Table of contents

1. General

CALCOPPER is a flexible pipe system suitable for temperatures of up to 120 °C. This piping is intended for use in small and medium-sized local heating networks.

CALCOPPER has a medium pipe made of copper. Manual processing of this piping is very easy.

The heat insulation consists of a flexible CFC-free hard polyurethane foam with outstanding heat insulation characteristics.

The flexibility of the CALCOPPER piping means that it can be adapted to virtually any pipe conditions with no problems. Pipes can cross above or below existing supply lines, and obstacles can be easily bypassed.

CALCOPPER makes it possible to choose the shortest pipe route, without taking classical pipe construction methods into consideration.

CALCOPPER is supplied to the site as one piece in the desired length, in rings. By and large, the pipe can be laid in the ground without any connection points so that the pipe trenches can be considerably narrower, making substantial savings possible on the underground construction work. This is particularly true of DUO lines.

Another feature: only a very short time is required to lay the pipe. All of these benefits mean that CALCOPPER is not only a technically perfect solution, but also that it offers the key to saving time and costs when constructing local heating networks - thanks to the reduced outlay on coordination at the site, and the fast and simple installation procedure.

2. Range of application

Heating: max. 120 °C and max 16 bar operating pressure

CALCOPPER can be supplied with one or two carrier pipes.

3. Medium pipe

Material: Soft copper, R220 to EN1057
Oxygen-free copper, deoxidised with phosphorus
SF-Cu F22 to DIN17671

Characteristics: Meets the requirements specified by EN 1057
(mechanical values in the delivered state)

Cu medium pipe	Reference temperature °C	Value	Examination norm
Density	–	8.93 kg/dm³	-
Proof stress		max. 140 N/mm²	DIN 17671
Ultimate tensile strength	–	220 to 270 N/mm²	DIN 17671
Hardness	–	40 to 70	DIN 17671
Modulus of elasticity	–	125'000 N/mm²	-
Linear expansion coefficient	–	16.6 · 10 E-6 1/K	-

4. Heat insulation

Material: CFC-free, 100% pentane-blown polyurethane foam (PUR)

PUR insulation	Reference temperature °C	Value	Examination norm
Density	–	> 60 kg/m³	DIN 53420
Heat conductivity	50	≤ 0.0255 W/mK	DIN 52612
Closed cells	–	≥ 90 %	–
Water absorption after 24 hours	–	≤ 10 %	EN 253

5. Protective casing

Material: Polyethylene of low density, PE-LD, extruded seamless

Purpose: Protection against mechanical effects and moisture

PE-LD protective casing	Reference temperature °C	Value	Examination norm
Density	–	928-938 kg/m	DIN 53479
Heat conductivity	–	0.43 W/mK	DIN 52612
Crystallite melting range	–	105-110 °C	–

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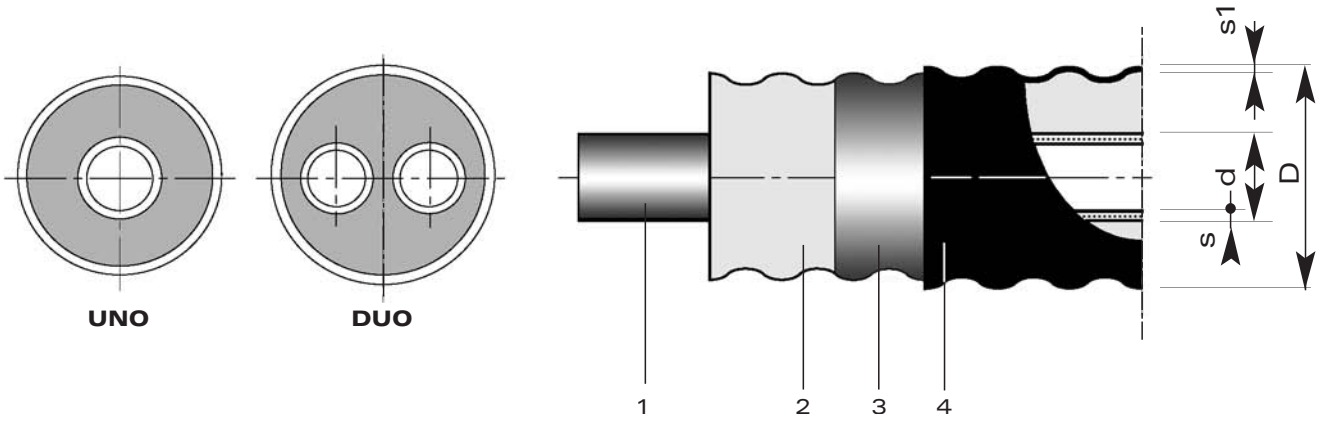
CALCOPPER

Local heating and house connection piping

Heating, 120 °C, 16 bar, UNO and DUO

CCO
9.115
3.9.2003



Pos	Material
1	Medium pipe in soft copper, R220, to EN1057, SF-Cu F22 to DIN 1787/17671/1754
2	Flexible, CFC-free polyurethane foam, resistant up to 130 °C Thermal conduction coefficient λ = 0.0255 W/mK at 50 °C average temperature
3	PE-LD film
4	Outer casing in black PE-LD polyethylene (VDE 0209), extruded seamless. Protection against mechanical effects and moisture.

CALCOPPER, UNO

Type	DN	Carrier pipe Cu d x s mm	Protective sheath D x s1min mm	Min. Bending radius m	Capacity carrier pipe l/m	Weight kg/m	max. Delivery length Ring without connections m
15/63*	10	15 x 1.0	63 x 1.8	0.7	0.13	0.93	280
15/76	10	15 x 1.0	76 x 2.0	0.7	0.13	1.09	280
18/63*	15	18 x 1.0	63 x 1.8	0.7	0.20	1.01	300
18/76	15	18 x 1.0	76 x 2.0	0.7	0.20	1.17	300
22/63*	20	22 x 1.0	63 x 1.8	0.7	0.31	1.12	200
22/76	20	22 x 1.0	76 x 2.0	0.7	0.31	1.27	200
28/76	25	28 x 1.2	76 x 2.0	0.7	0.51	1.57	130
35/9	32	35 x 1.5	91 x 2.2	0.8	0.83	2.27	On request

