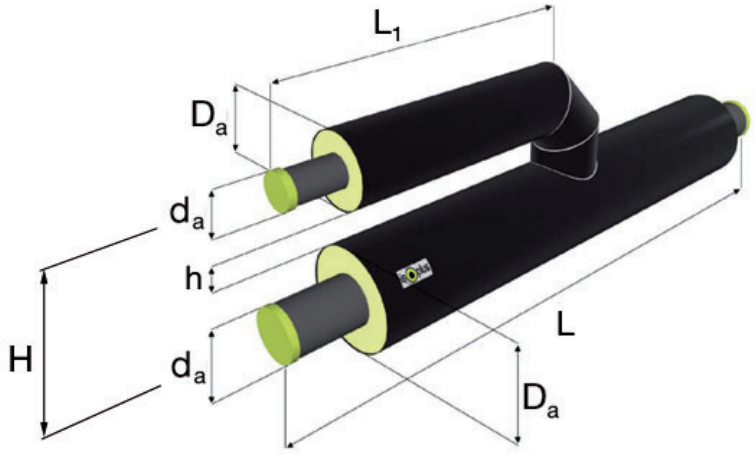
Branch Exit	Transmission respectively main pipe dimensions																	
	DN		200		250		300		350		400		450		500		600	
	Inch		8“		10“		12“		14“		16“		18“		20“		24“	
	d_a		219,1		273,0		323,9		355,6		406,4		457,0		508,0		610,0	
	s		4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1	
DN	D_a		400		500		560		630		710		800		900		1000	
20	L	L_1	1100	865	1100	915	1100	945	1100	980	1100	1000	1100	1020	1100	1067	1100	1118
	h	H	70	335	70	385	70	415	70	450	70	470	70	490	70	535	70	635
25	L	L_1	1100	865	1100	915	1100	945	1100	980	1100	1000	1100	1020	1100	1067	1100	1118
	h	H	70	335	70	385	70	415	70	450	70	470	70	490	70	535	70	635
32	L	L_1	1100	875	1100	925	1100	955	1100	990	1100	1010	1100	1030	1100	1075	1100	1125
	h	H	70	340	70	390	70	420	70	455	70	475	70	495	70	540	70	640
40	L	L_1	1100	875	1100	925	1100	955	1100	990	1100	1010	1100	1030	1100	1075	1100	1125
	h	H	70	340	70	390	70	420	70	455	70	475	70	495	70	540	70	640
50	L	L_1	1100	885	1100	935	1100	965	1100	1000	1100	1020	1100	1040	1100	1085	1100	1135
	h	H	70	350	70	400	70	430	70	465	70	485	70	505	70	550	70	650
65	L	L_1	1100	895	1100	945	1100	965	1100	1010	1100	1030	1100	1050	1100	1085	1100	1145
	h	H	70	360	70	410	70	440	70	475	70	495	70	515	70	560	70	660
80	L	L_1	1200	950	1200	1000	1200	1000	1200	1050	1200	1050	1200	1100	1200	1150	1200	1140
	h	H	70	370	70	420	70	450	70	485	70	505	70	525	70	570	70	670
100	L	L_1	1200	950	1200	1000	1200	1000	1200	1050	1200	1100	1200	1100	1200	1150	1200	1175
	h	H	70	395	70	445	70	475	70	510	70	530	70	550	70	595	70	695
125	L	L_1	1300	1000	1300	1050	1300	1050	1300	1100	1300	1100	1300	1150	1300	1200	1300	1178
	h	H	70	410	70	460	70	490	70	525	70	545	70	565	70	610	70	710
150	L	L_1	1300	1000	1300	1050	1300	1050	1300	1100	1300	1150	1300	1200	1300	1200	1300	1203
	h	H	70	430	70	480	70	510	70	545	70	565	70	585	70	630	70	730
200	L	L_1	1400	1050	1400	1100	1400	1150	1400	1150	1400	1200	1400	1250	1400	1300	1400	1263
	h	H	70	470	70	520	70	550	70	585	70	605	70	625	70	670	70	770
250	L	L_1			1500	1200	1500	1200	1500	1250	1500	1250	1500	1300	1500	1350	1500	1330
	h	H			70	570	70	600	70	635	70	655	70	675	70	720	70	820
300	L	L_1					1600	1250	1600	1300	1600	1300	1600	1350	1600	1400	1600	1395
	h	H					70	630	70	665	70	685	70	705	70	750	70	850
350	L	L_1							1700	1350	1700	1350	1700	1400	1700	1450	1700	1415
	h	H							70	700	70	720	70	740	70	785	70	885
400	L	L_1									1700	1400	1700	1450	1700	1500	1700	1455
	h	H									70	740	70	760	70	805	70	905
450	L	L_1											1800	1450	1800	1500	1800	1490
	h	H											70	780	70	825	70	925
500	L	L_1													1800	1600	1800	1545
	h	H													70	870	70	970
600	L	L_1															2000	1700
	h	H															70	1070

ATTENTION: Insulation class 2x reinforced are special products. Please check availability in case of request.

Legend, information and explanation see **previous page**

Edition: 25.03.2020

Parallel-Branch / Insulation Class Standard



Dimensions Insulation Class Standard

Branch Exit	Transmission respectively main pipe dimensions																					
DN	DN		20		25		32		40		50		65		80		100		125		150	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
	s		2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		90		90		110		110		125		140		160		200		225		250	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	210	120	210	120	220	120	220	120	230	120	235	120	245	120	265	120	280	120	290
25	L	L_1			1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H			120	210	120	220	120	220	120	230	120	235	120	245	120	265	120	280	120	290
32	L	L_1					1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H					120	230	120	230	120	240	120	245	120	255	120	275	120	290	120	300
40	L	L_1							1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H							120	230	120	240	120	245	120	255	120	275	120	290	120	300
50	L	L_1									1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H									120	245	120	255	120	265	120	285	120	295	120	310
65	L	L_1											1100	600	1100	600	1100	600	1100	600	1100	600
	h	H											120	260	120	270	120	290	120	305	120	315
80	L	L_1													1200	600	1200	600	1200	600	1200	600
	h	H													130	290	120	300	120	315	120	325
100	L	L_1															1200	550	1200	550	1200	550
	h	H															120	320	120	335	120	345
125	L	L_1																	1300	600	1300	600
	h	H																	140	365	140	380
150	L	L_1																			1300	650
	h	H																			122	375

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

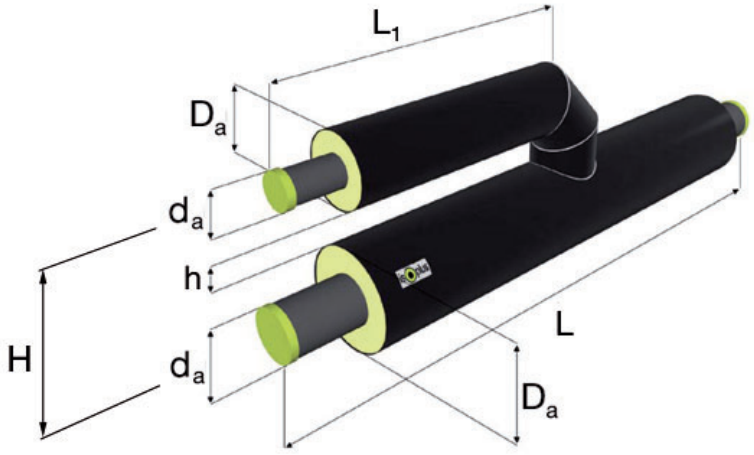
Parallel-Branch / Insulation Class Standard

Dimensions Insulation Class Standard

Branch Exit			Transmission respectively main pipe dimensions																			
DN			200		250		300		350		400		450		500		600		700		800	
Inch			8“		10“		12“		14“		16“		18“		20“		24“		28“		32“	
d_a			219,1		273,0		323,9		355,6		406,4		457,0		508,0		610,0		711,0		813,0	
s			4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1		8,0		8,8	
DN	D_a		315		400		450		500		560		630		710		800		900		1000	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	325	120	365	120	390	120	415	120	445	120	480	120	500	120	565	120	615	120	665
25	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	325	120	365	120	390	120	415	120	445	120	480	120	500	120	565	120	615	120	665
32	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	335	120	375	120	400	120	425	120	455	120	490	120	510	120	575	120	625	120	675
40	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	335	120	375	120	400	120	425	120	455	120	490	120	510	120	575	120	625	120	675
50	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	340	120	385	120	410	120	435	120	465	120	500	120	520	120	585	120	635	120	685
65	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	350	120	390	120	415	120	440	120	470	120	505	120	525	120	590	120	640	120	690
80	L	L_1	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600
	h	H	120	360	120	400	120	425	120	450	120	480	120	515	120	535	120	600	120	650	120	700
100	L	L_1	1200	550	1200	550	1200	550	1200	550	1200	550	1200	550	1200	550	1200	550	1200	550	1200	550
	h	H	120	380	120	420	120	445	120	470	120	500	120	535	120	555	120	620	120	670	120	720
125	L	L_1	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600
	h	H	120	390	120	433	120	458	120	483	120	515	120	548	120	568	120	635	120	685	120	735
150	L	L_1	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650
	h	H	114	390	140	465	140	490	140	515	140	545	140	580	140	600	140	665	140	715	140	765
200	L	L_1	1400	700	1400	700	1400	700	1400	700	1400	700	1400	700	1400	700	1400	700	1400	700	1400	750
	h	H	168	485	150	510	150	535	190	600	190	630	180	655	185	680	160	720	160	770	160	820
250	L	L_1			1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800
	h	H			197	600	197	625	188	640	184	665	174	690	230	765	220	820	180	830	180	880
300	L	L_1					1600	850	1600	850	1600	850	1600	850	1600	850	1600	850	1600	850	1600	850
	h	H					261	715	252	730	247	755	238	780	243	805	229	855	230	905	220	945
350	L	L_1							1700	900	1700	900	1700	900	1700	900	1700	900	1700	900	1700	900
	h	H							312	815	308	840	298	865	304	890	289	940	290	990	291	1045
400	L	L_1									1700	1000	1700	1000	1700	1000	1700	1000	1700	1000	1700	1000
	h	H									355	915	345	940	351	970	336	1020	337	1070	338	1120
450	L	L_1											1800	1100	1800	1100	1800	1100	1800	1100	1800	1100
	h	H											399	1030	404	1055	390	1105	391	1160	392	1210
500	L	L_1													1800	1200	1800	1200	1800	1200	1800	1200
	h	H													473	1145	459	1195	460	1245	460	1295
600	L	L_1															2000	1250	2000	1250	2000	1250
	h	H															546	1350	572	1425	573	1475
700	L	L_1																	2100	1400	2100	1400
	h	H																	688	1590	689	1640
800	L	L_1																			2200	1600
	h	H																			816	1820

Legend, information and explanation see **previous page**

Parallel-Branch / Insulation Class 1x reinforced



Dimensions Insulation Class 1x reinforced

Branch Exit	Transmission respectively main pipe dimensions																					
DN	DN		20		25		32		40		50		65		80		100		125		150	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
	s		2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		110		110		125		125		140		160		180		225		250		280	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	230	120	230	120	240	120	240	120	245	120	255	120	265	120	290	120	300	120	315
25	L	L_1			1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H			120	230	120	240	120	240	120	245	120	255	120	265	120	290	120	300	120	315
32	L	L_1					1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H					120	245	120	245	120	255	120	265	120	275	120	295	120	310	120	325
40	L	L_1							1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H							120	245	120	255	120	265	120	275	120	295	120	310	120	325
50	L	L_1									1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H									120	260	120	270	120	280	120	305	120	315	120	330
65	L	L_1											1100	600	1100	600	1100	600	1100	600	1100	600
	h	H											120	280	120	290	120	315	120	325	120	340
80	L	L_1													1200	600	1200	600	1200	600	1200	600
	h	H													120	300	120	325	120	335	120	350
100	L	L_1															1200	600	1200	600	1200	600
	h	H															120	345	120	360	120	375
125	L	L_1																	1300	600	1300	600
	h	H																	120	370	140	405
150	L	L_1																			1300	650
	h	H																			140	420

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 16.01.2012

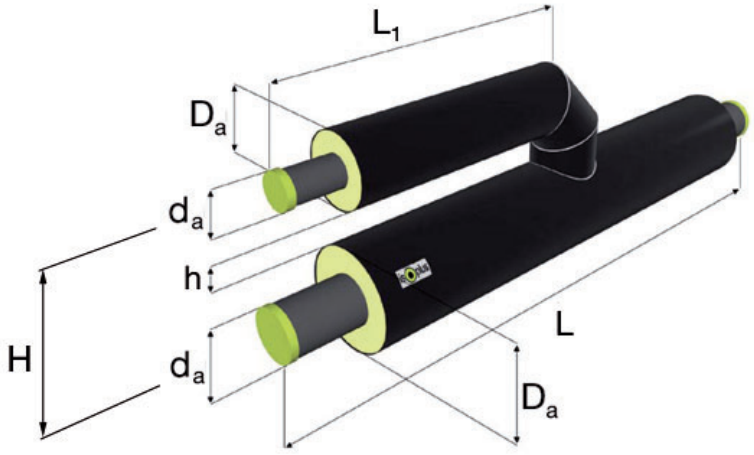
Parallel-Branch / Insulation Class 1x reinforced

