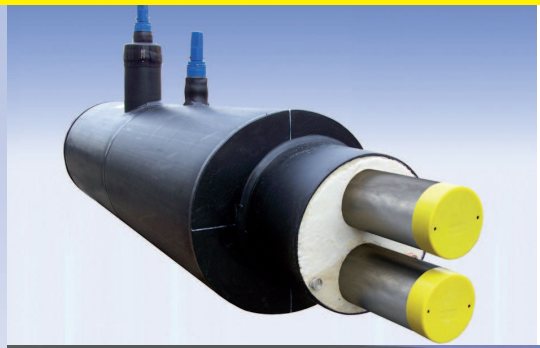
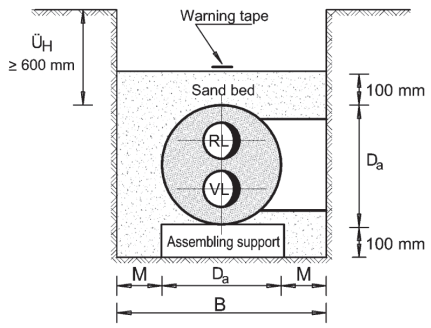
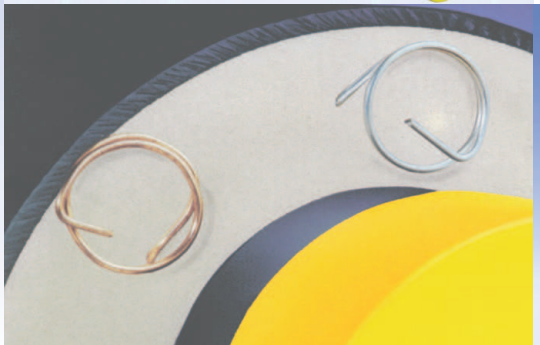
isoplus®

Transporting energy.

DOUBLE - PIPE







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The **isoplus double-pipe** is a perfect solution for delivering district heating with **eco**logical and **eco**nomical advantage to the consumer. Due to the vertical geometry of flow and return line in one common jacketpipe an insulation thickness will be reached which can be compared with reinforced insulated single pipes.

This will lead to a thermal-blockage which will result in essential reduction of heat-loss. With this principle of construction an optimum of efficiency of insulation from PUR-hard foam will be reached, by minimum use of material. The result is an ideal insulation technology.

Heat-Insulation

isoplus double-pipes will be insulated with Polyurethane-hard foam (PUR). During discontinuous production procedure foamed between medium pipe and jacket-pipe, a high quality insulation with excellent thermal conductivity, λ_{50} = maximal 0,0275 W/(m•K), at low specific weight will develop due to an exothermal chemical reaction.

isoplus is using generally PUR-foam which is 100% free of chlorofluorocarbon (CFC). Cyclopentan (C_5H_{10}) 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) = < 2 !

Jacket Pipe

As jacket-pipe the reliable PEHD pipe with plain surface will be used for **isoplus double-pipe**. Polyethylene High Density is a seamless extruded, shock- and break proof, viscoplastic hard polyethylene. Corona treated for optimum compound with PUR-hard foam according to EN 253. Measures respectively wall thickness at least according to EN 253, thermal conductivity λ_{PE80} = 0,40 W/(m•K).

PEHD is resistant against weather conditions and UV-rays in a high extent as well as practically against all chemical reactions which may develop in the soil. Therefore PE is declared in all national and international standards as the only suitable material for direct buried pipe-lying.

Service-Pipe

The service pipe of **isoplus double-pipe** consists of a welded circular steel with welding factor V = 1,0 respectively 100 % (B) calculated tension.

Up to DN 80 in P235TR1 (material No. 1.0254) or P235GH (material No. 1.0345), technical delivery conditions according to DIN EN 10217-1 or DIN EN 10217-2. From DN 100 exclusively in P235GH (material No. 1.0345), technical delivery conditions according to DIN EN 10217-2.

All pipes tested according to DIN EN 10204-3.1 with material certificate (APZ). From wall thickness > 3,2 mm with weld seam preparation by 30° bevelled ends according to DIN EN ISO 9692-1.

