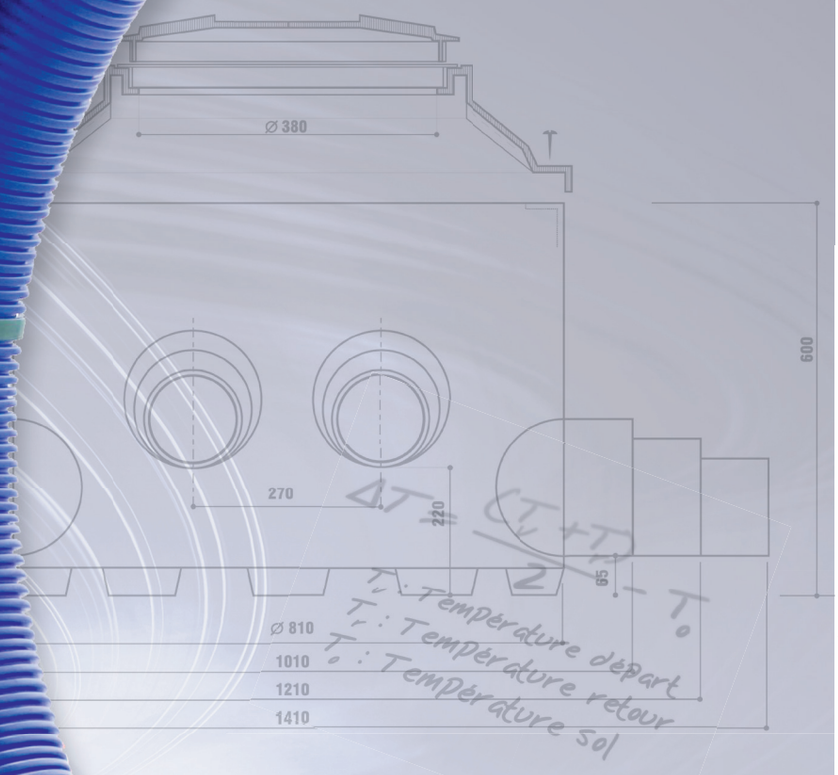
MICROFLEX®

Flexibility, all the way.



Technical Manual

Edition 2015

MICROFLEX®

THE FLEXIBLE PRE-INSULATED PIPING SYSTEM

- **System Description**
- **Product Range**
- **Points of Attention for Assembly**
- **Operating Instructions**
- **Appendix**

Microflex's quality management systems are certified in accordance with NBN EN ISO-9001: 2008.

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1. System Description

1.1 Description

Essential for energy saving is a well performing piping system. Microflex's pre-insulated piping system, composed of a thermal insulation around a carrier pipe and covered by a "closed chamber " protective casing, is therefore your best choice.

Microflex piping is suitable for use in heating, cooling and sanitary applications and provides significant advantages such as, low-weight, hyper flexibility, robustness, and easy and rapid laying even over obstacles and around corners. System accessories can be mounted without any special tools.

Our PE-Xa Central Heating carrier pipe (made from cross-linked polyethylene) is oxygen diffusion proof in accordance with DIN 4726. It can transport a large number of different liquids and is fully corrosion free.

Microflex® is made available as a single, twin or quadruple piping system. It is manufactured free of CFCs.

1.2 Fields of Application

- **Heating**
  - Hot Water Distribution
  - Supply to Individual Buildings
  - Distribution Inside Buildings
- **Local or Remote Heating Networks**
- **Sanitary Water**
  - Distribution of Potable and Non-Potable Water
- **Renewable Energy**
  - Heat Pumps
  - Biogas and Biomass Installations
  - Combined Heat and Power (CHP)
  - Pellet Fuels
  - Geothermal Applications
- **Special Applications**
  - Transport of Chemicals
  - Food Industry
  - Cooling Systems
  - Swimming Pools, Leisure Centres

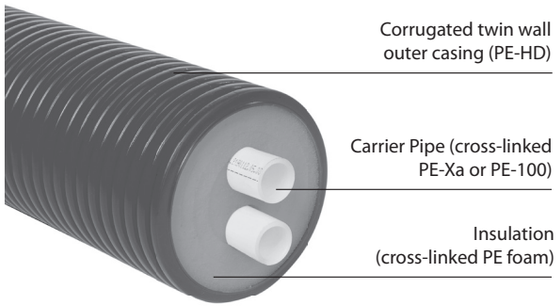
1.3 Properties

- Versatility
- Oxygen Diffusion Barrier to DIN 4726
- Low Weight
- Completely Corrosion Resistant
- Environmentally Friendly Manufacture
- Maintenance Free
- Long Life Expectancy
- Superior Quality

1.4 Structure of the Microflex System

The Microflex piping system consists of three integrated components and is manufactured according to the EN 15632: 1-3 norm

- **Piping system with one pipe: UNO**



Microflex UNO
PN 6 - PN 10 - PN 16

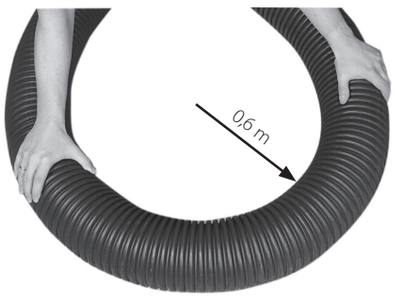
Piping system with two pipes: DUO

Microflex DUO
PN 6 - PN 10 - PN 16

- **Piping system with four pipes: QUADRO**

Microflex QUADRO
2 x PN 6 - 2 x PN 10

The Hyper Flexibility of the Microflex® Piping System



- Placement of the pipe over obstacles and around corners is possible.
- The inside bending radii of the different pipes are specified in the Product Range Tables (see section 2.1). Measurements are taken from the inside of the pipe. A reserve factor is taken into account.
- For example: two PE-Xa pipes of Ø 40 mm can form a curve with an inside radius of 0.6m (see picture).

1.5 PE-Xa Carrier Pipe

The carrier or media transport pipe, as it is often called, used by Microflex is a PE-Xa pipe, which is manufactured according to DIN 16892/16893 and ISO 15875 standards. PE-Xa stands for cross-linked PE, whereby cross-connections between the PE molecules are formed. The resulting molecule is more resistant to extremes of temperatures/pressures and chemical attack.

Thermal Properties

The life expectancy of the pipe is highly dependent on a combination of pressures and temperatures. The carrier pipe has a life expectancy of 50 years, as detailed in the enclosed table, when the pressure and temperature are kept constant and thus meets the ISO 15875 norm.

This table serves as a general guideline. In practice, it's necessary to take into account widely varying pressures and temperatures.

The pipes are, in normal operation, able to withstand operating temperatures and pressures of 85°C / 6 bar for heating and 85°C / 10 bar for sanitary installations.

For a short time, the material is also resistant to temperatures of 95°C.

Life expectancy PE-Xa pipes at constant pressure and temperature (safety factor C=1,25)

Temperature	Life expectancy	SDR	
		11	7.4
		operating pressure	
°C	years	bar	
10	50	17.1	27.1
20	50	15.1	24.0
30	50	13.4	21.3
40	50	11.9	18.9
50	50	10.6	16.8
60	50	9.5	15.0
70	50	8.5	13.4
80	50	7.5	12.0
90	50	6.8	10.9

Chemical Resistance

Most chemicals have no influence on the pipe, even at elevated temperatures. Typically, plastics that are exposed to chemical substances are prone to physical changes in their properties, such as, swelling or dissolution of the polymers. Due to the chemical bonding of the polymer chains, PE-Xa pipes (cross-linked PE) are more resilient in that respect than pipes of non-cross-linked PE. In order to assess the resistance to different materials changes in the tensile and elongation characteristics were monitored. In a pressurised piping system the resistance to unknown chemicals cannot generally be extrapolated from experience of known chemicals. For this, durability tests with the unknown chemicals in test piping are required. For the list of Chemical Resistance, see Appendix, section 5.9.

High Abrasion Resistance

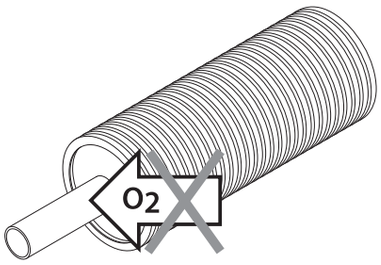
PE-Xa pipes provide an enhanced abrasion resistance and durability. Pipes conveying aggressive sludge at fairly high velocities do not suffer internal erosion.

Pipe Roughness

The smooth bore offers less resistance to flow than conventional pipes resulting in excellent flow characteristics with minimal flow loss without formation of any sedimentary deposits.

Environmentally Friendly

PE-Xa pipes are certified to comply with international potable water quality requirements such as DVGW, WRAS and ACS (copies of the certificates are available on request). The pipe imparts neither taste nor odour and is non-toxic. Consequently it is ideally suited for different branches of the food industry.



Oxygen Diffusion Barrier

The PE-Xa carrier pipe for central heating applications also features an oxygen diffusion barrier (EVOH) that prevents oxygen permeating into the piping system (according DIN 4726). Such an oxygen barrier layer enhances the life of any ferrous components of the system (pumps, valves, etc.)

Material Properties PE-Xa Pipes

Mechanical Properties	Temp	Standard	Value	Unit
Density			938	kg/m^3
Cross Linking Degree			80	%
Elasticity Modulus	@ 20 °C	DIN 53457	600 - 900	N/mm^2
Tensile Strength	@ 20 °C	DIN 53455	19	N/mm^2
Elongation at Break	@ 20 °C	DIN 53455	> 400	%
Moisture Absorption	@ 20 °C		< 0.01	mg/4day
Oxygen Permeability	@ 80 °C	DIN 4726	0.02	mg/lday
Roughness Factor			0.007	mm

Thermal Properties	Temp	Standard	Value	Unit
Operating Temperature			-80+110	°C
Coefficient of Linear Expansion	@ 20 °C @ 100 °C		1.4×10^{-4} 2.0×10^{-4}	1/K 1/K
Softening Temperature			133	°C
Coefficient of Thermal Conductivity	@ 20 °C		0.35	W/mK

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1.6 Insulating Material

The insulating material used consists of microcellular, cross-linked polyethylene foam. In addition to the excellent insulating properties, the closed-cell structure of the material ensures that there is only minimal water absorption.

The material is CFC free.

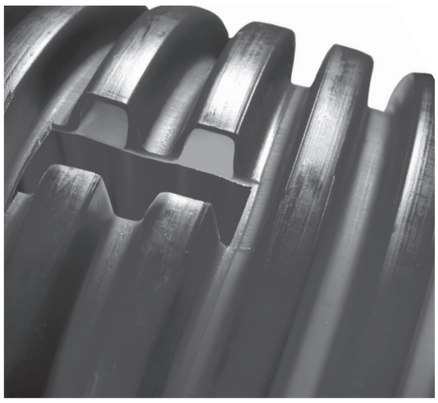
Durability

The closed cell structure ensures optimal quality preservation with constant insulation performance throughout its long service life.

The shape memory of the cross-linked polyethylene foam makes it permanently elastic and ensures the continuance of the initial insulation performance, even after repeated rolling, unrolling and bending of the system. The durable insulation performance makes the Microflex pipe therefore extremely resistant to aging.

Insulation Material Properties

	Temp	Standard	Value	Unit
Density		ISO 845	28.0	kg/m³
Tensile Strength Longitudinally at Fracture	@ 23 °C	ISO 1926	299.0	kPa
Longitudinal Elongation at Fracture	@ 23 °C	ISO 1926	122.0	%
Thermal Stability: Max Temperature			100	°C
Water Absorption		ISO 2896	<1	%
Thermal Conductivity	@ 40 °C	ISO 8301	0.040	W/mK



1.7 Corrugated PE-HD Double-Walled Casing

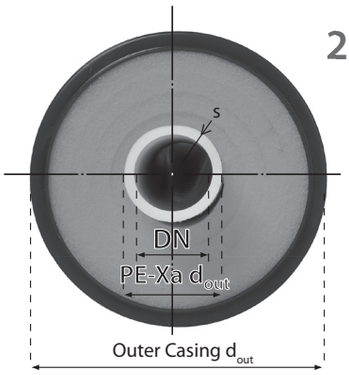
The outer cover made from PE-HD following the "closed chamber" principle, protects the inner pipe as well as the insulating material from external impacts. The ribs of the corrugated outer cover are completely closed; water ingress due to superficial damage to the outer cover is therefore impossible. Due to the corrugated structure, the piping has longitudinal flexibility and resistance to impacts.

Microflex piping is very robust and resistant to aggressive substances.

1.8 Dimensions of Coils

The standard length of a coil is 100m. Tailored lengths can be cut. The coils are designed to fit standard HGV trailers and containers. For transport and storage specifications see section 3.1.

Casing Ø	Coil Inner Ø	Coil Outer Ø	Coil Width	LM
mm	mm	mm	mm	
Microflex UNO				
75	1200	1900	300	0.3
90	1200	1850	500	0.45
125	1200	2100	700	0.7
160	1200	2350	850	0.8
200	1200	2300	1400	1.4
Microflex DUO for Central Heating – Cooling Systems				
125	1200	2100	700	0.7
160	1200	2350	850	0.8
200	1200	2300	1400	1.4
Microflex QUADRO				
160	1200	2350	850	0.8

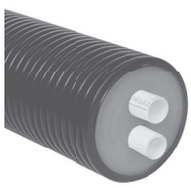


2. Product Range

2.1 Pre-Insulated Pipes

a. Central Heating

Standard Range



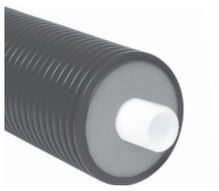
Economy Range

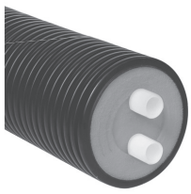
b. Quadro

Pipe	PE-Xa d_{out} x s	PE-Xa d_{in}	Outer Casing d_{out}	Weight	Inner Bending Radius	Average Thickness of Insulation
Art. No.	mm	DN	mm	kg/m	m	mm
Microflex UNO PN 6 / 95°C						SDR 11
M7525 C	25 x 2.3	20	75	0.65	0.20	19.0
M9032 C	32 x 2.9	25	90	1.00	0.25	21.5
M16040 C	40 x 3.7	32	160	2.19	0.35	49.0
M16050 C	50 x 4.6	40	160	2.43	0.45	44.0
M16063 C	63 x 5.8	50	160	2.72	0.55	37.5
M20075 C	75 x 6.8	65	200	3.99	0.80	48.5
M20090 C	90 x 8.2	75	200	4.58	1.10	41.0
M200110 C	110 x 10.0	90	200	5.53	1.20	31.0
M200125 C	125 x 11.4	100	200	6.48	1.40	23.5
Microflex DUO PN 6 / 95°C						SDR 11
MD16025 C	2 x 25/2.3	20	160	2.07	0.50	
MD16032 C	2 x 32/2.9	25	160	2.31	0.50	
MD16040 C	2 x 40/3.7	32	160	2.57	0.60	
MD20050 C	2 x 50/4.6	40	200	3.93	0.80	
MD20063 C	2 x 63/5.8	50	200	4.70	1.20	
Microflex Primo UNO PN 6 / 95°C						SDR 11
M9040 C	40 x 3.7	32	90	1.16	0.30	17.5
M12540 C	40 x 3.7	32	125	1.68	0.30	33.0
M12550 C	50 x 4.6	40	125	1.92	0.40	28.0
M12563 C	63 x 5.8	50	125	2.19	0.50	21.5
M16075 C	75 x 6.8	65	160	3.10	0.75	31.5
M16090 C	90 x 8.2	75	160	3.69	1.00	24.0
Microflex Primo DUO PN 6 / 95°C						SDR 11
MD12525 C	2 x 25/2.3	20	125	1.60	0.40	
MD12532 C	2 x 32/2.9	25	125	1.78	0.40	
MD16050 C	2 x 50/4.6	40	160	3.02	0.70	
Microflex QUADRO PN 6 Central Heating / PN 10 Sanitary						SDR 11 / SDR 7.4
MQ16025C2520S	25 x 2.3 C (2 x) 25 x 3.5 S (1 x) 20 x 2.8 S (1 x)	20 20 15	160	2.49	0.60	
MQ16032C2520S	32 x 2.9 C (2 x) 25 x 3.5 S (1 x) 20 x 2.8 S (1 x)	25 20 15	160	2.65	0.60	
MQ16032C3225S	32 x 2.9 C (2 x) 32 x 4.4 S (1 x) 25 x 3.5 S (1 x)	25 25 20	160	2.88	0.60	

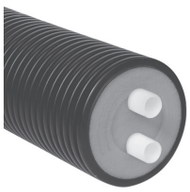
c. Sanitary Applications

Standard Range





Economy Range



d. Cool without Self-Regulating Heating Cable

e. Cool with Self-Regulating Heating Cable

Pipe	PE-Xa d_{out} x s	PE-Xa d_{in}	Outer Casing d_{out}	Weight	Inner Bending Radius	Average Thickness of Insulation
Art. No.	mm	DN	mm	kg/m	m	mm
Microflex UNO PN 10 / 95°C						SDR 7.4
M7525 S	25 x 3.5	20	75	0.73	0.20	19.0
M9032 S	32 x 4.4	25	90	1.13	0.25	21.5
M12540 S	40 x 5.5	32	125	1.82	0.40	33.0
M12550 S	50 x 6.9	40	125	2.09	0.50	28.0
M12563 S	63 x 8.7	50	125	2.70	0.60	21.5
Microflex DUO PN 10 / 95°C						SDR 7.4
MD16025 S	2 x 25/3.5	20	160	2.23	0.50	
MD1603225 S	1 x 32/1 x 25	25 20	160	2.37	0.50	
MD1604025 S	1 x 40/1 x 25	32 20	160	2.57	0.60	
MD1605025 S	1 x 50/1 x 25	40 20	160	2.90	0.60	
MD1605032 S	1 x 50/1 x 32	40 25	160	3.02	0.60	
Microflex Primo DUO PN 10 / 95°C						SDR 7.4
MD1252520 S	1 x 25/1 x 20	20 15	125	1.64	0.40	
MD1253225 S	1 x 32/1 x 25	25 20	125	1.86	0.40	

Pipe	PE-Xa d_{out} x s	PE-Xa d_{in}	Outer Casing d_{out}	Weight	Inner Bending Radius	Average Thickness of Insulation
Art. No.	mm	DN	mm	kg/m	m	mm
Microflex Cool UNO without Self-Regulating Heating Cable PN 16 / 25°C						SDR 11
M9032 PE	32 x 2.9	25	90	1.03	0.25	21.5
M9040 PE	40 x 3.7	32	90	1.16	0.30	17.5
M12550 PE	50 x 4.6	40	125	1.90	0.40	28.0
M12563 PE	63 x 5.8	50	125	2.21	0.50	21.5
M16075 PE	75 x 6.8	65	160	3.14	0.75	31.5
M16090 PE	90 x 8.2	75	160	3.73	1.00	24.0
M200110 PE	110 x 10.0	90	200	5.57	1.20	31.0
M200125 PE	125 x 11.4	100	200	6.44	1.40	23.5
Microflex Cool DUO PN 16 / 25°C						SDR 11
MD12532 PE	2 x 32/2.9	25	125	1.82	0.40	
MD16040 PE	2 x 40/3.7	32	160	2.63	0.60	
MD16050 PE	2 x 50/4.6	40	160	3.10	0.60	
MD20063 PE	2 x 63/5.8	50	200	4.64	1.20	
Microflex Cool UNO with Self-Regulating Heating Cable PN 16 / 25°C						SDR 11
MV7532 PE	32 x 2.9	25	75	0.81	0.25	15.5
MV9040 PE	40 x 3.7	32	90	1.26	0.30	17.5
MV12550 PE	50 x 4.6	40	125	1.95	0.50	28.0
MV12563 PE	63 x 5.8	50	125	2.31	0.60	21.5
MV16075 PE	75 x 6.8	65	160	3.20	0.75	31.5
MV16090 PE	90 x 8.2	75	160	3.77	1.00	24.0
MV200110 PE	110 x 10.0	90	200	5.65	1.20	31.0
MV200125 PE	125 x 11.4	100	200	6.46	1.40	23.5

2.2 PE-X Couplings

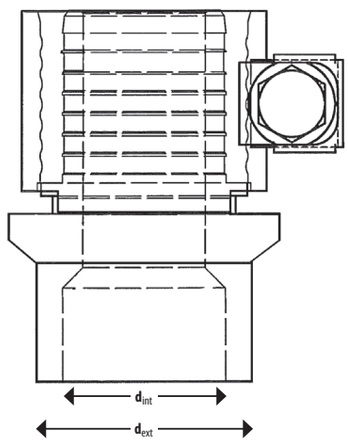
All PE-X couplings are made of brass (EN 12165). All clamping rings are made of brass that is resistant to dezincification (DZR – ISO 6509). The material of the pipe sections meets the latest potable water directives.