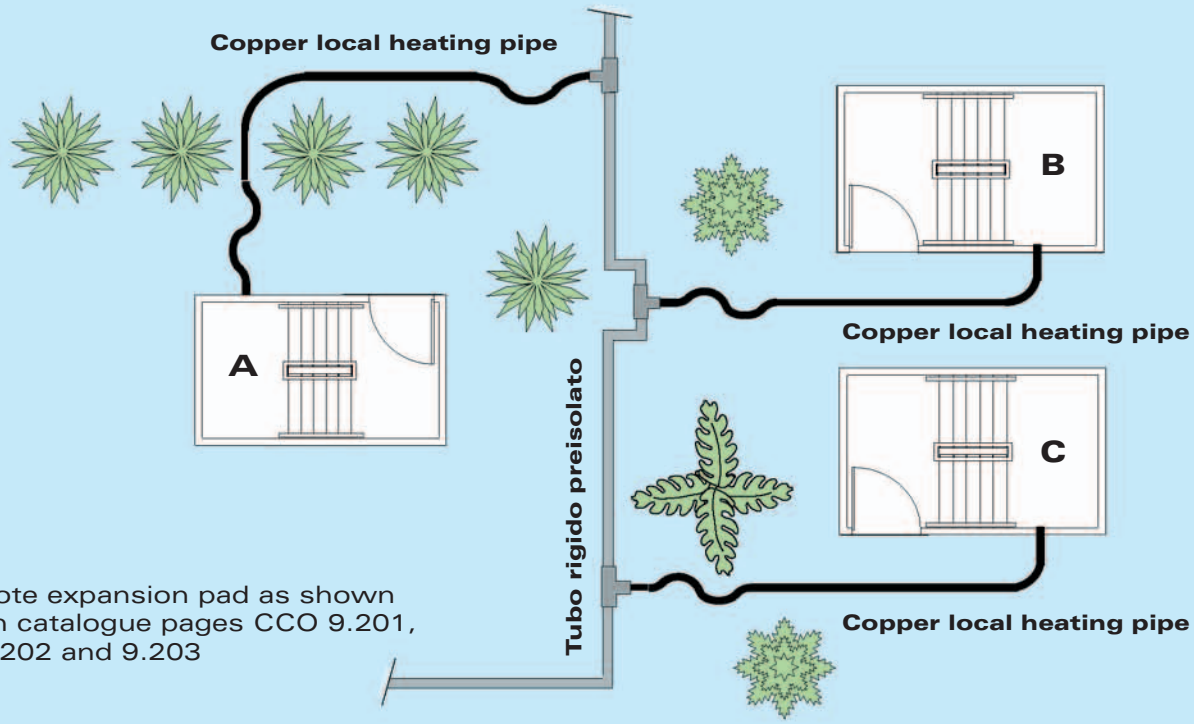
*Dimension without corrugated protective casing
Ring dimensions: Ø 2800 x 800 mm (width) / pipe length without interrelated fittings

CALCOPPER, DUO

Type	DN	Carrier pipe Cu d x s mm	Protective sheath D x s1min mm	Min. Bending radius m	Capacity carrier pipe l/m	Weight kg/m	max. Delivery length Ring without connections m
15+15/91	10	15 x 1.0	91 x 2.2	0.8	2 x 0.13	1.35	280
18+18/91	15	18 x 1.0	91 x 2.2	0.8	2 x 0.20	1.50	300
22+15/91	20	22 x 1.0	91 x 2.2	0.8	1 x 0.31	1.51	200
	10	15 x 1.0	–	–	1 x 0.13		
22+22/91	20	22 x 1.0	91 x 2.2	0.8	2 x 0.31	1.72	200
28+15/91	25	28 x 1.2	91 x 2.2	0.8	1 x 0.51	1.92	130
	10	15 x 1.0	–	–	1 x 0.13		
28+22/91	25	28 x 1.2	91 x 2.2	0.8	1 x 0.51	2.03	130
	20	22 x 1.0	–	–	1 x 0.31		

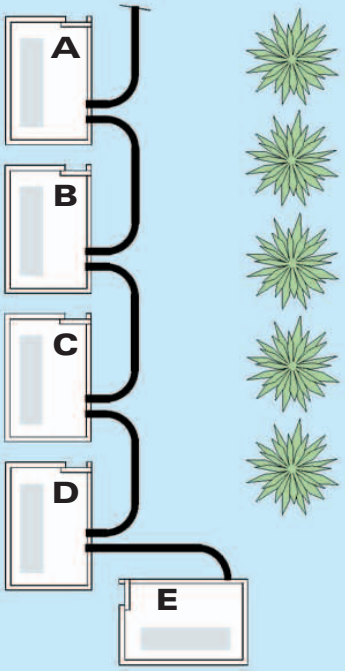
Examples of pipe routing

Connection: copper local heating pipe - plastic casing pipe



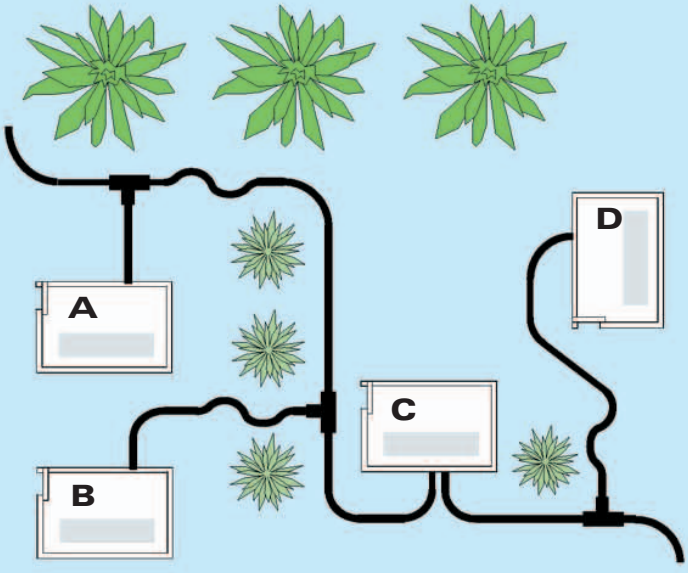
Note expansion pad as shown on catalogue pages CCO 9.201, 9.202 and 9.203

Looping-in method



Note expansion pad as shown on catalogue pages CCO 9.201, 9.202 and 9.203

Copper-copper connection



Note expansion pad as shown on catalogue pages CCO 9.201, 9.202 and 9.203

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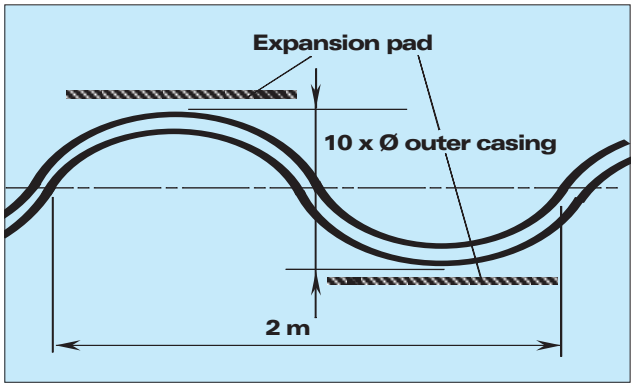
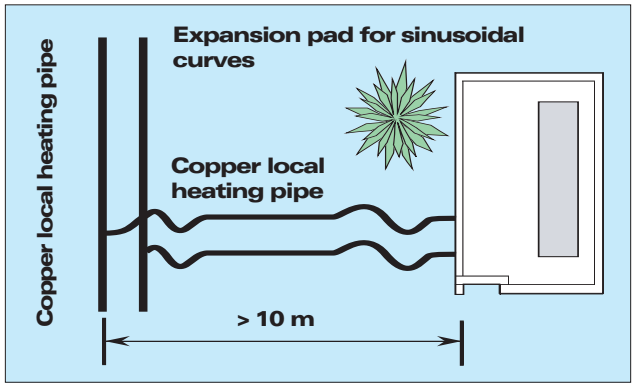
Pipelaying instructions Part 1

CCO
9.201
3.9.2003

Pipelaying instructions

If the lengths of pipe to be laid exceed 5 m, the copper junction pipes must first be bent into a sinusoidal shape (curve length: L = 2 m, amplitude: 10 x outer diameter of copper local heating pipe).