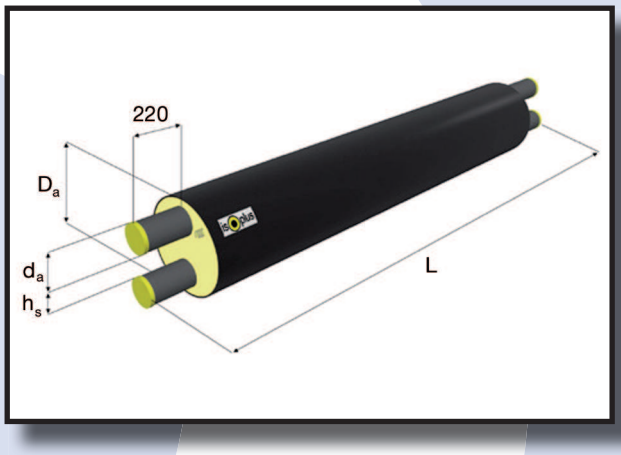
System

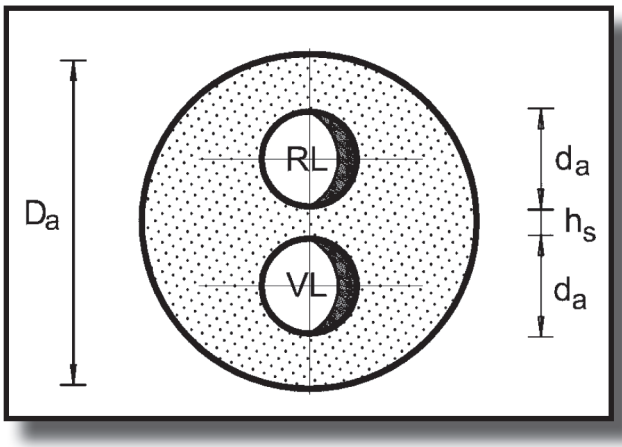
Double-Pipe

Applications

Maximum permissible operating temperature T_{max} : at the minimum according to EN 253
Maximum permissible spread VL / RL (ΔT): 50 K
Maximum permissible operating pressure p_B : 25 bar
Maximum permissible axial tension σ_{max} : 190 N/mm²
Leak detecting: **IPS-Cu®** und **IPS-NiCr®**
Possible liquids: Heating water as well as other material resistant liquids

Technical data P235GH / P235TR1 at 20 °C					
Property	**Unit**	**Value**	**Property**	**Unit**	**Value**
Volume weight ρ	kg/dm³	7,87	Elastic modulus *E*	N/mm²	212.000
Tensile stress R_m	N/mm²	360 - 500	Thermal conductivity λ	W/(m•K)	52,33
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 bei T_{max}	K^{-1}	$12,7 \cdot 10^{-6}$





Dimensions respectively Types

Dimensions Steel Pipe P235GH / TR1												
Type	Nominal Diameter / Dimension in		Outside-Ø **d_a** in mm	Wall-thickness **s** in mm	Delivery length **L** in mm	Jacket-Pipe Outside-Ø **D_a** in mm		Clear Pipe-distance **h_S** in mm	Weight **G** without water in kg/m		Heat-Loss Coefficient **k-Value** in W/(m•K)	
						Insulation Class			Insulation Class		Insulation Class	
	DN	**Inches**				**Standard**	**1x reinforced**		**Standard**	**1x reinforced**	**Standard**	**1x reinforced**
DR - 20	**2 • 20**	3/4“	26,9	2,6	6/12	125	140	20	5,02	5,39	0,2076	0,1875
DR - 25	**2 • 25**	1“	33,7	3,2	6/12	140	160	20	7,04	7,58	0,2268	0,1990
DR - 32	**2 • 32**	11/4“	42,4	3,2	6/12	160	180	20	8,87	9,46	0,2469	0,2172
DR - 40	**2 • 40**	11/2“	48,3	3,2	6/12	160	180	20	9,74	10,33	0,2909	0,2469
DR - 50	**2 • 50**	2“	60,3	3,2	6/12	200	225	20	13,23	14,18	0,2848	0,2452
DR - 65	**2 • 65**	21/2“	76,1	3,2	6/12	225	250	20	16,40	17,56	0,3352	0,2826
DR - 80	**2 • 80**	3“	88,9	3,2	6/12	250	280	25	19,32	20,81	0,3774	0,3031
DR - 100	**2 • 100**	4“	114,3	3,6	6/12/16	315	355	25	28,45	31,33	0,3808	0,3052
DR - 125	**2 • 125**	5“	139,7	3,6	6/12/16	400	450	30	38,61	42,97	0,3539	0,2912
DR - 150	**2 • 150**	6“	168,3	4,0	6/12/16	450	500	40	50,14	55,14	0,4264	0,3363
DR - 200	**2 • 200**	8“	219,1	4,5	6/12/16	560	630	45	74,68	83,27	0,4833	0,3557