Dimensions Insulation Class 1x reinforced

Branch Exit			Transmission respectively main pipe dimensions																			
DN			200		250		300		350		400		450		500		600		700		800	
Inch			8“		10“		12“		14“		16“		18“		20“		24“		28“		32“	
d_a			219,1		273,0		323,9		355,6		406,4		457,2		508,0		610,0		711,0		813,0	
s			4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1		8,0		8,8	
DN	D_a		355		450		500		560		630		710		800		900		1000		1100	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	355	120	400	120	425	120	455	120	490	120	510	120	530	120	625	120	675	120	725
25	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	355	120	400	120	425	120	455	120	490	120	510	120	530	120	625	120	675	120	725
32	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	360	120	410	120	435	120	465	120	500	120	520	120	540	120	635	120	685	120	735
40	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	360	120	410	120	435	120	465	120	500	120	520	120	540	120	635	120	685	120	735
50	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	370	120	415	120	440	120	470	120	505	120	525	120	545	120	640	120	690	120	740
65	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	380	120	425	120	450	120	480	120	515	120	535	120	555	120	650	120	700	120	750
80	L	L_1	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600
	h	H	120	390	120	435	120	460	120	490	120	525	120	545	120	565	120	660	120	710	120	760
100	L	L_1	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600
	h	H	120	410	120	460	120	485	120	515	120	550	120	570	120	590	120	685	120	735	120	785
125	L	L_1	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600
	h	H	120	425	120	470	120	495	120	525	120	560	120	580	120	600	120	695	120	745	120	795
150	L	L_1	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650
	h	H	140	460	140	505	140	530	140	560	140	595	140	615	140	635	140	730	140	780	140	830
200	L	L_1	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750
	h	H	128	485	160	565	160	590	160	620	160	655	160	680	160	695	160	790	160	840	160	890
250	L	L_1			1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800
	h	H			147	600	147	625	180	685	170	710	180	740	180	760	180	855	180	905	180	955
300	L	L_1					1600	850	1600	850	1600	850	1600	850	1600	850	1600	850	1600	850	1600	850
	h	H					211	711	197	730	237	805	193	780	198	805	220	920	220	970	220	1020
350	L	L_1							1700	900	1700	900	1700	900	1700	900	1700	900	1700	900	1700	900
	h	H							252	815	243	840	248	865	254	890	260	990	260	1040	260	1090
400	L	L_1									1700	1000	1700	1000	1700	1000	1700	1000	1700	1000	1700	1000
	h	H									285	915	290	940	296	970	300	1065	300	1115	300	1165
450	L	L_1											1800	1100	1800	1100	1800	1100	1800	1100	1800	1100
	h	H											359	1030	364	1055	320	1105	321	1160	322	1210
500	L	L_1													1800	1200	1800	1200	1800	1200	1800	1200
	h	H													433	1145	389	1195	390	1245	390	1295
600	L	L_1															2000	1250	2000	1250	2000	1250
	h	H															446	1350	472	1425	473	1475
700	L	L_1																	2100	1400	2100	1400
	h	H																	588	1590	589	1640
800	L	L_1																			2200	1600
	h	H																			716	1820

Legend, information and explanation see **previous page**

Parallel-Branch / Insulation Class 2x reinforced



Dimensions Insulation Class 2x reinforced

Branch Exit	Transmission respectively main pipe dimensions																					
DN	DN		20		25		32		40		50		65		80		100		125		150	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3	
	s		2,6		3,2		3,2		3,2		3,2		3,2		3,2		3,6		4,0		4,5	
DN	D_a		125		125		140		140		160		180		200		250		280		315	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	245	120	245	120	255	120	255	120	265	120	275	120	285	120	310	120	325	120	340
25	L	L_1			1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H			120	245	120	255	120	255	120	265	120	275	120	285	120	310	120	325	120	340
32	L	L_1					1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H					120	260	120	260	120	270	120	280	120	290	120	315	120	330	120	350
40	L	L_1							1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H							120	260	120	270	120	280	120	290	120	315	120	330	120	350
50	L	L_1									1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H									120	280	120	290	120	300	120	325	120	340	120	360
65	L	L_1											1100	600	1100	600	1100	600	1100	600	1100	600
	h	H											120	300	120	310	120	335	120	350	120	370
80	L	L_1													1200	600	1200	600	1200	600	1200	600
	h	H													120	320	120	345	120	360	120	380
100	L	L_1															1200	600	1200	600	1200	600
	h	H															120	370	120	385	120	405
125	L	L_1																	1300	600	1300	600
	h	H																	120	400	120	420
150	L	L_1																			1300	650
	h	H																			120	435

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm
h = Clear component height in mm
H = Axle distance in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 16.01.2012

Parallel-Branch / Insulation Class 2x reinforced

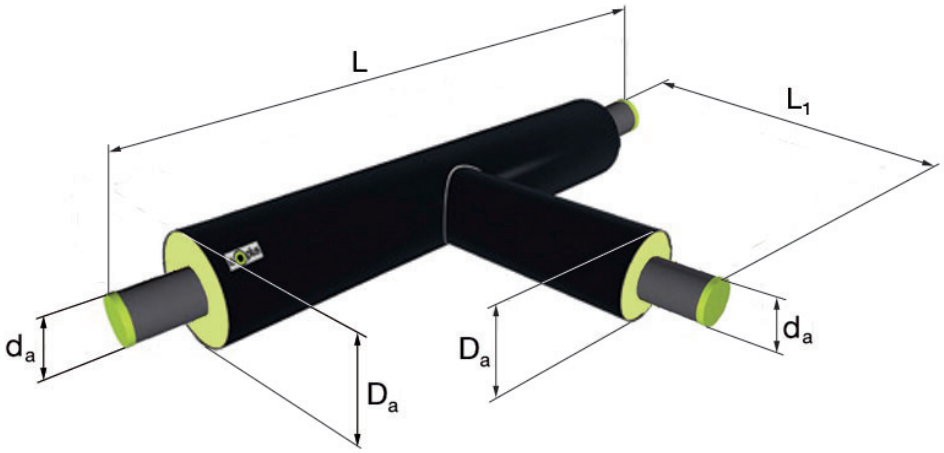
Dimensions Insulation Class 2x reinforced

Branch Exit	Transmission respectively main pipe dimensions																	
DN			200		250		300		350		400		450		500		600	
Inch			8“		10“		12“		14“		16“		18“		20“		24“	
d_a			219,1		273,0		323,9		355,6		406,4		457,2		508,0		610,0	
s			4,5		5,0		5,6		5,6		6,3		6,3		6,3		7,1	
DN	D_a		400		500		560		630		710		800		900		1000	
20	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	385	120	435	120	465	120	500	120	520	120	540	120	585	120	685
25	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	385	120	435	120	465	120	500	120	520	120	540	120	585	120	685
32	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	390	120	440	120	570	120	505	120	525	120	545	120	590	120	690
40	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	390	120	440	120	470	120	505	120	525	120	545	120	590	120	690
50	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	400	120	450	120	480	120	515	120	535	120	555	120	600	120	700
65	L	L_1	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600	1100	600
	h	H	120	410	120	460	120	490	120	525	120	545	120	565	120	610	120	710
80	L	L_1	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600
	h	H	120	420	120	470	120	500	120	535	120	555	120	575	120	620	120	720
100	L	L_1	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600	1200	600
	h	H	120	445	120	495	120	525	120	560	120	580	120	600	120	645	120	745
125	L	L_1	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600	1300	600
	h	H	120	460	120	510	120	540	120	575	120	595	120	615	120	660	120	760
150	L	L_1	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650	1300	650
	h	H	120	480	120	530	120	560	120	600	120	615	120	635	120	680	120	780
200	L	L_1	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750	1400	750
	h	H	140	540	120	570	120	600	120	635	120	655	120	675	120	720	120	820
250	L	L_1			1500	800	1500	800	1500	800	1500	800	1500	800	1500	800	1500	800
	h	H			150	650	142	675	130	695	130	715	135	740	120	770	130	880
300	L	L_1					1600	850	1600	850	1600	850	1600	850	1600	850	1600	850
	h	H					151	715	185	780	190	805	195	830	175	855	150	930
350	L	L_1							1700	900	1700	900	1700	900	1700	900	1700	900
	h	H							182	815	188	840	245	915	225	940	180	995
400	L	L_1									1700	1000	1700	1000	1700	1000	1700	1000
	h	H									245	915	250	940	231	970	230	1065
450	L	L_1											1800	1100	1800	1100	1800	1100
	h	H											319	1030	299	1055	250	1105
500	L	L_1													1800	1200	1800	1200
	h	H													343	1145	294	1195
600	L	L_1															2000	1250
	h	H															346	1350

ATTENTION: Insulation class 2x reinforced are special products. Please check availability in case of request.

Legend, information and explanation see **previous page**

90°-Vertical-Branch / Insulation Class Standard



Dimensions Insulation Class Standard

Branch Exit		Transmission respectively main pipe dimensions									
	DN	20	25	32	40	50	65	80	100	125	150
	Inch	¾“	1“	1 ½“	1 ¼“	2“	2 ½“	3“	4“	5“	6“
	d_a	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3
	s	2,6	3,2	3,2	3,2	3,2	3,2	3,2	3,6	3,6	4,0
DN	D_a	90	90	110	110	125	140	160	200	225	250
20	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	600	600	600	600	600	650	650	650	700	700
25	L		1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1		600	600	600	600	650	650	650	700	700
32	L			1100	1100	1100	1100	1100	1100	1100	1100
	L_1			600	600	600	650	650	650	700	700
40	L				1100	1100	1100	1100	1100	1100	1100
	L_1				600	600	650	650	650	700	700
50	L					1100	1100	1100	1100	1100	1100
	L_1					600	650	650	650	700	700
65	L						1100	1100	1100	1100	1100
	L_1						650	650	650	700	700
80	L							1200	1200	1200	1200
	L_1							650	650	700	700
100	L								1200	1200	1200
	L_1								650	700	700
125	L									1300	1300
	L_1									700	700
150	L										1300
	L_1										700

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 16.01.2012

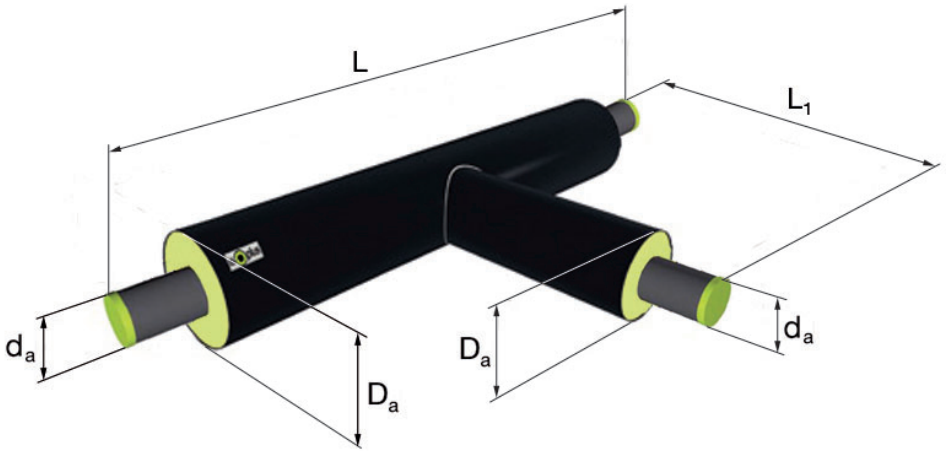
90°-Vertical-Branch / Insulation Class Standard

Dimensions Insulation Class Standard

Branch Exit		Transmission respectively main pipe dimensions									
DN		200	250	300	350	400	450	500	600	700	800
Inch		8“	10“	12“	14“	16“	18“	20“	24“	28“	32“
d_a		219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0	711,0	813,0
s		4,5	5,0	5,6	5,6	6,3	6,3	6,3	7,1	8,0	8,8
DN	D_a	315	400	450	500	560	630	710	800	900	1000
20	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
25	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
32	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
40	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
50	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
65	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
80	L	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000	1000	1100
100	L	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000	1000	1100
125	L	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000	1000	1100
150	L	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000	1000	1100
200	L	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
	L_1	700	800	800	800	800	900	900	1000	1000	1100
250	L		1500	1500	1500	1500	1500	1500	1500	1500	1500
	L_1		800	800	800	800	900	900	1000	1000	1100
300	L			1600	1600	1600	1600	1600	1600	1600	1600
	L_1			800	800	800	900	900	1000	1000	1100
350	L				1700	1700	1700	1700	1700	1700	1700
	L_1				800	800	900	900	1000	1000	1100
400	L					1700	1700	1700	1700	1700	1700
	L_1					800	900	900	1000	1000	1100
450	L						1800	1800	1800	1800	1800
	L_1						900	900	1000	1000	1100
500	L							1800	1800	1800	1800
	L_1							900	1000	1000	1100
600	L								2000	2000	2000
	L_1								1000	1000	1100
700	L									2100	2100
	L_1									1000	1100
800	L										2200
	L_1										1100