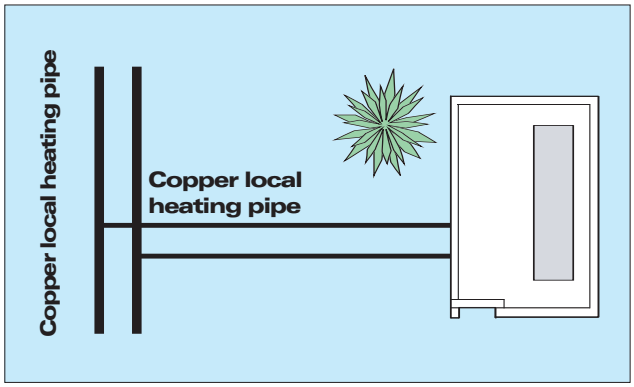


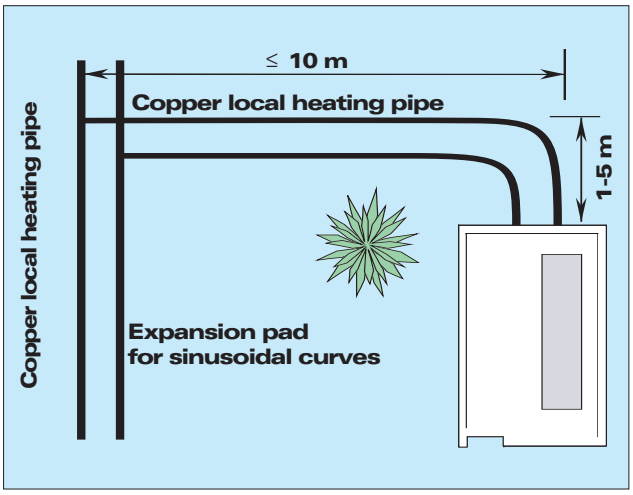


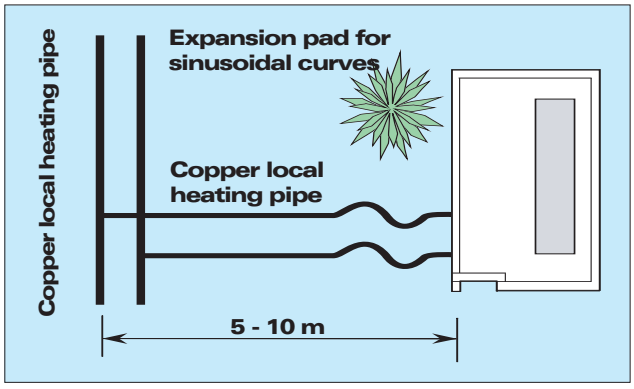
Special brazing must be used to solder the pipes together (this must be resistant to galvanic or electrochemical corrosion). The brazing instructions / manufacturer's instructions for the copper fittings must be followed without fail.

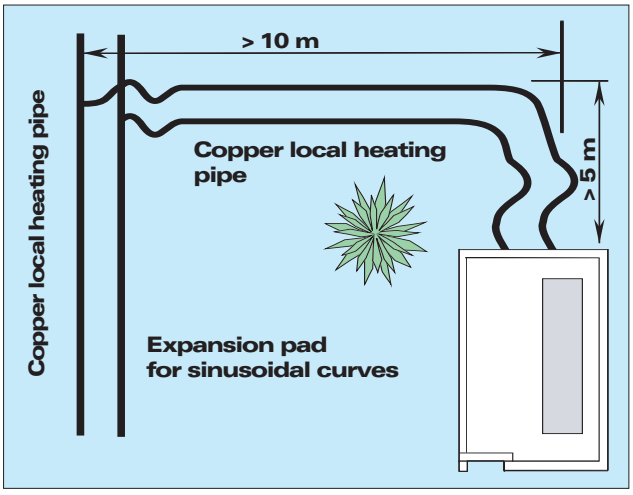
The shape of the copper piping should not be bent more than three times. This also includes rolling apart and rolling together.

Esempi di scavo





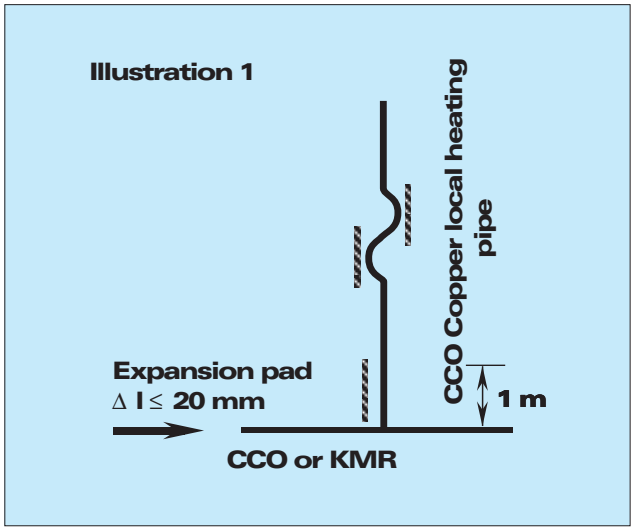


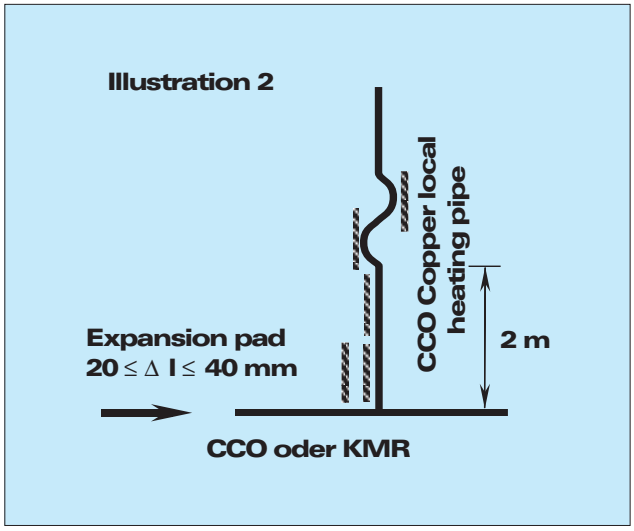


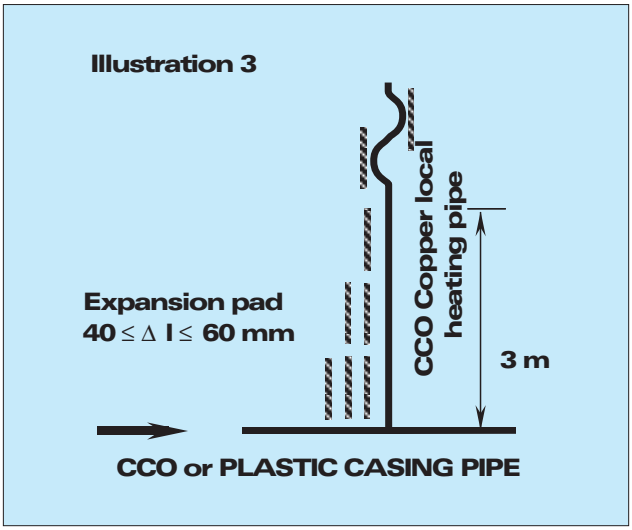
Pipe junctions from copper or steel
Main pipes on copper
Local heating pipes

The copper local heating pipe can only accommodate forces and deformations from connected external pipes to a limited extent.