2.2.1. Microflex PE-X Terminal Connections for Central Heating and Cooling Applications PN 6 (PN 16) – SDR 11

	ø Pipe / Wall Thickness	Ø External Thread	Ø Outer Diameter of Pipe
Art. No.	mm	inch	mm
Straight Coupling, Male			
MJ3413425/23	25 / 2.3	3/4″	25
MJ3414432/29	32 / 2.9	1″	32
MJ3415440/37	40 / 3.7	1 1/4″	40
MJ3416450/46	50 / 4.6	1 1/2″	50
MJ341263/58	63 / 5.8	2″	63
MJ34121275/68	75 / 6.8	2 1/2″	75
MJ341390/82	90 / 8.2	3″	90
MJ3414110/100	110 / 10.0	4″	110
MJ3414125/114	125 / 11.4	4″	125
PE-X x PE-X Straight Coupling			
MJ27025/23	25 / 2.3	2 x 3/4″	25 x 25
MJ27032/29	32 / 2.9	2 x 1″	32 x 32
MJ27040/37	40 / 3.7	2 x 1 1/4″	40 x 40
MJ27050/46	50 / 4.6	2 x 1 1/2″	50 x 50
MJ27063/58	63 / 5.8	2 x 2″	63 x 63
MJ27075/68	75 / 6.8	2 x 2 1/2″	75 x 75
MJ27090/82	90 / 8.2	2 x 3″	90 x 90
MJ270110/100	110 / 10.0	2 x 4″	110 x 110
MJ270125/114	125 / 11.4	2 x 4″	125 x 125
PE-X x PE-X Elbow Coupling			
MJ9025/23	25 / 2.3	2 x 3/4″	25 x 25
MJ9032/29	32 / 2.9	2 x 1″	32 x 32
MJ9040/37	40 / 3.7	2 x 1 1/4″	40 x 40
MJ9050/46	50 / 4.6	2 x 1 1/2″	50 x 50
MJ9063/58	63 / 5.8	2 x 2″	63 x 63
MJ9075/68	75 / 6.8	2 x 2 1/2″	75 x 75
MJ9090/82	90 / 8.2	2 x 3″	90 x 90
MJ90110/100	110 / 10.0	2 x 4″	110 x 110
MJ90125/114	125 / 11.4	2 x 4″	125 x 125

Tee-Coupling 3 x PE-X			
MJ13025/23	25 / 2.3	3 x 3/4"	25 x 25 x 25
MJ13032/29	32 / 2.9	3 x 1"	32 x 32 x 32
MJ1304032/37	40 / 3.7 + 32 / 2.9	2 x 1 1/4" + 1 x 1"	40 x 32 x 40
MJ13040/37	40 / 3.7	3 x 1 1/4"	40 x 40 x 40
MJ1305040/46	50 / 4.6 + 40 / 3.7	2 x 1 1/2" + 1 x 1 1/4"	50 x 40 x 50
MJ13050/46	50 / 4.6	3 x 1 1/2"	50 x 50 x 50
MJ1306350/58	63 / 5.8 + 50 / 4.6	2 x 2" + 1 x 1 1/2"	63 x 50 x 63
MJ13063/58	63 / 5.8	3 x 2"	63 x 63 x 63
MJ13075/68	75 / 6.8	3 x 2 1/2"	75 x 75 x 75
MJ13090/82	90 / 8.2	3 x 3"	90 x 90 x 90
MJ130110/100	110 / 10.0	3 x 4"	110 x 110 x 110
MJ130125/114	125 / 11.4	3 x 4"	125 x 125 x 125

	Ø Pipe / Wall Thickness	Ø d_{ext}	Ø d_{int}
Art. No.	mm	mm	mm
Weld-End Coupling			
MJ3412725/23L	25 / 2.3	26.90	21.50
MJ3413332/29L	32 / 2.9	33.70	27.00
MJ3414240/37L	40 / 3.7	42.40	36.00
MJ3414550/46L	50 / 4.6	48.30	42.00
MJ3415763/58L	63 / 5.8	60.30	53.00
MJ3417675/68L	75 / 6.8	76.10	68.00
MJ3418990/82L	90 / 8.2	88.90	80.00
MJ341110110/10L	110 / 10.0	114.30	105.00
MJ341114125/114L	125 / 11.4	114.30	105.00



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2.2.2. Microflex PE-X Couplings for Sanitary Applications PN 10 – SDR 7.4

	Ø Pipe / Wall Thickness	Ø External Thread	Ø Outer Diameter of Pipe
Art. No.	mm	inch	mm
Straight Coupling, Male			
MJ3413420/28	20 / 2.8	3/4″	20
MJ3413425/35	25 / 3.5	3/4″	25
MJ3414432/44	32 / 4.4	1″	32
MJ3415440/55	40 / 5.5	1 1/4″	40
MJ3416450/69	50 / 6.9	1 1/2″	50
MJ341263/87	63 / 8.7	2″	63

PE-X x PE-X Coupling			
MJ27025/35	25 / 3.5	2 x 3/4″	25 x 25
MJ27032/44	32 / 4.4	2 x 1″	32 x 32
MJ27040/55	40 / 5.5	2 x 1 1/4″	40 x 40
MJ27050/69	50 / 6.9	2 x 1 1/2″	50 x 50
MJ27063/87	63 / 8.7	2 x 2″	63 x 63

PE-X x PE-X Elbow Coupling			
MJ9025/35	25 / 3.5	2 x 3/4″	25 x 25
MJ9032/44	32 / 4.4	2 x 1″	32 x 32
MJ9040/55	40 / 5.5	2 x 1 1/4″	40 x 40
MJ9050/69	50 / 6.9	2 x 1 1/2″	50 x 50
MJ9063/87	63 / 8.7	2 x 2″	63 x 63

Tee-Coupling 3 x PE-X			
MJ13025/35	25 / 3.5	3 x 3/4″	25 x 25 x 25
MJ13032/44	32 / 4.4	3 x 1″	32 x 32 x 32
MJ1304032/55	40 / 5.5 + 32 / 4.4	2 x 1 1/4″ + 1 x 1″	40 x 32 x 40
MJ13040/55	40 / 5.5	3 x 1 1/4″	40 x 40 x 40
MJ1305040/69	50 / 6.9 + 40 / 5.5	2 x 1 1/2″ + 1 x 1 1/4″	50 x 40 x 50
MJ13050/69	50 / 6.9	3 x 1 1/2″	50 x 50 x 50
MJ1306350/87	63 / 8.7 + 50 / 6.9	2 x 2″ + 1 x 1 1/2″	63 x 50 x 63
MJ13063/87	63 / 8.7	3 x 2″	63 x 63 x 63

2.2.3. Accessories for PE-X Couplings

Bronze – Conical Male Thread (ISO 7) - Parallel Female Thread (ISO 228)

Art. No.	Ø inch
Fix Point	
MFP34	3/4″
MFP44	1″
MFP54	1 1/4″
MFP64	1 1/2″
MFP2	2″
MFP212	2 1/2″
MFP3	3″
MFP4	4″

Bronze – Parallel Thread (ISO 228)

Sleeve F x F	
VW27034	3/4″
VW27044	1″
VW27054	1 1/4″
VW27064	1 1/2″
VW2702	2″
VW270212	2 1/2″
VW2703	3″
VW2704	4″

Bronze – Parallel Thread (ISO 228)

Elbow 90° F x F	
VW9034	3/4″
VW9044	1″
VW9054	1 1/4″
VW9064	1 1/2″
VW902	2″
VW90212	2 1/2″
VW903	3″
VW904	4″

Bronze – Parallel Thread (ISO 228)

Tee F x F x F	
VW13034	3/4″
VW13044	1″
VW13054	1 1/4″
VW13064	1 1/2″
VW1302	2″
VW130212	2 1/2″
VW1303	3″
VW1304	4″

Reducing Bush M x F	
VW2414434	1″x 3/4″
VW2415434	1 1/4″x 3/4″
VW2415444	1 1/4″x 1″
VW2416434	1 1/2″x 3/4″
VW2416444	1 1/2″x 1″
VW2416454	1 1/2″x 1 1/4″
VW241234	2″x 3/4″
VW241244	2″x 1″
VW241254	2″x 1 1/4″
VW241264	2″x 1 1/2″
VW24121254	2 1/2″x 1 1/4″
VW24121264	2 1/2″x 1 1/2″
VW2412122	2 1/2″x 2″

Brass – Parallel Thread (ISO 228)

Art. No.	Ø inch
Reducing Bush M x F	
VW241344	3″x 1″
VW241354	3″x 1 1/4″
VW241364	3″x 1 1/2″
VW24132	3″x 2″
VW2413212	3″x 2 1/2″
VW24142	4″x 2″
VW2414212	4″x 2 1/2″
VW24143	4″x 3″

Galvanised Steel

Screwed Flange	
MDF34	3/4″
MDF44	1″
MDF54	1 1/4″
MDF64	1 1/2″
MDF2	2″
MDF212	2 1/2″
MDF3	3″
MDF4	4″

Nickel Plated Brass –
Conical Thread (ISO 7)

Nipples	
VW28034	3/4″
VW28044	1″
VW28054	1 1/4″
VW28064	1 1/2″
VW2802	2″
VW280212	2 1/2″
VW2803	3″
VW2804	4″

Nickel Plated Brass –
Parallel Thread (ISO 228)

Stop	
VW29034	3/4″
VW29044	1″
VW29054	1 1/4″
VW29064	1 1/2″
VW2902	2″
VW290212	2 1/2″
VW2903	3″
VW2904	4″

Nickel Plated Brass

Ball Valve	
VW35034	3/4″
VW35044	1″
VW35054	1 1/4″
VW35064	1 1/2″
VW3502	2″
VW350212	2 1/2″
VW3503	3″
VW3504	4″

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2.2.4. PE Couplings

Maximum working pressure at 20 °C: 16 bar for 32 - 63mm

Maximum working pressure at 20 °C: 10 bar for 75 – 110mm

The PE couplings are made from Polypropylene and are for use in cold and cooling water systems. These are ideal for use in chlorine environments, e.g. swimming pool. Suitable for connecting PE carrier transport pipes.

Male-threaded coupling

	PE d_{out}/S	Thread
Art. No.	mm	inch
MPP3414432/29	32 / 2.9	1" M
MPP3415440/37	40 / 3.7	1 1/4" M
MPP3416450/46	50 / 4.6	1 1/2" M
MPP341263/58	63 / 5.8	2" M
MPP34121275/68	75 / 6.8	2 1/2" M
MPP341390/82	90 / 8.2	3" M
MPP3414110/100	110 / 10.0	4" M

PE x PE Pipe Coupling

	PE d_{out}/S	PE d_{out} x d_{out}
Art. No.	mm	mm
MPP27032/29	32 / 2.9	32 x 32
MPP27040/37	40 / 3.7	40 x 40
MPP27050/46	50 / 4.6	50 x 50
MPP27063/58	63 / 5.8	63 x 63
MPP27075/68	75 / 6.8	75 x 75
MPP27090/82	90 / 8.2	90 x 90
MPP270110/100	110 / 10.0	110 x 110

PE x PE Elbow Piece

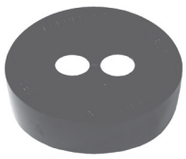
	PE d_{out}/S	PE d_{out} x d_{out}
Art. No.	mm	mm
MPP9032/29	32 / 2.9	32 x 32
MPP9040/37	40 / 3.7	40 x 40
MPP9050/46	50 / 4.6	50 x 50
MPP9063/58	63 / 5.8	63 x 63
MPP9075/68	75 / 6.8	75 x 75
MPP9090/82	90 / 8.2	90 x 90
MPP90110/100	110 / 10.0	110 x 110

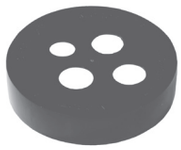
3 x PE T-Piece

	PE d_{out}/S	PE d_{out} x d_{out} x d_{out}
Art. No.	mm	mm
MPP13032/29	32 / 2.9	32 x 32 x 32
MPP13040/37	40 / 3.7	40 x 40 x 40
MPP13050/46	50 / 4.6	50 x 50 x 50
MPP13063/58	63 / 5.8	63 x 63 x 63
MPP13075/68	75 / 6.8	75 x 75 x 75
MPP13090/82	90 / 8.2	90 x 90 x 90
MPP130110/100	110 / 10.0	110 x 110 x 110

2.3 Accessories

2.3.1. Microflex Dust Caps prevent the ingress of dust.





Dimensions in mm	Art. No.	Ø Outer Casing	Ø Pipe
Dust caps for Microflex UNO	MS7525	75	25
	MS7532	75	32
	MS9032	90	32
	MS9040	90	40
	MS12540	125	40
	MS12550	125	50
	MS12563	125	63
	MS16040	160	40
	MS16050	160	50
	MS16063	160	63
	MS16075	160	75
	MS16090	160	90
	MS20075	200	75
	MS20090	200	90
	MS200110	200	110
	MS200125	200	125
Dust caps for Microflex DUO	MSD12525	125	2 x 25
	MSD12532	125	2 x 32
	MSD16025	160	2 x 25
	MSD16032	160	2 x 32
	MSD16040	160	2 x 40
	MSD16050	160	2 x 50
	MSD20050	200	2 x 50
	MSD20063	200	2 x 63
	MSD1252520	125	1x25/1x20
	MSD1253225	125	1x32/1x25
	MSD1603225	160	1x32/1x25
	MSD1604025	160	1x40/1x25
	MSD1605025	160	1x50/1x25
	MSD1605032	160	1x50/1x32
Dust caps for Microflex QUADRO	MSQ160252520	160	2x25/1x25/1x20
	MSQ160322520	160	2x32/1x25/1x20
	MSQ160323225	160	2x32/1x32/1x25

2.3.2. Microflex Heat Shrinkable Caps are used for preventing the ingress of water between the outer casing and insulated carrier pipe. Pressure resistant up to 0.3 bar.

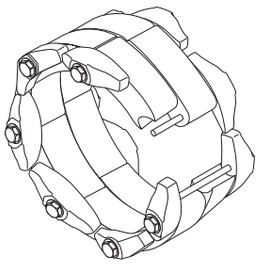
Dimensions in mm	Art. No.	Ø Outer Casing	Ø Pipe
Heat shrink caps for UNO	MK2000	75	25
	MK2100	75/90	32 of 40
	MK2200	125	40 of 50
	MK2400	125	63
	MK2340	160	40 of 50
	MK2500	160	63 tot 90
	MK2600	200	75 tot 125
Heat shrink caps for DUO	MK3250-P604	125	1x25/1x20
	MK3250-P604	125	2x25
	MK3250-P604	125	1x32/1x25
	MK3280	125	2 x 32
	MK3350-01	160	2x25 of 2 x 32
	MK3350-02	160	2 x 40
	MK3350-01	160	1x32/1x25
	MK3350-02	160	1x40/1x25
	MK3360-01	160	1x50/1x25
	MK3350-03	160	1x50/1x32
	MK3350-03	160	2 x 50
	MK3350-03	200	2 x 50
	MK3350-05	200	2x63

2.3.3. Microflex EPDM Rubber End-Caps are used for preventing the ingress of water between the outer casing and insulated carrier pipe. Pressure resistant up to 0.3 bar.

Dimensions in mm	Art. No.	Ø Outer Casing	Ø Pipe
EPDM Rubber end-cap for UNO	MG751832	75	1 x 18, 25, 28 of 32
	MG901840	90	1 x 18, 25, 32 of 40
	MG1252532	125	1 x 25, 28 of 32
	MG1254063	125	1 x 40, 50 of 63
	MG1603250	160	1 x 32, 40 of 50
	MG1606390	160	1 x 63, 75 of 90
	MG20075125	200	1 x 75, 90, 110 of 125
EPDM Rubber end-cap for DUO	MGD1251832	125	2 x 18, 20, 25, 28 of 32
	MGD1601840	160	2 x 18, 28, 32 of 40
	MGD1602550	160	2 x 25, 32, 40 of 50
	MGD2004063	200	2 x 40, 50 of 63

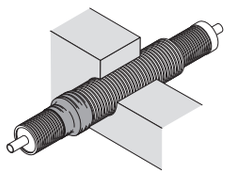
2.3.4. MICRO SEAL Wall Feedthrough (Subterranean Use)

This mechanically expanded water-impermeable wall seal can be applied directly in drilled holes and built-in plastic and fibre-cement wall feedthroughs. It is designed for use under ground where the piping seals are exposed to ground water under pressure.
The Micro Seal chain comprises a number of links that expand when tightened to produce a very tight seal.



Micro Seal	Outside Casing d_{out}	Wall Opening	Torque Nm
Art. No.	mm	mm	Max.
7LS300	75	110 - 112	6
8LS300	90	130 - 132	6
6LS325	125	180 - 182	6
7LS475	125	200 - 202	20
13LS300	160	200 - 202	6
9LS325	200	250 - 255	6
8LS400	200	280 - 282	20

Other combinations are available on request.



2.3.5. MMDV Wall Feedthrough (Above Ground/Surface Use)

The MMDV wall feedthrough comprises a corrugated PE-HD pipe and shrink sleeve. The feedthrough seals are designed to withstand typical weather conditions and are resistant to water splashing. After the pipe is bricked in (protruding 10cm out of the wall), the Microflex pipe is fed through and sealed with the shrink sleeve. The maximum wall thickness is 40cm.

	Microflex Pipe with Casing d_{out}	Wall Feedthrough Pipe d_{out}	Cavity
Art. No.	mm	mm	mm
MMDV75/90	75 - 90	110	210
MMDV125	125	160	260
MMDV160	160	200	300
MMDV200	200	235	350

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2.3.6. Microflex Insulated T-Piece Kit

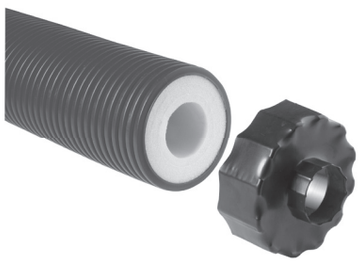
Guarantees complete insulation and sealing of branch connections between UNO, DUO and QUADRO pipes. The kit comprises 2 halves in PE-HD, Rockwool insulation, bitumen rubber sealer kit, stainless steel bolts and assembly instructions. Heat shrinkable caps to be ordered separately.

	Microflex Pipe with Casing d_{out}	L	W	H	Weight
Art. No.	mm	mm	mm	mm	kg
MT129075	125/90/75	970	580	190	7.5
MT201612	200/160/125	1210	795	270	11.1

2.3.7. Microflex Insulated Double T-Piece Kit

Guarantees complete insulation and sealing of branch connections between UNO, DUO and QUADRO pipes. The kit comprises 2 halves in PE-HD, Rockwool insulation, bitumen rubber sealer kit, stainless steel bolts and assembly instructions. Heat shrinkable caps to be ordered separately.

	Microflex Pipe with Casing d_{out}	L	W	H	Weight
Art. No.	mm	mm	mm	mm	kg
MDT201612	200/160/125	1180	1180	270	20.4



2.3.8. Microflex Reducers for Insulated T-Piece Kit MT201612 and MDT201612

Used where a transition from a 160mm outer casing to 90mm or 75mm is necessary. Reducers comprise an outside casing with interior insulation and a shrink sleeve. The reducer is pressed into the insulated T-piece kit.

Art. No.	Description
MR24116075	160 to 75/90 reduction

2.3.9. Microflex Insulated Straight Coupling Kit

Guarantees complete insulation and sealing of straight connections between UNO, DUO and QUADRO pipes. The kit comprises 2 halves in PE-HD, Rockwool insulation, bitumen rubber sealer kit, stainless steel bolts and assembly instructions. Heat shrinkable caps to be ordered separately.

	Microflex Pipe with Casing d_{out}	L	W	H	Weight
Art. No.	mm	mm	mm	mm	kg
MM129075	125/90/75	970	250	200	5.5
MM201612	200/160/125	1210	380	270	7.7

2.3.10. Microflex Insulation Straight Coupling Kit - Alternative

Guarantees complete insulation and sealing of straight extensions between UNO, DUO and QUADRO pipes. The kit comprises a connection piece, 2 shrink sleeves, Rockwool insulation, adhesive tape and assembly instructions.

	Microflex Pipe with Casing d_{out}	L
Art. No.	mm	mm
MM75/90	75 - 90	700
MM125	125	850
MM160	160	1000
MM200	200	1000

2.3.11. Microflex Insulated 90° Elbow Kit

Guarantees complete insulation and sealing of perpendicular connections between UNO, DUO and QUADRO pipes. The kit comprises 2 halves in PE-HD, Rockwool insulation, bitumen rubber sealer kit, stainless steel bolts and assembly instructions. Heat shrinkable caps to be ordered separately.

	Microflex Pipe with Casing d_{out}	L	W	H	Weight
Art. No.	mm	mm	mm	mm	kg
MH201612	200/160/125	770	770	270	9.3

2.3.12. Microflex Insulated Y-Piece Kit

Guarantees complete insulation and sealing of straight connections between 1 Quadro and 2 Duo or 1 Duo to 2 Uno pipes. The kit comprises 2 halves in PE-HD, Rockwool insulation, bitumen rubber sealer kit, stainless steel bolts and assembly instructions. Heat shrinkable caps to be ordered separately.

