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System description

1. General

FLEXSTAR is the trademarked name for the most flexible pipe system from BRUGG Pipes, which is manufactured specially for low-temperature and heat pump applications in accordance with the current standard EN 15632-1/-2.

FLEXSTAR is ideal for use as a heat pump line and in small local heating networks.

The carrier pipes of the FLEXSTAR pipe system are made of cross-linked polyethylene PEXa and are equipped with an organic oxygen diffusion barrier (EVOH). The material was selected due to its outstanding thermal and mechanical properties. In addition, the carrier pipe features high corrosion and chemical resistance. It is also easy to process by hand and fulfils the applicable standards.

FLEXSTAR uses innovative thermal insulation based on the patented elastic polyurethane foam. This foam not only has excellent thermal insulation properties, but also perfectly encases the carrier pipes during the manufacturing process.

FLEXSTAR uses innovative thermal insulation based on the patented elastic polyurethane foam. This foam not only has excellent thermal insulation properties, but also perfectly encases the carrier pipes during the manufacturing process. The result is extremely stable adhesion and a force-locking bond that is an optimal complement to the physical properties of the PEXa carrier pipe. This means that FLEXSTAR can be installed without fear of thermal expansion.

Thanks to its exceptional bending capabilities, FLEXSTAR can be easily adapted to any house or heat pump inlet, making it easy to bypass obstacles without incurring additional costs.

FLEXSTAR solutions are available in different configurations. They can either be delivered as sets or transported to the construction site in the desired length in endless rings or on a drum. The option of longer delivery lengths in particular allows for laying without joints in the ground, which means the required pipe trench can be considerably narrower. This leads to substantial savings in civil engineering work, especially for DUO lines.

The FLEXSTAR systems are not only technically perfect, but also significantly optimize processes on the construction site thanks to their extremely short installation time. This makes them the key to creating heat pump or local heating connections that save both time and money.

Installing the connection pieces is very simple. Whether with conventional screw connections or press fittings, installation of the connections is quick and safe. Our extensive range of accessories also guarantees solutions for any conceivable situation.

Additional accessories such as wall seals with cable glands or EPDM end caps round out and complement our product range to even better cover your needs.

2. Application area

Heating, pipe series 5 (SDR 11):

Max. operating temp. T_{max} : 95 °C (fluctuating)

Max. operating pressure p: 6 bar

System description

1. Composite system

Requirements Factory-insulated, flexible pipe systems according to EN 15632-1/-2
Fire behaviour Building material class B2 (normal flammability) according to DIN 4102

2. Carrier pipe

Materials Base material: High-density polyethylene (HDPE), peroxide-crosslinked (PEXa), colour: black
Bonding agent Modified PE, heat-stabilised, colour: black
Oxygen barrier layer Ethylene vinyl alcohol (EVOH), heat-stabilised, colour: black
Requirements According to DIN 16892 / DIN 16893
Oxygen tightness According to DIN 4726, at 40 °C, oxygen tightness related to the internal pipe volume of $\leq 0.10 \text{ g} / (\text{m}^3 \times \text{d})$ according to DIN 4726
DIN 16893 pipe rows Series 5 (SDR 11)
Long-term behaviour See catalogue sheet FXS 0.110
Properties Unaffected by aggressive water, low pressure losses, very good chemical and mechanical resistance

| PEXa carrier pipe | Reference temp. °C | Value | Test standard |
|--------------------------------------|--------------------|-----------------------------|---------------------|
| Density | - | 938 kg/m ³ | DIN 53479 |
| Thermal conductivity | 20 | 0.38 W/mK | DIN 52612 |
| Oxygen permeability | - | < 0.1 g/(m ³ *d) | DIN 4726, ISO 17455 |
| Elongation | - | > 400% | DIN 53455 |
| Linear thermal expansion coefficient | 20 | 1.4 · 10 E-4 1/K | DIN 52328 |
| Linear thermal expansion coefficient | 100 | 2.0 · 10 E-4 1/K | - |

3. Insulation

Materials **FLEXSTAR (heating, 6 bar)**
CFC-free, cyclopentane-blown polyurethane foam (PUR)

| PUR insulation | Reference temp. °C | FLEXSTAR | Test standard |
|--|--------------------|------------------------|---------------------|
| Density | - | > 50 kg/m ³ | EN 253 |
| Axial shear strength | - | ≥ 90 kPa | EN 15632-2 |
| Thermal conductivity, flexible systems | 50 | ≤ 0.024 W/mK | EN 253 and ISO 8497 |
| Closed-cell structure | - | ≥ 88 % | EN 253 |
| Water absorption | 100 | ≤ 10 % | EN 15632-1 |

4. Protective casing

Materials Linear low-density polyethylene (LLDPE), seamlessly extruded, UV-protected
Task To protect against mechanical influences and moisture

| LLDPE protective casing | Reference temp. °C | Value | Test standard |
|-------------------------|--------------------|---------------------------|---------------|
| Density | - | 918–922 kg/m ³ | ASTM D792 |
| Thermal conductivity | - | 0.33 W/mK | DIN 52612 |

Long-term behaviour

Service life calculation

| Safety factor | Operating temperature °C | FLEXSTAR (pipe series 5 / SDR 11) Years | | | | | |
|---------------|-----------------------------|--|------|------|--------------------|------|------|
| | | 1 | 5 | 10 | 25 | 50 | 100 |
| 1.5 | 10 | 17.9 | 14.6 | 14.5 | 14.4 | 14.2 | 14.1 |
| 1.5 | 20 | 13.2 | 12.9 | 12.8 | 12.7 | 12.6 | 12.5 |
| 1.5 | 30 | 11.7 | 11.5 | 11.4 | 11.3 | 11.2 | 11.1 |
| 1.5 | 40 | 10.4 | 10.2 | 10.1 | 10.0 | 9.9 | 9.8 |
| 1.5 | 50 | 9.3 | 9.1 | 9.0 | 8.9 | 8.8 | 8.8 |
| 1.5 | 60 | 8.3 | 8.1 | 8.0 | 7.9 | 7.9 | - |
| 1.5 | 70 | 7.4 | 7.3 | 7.2 | 7.1 | 7.0 | - |
| 1.5 | 80 | 6.6 | 6.5 | 6.4 | (6.4) ^a | - | - |
| 1.3 | 90 | 6.9 | 6.7 | 6.6 | - | - | - |
| 1.3 | 95 | 6.5 | 6.3 | 6.3 | - | - | - |

The values in brackets apply to verification of test times longer than one year for the 110 °C test

Long-term behaviour

The permissible operating pressures according to DIN 16892/3 and 15632-2 are based on water as a flow medium and have been designed with a safety factor:

| Temperature | Safety factor | Temperature range |
|--|---------------|----------------------------|
| Operating temperature (T_{op}) | 1.5 | ≤ 80 °C |
| Maximum operating temperature (T_{max}) | 1.3 | > 80 °C to ≤ 95 °C |
| Fault temperature (T_{mal}) | 1.0 | > 95 °C to ≤ 110 °C |
| ^a The specified temperature range defines the safety factors that must be applied to temperature/time profiles deviating from Table 1 and calculated in line with Appendix A. | | |

The values are monitored by the plastic pipe producer through long-term studies and are confirmed and tested by independent test institutes. The max. operating temperature is between 81°C and 95°C; however, a short-term overtemperature (fault temperature) of 96°C to 110°C is considered.

A typical smooth temperature distribution in the flow in the district heating systems results in an average temperature/year of approx. 66°C.

For the use of a PEX pipe system with changing operating temperatures, the operating time can be calculated using Miner's rule.

Usage examples

| Operating temperature °C | Example 1 Annual operating duration h | Example 2 Annual operating duration h | Example 3 Annual operating duration h | Example 4 Annual operating duration h |
|-----------------------------|--|--|--|--|
| 50 | 0 | 0 | 185 | 0 |
| 55 | 0 | 0 | 160 | 4380 |
| 60 | 0 | 0 | 145 | 4380 |
| 65 | 0 | 535 | 130 | 0 |
| 70 | 0 | 3720 | 120 | 0 |
| 75 | 0 | 840 | 115 | 0 |
| 80 | 8468 | 3500 | 110 | 0 |
| 85 | 0 | 165 | 4500 | 0 |
| 90 | 258.7 | 0 | 0 | 0 |
| 95 | 33.3 | 0 | 5465 | 8760 |
| Operating duration h/a | 8760 | 8760 | > 30 years | > 100 years ^a |
| Calculated service life | 30 years + 100 h | > 50 years | | |

Pipe systems that comply with the EN 15632-2 standard are designed for a service life of at least 30 years as long as they are operated at the following temperature profile:

29 years at 80 °C

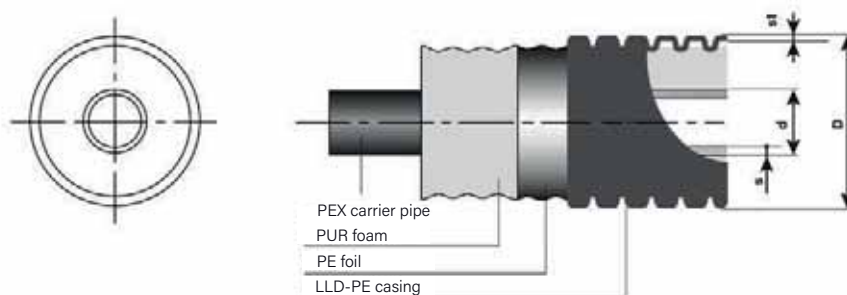
+ 1 year at 90 °C

+ 100 h at 95 °C

30 years + 100 h

FLEXSTAR range

FLEXSTAR UNO (heating, 6 bar)



FLEXSTAR heating, 6 bar, UNO

| Type | Inner pipe d x s | Nominal diameter | | Outer casing D x s1 mm | Min. bending radius for laying m | Bending radius to EN 15632-1/-2 m | Volume of inner pipe l/m | Weight kg/m | Max. delivery length m |
|---------|---------------------|------------------|-------------|------------------------------|--|---|--------------------------------|----------------|------------------------------|
| | | DN mm | Inches " | | | | | | |
| 25/ 70* | 25 x 2.3 | 20 | ¾ | 71 x 1.5 | 0.30 | 0.85 | 0.32 | 0.73 | 200 |
| 32/ 70 | 32 x 2.9 | 25 | 1 | 71 x 1.5 | 0.30 | 0.90 | 0.53 | 0.84 | 200 |
| 40/ 90 | 40 x 3.7 | 32 | 1¼ | 90 x 1.6 | 0.30 | 1.00 | 0.83 | 1.25 | 200 |
| 50/ 90 | 50 x 4.6 | 40 | 1½ | 90 x 1.6 | 0.30 | 1.05 | 1.30 | 1.44 | 200 |
| 63/105 | 63 x 5.8 | 50 | 2 | 106 x 1.7 | 0.30 | 1.20 | 2.07 | 2.07 | 200 |

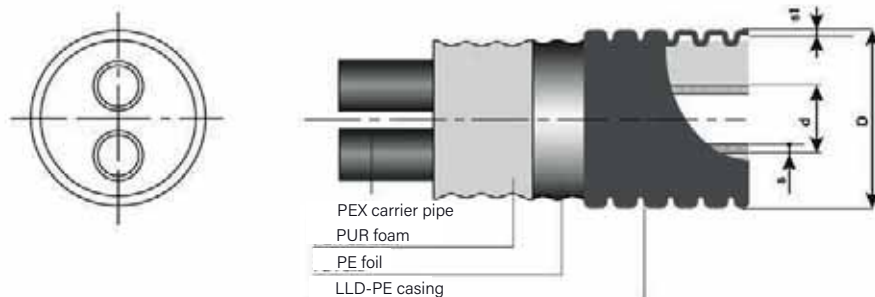
* carrier pipe PEXc

Longer or shorter delivery lengths can be supplied on drums on request.