Expansion padding has to be applied to copper local heating junction pipes. The number of expansion pads required depends on the movement of the main pipe. The 3 illustrations shown below provide the basic rules:







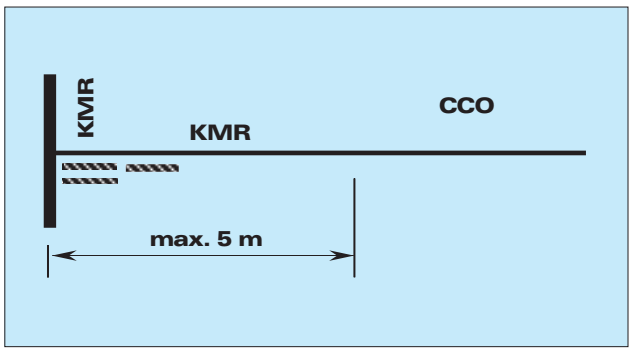
Thickness of expansion pads: 40 mm

The expansion pads must be applied as far as the casing of the main pipe (i.e. they are positioned on top).

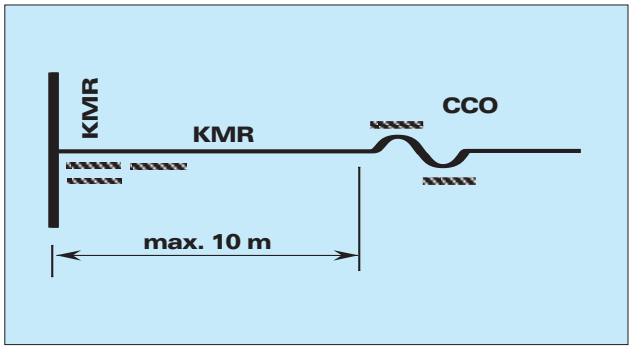
The first layer of expansion pad is positioned around the local copper heating pipe which branches off (the junction pipe).
The second and third layers of expansion pad are only applied at the sides (i.e. they are placed adjacently). The foregoing illustrations assume that junction sleeves are used.

Straight transitions from plastic casing pipes to the copper local heating pipe

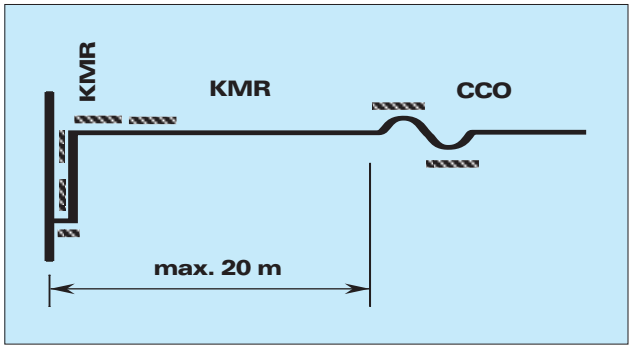
For transitions from plastic casing pipes to the copper local heating pipe, it should be noted that the copper local heating pipe can only absorb the heat expansion to a limited extent. The following examples show how this can be guaranteed:



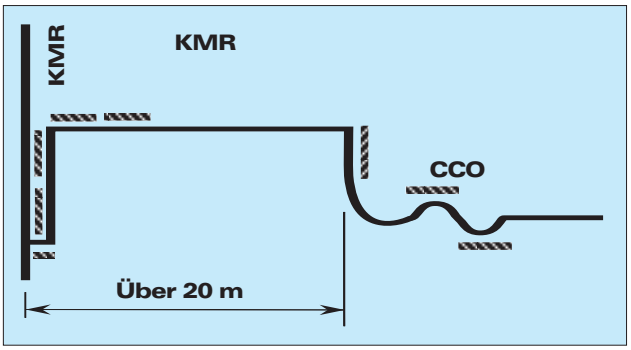
The maximum length of the plastic casing pipe is 5 m. Expansion padding is required. No sinusoidal curve is required on the copper pipe.



The maximum length of the plastic casing pipe is 10 m. Expansion padding is required.



The maximum length of the plastic casing pipe is 20 m. Expansion padding is required.

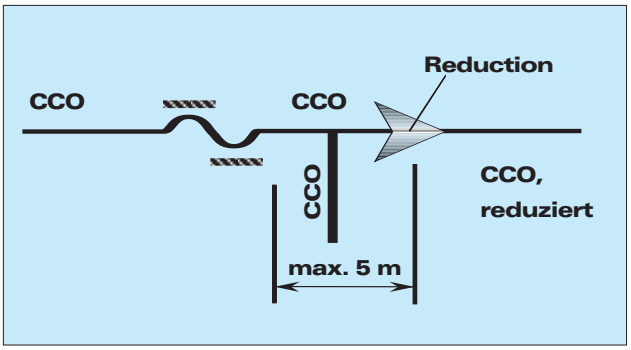


The length of the plastic casing pipe may exceed 20 m. Expansion padding is required.

Instructions for reducing the medium pipe

The following rules must be followed for a reduction of the medium pipes:

1. If gunmetal reductions are used, no particular instructions need to be followed.
2. The following instructions refer to reductions with normal copper fittings.



The heat expansion is absorbed by the sinusoidal curve (see page CCO 9.210) upstream of the T-junction. Expansion padding is required.