Legend, information and explanation see **previous page**

90°-Vertical-Branch / Insulation Class 1x reinforced



Dimensions Insulation Class 1x reinforced

Branch Exit		Transmission respectively main pipe dimensions									
	DN	20	25	32	40	50	65	80	100	125	150
	Inch	¾“	1“	1 ½“	1 ¼“	2“	2 ½“	3“	4“	5“	6“
	d_a	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3
	s	2,6	3,2	3,2	3,2	3,2	3,2	3,2	3,6	4,0	4,5
DN	D_a	110	110	125	125	140	160	180	225	250	280
20	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	600	600	600	600	600	650	650	650	700	700
25	L		1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1		600	600	600	600	650	650	650	700	700
32	L			1100	1100	1100	1100	1100	1100	1100	1100
	L_1			600	600	600	650	650	650	700	700
40	L				1100	1100	1100	1100	1100	1100	1100
	L_1				600	600	650	650	650	700	700
50	L					1100	1100	1100	1100	1100	1100
	L_1					600	650	650	650	700	700
65	L						1100	1100	1100	1100	1100
	L_1						650	650	650	700	700
80	L							1200	1200	1200	1200
	L_1							650	650	700	700
100	L								1200	1200	1200
	L_1								650	700	700
125	L									1300	1300
	L_1									700	700
150	L										1300
	L_1										700

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

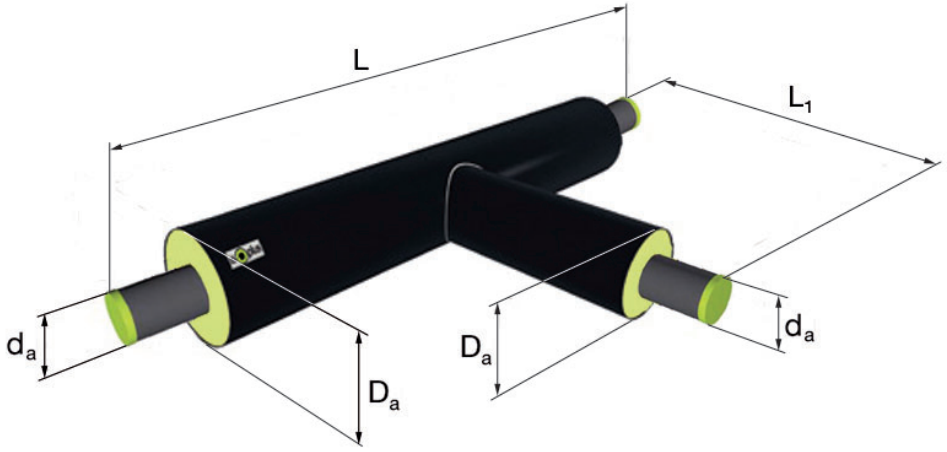
90°-Vertical-Branch / Insulation Class 1x reinforced

Dimensions Insulation Class 1x reinforced

Branch Exit		Transmission respectively main pipe dimensions									
	DN	200	250	300	350	400	450	500	600	700	800
	Inch	8“	10“	12“	14“	16“	18“	20“	24“	28“	32“
	d_a	219,1	273,0	323,9	355,6	406,4	457,0	508,0	610,0	711,0	813,0
	s	4,5	5,0	5,6	5,6	6,3	6,3	6,3	7,1	8,0	8,8
DN	D_a	355	450	500	560	630	710	800	900	1000	1100
20	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
25	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
32	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
40	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
50	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
65	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000	1000	1100
80	L	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000	1000	1100
100	L	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000	1000	1100
125	L	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000	1000	1100
150	L	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000	1000	1100
200	L	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
	L_1	700	800	800	800	800	900	900	1000	1000	1100
250	L		1500	1500	1500	1500	1500	1500	1500	1500	1500
	L_1		800	800	800	800	900	900	1000	1000	1100
300	L			1600	1600	1600	1600	1600	1600	1600	1600
	L_1			800	800	800	900	900	1000	1000	1100
350	L				1700	1700	1700	1700	1700	1700	1700
	L_1				800	800	900	900	1000	1000	1100
400	L					1700	1700	1700	1700	1700	1700
	L_1					800	900	900	1000	1000	1100
450	L						1800	1800	1800	1800	1800
	L_1						900	900	1000	1000	1100
500	L							1800	1800	1800	1800
	L_1							900	1000	1000	1100
600	L								2000	2000	2000
	L_1								1000	1000	1100
700	L									2100	2100
	L_1									1000	1100
800	L										2200
	L_1										1100

Legend, information and explanation see **previous page**

90°-Vertical-Branch / Insulation Class 2x reinforced



Dimensions Insulation Class 2x reinforced

Branch Exit		Transmission respectively main pipe dimensions									
	DN	20	25	32	40	50	65	80	100	125	150
	Inch	¾“	1“	1 ½“	1 ¼“	2“	2 ½“	3“	4“	5“	6“
	d_a	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3
	s	2,6	3,2	3,2	3,2	3,2	3,2	3,2	3,6	4,0	4,5
DN	D_a	125	125	140	140	160	180	200	250	280	315
20	L	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	600	600	600	600	600	650	650	650	700	700
25	L		1100	1100	1100	1100	1100	1100	1100	1100	1100
	L_1		600	600	600	600	650	650	650	700	700
32	L			1100	1100	1100	1100	1100	1100	1100	1100
	L_1			600	600	600	650	650	650	700	700
40	L				1100	1100	1100	1100	1100	1100	1100
	L_1				600	600	650	650	650	700	700
50	L					1100	1100	1100	1100	1100	1100
	L_1					600	650	650	650	700	700
65	L						1100	1100	1100	1100	1100
	L_1						650	650	650	700	700
80	L							1200	1200	1200	1200
	L_1							650	650	700	700
100	L								1200	1200	1200
	L_1								650	700	700
125	L									1300	1300
	L_1									700	700
150	L										1300
	L_1										700

d_a = Steel pipe outside diameter in mm
s = Steel pipe wall thickness acc. to **isoplus** in mm
D_a = Jacket-pipe outside diameter in mm
L = Construction length passage in mm
L_1 = Construction axis length exit in mm

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. Length of bare steel pipe ends: 220 mm ± 10 mm.

For reasons of optimization and in order to follow the actual technical standard we will reserve modifications of dimensions as well as technical modifications. No obligation can be derived in case of possible dimension variations as well as in case of technical modifications.

Edition: 04.10.2012

90°-Vertical-Branch / Insulation Class 2x reinforced

Dimensions Insulation Class 2x reinforced

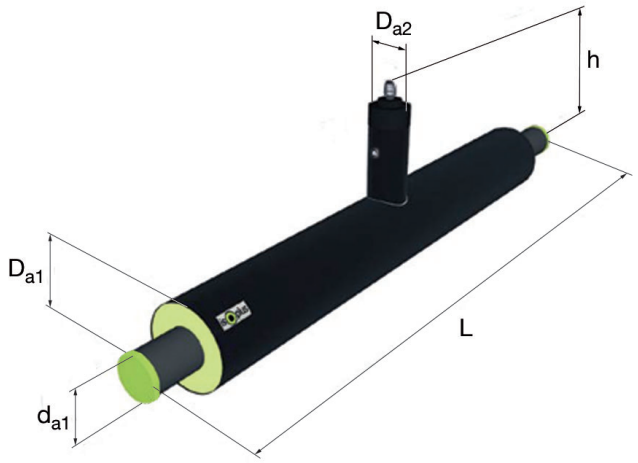
Branch Exit		Transmission respectively main pipe dimensions							
DN	DN	200	250	300	350	400	450	500	600
	Inch	8“	10“	12“	14“	16“	18“	20“	24“
	d_a	219,1	273,0	323,9	355,6	406,4	457,2	508,0	610,0
	s	4,5	5,0	5,6	5,6	6,3	6,3	6,3	7,1
DN	D_a	400	500	450	560	710	800	900	1000
20	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
25	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
32	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
40	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
50	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
65	L	1100	1100	1100	1100	1100	1100	1100	1100
	L_1	700	800	800	800	800	900	900	1000
80	L	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000
100	L	1200	1200	1200	1200	1200	1200	1200	1200
	L_1	700	800	800	800	800	900	900	1000
125	L	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000
150	L	1300	1300	1300	1300	1300	1300	1300	1300
	L_1	700	800	800	800	800	900	900	1000
200	L	1400	1400	1400	1400	1400	1400	1400	1400
	L_1	700	800	800	800	800	900	900	1000
250	L		1500	1500	1500	1500	1500	1500	1500
	L_1		800	800	800	800	900	900	1000
300	L			1600	1600	1600	1600	1600	1600
	L_1			800	800	800	900	900	1000
350	L				1700	1700	1700	1700	1700
	L_1				800	800	900	900	1000
400	L					1700	1700	1700	1700
	L_1					800	900	900	1000
450	L						1800	1800	1800
	L_1						900	900	1000
500	L							1800	1800
	L_1							900	1000
600	L								2000
	L_1								1000

ATTENTION: Insulation class 2x reinforced are special products. Please check availability in case of request.

Legend, information and explanation see **previous page**

Edition: 25.03.2020

2.2.9 Drain / Vent - Branch



Dimensions carrier pipe				Jacket-Pipe-Outside-diameter D_{a1} in mm			Drain / Vent			Overall-length L in mm
Nominal Diameter / Dimension in		Outside-Ø d_{a1} in mm	Wall-thickness s in mm	Insulation Class			Nom. Diameter in	Jack.-P.-Ø D_{a2} in mm	Overall-height h in mm	
DN	Inch			Standard	1x reinforced	2x reinforced	DN	Standard		
25	1“	33,7	3,2	90	110	*125*	25	90	1000	1100
32	1¼“	42,4	3,2	110	125	*140*	25	90	1000	1100
40	1½“	48,3	3,2	110	125	*140*	25	90	1000	1100
50	2“	60,3	3,2	125	140	*160*	25	90	1000	1100
65	2½“	76,1	3,2	140	160	*180*	25	90	1000	1100
80	3“	88,9	3,2	160	180	*200*	50	125	1000	1100
100	4“	114,3	3,6	200	225	*250*	50	125	1000	1100
125	5“	139,7	3,6	225	250	*280*	50	125	1000	1100
150	6“	168,3	4,0	250	280	*315*	50	125	1000	1100
200	8“	219,1	4,5	315	355	*400*	50	125	1000	1100
≥ 250	10“	273,0	5,0	400	450	*500*	50	125	1000	1200

ATTENTION: Italicised mentioned jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement. The ELE-/ELÜ ball-valve is made only in the mentioned sizes with standard insulation thickness. Other insulation thickness is not available!

Carrier Pipe with corresponding wall thickness like the pipe bars. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends: 220 mm ± 10 mm.

Carried out as a vertical branch in accordance with **chapter 2.2.8**. At the outlet end, however, an ELE-/ELÜ ball valve (reduced bore) is fitted with a stainless steel housing and internal thread connection together with the associated plug. The factory fitted shrunk-on end cap is between the HDPE casing pipe end and the ball valve. For a detailed description of the ELE-/ELÜ- ball valve see **chapter 2.2.10**.

Assembling hint see **chapter 10.2.6**
Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.2.1**.
Material specification PUR-Hard foam see **chapter 7.1.7**

2.2.10 Drain / Vent - Pipe

As an alternative to the ELE-/ELÜ branch, it is possible to put together drainage or vents on site using a modular principle. Here the ELE-/ELÜ pipe is to be welded on to a vertical branch as in **chapter 2.2.8**. This has the advantage that the height of the ELE-/ELÜ ball valve can be exactly adapted to local conditions. The PEHD casing pipe coupler required for this is not included with the ELE-/ELÜ pipe.

Carrier Pipe with corresponding wall thickness like the pipe bars. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends: 220 mm ± 10 mm.

At the end of the tube is an ELE-/ELÜ ball valve (reduced bore) mounted with a stainless steel housing and internal thread connection and the associated end cap. The factory fitted shrunk on end cap is between the PEHD casing pipe end and the ball valve.

The valve housing and valve plug of the ball valve are made of stainless steel, material no. 1.4301 with a cylindrical internal or external thread conforming to DIN EN 10226-1 or DIN EN ISO 228-1. The actuation of the ball valve is with a No. 19 Allen key, the position indicator is on the housing. To fit the plug a No. 19 Allen key is required for DN 25 and No. 27 for DN 50.

If the ball valve permanently remains in the closed position after installation, it is recommended to operate this 1x a year to prevent setting the seal on the ball.