When ordering at the construction site, please observe the total weight of the ring (unwinding equipment)

FLEXSTAR range

FLEXSTAR DUO (heating, 6 bar)



FLEXSTAR heating, 6 bar, DUO

| Type | Inner pipe d x s mm | Nominal diameter | | Outer casing D x s1 mm | Min. bending radius for laying m | Bending radius to EN 15632-1/-2 m | Volume of inner pipe l/m | Weight kg/m | Max. delivery length m |
|------------|---------------------------|------------------|--------|------------------------------|--|---|--------------------------------|----------------|------------------------------|
| | | DN | Inches | | | | | | |
| 25+25/ 90* | 2x25x2.3 | 20+20 | 2x¾" | 90 x 1.6 | 0.30 | 1.00 | 2x0.32 | 1.16 | 200 |
| 32+32/105 | 2x32x2.9 | 25+25 | 2x1" | 106 x 1.7 | 0.30 | 1.15 | 2x0.53 | 1.66 | 200 |
| 40+40/125 | 2x40x3.7 | 32+32 | 2x1¼" | 126 x 1.8 | 0.35 | 1.30 | 2x0.83 | 2.28 | 200 |
| 50+50/150 | 2x50x4.6 | 40+40 | 2x1½" | 151 x 1.9 | 0.40 | 1.50 | 2x1.30 | 3.05 | 150 |

* carrier pipe PEXc

When ordering at the construction site, please observe the total weight of the ring (unwinding equipment)

Pressure loss diagram

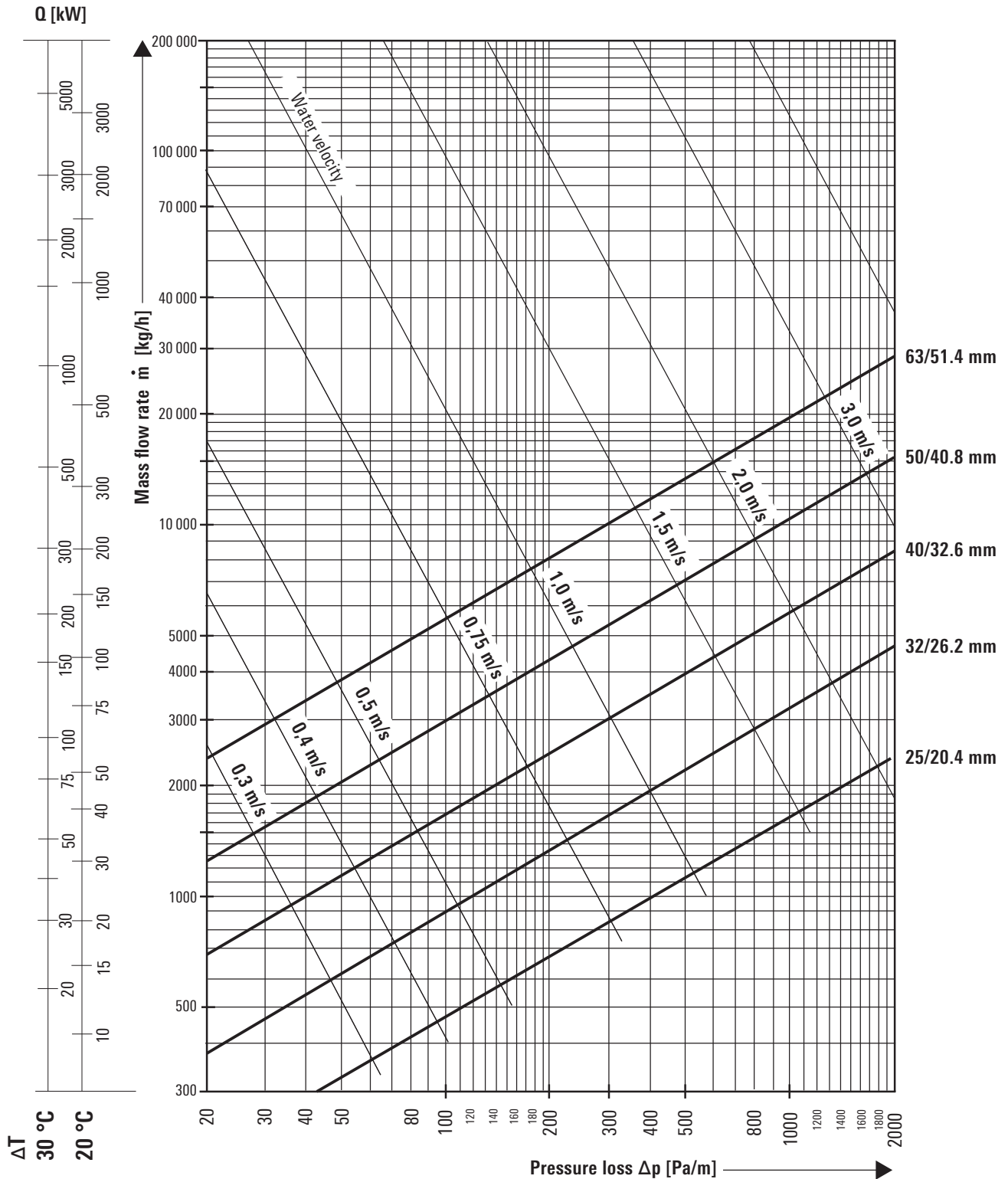
FLEXSTAR (heating, 6 bar)

Water temperature 80 °C

Surface roughness $\epsilon = 0.007$ mm (PEX)

(1 mmWS = 9.81 Pa)

| | | |
|--|--------------|---|
| $\dot{m} \approx \frac{Q \cdot 860}{\Delta T}$ | \dot{m} = | flow in kg/h |
| | Q = | power requirement in kW |
| | ΔT = | temperature difference Flow/return in °C |



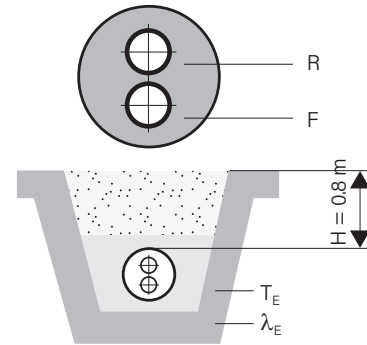
Heat loss

FLEXSTAR (heating, 6 bar)

FLEXSTAR DUO

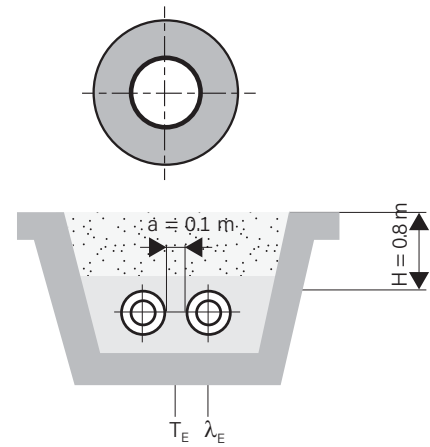
(flow and return in one pipe)

| Heat losses q [W/m] for a laid DUO pipe | | | | | | | |
|---|-------------------|---|------|------|------|------|------|
| Type | U value [W/mK] | Average operating temperature T _B [°C] | | | | | |
| | | 40° | 50° | 60° | 70° | 80° | 90° |
| 25 + 25/ 90 | 0.22 | 6.5 | 8.7 | 10.8 | 13.0 | 15.1 | 17.3 |
| 32 + 32/105 | 0.24 | 7.2 | 9.7 | 12.1 | 14.5 | 16.9 | 19.3 |
| 40 + 40/125 | 0.26 | 7.7 | 10.3 | 12.8 | 15.4 | 18.0 | 20.5 |
| 50 + 50/150 | 0.28 | 8.3 | 11.1 | 13.9 | 16.7 | 19.5 | 22.3 |



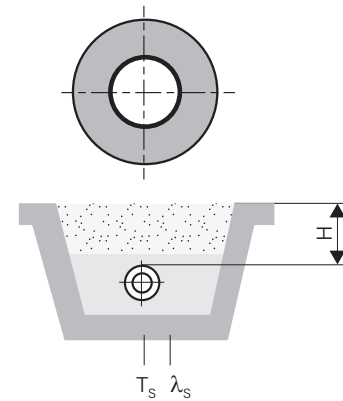
FLEXSTAR UNO

| Heat losses q [W/m] for for two UNO pipes laid in pairs | | | | | | | |
|---|-------------------|---|------|------|------|------|------|
| Type | U value [W/mK] | Average operating temperature T _B [°C] | | | | | |
| | | 40° | 50° | 60° | 70° | 80° | 90° |
| 25/ 70 | 0.26 | 7.8 | 10.4 | 13.0 | 15.6 | 18.2 | 20.8 |
| 32/ 70 | 0.33 | 9.9 | 13.2 | 16.5 | 19.8 | 23.1 | 26.4 |
| 40/ 90 | 0.33 | 9.8 | 13.1 | 16.4 | 19.7 | 23.0 | 26.3 |
| 50/ 90 | 0.43 | 13.0 | 17.3 | 21.7 | 26.0 | 30.3 | 34.7 |
| 63/105 | 0.48 | 14.3 | 19.1 | 23.9 | 28.7 | 33.5 | 38.2 |