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Pressure loss

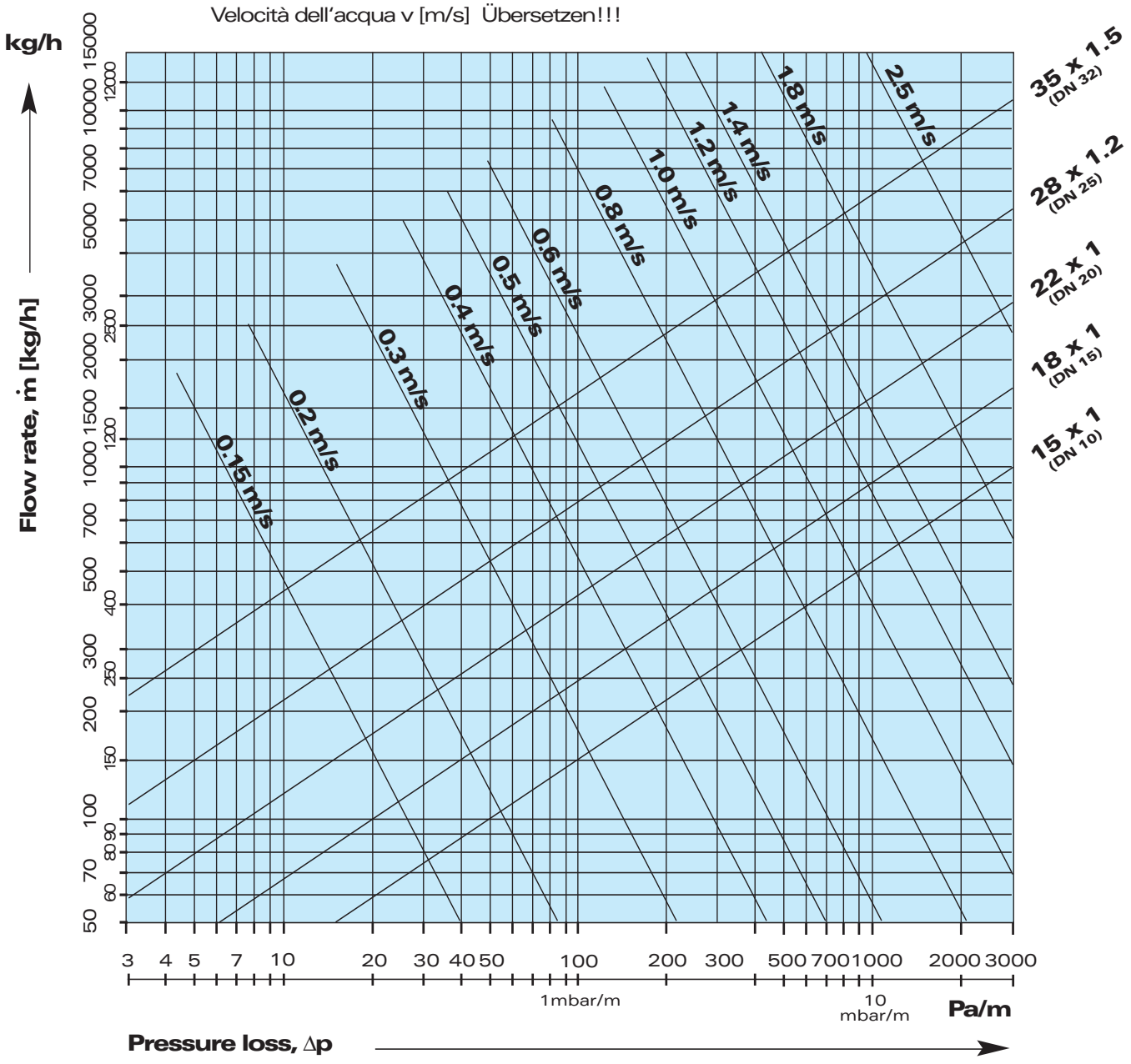
CCO
9.210
3.9.2003

Water, average temperature 80 °C

Roughness ε = 0.0015 mm (copper)
(1 mm water column = 9.81 Pa)

$$\dot{m} = \frac{Q \cdot 860}{\Delta T}$$

$\dot{m}$ = flow in kg/h
Q = power required in kW
ΔT = temperature difference forward and return flow in °C



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CALCOPPER

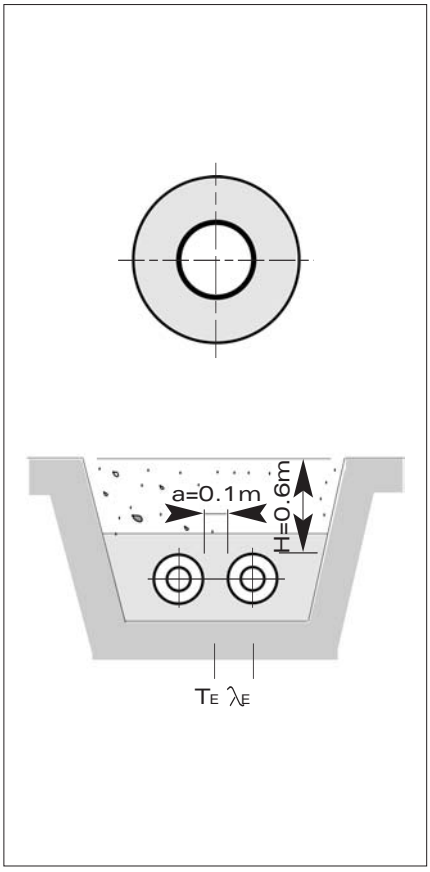
Heat loss

Heating, 120°C, 16 bar, UNO and DUO

CCO
9.220
3.9.2003

Copper heating pipe

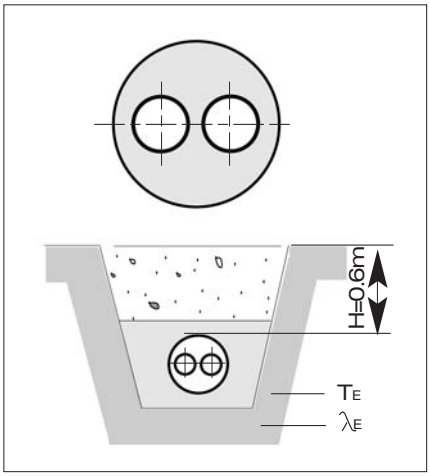
Heat loss q [W/m] for single-line pipe UNO							
Type	U-Value	average operating temperature TB [°C]					
CCO UNO	[W/mk]	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
15/63	0.108	6.48	7.56	8.64	9.72	10.8	11.88
15/76	0.095	5.7	6.65	7.6	8.55	9.5	10.45
18/63	0.123	7.38	8.61	9.84	11.07	12.3	13.53
18/76	0.107	6.42	7.49	8.56	9.63	10.7	11.77
22/63	0.146	8.76	10.22	11.68	13.14	14.6	16.06
22/76	0.123	7.38	8.61	9.84	11.07	12.3	13.53
28/76	0.151	9.06	10.57	12.08	13.59	15.1	16.61
35/91	0.161	9.66	11.27	12.88	14.49	16.1	17.71



Copper heating pipe

(Forward and return flow in the same protective sheath)

Heating loss q [W/m] for twin-line pipe DUO							
Type	U-Value	average operating temperature TB [°C]					
CCO DUO	[W/mk]	**70°**	**80°**	**90°**	**100°**	**110°**	**120°**
15+15/91	0.133	7.98	9.31	10.64	11.97	13.3	14.63
18+18/91	0.1518	9.108	10.626	12.144	13.662	15.18	16.698
22+15/91	0.163	9.78	11.41	13.04	14.67	16.3	17.93
22+22/91	0.187	11.22	13.09	14.96	16.83	18.7	20.57
28+15/91	0.203	12.18	14.21	16.24	18.27	20.3	22.33
28+22/91	0.222	13.32	15.54	17.76	19.98	22.2	24.42



Method of laying:	2 separate UNO pipes underground
Covering height:	H = 0.60 m
Earth-temperature:	T_E = 10 °C
Conductivity of ground:	λ_E = 1.2 W/mK
Conductivity of PUR-foam:	λPU = 0.0255 W/mK
Conductivity of CU-pipe:	λCU = 305 W/mK
Conductivity of PE-casing:	λPE = 0.43 W/mK

Heat loss during operation: q = U (TB -TE) [W/m]
U = Specific heat losses [W/mK]
TB = Average operating temperature [°C]
TE = Average earth temperature [°C]

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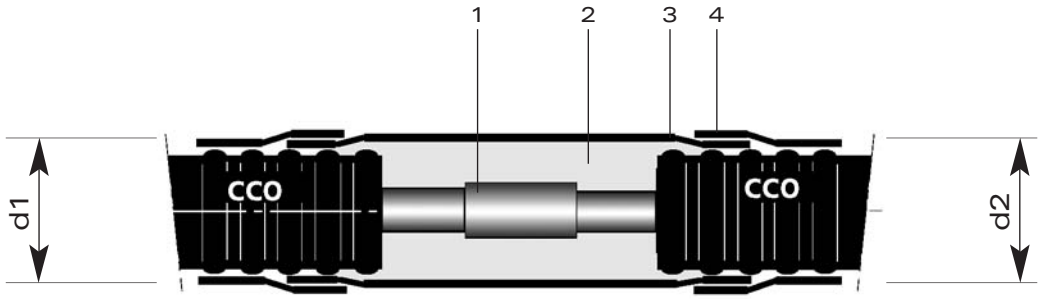
Connecting socket
Tee Branch insulation kit