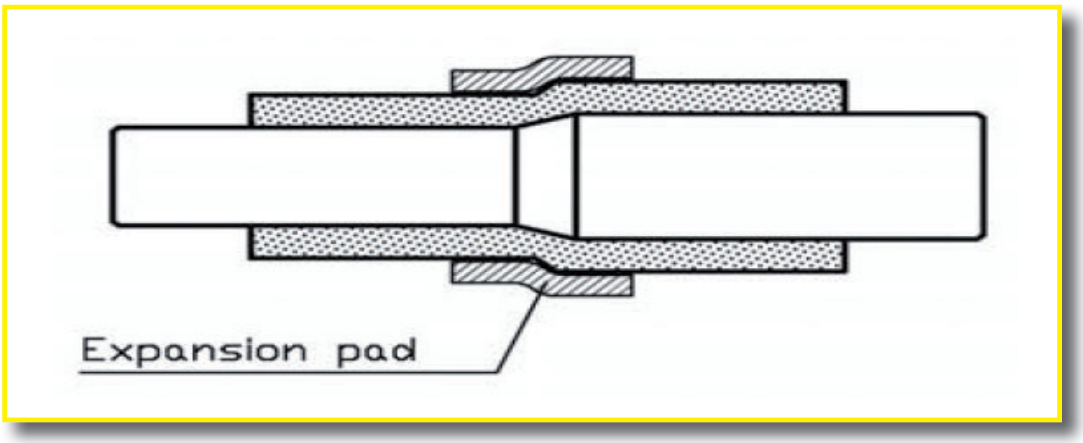
Alternatively, it is possible to close the valve with the plug and leave it in the open position. This ensures that seat rings and ball are surrounded by water, making the seat rings are greased and the surface of the sphere is protected against deposits.

Material specifications jacket pipe see **chapter 2.1.4**
Material specifications carrier pipe see **chapter 2.2.1**
Material specifications PUR hard foam see **chapter 7.1.7**

2.2.11 Reducing Piece

In order to avoid not permissible high frontal soilpressure loads due to axial expansion movements, it may be reduced maximal about two nominal diameters. At the bonding area of a thermal pre-stressed line generally only **one** dimension step will be allowed.

The reducing piece has to be padded generally at the centric jacket-pipe reduction. The expansion pad is not included in the delivery range of the reducing piece.



As carrier pipe reduction generally a conical respectively a centric steel piece acc. to DIN 10253-2 with welded pipe-socket will be used.

From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends: 220 mm ± 10 mm.

Cylindrical pipe depending on size available as seamless or welded steel with corresponding wall thickness like the pipe bars.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.2.1**
Material specification PUR-Hard foam see **chapter 7.1.7**

Edition: 16.01.2012

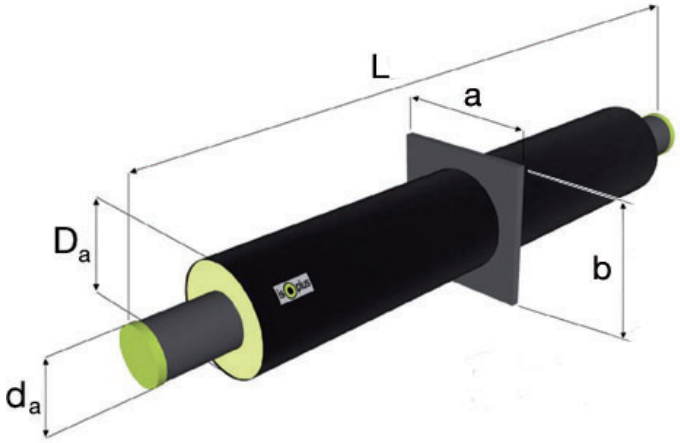
Dimensions Reducing Piece

Nominal Dimension 1					Nominal Dimension 2					Overall-length
Carrier Pipe		Jacket-Pipe-Outside-Ø D_{a1} in mm			Carrier Pipe		Jacket-Pipe-Outside-Ø D_{a2} in mm			
Nominal Dimension	Outside-Ø d_{a1} in mm	Insulation Class			Nominal Dimension	Outside-Ø d_{a2} in mm	Insulation Class			L in mm
DN		Standard	1x reinf.	2x reinf.	DN		Standard	1x reinf.	2x reinf.	
25	33,7	90	110	*125*	**20**	26,9	90	110	*125*	1500
32	42,4	110	125	*140*	**25** **20**	33,7 26,9	90 90	110 110	*125* *125*	1500
40	48,3	110	125	*140*	**32** **25**	42,4 33,7	110 90	125 110	*140* *125*	1500
50	60,3	125	140	*160*	**40** **32**	48,3 42,4	110 110	125 125	*140* *140*	1500
65	76,1	140	160	*180*	**50** **40**	60,3 48,3	125 110	140 125	*160* *140*	1500
80	88,9	160	180	*200*	**65** **50**	76,1 60,3	140 125	160 140	*180* *160*	1500
100	114,3	200	225	*250*	**80** **65**	88,9 76,1	160 140	180 160	*200* *180*	1500
125	139,7	225	250	*280*	**100** **80**	114,3 88,9	200 160	225 180	*250* *200*	1500
150	168,3	250	280	*315*	**125** **100**	139,7 114,3	225 200	250 225	*280* *250*	1500
200	219,1	315	355	*400*	**150** **125**	168,3 139,7	250 225	280 250	*315* *280*	1500
250	273,0	400	450	*500*	**200** **150**	219,1 168,3	315 250	355 280	*400* *315*	1500
300	323,9	450	500	*560*	**250** **200**	273,0 219,1	400 315	450 355	*500* *400*	1500
350	355,6	500	560	*630*	**300** **250**	323,9 273,0	450 400	500 450	*560* *500*	1500
400	406,4	560	630	*710*	**350** **300**	355,6 323,9	500 450	560 500	*630* *560*	1500
450	457,0	630	710	*800*	**400** **350**	406,4 355,6	560 500	630 560	*710* *630*	1500
500	508,0	710	800	*900*	**450** **400**	457,0 406,4	630 560	710 630	*800* *710*	1500
600	610,0	800	900	*1000*	**500** **450**	508,0 457,0	710 630	800 710	*900* *800*	1500

ATTENTION: Italicised mentioned jacket-pipe dimensions (*) are special productions. Please check availability in case of requirement.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.2.1**.
Material specification PUR-Hard Foam see **chapter 7.1.7**.

2.2.12 Anchor



Dimensions Carrier Pipe				Jacket-Pipe Outside-Diameter D_a in mm			Minimum Dimensions Steel Flange		Overall-length
Nominal Diameter / Dimension in		Outside-Ø d_a in mm	Wall-thickness s in mm	Insulation Class			Lateral Length a • b in mm	Steel-thickness s in mm	L in mm
DN	Inch			Standard	1x reinforced	2x reinforced			
20	¾“	26,9	2,6	90	110	125	200 • 200	15	2000
25	1“	33,7	3,2	90	110	125	200 • 200	15	2000
32	1¼“	42,4	3,2	110	125	140	200 • 200	15	2000
40	1½“	48,3	3,2	110	125	140	200 • 200	15	2000
50	2“	60,3	3,2	125	140	160	250 • 250	20	2000
65	2½“	76,1	3,2	140	160	180	250 • 250	20	2000
80	3“	88,9	3,2	160	180	200	250 • 250	20	2000
100	4“	114,3	3,6	200	225	250	330 • 330	25	2000
125	5“	139,7	3,6	225	250	280	330 • 330	25	2000
150	6“	168,3	4,0	250	280	315	380 • 380	25	2000
200	8“	219,1	4,5	315	355	400	500 • 500	25	2000
250	10“	273,0	5,0	400	450	500	600 • 600	30	2000
300	12“	323,9	5,6	450	500	560	700 • 700	30	2000

ATTENTION: Anchors are special productions. Please check availability in case of requirement.

The mentioned steel pipe wall thicknesses are corresponding with the minimum requirements acc. to the standard respectively to the **isoplus** standard wall thicknesses. These have to be calculated generally against inside pressure [p] according to DIN 2413. Carrier pipe with corresponding wall thickness as the rigid pipe bars. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends: 220 mm ± 10 mm.

Steel flange at anchor quadric in discoid construction, designed for max. load of $L_{max}/2$. The occurring forces will be transferred via this flange to the corresponding dimensioned concreteblock. Two kinds of construction are available:

Type A: **Standard**-construction
Type B: **Thermal- and electrical seperated** construction

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.2.1**
Material specification PUR-Hard Foam see **chapter 7.1.7**
Assembling anchor - concrete block in B 25 see **chapter 10.2.7**

Edition: 16.01.2012

2.3.1 Advantages / Carrier Pipe / Connection Technology / Operating Conditions

Advantages

⇒ essential less heat-loss, more economic production of preinstalled pipe system
⇒ 50% reduced use of connection couplers
⇒ essential reduction of expansion pads at angles and T-pieces
⇒ more fast total construction time, shorter traffic hindrance etc.
⇒ pipe-static dimensioning only for medium temperature of primary- and secondary line
⇒ no trench jumps at branches (flow- and exit on same level)
⇒ no additional fittings are required for expansion compensation
⇒ double working distance of leak detecting- and location systems
⇒ reduced excavated material and re-installation

Carrier Pipe, welded

Welded, circular, unalloyed and calmed down steel, description and technical conditions acc. to EN 253, EN 10217-1 and -2.

Materials P235GH (1.0345), P235TR1 (1.0254), P235TR2 (1.0255). All pipes acc. to EN 10204 - 3.1 with acceptance certificate (APZ) approved. From wall thickness > 3,0 mm with welding-seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.

ATTENTION: For the production of **isopipe**-Double exclusively welded carrier pipe is used.

Connection Technology

The joints between the steel pipes can be made using the following methods according to DIN ISO 857-1: manual arc welding, gas welding with oxygen-acetylene flame, tungsten inert gas (TIG) or a combination of processes. The testing and evaluation of the quality of the weld is according to AGFW Worksheet FW 446.

Operating Conditions

Maximum operating temperature T_{max} :	at least acc. to EN 253
Maximum permissible Spread VL / RL (ΔT) :	90 K
Maximum operating pressure p_B :	25 bar
Maximum permissible axial-tension σ_{max} :	190 N/mm²
Leak detecting:	**IPS-Cu** and **IPS-NiCr**, at continuous production only **IPS-Cu**
Possible liquids: Heating water as well as other material resistant liquids	

Technical data P235TR1/TR2/GH bei 20° C					
Property	**Unit**	**Value**	**Property**	**Unit**	**Value**
Volume weight ρ	kg/dm³	7,85	Elastic modulus *E*	N/mm²	211.800
Tensile stress R_m	N/mm²	360 - 500	Thermal conductivity λ	W/(m•K)	55,2
Yield stress R_e	N/mm²	235	Specific heat capacity c_m	kJ/kg°C	0,46
Wall roughness *k*	mm	0,02	Thermal expansion coeff. α at T_{max}	K^{-1}	11,3 • 10^{-6}

Carrier pipe wall thickness see **chapter 2.3.2** resp. **2.3.3**.

2.3.2 Dimensions resp. Types — straight pipe bar - Disconti

Discontinuous production - Carrier Pipe, welded

Type	Dimensions Steel Pipe P235TR1 / TR2 / GH: Nominal Diameter / Dimension in		Outside-Ø d_a in mm	Wall-thickness acc. to **isoplus** **s** in mm	Wall-thickness acc. to EN 253 **s** in mm	Dimensions Jacket-Pipe PEHD: PEHD - Jacket-Pipe-Outside-Ø • Wall thickness D_a • **s** in mm								Clear Pipe-distance h_s in mm	Weight without Water **G** in kg/m (**s** acc. to **isoplus**)	
						Insulation Class / Del. length **L** in m									Insulation Class	
	DN	Inch				Standard	6	12	16	1x reinforced	6	12	16		Standard	1x reinf.
DRD-20	20	3/4“	2 • 26,9	2,6	2,0	125 • 3,0	√	-	-	140 • 3,0	√	-	-	19	4,92	5,27
DRD-25	25	1“	2 • 33,7	3,2	2,3	140 • 3,0	√	√	-	160 • 3,0	√	√	-	19	6,91	7,41
DRD-32	32	1¼“	2 • 42,4	3,2	2,6	160 • 3,0	√	√	-	180 • 3,0	√	√	-	19	8,70	9,23
DRD-40	40	1½“	2 • 48,3	3,2	2,6	160 • 3,0	√	√	-	180 • 3,0	√	√	-	19	9,58	10,11
DRD-50	50	2“	2 • 60,3	3,2	2,9	200 • 3,2	√	√	-	225 • 3,4	√	√	-	20	12,56	13,49
DRD-65	65	2½“	2 • 76,1	3,2	2,9	225 • 3,4	√	√	-	250 • 3,6	√	√	-	20	15,73	16,75
DRD-80	80	3“	2 • 88,9	3,2	3,2	250 • 3,6	√	√	-	280 • 3,9	√	√	-	25	18,54	19,93
DRD-100	100	4“	2 • 114,3	3,6	3,6	315 • 4,1	√	√	√	355 • 4,5	√	√	√	25	27,20	29,52
DRD-125	125	5“	2 • 139,7	3,6	3,6	400 • 4,8	√	√	√	450 • 5,2	√	√	√	30	36,05	39,54
DRD-150	150	6“	2 • 168,3	4,0	4,0	450 • 5,2	√	√	√	500 • 5,6	√	√	√	40	46,83	50,70
DRD-200	200	8“	2 • 219,1	4,5	4,5	560 • 6,0	√	√	√	630 • 6,6	√	√	√	45	70,61	75,56

For nominal diameters DN 25 to DN 65 isoplus provides only steel pipes and fittings with wall thickness of 3,2 mm, this is to observe in comparison with competitors.