FLEXSTAR UNO

| Heat losses q [W/m] for a single UNO pipe | | | | | | | |
|---|-------------------|---|------|------|------|------|------|
| Type | U value [W/mK] | Average operating temperature T _B [°C] | | | | | |
| | | 40° | 50° | 60° | 70° | 80° | 90° |
| 25/ 70 | 0.15 | 4.6 | 6.1 | 7.6 | 9.1 | 10.7 | 12.2 |
| 32/ 70 | 0.20 | 6.1 | 8.1 | 10.2 | 12.2 | 14.2 | 16.3 |
| 40/ 90 | 0.20 | 5.9 | 7.8 | 9.8 | 11.8 | 13.7 | 15.7 |
| 50/ 90 | 0.28 | 8.3 | 11.1 | 13.8 | 16.6 | 19.4 | 22.1 |
| 63/105 | 0.31 | 9.3 | 12.4 | 15.5 | 18.6 | 21.7 | 24.8 |

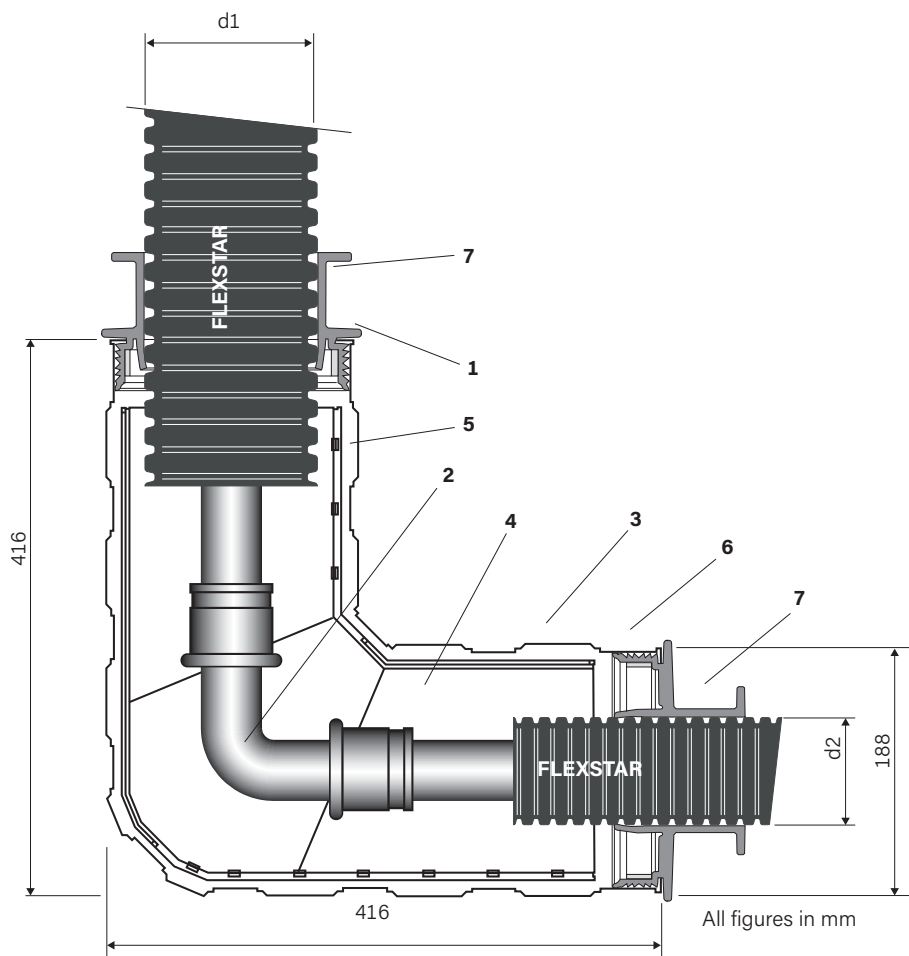


Pipe spacing: a = 0.10 m
 Cover height: H = 0.80 m
 Ground temperature: T_S = 10 °C
 Conductivity of the ground: λ_S = 1,000 $\frac{W}{mK}$
 Conductivity of the PUR foam: λ_i = 0.023 $\frac{W}{mK}$
 Conductivity of the PE casing: λ_{PE} = 0,330 $\frac{W}{mK}$

average operating temperature T_B (C°)
 Flow: F
 Return: R
 thermal transmittance coefficient U [$\frac{W}{m}$]
 Heat loss during operation: q = U (T_B-T_S) [$\frac{W}{m}$]

L-shell

Dimensions: Ø 70–125 mm



Clip-L-shell, UNO/DUO

| Outer casing Ø d1 | Ø d2 | | | |
|----------------------|------|----|-----|-----|
| | 70 | 90 | 105 | 125 |
| 70 | F | | | |
| 90 | | C | | |
| 105 | | | F | |
| 125 | | | | C |

F = FLEXSTAR

C = CALPEX

Structure of the half-shells

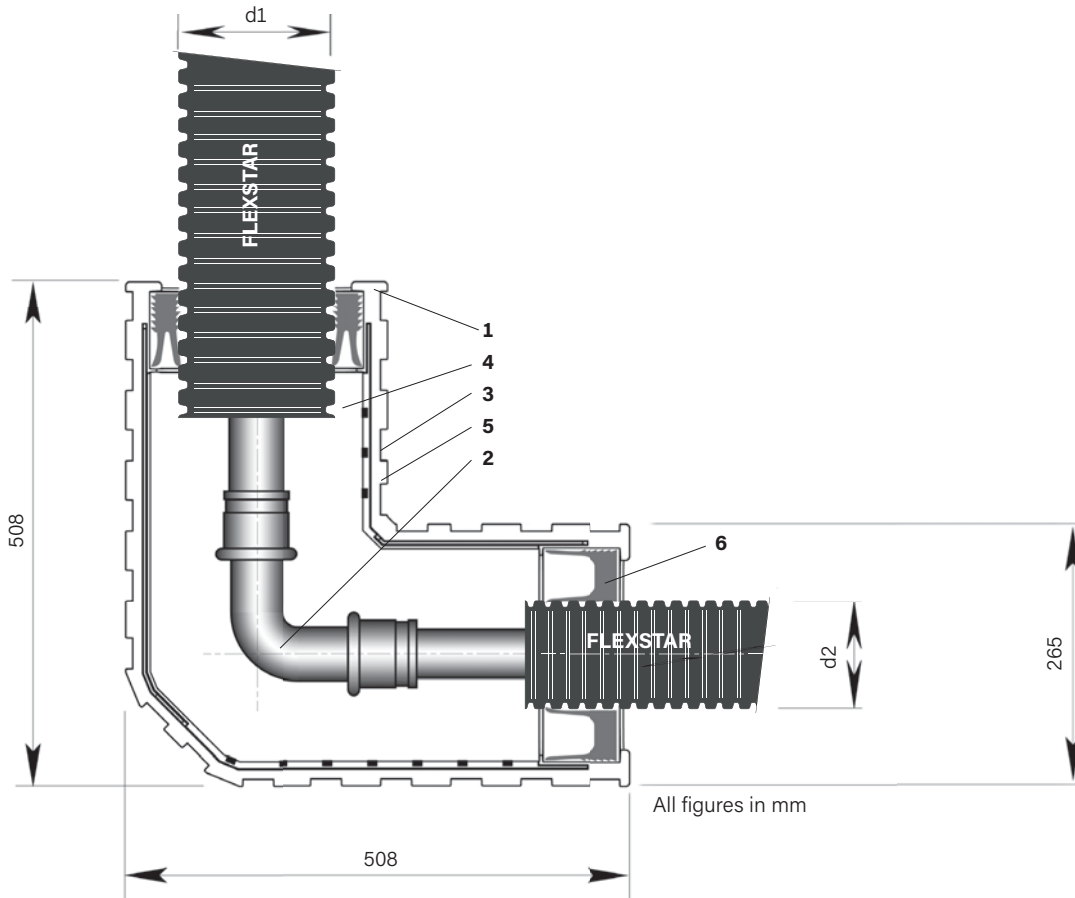
- 1 ABS half-shells
- 2 PEX angled coupling; see FXS 0.385
- 3 Locking clips (15 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring
- 7 Hose clips

CALPEX shells must be installed so that they are protected from solar radiation if possible.

Can be combined with CALPEX sealing rings

Big L-shell

Dimensions: Ø 70–150 mm



Clip-Big L-shell, UNO/DUO

| Outer casing Ø d1 | Ø d2 | | | | |
|----------------------|------|----|-----|-----|-----|
| | 70 | 90 | 105 | 125 | 150 |
| 70 | F | | | | |
| 90 | | F | | | |
| 105 | | | F | | |
| 125 | | | | F | |
| 150 | | | | | F |

F = FLEXSTAR

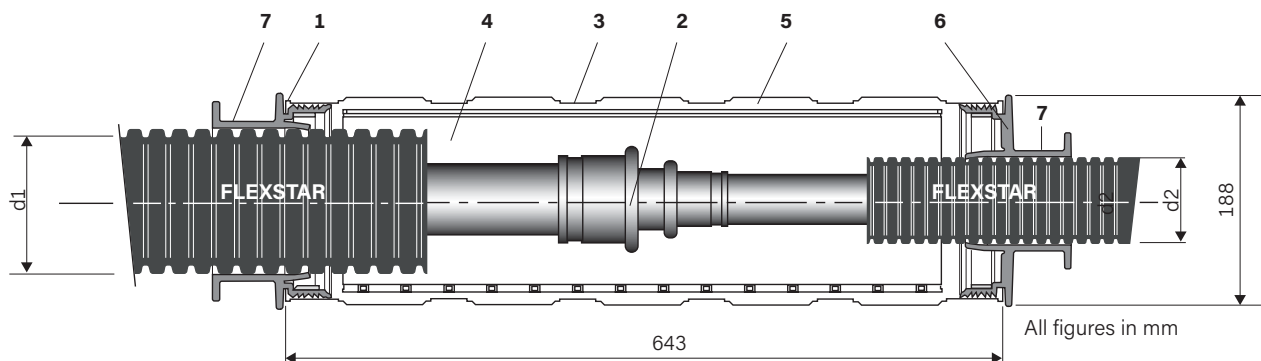
Structure of the half-shells

- 1 ABS half-shells
- 2 PEX angled coupling; see FXS 0.385
- 3 Locking clips (22 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring

CALPEX shells must be installed so that they are protected from solar radiation if possible.

