

# Table of Contents

## 2.0 Table of Contents

### 2.1 System description

- 2.100 System description (general)
- 2.105 System description (data)
- 2.115 COOLFLEX range, SDR 11 (coils)

### 2.2 Planning, design engineering

- 2.200 Pressure loss chart for water, SDR 11
- 2.201 Pressure loss chart for ethylene glycol, SDR 11
- 2.210 Heat losses

### 2.3 Components

- 2.300 House entry bend, 90°
- 2.315 COOLFLEX L-shell, dimension Ø 76 - 126 mm
- 2.316 COOLFLEX Big L-shell, dimension Ø 162 - 202 mm
- 2.320 Joint (PE-HD shrink sleeve), dimension Ø 76 - 202 mm
- 2.325 COOLFLEX I-shell, dimension Ø 76 - 126 mm
- 2.326 COOLFLEX Big I-shell, dimension Ø 162 - 202 mm
- 2.330 COOLFLEX T-shell, dimension Ø 76 - 126 mm
- 2.335 COOLFLEX Big T-shell, dimension Ø 162 - 202 mm
  
- 2.345 Insulation material
- 2.350 PE jointing methods, screwed connectors (Outer thread, weld end)
- 2.355 PE jointing methods, screwed connectors (Coupling: equal, elbow 90°)
- 2.359 PE jointing methods, fusion welded
- 2.360 PE jointing methods, alternative connections
  
- 2.365 End closure, shrink-type closure, end cap (LD-PE)
- 2.370 Wall sealing ring for wall openings
- 2.375 Building entry, wall opening
- 2.380 Building entry, core bores/cement pipe liners

### 2.5 Underground construction, installation

- 2.500 Pipe routing
- 2.505 Trench dimensions
- 2.510 Open installation

# System description

## 1. General

COOLFLEX is the registered trade name for a flexible pipe system.

This pipe system is especially suitable for use in local and district cooling networks, in industrial and with restrictions also for combined heat pump systems (cooling and heating).

The COOLFLEX district cooling pipe has a carrier pipe produced from high-density polyethylene (PE100) as per standard DIN EN 12201. The polyethylene pressure pipes are the standard for drinking water and waste water systems, and also for the gas supply sector. The pipes are joined by means of standard screwed connectors, mechanical pipe couplings, with normal commercial electrofusion fittings or by means of butt fusion welding technology.

The heat insulation consists of CFC-free polyurethane foam with excellent insulating properties. COOLFLEX district cooling pipe can be adapted to all pipe routing conditions without problems. It is possible to pass over or under existing supply pipes, and obstacles are easily bypassed. With the flexible COOLFLEX district cooling pipe, you can choose the shortest pipe route without considering the classical method of pipe construction.

The flexible COOLFLEX district cooling pipe is delivered to the site in continuous coils or on a drum. Generous delivery lengths enable pipes to be laid largely without underground connections. Pipe trench can be considerably narrower and this allows considerable savings on underground work.

Taking account of the very short time required for installation, COOLFLEX district cooling pipe is not only a technically perfect solution but also the key to saving time and expense when setting up district cooling networks, because less coordination is required on site and the pipes are laid simply and quickly.

## 2. Range of applications

Max. continuous operating temperature  $T_{Bmax}$ :  
-20 to +20 °C (+40°C\*)

Max. permitted operating pressure p:  
max. 16 bar

\*warm water application with limited life-time and operating pressure (as per DIN 8074)

# System description

## 1. Bonded system

Requirements	Factory insulated, flexible pipe systems according EN 17414-1/-2
Fire behaviour	Building material class B2 (normally flammable) according to DIN 4102

## 2. Carrier pipe

Materials	Polyethylene class PE100 with high density, in accordance with DIN EN 12201/DIN 8074/DIN 8075
Life expectancy	50 years at 20 °C (16 bar) or 40 °C (11.6 bar) in accordance with DIN 8074 (SF 1.25)
Properties	Suitable as a district cooling, cold water and hot water pipe

PE carrier pipe	Reference temperature °C	Value	Test standard
Density	–	952 - 960 kg/m <sup>3</sup>	DIN 53479
Thermal conductivity	40 °C	0.40 W/mK	DIN 52612
Tensile strength	20 °C	32 N/mm <sup>2</sup>	DIN 53455
Modulus of elasticity	20 °C	1000 N/mm <sup>2</sup>	DIN 53457
Linear expansion coefficient	20 °C	1.8 · 10 <sup>-4</sup> 1/K	DIN 52328
Crystallite melting range	–	130 - 135 °C	–

## 3. Thermal insulation

Materials	CFC-free, 100 % CO <sub>2</sub> -blown polyurethane foam (PUR)
-----------	----------------------------------------------------------------

PUR-Dämmung	Reference temperature °C	Value	Test standard
Density	–	> 60 kg/m <sup>3</sup>	ISO 845
Thermal conductivity	30 °C	≤ 0.0234 W/mK	EN 253 und ISO 8497
Percentage of closed cells	–	≥ 90 %	–
Water absorption after 24 hours	–	≤ 10 %	EN 253

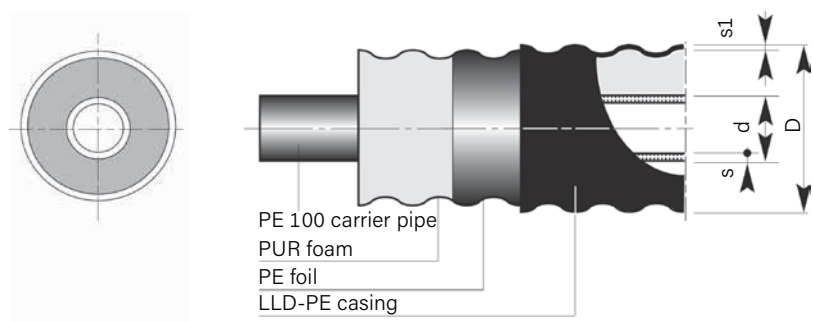
## 4. Protective casing

Materials	linear polyethylene, low density (LLD-PE), seamlessly extruded
Purpose	mechanical protection and moisture resistance

LLD-PE-Schutzmantel	Reference temperature °C	Value	Test standard
Density	–	918 - 922 kg/m <sup>3</sup>	ISO 1183
Thermal conductivity	–	0.33 W/mK	DIN 52612
Percentage of closed cells	–	122 °C	ISO 11357-3

# COOLFLEX range

Dimensions SDR 11 (coils)



## Dimensions SDR 11

Type	PE inner pipe		Outer casing D x s1 mm	Minimum Bending radius m	Volume Inner pipe l/m	Weight kg/m	Maximum delivery lengths*	
	d x s mm						Jumbo coil m	Maxi coil m
25/ 76	25 x 2.3		78 x 2.0	0.7	0.327	0.90	520	780
32/ 76	32 x 2.9		78 x 2.0	0.7	0.539	1.00	520	780
40/ 91	40 x 3.7		93 x 2.2	0.8	0.835	1.39	370	570
50/ 91	50 x 4.6		93 x 2.2	0.8	1.307	1.54	370	570
63/126	63 x 5.8		128 x 2.7	1.0	2.091	2.60	192	291
75/126	75 x 6.8		128 x 2.7	1.0	2.961	2.75	192	291
90/162	90 x 8.2		163 x 3.2	1.2	4.254	4.56	92	149
110/162	110 x 10.0		163 x 3.2	1.2	6.362	5.69	92	149
125/182	125 x 11.4		183 x 3.3	1.4	8.200	6.37	52	86
140/202	140 x 12.7		202 x 3.3	1.4	10.310	8.40	46	80

\* Partial lengths can be delivered

- All dimensions are available in straight lengths on request.
- We will produce different dimensions or special items on request (> 500 m).
- Larger or smaller delivery lengths can be supplied on drums if requested.
- Coil dimensions:
 