	Microflex Pipe with Casing d_{out}	L	W	H	Weight
Art. No.	mm	mm	mm	mm	kg
MBR201612	200/160/125	1100	456	232	8.3
IN	1 x 200/160/125				
OUT	2 x 160/125				

2.3.13. Inspection Chamber

Can be used as an alternative for MM, MT, MDT or MBR insulation kits. The PE-HD inspection chamber has 6 connection points, enabling connections of different pipes and integration of shut off valves. The kit comprises inspection chamber, lid, stainless steel bolts, bitumen rubber sealer kit and assembly instructions. Heat shrinkable caps and sleeves to be ordered separately.

	For Outer Casing	Outer Diameter	Weight
Art. No.	mm	mm	kg
MIS	6 x 200/160/125	810	32
Shrink Sleeve for Inspection Chamber			
MHM125	125		
MHM160	160		
MHM235	200		

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2.3.14. Repair Tape

Used to repair incidental local damage to the outside casing.
MHB200: Heat-shrinkable wrapping tape
MHK150: Cold-applied wrapping tape

	Repair Tape	L x B
Art. No.		m
MHB200	Heat-shrinkable tape	10 m x 0.20 m
MHK150	Cold-applied tape	10 m x 0.15 m

2.3.15. Shrink Sleeve

Used to seal connections made to an Inspection Chamber (see section 2.3.13) and to repair incidental local damage to the casing. Slide the sleeve over the damaged area, heat with hot air (be sure not to burn the outside casing) and apply gentle pressure whilst wearing protective gloves.

	Outside Casing d_{out}	Width
Art. No.	mm	mm
MHM75/90	75 - 90	220
MHM125	125	220
MHM160	160	220
MHM200	200	220
MHM235*	200	220

* Shrink Sleeve For Inspection Chamber

2.3.16. Warning Tape

Used to show the location of underground pipes during excavation work. The tape is placed in the trenches above the pre-insulated pipe.

Warning Tape		Length
MTRW	ATTENTION: water pipe (red)	250 m
MTRB	ATTENTION: water pipe with heating cable (blue)	250 m

2.3.17. Ambient Thermostat MVTH

The thermostat switches power to the heating cable depending on the changing ambient temperature. The use of this thermostat is strongly recommended because it prevents the heating cable from being powered on at all times and so cuts energy consumption and prevents possible over-heating.

- Operation: Automatic / EN 60730-1
- Protection Level: IP 54 / EN 60529
- Regulating Range: -10°C…+40°C
- Differential: Δt=2°C at 16A
- Maximum Current: 16A / 230VAC
- Voltage: 230VAC

2.3.18. MVBOX

This PVC distribution box connects the heating cable to the current feed.

– Protection level: IP55

2.3.19. MVKITGR

One kit comprising:

– 3 shrink sleeves to insulate the feed wire and the earthing of the heating cable
– 1 long shrink sleeve to insulate the heating cable at the connection
– 2 short shrink sleeves to insulate the end of the heating cable
– 1 bulkhead feedthrough for the MVBOX

2.3.20. MVKITM

Used for the connection of one or more straight extensions, with a maximum length of 100m.

One kit comprising:

– 1 x MVBOX
– 2 x MVKITGR

2.3.21. MVKITT

Used for the connection of one or more T-piece extensions, with a maximum length of 100m.

One kit comprising:

– 1 x MVBOX
– 3 x MVKITGR

3. Points of Attention for Assembly

3.1 Transport and Storage

Microflex pipelines are supplied in coils with a maximum length of 100 metres. Pipe ends are sealed with protective end caps to prevent the entry of foreign material and should not be removed during transport or storage. Microflex pipelines must be transported upright.

Whilst in storage, care must be taken to ensure that the PE-Xa carrier pipe is protected from sunlight and that no undesirable deformation of the coil is occurring.

Pipes must be transported and stored in such a way that sharp objects, like stones and tree roots cannot damage them. Pipes must not be dragged along the ground. Unloading and transport to the end location should only be done by a forklift truck. Only nylon or textile straps should be used for fastening the coils during transport.

3.2 Pipe Cutting

Microflex carrier pipes need to be cut at a right angle with a pair of PE-X scissors. This way, the carrier pipe will be closely mated to the coupling and therefore reduce the risk of leakage. The pipe end-cuts must be deburred with an appropriate tool and the resulting swarf removed completely. Residual burrs on the pipe ends and loose swarf could prevent the coupling from sealing correctly and consequently leakage might occur. It is possible that swarf could eventually block other system components such as heat exchangers.

Microflex Quadro pipes are susceptible to deformation (kinking of the PE-X carrier pipes) after cutting. The smaller sizes are especially susceptible to this problem. We advise to pressure test every cut pipe using compressed air.

3.3 Instructions for Laying Microflex Pipes in Soil

Utility Trench Profiling

Before the excavation work can begin, one must check that no conflict may arise with existing and/or planned lines or structures. Excavation works must be carried out in the approved manner, according to the rules and regulations of local authorities. Prior permission is very often required.

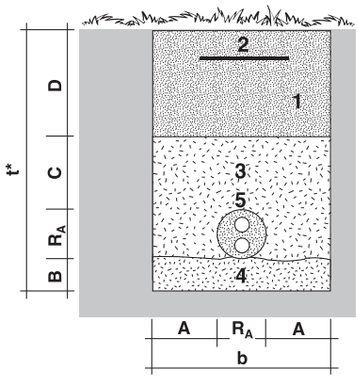
Up to a trench depth of 120cm, we recommend digging a trench with vertical sidewalls; deeper than 120cm we recommend a V-shaped trench.

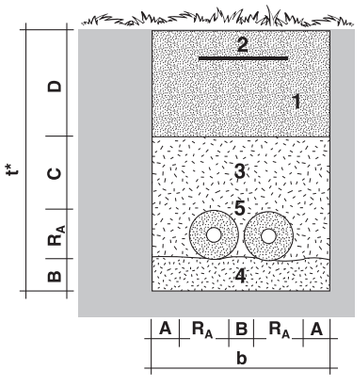
The profile of the utility trenches must conform to the Microflex guidelines for laying pipes. **Particular attention must be paid to ground frost depth.**

ATTENTION:

Minimum laying temperature for Microflex pipes: -5°C.

1 Backfill
2 Warning Tape
3 Sand Fill
4 Sand Bed
5 Microflex Pipe





Profiles of Utility Trenches

NB: Particular attention must be paid to ground frost depth.

Profile of trench for Microflex DUO pipe

R_A mm Casing Ø	A mm	B mm	C mm	D mm ≥	b mm Width	t* mm Depth ≥
125	150	100	150	250	425	625
160	180	100	150	250	520	660
200	180	100	150	250	560	700

Profile of trench for 2 Microflex single pipes (2 x UNO) **without** underground connection

R_A mm Casing Ø	A mm	B mm	C mm	D mm ≥	b mm Width	t* mm Depth ≥
75	150	100	150	250	550	575
90	150	100	150	250	580	590
125	150	100	150	250	650	625
160	180	100	150	250	780	660
200	180	100	150	250	860	700

The minimum cover (C+D) is valid without having taking into account the traffic load. Loading up to SLW60 according to DIN 1072 when covered at minimum 900mm. The static calculations of buried pipes are according to ATV-DVWK-A127.

Laying Microflex Pipes in Soil

Microflex pipes are rolled up for easy storage and transport. As a result of this rolling up, the pipes are under mechanical stress. Please take care that untethered pipe ends don't whip back when untying the textile straps. Given that all windings are individually bound, we strongly recommend removing every strap sequentially to gradually release the inbuilt tension rather than removing them simultaneously.

The pipes may be laid into the trench directly from the coil. This may only be done by pulling the carrier pipes (never pull the casing). When laying larger dimensions and lengths, pulling devices such as winches or tail-end rollers may be used. Always connect these devices to the carrier pipe.

Carefully place the Microflex pipeline on a compacted 10cm bed of sand on the bottom of the trench. The sand bed must be evenly laid to provide uniform support for the pipeline. This has a decisive influence on the compressive stress of the piping system. Take care that the pipe is not dragged along the ground or is damaged by sharp objects (in order to prevent damage to the outer casing). The bending radii (see Product Range, section 2.1) must not fall below the prescribed minimum either during installation or in the final position of the pipeline. Pipes must be laid in a serpentine course in order to minimise the expansion/contraction forces on the pipe. In order to keep the pipes in position during laying, cover them at regular intervals with sand.

Horizontal Directional Boring (HDD)

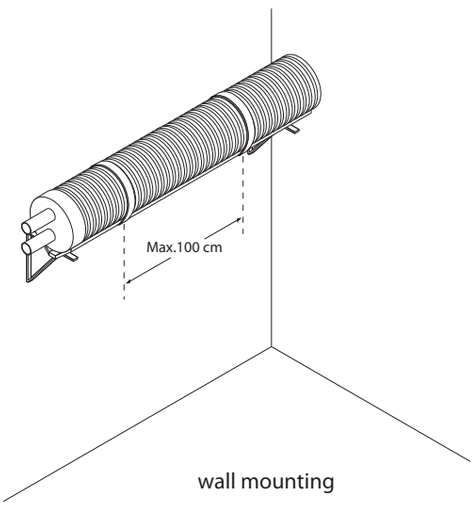
Horizontal Directional Boring is used for crossing waterways, roadways, congested areas, and areas where other methods are costlier or not possible or practical. The technique consists of making a borehole and pulling the Microflex pipeline through.

For the correct process of Horizontal Directional Boring we refer to the guidelines of this technique.

Before pulling the Microflex pipeline through the borehole there are some points of attention:

- Drill hole Diameter. Increase the reamer's diameter according to the outer diameter of the Microflex pipe to achieve an optimal result.
- Connecting. When coupling the Microflex pipe to the reamer, ensure that both the PE-Xa carrier pipe and the outer casing are fastened.
- Pulling. It is important that the piping is ready in its entirety so that the pulling through can happen in one smooth, fluid movement. For this we recommend to remove every nylon strap and to unroll the pipe completely. Rotation or twisting of the pipe during the pulling operation must be avoided at all cost. This way no torsional forces will be exerted on the piping.
- Traction forces. The Maximum pulling forces for the different PE-Xa medium pipes are given in the table below. Attention: these values are for UNO models only. For DUO models, please double the value.

Outer Pipe Diameter UNO	Maximum Traction Forces per Pipe (kg)
25	150
32	200
40	300
50	400
63	400
75	400
90	400
110	400
125	400



wall mounting

3.4 Mounting onto Walls or Ceilings

For this purpose, the pipe must be supported every meter along its entire length because of its inherent flexibility. To avoid sagging, the pipe must be tied with straps to a supporting structure.

3.5 Guidelines for Pipe Laying on the Ground Surface

If the pipeline is laid on the ground, points of support must be provided to prevent slipping away. All objects on the ground that may cause damage to the outer casing of the pipe need to be removed. On uneven ground, the pipe should be tied at intervals of about 25m, and care must be taken to ensure that the pipes are well supported. For this purpose a supporting structure can be set up.

Attention: Our pipes have limited UV resistance. Therefore it is necessary to protect the pipe against UV-radiation when they are laid at their final aboveground placement. Please contact us for alternative options.

3.6 MICRO SEAL Wall Feedthrough (Subterranean Use)

The pre-drilled hole in the wall must correspond to the minimum and maximum dimensions, mentioned in the table below. Loose particles must be removed and the drilled hole must have a smooth bore to obtain an optimal seal.

Micro Seal	Outside Casing d_{out}	Wall Opening	Torque Nm
Art. No.	mm	mm	Max.
7LS300	75	110 - 112	6
8LS300	90	130 - 132	6
6LS325	125	180 - 182	6
7LS475	125	200 - 202	20
13LS300	160	200 - 202	6
9LS325	200	250 - 255	6
8LS400	200	280 - 282	20

Make sure that a straight section of the outer casing of at least 60cm is maintained before and after the feedthrough (no bends allowed). This will help with the feedthrough sealing and stability of the pipe.

Clean the Micro Seal and the outer casing before assembly. Any contamination can have an adverse impact on the sealing between the casing and Micro Seal chains, with water intrusion as the worst result. Also check that the stainless steel bolts threads have been lubricated with copper grease in order to avoid the risk of galling.

When applying the Micro Seal chains around the outer casing check the distance between the different pressure plates is uniform to ensure an even stress distribution on the pipe.

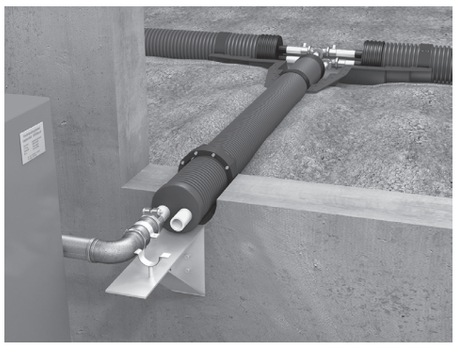
To prevent over-torqueing of the bolts, don't use electrical tools. For further information, refer to the Operating Instructions, section 4.1.

3.7 MMDV Wall Feedthrough (Surface/Above Ground Use)

This wall sleeve consists of a corrugated HD-PE pipe and a shrink sleeve. The corrugated HD-PE pipe can be either cemented into concrete or mortared into the wall opening (the correct sizes can be found in the table below).

Approximately 100mm of the corrugated pipe must protrude to the outside in order to seal the pipe with the Microflex shrink sleeve. Attention: the wall thickness must be less than or equal to 400mm. When heating the shrink sleeve, take care not to burn/damage the outer casing or the shrink sleeve.

	Pipe with Casing d_{out}	Wall Feedthrough Pipe d_{out}	Wall Hole
Art. No.	mm	mm	mm
MMDV75/90	75 - 90	110	210
MMDV125	125	160	260
MMDV160	160	200	300
MMDV200	200	235	350



3.8 Securing the Pipe

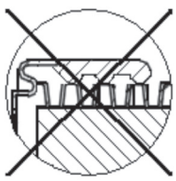
The ends of a pipe network will be (usually) located inside a building, connected to a source or user. A dust cap provides for a dust tight closure of the pipe.

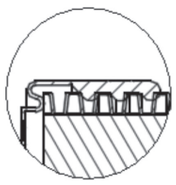
As the carrier pipes are constantly subjected to a double-action force (thermal and longitudinal expansion/contraction), it is necessary to anchor it to a support system using fixing points. Fixing points limit the effects of these forces. Non-usage of these fixing points can lead to serious damage to the pipe network and to the connection with the source or user. **The use of fixing points is mandatory for warranty eligibility.**

3.9 Shrink Caps Type MK

A shrink cap prevents ingress of water between the outer casing and the insulated carrier pipe. After being slipped over the carrier pipe and the outer casing, it can be warmed up for fixation around the pipe. Use a heat gun or mini torch to gently shrink the cap.

Attention: Using too high a temperature can damage the shrink cap or casing.





3.10 EPDM Rubber End-Caps

Use the correct tool for the cutting of the EPDM Rubber end-cap (sharp knife or scissors). Under no circumstances should the end-cap be sawn. The cut should be straight and neat. Damages, like splits or tears on the cut section, can cause leaks.

Use only water for cleaning or wetting the end-cap or pipe. The use of a lubricant (soap, grease or oil) can cause damage to the various parts.

The three seal ridges must grip into the ridges of the outer casing in order to obtain a watertight seal.

3.11 Couplings

A properly installed coupling is essential in the Microflex Pipe system. The following points need to be adhered to obtain a correct mounting:

- Cutting of the PE-Xa Carrier Pipe. It is essential to cut the PE-Xa pipe at a right angle with a pair of PE-X scissors or a pipe cutter. The PE-Xa carrier pipe needs to touch the flange of the coupling completely in order to have a good seal. If this is not the case (because of a sloping cut or because the support pipe is not inserted sufficiently), a watertight seal cannot be guaranteed.
- Deburring of the Cut PE-Xa Carrier Pipe. It is essential to deburr every cut carrier pipe with an appropriate tool. Residual burrs cause extra friction in the pipe during assembly of the couplings and swarf from inadequately cleaned pipe end-cuts may cause pressure loss through poor sealing. Other components, such as heat exchangers, may also encounter problems when deburring and swarf removal is not properly done.
- Pay Attention to the Direction of the Clamping Ring. Ensure that the notch on the inside of the clamping ring is facing the fitting. If not, the coupling won't be leak tight.
- Stainless Steel Bolt, Nut and Washer. Always use a stainless steel bolt, nut and washer for tightening the coupling and make sure that they are lubricated with copper grease. Non-usage of copper grease can lead to galling of the bolts with leakage as a result of incomplete tightening.
- Watertight Sealing. After half an hour, one must again re-tighten the bolts in order to ensure a watertight seal.
- Pressure Test. The pressure test procedure is obligatory before closing the trench

3.12 Self-Regulating Heating Cable

Cable Preparations

Use a sharp cutter (Stanley knife) to score the outer insulation sheath of the heating cable to bare the conductor cables. Take care not to damage the conductor cables themselves.

The heat-shrink sleeves are applied with a heat source (hot air gun or equivalent). Ensure the heat is applied uniformly to obtain a good seal. Using too high a temperature can damage the cable insulation.

Always insulate the end of the cable. Under no circumstances should the two connectors be allowed to touch one another. A short-circuit will occur otherwise.

The operation of the heating cable is explained in the Appendix, section 5.11.

Connections

When connecting the heating cable to the mains power via the MVTH and MVBOX, the electricity must be turned off before connecting the various conductors. This way the risk of electrocution is avoided.

Keep in mind that the MVTH can operate a heating cable with a maximum total length of 100m. If this length is exceeded, the operation of the thermostat can no longer be guaranteed. The cable would be heating irregularly, with potential large losses as a result.

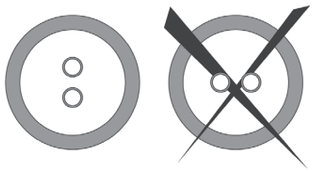
Connect the corresponding conductors and earthing with each other inside the MVBOX. To check that the conductors/earthing are securely clamped, pull the insulation of the conductors/earth using pliers.

The attachment of the MVTH and MVBOX must be performed according to the included installation instructions.

3.13 Insulation Kits

The following insulation sets are available:

- Insulated Straight Coupling kit
- Insulated T-piece kit
- Insulated Double T-piece kit
- Insulated Elbow 90° kit
- Insulated Y-Connection kit



When connecting a Microflex DUO pipe with one of the above listed insulation kits, it is recommended to position the pipes in a vertical orientation. This method makes the assembly of the terminal connections in the casing much easier.

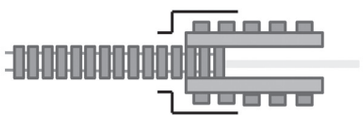
When supplying the insulation kits, both insulation halves are already connected via screw connections. Before separation, the shells can be cut along a chosen line to obtain the desired diameter. Cutting needs to be done in a straight line to avoid any chance of leakage.

The correct mounting of type MK shrink caps (see section 4.3) will minimise the chance of leakage. The use of MK heat shrinkable caps is compulsory to be eligible for the warranty. Instructions for the assembly of the couplings can be found in sections 3.11 and 4.5.

Cut the bitumen strips to suit the pipe casing outer diameter. Before applying, check that the outer casing is dry to ensure a good contact. After cutting to the desired size, apply the bitumen strips around the carrier pipe. Make sure that the connections are properly covered.

Before placing a pipe in one of the shells, ensure sealant is applied to the grooves as described in the instructions in section 4.7. Apply the sealant uniformly along the flanges on the top and bottom of the casing before tightening the stainless steel bolts. It is extremely important that the insulation kits are properly sealed. Depending on the chemical composition of the soil, rising groundwater may be slightly acidic and therefore mildly corrosive. The ingress of this groundwater could eventually cause corrosion of couplings, sleeves, connections etc. and might lead to leakages.

MR24116075



When using a (double) T-piece with an outer casing diameter of 160mm to an outer casing diameter of 90 or 75mm, one can use the MR24116075. This set comprises an outside casing (160mm) with interior insulation (but no carrier pipe) and a shrink sleeve (type MK2500). The reducer is pressed into the insulated T-piece kit.

Slide the shrink cap over both protruding ends, ensuring that both are well covered. Use a torch or hot air gun to slowly heat the shrink cap. Make sure to use the heat gun on a medium heat setting to gently shrink the sleeve half over the insulation kit and half over the MR reducer kit.

3.14 Inspection Chamber

This inspection chamber unit can be used as an alternative to our insulation kits. It is equipped with 6 marked entries. Each of them can be cut off to suit various opening sizes (125, 160 or 200mm). The installation and points of attention are as for the insulation kits.

After installing the chamber and completing the pipe connections it is recommended to remove the manhole cover and perform an internal inspection of the installation. It is also recommended to connect shut-off valves to allow for future alterations to the pipe network.

Obviously one must take precautions to prevent water infiltration in order to minimise wear and corrosion of the different internal parts. Shrink caps and couplings need to be installed in the proper way (see sections 4.3, 4.4, and 4.5).