I-shell

Dimensions: Ø 70–125 mm



Clip-I-shell, UNO/DUO

| Outer casing Ø d1 | Ø d2 | | | |
|----------------------|------|----|-----|-----|
| | 70 | 90 | 105 | 125 |
| 70 | F | | | |
| 90 | | C | | |
| 105 | | | F | |
| 125 | | | | C |

F = FLEXSTAR

C = CALPEX

Structure of the half-shells

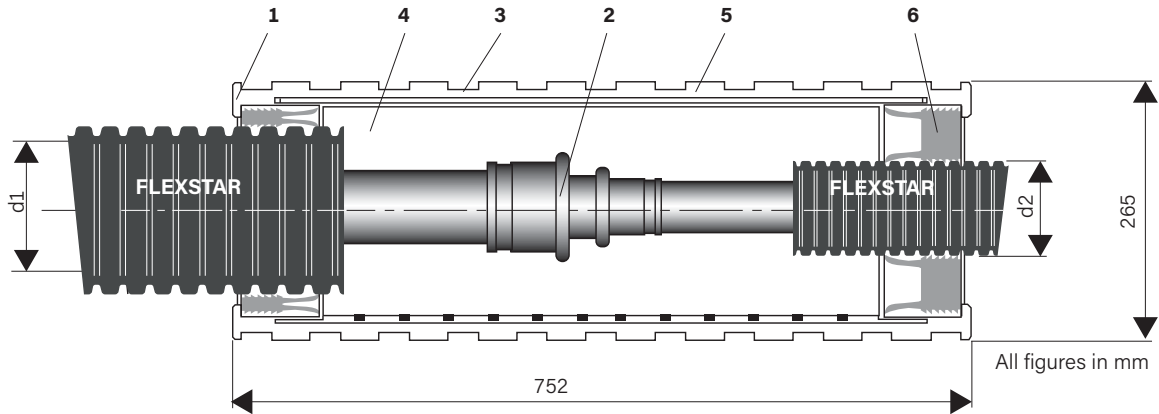
- 1 ABS half-shells
- 2 PEX angled coupling; see FXS 0.380
- 3 Locking clips (14 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring
- 7 Hose clips

CALPEX shells must be installed so that they are protected from solar radiation if possible.

Can be combined with CALPEX sealing rings

Big I-shell

Dimensions: Ø 70–150 mm



Clip-Big I-shell, UNO/DUO/QUADRIGA

| Outer casing Ø d1 | Ø d2 | | | | |
|----------------------|------|----|-----|-----|-----|
| | 70 | 90 | 105 | 125 | 150 |
| 70 | F | | | | |
| 90 | F | F | | | |
| 105 | F | F | F | | |
| 125 | F | F | F | F | |
| 150 | F | F | F | F | F |

F = FLEXSTAR

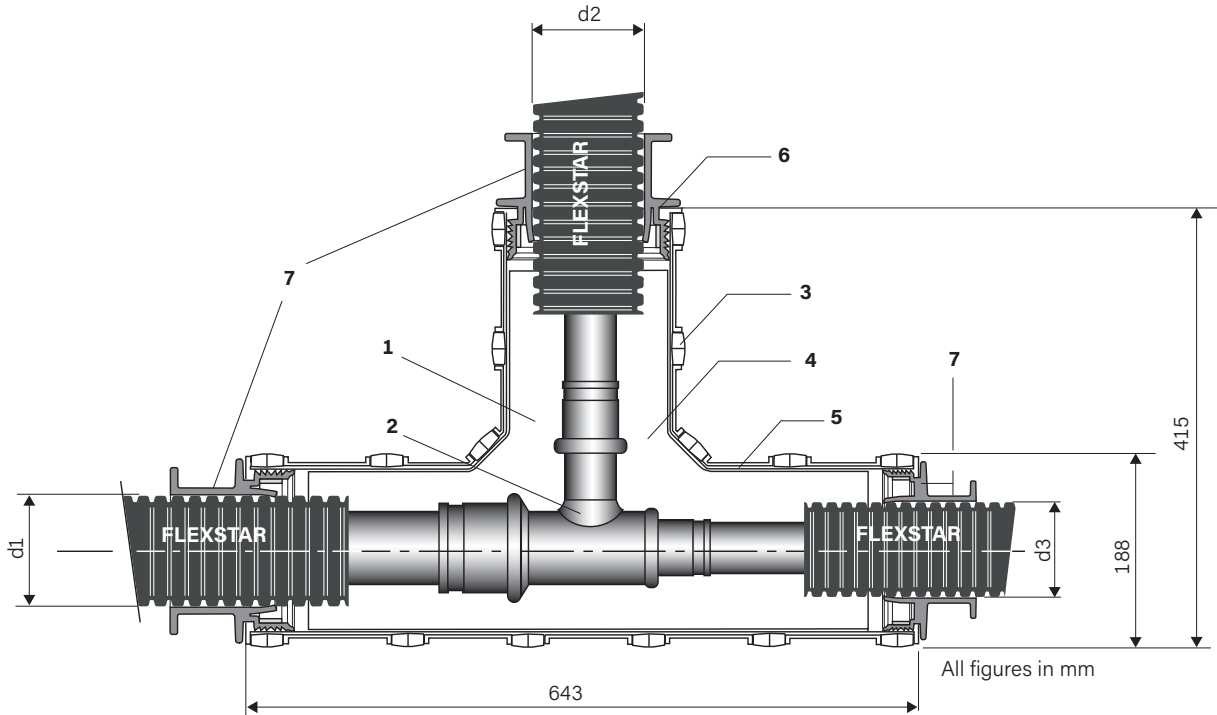
Structure of the half-shells

- 1 ABS half-shells
- 2 PEX angled coupling; see FXS 0.380
- 3 Locking clips (22 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring

CALPEX shells must be installed so that they are protected from solar radiation if possible.

T-shell

Dimensions: Ø 70–125 mm



All figures in mm

Clip-T-shell, UNO/DUO

| Outer casing Ø d1-Ø d3 | Branch, Ø d2 | | | |
|---------------------------|--------------|----|-----|-----|
| | 70 | 90 | 105 | 125 |
| 70 | F | | | |
| 90 | | C | | |
| 105 | | | F | |
| 125 | | | | C |

F = FLEXSTAR

C = CALPEX

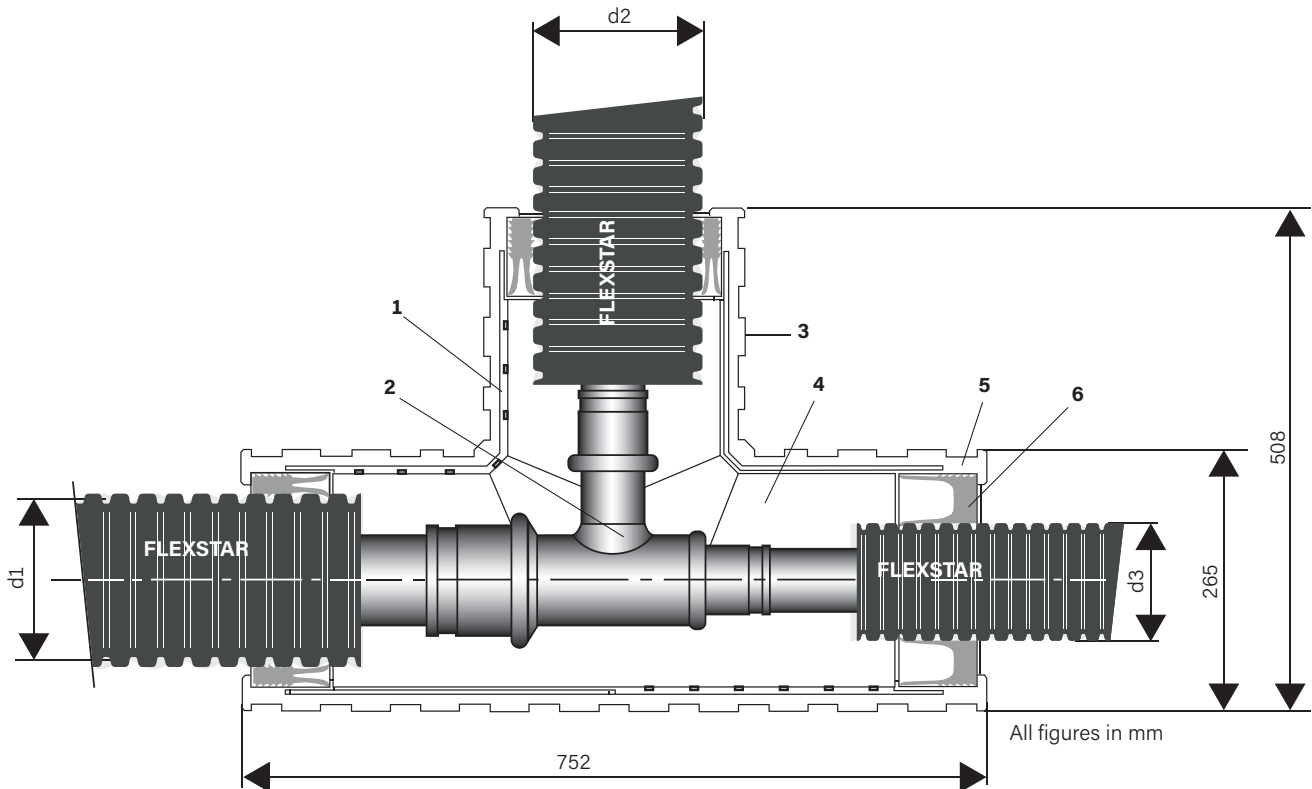
Structure of the half-shells

- 1 ABS half-shells
- 2 PEX T-piece; see FXS 0.390
- 3 Locking clips (20 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring
- 7 Hose clips

CALPEX shells must be installed so that they are protected from solar radiation if possible.

Big T-shell

Dimensions: Ø 70–150 mm



Structure of the half-shells

- 1 ABS half-shells
- 2 PEX T-piece; see FXS 0.390
- 3 Locking clips (27 pcs.)
- 4 Insulating material; see FXS 0.365
- 5 Adhesive surfaces
- 6 Reducer ring or sealing ring

Clip-Big T-shell, UNO/DUO

| Outer casing Ø d1 | Ø d2 | | | | |
|----------------------|------|----|-----|-----|-----|
| | 70 | 90 | 105 | 125 | 150 |
| 70 | F | | | | |
| 90 | F | F | | | |
| 105 | F | F | F | | |
| 125 | F | F | F | F | |
| 150 | F | F | F | F | F |

F = FLEXSTAR

CALPEX shells must be installed so that they are protected from solar radiation if possible.

Insulating material

PUR foam container

Insulating material for shrink-on sleeves and the Clip-shells

PUR foam container (25/70-50 + 50/150)

CFC-free, CO₂-blown PUR foam in plastic bottles

The required amount of PUR foam (CFC-free) is supplied in the appropriate container sizes for the various sleeves and T-pieces. The components are supplied in two separate bottles and are only mixed when used. Please note the safety regulations in the installation instructions provided.