The mentioned steel wall thickness are corresponding with the minimum requirements according to the AGFW-guidelines FW 401 (working association district heating e.V.) and ÖNORM (Austrian institute for standardisation). Length of bare steel pipe ends 220mm ± 10mm. In the tubular rod may be auxiliary webs due to the production but these have no pipe-static function. In order to improve and to follow the technical development we will reserve technical modifications of the values mentioned in the table.

Heating Pipe

Thermal Transmission Coefficient [k_{DR}] and Heat Loss [q]

Type	Jacket-Pipe Outside-Ø D_a in mm		Coefficient k_{DR} in W/(m•K)		q at Average Temperature T_M = 100 K in W/m		q at Average Temperature T_M = 60 K in W/m		q at Average Temperature T_M = 50 K in W/m	
	Insulation Class		Insulation Class		Insulation Class		Insulation Class		Insulation Class	
	Standard	1 x reinforced	Standard	1 x reinforced	Standard	1 x reinforced	Standard	1 x reinforced	Standard	1 x reinforced
DR - 20	125	140	0,2076	0,1875	20,749	18,739	12,459	11,252	10,374	9,370
DR - 25	140	160	0,2268	0,1990	22,668	19,893	13,612	11,944	11,334	9,946
DR - 32	160	180	0,2469	0,2172	24,674	21,709	14,819	13,038	12,337	10,854
DR - 40	160	180	0,2909	0,2469	29,071	24,679	17,459	14,822	14,536	12,339
DR - 50	200	225	0,2848	0,2452	28,462	24,501	17,093	14,714	14,231	12,251
DR - 65	225	250	0,3352	0,2826	33,495	28,243	20,116	16,960	16,747	14,121
DR - 80	250	280	0,3774	0,3031	37,726	30,289	22,651	18,192	18,863	15,145
DR - 100	315	355	0,3808	0,3052	38,063	30,498	22,853	18,321	19,032	15,249
DR - 125	400	450	0,3539	0,2912	35,366	29,094	21,239	17,477	17,683	14,547
DR - 150	450	500	0,4264	0,3363	42,627	33,596	25,590	20,186	21,313	16,798
DR - 200	560	630	0,4833	0,3557	48,324	35,542	28,998	21,354	24,162	17,771

Heat Loss Comparison Double- to Single-Pipe, T_M = 70 K

Double-Pipe - Standard Insul.			2x Single-Pipe - Standard Insulation				2x Single-Pipe - 1x reinforced Insul.			
Type	Heat Loss		PEHD-Ø D_a in mm	Heat Loss		Saving in %	PEHD-Ø D_a in mm	Heat Loss		Saving in %
	k_{DR} in W/(m•K)	q_{DR} in W/m		k_{ER} in W/(m•K)	q_{ER} in W/m			k_{ER} in W/(m•K)	q_{ER} in W/m	
DR - 20	0,2076	14,531	90	0,2744	19,208	24,35	110	0,2357	16,496	11,91
DR - 25	0,2268	15,876	90	0,3342	23,395	32,14	110	0,2785	19,492	18,55
DR - 32	0,2469	17,283	110	0,3417	23,919	27,74	125	0,3026	21,183	18,41
DR - 40	0,2909	20,362	110	0,3922	27,456	25,84	125	0,3416	23,912	14,85
DR - 50	0,2848	19,935	125	0,4376	30,631	34,92	140	0,3819	26,735	25,43
DR - 65	0,3352	23,461	140	0,5142	35,992	34,82	160	0,4282	29,977	21,74
DR - 80	0,3774	26,420	160	0,5304	37,130	28,84	180	0,4489	31,420	15,91
DR - 100	0,3808	26,655	200	0,5624	39,369	32,29	225	0,4714	32,995	19,22
DR - 125	0,3539	24,771	225	0,6490	45,431	45,48	250	0,5428	37,994	34,80
DR - 150	0,4264	29,849	250	0,7672	53,704	44,42	280	0,6142	42,995	30,58
DR - 200	0,4833	33,830	315	0,8355	58,486	42,16	355	0,6527	45,692	25,96