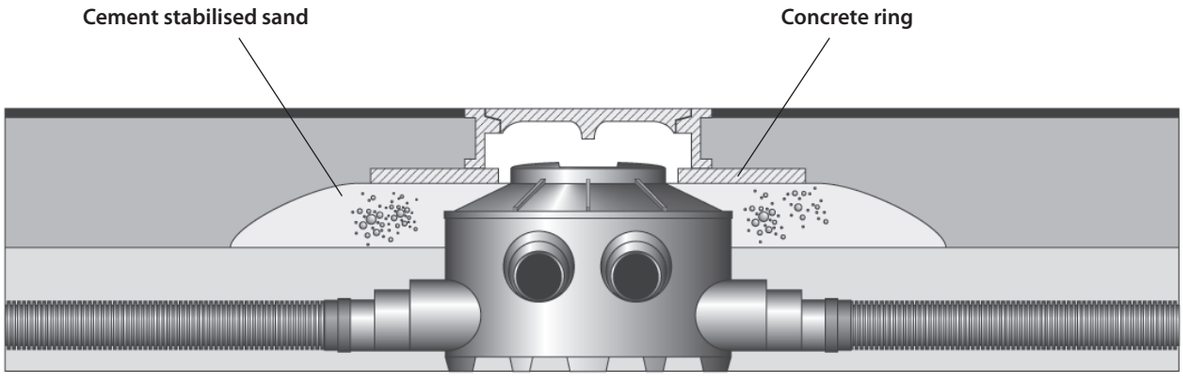
Before closing the inspection chamber, make sure that all pipe connections and fittings are secure. It is necessary to uniformly apply sealant to the upper edge of the chamber body part at a thickness of about 10mm by 10mm wide before affixing the cover. This will prevent any water infiltration. The pitched top is secured on the body part by use of 6 stainless steel bolts. The threads of the bolts need to be lubricated with copper grease before tightening. This is to prevent galling. Once the pitched top has properly been installed, the lid can be carefully turned clockwise. Do not damage the black gasket between body and top cover. Do not use excessive force when tightening the bolts.

The carrier pipes can exert lateral forces on the inspection chamber due to expansion/contraction. These forces may result in a slight deformation/movement of the chamber. Therefore it is recommended to provide additional concrete reinforcement to the edges/sides of the chamber.

If the chamber is subject to a high traffic load, it is recommended to provide appropriate additional concrete reinforcement. These concrete slabs or rings must be placed on a bed of stabilised cement (see picture below).

ATTENTION:

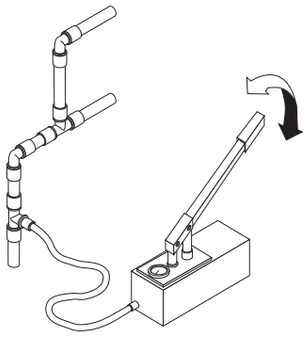
Consider local frost depths when determining the minimum coverage.



3.15 Pressure Test

Pressure test according to DIN 1988 Part 2

The pressure test procedure is <u>obligatory</u> before closing the trench. The report of this test , fully completed and signed, has to be send to our production plant.



1. **Pressure test**

   constitute contractually agreed auxiliary work essential to the accomplishment of the contract and also form part of the contractor's performance without being stated in the performance specification. Prior to concealing, fill the finished pipework with water, taking care to avoid air locks. The pressure test must be conducted in two parts, starting with the preliminary test, followed by the main test.

2. **Preliminary test**

   The preliminary test involves applying a test pressure equal to 1.5 times the admissible operating pressure. This pressure must be regenerated twice within the space of 30 minutes at intervals of 10 minutes. Following a rest period of at least 30 minutes at full pressure, the test pressure must not have fallen by more than 0.6 bar (0.1 bar every 5 minutes). Leakages must not occur at any point in the system being tested.

3. **Main test**

   The main test has to be conducted immediately after the preliminary test. The test takes 2 hours. At the end of this period, the test pressure recorded after the preliminary test must not have fallen by more than 0.2 bar. Leakages must not occur at any point in the system being tested.

In order to validate the pressure test, send the report to:

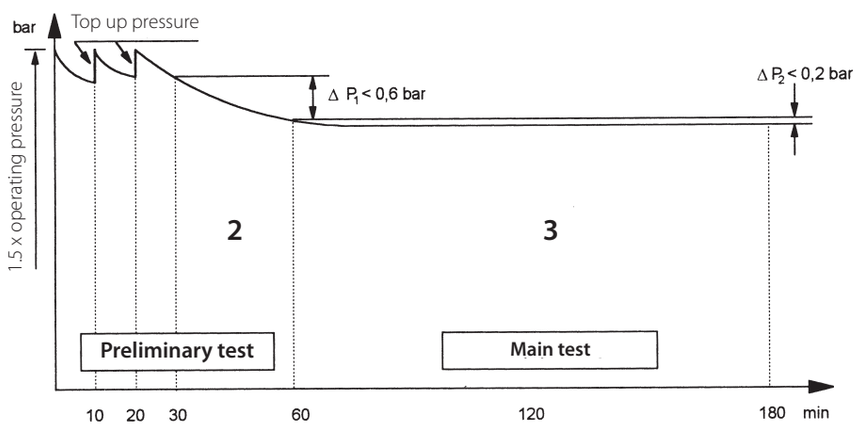
WATTS INDUSTRIES S.r.l.
Via Vienna 3
I-38121 GARDOLO
ITALIA

Fax: +39 0461 96 55 50
Mail: microflex@wattswater.com

2	**Preliminary Test**	bar / psi
2.1	Operating pressure x 1.5	
2.2	After 10 min (restore 2.1)	
2.3	After 20 min (restore 2.1)	
2.4	After 30min	
2.5	After 60 min admissible pressure drop < 0.6 bar	

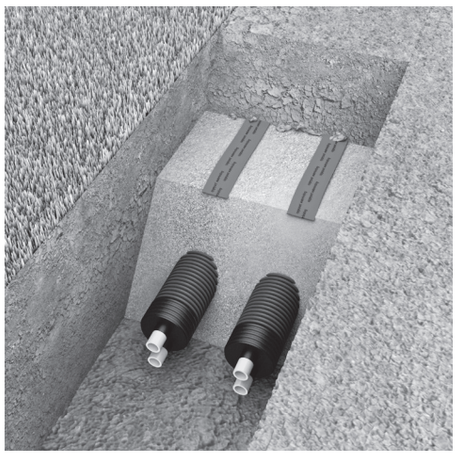
3	**Main Test**	bar / psi
3.1.1	Beginning	
3.1.2	End	
3.2	Test pressure	
3.3	After 120 min	
3.4	Admissible pressure drop < 0.2 bar	

Leakage Testing - DIN 1988



Test the finished pipe-work before concealing! The correct execution and documentation of the pressure test for the entire piping system are requirements for the warranty.

To ensure that the underground network is completely watertight, we advise you to heat the system at 85°C for one hour, regularly checking that the connections are secure. Let the system cool down to 20°C before conducting a final check of all pipe connections.



3.16 Backfilling Guidelines

Before the trench can be filled, the entire pipe system with all its connections has to be **pressure tested** (see section 3.15). **The correct implementation and documentation of the pressure test are requirements for the warranty to be valid.**

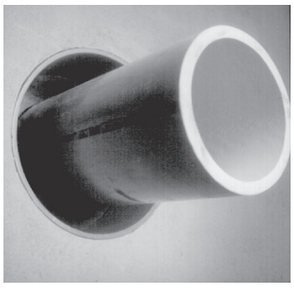
Make sure that the pipes are fully covered with sand (granular range of 0-3 mm). Backfilling should be in layers of about 20 cm and compacted by hand. Care should be taken to remove any sharp objects from the backfill material. When the backfill depth is about 50cm above the top of the pipe, a vibrating tamper may be used to compact the remainder of the soil (measured from the top of the pipe). There should also be a warning tape bearing the legend "water pipe" laid directly above the buried piping.

3.17 Before Usage

For hygiene reasons, we recommend rinsing all sanitary pipes for 15 minutes before use.

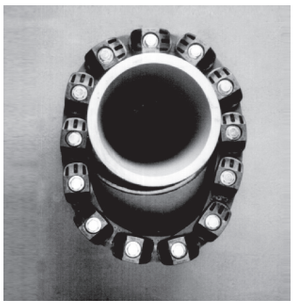
4. Operating Instructions

4.1 MICRO SEAL Wall Feedthrough (Subterranean Use)



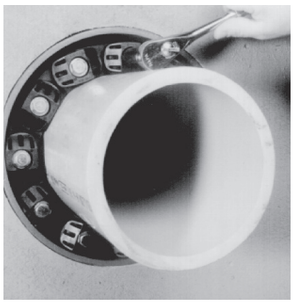
Centre the pipe in wall opening or casing. Make sure the pipe will be adequately supported on both ends. Micro Seal feedthrough seals are not intended to support the weight of the pipe.

Loosen the pressure plate bolts just enough so the links can move freely. Connect both sections of the feedthrough around the pipe.



Ensure all bolt heads are facing the installer. Extra slack or sag is normal. Do not remove any links if extra slack exists. Note: On smaller diameter pipe, links may need to be stretched.

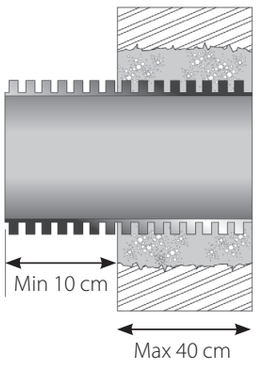
Slide the Micro Seal assembly into the annular space (ring-shaped cavity between the pipe and the wall). For larger size chains, start inserting the feedthrough at the 6 o'clock position and work both sides up toward the 12 o'clock position in the annular space.



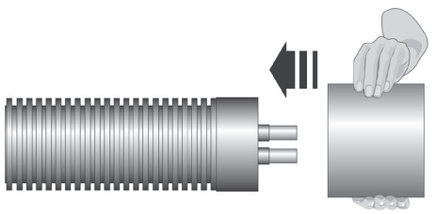
Manually tighten using a spanner or wrench only. Do not tighten any bolt more than 4 turns at a time. Tighten the bolts in a crisscross pattern or sequence until all bolts have been uniformly secured. Repeat this after a couple of hours to ensure long-term tightness of the bolts.

4.2 MMDV Wall Feedthrough (Above Ground/Surface Use)

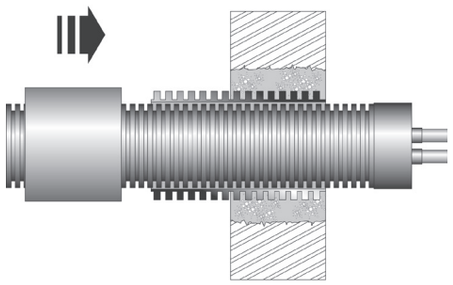
This wall feedthrough consists of a corrugated pipe casing and a shrink sleeve.



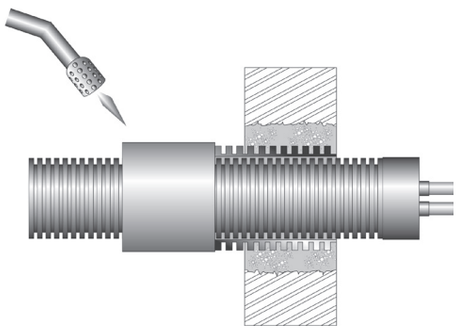
Brick the corrugated casing in so as to protrude about 10cm out from the wall.



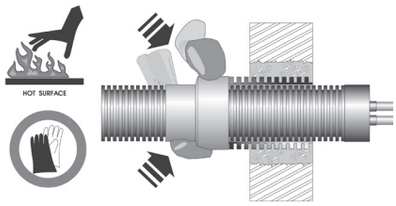
Slide the shrink sleeve over the Microflex pipe.
NEVER CUT THE SLEEVE LENGTHWISE.



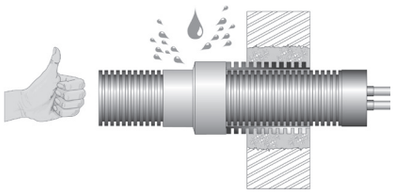
Push the Microflex pipe through the bricked in corrugated casing.



Use a heat gun to gently shrink the sleeve half onto the corrugated pipe and half onto the casing of the Microflex pipe.



Manually press the sleeve onto the casing and corrugation whilst wearing protective gloves.

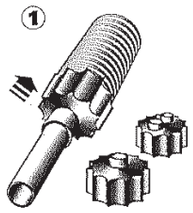


The wall feedthrough is now ready.

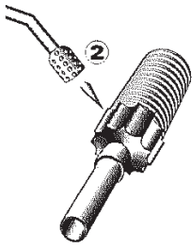
	Microflex Pipe with Casing d_{out}	Wall Feedthrough Pipe d_{out}	Wall Hole
Art. No.	mm	mm	mm
MMDV75/90	75 - 90	110	210
MMDV125	125	160	260
MMDV160	160	200	300
MMDV200	200	235	350

Tel. + 32 (0)16 44 21 31 • Fax + 32 (0)16 44 03 68
sales@wattsinsulation.com • www.microflex.be • www.wattsinsulation.com

4.3 Shrink Caps Type MK



1. Slide the cap over the carrier pipe and the casing.



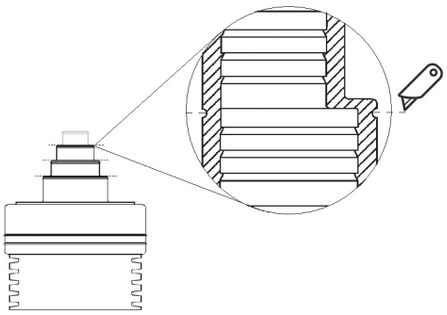
2. Use a heat gun to gently shrink the cap.

3. Press the cap onto the carrier pipe whilst wearing protective gloves.

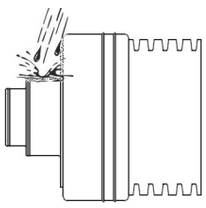
4. The tail end of the pipe is now sealed watertight.

Tel. + 32 (0)16 44 21 31 • Fax + 32 (0)16 44 03 68
sales@wattsinsulation.com • www.microflex.be • www.wattsinsulation.com

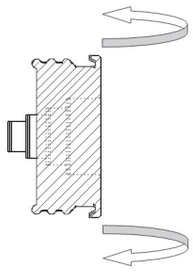
4.4 EPDM Rubber End-Caps



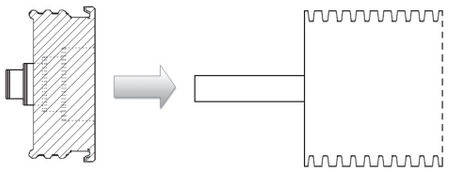
Cut the sleeve for the carrier pipe at the appropriate place (see expanded diagram). Use the correct tool for the cutting (sharp knife or scissors). The cut has to be straight and neat to ensure tightness of the rubber end-cap. Damages, like splits or tears on the cut section, can cause leaks.



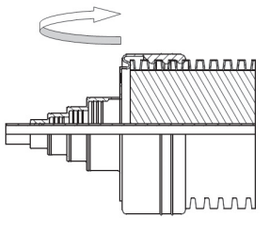
The pipe ends and the rubber end-caps must be cleaned only with water before installation.



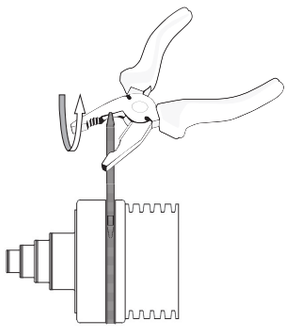
Fold the sealing sleeve back.



Put the rubber end-cap over the carrier pipe and push it against the insulation. If needed, wet the carrier pipe with water. Do not use soap, grease or oil for lubrication.



Pull the sealing ridges onto the outer casing of the pipe. The three seal ridges must grip into the ridges of the outer casing.



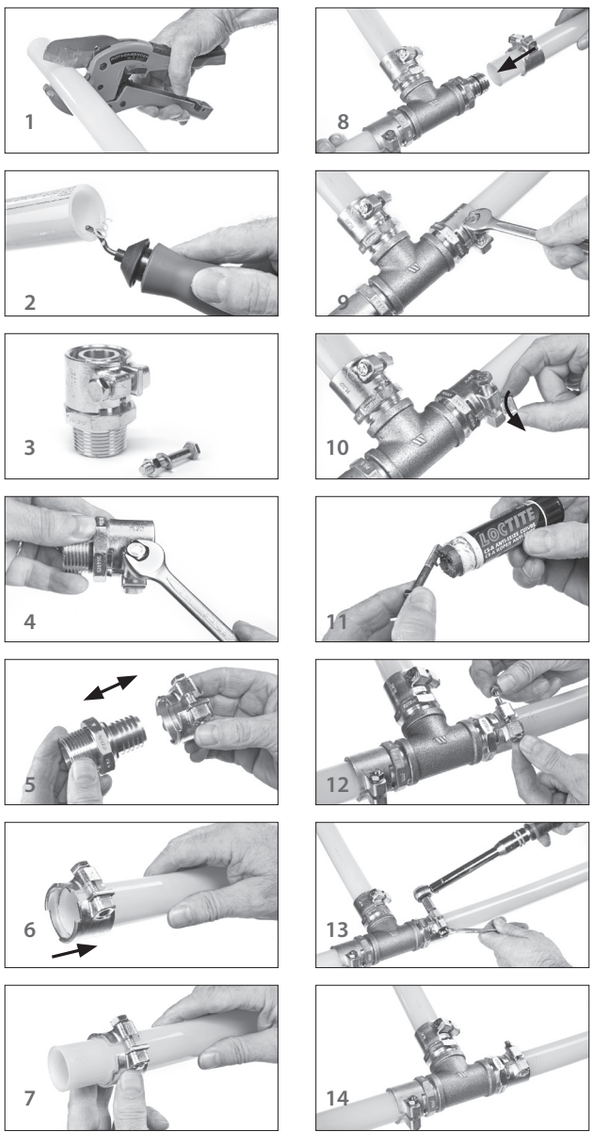
Insert the provided tie wrap between the two rings. Pull the end of the tie wrap with a rotating movement tight around the cap using universal pliers.

4.5 Microflex PE-X Couplings

Microflex PE-X connections are professional fittings for central heating and sanitary applications. They are available as a straight coupling with male thread:

- In 25 to 125 mm sizes for a maximum pressure of 6 bar (Central Heating)/ 16 bar (cooling)
- In 20 to 63 mm sizes for a maximum pressure of 10 bar (Sanitary)

Microflex PE-X terminal connections can be combined with a variety of threaded fittings to make tees, elbows and other ancillary connections.



Assembly instructions

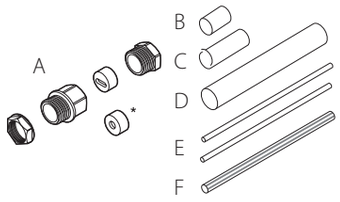
1. Cut the PE-X pipe at a right angle with a pair of PE-X scissors or a pipe cutter.
2. Deburr the pipe with an appropriate tool.
3. The clamping ring is loosely attached to the coupling.
4. Turn the bolt slightly clockwise in order to remove the clamping ring.
5. Remove the clamping ring.
6. Slide the clamping ring over the pipe. NB! DO NOT rotate the clamping ring.
7. Ensure that the notch on the inside of the clamping ring is facing the fitting.
8. Push the pipe COMPLETELY over the coupling. Slide the clamping ring back to COMPLETELY cover the fitting.
9. Loosen the bolt.
10. Remove the bolt and the steel plate.
11. Put copper grease on the threads of the stainless steel bolt and nut.
12. Assemble the bolt, washer, and nut provided and tighten the clamping ring until it is watertight.
13. Retighten the bolt and nut after half an hour.
14. Inspect all fittings for security and correct positioning.

NB:
Please make sure to lubricate the threads on the bolt, as well as the nut, with some copper grease.

4.6 Self-Regulating Heating Cable

For Microflex COOL pipes with self-regulating heating cable you need a connection kit that consists of:

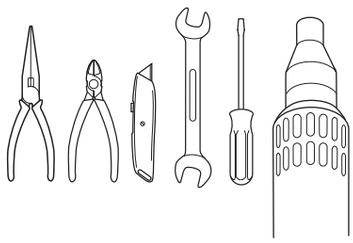
- MVKITGR for the cable preparations
- MVTH and MVBOX for the connection to the mains power



Cable preparations

The contents of the MVKITGR are necessary for the cable preparations. The kit contains:

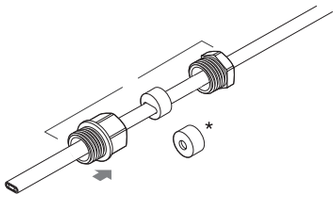
- 1 cable gland for connection to the MVBOX (A)
- 2 short heat-shrink sleeves to insulate the end of the heating cable (B+C)
- 1 long heat-shrink sleeve to insulate the heating cable to the connection (D)
- 3 heat-shrink sleeves to insulate the two heating cables and earthing cable (E+F)



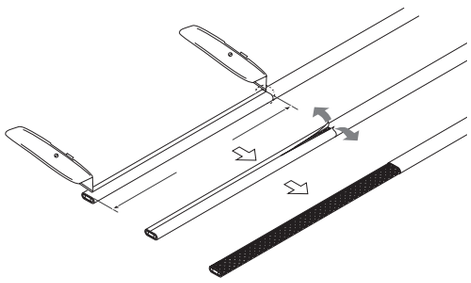
You also need to have the following tools at hand:

- Needle-nose pliers
- Side cutters
- Utility Knife
- Slot-head screwdriver
- Heat gun

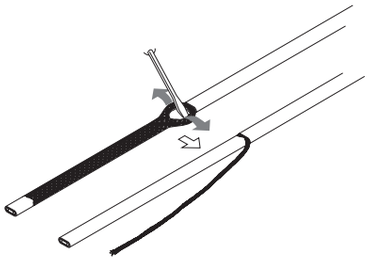
Cable Preparation for Connection to the MVBOX



Slide the different parts of the cable gland over the heating cable (A). See picture for the correct order. Connect the parts together and make sure they are tight.