Safety regulations

For foaming, eye protection and gloves must be used.

Plastic gloves



Eye protection



Screw connections

External thread, weld end

Connection with external thread



FLEXSTAR (heating, 6 bar)

Material: Brass

| PEX pipe mm | Screw connection mm | L/L1 mm |
|----------------|------------------------|------------|
| 25 x 2.3 | 25 x 2.3-3/4" | 61/26 |
| 32 x 2.9 | 32 x 2.9-1" | 68/29 |
| 40 x 3.7 | 40 x 3.7-1 1/4" | 77/36 |
| 50 x 4.6 | 50 x 4.6-1 1/2" | 79/36 |
| 63 x 5.7 | 63 x 5.7-2" | 97/46 |

Connection with weld end



FLEXSTAR (heating, 6 bar)

Material: Steel

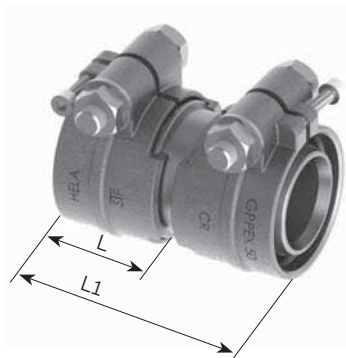
| PEX pipe mm | Weld end mm | L/L1 mm |
|----------------|----------------|------------|
| 25 x 2.3 | 26.9 x 2.3 | 61/26 |
| 32 x 2.9 | 33.7 x 2.6 | 63/29 |
| 40 x 3.7 | 42.4 x 2.6 | 75/36 |
| 50 x 4.6 | 48.3 x 2.6 | 84/36 |
| 63 x 5.7 | 60.3 x 2.9 | 88/46 |

Connections with weld ends must be welded first and then crimped.

Screw connection

Coupling, any, elbow 90°

Coupling, any



FLEXSTAR (heating, 6 bar)

Material: Brass

| PEX pipe mm | Coupling mm | L/L1 mm |
|----------------|----------------|------------|
| 25 x 2.3 | 25 x 2.3 | 68/26 |
| 32 x 2.9 | 32 x 2.9 | 75/29 |
| 40 x 3.7 | 40 x 3.7 | 90/36 |
| 50 x 4.6 | 50 x 4.6 | 90/36 |
| 63 x 5.7 | 63 x 5.7 | 110/46 |

Reduced couplings (soldered) can be supplied on request

Elbow 90°



FLEXSTAR (heating, 6 bar)

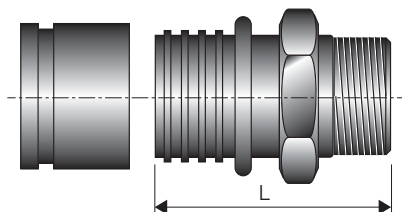
Material: Brass, soldered

| PEX pipe mm | On PEX pipe mm |
|----------------|-------------------|
| 25 x 2.3 | 25 x 2.3 |
| 32 x 2.9 | 32 x 2.9 |
| 40 x 3.7 | 40 x 3.7 |
| 50 x 4.6 | 50 x 4.6 |
| 63 x 5.7 | 63 x 5.7 |

Press fittings

External thread, weld end

Connection with external thread

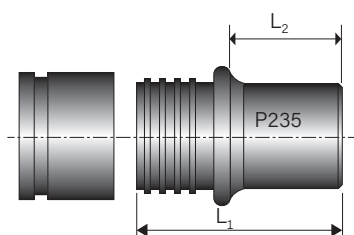


FLEXSTAR (heating, 6 bar)

Material: Brass

| PEX pipe mm | Screw connection mm | L mm |
|----------------|------------------------|---------|
| 25 x 2.3 | 25 x 2.3-3/4" | 62 |
| 32 x 2.9 | 32 x 2.9-1" | 72 |
| 40 x 3.7 | 40 x 3.7-1 1/4" | 82 |
| 50 x 4.6 | 50 x 4.6-1 1/2" | 89 |
| 63 x 5.8 | 63 x 5.7-2" | 109 |

Connection with weld end



FLEXSTAR (heating, 6 bar)

Material: Steel (P235)

| PEX pipe mm | Weld end mm | L1 mm | L2 mm |
|----------------|----------------|----------|----------|
| 25 x 2.3 | 26.9 x 2.65 | 50 | 20 |
| 32 x 2.9 | 33.7 x 2.3 | 60 | 24 |
| 40 x 3.7 | 42.4 x 2.6 | 70 | 29 |
| 50 x 4.6 | 48.3 x 2.6 | 85 | 37 |
| 63 x 5.8 | 60.3 x 2.9 | 90 | 32 |

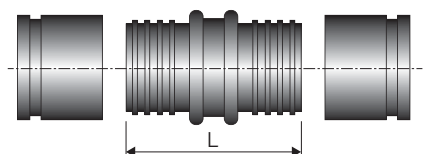
Connections with weld ends must be welded first and then crimped.

For pressing tools, see FXS 0.540

Press fittings

Coupling, any, reduced coupling, elbow 90°

Coupling

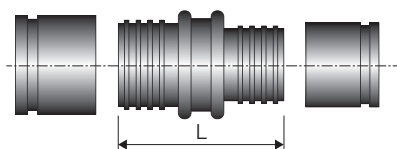


FLEXSTAR (heating, 6 bar)

Material: Brass

| PEX pipe mm | Coupling mm | L mm |
|----------------|----------------|---------|
| 25 x 2.3 | 25 x 2.3 | 67.0 |
| 32 x 2.9 | 32 x 2.9 | 88.0 |
| 40 x 3.7 | 40 x 3.7 | 100.0 |
| 50 x 4.6 | 50 x 4.6 | 114.0 |
| 63 x 5.8 | 63 x 5.7 | 141.0 |

Coupling, reduced

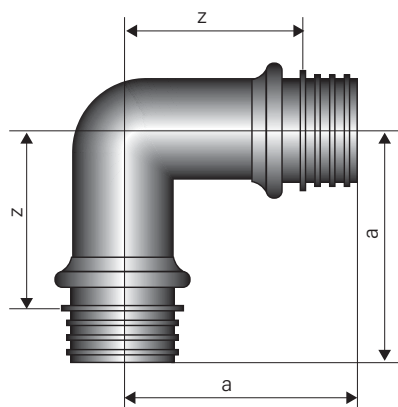


FLEXSTAR (heating, 6 bar)

Material: Brass/steel* (P235)

| PEX pipe mm | Coupling mm | L mm |
|----------------|----------------|---------|
| 32 x 2.9 | 25 x 2.3 | 80.0 |
| 40 x 3.7 | 32 x 2.9 | 100.0 |
| 50 x 4.6 | 40 x 3.7 | 108.0 |
| 63 x 5.8 | 50 x 4.6 | 129.0 |

Elbow 90°



FLEXSTAR (heating, 6 bar)

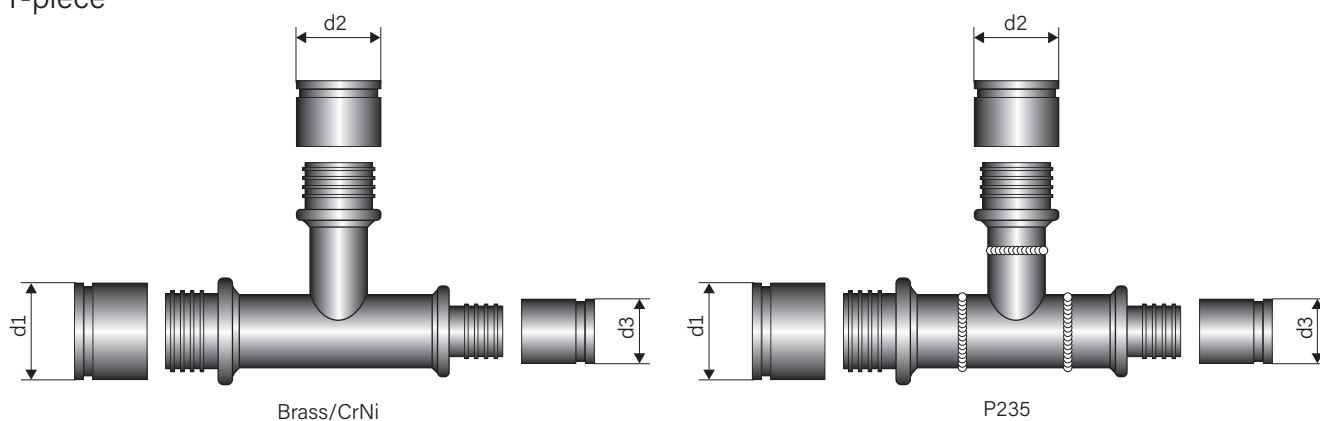
Material: Brass/steel* (P235)

| PEX pipe mm | PEX pipe mm | a mm | z mm |
|----------------|----------------|---------|---------|
| 25 x 2.3 | 25 x 2.3 | 54 | 32 |
| 32 x 2.9 | 32 x 2.9 | 64 | 37 |
| 40 x 3.7 | 40 x 3.7 | 74 | 42 |
| 50 x 4.6 | 50 x 4.6 | 87 | 48 |
| 63 x 5.8 | 63 x 5.8 | 106 | 60 |

For pressing tools, see FXS 0.540

Press fittings

T-piece



FLEXSTAR (Heating, 6 bar)

| ø d1 ø d3 mm | Branch, ø d2 | | | | |
|--------------------|------------------|------------------|------------------|----------|----------|
| | mm | | | | |
| | 25 x 2.3 | 32 x 2.9 | 40 x 3.7 | 50 x 4.6 | 63 x 5.8 |
| 25 x 2.3- 25 x 2.3 | o/x | | | | |
| 32 x 2.9- 32 x 2.9 | o/x | o/x | | | |
| 32 x 2.9- 25 x 2.3 | o/x | | | | |
| 40 x 3.7- 40 x 3.7 | o/x | o/x | o/x | | |
| 40 x 3.7- 32 x 2.9 | o/x ¹ | o/x ¹ | | | |
| 50 x 4.6- 50 x 4.6 | o/x | o/x | o/x | o/x | |
| 50 x 4.6- 40 x 3.7 | o/x | o/x | o/x ¹ | | |
| 63 x 5.8- 63 x 5.8 | o/x | o/x | o/x | o/x | o/x |
| 63 x 5.8- 50 x 4.6 | o/+ | o/x | o/x | o/x | |

¹ Soldered fittings

- T-pieces made of steel can be supplied on request
- Other T-pieces can be supplied on request.