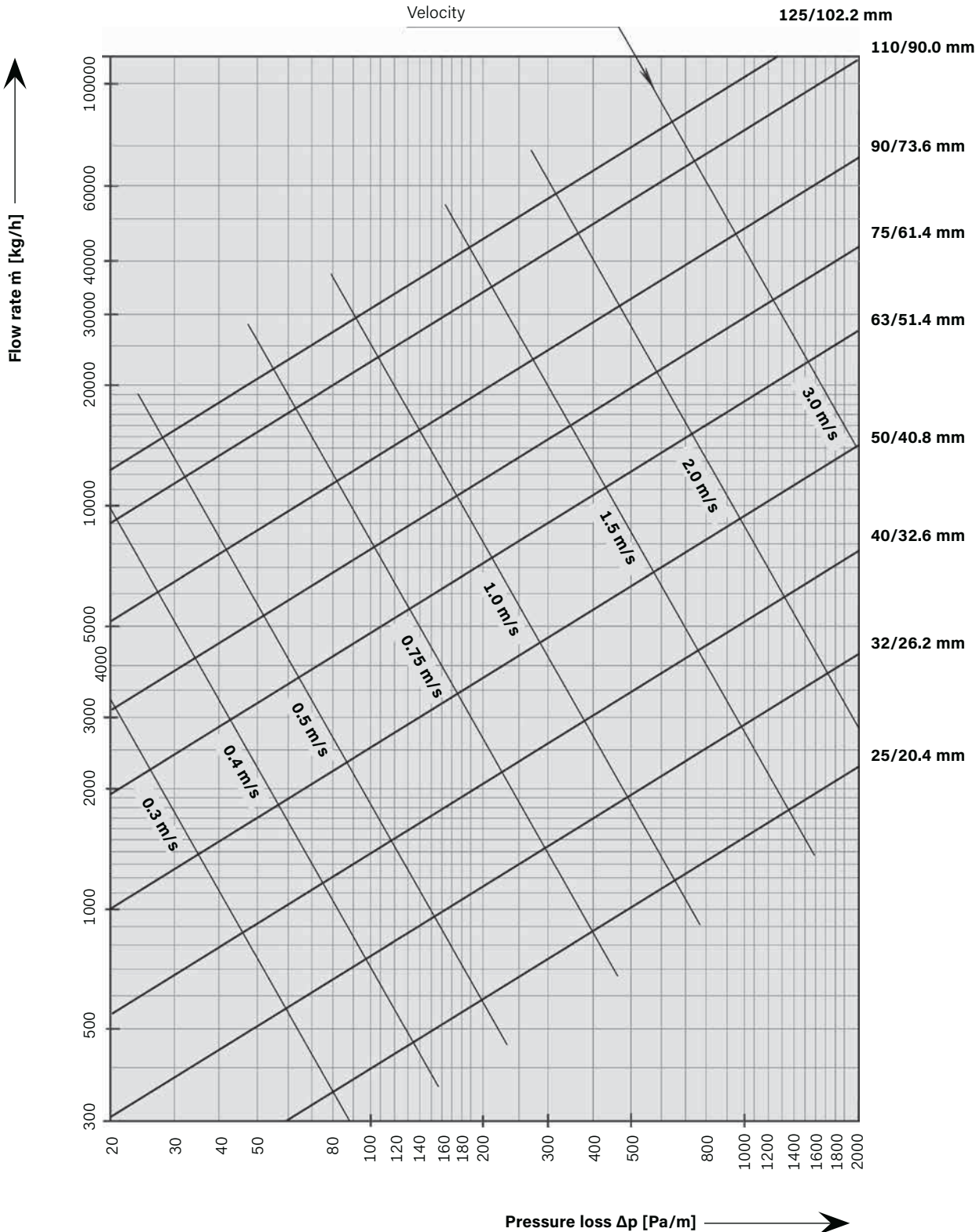
<b>Jumbo coil</b>	outer diameter 2800 mm x 800 mm (width)
<b>Maxi coil</b>	outer diameter 2800 mm x 1200 mm (width)

# Pressure loss chart for water

SDR 11

Water temperature 10 °C

Roughness  $\epsilon = 0.01$  mm (PE100)



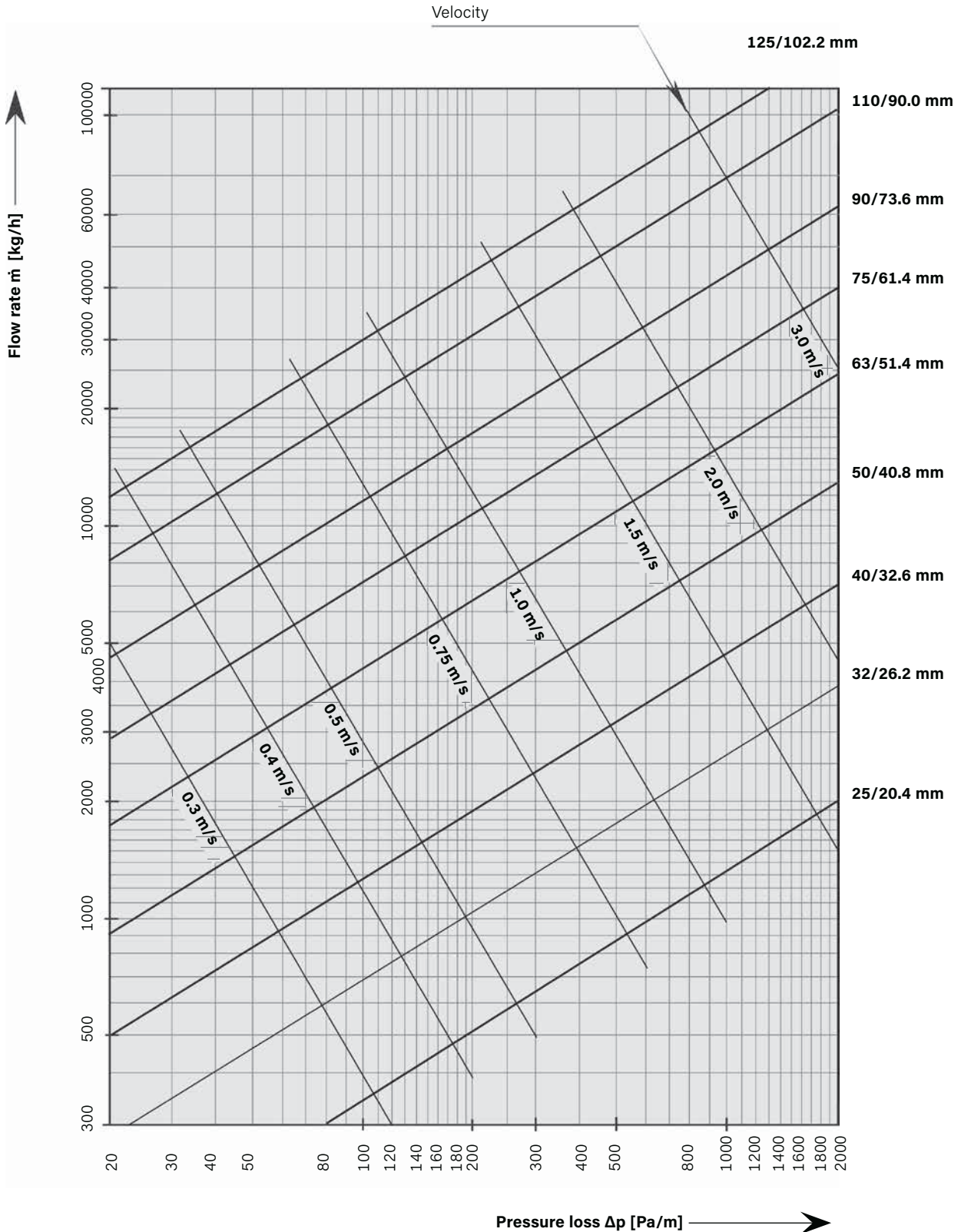
# Pressure loss chart for ethylene glycol concentration

SDR 11

Medium temperature 10 °C

Ethylene glycol 30 % concentration

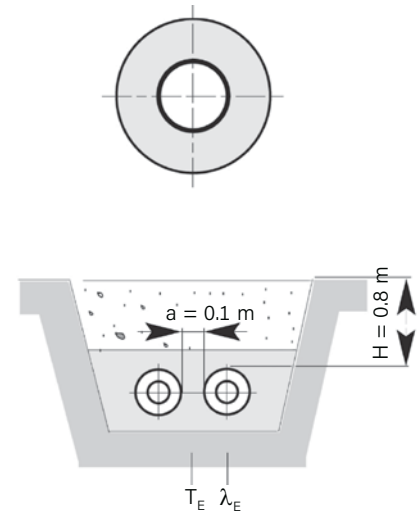
Roughness  $\epsilon = 0.01$  mm (PE100)



# Energy losses

Laid in the ground

Heat losses q [W/m]						
COOLFLEX	U-value [W/mK]	Average operating temperature T <sub>B</sub> [°C]				
		4°	8°	12°	16°	20°
25/ 76	0.1127	-0.68	-0.23	0.23	0.68	1.13
32/ 76	0.1392	-0.84	-0.28	0.28	0.84	1.39
40/ 91	0.1447	-0.87	-0.29	0.29	0.87	1.45
50/ 91	0.1857	-1.11	-0.37	0.37	1.11	1.86
63/126	0.1662	-1.00	-0.33	0.33	1.00	1.66
75/126	0.2076	-1.25	-0.42	0.42	1.25	2.08
90/162	0.1895	-1.14	-0.38	0.38	1.14	1.90
110/162	0.2557	-1.53	-0.51	0.51	1.53	2.56
125/182	0.2603	-1.56	-0.52	0.52	1.56	2.60
140/202	0.2642	-1.59	-0.53	0.53	1.59	2.64