Remove the outer sleeving over a length of 170mm. Take care not to damage the braiding.



Use a slot-head screwdriver to unravel braiding and twist together.

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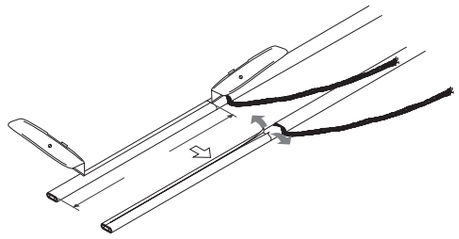
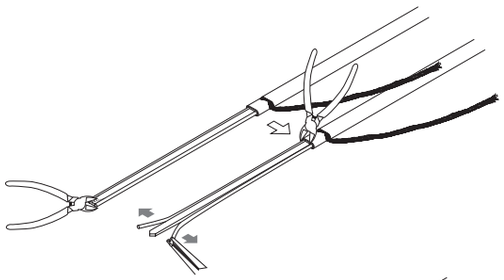
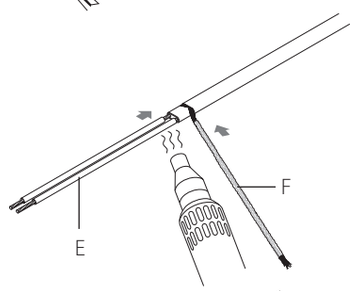


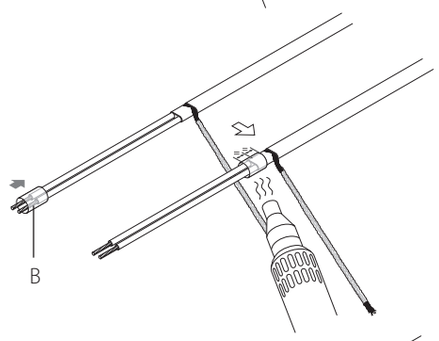
Score with a sharp utility knife and remove the electrical insulation over a length of 150mm. Take care not to damage the conductors.



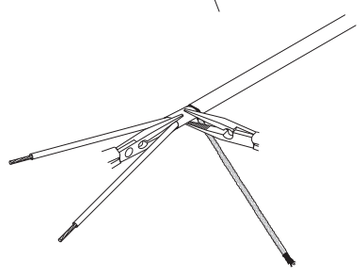
Use side cutters to expose the ends of both conductor cables from the core. Pull both conductors away from the insulated core with the use of needle-nose pliers. Remove the remaining core material. Take care not to damage the conductors.



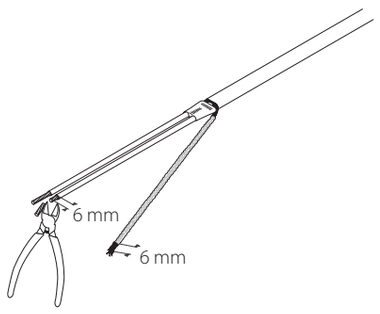
Slide the long heat-shrink sleeves (E) over the conductors and the twisted earthing braid (F). Carefully shrink with heat source (hot air gun or equivalent).



Position the short sleeve (B) over both conductors and outer jacket. Carefully shrink with heat source.



Pull both conductors outwards and squeeze the heat-shrink sleeve. If no adhesive appears reheat and re-squeeze.



Trim conductors to leave 6mm exposed.

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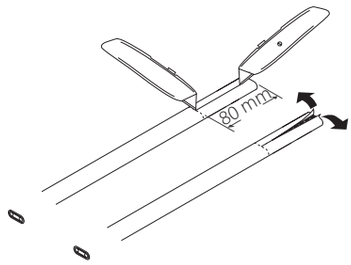
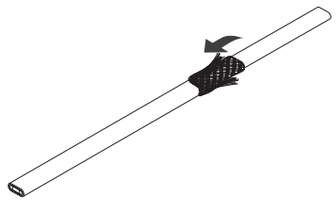
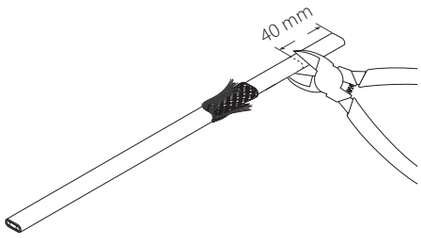
End Seal Installation



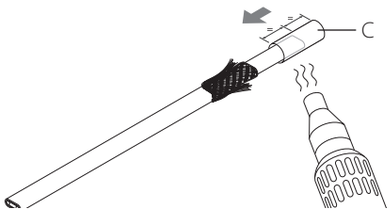
Remove the outer sleeving over a length of 80mm. Take care not to damage the protective braid.



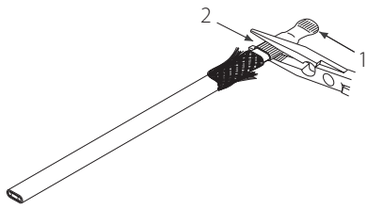
Push back the braid.



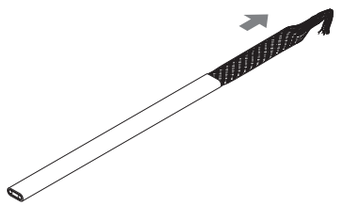
Cut off 40mm of the exposed heating cable.



Slide the short heat-shrink sleeve (C) partly over the heating cable (see picture). Shrink with heat source (hot air gun or equivalent).



Immediately squeeze positions 1 and 2 for 5 seconds, so that molten adhesive appears at the edges.



Pull braid back, gather strands and bend back over.

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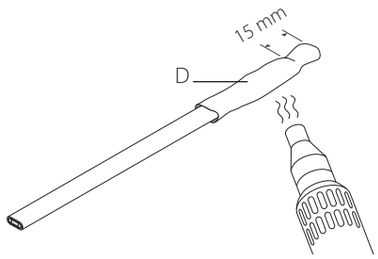
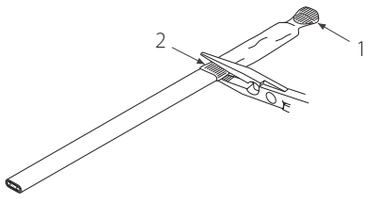
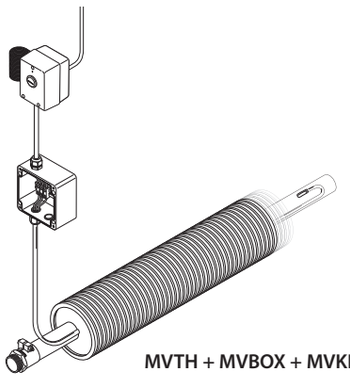


Position heat-shrink sleeve (D) over braid (leave 15mm sticking out) and shrink with heat source. Proceed immediately to the next step.



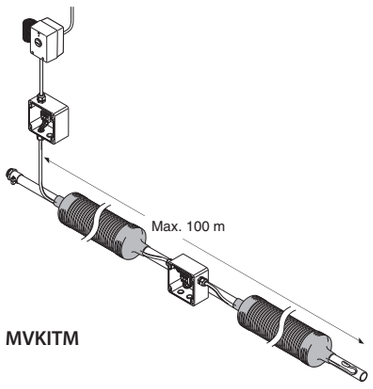
Squeeze positions 1 and 2 for 5 seconds so that molten adhesive appears at edges. If no adhesive appears reheat and re-squeeze.



MVTH + MVBOX + MVKITGR

Connection to the Mains

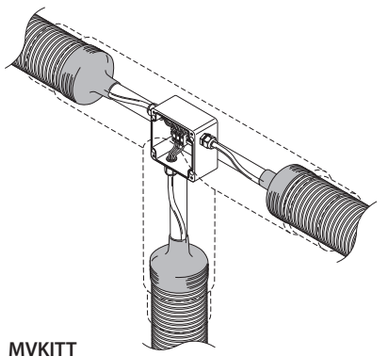
When all cable preparations are done, connection to the mains network can occur. A MVTH and MVBOX will be needed.



MVKITM

Connection between 2 Pipes

For the connection between two pipes, a MVKITM is needed. This kit consists of 1 x MVBOX and 2 x MVKITGR. The MVKITGR is used for the preparation of both heating cables. The MVBOX is positioned in between both pipes. Connection of electrical cables and earthing takes place in this box. The thermostat can control (a) heating cable(s) up to a maximum length of 100m.

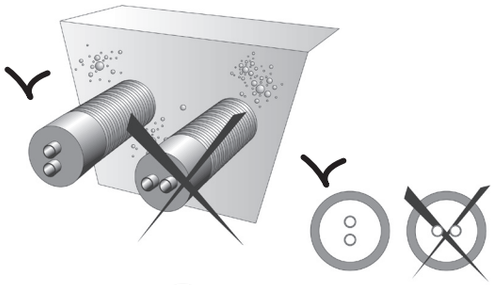


MVKITT

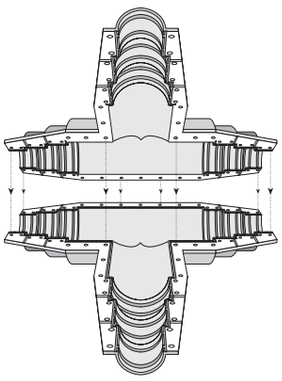
Tee Connection.

For a Tee connection, a MVKITT is needed. This kit consists of 1 x MVBOX and 3 x MVKITGR. The MVKITGR kits are used for the preparation of all heating cables. The MVBOX is positioned in between the three pipes. Connection of electrical cables and earthing takes place in this box. The thermostat can control (a) heating cable(s) up to a maximum length of 100m.

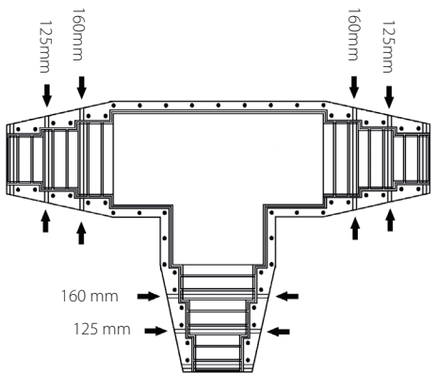
4.7 Insulation Kits



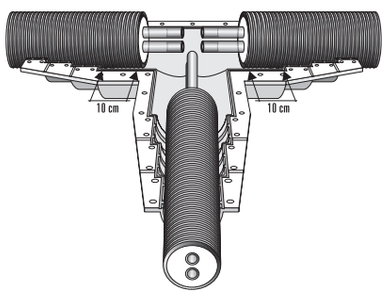
When a Microflex DUO pipe is to be connected in an insulated casing, we recommend positioning the pipes in a vertical orientation. This method makes the assembly of the terminal connections in the casing much easier.



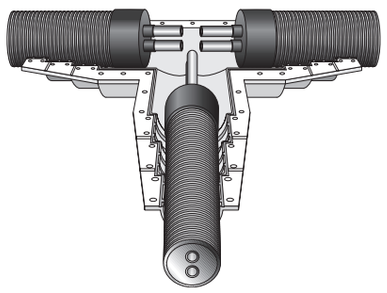
Holes in both shell-shaped casings (top and bottom are identical) are predrilled.



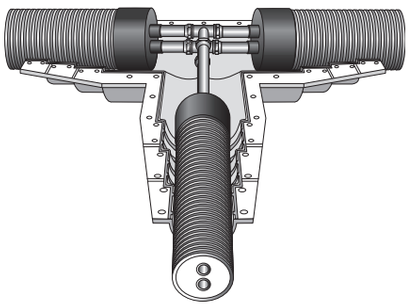
The casings are designed for enclosing pipe casings of either 125, 160 or 200mm in diameter or 75, 90 or 125mm. Shells can be cut along a chosen line thereby obtaining the desired diameter.



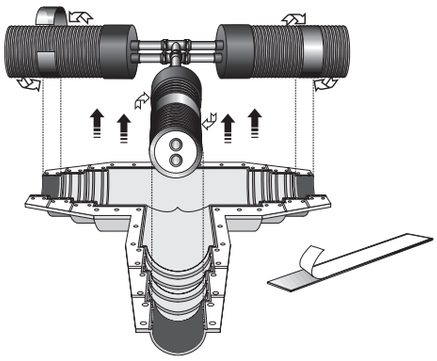
Strip a sufficient length of PE-Xa pipes of their insulation and casings (be careful not to damage the pipes) so as to put the terminal connection in the centre. Make sure that the pre-insulated Microflex pipe passes the 200mm mark by 10cm.



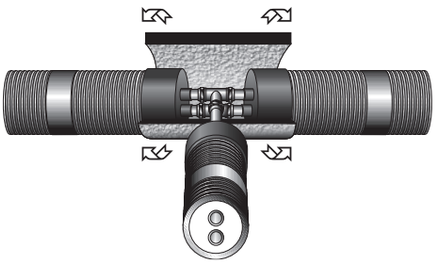
One of the two shells can be used as a template to define the desired distance between the carrier pipes.

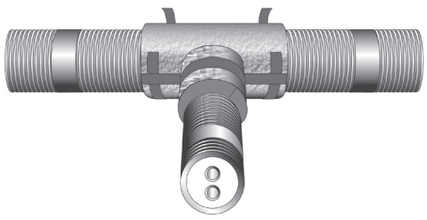


The use of MK heat shrinkable caps is mandatory to be eligible for the warranty.



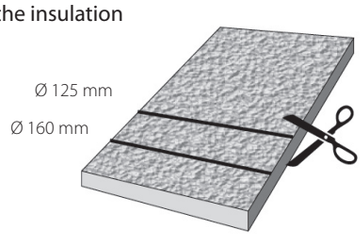
Cut the bitumen strips to suit the pipe casing outer diameter. Remove the protective layer and fit the bitumen strips to the inside of the insulation casings at the pipe entry points.

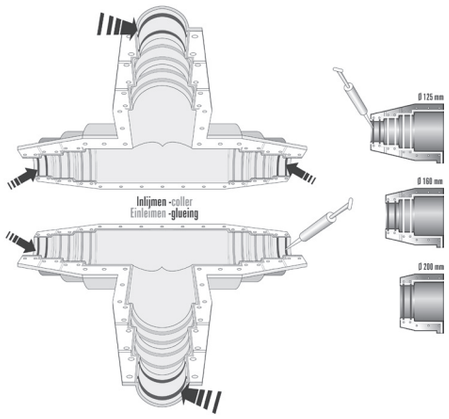




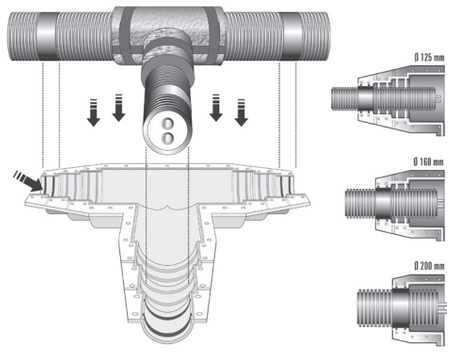
After the insulating blanket has been cut to the desired size, it can be wrapped around the carrier pipe so that the connections are properly covered. Tie with the supplied tape.

Cut the insulation

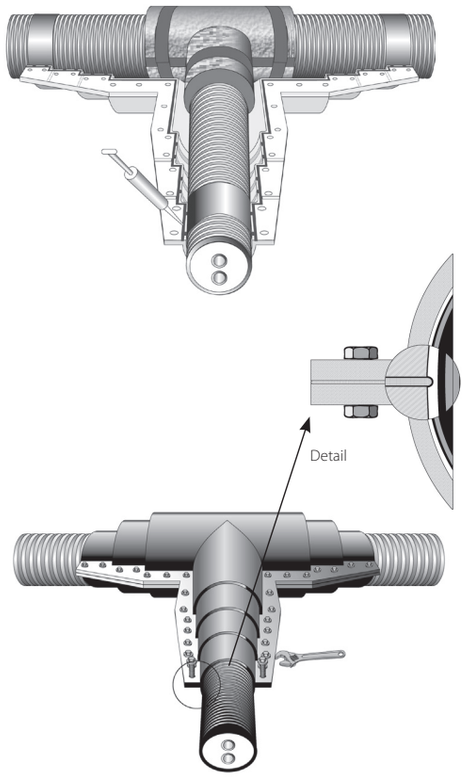




Apply the sealant uniformly to the grooves of both shell-shaped casings. We recommend a thickness of about 4mm and a width of 5mm.



Place the connected pipes into one shell-shaped casing.



Then apply the sealant uniformly along the flanges of the top and bottom casing (next to the drilled holes) to a thickness of about 6mm.

Take care to align the two shell-shaped casings correctly. Tighten the stainless steel bolts.

To ensure a watertight seal is made, check that the sealant is squeezed out through the lateral openings.

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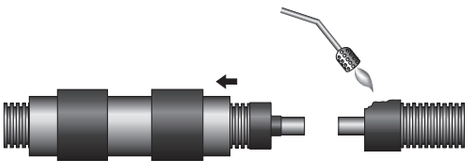
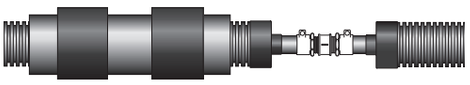
4.8 Insulated Straight Coupling Kit Type MM75 – MM200

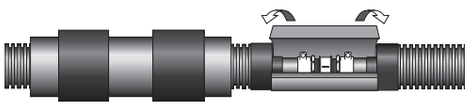
The set consists of 1 rigid sleeve and 2 heat shrinkable sleeves. Slide the rigid sleeve over the Microflex pipe.



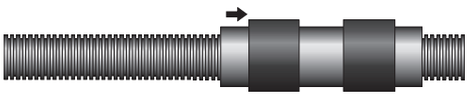
The use of MK heat shrinkable sleeves is mandatory to be eligible for the warranty.



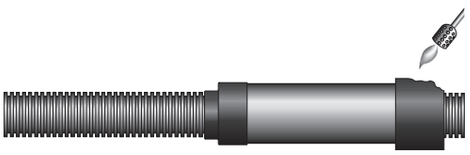
Secure the terminal connections.



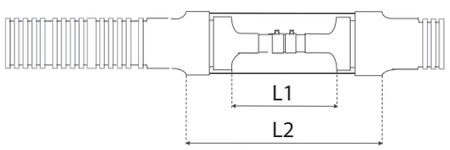
Wrap the insulating blanket around the carrier pipe so that the connections are properly covered. Tie with the supplied tape.



Slide the rigid sleeve back so as to enclose the connections.



Use a heat gun or mini torch with soft yellow flame (do NOT use a blue flame) to gently shrink both sleeves half onto the rigid sleeve and half onto the casing of the Microflex pipe.



Art. No.	L1	L2
MM75	220	600
MM90	220	600
MM125	260	850
MM160	350	1000
MM200	400	1000

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4.9 Inspection Chamber

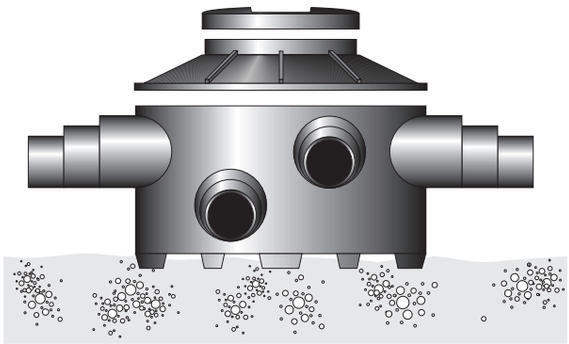
This inspection chamber unit can be used as an alternative to our MM, MT, MDT or MBR casings. It is equipped with 6 marked entries. Each of them can be cut off to suit various opening sizes (125, 160 or 200mm). Several connections can be made in this unit. It can even house shut-off valves.