Material:

- x = Brass CuZn39Pb3 (DN 20 - DN 50),
Gunmetal Rg7 (DN 65 - DN 100)
- o = P235 welded
- + = CrNi 1.4404, 1.4432, 1.4435 (316L)

End caps

Shrink-on end cap, UNO



End cap EPDM, UNO



End cap, UNO (LDPE)



Shrink-on end cap, DUO



End cap EPDM, DUO



End cap, DUO (LDPE)



FLEXSTAR UNO

Type

25/70

32/70

40/90

50/90

63/105

FLEXSTAR DUO

Type

25 + 25/90

32 + 32/105

40 + 40/125

50 + 50/150

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

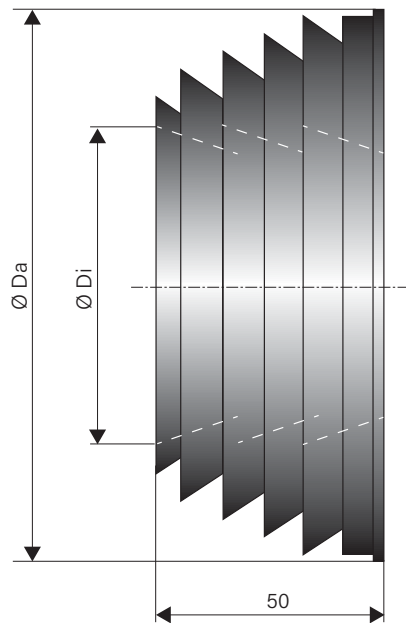
EPDM end caps provide optimal protection against splash water, moisture and vermin.

With exact markings for cutting the collars. Can be installed without special tools.

If a pre-insulated pipe ends in the ground, using stainless steel tightening straps provided by the customer is mandatory.

Wall sealing insert

for wall openings



All figures in mm

FLEXSTAR UNO, DUO

| Outer casing diameter mm | Labyrinth wall sealing ring Ø Di, inner mm | Ø Da, outer mm |
|-----------------------------|--|-------------------|
| 70 | 74 | 118 |
| 90 | 88 | 133 |
| 105 | 107 | 153 |
| 125 | 122 | 168 |
| 150 | 137 | 183 |

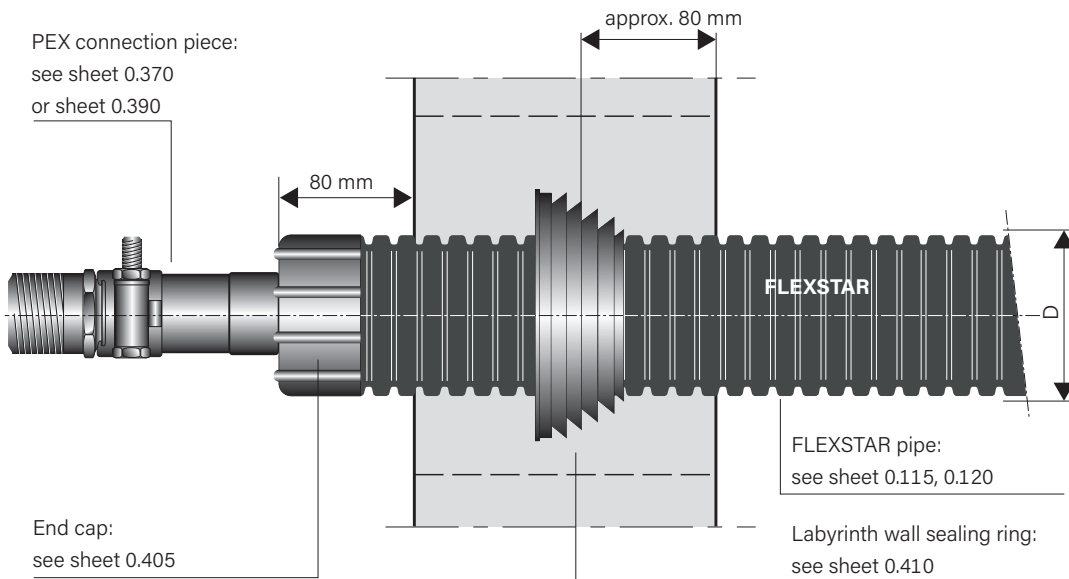
Building entry (see sheet FXS 0.415)

Building entry

Wall opening

Wall sealing insert

PEX connection piece:
see sheet 0.370
or sheet 0.390

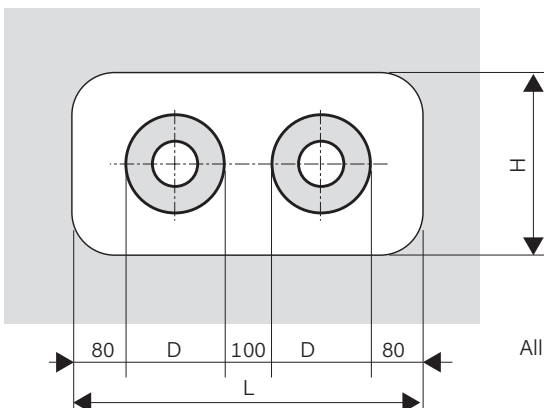


End cap:
see sheet 0.405

FLEXSTAR pipe:
see sheet 0.115, 0.120

Labyrinth wall sealing ring:
see sheet 0.410

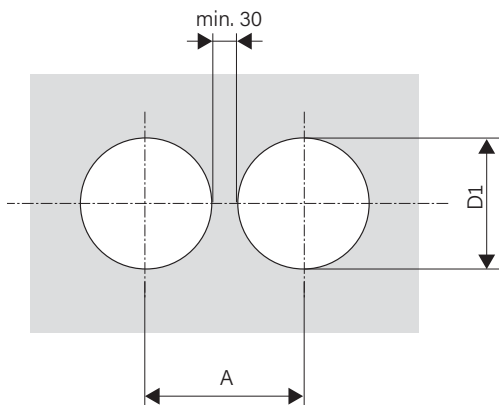
Wall opening



All figures in mm

| Outer casing Ø D mm | L min. mm | H min. mm |
|---------------------------|--------------|--------------|
| 78 | 450 | 250 |
| 93 | 500 | 250 |
| 113 | 500 | 300 |
| 128 | 550 | 300 |
| 143 | 600 | 350 |
| 163 | 650 | 350 |
| 183 | 670 | 380 |
| 202 | 720 | 400 |
| 225 | 740 | 400 |
| 250 | 810 | 450 |

Core drillings



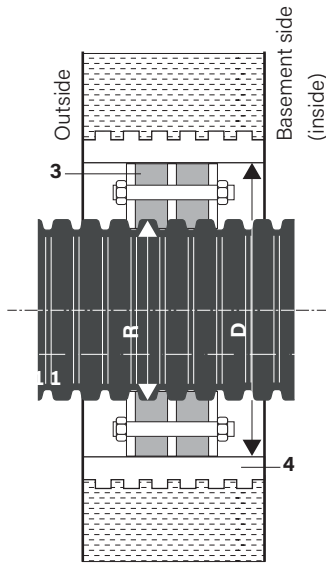
All figures in mm

| Outer casing Ø D mm | A mm | D1 mm |
|---------------------------|---------|----------|
| 78 | 210 | 180 |
| 93 | 230 | 180 |
| 113 | 250 | 220 |
| 128 | 270 | 230 |
| 143 | 290 | 230 |
| 163 | 310 | 280 |
| 183 | 330 | 280 |
| 202 | 400 | 350 |
| 225 | 400 | 350 |
| 250 | 420 | 380 |

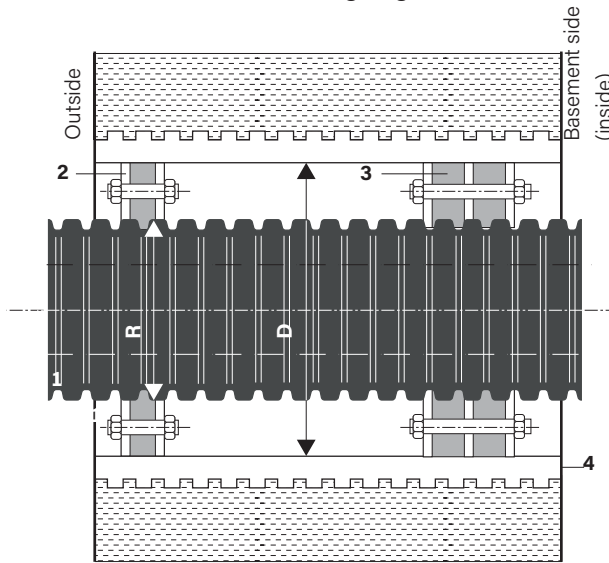
Wall sealing insert

Core drillings/cement casing pipes

Standard



With additional centring ring



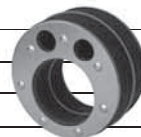
- 1 FLEXSTAR heat-pump pipe
- 2 Sealing insert, single-seal with wall thickness > 30 cm/not suitable against pressing water
1 x 40 mm, Shore hardness D 35. Also available with cable duct gland 2x Ø 32 mm.
- 3 Sealing insert, double-seal/suitable against pressing water (up to 0.5 bar)
2 x 40 mm, Shore hardness D 35. Also available with cable duct gland 2x Ø 32 mm.
- 4 Casing pipe made of fibre cement or coated core drilling

Core drillings/ Cement casing pipes

The holes must be faultless for installation. As there may be hairline cracks in the concrete or these may appear as a result of the processing work, we recommend sealing the entire wall of the drill hole with a suitable sealant (e.g. AQUAGARD).