Double-Pipe - 1x reinforced Insul.			2x Single-Pipe - 1x reinforced Insulation				2x Single-Pipe - 2x reinforced Insul.			
Type	Heat Loss		PEHD-Ø D_a in mm	Heat Loss		Saving in %	PEHD-Ø D_a in mm	Heat Loss		Saving in %
	k_{DR} in W/(m•K)	q_{DR} in W/m		k_{ER} in W/(m•K)	q_{ER} in W/m			k_{ER} in W/(m•K)	q_{ER} in W/m	
DR - 20	0,1875	13,123	110	0,2357	16,496	20,45	125	0,2164	15,147	13,36
DR - 25	0,1990	13,931	110	0,2785	19,492	28,53	125	0,2519	17,636	21,01
DR - 32	0,2172	15,206	125	0,3026	21,183	28,22	140	0,2749	19,244	20,98
DR - 40	0,2469	17,286	125	0,3416	23,912	27,71	140	0,3067	21,469	19,48
DR - 50	0,2452	17,161	140	0,3819	26,735	35,81	160	0,3324	23,267	26,24
DR - 65	0,2826	19,781	160	0,4282	29,977	34,01	180	0,3734	26,141	24,33
DR - 80	0,3031	21,217	180	0,4489	31,420	32,47	200	0,3992	27,941	24,06
DR - 100	0,3052	21,366	225	0,4714	32,995	35,24	250	0,4127	28,889	26,04
DR - 125	0,2912	20,382	250	0,5428	37,994	46,35	280	0,4615	32,302	36,90
DR - 150	0,3363	23,538	280	0,6142	42,995	45,25	315	0,5102	35,711	34,09
DR - 200	0,3557	24,901	355	0,6527	45,692	45,50	400	0,5353	37,472	33,55

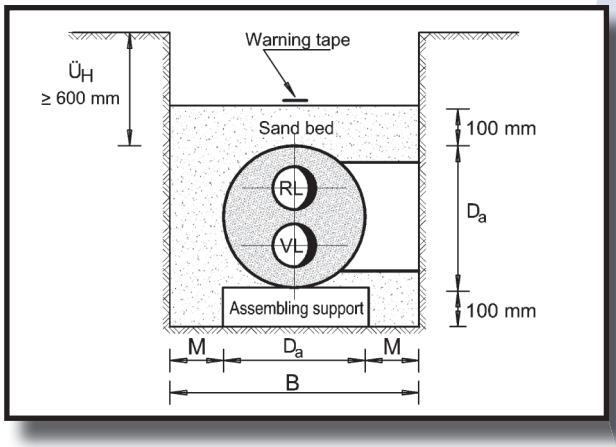
The mentioned data are based on a covering height [ÜH] of 0,60 m, a thermal conductivity of soil [λ_E] of 1,2 W/(m•K), a soil temperature [T_E] of 10 °C as well as a pipe distance of 150 mm at single-pipes; $T_M = (T_{VL} + T_{RL}) : 2 - T_E$ => Example: (100° + 60°) : 2 - 10° = 70 K.