Installation type CLX:	2-pipe, laid in the ground
Pipe distance:	a = 0.10 m
Cover above pipe:	H = 0.80 m
Ground temperature:	T <sub>E</sub> = 10°C
Soil conductivity:	λ <sub>E</sub> = 1.2 W/mK
Conductivity of PUR foam:	λ <sub>PU</sub> = 0.0234 W/mK
Conductivity of PE pipe:	λ <sub>PE</sub> = 0.40 W/mK
Conductivity of PE casing:	λ <sub>PE</sub> = 0.33 W/mK

### Heat loss during operation:

$$q = U (T_B - T_E) \text{ [W/m]}$$

U = Heat transfer coefficient [W/mK]

T<sub>B</sub> = Average operating temperature [°C]

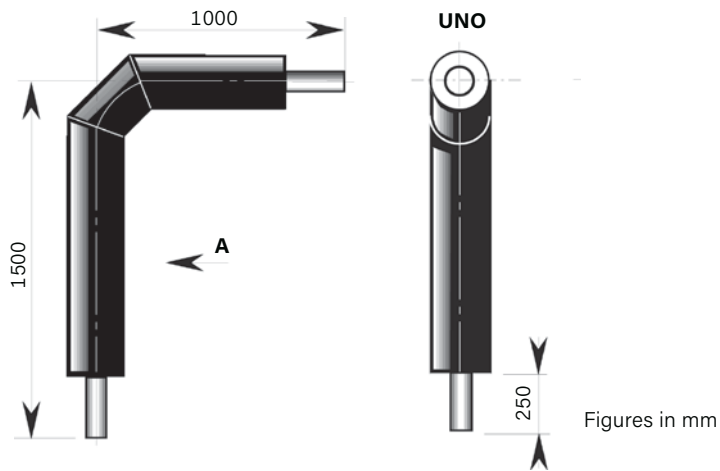
T<sub>E</sub> = Average ground temperature [°C]

VL= Flow

RL= Return

**On request, we shall be glad to calculate the heat losses for surface mounted pipe systems.**

# Bend, 90°

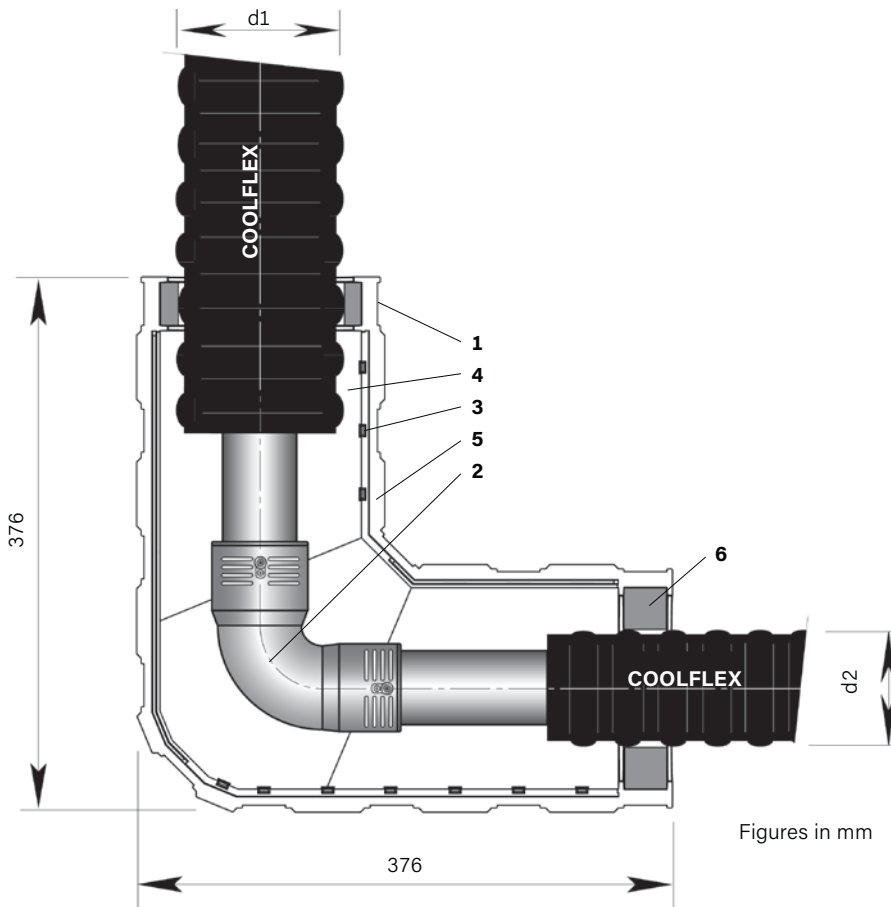


Type	PE inner pipe d x s mm	Outer pipe D x s1 mm	Volume Inner pipe l/m
25/ 76	25 x 2.3	75 x 4.5	0.327
32/ 76	32 x 2.9	75 x 4.5	0.539
40/ 91	40 x 3.7	90 x 3.5	0.835
50/ 91	50 x 4.6	90 x 3.5	1.307
63/126	63 x 5.8	125 x 4.8	2.091
75/126	75 x 6.8	125 x 4.8	2.961
90/162	90 x 8.2	160 x 4.9	4.254
110/162	110 x 10.0	160 x 4.9	6.362
140/202	140 x 12.7	202 x 4.9	10.310



# COOLFLEX L-shell

Ø 76 - 126 mm



Figures in mm

## COOLFLEX L-shell

Outer casing Ø d1	Ø d2		
	76	91	126
76	x		
91		x	
126			x

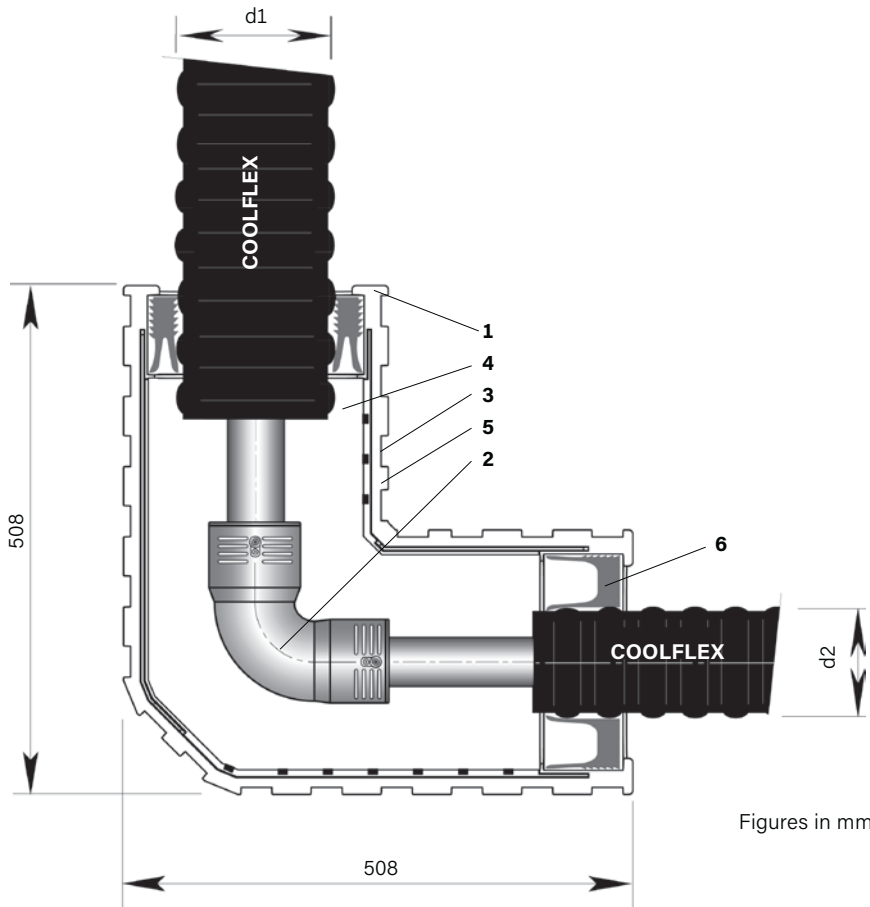
PE jointing methods; see CLX 2.350 - 2.360

## Structure of the half-shell

- 1 ABS half-shells
- 2 PE fusion welded joints; see CLX 2.359
- 3 Sealing clamps (14 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# COOLFLEX Big L-shell