Adhering to this recommendation is the only way to ensure leak-tightness.

| Outer casing Ø R mm | Casing pipe Ø D mm | Core drilling Ø mm |
|---------------------------|--------------------------|--------------------------|
| 70 | 150 | 150 |
| 90 | 150 | 200 |
| 105 | 200 | 200 |
| 125 | 200 | 200 |
| 150 | 250 | 250 |

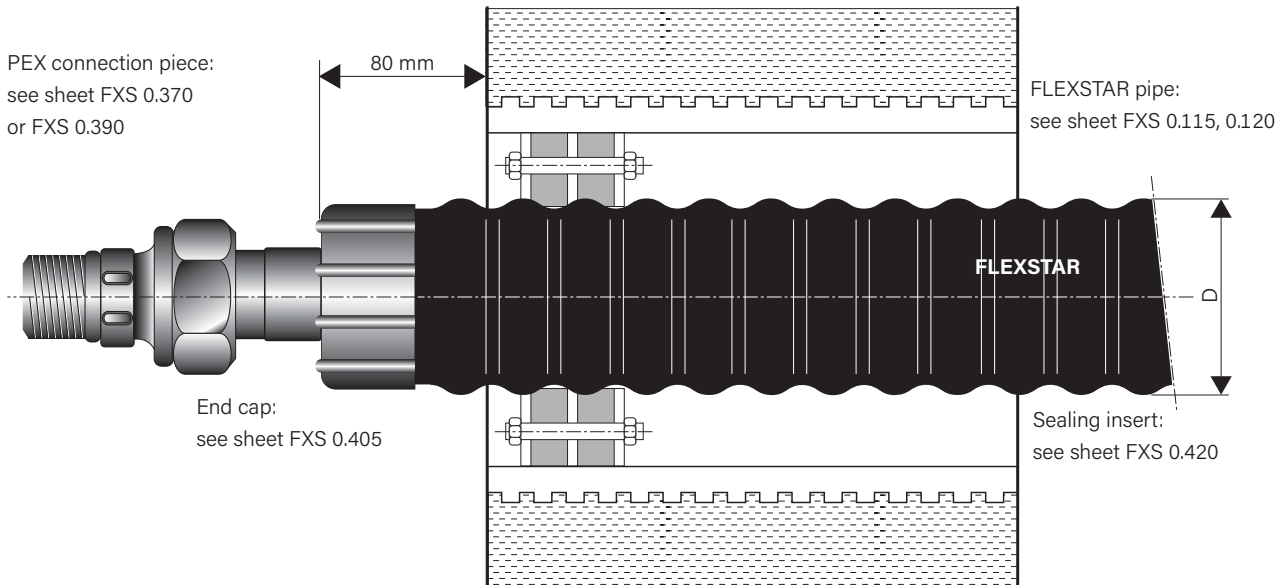


Building entry (see sheet FXS 0.425)

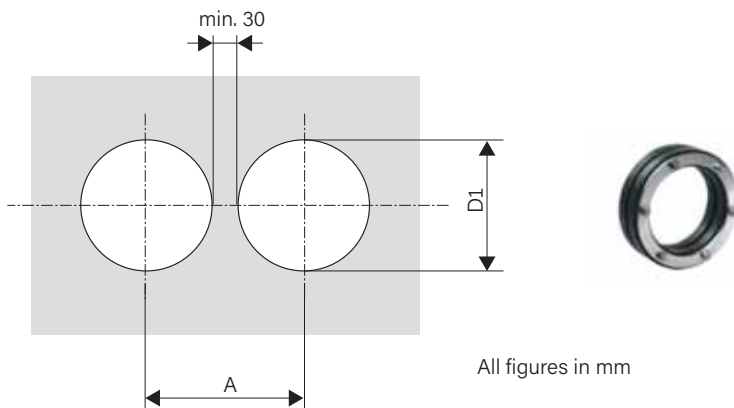
Building entry

Core drillings/cement casing pipes

Wall sealing insert



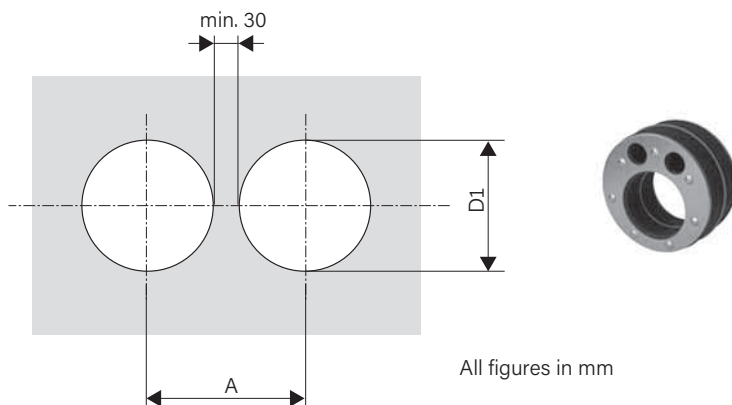
Core drillings/cement casing pipes for wall seal without cable gland 2 x Ø 32 mm



| Outer casing Ø D mm | A mm | D1 mm |
|---------------------------|---------|----------|
| 70 | 180 | 150 |
| 90 | 180 | 150 |
| 105 | 230 | 200 |
| 125 | 230 | 200 |
| 150 | 280 | 250 |

All figures in mm

Core drillings/cement casing pipes for wall seal with cable gland 2 x Ø 32 mm

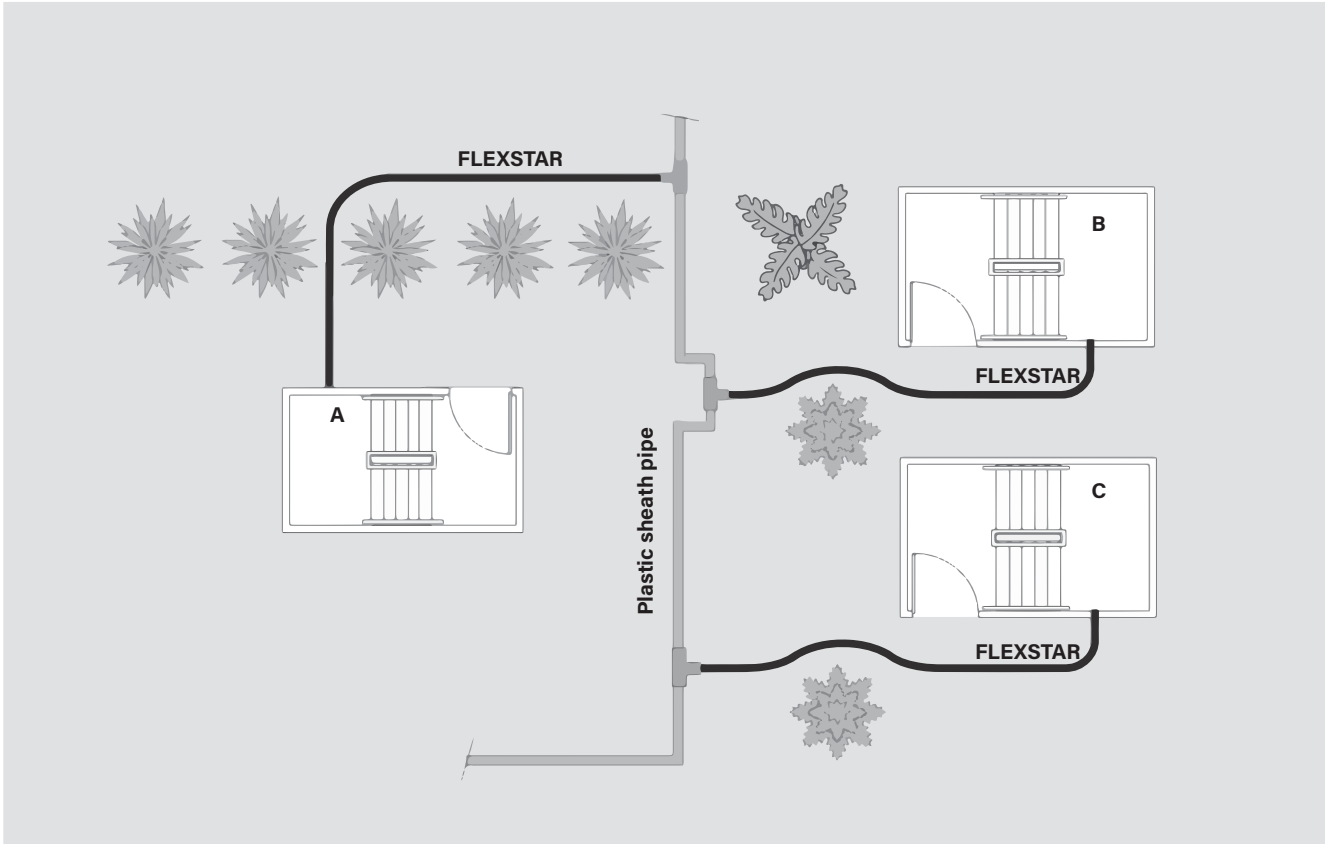


| Outer casing Ø D mm | A mm | D1 mm |
|---------------------------|---------|----------|
| 70 | 180 | 150 |
| 90 | 230 | 200 |
| 105 | 230 | 200 |
| 125 | 230 | 200 |
| 150 | 280 | 250 |

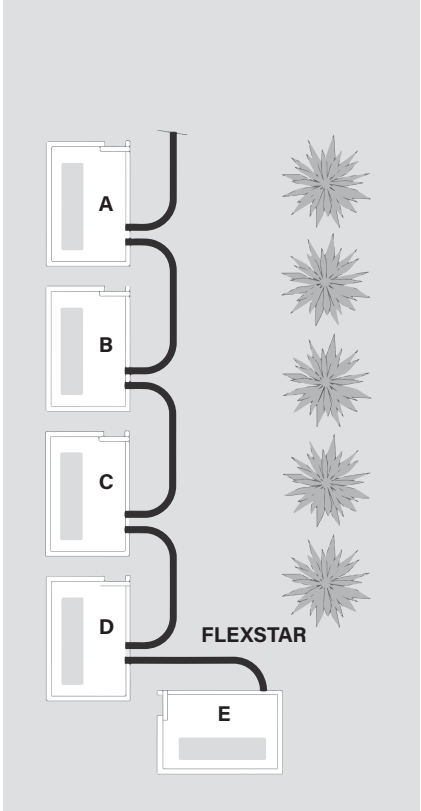
All figures in mm

Route

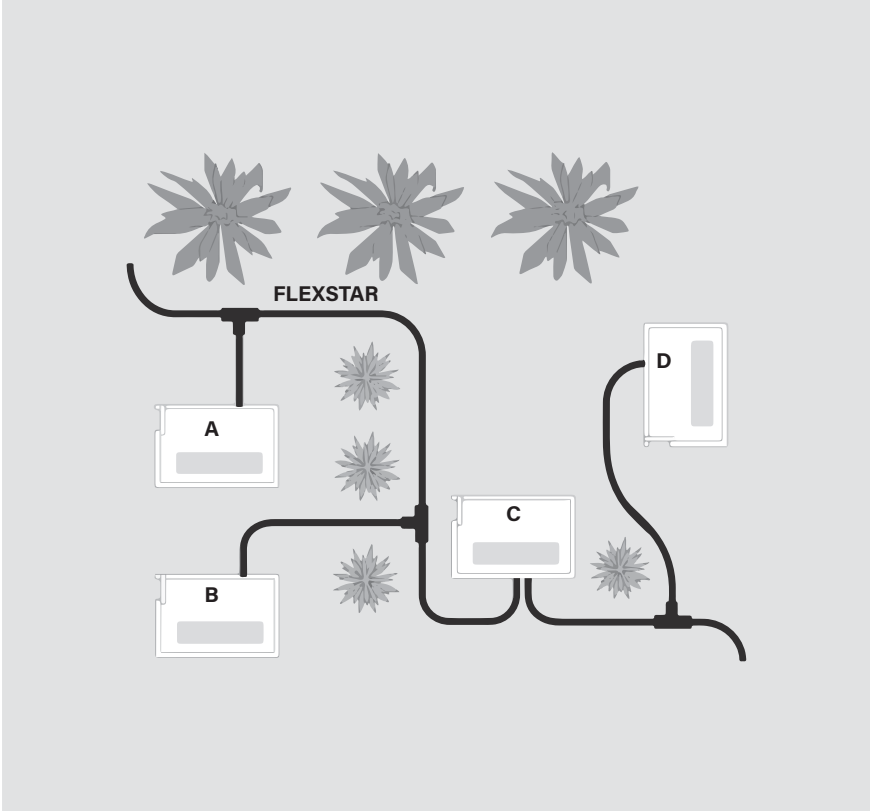
Connection between FLEXSTAR and plastic sheath pipe