Length of bare steel pipe ends: 220 mm ± 10 mm. Wall thickness jacket pipe **isoplus** acc. to EN 253, Wall thickness carrier pipe **isoplus** acc. to AGFW FW 401. The mentioned steel wall thicknesses are corresponding with the standard wall thicknesses of **isoplus**, which are generally calculated against inside pressure [p] acc. to DIN 2413. The mentioned weights are valid for steel wall thickness acc. to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, PEHD = Ø 0,95 kg/dm^3.

Auxiliary ridges may be located in the pipe bars. However, these have no pipe-static function. They serve only as a centering during production. In order to improve and to follow the technical development we will reserve technical modifications of the values mentioned in the table.

Attention: Thermal prestressing with electric power is not allowed at isoplus double-pipe!

Specification carrier pipe see **chapter 2.3.1**

Edition: 10.12.2013

2.3.2 Dimensions resp. Types — straight pipe bar - Conti

Continuous Production - Carrier-Pipe, welded

Type	Nominal Diameter / Dimension in		Outside-Ø d_a in mm	Wall-thickn. acc. to **isoplus** **s** in mm	Wall-thickn. acc. to EN 253 **s** in mm	Dimensions Jacket-Pipe PEHD: PEHD - Jacket-Pipe Outside-Ø • Wall thickness D_a • **s** in mm								Clear Pipe-distance h_s in mm	Weight without Water **G** in kg/m (**s** acc. to **isoplus**)	
						Insulation Class / Del. Length **L** in m									Insulation Class	
	DN	**Inch**				**Standard**	**6**	**12**	**16**	**1x reinf.**	**6**	**12**	**16**		**Standard**	**1x reinf.**
KRD-25	**25**	1“	2 • 33,7	3,2	2,3	140 • 3,0	-	√	-	160 • 3,0	-	√	-	19	6,83	7,36
KRD-32	**32**	1¼“	2 • 42,4	3,2	2,6	160 • 3,0	-	√	-	180 • 3,0	-	√	-	19	8,61	9,18
KRD-40	**40**	1½“	2 • 48,3	3,2	2,6	160 • 3,0	-	√	-	180 • 3,0	-	√	-	19	9,46	10,03
KRD-50	**50**	2“	2 • 60,3	3,2	2,9	200 • 3,2	-	√	-	225 • 3,4	-	√	-	20	12,84	13,77
KRD-65	**65**	2½“	2 • 76,1	3,2	2,9	225 • 3,4	-	√	-	250 • 3,6	-	√	-	20	15,92	17,05
KRD-80	**80**	3“	2 • 88,9	3,2	3,2	250 • 3,6	-	√	-	280 • 3,9	-	√	-	25	18,76	20,20
KRD-100	**100**	4“	2 • 114,3	3,6	3,6	315 • 4,1	-	√	-	355 • 4,5	-	√	-	25	27,62	30,42

For nominal diameters DN 25 to DN 65 isoplus provides only steel pipes and fittings with wall thickness of 3,2 mm, this is to observe in comparison with competitors.

Length of bare steel pipe ends: 220 mm ± 10 mm. Wall thickness jacket pipe **isoplus** acc. to EN 253, Wall thickness carrier pipe **isoplus** acc. to AGFW FW 401. The mentioned steel wall thicknesses are corresponding with the standard wall thicknesses of **isoplus**, which are generally calculated against inside pressure [p] acc. to DIN 2413. The mentioned weights are valid for steel wall thickness acc. to **isoplus**, material density [ρ] P235 = Ø 7,85 kg/dm^3, PUR-Foam = Ø 0,07 kg/dm^3, PEHD = Ø 0,95 kg/dm^3.

Attention: Thermal prestressing with electric power is not allowed at isoplus double-pipe!

Specification carrier pipe see **chapter 2.3.1**.

2.3.4 Dimensions resp. Types — Bowed Pipe

Discontinuous und continuous production

Dimensions carrier pipe		Max. permissible bow-angle	Minimum-bending-radius	Circle segment at r_{Fmin} and 12,00 m		
Nominal Diameter in **DN**	Outside-Ø d_a in mm	α_{max} in °	$r_{F\,min}$ in m	Secant-length s_L in m	Secant-height s_{hF} in m	Tangent-length t_L in m
50	2 • 60,3	40,0	11,75	11,56	1,28	6,15
65	2 • 76,1	36,0	13,05	11,64	1,15	6,12
80	2 • 88,9	34,0	13,82	11,68	1,09	6,11
100	2 • 114,3	28,0	16,78	11,78	0,90	6,07
125	2 • 139,7	28,0	16,78	11,78	0,90	6,07
150	2 • 168,3	25,0	18,80	11,83	0,80	6,06
200	2 • 219,1	22,5	15,30	11,86	0,83	6,05

The double pipe / bowed pipe production used at the factory is only possible with a high density polyethylene jacket in 12 m lengths and only above a nominal diameter of DN 50. The values given in the table are valid regardless of the PEHD casing pipe diameter (standard or 1x reinforced). For nominal diameters DN 20 to DN 80, it is usually sufficient to compensate for pipe elbows with on-site bending (elastic distortion of a pipe length).

Due to production constraints, bowed pipes of up to PEHD casing pipe diameters $\mathbf{D_a} \leq 450$ mm have 2,0 m long straight pipe ends, while from $\mathbf{D_a} \geq 500$ these ends are approximately 3,0 m long. For this reason, the production bending radius [$\mathbf{r_F}$] is also different from the design radius [$\mathbf{r_P}$], see **chapter 2.2.4**.

Bowed pipes are bent mechanically according to the route of the pipeline and the permitted production bending radius, according to local management instructions (bending angle and design radius). When ordering, the angle, design radius and bending direction, left or right (depending on the route of the network monitoring) should be given. If necessary, these parameters are determined by **isoplus**.

Edition: 16.01.2012

2.3.5 Energy Loss isoplus - Double Pipe Disconti

Type	Jacket-Pipe Outside-Diameter D_a in mm			Coefficient u_{DRD} in W/(m•K)			q at average temperature T_M = 100 °C in W/m			q at average temperature T_M = 80 °C in W/m			q at average temperature T_M = 60 °C in W/m		
	Insulation Class			Insulation Class			Insulation Class			Insulation Class			Insulation Class		
	Stand.	1x reinf.	2x reinf.	Stand.	1x reinf.	2x reinf.	Stand.	1x reinf.	2x reinf.	Stand.	1x reinf.	2x reinf.	Stand.	1x reinf.	2x reinf.
DRD - 20	125	140	160	0,1830	0,1608	0,1423	16,472	14,474	12,808	12,812	11,257	9,961	9,151	8,041	7,115
DRD - 25	140	160	180	0,1981	0,1700	0,1516	17,828	15,299	13,641	13,866	11,899	10,610	9,905	8,500	7,578
DRD - 32	160	180	200	0,2154	0,1856	0,1661	19,387	16,708	14,949	15,079	12,995	11,627	10,771	9,282	8,305
DRD - 40	160	180	200	0,2573	0,2144	0,1882	23,154	19,296	16,935	18,009	15,008	13,171	12,863	10,720	9,408
DRD - 50	200	225	250	0,2495	0,2076	0,1833	22,454	18,686	16,494	17,464	14,534	12,829	12,475	10,381	9,163
DRD - 65	225	250	280	0,2923	0,2430	0,2074	26,311	21,868	18,665	20,464	17,008	14,517	14,617	12,149	10,370
DRD - 80	250	280	315	0,3343	0,2653	0,2199	30,087	23,874	19,792	23,401	18,569	15,394	16,715	13,264	10,995
DRD - 100	315	355	400	0,3348	0,2635	0,2197	30,130	23,716	19,769	23,435	18,446	15,376	16,739	13,176	10,983
DRD - 125	400	450	500	0,3100	0,2488	0,2126	27,899	22,388	19,135	21,699	17,413	14,883	15,499	12,438	10,631
DRD - 150	450	500	560	0,3763	0,2914	0,2379	33,866	26,228	21,413	26,340	20,399	16,654	18,815	14,571	11,896
DRD - 200	560	630	-	0,4115	0,3037	-	37,033	27,330	-	28,803	21,256	-	20,574	15,183	-

Energy Loss Comparison Double- to Single Pipe, T_M = 80 °C, discontinuous production

Double Pipe - Standard			2x Single Pipe - Standard Insulation Class				2x Single Pipe - 1x reinf. Insulation Class			
DN / D_a	u_{DRD} in W/(m•K)	q_{DRD} in W/m	DN / D_a	u_{DRE} in W/(m•K)	q_{DRE} in W/m	Saving in %	DN / D_a	u_{DRE} in W/(m•K)	q_{DRE} in W/m	Saving in %
20 / 125	0,1830	12,812	20 / 90	0,2590	18,132	29,34	20 / 110	0,2228	15,599	17,87
25 / 140	0,1981	13,866	25 / 90	0,3128	21,899	36,68	25 / 110	0,2616	18,309	24,26
32 / 160	0,2154	15,079	32 / 110	0,3178	22,248	32,22	32 / 125	0,2839	19,875	24,13
40 / 160	0,2573	18,009	40 / 110	0,3620	25,341	28,93	40 / 125	0,3187	22,307	19,27
50 / 200	0,2495	17,464	50 / 125	0,4026	28,180	38,03	50 / 140	0,3526	24,679	29,23
65 / 225	0,2923	20,464	65 / 140	0,4650	32,550	37,13	65 / 160	0,3959	27,714	26,16
80 / 250	0,3343	23,401	80 / 160	0,4837	33,857	30,88	80 / 180	0,4152	29,065	19,49
100 / 315	0,3348	23,435	100 / 200	0,5085	35,597	34,17	100 / 225	0,4297	30,077	22,09
125 / 400	0,3100	21,699	125 / 225	0,5761	40,325	46,19	125 / 250	0,4918	34,428	36,97
150 / 450	0,3763	26,340	150 / 250	0,6737	47,161	44,15	150 / 280	0,5589	39,123	32,67
200 / 560	0,4115	28,803	200 / 315	0,7372	51,607	44,19	200 / 355	0,5906	41,339	30,32

Double Pipe - 1x reinforced			2x Single Pipe - 1x reinf. Insulation Class				2x Single Pipe - 2x reinf. Insulation Class			
DN / D_a	u_{DRD} in W/(m•K)	q_{DRD} in W/m	DN / D_a	u_{DRE} in W/(m•K)	q_{DRE} in W/m	Saving in %	DN / D_a	u_{DRE} in W/(m•K)	q_{DRE} in W/m	Saving in %
20 / 140	0,1608	11,257	20 / 110	0,2228	15,599	27,83	20 / 125	0,2056	14,394	21,79
25 / 160	0,1700	11,899	25 / 110	0,2616	18,309	35,01	25 / 125	0,2382	16,671	28,62
32 / 180	0,1856	12,995	32 / 125	0,2839	19,875	34,61	32 / 140	0,2581	18,067	28,07
40 / 180	0,2144	15,008	40 / 125	0,3187	22,307	32,72	40 / 140	0,2865	20,054	25,16
50 / 225	0,2076	14,534	50 / 140	0,3526	24,679	41,11	50 / 160	0,3114	21,795	33,32
65 / 250	0,2430	17,008	65 / 160	0,3959	27,714	38,63	65 / 180	0,3488	24,419	30,35
80 / 280	0,2653	18,569	80 / 180	0,4152	29,065	36,11	80 / 200	0,3694	25,857	28,19
100 / 355	0,2635	18,446	100 / 225	0,4297	30,077	38,67	100 / 250	0,3810	26,670	30,84
125 / 450	0,2488	17,413	125 / 250	0,4918	34,428	49,42	125 / 280	0,4277	29,938	41,84
150 / 500	0,2914	20,399	150 / 280	0,5589	39,123	47,86	150 / 315	0,4686	32,805	37,82
200 / 630	0,3037	21,256	200 / 355	0,5906	41,339	48,58	200 / 400	0,4943	34,604	38,57

Double Pipe - 2x reinforced			2x Single Pipe - 2x reinf. Insulation Class			
DN / D_a	u_{DRD} in W/(m•K)	q_{DRD} in W/m	DN / D_a	u_{DRE} in W/(m•K)	q_{DRE} in W/m	Saving in %
20 / 160	0,1423	9,961	20 / 125	0,2056	14,394	30,79
25 / 180	0,1516	10,610	25 / 125	0,2382	16,671	36,36
32 / 200	0,1661	11,627	32 / 140	0,2581	18,067	35,64
40 / 200	0,1882	13,171	40 / 140	0,2865	20,054	34,32
50 / 250	0,1833	12,829	50 / 160	0,3114	21,795	41,14
65 / 280	0,2074	14,517	65 / 180	0,3488	24,419	40,55
80 / 315	0,2199	15,394	80 / 200	0,3694	25,857	40,47
100 / 400	0,2197	15,376	100 / 250	0,3810	26,670	42,35
125 / 500	0,2126	14,883	125 / 280	0,4277	29,938	50,29
150 / 560	0,2379	16,654	150 / 315	0,4686	32,805	49,23

The mentioned data are based on a covering height [$Ü_H$] of 0,80 m, a thermal conductivity of soil [λ_E] of 1,0 W/(m•K), a soil temperature [T_E] of 10 °C as well as a pipe distance at single pipes according **chapter 2.2.5**;

$T_M = (T_{VL} + T_{RL}) : 2$

Example: (100 °C + 60 °C) : 2 = 80 °C.