Ø 162 - 202 mm



Figures in mm

## COOLFLEX Big L-shell

Outer casing Ø d1	Ø d2					
	76	91	126	162	182	202
76						
91						
126						
162				x		
182					x	
202						x

COOLFLEX Big-shells are freely reducible from Ø 202 mm to Ø 76 mm  
PE jointing methods; see CLX 2.350 - 2.360

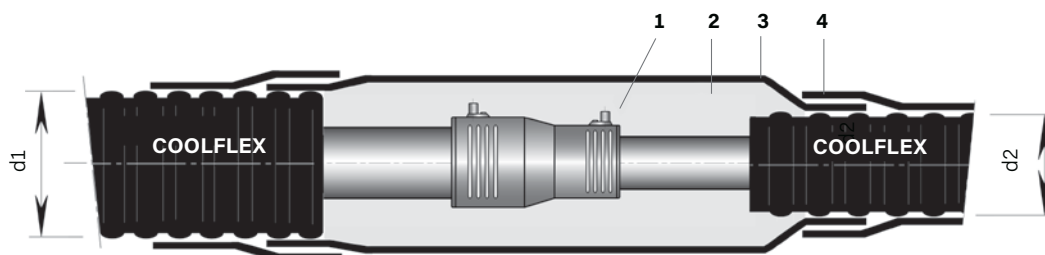
## Structure of the half-shell

- 1 ABS half-shells
- 2 PE fusion welded joints; see CLX 2.359
- 3 Sealing clamps (24 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# Joint using PE-HD shrink sleeve

Dimensions Ø 76 - 202 mm

## COOLFLEX joints and reduction joints



- 1 PE fusion welded joints; see CLX 2.359
- 2 Insulation material, PUR or PE; see CLX 2.345
- 3 Shrink sleeve pipe
- 4 Shrink hose

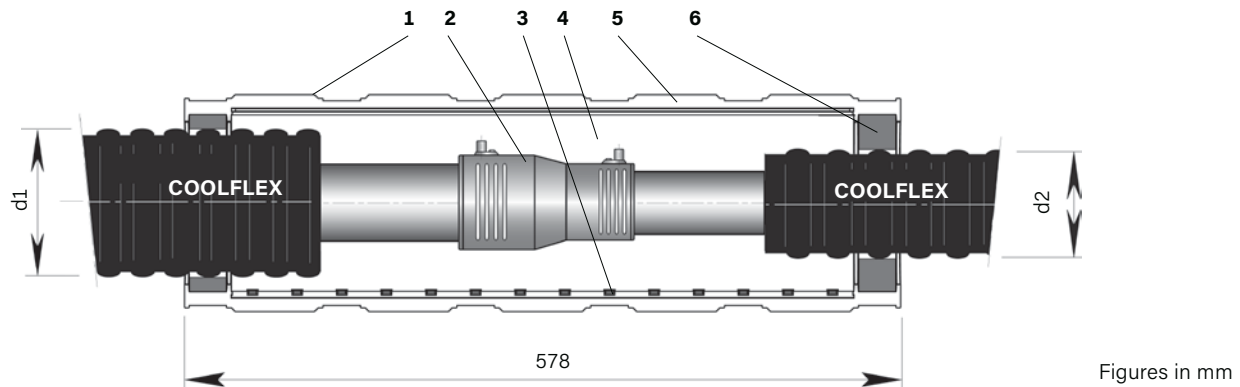
### COOLFLEX - COOLFLEX

Ø d2	76	91	126	162	182	202
Ø d1	76	x				
	91	x	x			
	126	x	x	x		
	162			x	x	
	182			x	x	x
	202				x	x

PE jointing methods; see CLX 2.350 - 2.360

# COOLFLEX I-shell

Ø 76 - 126 mm



Figures in mm

## COOLFLEX I-shell

Outer casing Ø d1	Ø d2		
	76	91	126
76	x		
91	x	x	
126	x	x	x

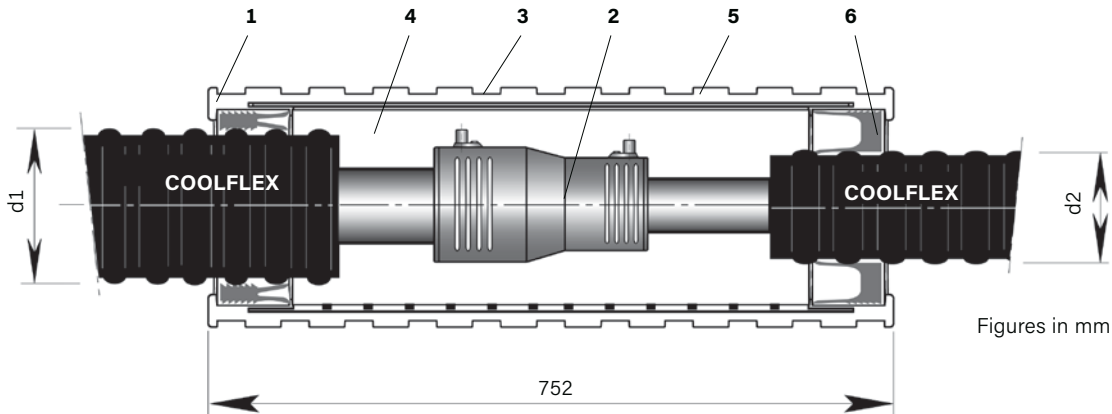
PE jointing methods; see CLX 2.350 - 2.360

## Structure of the half-shell

- 1 ABS half-shells
- 2 PE fusion welded joints; see CLX 2.359
- 3 Sealing clamps (12 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# COOLFLEX Big I-shell

Ø 162 - 202 mm



## COOLFLEX Big I-shell

Outer casing Ø d1	Ø d2					
	76	91	126	162	182	202
76						
91						
126						
162			x	x		
182				x	x	
202				x	x	x

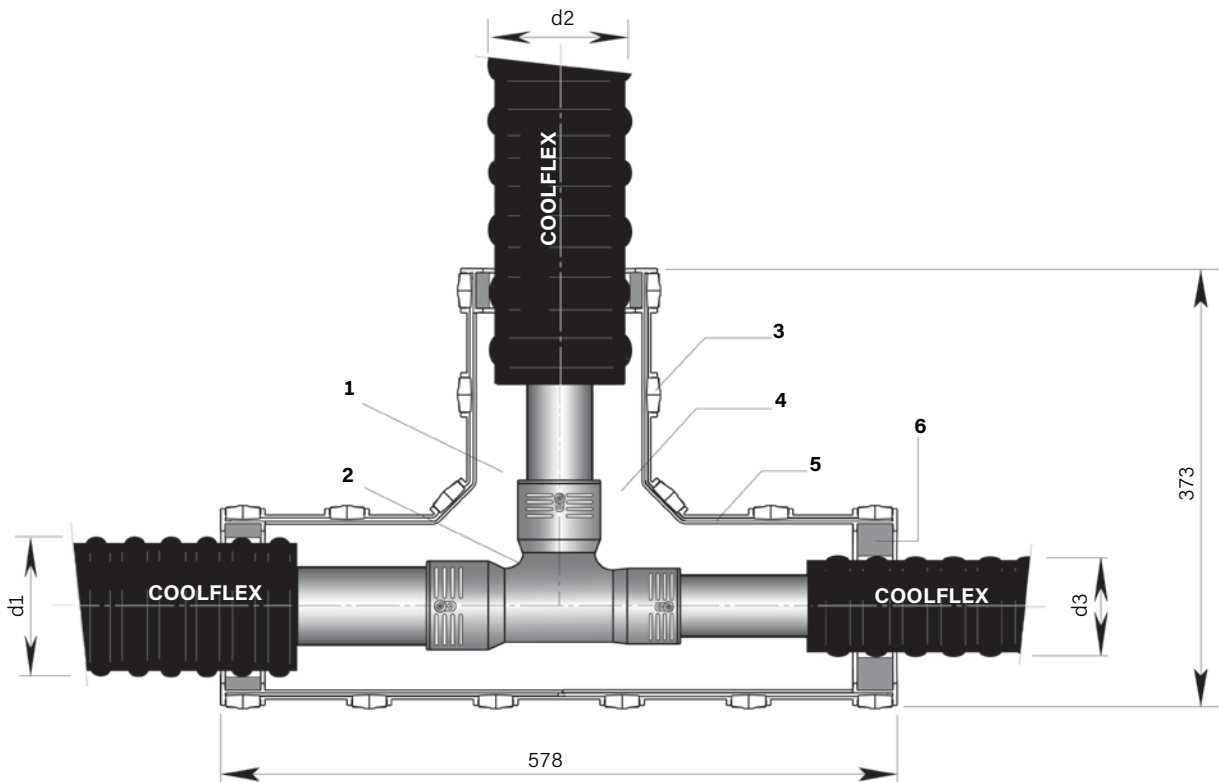
COOLFLEX Big-shells are freely reducible from Ø 202 mm to Ø 76 mm  
PE jointing methods; see CLX 2.350 - 2.360