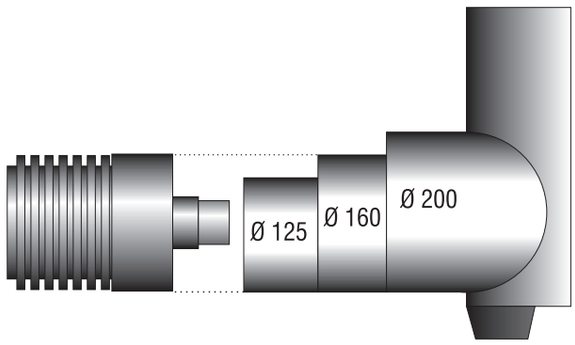
The unit comes with a top lid, stainless steel bolts, a sealing kit and an instruction leaflet.

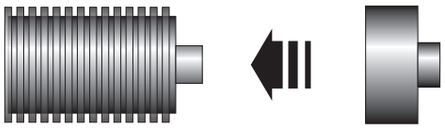
The following steps describe making a successful waterproof connection.

Installation

Entries are marked and are to be cut off to suit the desired opening sizes. Carefully lower the inspection chamber on a bed of sand, free of sharp objects.



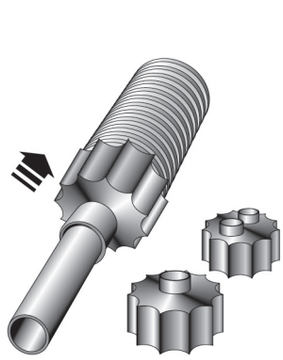




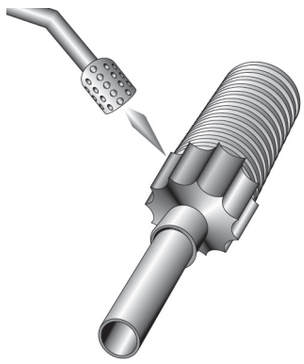
Connection

Before the pipes are connected in the inspection chamber, slide a shrink cap (MK model) over the casing and the carrier pipe. Use a heat gun or mini torch with soft yellow flame (do NOT use a blue flame) to gently shrink the cap.

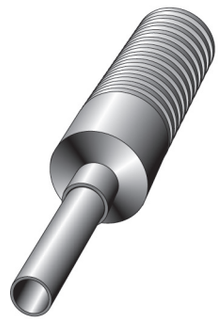
The use of MK shrink caps is mandatory.



❶



❷



❸

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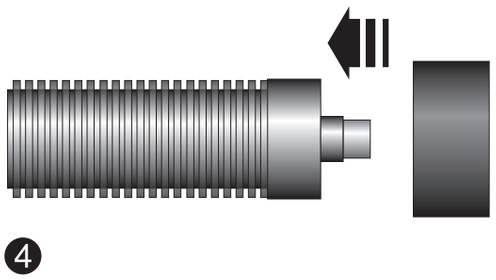
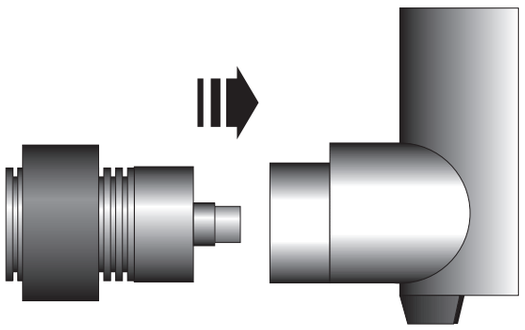


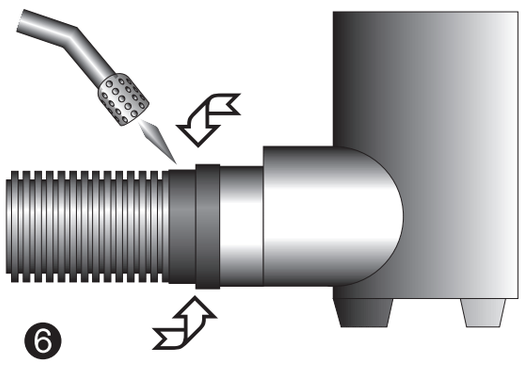
4

Slide a shrink sleeve (MHM model) over the casing prior to positioning the Microflex pipe in the inspection chamber.



5

Make all the necessary connections in the chamber.



6

Gently shrink the MHM sleeve onto the casing using a heat gun or mini torch to ensure a waterproof connection between the casing and inspection chamber.

The use of MHM shrink sleeves is mandatory.

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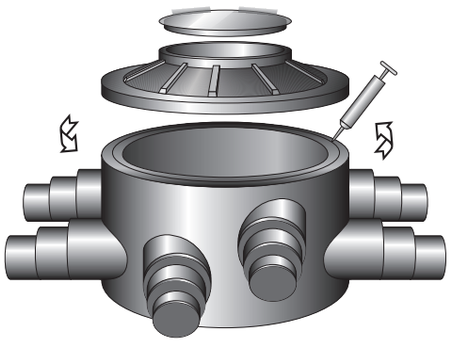
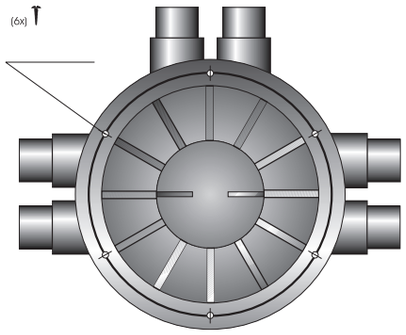
Sealing of Inspection Chamber



Apply sealant uniformly to the upper edge of chamber body part to a thickness of about 10mm and a width of 10mm.

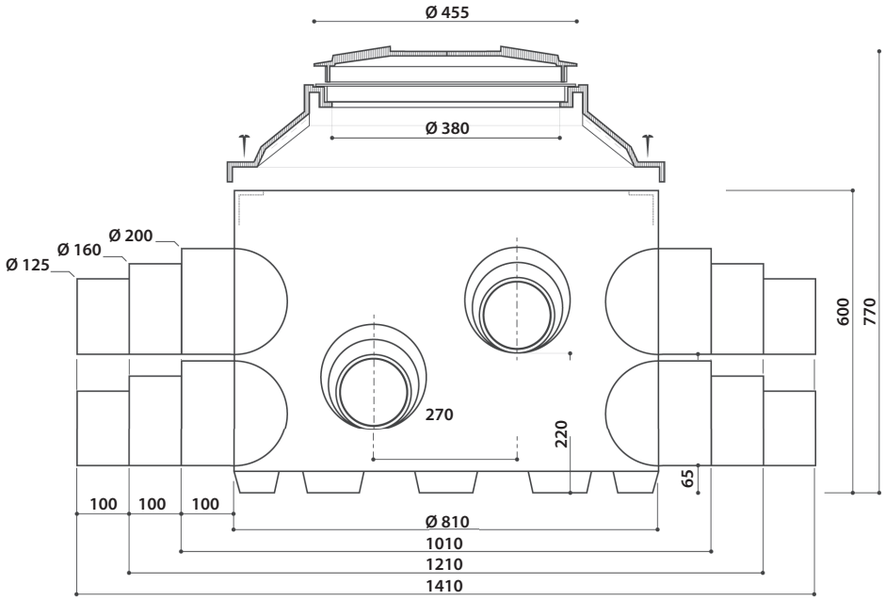


Place the pitched top on the body part. Tighten the 6 stainless steel bolts.

Carefully turn the lid clockwise. Do not damage the black gasket between body and top part.

Do not use excessive force.

Dimensions



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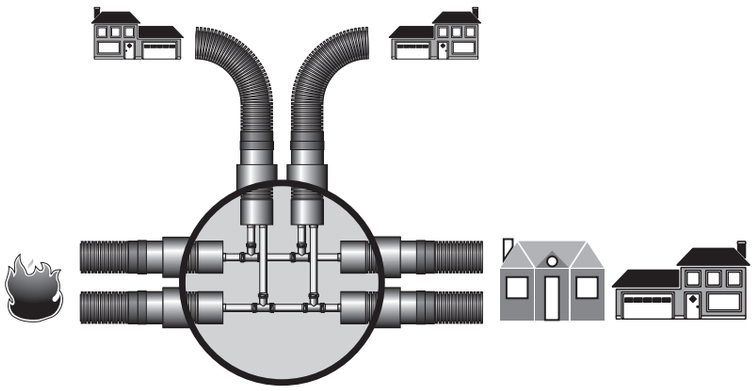
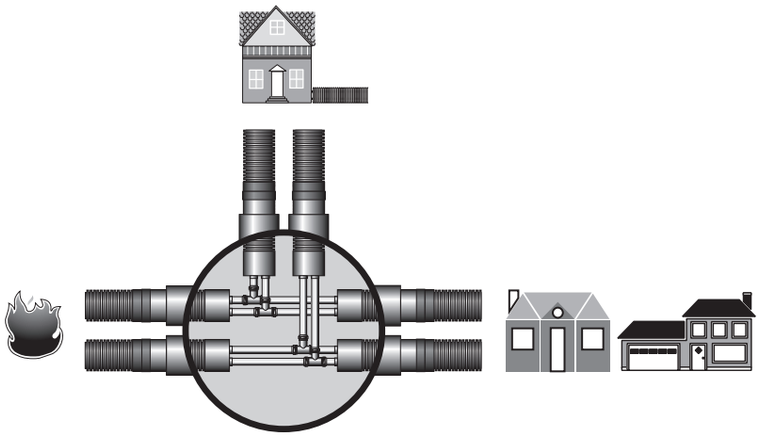
Branching Possibilities

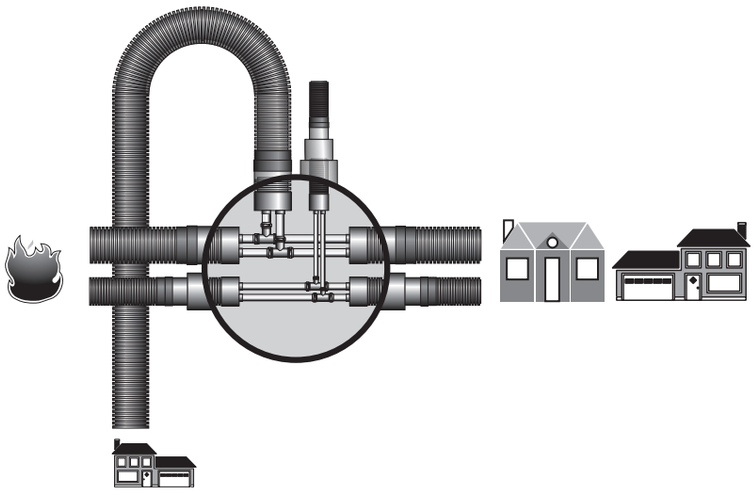
The inspection chamber, made of shock-resistant polyethylene, is very solid. It offers the possibility of:



- Branching from UNO to DUO pipes



- Branching from DUO to DUO (be it or Sanitary)



- Branching of several DUO pipes having various diameters

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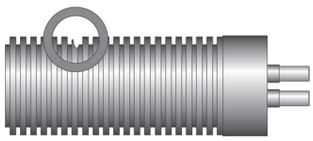
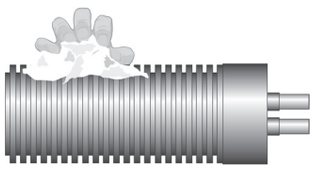
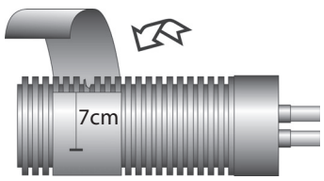
4.10 MHK 150 Cold-Applied Wrapping Tape

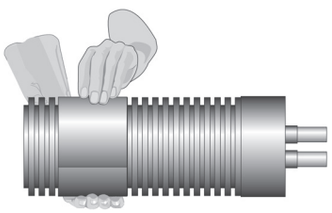




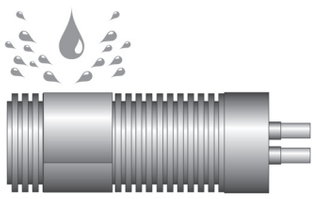
Make sure the casing of the pipe is dry and clean.



Wrap the tape around the damaged casing, overlapping each preceding layer by about 7cm (press slightly).



Press firmly around the pipe casing.

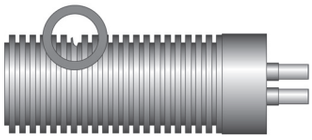


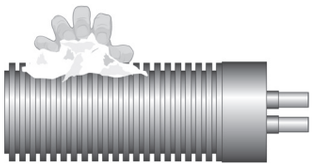
The damaged pipe casing is now repaired.

For an outer casing having

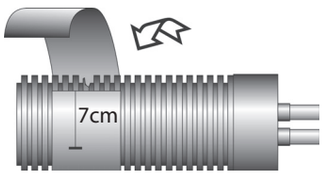
A diameter of	75 mm	use a length of	305 mm
	90 mm		355 mm
	125 mm		465 mm
	160 mm		575 mm
	200 mm		700 mm

4.11 MHB 200 Heat-Shrinkable Wrapping Tape

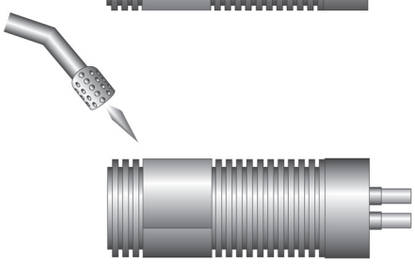




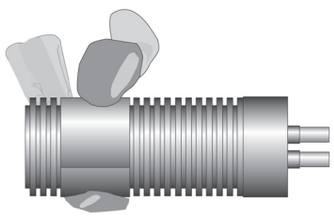
Make sure the casing of the pipe is dry and clean.



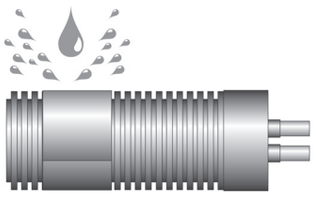
Wrap the repair tape around the damaged casing, overlapping each preceding layer by about 7cm.



Use a heat gun or mini torch with soft yellow flame (do NOT use a blue flame) to gently shrink the repair sleeve.



Press the sleeve onto the casing whilst wearing protective gloves.

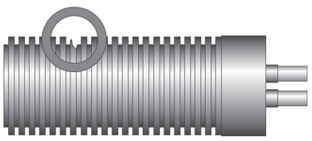


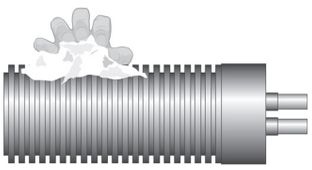
The damaged casing is now sealed watertight.

For an outer casing having

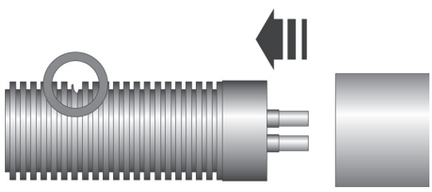
A diameter of	75 mm	use a length of	305 mm
	90 mm		355 mm
	125 mm		465 mm
	160 mm		575 mm
	200 mm		700 mm

4.12 MHM Shrink Sleeve

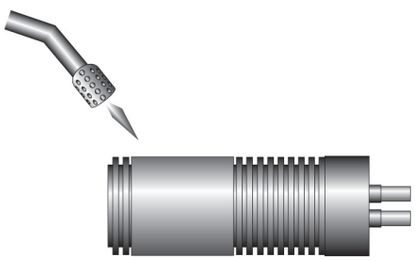




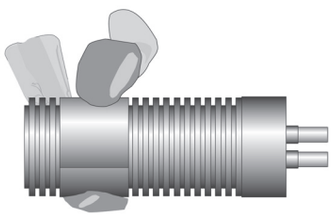
Make sure the casing of the pipe is dry and clean.



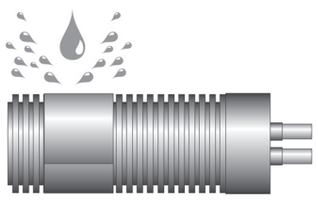
Slide the shrink sleeve over the damaged Microflex pipe. **NEVER CUT THE SLEEVE LENGTHWISE!**



Use a heat gun or mini torch with soft yellow flame (do **NOT** use a blue flame) to **gently** shrink the repair sleeve.



Press the sleeve onto the casing whilst wearing protective gloves.



The damaged casing is now sealed watertight.

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5. Appendix

5.1 Equivalent Pipe Length for a Bending Angle of 45° and 90°

	Pipe Model	Bending Radius	Equivalent Pipe Length for a Bending Angle of:	
			90°	45°
		m	m	m
Standard	M7525C	0.20	0.37	0.19
	M9032C	0.25	0.46	0.23
	M16040C	0.35	0.68	0.34
	M16050C	0.45	0.83	0.42
	M16063C	0.55	0.99	0.49
	M20075C	0.80	1.41	0.71
	M20090C	1.10	1.88	0.94
	M200110C	1.20	2.04	1.02
	M200125C	1.40	2.36	1.18
	MD16025C	0.50	0.91	0.46
	MD16032C	0.50	0.91	0.46
	MD16040C	0.60	1.07	0.53
	MD20050C	0.80	1.41	0.71
	MD20063C	1.20	2.04	1.02
Primo	M9040C	0.30	0.54	0.27
	M12540C	0.30	0.57	0.28
	M12550C	0.40	0.73	0.36
	M12563C	0.50	0.88	0.44
	M16075C	0.75	1.30	0.65
	M16090C	1.00	1.70	0.85
	MD12525C	0.30	0.57	0.28
	MD12532C	0.30	0.57	0.28
	MD16050C	0.60	1.07	0.53

5.2 Pipe Capacity

Microflex PE-Xa for Central Heating PN 6 - SDR 11		
Ø Pipe / Pipe Thickness mm	Ø Outer Pipe Diameter mm	Pipe Capacity L/m
25/2.3	25	0.327
32/2.9	32	0.539
40/3.7	40	0.835
50/4.6	50	1.307
63/5.8	63	2.075
75/6.8	75	2.961
90/8.2	90	4.254
110/10.0	110	6.362
125/11.4	125	8.203

Microflex PE-Xa for Sanitary PN 10 - SDR 7.4		
Ø Pipe / Pipe Thickness mm	Ø Outer Pipe Diameter mm	Pipe Capacity L/m
20/2.8	20	0.163
25/3.5	25	0.254
32/4.4	32	0.423
40/5.5	40	0.660
50/6.9	50	1.029
63/8.7	63	1.633

5.3 Determine the Necessary Power of the Heat Source

The necessary power of the heat source is calculated as a function of the required capacity and the heat loss of the network. To calculate the heat loss one has to take into account the following factors:

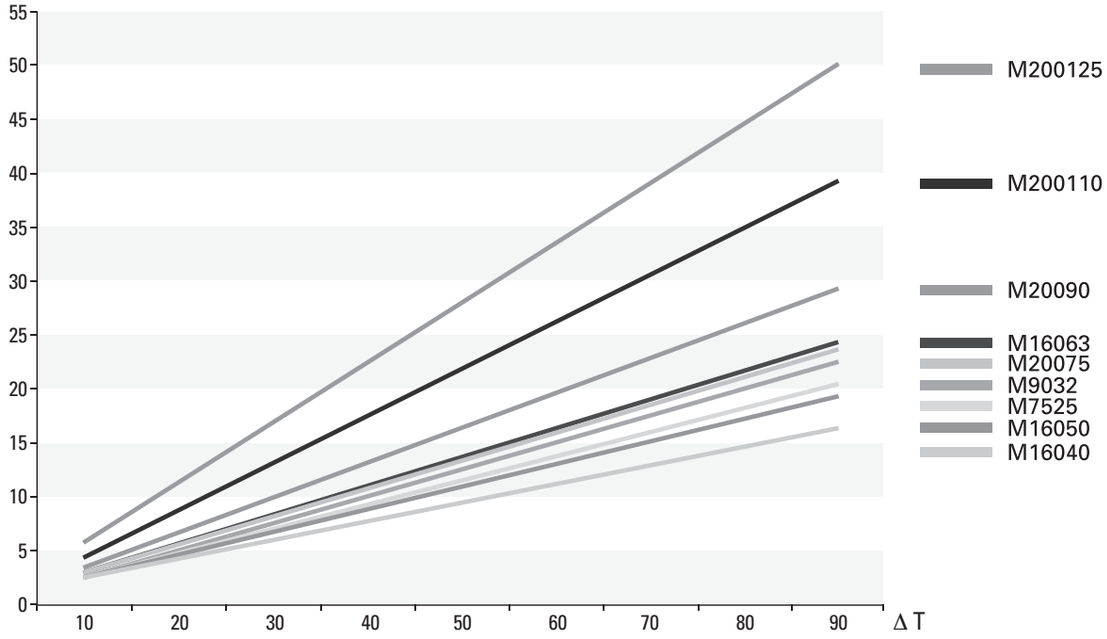
- λ insulation: 0.040 W/mK at 40°C
- λ ground: 1 W/mK
- λ PE-Xa pipe: 0.35 W/mK
- Depth of cover over top of pipe: 80cm

In sections 5.4 to 5.7 the heat loss tables/graphs for the different Central Heating models (UNO, Uno Primo, Duo and Duo Primo) are listed. These tables/graphs list the various diameters available for the pipes and are cross-referenced to the temperature differential with respect to the ground. By comparing a known pipe size (with a known media temperature) and knowing the local ground temperature, the ΔT column lists the heat loss in the pipe per meter. By multiplying this heat loss per meter with the total pipe length, you arrive at the total heat loss for the entire pipe.