CCO
9.320
3.9.2003

Connecting socket

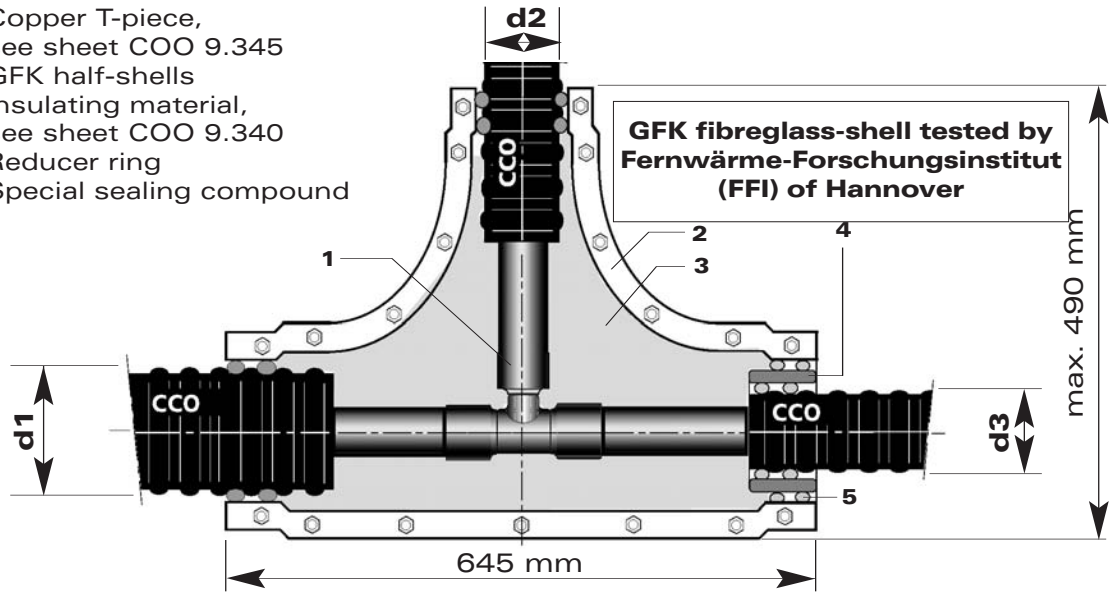


	d2	63	75	90
	63	x		
d1	75		x	
	90			x

1 Copper fitting, see sheet CCO 9.345
2 Insulation material, see sheet CCO 9.340
3 Shrinking socket
4 Shrinking hose

Tee Branch insulation kit

1 Copper T-piece, see sheet COO 9.345
2 GFK half-shells
3 Insulating material, see sheet COO 9.340
4 Reducer ring
5 Special sealing compound



Dimensions of GFK shell

Ø external d1 d3	Junction, d2 63	75	90
63 - 63	x	x	x
63 - 76	x	x	x
63 - 91	x	x	x
76 - 63	x	x	x
76 - 76	x	x	x
76 - 91	x	x	x
91 - 63	x	x	x
91 - 76	x	x	x
91 - 91	x	x	x

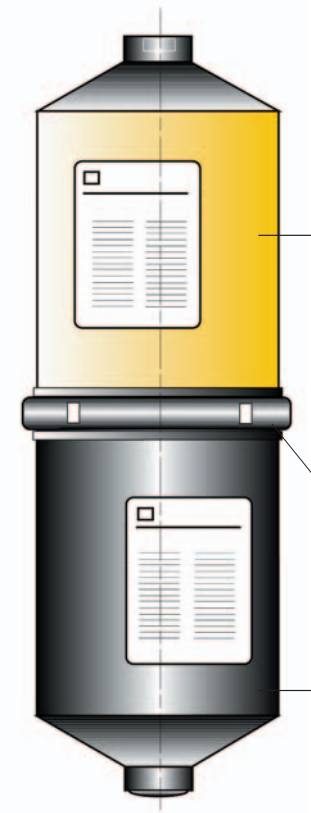
T-piece sets and sockets

PUR - foam bottle

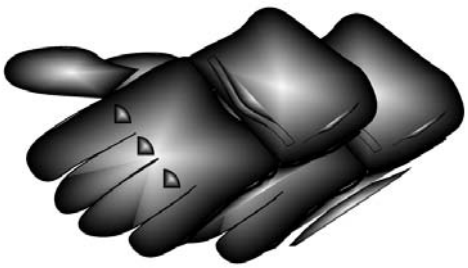
The required volume of polyurethane is supplied in the appropriate container size for the various sleeves or T-pieces. For fitting, the mixing rod supplied with the container is pushed through the container and the components are mixed together with a hand drill.

PUR - foam bottle

Base: CO2 -blown,
CFC-free PUR-foam



Security requirement for the foam insulation



plastic gloves

eye protection

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CALCOPPER

Soldering instructions Soldered fittings

CCO
9.345
3.9.2003

Copper fittings

Brugg Pipe Systems recommends fittings from the Georg Fischer company (+GF+).
All joints and T-pieces, etc. can be obtained in all dimensions from 18 to 35 mm.

Brazing instructions

The special BRUGG brazing must be used to solder the fittings.

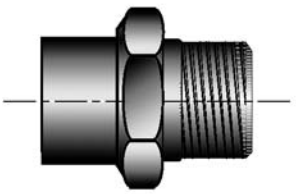
Joint, equal

Art-No. 7270 +GF+

Joint, reduced

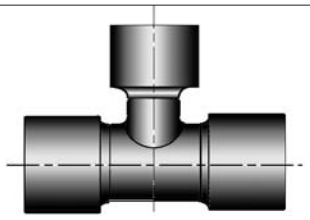
Art-No. 7240 +GF+

Connection with external thread



Art-No. 7271 +GF+

T-connection piece, equal, reduced

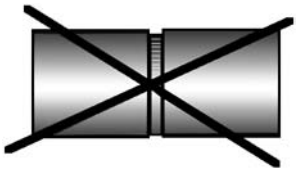


Art-No. 7130 +GF+

Brazing (high argentiferous)

Type	BRL 8.50.34					
Euro standardisation	pr EN 1044					
ISO 3677	B Cu Ag Zn Sn 630-730					
Composition Guideline analysis (%)	Ag 34	Zn 27	Sn 3	Si 0.1-02		Cu 36
Application	Capillary brazing joints brazing for steels, copper and copper alloys, nickel and nickel alloys. For brazing points with operating temperatures up to 200 °C. Suitable for Cu pipe installation to DVGW working sheet GW 2.					
Flux	Rods thinly covered with flux					
Technical information	Working temperature Melting range Tensile strength Specific gravity Elongation Electrical conductivity				710 °C 630-730 °C St 37 360 N/mm² St 50 480 N/mm² 9.0 g/cm³ > 12% 14 Sm/mm²	
Heat sources	Acetylene/oxygen mixture The oxy-fuel gas flame must be set to neutral.					

Caution!
Copper fittings with notches are available in the trade; under no circumstances must these be used!



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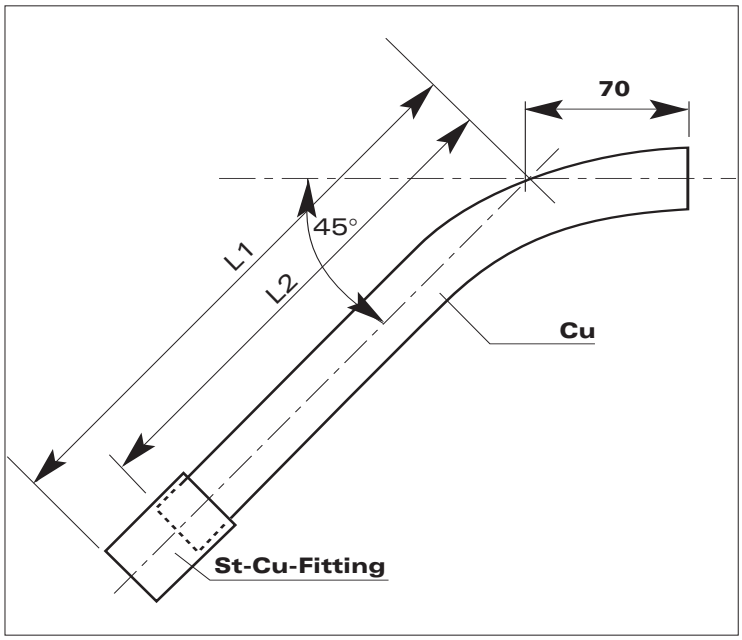
CALCOPPER

Connection of copper heating pipe to KMR

CCO
9.355
3.9.2003

St-Cu-Fitting



The branche line of the Copper Heating pipe to KMR (plastic sheath pipe) would be connected using prefactored St-Cu-fitting. The fitting would be welded on his steel end and would be connected with copper fitting on his copper end.