## Structure of the half-shell

- 1 ABS half-shells
- 2 PE fusion welded joints; see CLX 2.359
- 3 Sealing clamps (22 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# COOLFLEX T-shell

Ø 76 - 126 mm



Figures in mm

## COOLFLEX T-shell

Outer pipe Ø d1 - Ø d3	Branch, Ø d2		
	76	91	126
76 - 76	x	x	x
91 - 91	x	x	x
91 - 76	x	x	x
126 - 126	x	x	x
126 - 91	x	x	x
126 - 76	x	x	x

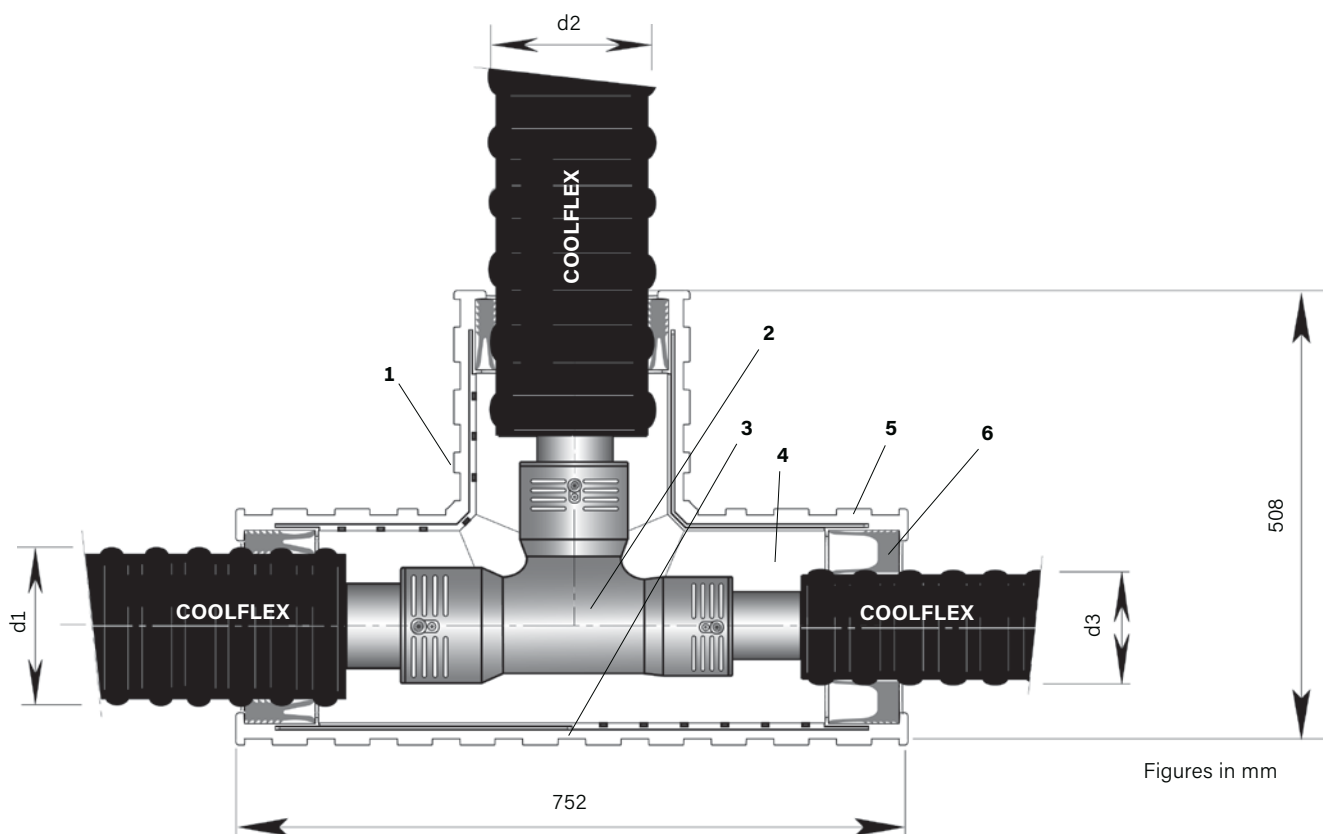
PE jointing methods; see CLX 2.350 - 2.360

## Structure of the half-shell

- 1 ABS half-shells
- 2 PE T-piece; see CLX 2.359
- 3 Sealing clamps (16 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# COOLFLEX Big T-shell

Ø 162 - 202 mm



Figures in mm

## COOLFLEX Big T-shell

Outer pipe Ø d1 - Ø d3	Branch, Ø d2					
	76	91	126	162	182	202
162 - 162	x	x	x	x	x	x
162 - 126	x	x	x	x	x	x
162 - 91	x	x	x	x	x	x
162 - 76	x	x	x	x	x	
182 - 182	x	x	x	x	x	x
182 - 162	x	x	x	x	x	x
182 - 126	x	x	x	x	x	x
182 - 91	x	x	x	x	x	x
182 - 76	x	x	x	x	x	x
202 - 202	x	x	x	x	x	x
202 - 182	x	x	x	x	x	x
202 - 162	x	x	x	x	x	x
202 - 126	x	x	x	x	x	x
202 - 91	x	x	x	x	x	x
202 - 76	x	x	x	x	x	x

PE jointing methods; see CLX 2.350 - 2.360

## Structure of the half-shell

- 1 ABS half-shells
- 2 PE T-piece; see CLX 2.359
- 3 Sealing clamps (27 pcs.)
- 4 Insulation material; see CLX 2.345
- 5 Glued surface
- 6 Reducer ring or sealing ring

# Insulation material

DN 20 - DN 125

## Insulation material for shrink joints and shell systems

### PUR foam containers

CFC-free, cyclopentane-blown PUR foam in plastic bottles

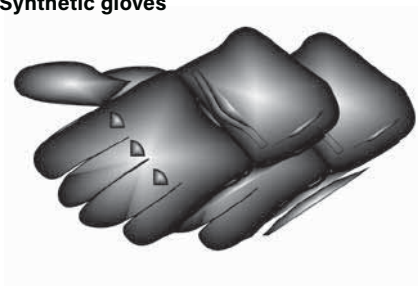
The required quantity of polyurethane foam is delivered in suitable container sizes for the various joints and T-pieces. The components are supplied separately in two bottles, and are only mixed together when needed. Please note the safety regulations in the installation instructions supplied with the product.



### Safety regulations

Protective goggles and gloves must be worn during the foaming process.

### Synthetic gloves



### Protective goggles





# Screwed connectors

Outer thread, weld end

## Connection with external thread



### COOLFLEX (Cooling, 16 bar at 20° C)

Material: brass

PE-pipe mm	Screwed connector mm	L/L1 mm
25 x 2.3	25 x 2.3-3/4"	61/26
32 x 2.9	32 x 2.9-1"	68/29
40 x 3.7	40 x 3.7-1 1/4"	77/36
50 x 4.6	50 x 4.6-1 1/2"	79/36
63 x 5.7	63 x 5.7-2"	97/46
75 x 6.8	75 x 6.8-2 1/2"	107/53
90 x 8.2	90 x 8.2-3"	119/58
110 x 10.0	110 x 10.0-4"	135/70
125 x 11.4	125 x 11.4-5"	144/69
140 x 12.7	140 x 12.7-4"	145/70

## Connection with weld end



### COOLFLEX (Cooling, 16 bar at 20° C)

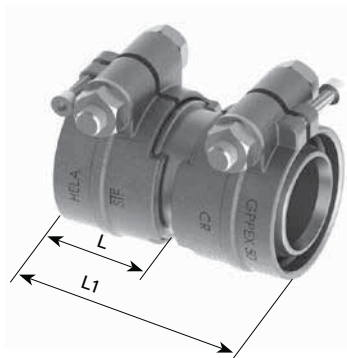
Material: steel

PE-pipe mm	Weld end mm	L/L1 mm
25 x 2.3	26.9 x 2.3	61/26
32 x 2.9	33.7 x 2.6	63/29
40 x 3.7	42.4 x 2.6	75/36
50 x 4.6	48.3 x 2.6	84/36
63 x 5.7	60.3 x 2.9	88/46
75 x 6.8	76.1 x 2.9	101/53
90 x 8.2	88.9 x 3.2	108/58
110 x 10.0	114.3 x 3.6	114/70
125 x 11.4	114.3 x 3.6	120/69
140 x 12.7	139.7 x 3.6	120/75