5.4 Graphs-Microflex UNO Pipes

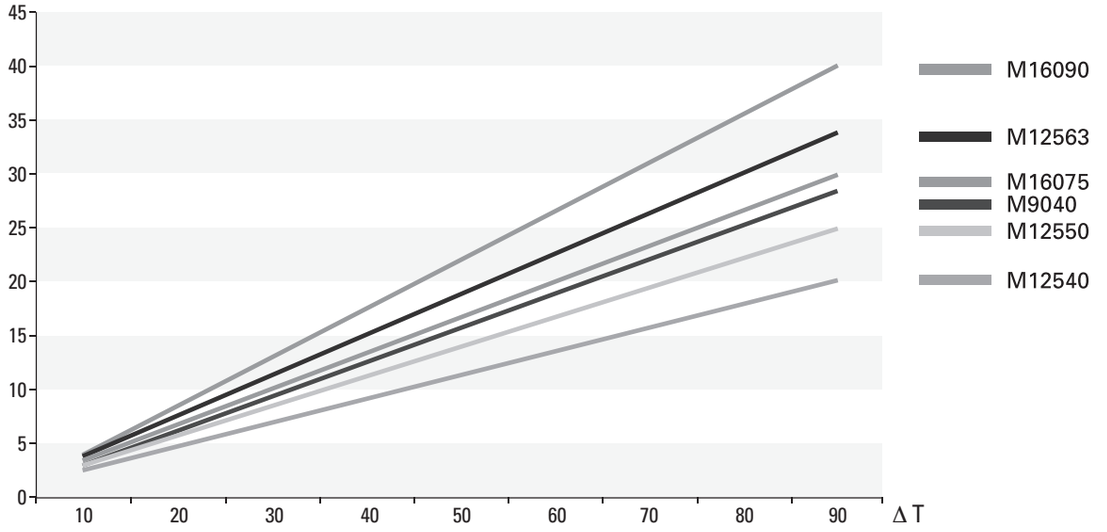
MICROFLEX® UNO Range

Heat losses in W/m



MICROFLEX® PRIMO UNO Range

Heat losses in W/m



For UNO
$\Delta T = T_v - T_o$

T_v : Flow temperature
T_o : Ground temperature

Using the above graphs the heat loss per meter can be calculated for a temperature differential (ΔT) between the pipe media and the ground temperature.

5.5 Tables-UNO Pipes

Listed below the tables for the UNO pipe.

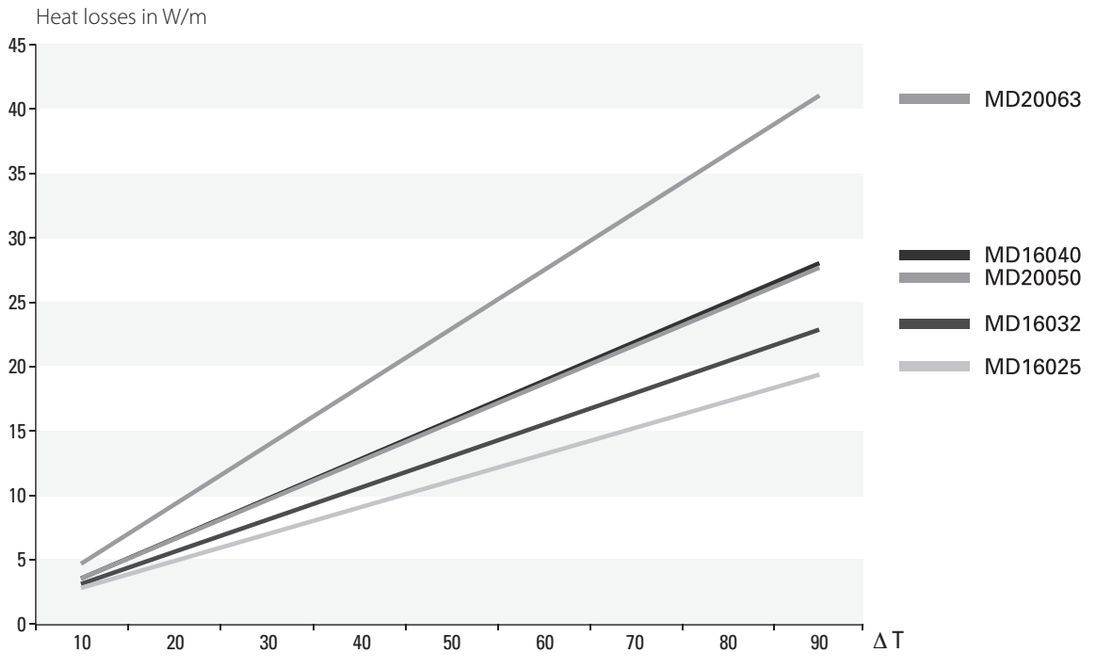
NB: The temperature value displayed above the different columns gives the temperature differential (ΔT) between the ground temperature and the pipe temperature.

	Microflex UNO Heat Loss in W/m									
U-value	ΔT / Type	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.552	M200125	5.520	11.040	16.560	22.080	27.600	33.120	38.640	44.160	49.680
0.431	M200110	4.310	8.620	12.930	17.240	21.550	25.860	30.170	34.480	38.790
0.321	M20090	3.210	6.420	9.630	12.840	16.050	19.260	22.470	25.680	28.890
0.270	M16063	2.700	5.400	8.100	10.800	13.500	16.200	18.900	21.600	24.300
0.260	M20075	2.600	5.200	7.800	10.400	13.000	15.600	18.200	20.800	23.400
0.246	M9032	2.460	4.920	7.380	9.840	12.300	14.760	17.220	19.680	22.140
0.228	M7525	2.280	4.560	6.840	9.120	11.400	13.680	15.960	18.240	20.520
0.216	M16050	2.160	4.320	6.480	8.640	10.800	12.960	15.120	17.280	19.440
0.182	M16040	1.820	3.640	5.460	7.280	9.100	10.920	12.740	14.560	16.380

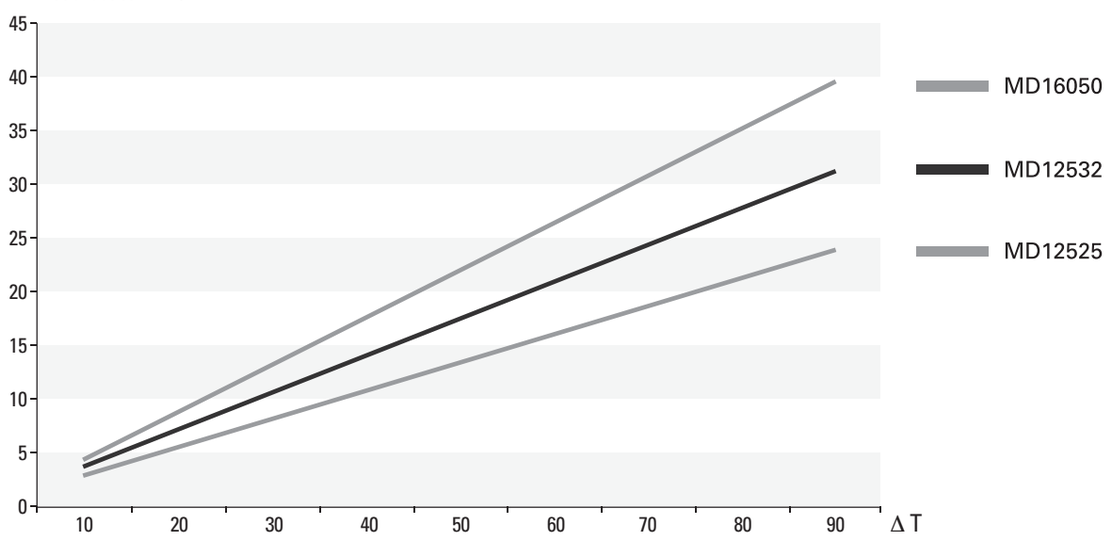
	Microflex PRIMO UNO Heat Loss in W/m									
U-value	ΔT / Type	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.439	M16090	4.390	8.780	13.170	17.560	21.950	26.340	30.730	35.120	39.510
0.371	M12563	3.710	7.420	11.130	14.840	18.550	22.260	25.970	29.680	33.390
0.333	M16075	3.330	6.660	9.990	13.320	16.650	19.980	23.310	26.640	29.970
0.314	M9040	3.140	6.280	9.420	12.560	15.700	18.840	21.980	25.120	28.260
0.277	M12550	2.770	5.540	8.310	11.080	13.850	16.620	19.390	22.160	24.930
0.222	M12540	2.220	4.440	6.660	8.880	11.100	13.320	15.540	17.760	19.980

5.6 Graphs-Microflex DUO Pipes

MICROFLEX® DUO Range



MICROFLEX® PRIMO DUO Range



For Duo

$$\Delta T = \frac{(T_v + T_r)}{2} - T_o$$

T_v : Flow temperature
T_r : Return temperature
T_o : Ground temperature

5.7 Tables-DUO Pipes

Listed below the tables for the Duo pipe.

NB: The temperature value displayed above the different columns gives the temperature differential between the ground temperature and the pipe temperature (average temperature between the flow and the return).

	Microflex DUO Heat Loss in W/m									
U-value	ΔT / Type	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.456	MD20063	4.560	9.120	13.680	18.240	22.800	27.360	31.920	36.480	41.040
0.316	MD16040	3.160	6.320	9.480	12.640	15.800	18.960	22.120	25.280	28.440
0.310	MD20050	3.100	6.200	9.300	12.400	15.500	18.600	21.700	24.800	27.900
0.253	MD16032	2.530	5.060	7.590	10.120	12.650	15.180	17.710	20.240	22.770
0.210	MD16025	2.100	4.200	6.300	8.400	10.500	12.600	14.700	16.800	18.900

	Microflex PRIMO DUO Heat Loss in W/m									
U-value	ΔT / Type	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.442	MD16050	4.420	8.840	13.260	17.680	22.100	26.520	30.940	35.360	39.780
0.343	MD12532	3.430	6.860	10.290	13.720	17.150	20.580	24.010	27.440	30.870
0.265	MD12525	2.650	5.300	7.950	10.600	13.250	15.900	18.550	21.200	23.850

5.8 Pressure Loss Tables

Heating capacity in Watts calculated at a ΔT of 20°C

Pipe Rugosity: 0.007 mm Water density: 0,971.90 g/cm³ Water temperature: 80°C

		PE-Xa Pipe							
		25 x 2.3		32 x 2.9		40 x 3.7			
l/s	Δt: 20°C Watt	v m/s	R Pa/m	v m/s	R Pa/m	v m/s	R Pa/m	l/s	Δt: 20°C Watt
1	2	5	6	7	8	9	10	11	12
0.030	2,512.0	**0.09**	**7.5**	-	-	-	-	0.100	8,373.6
0.035	2,930.7	**0.11**	**9.8**	-	-	-	-	0.150	12,560.4
0.040	3,349.4	**0.12**	**12.3**	-	-	-	-	0.200	16,747.2
0.045	3,768.1	**0.14**	**15.1**	-	-	-	-	0.250	20,934.0
0.050	4,186.8	**0.16**	**18.2**	0.09	5.5	-	-	0.300	25,120.8
0.055	4,605.5	**0.17**	**21.5**	0.10	6.5	-	-	0.350	29,307.6
0.060	5,024.1	**0.18**	**25.0**	0.11	7.6	-	-	0.400	33,494.4
0.065	5,442.8	**0.20**	**28.7**	0.12	8.7	-	-	0.450	37,681.2
0.070	5,861.5	**0.21**	**32.7**	0.13	9.9	-	-	0.500	41,868.0
0.075	6,280.2	**0.23**	**36.9**	0.14	11.2	0.09	4.0	0.550	46,054.8
0.080	6,698.9	**0.24**	**41.4**	0.15	12.5	0.10	4.4	0.600	50,241.6
0.085	7,117.5	**0.26**	**46.0**	0.16	13.9	0.10	4.9	0.650	54,428.4
0.090	7,536.2	**0.28**	**50.9**	0.17	15.4	0.11	5.4	0.700	58,615.2
0.095	7,954.0	**0.29**	**56.0**	0.18	16.9	0.11	6.0	0.750	62,802.0
0.100	8,373.6	**0.31**	**61.4**	0.19	18.5	0.12	6.5	0.800	66,988.8
0.120	10,048.3	**0.37**	**84.8**	0.22	25.6	0.14	9.0	0.850	71,175.6
0.140	11,723.0	**0.43**	**111.5**	0.26	33.6	0.17	11.8	0.900	75,362.4
0.160	13,397.7	**0.49**	**141.6**	0.30	42.5	0.19	14.9	0.950	79,549.2
0.180	15,072.4	**0.55**	**174.9**	0.33	52.4	0.22	18.4	1.000	83,736.0
0.200	16,747.0	**0.61**	**211.3**	0.37	63.2	0.24	22.1	1.050	87,922.8
0.220	18,421.9	**0.67**	**250.9**	0.41	74.9	0.26	26.2	1.100	92,109.6
0.240	20,096.6	**0.73**	**239.5**	0.45	87.5	0.29	30.6	1.150	96,296.4
0.260	21,771.3	**0.80**	**339.3**	**0.48**	**101.0**	0.31	35.3	1.200	100,483.2
0.280	23,446.0	**0.86**	**388.1**	**0.52**	**115.4**	0.34	40.3	1.250	104,670.0
0.300	25,120.8	**0.92**	**439.9**	**0.56**	**130.7**	0.36	45.5	1.300	108,856.8
0.320	26,795.5	**0.98**	**494.7**	**0.59**	**146.8**	0.38	51.1	1.350	113,043.6
0.340	28,470.2	**1.04**	**552.4**	**0.63**	**163.7**	0.41	57.0	1.400	117,230.4
0.360	30,144.9	**1.10**	**613.2**	**0.67**	**181.5**	0.43	63.1	1.450	121,417.2
0.380	31,819.6	1.16	676.9	**0.70**	**200.2**	0.46	69.5	1.500	125,604.0
0.400	33,494.4	1.22	743.5	**0.74**	**219.6**	0.48	76.3	1.550	129,790.8
0.420	35,169.1	1.28	813.1	**0.78**	**240.0**	0.50	83.2	1.600	133,977.6
0.440	36,843.8	1.35	885.6	**0.82**	**261.1**	0.53	90.5	1.650	138,164.4
0.460	38,518.5	1.41	961.0	**0.85**	**283.1**	0.55	98.1	1.700	142,351.2
0.480	40,193.2	1.47	1,039.3	**0.89**	**305.8**	**0.58**	**105.9**	1.750	146,538.0
0.500	41,868.0	1.53	1,120.5	**0.93**	**329.4**	**0.60**	**114.0**	1.800	150,724.8
0.550	46,054.8	1.68	1,336.0	**1.02**	**392.0**	**0.66**	**135.4**	1.900	159,098.4
0.600	50,241.6	1.84	1,569.5	**1.11**	**459.6**	**0.72**	**158.6**	2.000	167,472.0
0.650	54,428.4	1.99	1,820.8	**1.21**	**532.2**	**0.78**	**183.4**	2.100	175,845.6
0.700	58,615.2	-	-	**1.30**	**609.8**	**0.84**	**209.8**	2.200	184,219.2
0.750	62,802.0	-	-	**1.39**	**692.3**	**0.90**	**237.9**	2.300	192,592.8
0.800	66,988.8	-	-	1.48	779.8	**0.96**	**267.7**	2.400	200,966.4
0.850	71,175.6	-	-	1.58	872.2	**1.02**	**299.0**	2.500	209,340.0
0.900	75,362.4	-	-	1.67	969.4	**1.08**	**332.0**	2.600	217,713.6
0.950	79,549.2	-	-	1.76	1.071.5	**1.14**	**366.6**	2.700	226,087.2
1.000	83,736.0	-	-	1.85	1.178.5	**1.20**	**402.8**	2.800	234,460.8
1.050	87,922.8	-	-	1.95	1.290.3	1.26	440,.6	2.900	242,834.4
1.100	92,109.6	-	-	2.04	1.406.9	1.32	480.0	3.000	251,208.0
1.150	96,296.4	-	-	-	-	1.38	521.0	3.100	259,581.6
1.200	100,483.2	-	-	-	-	1.44	563.5	3.200	267,955.2
1.250	104,670.0	-	-	-	-	1.50	607.6	3.300	276,328.8
1.300	108,856.8	-	-	-	-	1.56	653.3	3.400	284,702.4
1.350	113,043.6	-	-	-	-	1.62	700.6	3.500	293,076.0
1.400	117,230.4	-	-	-	-	1.68	749.4	3.600	301,449.6
1.450	121,417.2	-	-	-	-	1.74	799.8	3.700	309,823.2
1.500	125,604.0	-	-	-	-	1.80	851.7	3.800	318,196.8
1.550	129,790.8	-	-	-	-	1.86	905.2	3.900	326,570.4
1.600	133,977.6	-	-	-	-	1.92	960.3	4.000	334,944.0
1.650	138,164.4	-	-	-	-	1.98	1,016.9	4.100	343,317.6
1.700	142,351.2	-	-	-	-	2.04	1,075.0	4.200	351,691.2