Connecting joint Outer ø in mm St x Cu	L 1 mm	L 2 mm
17.2 x 15	215	185
26.9 x 18	215	185
26.9 x 22	215	185
33.7 x 28	215	185
42.4 x 35	225	145

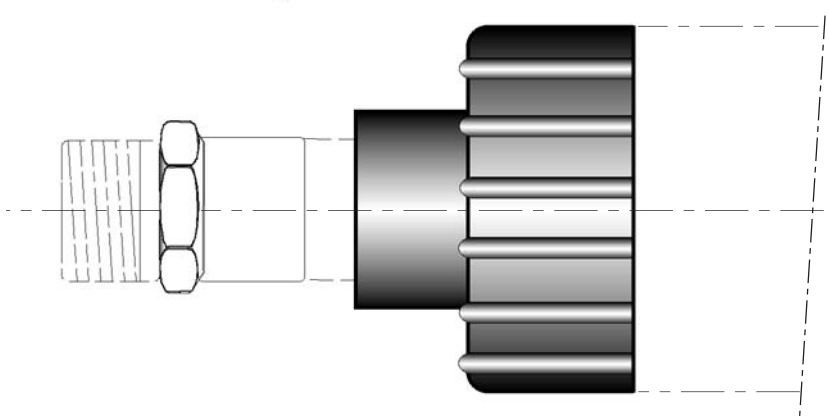
Flex-T-Socket

The branche line would be insulated by the shrinking socket, double internal and external sealed

KMR-Pipe Outer ø / Branche line Outer ø mm	90 mm	110 - 140 mm	160 - 200 mm	225 - 250 mm	280 - 315 mm
63	x	x	x	x	x
76	x	x	x	x	x
91	x	x	x	x	x

End cap

Shrinkdown end cap



The cap is shrunk onto the pipe end with a gas flame or hairdryer. Suitable for moist rooms and introduction into shafts.

Data table

Copper heating pipe	
Typ CCO	Shrinkdown end cap
15/63	DHEC 2000
15/76	DHEC 2000
18/63	DHEC 2000
18/76	DHEC 2000
22/63	DHEC 2000
22/76	DHEC 2000
28/76	DHEC 2000
35/91	DHEC 2100
15+15/91	DHEC 3200
18+18/91	DHEC 3200
22+15/91	DHEC 3250
22+22/91	DHEC 3250 P604
28+15/91	DHEC 3250
28+22/91	DHEC 3250 P604

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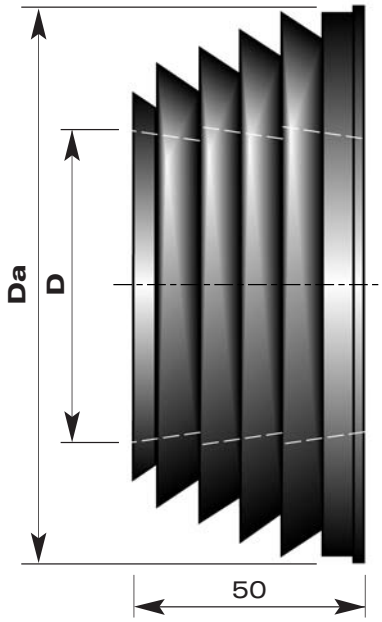
Wall sealing ring
Pipe warning tape

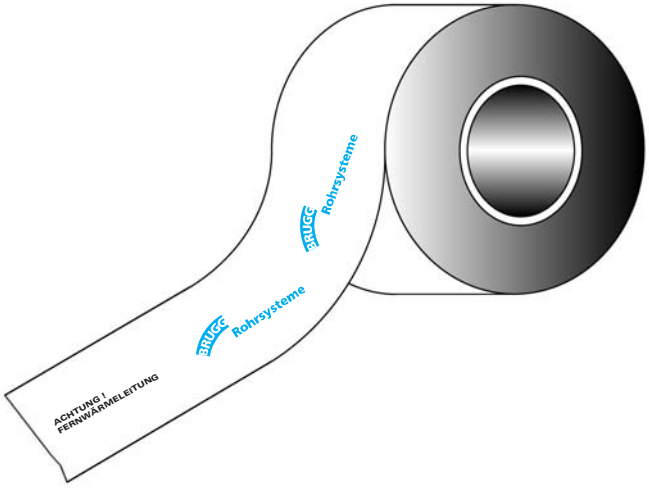
CCO
9.370
3.9.2003

Wall sealing ring



Copper heating pipe		
Type CCO	Wall sealing ring Outer pipe casing D	Da
15/63	765	102
15/76	78	118
18/63	65	102
18/76	78	118
22/63	65	102
22/76	78	118
28/76	78	118
35/91	93	133
15+15/91	93	133
18+18/91	93	133
22+15/91	93	133
22+22/91	93	133
28+15/91	93	133
28+22/91	93	133