# Screwed connector

Coupling: equal, elbow 90°

## Coupling, equal



### COOLFLEX (Cooling, 16 bar at 20° C)

Material: brass

PEX pipe mm	Coupling mm	L/L1 mm
25 x 2.3	25 x 2.3	68/26
32 x 2.9	32 x 2.9	75/29
40 x 3.7	40 x 3.7	90/36
50 x 4.6	50 x 4.6	90/36
63 x 5.7	63 x 5.7	110/46
75 x 6.8	75 x 6.8	128/52
90 x 8.2	90 x 8.2	144/58
110 x 10.0	110 x 10.0	168/70
125 x 11.4	125 x 11.4	167/69
140 x 12.7	140 x 12.7	-
160 x 14.6	160 x 14.6	168/70

On request reduced couplings (soldered) are available

## Elbow 90°



### COOLFLEX (Cooling, 16 bar at 20° C)

Material: brass soldered

PEX pipe mm	on PEX pipe mm
25 x 2.3	25 x 2.3
32 x 2.9	32 x 2.9
40 x 3.7	40 x 3.7
50 x 4.6	50 x 4.6
63 x 5.7	63 x 5.7
75 x 6.8	75 x 6.8
90 x 8.2	90 x 8.2
110 x 10.0	110 x 10.0
125 x 11.4	125 x 11.4
140 x 12.7	140 x 12.7

# Electrofusion fittings

Dimension Ø 25 - 140 mm

## T-piece equal



<b>COOLFLEX</b>	
<b>(Cooling, 16 bar at 20° C)</b>	
Material: cross-linked polyethylene	
<b>PE-pipe</b>	
<b>mm</b>	
25	
32	
40	
50	
63	
75	
90	
110	
125	
140	

## Angle piece, 90°



<b>COOLFLEX</b>	
<b>(Cooling, 16 bar at 20° C)</b>	
Material: cross-linked polyethylene	
<b>PE-pipe</b>	<b>PE-pipe</b>
<b>mm</b>	<b>mm</b>
25	25
32	32
40	40
50	50
63	63
75	75



## T-piece equal (without welding socket)



<b>COOLFLEX</b>	
<b>(Cooling, 16 bar at 20° C)</b>	
Material: cross-linked polyethylene	
<b>PE-pipe</b>	
<b>mm</b>	
25	
32	
40	
50	
63	
75	
90	
110	
125	
140	

## Angle piece, 90° (without welding socket)



<b>COOLFLEX</b>	
<b>(Cooling, 16 bar at 20° C)</b>	
Material: cross-linked polyethylene	
<b>PE-pipe</b>	<b>PE-pipe</b>
<b>mm</b>	<b>mm</b>
90	90
110	110
125	125
140	140

## Sleeves



<b>COOLFLEX</b>	
<b>(Cooling, 16 bar at 20° C)</b>	
Material: cross-linked polyethylene	
<b>PE-pipe</b>	<b>PE-pipe</b>
<b>mm</b>	<b>mm</b>
25	25
32	32
40	40
50	50
63	63
75	75
90	90
110	110
125	125
140	140



(Source: Georg Fischer Rohrleitungssysteme AG)

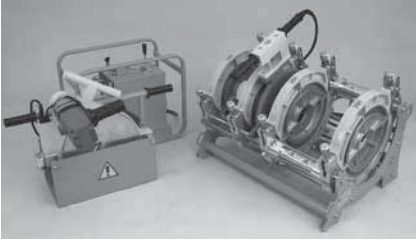
The electrofusion couplers for PE connections must only be installed by trained personnel using suitable welding equipment.

All connection techniques listed on this sheet are available on request.

# PE jointing methods

Alternative connections

## Butt fusion



(Source: PF-Schweisstechnologie GmbH)

## Mechanical pipe couplings



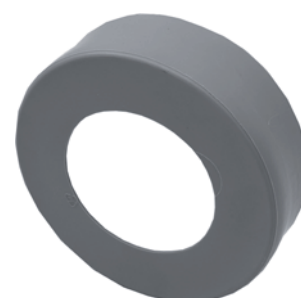
### To join:

plastic to plastic, or  
plastic to metal pipes  
Ø 40 - 250 mm

(Source: Straub Werke AG)

**All jointing methods listed on this sheet are available on request.**

# End caps

**Shrink end cap UNO****EPDM end cap UNO****LD-PE end cap UNO****COOLFLEX****Type**

25/ 76

32/ 76

40/ 91

50/ 91

63/126

75/126

90/162

110/162

125/182

140/202

LD-PE end caps are pushed on and are suitable for dry rooms.

EPDM end caps offer optimum protection against splash water, moisture and vermin.

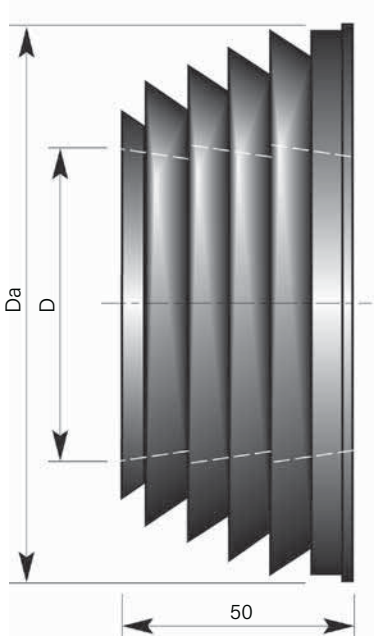
With precise markings for cutting off the collars. Can be fitted without special tools.

If a pre-insulated pipe ends in the ground, stainless steel clamping straps must be used on site.

# Wall sealing ring

for wall openings

## Wall sealing ring

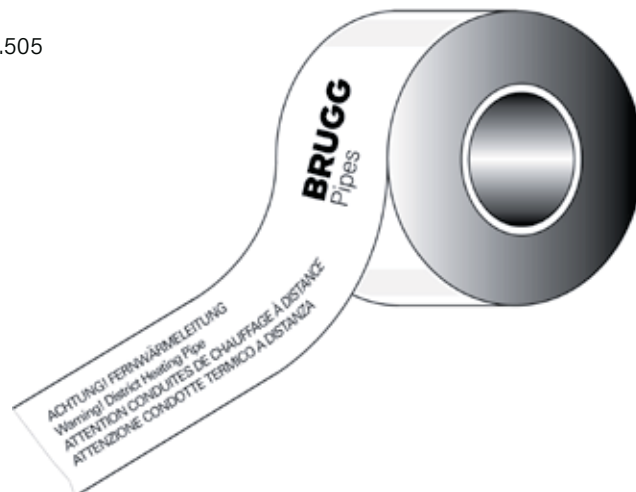


### COOLFLEX

Type CLX	Da
25/ 76	118
32/ 76	118
40/ 91	133
50/ 91	133
63/126	168
75/126	168
90/162	203
110/162	203
125/182	223
140/202	230

## Pipe warning tape

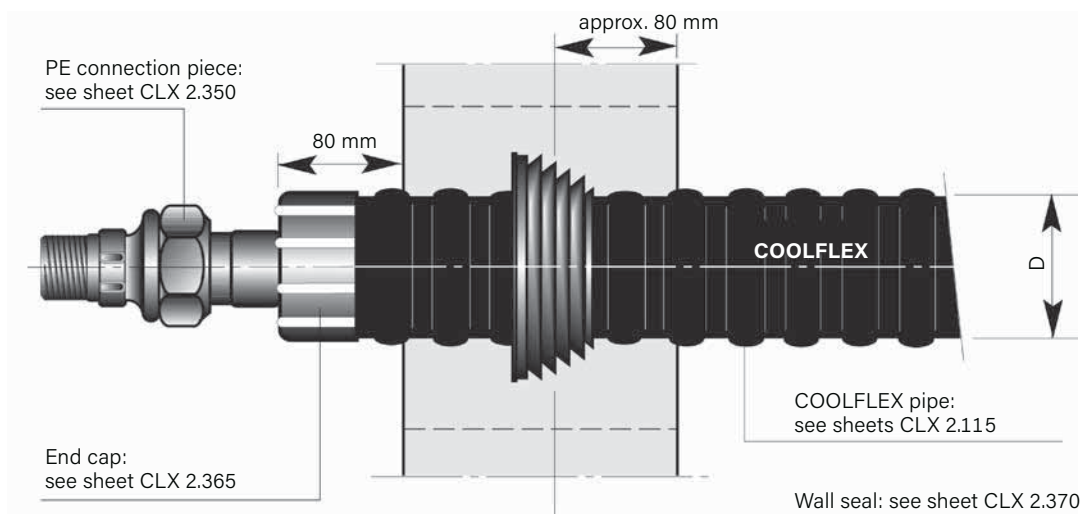
- To be laid in the ground
- Standard roll length: 250 m
- Installation depth: see sheet CLX 2.505