All values are based on a thermal conductivity of polyurethane foam λ_{50} = 0,027 W/(m•K).

2.3.6 Energy Loss isoplus - Double Pipe Conti

Type	Jacket-Pipe Outside-Ø D_a in mm		Coefficient u_{KRD} in W/(m•K)		q at Average Temperature T_M = 100 °C in W/m		q at Average Temperature T_M = 80 °C in W/m		q at Average Temperature T_M = 60 °C in W/m	
	Insulation Class		Insulation Class		Insulation Class		Insulation Class		Insulation Class	
	1x reinforced	2x reinforced	1x reinforced	2x reinforced	1x reinforced	2x reinforced	1x reinforced	2x reinforced	1x reinforced	2x reinforced
KRD - 25	160	180	0,1526	0,1359	13,734	12,228	10,682	9,511	7,630	6,793
KRD - 32	180	200	0,1667	0,1490	15,007	13,408	11,672	10,429	8,337	7,449
KRD - 40	180	200	0,1929	0,1690	17,360	15,207	13,502	11,828	9,645	8,449
KRD - 50	225	250	0,1866	0,1644	16,791	14,798	13,060	11,509	9,329	8,221
KRD - 65	250	280	0,2187	0,1862	19,681	16,760	15,307	13,036	10,934	9,311
KRD - 80	280	315	0,2389	0,1975	21,503	17,776	16,725	13,826	11,946	9,876
KRD - 100	355	-	0,2371	-	21,338	-	16,596	-	11,854	-

Energy Loss Comparison Double- to Single Pipe, T_M = 80 °C, continuous production

Double-Pipe - 1x reinforced			2x Single-Pipe - 1x reinforced Insul.				2x Single-Pipe - 2x reinforced Insul.			
DN / D_a	u_{KRD} in W/(m•K)	q_{KRD} in W/m	DN / D_a	u_{KRE} in W/(m•K)	q_{KRE} in W/m	Saving in %	DN / D_a	u_{KRE} in W/(m•K)	q_{KRE} in W/m	Saving in %
25 / 160	0,1526	10,682	**25 / 110**	0,2355	16,488	**35,21**	**25 / 125**	0,2141	14,990	**28,74**
32 / 180	0,1667	11,672	**32 / 125**	0,2559	17,910	**34,83**	**32 / 140**	0,2322	16,254	**28,19**
40 / 180	0,1929	13,502	**40 / 125**	0,2877	20,136	**32,94**	**40 / 140**	0,2581	18,066	**25,26**
50 / 225	0,1866	13,060	**50 / 140**	0,3186	22,302	**41,44**	**50 / 160**	0,2806	19,640	**33,50**
65 / 250	0,2187	15,307	**65 / 160**	0,3581	25,067	**38,93**	**65 / 180**	0,3147	22,029	**30,51**
80 / 280	0,2389	16,725	**80 / 180**	0,3756	26,295	**36,40**	**80 / 200**	0,3334	23,337	**28,33**
100 / 355	0,2371	16,596	**100 / 225**	0,3885	27,196	**38,98**	**100 / 250**	0,3437	24,057	**31,01**

Double-Pipe - 2x reinforced			2x Single-Pipe - 2x reinforced Insul.			
DN / D_a	u_{KRD} in W/(m•K)	q_{KRD} in W/m	DN / D_a	u_{KRE} in W/(m•K)	q_{KRE} in W/m	Saving in %
25 / 180	0,1359	9,511	**25 / 125**	0,2141	14,990	**36,55**
32 / 200	0,1490	10,429	**32 / 140**	0,2322	16,254	**35,84**
40 / 200	0,1690	11,828	**40 / 140**	0,2581	18,066	**34,53**
50 / 250	0,1644	11,509	**50 / 160**	0,2806	19,640	**41,40**
65 / 280	0,1862	13,036	**65 / 180**	0,3147	22,029	**40,82**
80 / 315	0,1975	13,826	**80 / 200**	0,3334	23,337	**40,76**

The mentioned data are based on a covering height [$Ü_H$] of 0,80 m, a thermal conductivity of soil [λ_E] of 1,0 W/(m•K), a soil temperature [T_E] of 10 °C as well as a pipe distance at single pipes according **chapter 2.2.6**;

$T_M = (T_{VL} + T_{RL}) : 2$

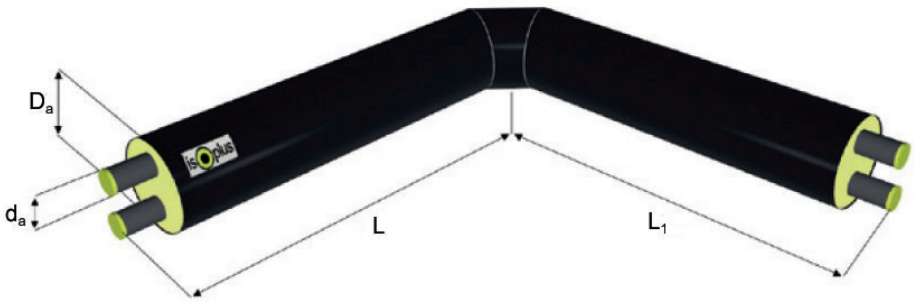
Example: (100 °C + 60 °C) : 2 = 80 °C.

All values are based on a thermal conductivity of polyurethane foam λ_{50} = 0,024 W/(m•K).

Edition: 30.12.2016

2.3.7 Elbow 90°

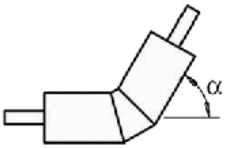
Elbow, horizontal



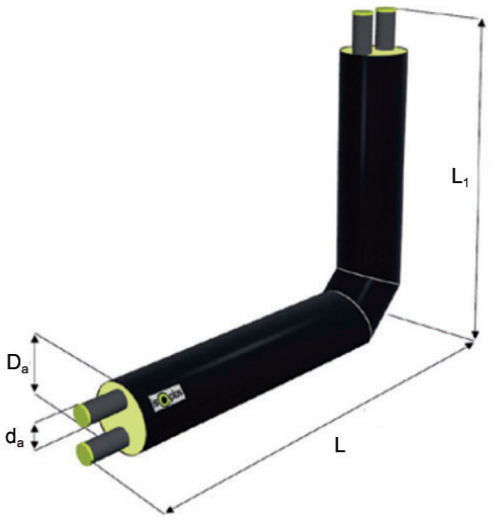
Dimensions carrier pipe			Carrier pipe elbow		Jacket-Pipe Outside-Ø D_a in mm		Length of Angle $L \bullet L_1$ in mm
Nominal Diameter / Dimension		Outside-Ø d_a in mm	Wall-thickness **s** in mm	Radius **r** in mm	Insulation Class		
DN	**Inch**				**Standard**	**1x reinforced**	
20	¾“	2 • 26,9	2,6	110,0	125	140	1000 • 1000
25	1“	2 • 33,7	3,2	110,0	140	160	1000 • 1000
32	1¼“	2 • 42,4	3,2	110,0	160	180	1000 • 1000
40	1½“	2 • 48,3	3,2	110,0	160	180	1000 • 1000
50	2“	2 • 60,3	3,2	125,0	200	225	1000 • 1000
65	2½“	2 • 76,1	3,2	140,0	225	250	1000 • 1000
80	3“	2 • 88,9	3,2	160,0	250	280	1000 • 1000
100	4“	2 • 114,3	3,6	270,0	315	355	1000 • 1000
125	5“	2 • 139,7	3,6	330,0	400	450	1000 • 1000
150	6“	2 • 168,3	4,0	390,0	450	500	1000 • 1000
200	8“	2 • 219,1	4,5	510,0	560	630	1200 • 1200

All carrier pipe elbows at least bent according to DIN EN 10220 in one piece or in accordance with DIN EN 10253-2 and welded pipe fittings, depending on dimension. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.
Cylindrical pipe as seamless or welded steel, depending on dimension. Length of bare steel pipe ends: 220 mm ± 10 mm, clear pipe-distance (h_S) like pipe bars. Orders for special degree elbows should generally indicate the complementary angle [α]. The mentioned length of angles apply to elbows 45° and special-elbows. Other length of angles on request.
Elbows with an angle length of 1,5 m are used in applications where preformed part is welded to preformed part and sliding up a coupler is otherwise not possible. It´s possible to use as house entry elbow. For improvements and in order to follow the technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.
ATTENTION: When ordering elbows for height differences in levels or for house connections in advance, consider the exact mounting position and specify the location of supply and return.When in doubt, a detailed drawing is to be made.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**



Elbow, vertical (s)

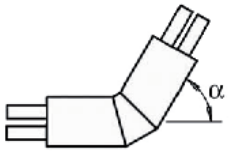


Dimensions carrier pipe			carrier pipe elbow		Jacket-Pipe Dimension-Ø D_a in mm		Length of Angle $L \cdot L_1$ in mm
Nominal Diameter/ Dimension in		Outside-Ø d_a in mm	Wall-thickness s in mm	Radius r in mm	Insulation Class		
DN	Inches				Standard	1x reinforced	
20	¾“	2 • 26,9	2,6	110,0	125	140	1000 • 1000
25	1“	2 • 33,7	3,2	110,0	140	160	1000 • 1000
32	1¼“	2 • 42,4	3,2	110,0	160	180	1000 • 1000
40	1½“	2 • 48,3	3,2	110,0	160	180	1000 • 1000
50	2“	2 • 60,3	3,2	135,0	200	225	1000 • 1000
65	2½“	2 • 76,1	3,2	175,0	225	250	1000 • 1000
80	3“	2 • 88,9	3,2	205,0	250	280	1000 • 1000
100	4“	2 • 114,3	3,6	270,0	315	355	1000 • 1000
125	5“	2 • 139,7	3,6	330,0	400	450	1000 • 1000
150	6“	2 • 168,3	4,0	390,0	--	500	1000 • 1000
200	8“	2 • 219,1	4,5	510,0	--	630	1200 • 1200

All carrier pipe elbows at least bent according to DIN EN 10220 in one piece or in accordance with DIN EN 10253-2 and welded pipe fittings, depending on dimension. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1.
Cylindrical pipe as seamless or welded steel, depending on dimension. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe-distance (h_S) like pipe bars. Orders for special degree elbows should generally indicate the complementary angle [α]. The mentioned length of angles apply to elbows 45° and special-elbows. Other length of angles on request.

Elbows with an angle length of 1,5 m are used in applications where preformed part is welded to preformed part and sliding up a coupler is otherwise not possible. It´s possible to use as house entry elbow. At DN 150 and DN 200 a 1x reinforced elbow with two additionally reducing shrinkable couplers has to be used.

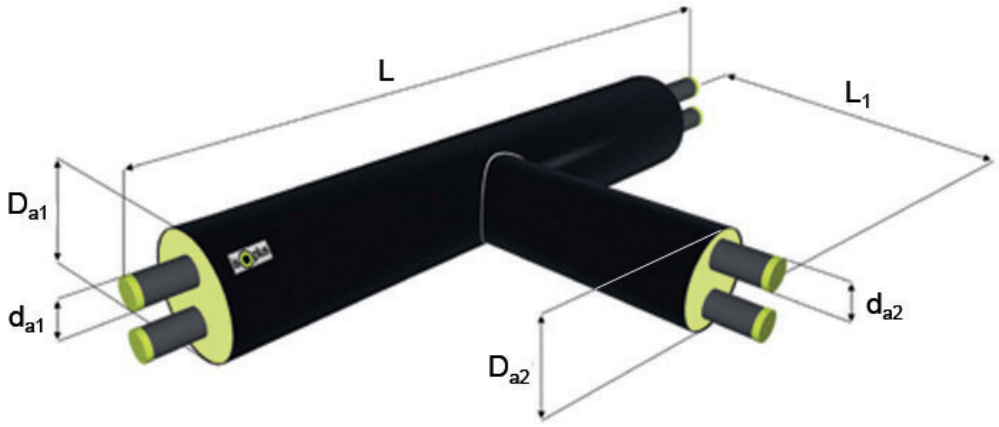
ATTENTION: Elbow for height differences in levels or for house connections see the **previous page**.



Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR Hard Foam see **chapter 7.1.7**

2.3.8 Branch 90° / Twin-Branch 90°

Branch 90°, straight



Carrier pipe passage and exit at least acc. to measure standard AGFW-guideline FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe-distance (h_S) like pipe bars.

All branches will be necked-out at the basic pipe or will be produced by use of weld-in T-pieces acc. to DIN EN 10253-2, depending on dimension. The following pipe cylinder will be welded by a round seam, which can be radio graphed. For improvements and in order to follow the technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.

The exit may be used up to the maximum admissible laying length of the corresponding dimension without expanding legs, like L-, Z- or U- elbow.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR Hard foam see **chapter 7.1.7**

Branch 90°, straight - Standard

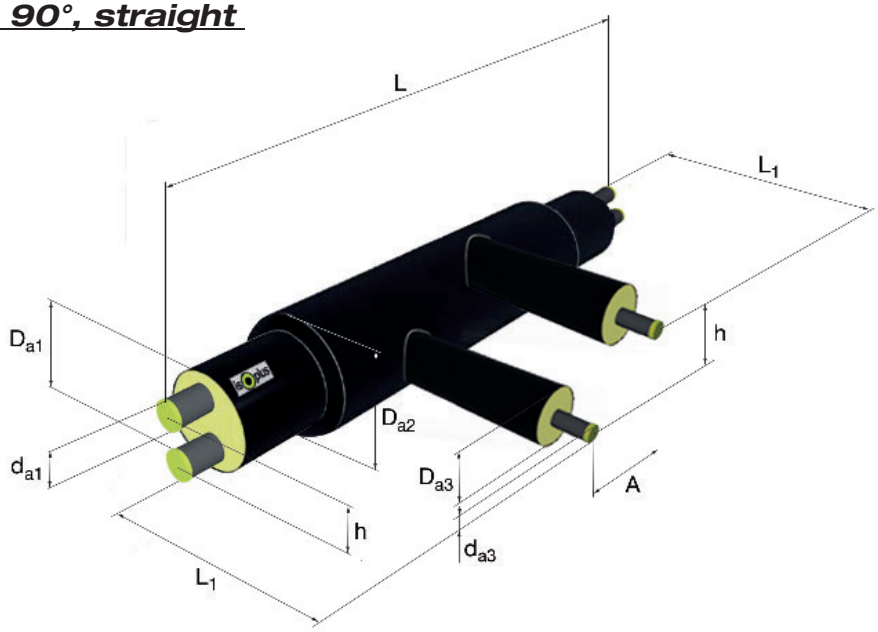
Branch Exit	Dimensions passage or main line																							
DN			20		25		32		40		50		65		80		100		125		150		200	
Inch			¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“		8“	
d_{a1}			26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3		219,1	
D_{a1}			125		140		160		160		200		225		250		315		400		450		560	
20	L	L_1	1200	550	1200	600	1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9	125	26,9
25	L	L_1			1200	600	1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}			140	33,7	140	33,7	140	33,7	140	33,7	140	33,7	140	33,7	140	33,7	140	33,7	140	33,7	140	33,7
32	L	L_1					1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}					160	42,4	160	42,4	160	42,4	160	42,4	160	42,4	160	42,4	160	42,4	160	42,4	160	42,4
40	L	L_1							1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}							160	48,3	160	48,3	160	48,3	160	48,3	160	48,3	160	48,3	160	48,3	160	48,3
50	L	L_1									1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}									200	60,3	200	60,3	200	60,3	200	60,3	200	60,3	200	60,3	200	60,3
65	L	L_1											1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}											225	76,1	225	76,1	225	76,1	225	76,1	225	76,1	225	76,1
80	L	L_1													1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}													250	88,9	250	88,9	250	88,9	250	88,9	250	88,9
100	L	L_1															1300	650	1300	700	1300	700	1300	800
	D_{a2}	d_{a2}															315	114,3	315	114,3	315	114,3	315	114,3
125	L	L_1																	1300	700	1300	700	1300	800
	D_{a2}	d_{a2}																	400	139,7	400	139,7	400	139,7
150	L	L_1																			1400	700	1400	800
	D_{a2}	d_{a2}																			450	168,3	450	168,3
200	L	L_1																					1600	800
	D_{a2}	d_{a2}																					560	219,1

Branch 90°, straight - 1x reinforced

Branch Exit	Dimensions passage or main line																							
DN			20		25		32		40		50		65		80		100		125		150		200	
Inch			¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“		8“	
d_{a1}			26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3		219,1	
D_{a1}			140		160		180		180		225		250		280		355		450		500		630	
20	L	L_1	1200	550	1200	600	1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9	140	26,9
25	L	L_1			1200	600	1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}			160	33,7	160	33,7	160	33,7	160	33,7	160	33,7	160	33,7	160	33,7	160	33,7	160	33,7	160	33,7
32	L	L_1					1200	600	1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}					180	42,4	180	42,4	180	42,4	180	42,4	180	42,4	180	42,4	180	42,4	180	42,4	180	42,4
40	L	L_1							1200	600	1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}							180	48,3	180	48,3	180	48,3	180	48,3	180	48,3	180	48,3	180	48,3	180	48,3
50	L	L_1									1200	600	1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}									225	60,3	225	60,3	225	60,3	225	60,3	225	60,3	225	60,3	225	60,3
65	L	L_1											1200	650	1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}											250	76,1	250	76,1	250	76,1	250	76,1	250	76,1	250	76,1
80	L	L_1													1200	650	1200	650	1200	700	1200	700	1200	800
	D_{a2}	d_{a2}													280	88,9	280	88,9	280	88,9	280	88,9	280	88,9
100	L	L_1															1300	650	1300	700	1300	700	1300	800
	D_{a2}	d_{a2}															355	114,3	355	114,3	355	114,3	355	114,3
125	L	L_1																	1300	700	1300	700	1300	800
	D_{a2}	d_{a2}																	450	139,7	450	139,7	450	139,7
150	L	L_1																			1400	700	1400	800
	D_{a2}	d_{a2}																			500	168,3	500	168,3
200	L	L_1																					1600	800
	D_{a2}	d_{a2}																					630	219,1

Edition: 04.10.2012

Twin-Branch 90°, straight



Twin branches are used as transition from a double main pipe line to a house connection with single pipes, i. e. **isoflex** or **isopex**. Carrier pipe passage and exit at least acc. to measure standard AGFW-guideline FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe-distance (h_S) like pipe bars.

All branches will be necked-out at the basic pipe or will be produced by use of weld-in T-pieces acc. to DIN EN 10253-2, depending on dimension. The following pipe cylinder will be welded by a round seam, which can be radio graphed. For improvements and in order to follow the technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**

Twin-Branch 90°, straight - Standard

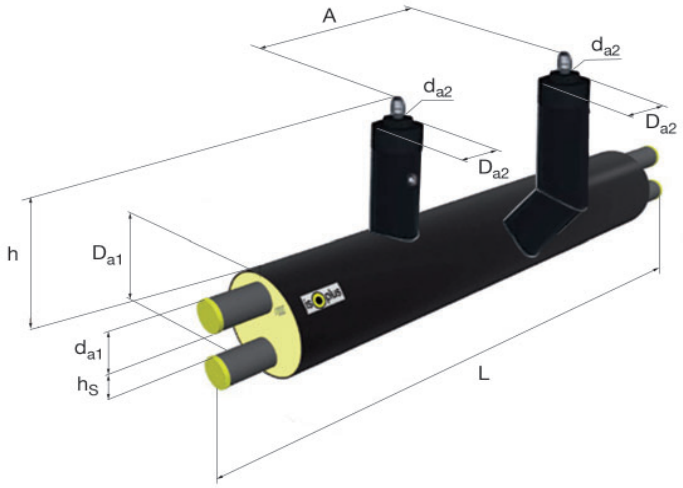
Branch Exit			Dimensions passage or main line																							
	DN		20		25		32		40		50		65		80		100		125		150		200	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“		8“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3		219,1	
	D_{a1}		125		140		160		160		200		225		250		315		400		450		560	
20	L	L_1	1300	500	1300	500	1300	500	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}	47	90	54	160	62	160	68	160	80	200	96	225	114	250	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90
	A		240		490		240		240		240		240		240		240		240		240		240	
25	L	L_1			1300	500	1300	500	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}			54	160	62	160	68	160	80	200	96	225	114	250	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}			33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90
	A				490		240		240		240		240		240		240		240		240		240	
32	L	L_1					1300	500	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}					62	180	68	180	80	200	96	225	114	250	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}					42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110
	A						240		240		240		240		240		240		240		240		240	
40	L	L_1							1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}							68	180	80	200	96	225	114	250	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}							48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110
	A								240		240		240		240		240		240		240		240	
50	L	L_1									1300	550	1300	550	1300	600	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}									80	225	96	225	114	250	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}									60,3	125	60,3	125	60,3	125	60,3	125	60,3	125	60,3	125	60,3	125
	A										240		240		240		240		240		240		240	
65	L	L_1											1300	600	1400	600	1400	600	1400	650	1400	700	1400	750
	h	D_{a2}											96	250	114	280	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}											76,1	140	76,1	140	76,1	140	76,1	140	76,1	140	76,1	140
	A												240		300		300		300		300		300	
80	L	L_1													1400	600	1400	600	1400	650	1400	700	1400	750
	h	D_{a2}													114	280	140	315	170	400	208	450	264	560
	d_{a3}	D_{a3}													88,9	160	88,9	160	88,9	160	88,9	160	88,9	160
	A														300		300		300		300		300	
100	L	L_1															1500	650	1500	650	1500	700	1500	750
	h	D_{a2}															140	355	170	400	208	450	264	560
	d_{a3}	D_{a3}															114,3	200	114,3	200	114,3	200	114,3	200
	A																350		300		350		350	
125	L	L_1																	1500	650	1500	700	1500	750
	h	D_{a2}																	170	400	208	450	264	560
	d_{a3}	D_{a3}																	139,7	225	139,7	225	139,7	225
	A																		300		350		350	
150	L	L_1																			1600	700	1600	750
	h	D_{a2}																			208	500	264	560
	d_{a3}	D_{a3}																			168,3	250	168,3	250
	A																				350		450	
200	L	L_1																					1700	750
	h	D_{a2}																					264	560
	d_{a3}	D_{a3}																					219,1	315
	A																						450	

Edition: 16.01.2012

Twin-Branch 90°, straight - 1x reinforced

Branch Exit	Dimensions passage or main line																							
	DN		20		25		32		40		50		65		80		100		125		150		200	
	Inch		¾“		1“		1 ½“		1 ¼“		2“		2 ½“		3“		4“		5“		6“		8“	
	d_a		26,9		33,7		42,4		48,3		60,3		76,1		88,9		114,3		139,7		168,3		219,1	
	D_{a1}		140		160		180		180		225		250		280		355		450		500		630	
20	L	L_1	1300	500	1300	500	1300	500	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}	47	140	54	160	62	180	68	180	80	225	96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	26,9	90	29,6	90	26,9	90	26,9	90	26,9	90
	A		240		240		240		240		240		240		240		240		240		240		240	
25	L	L_1			1300	500	1300	500	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}			54	160	62	180	68	180	80	225	96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}			33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90	33,7	90
	A				240		240		240		240		240		240		240		240		240		240	
32	L	L_1					1300	550	1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}					62	180	68	180	80	225	96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}					42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110	42,4	110
	A						240		240		240		240		240		240		240		240		240	
40	L	L_1							1300	550	1300	550	1300	550	1300	550	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}							68	180	80	225	96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}							48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110	48,3	110
	A								240		240		240		240		240		240		240		240	
50	L	L_1									1300	550	1300	550	1300	600	1300	600	1300	650	1300	700	1300	750
	h	D_{a2}									80	225	96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}									60,3	125	60,3	125	60,3	125	60,3	125	60,3	125	60,3	125	60,3	125
	A										240		240		240		240		240		240		240	
65	L	L_1											1300	600	1400	600	1400	600	1400	650	1400	700	1400	750
	h	D_{a2}											96	250	114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}											76,1	140	76,1	140	76,1	140	76,1	140	76,1	140	76,1	140
	A												240		300		300		300		300		300	
80	L	L_1													1400	600	1400	600	1400	650	1400	700	1400	750
	h	D_{a2}													114	280	139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}													88,9	160	88,9	160	88,9	160	88,9	160	88,9	160
	A														300		300		300		300		300	
100	L	L_1															1500	650	1500	650	1500	700	1500	750
	h	D_{a2}															139	355	170	450	208	500	264	630
	d_{a3}	D_{a3}															114,3	200	114,3	200	114,3	200	114,3	200
	A																350		350		350		350	
125	L	L_1																	1500	650	1500	700	1500	750
	h	D_{a2}																	170	450	208	500	264	630
	d_{a3}	D_{a3}																	139,7	225	139,7	225	139,7	225
	A																		350		350		350	
150	L	L_1																			1600	700	1600	750
	h	D_{a2}																			208	500	264	630
	d_{a3}	D_{a3}																			168,3	250	168,3	250
	A																				350		450	
200	L	L_1																					1700	750
	h	D_{a2}																					264	630
	d_{a3}	D_{a3}																					219,1	315
	A																						450	