Pipe warning tape



To be laid in the ground

Standard roll length:
250 m

Laying depth:
see sheet CCO 9.500

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CALCOPPER

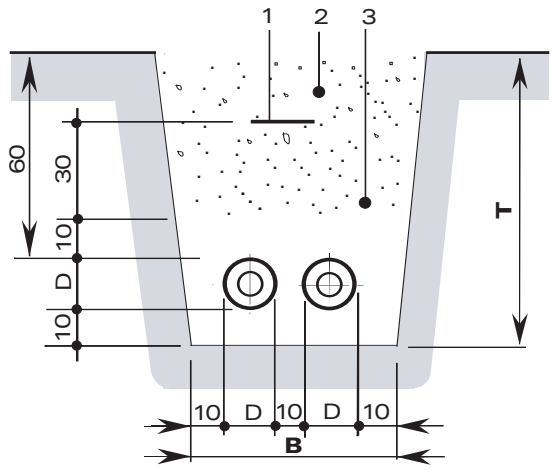
Trench dimensions

CCO
9.500
3.9.2003

Trench profile, 2 copper local heating pipes

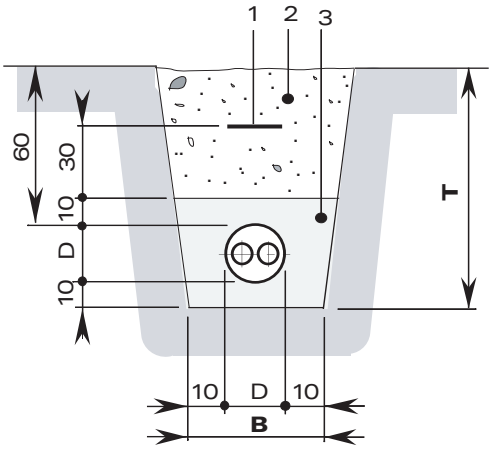
all dimensions in cm

UNO
Normal trench cross-section in road area



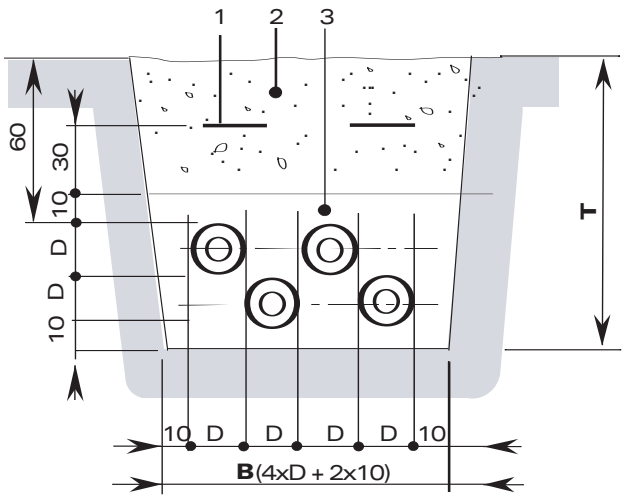
Pipe casing Ø D cm	Width B cm	Depth T cm	Minimum radius of curvature, m
63	43	77	0.7
76	45	78	0.7
91	48	79	0.8

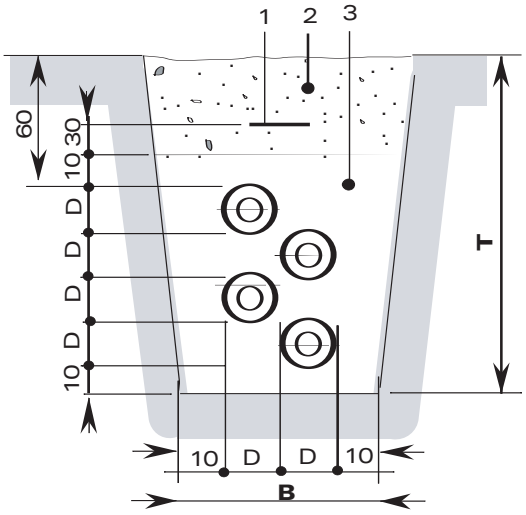
DUO



Pipe casing Ø D cm	Width B cm	Depth T cm	Minimum radius of curvature, m
91	30	80	0.8

Trench profile, 4 copper local heating pipes (loop-in method)





1 Pipe warning tape
2 Excavated material
3 Washed sand, grain size 0-3/4 mm

Laying depth:
maximum laying depth: 2.6 m
Our approval is required before laying at greater depths.

SLW 30 = 300 kN total load to DIN 1072; for exposure to higher operating loads (such as SLW 60), a load-distributing superstructure to RStO75 is required.

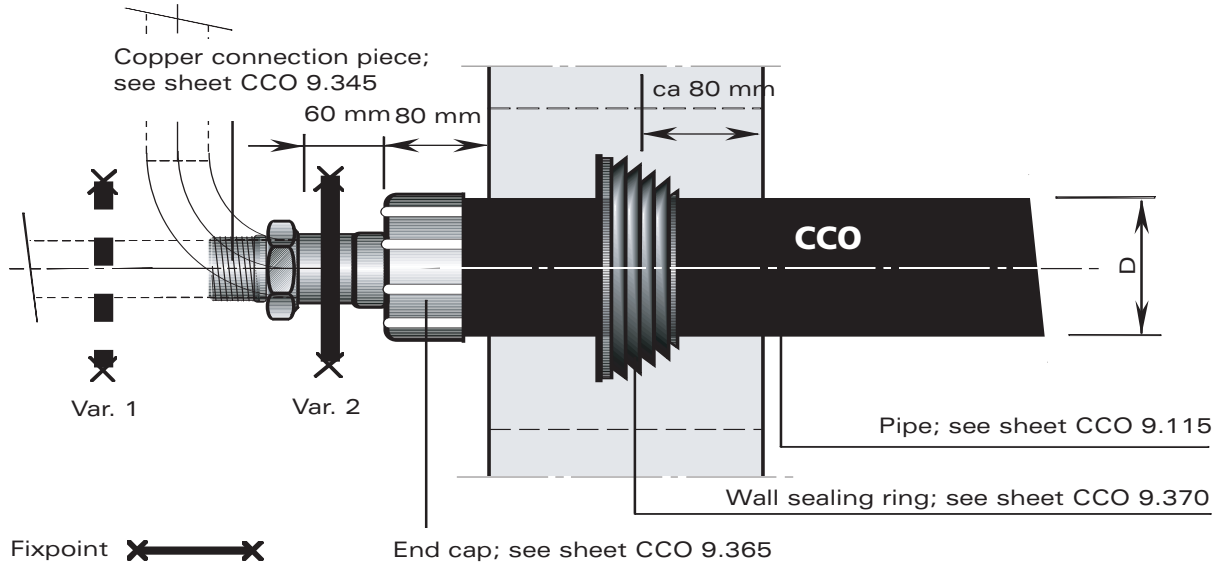
With no traffic load, the minimum trench depth T can be reduced by 20 cm.

When digging the pipe trench, make sure that the pipes lie in a sand bed (grain size: 0-8 mm) of at least 10 cm, and that there is coverage of the same thickness above.

Entry into buildings

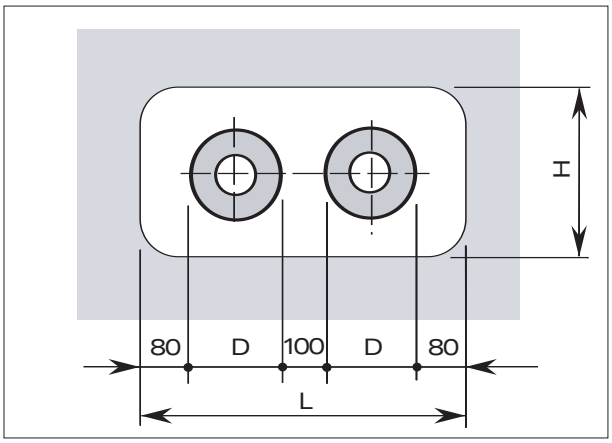
Entry into buildings

Wall openings



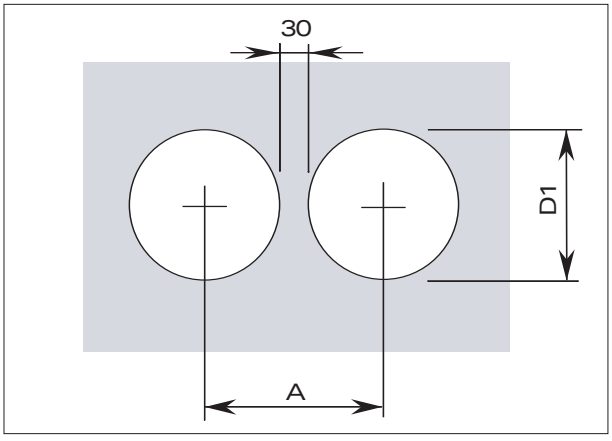
Due to the expansion of the CALCOPPER piping fixpoints must be installed

Wall opening



Outer casing Ø D mm	L min mm	H mm
63	400	250
76	450	250
91	500	250

Breakthrough bored



Outer casing Ø D mm	D1 min mm	A mm
63	160	190
76	180	210
91	200	230