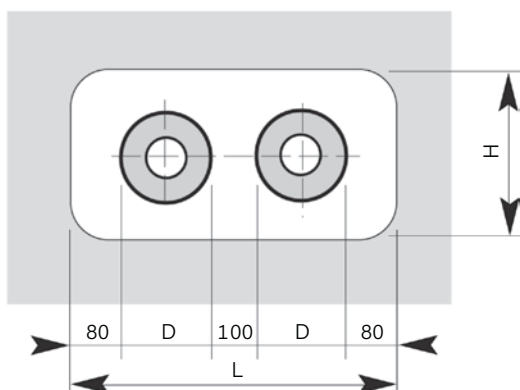
# Building entry

Wall opening

## Wall leadthrough



## Wall opening



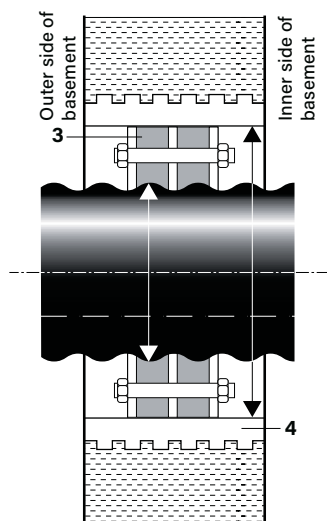
Figures in mm

Outer casing Ø D mm	L min mm	H min mm
78	450	250
93	500	250
113	500	300
128	550	300
143	600	350
163	650	350
183	670	380
202	720	400

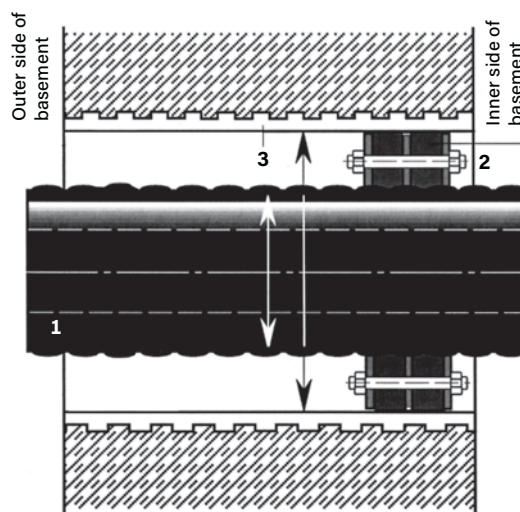
# Wall seal

Core bores/cement liner pipes

## Standard



## With additional centering ring



- 1 COOLFLEX district cooling pipe
- 2 Seal set, double-seal\* suitable for pressure from water up to 0.5 bar  
2 x 40 mm, Shore hardness D 35
- 3 Liner pipe: made of fibre cement or coated core bore

## Core bores

Perfect bores are required for installation. As hairline cracks may be present in the concrete or result from drilling, it is advisable to seal the entire length of the borehole with suitable sealant (such as AQUAGARD).

Tightness can only be guaranteed if this recommendation is followed.

Outer pipe Ø R mm	Liner pipe, core bore Ø D mm	Seal set Ø innen mm	Core bore Ø mm
76	150	78 - 85	150
91	150	86 - 94	150
111	200	105 - 115	200
126	200	125 - 135	200
142	200	137 - 145	200
162	250	157 - 165	250
182	250	180 - 190	250

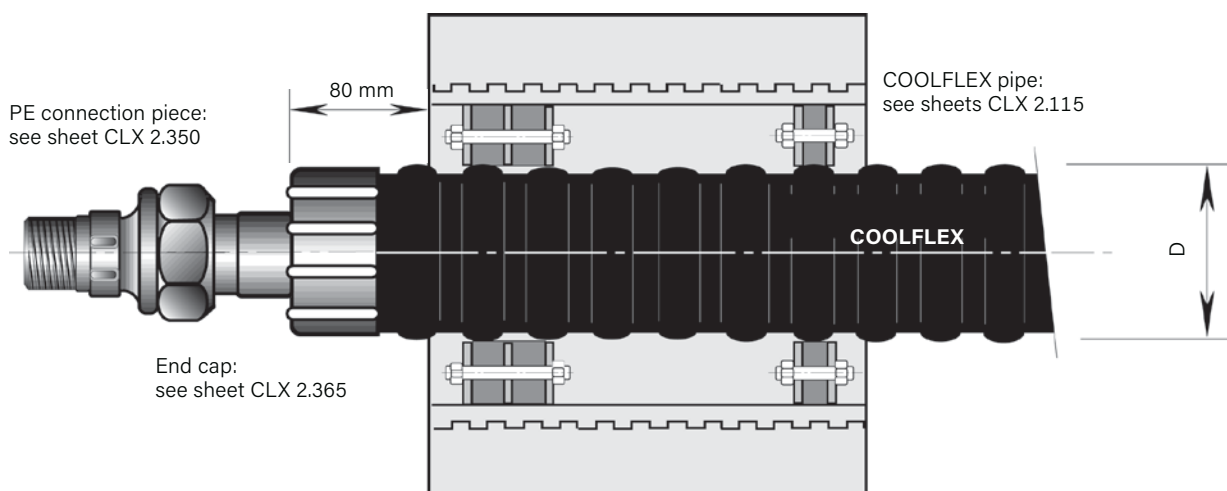
Building entry (see sheet CLX 2.375)