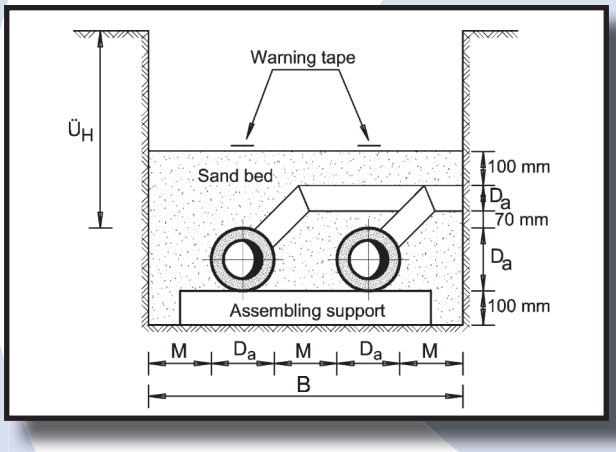
Transmittable Capacity [P]

Type	Volume Flow V´ in m^3/h		Flow Speed w in m/s		Transmittable Capacity P in kW at spread					
					20 K		30 K		40 K	
	from	to	from	to	from	to	from	to	from	to
DR - 20	0,703	1,547	0,50	1,10	16	36	25	54	33	72
DR - 25	1,148	2,526	0,50	1,10	27	59	40	88	53	118
DR - 32	2,348	4,695	0,60	1,20	55	109	82	164	109	218
DR - 40	3,151	6,303	0,60	1,20	73	147	110	220	147	293
DR - 50	5,879	11,757	0,70	1,40	137	273	205	410	273	547
DR - 65	9,781	19,563	0,70	1,40	228	455	341	683	455	910
DR - 80	15,395	30,791	0,80	1,60	358	716	537	1.074	716	1.432
DR - 100	25,945	51,891	0,80	1,60	604	1.207	905	1.811	1.207	2.414
DR - 125	49,639	89,350	1,00	1,80	1.155	2.078	1.732	3.118	2.309	4.157
DR - 150	87,185	152,573	1,20	2,10	2.028	3.549	3.042	5.324	4.056	7.098
DR - 200	174,732	299,541	1,40	2,40	4.064	6.968	6.097	10.451	8.129	13.935

All data are based on an average specific thermal capacity [c_m] of the water of 4.187 J/(kg•K). The flow speed [w] has generally to be determined on dependence of application.

Comparison Trench Excavation - Standard Insulation





Type	Double-Pipe - Standard Insulation					2 x Single-Pipe - Standard Insulation					Saving
	PEHD-Ø D_a in mm	Trench Dimension				PEHD-Ø D_a in mm	Trench Dimension				
		Distance M in mm	Depth T in m	Width B in m	Area A in m^2		Distance M in mm	Depth T in m	Width B in m	Area A in m^2	< in %
DR - 20	125	150	0,825	0,425	0,315	110	150	0,810	0,670	0,543	**35,39**
DR - 25	140	150	0,840	0,440	0,370	110	150	0,810	0,670	0,543	**31,90**
DR - 32	160	150	0,860	0,460	0,396	125	150	0,825	0,700	0,578	**31,50**
DR - 40	160	150	0,860	0,460	0,396	125	150	0,825	0,700	0,578	**31,50**
DR - 50	200	150	0,900	0,500	0,450	140	150	0,840	0,730	0,613	**26,61**
DR - 65	225	200	0,925	0,625	0,578	160	200	0,860	0,920	0,791	**26,93**
DR - 80	250	200	0,950	0,650	0,618	180	200	0,880	0,960	0,845	**26,91**
DR - 100	315	200	1,015	0,715	0,726	225	200	0,925	1,050	0,971	**25,28**
DR - 125	400	200	1,100	0,800	0,880	250	200	0,950	1,100	1,045	**15,79**
DR - 150	450	250	1,150	0,950	1,093	280	300	0,980	1,460	1,431	**23,64**
DR - 200	560	250	1,260	1,060	1,336	355	300	1,055	1,610	1,699	**21,37**

The values are based on a covering height [$Ü_H$] of 0,60 m, a sand-bed of 0,10 m as well as on a trench excavation without escarp and side slope. The soil-width [B] is calculated from jacket-pipe-diameter [D_a] and the minimum assembling distance [M] depending from dimension.

Double-Pipe

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