2.3.9 Drain / Vent



Dimensions Double Pipe				Length	Dimensions Drain /Vent			
Nominal Diameter/ Dimension	Steel-Pipe-Outside Ø	Carrier Pipe-outside-Ø D_{a1} in mm		Length **L**	Axes-distance **A**	ELE Outside-Ø d_{a2}	ELE Outside-Ø D_{a2}	Overall-height **h**
DN	d_{a1} in mm	**Standard**	**1x reinforced**	in mm	in mm	in mm	in mm	in mm
20	2 • 26,9	125	140	1200	150	26,9	90	500
25	2 • 33,7	140	160	1200	150	33,7	90	500
32	2 • 42,4	160	180	1200	150	33,7	90	500
40	2 • 48,3	160	180	1200	150	33,7	90	500
50	2 • 60,3	200	225	1200	150	33,7	90	500
65	2 • 76,1	225	250	1200	150	33,7	90	500
80	2 • 88,9	250	280	1200	150	33,7	90	500
100	2 • 114,3	315	355	1200	150	33,7	90	500
125	2 • 139,7	400	450	1200	150	33,7	90	500
150	2 • 168,3	450	500	1200	150	33,7	90	500
200	2 • 219,1	560	630	1200	150	33,7	90	500

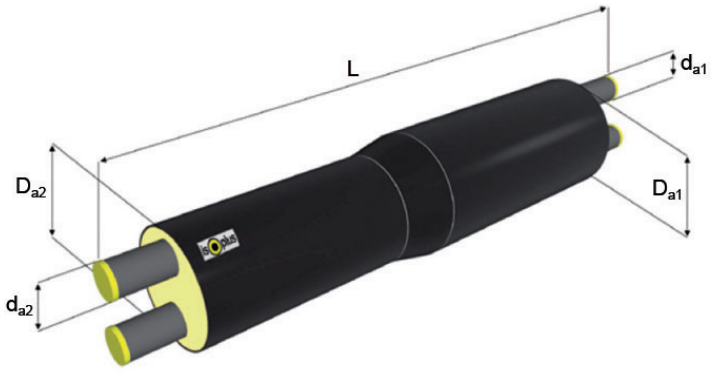
Carrier pipe passage and venting at least acc. to measure standard AGFW-guideline FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe distance (h_S) double pipe like pipe bars. All venting branches may not be shortened as they include a foamed in **isoplus**-ball valve with outside located support-handle. Information ELE-/ELÜ-ball valve see **chapter 2.2.10.** For improvements and in order to follow the actual technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.

The not insulated branch-end is manufactured generally with galvanised pipe end with outside thread-connection and an end cap. For manufacturing-technical reasons venting branches will be generally insulated with standard insulation. At areas of L-, Z- or U-elbows the assembling will be not permitted, due to bending tension which will occur. In order to guarantee the operation and access to the venting, the installation should be installed in a manhole acc. to DIN 4034. The manhole has to fulfil the corresponding construction static requirements.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**

Edition: 04.10.2012

2.3.10 Reducing Piece



Dimensions Nominal Diameter 1				Dimensions Nominal Diameter 2				Overall-length L in mm
Carrier pipe		Jacket-Pipe-Outside-Ø D_{a1} in mm		Carrier pipe		Jacket-Pipe-Outside-Ø D_{a2} in mm		
Nominal Diameter / Dimension DN	Outside-Ø d_{a1} in mm	Insulation Class		Nominal Diameter / Dimension	Outside-Ø d_{a2} in mm	Insulation Class		
		Standard	1x reinforced			Standard	1x reinforced	
25	2 • 33,7	140	160	**20**	2 • 26,9	125	140	1500
32	2 • 42,4	160	180	**25**	2 • 33,7	140	160	1500
				20	2 • 26,9	125	140	1500
40	2 • 48,3	160	180	**32**	2 • 42,4	160	180	1500
				25	2 • 33,7	140	160	1500
50	2 • 60,3	200	225	**40**	2 • 48,3	160	180	1500
				32	2 • 42,4	160	180	1500
65	2 • 76,1	225	250	**50**	2 • 60,3	200	225	1500
				40	2 • 48,3	160	180	1500
80	2 • 88,9	250	280	**65**	2 • 76,1	225	250	1500
				50	2 • 60,3	200	225	1500
100	2 • 114,3	315	355	**80**	2 • 88,9	250	280	1500
				65	2 • 76,1	225	250	1500
125	2 • 139,7	400	450	**100**	2 • 114,3	315	355	1500
				80	2 • 88,9	250	280	1500
150	2 • 168,3	450	500	**125**	2 • 139,7	400	450	1500
				100	2 • 114,3	315	355	1500
200	2 • 219,1	560	630	**150**	2 • 168,3	450	500	1500
				125	2 • 139,7	400	450	1500

Carrier pipe at least acc. to measure standard AGFW-guideline FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe distance (h_S) like pipe bars.
As carrier pipe reducer generally an eccentric piece of steel acc. to DIN EN 10253-2 with welded pipe socket will be used. For improvements and in order to follow the actual technical development we will reserve modifications of measures and as well technical modifications of the values mentioned in the table.

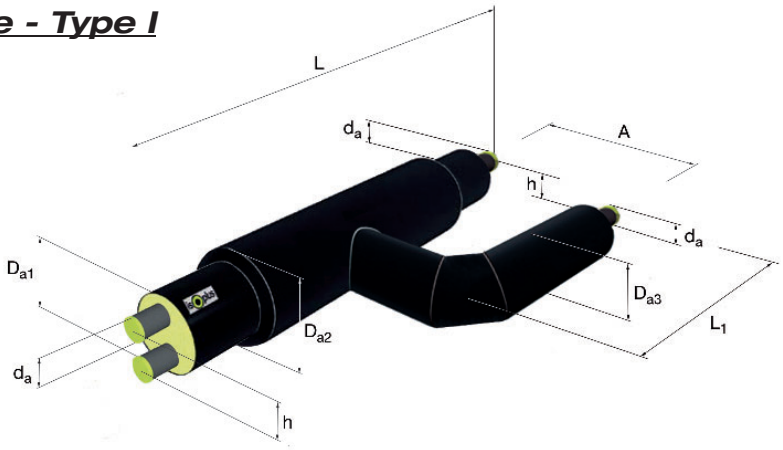
In order to avoid unacceptable high frontal soil-pressure loads, the reducing piece has to be padded in. Expansion pads are not part of the delivery range of the reducing piece.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**

Edition: 16.01.2012

2.3.11 Bifurcated Pipe

Bifurcated Pipe - Type I

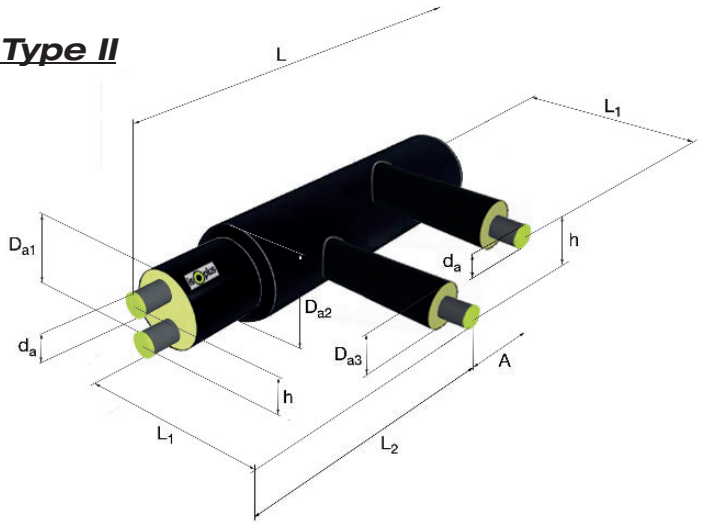


Dimensions Steel Pipe		Dimensions Double Pipe				Dimension Single Pipe	Axes-distance	Length	Length
Nominal Diameter / Dimension	Outside-Ø d_a in mm	Jacket-Pipe-Outside-Ø $D_{a1/2}$ in mm				D_{a3} in mm	A in mm	L in mm	L_1 in mm
		Insulation Class Standard		Insulation Class 1x reinf.					
DN		D_{a1}	D_{a2}	D_{a1}	D_{a2}				
20	2 • 26,9	125	140	140	140	90	240	1200	600
25	2 • 33,7	140	160	160	160	90	240	1200	600
32	2 • 42,4	160	180	180	180	110	260	1200	600
40	2 • 48,3	160	180	180	180	110	260	1200	600
50	2 • 60,3	200	225	225	225	125	290	1200	600
65	2 • 76,1	225	250	250	250	140	310	1200	600
80	2 • 88,9	250	280	280	280	160	350	1200	600
100	2 • 114,3	315	355	355	355	200	375	1200	600
125	2 • 139,7	400	400	450	450	225	450	1200	600
150	2 • 168,3	450	500	500	500	250	510	1300	650
200	2 • 219,1	560	630	630	630	315	610	1400	700

Bifurcated pipes are used for transitions from two single pipes to the **isoplus**-double pipe. Carrier pipe at least acc. to measure standard AGFW-guideline FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe distance (h_S) like pipe bars. For improvements and in order to follow the actual technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.
ATTENTION: Orders for bifurcated pipes should clearly indicate **all** carrier and jacket-pipe diameters. During assembling the correct position of single- and double pipes resp. the installation position of the bifurcated pipe as well as the manufacturing-technical determined axis-measure **A** has to be considered. There must be the possibility of expansion compensation at the transition before the bifurcated pipe (Z- or U-elbow), because bifurcated pipes should be assembled generally at pipe-static neutral line-positions. This will be also valid in case of a system-change in an exit of a single pipe-branch.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**

Bifurcated Pipe - Type II



Dimensions Steel Pipe		Dimensions Double Pipe				Dimension Single Pipe	Axes-distance	Height offset	Length	Length	Length
Nominal Diameter / Dimension	Outside-Ø	Jacket-Pipe-Outside-Ø $D_{a1/2}$ in mm									
		Insulation Class Standard		Insulation Class 1x reinf.							
DN	d_a in mm	D_{a1}	D_{a2}	D_{a1}	D_{a2}	D_{a3} in mm	A in mm	h in mm	L in mm	L_1 in mm	L_2 in mm
20	2 • 26,9	125	140	140	140	90	240	47	1100	600	760
25	2 • 33,7	140	160	160	160	90	240	54	1100	600	760
32	2 • 42,4	160	180	180	180	110	260	62	1100	600	740
40	2 • 48,3	160	180	180	180	110	260	68	1100	600	740
50	2 • 60,3	200	225	225	225	125	300	80	1100	600	700
65	2 • 76,1	225	250	250	250	140	310	96	1100	600	690
80	2 • 88,9	250	280	280	280	160	360	114	1200	600	640
100	2 • 114,3	315	355	355	350	200	400	139	1300	650	750
125	2 • 139,7	400	400	450	450	225	425	170	1300	700	725
150	2 • 168,3	450	500	500	500	250	450	208	1400	700	775
200	2 • 219,1	560	630	630	630	315	615	264	1700	750	885

Bifurcated pipes are used for transitions from two single pipes to the **isoplus** double pipe. Carrier pipe at least acc. to measure standard AGFW-guidelines FW 401. From wall thickness > 3,0 mm with weld seam preparation by 30° bevelled ends acc. to DIN EN ISO 9692-1. Length of bare steel pipe ends 220 mm ± 10 mm, clear pipe distance (h_S) like pipe bars. For improvements and in order to follow the actual technical development we will reserve modifications of measures as well as technical modifications of the values mentioned in the table.

ATTENTION: Orders for bifurcated pipes should clearly indicate **all** carrier and jacket pipe diameters. During assembling the correct position of single- and double pipes resp. the installation position of the bifurcated pipe as well as the manufacturing-technical determined axis-measure **A** has to be considered. There must be the possibility of expansion compensation at the transition before the bifurcated pipe (Z- or U-elbow), because bifurcated pipes should be assembled generally at pipe-static neutral line-positions. This will be also valid in case of a system-change in an exit of a single pipe-branch.

Material specification jacket pipe see **chapter 2.1.4**
Material specification carrier pipe see **chapter 2.3.1**
Material specification PUR-hard foam see **chapter 7.1.7**