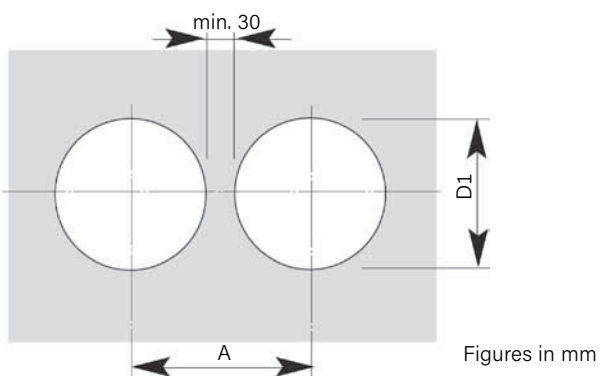
# Building entry

Core bores/cement pipe liners

## Wall leadthrough



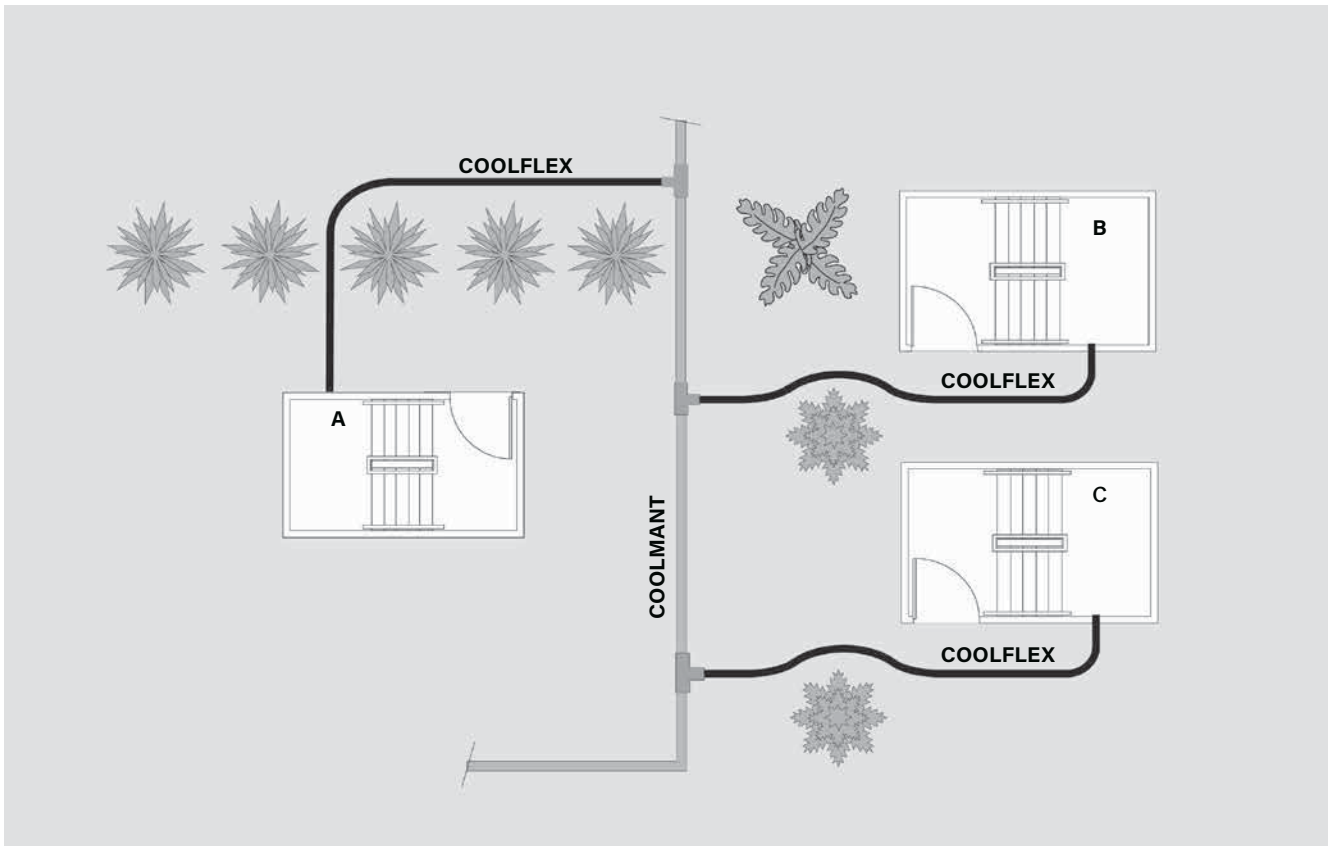
## Core bores



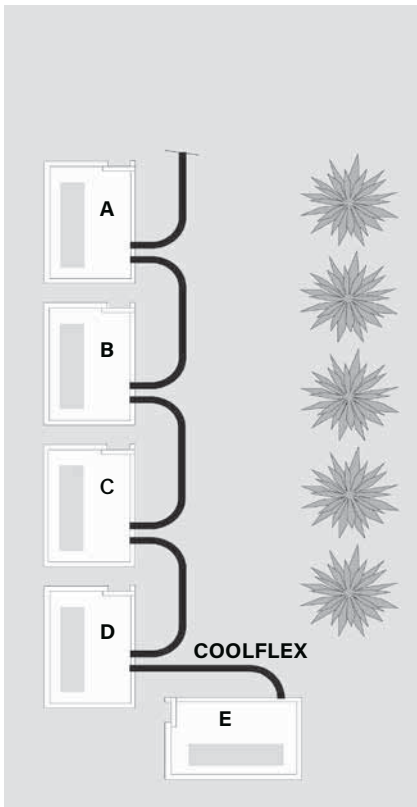
Outer casing Ø D mm	D1 mm	A mm
78	180	150
93	180	150
113	230	200
128	230	200
143	230	200
163	280	250
183	280	250
202	280	250

# Pipe routing

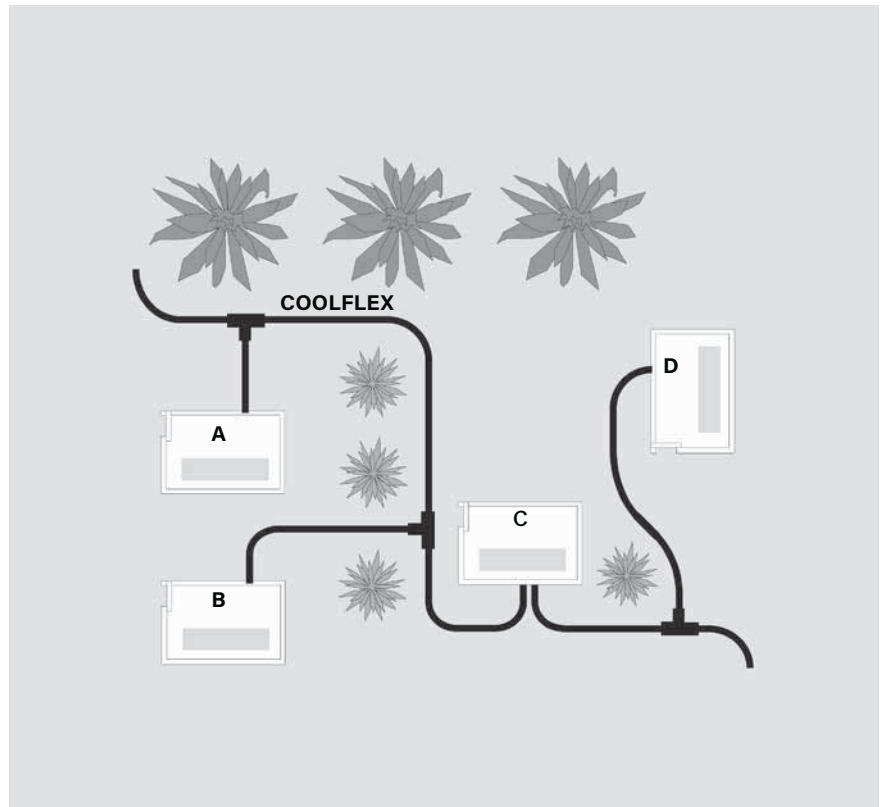
## COOLFLEX - COOLMANT connection



## Loop-in method



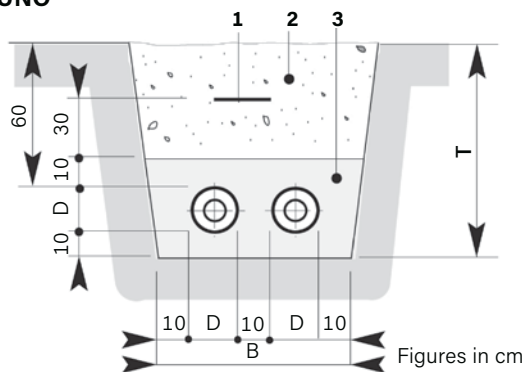
## COOLFLEX - COOLFLEX connection



# Trench dimensions

## Trench profile, 2 COOLFLEX pipes

### UNO



- 1 Pipe warning tape; see sheet CLX 2.370
- 2 Excavated material
- 3 Sand, washed, max. grain size 8 mm

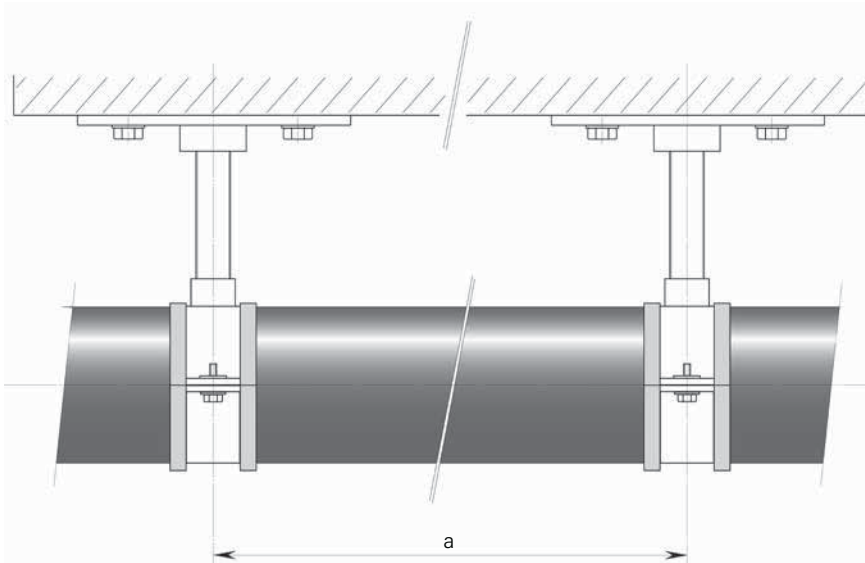
Casing pipe Ø D mm	Width B cm	Depth T cm
78	45	80
93	50	80
113	55	85
128	55	85
143	60	85
163	65	90
183	70	95
202	75	95

Installation depth:  
 max. installation depth: 2.6 m  
 Our approval is required for installation at greater depths.

SLW 30  $\hat{=}$  300 kN total load as per DIN 1072; if subject to higher traffic loads (e.g. SLW 60), a load-distributing superstructure as per RStO75 is required.

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

# Surface installation



Special measures are required for surface installation of COOLFLEX district cooling pipes:

- Provide supports for changes of direction
- Secure with clamps and pressure distribution plates at specified intervals, in the 90° bend
- Clamps
- Fix ends with fixed points
- Assistance with design engineering and planning from BRUGG

Type	Weight including water kg/m	Minimum Bending radius m	distance between clamps a m
25/ 76	1.2	0.7	0.6
32/ 76	1.5	0.7	0.8
40/ 91	2.2	0.8	1.0
50/ 91	2.8	0.8	1.2
63/126	4.7	1.0	1.4
75/126	5.7	1.0	1.7
90/162	8.8	1.2	1.8
110/162	12.1	1.2	2.1
125/182	14.6	1.4	2.2
140/202	18.7	1.4	2.4