PE-Xa Pipe						PE-Xa Pipe						PE-Xa Pipe			
50 x 4.6		63 x 5.8				75 x 6.8		90 x 8.2				110 x 10		125 x 11.4	
v m/s	R Pa/m	v m/s	R Pa/m	l/s	Δt: 20°C Watt	v m/s	R Pa/m	v m/s	R Pa/m	l/s	Δt: 20°C Watt	v m/s	R Pa/m	v m/s	R Pa/m
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0.08	2.3	0.05	0.7	0.30	25.116	0.10	2.2	0.07	0.9	0.40	33.488	0.06	0.6	-	-
0.11	4.6	0.07	1.5	0.35	29.302	0.12	2.9	0.08	1.2	0.50	41.860	0.08	0.9	-	-
0.15	7.6	0.10	2.5	0.40	33.488	0.14	3.7	0.09	1.5	0.60	50.233	0.09	1.2	-	-
0.19	11.2	0.12	3.7	0.45	37.674	0.15	4.5	0.11	1.9	0.70	58.605	0.11	1.6	-	-
0.23	15.5	0.14	5.0	0.50	41.860	0.17	5.4	0.12	2.3	0.80	66.977	0.13	2.0	-	-
0.27	20.4	0.17	6.6	0.55	46.047	0.19	6.4	0.13	2.7	0.90	75.349	0.14	2.5	-	-
0.31	25.9	0.19	8.4	0.60	50.233	0.20	7.5	0.14	3.1	1.00	83.721	0.16	3.0	-	-
0.34	31.9	0.22	10.3	0.65	54.419	0.22	8.6	0.15	3.6	1.20	100.465	0.19	4.1	-	-
0.38	38.6	0.24	12.5	0.70	58.605	0.24	9.9	0.16	4.1	1.40	117.209	0.22	5.4	-	-
0.42	**45.8**	0.26	14.8	0.75	62.791	0.25	11.2	0.18	4.7	1.60	133.953	0.25	6.9	-	-
0.46	**53.5**	0.29	17.3	0.80	66.977	0.27	12.5	0.19	5.2	1.80	150.698	0.28	8.5	-	-
0.50	**61.8**	0.31	19.9	0.85	71.163	0.29	14.0	0.20	5.8	2.00	167.442	0.31	10.3	-	-
0.54	**70.7**	0.33	22.8	0.90	75.349	0.30	15.5	0.21	6.5	2.40	200.930	0.38	14.3	-	-
0.57	**80.1**	0.36	25.8	0.95	79.535	0.32	17.0	0.22	7.1	2.80	234.419	0.44	18.9	-	-
0.61	**90.0**	0.38	28.9	1.00	83.721	0.34	18.7	0.24	7.8	3.20	267.907	**0.50**	**24.1**	-	-
0.65	**100.4**	0.41	32.3	1.05	87.907	0.35	20.4	0.25	8.5	3.60	301.395	**0.57**	**29.8**	-	-
0.69	**111.4**	0.43	35.8	1.10	92.093	0.37	22.2	0.26	9.3	4.00	334.884	**0.63**	**36.2**	-	-
0.73	**122.9**	0.45	39.4	1.15	96.279	0.39	24.0	0.27	10.0	4.40	368.372	**0.69**	**43.0**	0.55	25.0
0.76	**134.9**	**0.48**	**43.2**	1.20	100.465	0.41	25.9	0.28	10.8	4.80	401.860	**0.75**	**50.5**	0.58	28.0
0.80	**147.4**	**0.50**	**47.2**	1.30	108.837	**0.44**	**30.0**	0.31	12.5	5.20	435.349	**0.82**	**58.4**	0.62	33.0
0.84	**160.5**	**0.53**	**51.4**	1.40	117.209	**0.47**	**34.3**	0.33	14.3	5.60	468.837	**0.88**	**66.9**	0.69	39.0
0.88	**174.0**	**0.55**	**55.7**	1.50	125.581	**0.51**	**38.8**	0.35	16.2	6.00	502.326	**0.94**	**76.0**	0.73	42.0
0.92	**188.1**	**0.57**	**60,1**	1.60	133.953	**0.54**	**43.6**	0.38	18.2	6.40	535.814	**1.01**	**85.6**	**0.75**	**46.0**
0.96	**202.7**	**0.60**	**64.7**	1.70	142.326	**0.57**	**48.7**	0.40	20.3	6.80	569.302	**1.07**	**95.7**	**0.84**	**53.0**
0.99	**217.8**	**0.62**	**69.5**	1.80	150.698	**0.61**	**54.0**	0.42	22.5	7.20	602.791	**1.13**	**106.3**	**0.87**	**58.0**
1.03	**233.4**	**0.65**	**74.4**	1.90	159.070	**0.64**	**59.6**	0.45	24.8	7.50	627.907	**1.18**	**114.6**	**0.91**	**62.0**
1.07	**249.5**	**0.67**	**79.5**	2.00	167.442	**0.68**	**65.4**	**0.47**	**27.2**	8.00	669.767	**1.26**	**129.2**	**0.98**	**71.0**
1.11	**266.1**	**0.69**	**84.8**	2.10	175.814	**0.71**	**71.5**	**0.49**	**29.7**	8.40	703.256	**1.32**	**141.4**	**1.02**	**75.0**
1.15	**283.2**	**0.72**	**90.2**	2.20	184.186	**0.74**	**77.9**	**0.52**	**32.3**	8.80	736.744	**1.38**	**154.1**	**1.08**	**83.0**
1.19	**300.8**	**0.74**	**95.7**	2.30	192.558	**0.78**	**84.4**	**0.54**	**35.0**	9.20	770.233	**1.45**	**167.4**	**1.13**	**90.0**
1.22	**318.8**	**0.77**	**101.4**	2.40	200.930	**0.81**	**91.3**	**0.56**	**37.9**	9.40	786.977	1.48	174,2	**1.15**	**93.0**
1.26	**337.4**	**0.79**	**107.3**	2.50	209.302	**0.84**	**98.3**	**0.59**	**40.8**	9.60	803.721	1.51	181.1	**1.17**	**96.0**
1.30	**356.5**	**0.81**	**113.3**	2.60	217.674	**0.88**	**105.7**	**0.61**	**43.8**	9.80	820.465	1.54	188.2	**1.20**	**101.0**
1.34	376.1	**0.84**	**119.4**	2.70	226.047	**0.91**	**113.2**	**0.63**	**46.9**	10.00	837.209	1.57	195.4	**1.24**	**106.0**
1.38	396.2	**0.86**	**125.8**	2.80	234.419	**0.95**	**121.0**	**0.66**	**50.1**	10.50	879.070	1.65	214.0	**1.29**	**114.0**
1.45	437.8	**0.91**	**138.8**	2.90	242.791	**0.98**	**129.1**	**0.68**	**53.4**	11.00	920.930	1.73	233.4	**1.34**	**123.0**
1.53	481.3	**0.96**	**152.5**	3.00	251.163	**1.01**	**137.4**	**0.71**	**56.8**	11.50	962.791	1.81	253.5	**1.40**	**132,0**
1.61	526.9	**1.00**	**166.8**	3.20	267.907	**1.08**	**154.7**	**0.75**	**63.9**	12.00	1,004.651	1.89	274.5	**1.46**	**141.0**
1.68	574.3	**1.05**	**181.6**	3.40	284.651	**1.15**	**172.9**	**0.80**	**71.4**	12.50	1,046.512	1.96	296.3	**1.53**	**154.0**
1.76	623.8	**1.10**	**197.1**	3.60	301.395	**1.22**	**192.2**	**0.85**	**79.3**	13.00	1,088.372	2.04	318.8	**1.60**	**166.0**
1.84	675.1	**1.15**	**213.1**	3.80	318.140	**1.28**	**212.3**	**0.89**	**87.6**	13.50	1,130.233	2.12	342.2	**1.65**	**177.0**
1.91	728.4	**1.20**	**229.8**	4.00	334.884	**1.35**	**233.4**	**0.94**	**96.2**	14.00	1,172.093	2.20	366.3	**1.71**	**187.0**
1.99	783.6	**1.24**	**247.0**	4.20	351.628	1.42	255.5	**0.99**	**105.3**	14.50	1,213.953	2.28	391.2	**1.77**	**197.0**
-	-	**1.29**	**264.8**	4.40	368.372	1.49	278.5	**1.03**	**114.7**	15.00	1,255.814	2.36	416.9	**1.82**	**208.0**
-	-	**1.34**	**283.2**	4.60	385.116	1.55	302.4	**1.08**	**124.4**	15.50	1,297.674	2.44	443.4	**1.89**	**223.0**
-	-	1.39	302.2	4.80	401.860	1.62	327.3	**1.13**	**134.6**	16.00	1,339.535	2.52	470.7	**1.97**	**238.0**
-	-	1.43	321.8	5.00	418.605	1.69	353.1	**1.18**	**145.1**	16.50	1,381.395	2.59	498.8	**2.00**	**251.0**
-	-	1.48	341.9	5.20	435.349	1.76	379.8	**1.22**	**156.0**	17.00	1,423.256	2.67	527.6	**2.04**	**264.0**
-	-	1.53	362.6	5.40	452.093	1.82	407.5	**1.27**	**167.3**	17.50	1,465.116	2.75	557.2	**2.11**	**275.0**
-	-	1.58	383.9	5.60	468.837	1.89	436.1	**1.32**	**178.9**	18.00	1,506.977	2.83	587.7	**2.18**	**286.0**
-	-	1.63	405.8	5.80	485.581	1.96	465.6	**1,36**	**190,9**	18.50	1,548.838	2.91	618.8	-	-
-	-	1.67	428.2	6.00	502.326	2.03	496.0	1.41	203.3	19.00	1,590.698	2.99	650.8	-	-
-	-	1.72	451.2	6.20	519.070	2.09	527.4	1.46	216.0	19.50	1,632.558	3.07	683.6	-	-
-	-	1.77	474.8	6.40	535.814	2.16	559.6	1.50	229.1	20.00	1,674.419	3.14	717.1	-	-
-	-	1.82	498.9	6.60	552.558	2.23	592.8	1.55	242.6	20.50	1,716.279	3.22	751.4	-	-
-	-	1.86	523.7	6.80	569.302	2.30	626.9	1.60	256.5	21.00	1,758.140	3.30	786.5	-	-
-	-	1.91	549.0	7.00	586.047	2.36	661.9	1.65	270.7	21.50	1,800.000	3.38	822.3	-	-
-	-	1.96	574.8	7.20	602.791	2.43	697.9	1.69	285.2	22.00	1,841.860	3.46	858.9	-	-
-	-	2.01	601.3	7.40	619.535	2.50	734.7	1.74	300.2	22.50	1,883.721	3.54	896.3	-	-

Conversion: 1 Watt = 0.860 kCal

5.9 Chemical Resistance: PE-Xa Carrier Pipe

Most chemicals have no influence on the pipe, even at elevated temperatures. Typically, plastics that are exposed to chemical substances are prone to physical changes in their properties, such as, swelling or dissolution of the polymers. Due to the chemical bonding of the polymer chains, PE-Xa pipes (cross-linked PE) are more resilient in that respect than pipes of non-cross-linked PE. In order to assess the resistance to different materials changes in the tensile and elongation characteristics were monitored. In a pressurised piping system the resistance to unknown chemicals cannot generally be extrapolated from experience of known chemicals. For this, durability tests with the unknown chemicals in test piping are required.

Legend
A = resistant
B = resistant at operating pressure
C = resistant at 60% of the operating pressure
D = resistant at 20% of the operating pressure
U = unsuitable

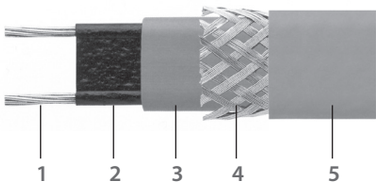
Compound	40 °C	60 °C	80 °C
Acetic Acid	A	A	
Acetone	C		
Acrylonitritle	A	A	A
Allyl Alcohol	A		
Aluminium Chloride	A	A	A
Aluminium Sulphate	A	A	A
Ammoniak, Aqueous	A	A	A
Ammonium Chloride	A	A	A
Ammonium Sulphate	A	A	A
Aniline, pure	A	A	
Aqua Regia	U	A	A
Axalic Acid	A	B	
Beer	A		
Benzoic Acid	A	A	B
Benzole Sulphonic Acid	U	A	A
Bitumen	A	C	A
Bleach	D	U	A
Bromine	U	C	
Butanediol	B	A	A
Butanol	A	A	A
Butter	A		B
Butter Acid	C	D	
Butyl Acetate	A	B	C
Carbon Dioxide	A	A	
Chlorine water saturated	A		B
Chlorine, dry gas	B		U
Chlorine, liquid	U		
Chloroform	D	U	
Chromic Acid, 50%	A	A	A
Chromo Sulfuric Acid	A	U	
Citric Acid	A		
Cod Liver Oil	B	C	
Cresol	A	C	
Cyclohexane	C	D	
Cyclohexanol	A		
Cyclohexanone	D	U	
Decahydro Naphtalene	B	C	
Detergents	A	B	
Dibutyl Ether	B	D	
Dibutyl Phthalate	B	C	C
Dichloorbenzene	C	U	
Dichloroethylene	U		
Diesel Oil	A	B	C
Diethyl Ether	C	D	U
Esteric Oils	B	B	B
Ethers	C	D	U
Ethyl Acetate	A	B	C
Ethyl Alcohol	A	A	A
Ethylene Glycol	A	A	A
Fluorbenzene	U		
Formaldehyde, 40%	A	A	
Formic Acid	A	A	B
Freon	U		
Fuel Oils	A	D	
Gasoline, pure	B	C	
Glycerine	A	A	A
Glycol, 10%	A	A	
Hexane	C	D	
Hydrochloric Acid, 30%	A		
Hydrochlorid Acid, 10%	A	A	A
Hydrogen Peroxide, 100%	A	U	
Hydrogen Peroxide, 30%	A	A	A
Hydrogen Sulphide	A		
Iodine Tincture of	A	C	
Linseed Oil	A	B	C
Magnesium Salts	A	A	
Maleic Acid	A	A	A
Mercury	A	A	A
Methyl Alcohol	A	A	A
Methyl Ethylketone	B	D	
Methylene Chloride	C	U	
Milk	A	A	A
Motor Oils			C
Nafta	B	U	
Naphthalene	A	C	
Nitric Acid, 30%	A	A	
Nitric Acid, 50%	B	C	
Nitrobenzene	C	U	
Oil	C	C	
Oil Acid			C
Oleum	U		
Ozone	C		U
Paraffin	A	B	C
Paraffin Oil	A	A	A
Perchloro Ethylene	U		
Petroleum	A	B	C
Petroleum Ether	A	D	
Phenols 100% (Carbolic Acid)	D		
Phosphates	A	A	A
Phosphoric Acid, 95%	A	A	
Phthalic Acid, 50%	A	A	A
Polyglycols	A	A	
Potassium Chloride	A	A	A
Potassium Chromate, 40%	A	A	A
Potassium Hydroxide, 50%	A	A	A
Potassium Permanganate, 18%	A	A	A
Propanol	A	A	A
Propanol	A	A	A
Propionic Acid, 50%	A	A	A
Pyridine	A	B	C
Silicone Oils	A	A	A
Soap Solution	A	A	A
sodium Hydroxide Con.	A	A	
Sodium Hypochlotite Solution	B		
Styrene	C	U	
Sulphur Solution	A		
Sulphuric Acid, up to 50%	A	A	A
Sulphuric Acid, up to 98%	U		
Tetrachlore Ethane	D	U	
Tetrahydro Furane	U		
Tetraline	B	U	
Toluene	D	U	
Transformater Oils	A	C	D
Trichloro Ethylene	U		
Turpentine	D	U	
Vaseline	A	B	C
Water	A	A	A
Wine	A	A	A
Xylol	C		U

5.10 Heat Loss Table for Heated Cool Pipes

This table features heat losses in the event of a negative ambient temperature around the pipe casing. If the heat loss exceeds 9 W/m **there exists a danger that pipes could freeze.**

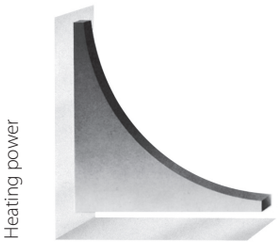
Casing d_{out} / Pipe d_{out}		75/32	90/40	125/50	125/63	160/75	160/90	200/110	200/125
Insulation thickness		15.5 mm	17.5 mm	28 mm	21.5 mm	31.5 mm	24 mm	31 mm	23.5 mm
temperature around the outside casing	-1	1	1	1	1	1	1	1	1
	-2	1	1	1	2	2	2	2	2
	-3	1	2	2	2	2	3	2	2
	-4	2	2	2	3	2	3	2	3
	-5	2	2	2	3	3	4	3	3
	-6	2	3	3	3	3	4	3	4
	-7	2	3	3	4	3	5	4	4
	-8	3	4	3	4	4	5	4	5
	-9	3	4	4	5	4	6	5	5
	-10	3	4	4	5	5	6	5	6
	-11	4	5	4	6	5	7	6	7
	-12	4	5	5	6	5	7	6	7
	-13	4	5	5	7	6	8	7	8
	-14	5	6	5	7	6	8	7	8
	-15	5	6	6	7	6	9	7	9
	-16	5	6	6	8	7	9	8	9
	-17	5	7	6	8	7	10	8	10
	-18	6	7	6	9	8	10	9	10
	-19	6	8	7	9	8	10	9	11
	-20	6	8	7	9	8	11	10	11
	-21	7	8	7	10	9	11	10	12
	-22	7	9	8	10	9	12	10	13
	-23	7	9	8	11	9	12	11	13
	-24	8	9	8	11	10	13	11	14
	-25	8	10	9	12	10	13	12	14
	-26	8	10	9	12	10	14	12	15
	-27	8	10	9	12	11	14	13	15
	-28	9	11	10	13	11	15	13	16
	-29	9	11	10	13	12	15	14	16
	-30	9	11	10	14	12	16	14	17
	-31	10	12	10	14	12	16	15	18
	-32	10	12	11	14	13	17	15	18
	-33	10	12	11	15	13	17	15	19
	-34	10	13	11	15	13	18	16	19
	-35	11	13	12	16	14	18	16	20
	-36	11	13	12	16	14	18	17	20
	-37	11	14	12	16	14	19	17	21
	-38	12	14	13	17	15	19	18	21
	-39	12	14	13	17	15	20	18	22
	-40	12	15	13	18	15	20	18	22
non-recommended temperatures	-41	13	15	13	18	16	21	19	23
	-42	13	15	14	18	16	21	19	24
	-43	13	16	14	19	16	22	20	24
	-44	13	16	14	19	17	22	20	25
	-45	14	16	15	19	17	23	21	25
	-46	14	17	15	20	17	23	21	26
	-47	14	17	15	20	18	23	22	26
	-48	15	17	15	21	18	24	22	27
	-49	15	17	16	21	18	24	23	27
	-50	15	18	16	21	19	25	23	28

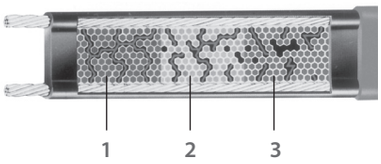
5.11 Self-Regulating Heating Cables: Structure and Operation



1 Tin-coated copper conductor
2 Self-regulating heating element
3 Electric insulation mantle
4 Safety plait in tin-coated copper
5 External safety cover

Schematic diagram





1 In the cold sections of the heating cable, the structure of the plastic will draw together, generating a large number of electrical currents through the carbon particles. The current is converted into heat in the heating element.

2 In the warmer sections, the structure of the plastic expands and progressively interrupts the currents in the carbon particles. This increases the resistance and reduces the current draw and thus the heating capacity.

3 In the hot sections, the expansion of the plastic structure breaks the currents almost entirely. This creates a very high electrical resistance and the heating capacity falls to almost 0.

Robust construction

The heating cable is a self-regulating cable with two parallel, multiwire tin-coated copper conductors and an intermediate semiconducting heating element.

This heating element is electrically insulated by means of a synthetic polyolefine or fluoropolymer cover. It is also covered by a plaited, tin-coated copper cord. This plaiting provides the earthing (safety conductor) for the heating cable, complies with prevailing safety standards (VDE 0100) and is fitted with an additional mechanical protection.

Proven lifespan

These self-regulating heating cables have been intensively tested in our laboratories using international standard tests and recognised scientific methods and procedures. These tests found that the self-regulating heating cable has a lifespan of over 40 years.

Licenses

All self-regulating heating cables are manufactured in accordance with the strictest quality norms and are subjected to ongoing quality controls. They are VDE-certified as well as with a variety of production, control and other licenses from many countries.

Parallel circuits

The current flows between two parallel copper conductors, regardless of where the heating cable is and right through the semiconducting, molecularly refined heating element. The electrical circuit diagram is similar to a parallel circuit in many temperature-dependent resistances.

The system's straightforward design and even simpler installation process will save you considerable expense. The heating cable is always connected to a 230 VAC output, regardless of its length.

Operation

The heating element consists of a specially formulated, molecularly refined plastic cover embedded with carbon particles which generate electrical currents between two parallel copper conductors. When the temperature rises, the plastic expands due to molecular expansion.

The carbon particles move further and further apart, resulting in the interruption of the electrical currents and a rise in the electrical resistance of the heating element. The current draw and the heating capacity fall proportionally.

When the element cools, the process is reversed and the heating capacity rises in response to low temperatures. The molecular refinement of the heating element gives it duroplastic properties, making the expansion behaviour at molecular level exactly reproducible, even under fluctuating temperatures. The self-regulating properties of the heating cable are thus incorporated into the material itself.

Thanks to this self-regulation, the heating cable responds to temperature fluctuations along the entire length of the system.

Energy conservation

Because the heating capacity adjusts to local temperatures, energy consumption is always adapting to prevailing requirements. The heating cables therefore save energy and costs through self-regulation.

Safe and reliable

Due to these self-regulating properties, the system cannot overheat or burn through, even if the heating cable overlaps.

5.12 Conversion Tables

Conversion of Energy units								
Unit	J	MJ	kWh	MWh	kcal	Mcal	kg SKE	BTU
1 J = 1 Nm = 1 Ws	1	10^{-6}	0.278×10^{-6}	0.278×10^{-9}	0.239×10^{-3}	0.239×10^{-6}	0.034×10^{-6}	948×10^{-6}
1 MJ = 10^6 J	10^{-6}	1	0.278	0.278×10^{-3}	239	0.239	0.034	948
1 kWh	3.6×10^6	3.6	1	10^{-3}	860	0.86	0.123	3412
1 MWh	3.6×10^9	3600	1000	1	860×10^3	860	123	3.412
1 kcal	4187	4.187×10^{-3}	1.163×10^{-3}	1.163×10^{-6}	1	0.001	1.43×10^{-4}	3.968
1 Mcal	4.187×10^6	4.187	1.163	1.163×10^{-3}	1000	1	0.143	3.968
1 kg SKE	29.31×10^6	29.31	8.14	8.14×10^{-3}	7000	7	1	27.8×10^3
1 BTU	1.05×10^3	1.05×10^{-3}	29.31×10^{-3}	0.293	0.252	2.52×10^{-4}	3.603×10^{-5}	1

Conversion of Pressure units									
Unit	N/m^2 Pa	kPA	bar	mbar	mmWS	at	atm	Torr	lb/in^2
1 Pa = 1 N/m^2	1	0.001	10^{-5}	0.01	0.102	1.02×10^{-5}	0.987×10^{-5}	0.75×10^{-2}	1.45×10^{-4}
1 kPa	1000	1	0.01	10	102	1.02×10^{-2}	0.987×10^{-2}	7.5	0.145
1 bar	10^5	100	1	1000	1.02×10^4	1.02	0.987	750	14.50
1 mbar	100	0,1	0.001	1	10.2	1.02×10^{-3}	0.987×10^{-3}	0.75	1.45×10^{-2}
1 mmWK = 1 kgf/m^2	9.81	9.81×10^{-3}	9.81×10^{-5}	9.81×10^{-2}	1	10^{-4}	0.968×10^{-4}	0.074	1.42×10^{-3}
1 at = 1 kgf/cm^2	9.81×10^4	98.1	0.981	981	10000	1	0.968	735	1.2
1 atm	1.01×10^{-5}	101	1.01	1010	10332	1.0332	1	760	14.7
1 Torr = 1 mmHg	133	0.133	1.33×10^{-3}	1.33	13.6	1.32×10^{-3}	1.36×10^{-3}	1	0.019
1 lb/in^2 = 1 psi	6.89×10^3	6.89	6.89×10^{-2}	68.9	703	0.068	0.07	51.7	1

List of keywords

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