Loop-in method



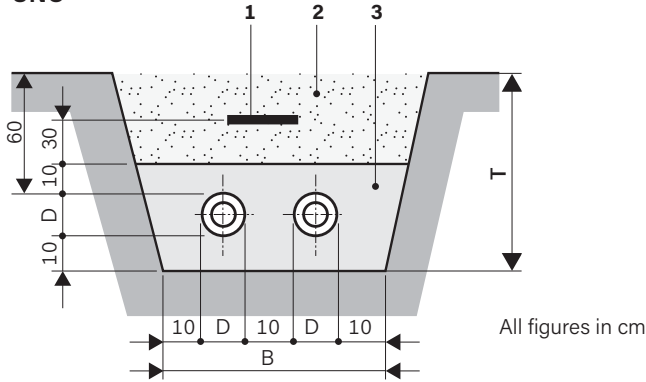
Connection between FLEXSTAR and FLEXSTAR



Trench dimensions

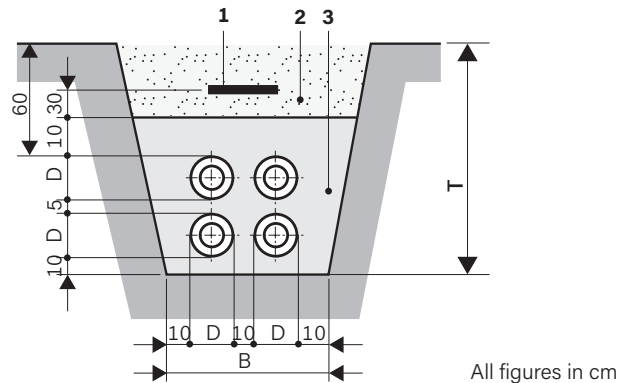
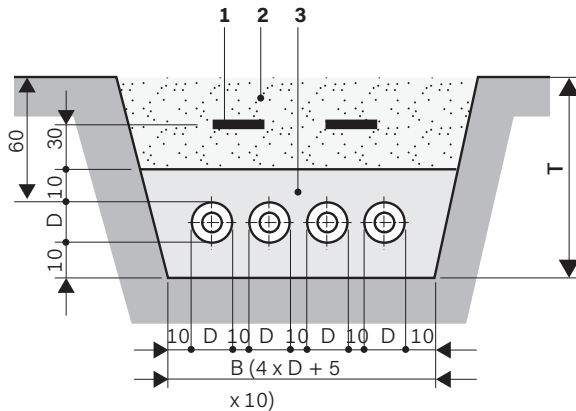
Trench profile, 2 FLEXSTAR pipes

UNO



| Sheath pipe Ø D mm | Width B cm | Depth T cm | Minimum winding radius m |
|--------------------------|------------------|------------------|--------------------------------|
| 71.5 | 45 | 80 | 0.30 |
| 90.0 | 50 | 80 | 0.30 |
| 106.5 | 55 | 85 | 0.30 |
| 126.5 | 55 | 85 | 0.35 |
| 151.5 | 65 | 90 | 0.40 |

Trench profile, 4 FLEXSTAR pipes



- 1 Pipe warning tape; see sheet FXS 1.430
- 2 Excavated material
- 3 Fill material in line with description below

Laying depth:
 Max. laying depth: 2.6 m
 Our approval is required for deeper installations

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

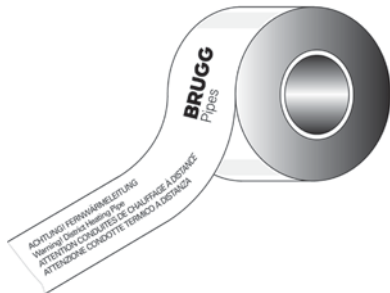
With no traffic load, the minimum trench depth T can be reduced by 20 cm.

The fill material in the embedment must comply with EN 13941-2 and satisfy the following minimum requirements:

- Friable, round-edged sand-gravel mixture
- Permissible grain size: 0–8 mm
- Coefficient of uniformity according to DIN EN ISO 14688-2 greater than 1.8
- Max. 10 percent by mass \leq 0.075 mm
- Max. 3 percent by mass \leq 0.02 mm
- Proctor density min. 94 %; ideal 97–98 %

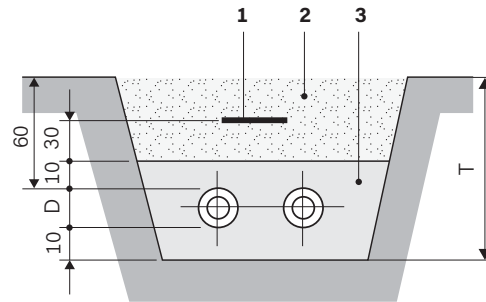
Pipe warning tape

BRUGG Pipes pipe warning tape



Pipe warning tape for laying in the ground.
Roll length 250 m

FLEXSTAR trench structure



- 1 Pipe warning tape
- 2 Excavated material
- 3 Sand, washed

For the laying depth, see sheet FXS 0.505

Laying aids

With the FLEXSTAR unwinding device and a motorised winch, you can unroll pipes quickly and with minimal effort before laying them in the ground.

Unwinding device



Dimensions: Ø 400 x 157 cm
Load-bearing capacity: 1000 kg

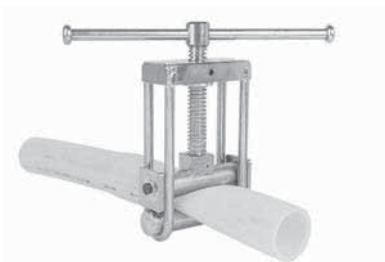
Motorised winch



Our recommendation:
<https://www.portablewinch.com>

Squeezing tools

for shutting of PE and PEX pipe provisionally



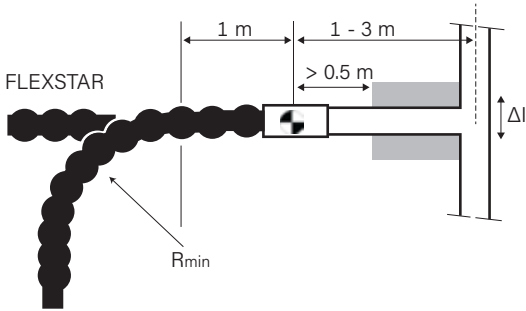
Squeezing tool Ø 32–63 mm (SDR11)

Connection (rigid/flexible)

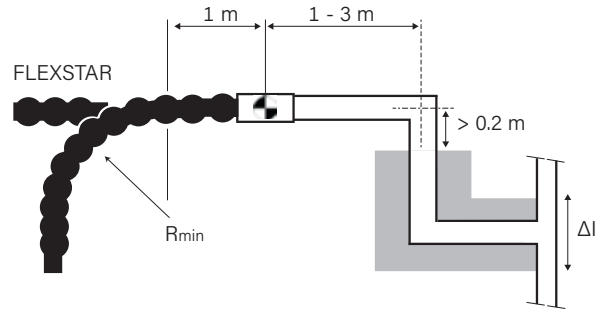
FLEXSTAR to insulated steel pipes

Installation instructions for transition from FLEXSTAR to insulated steel pipe (KMR)

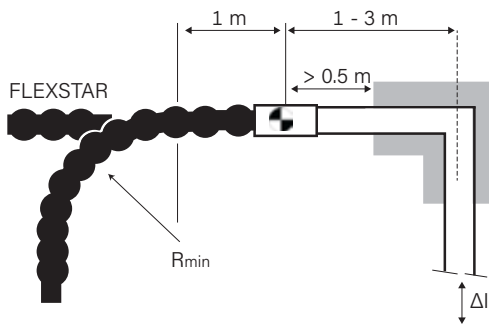
1. Connection to T-piece (Δl small)



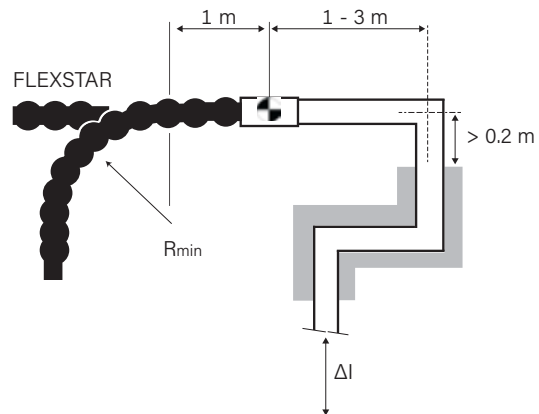
2. Connection to T-piece (Δl large)



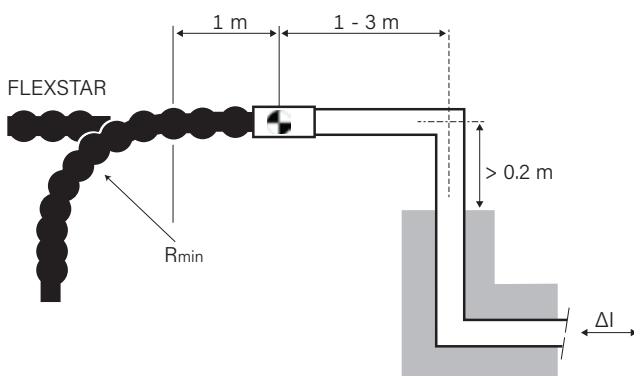
3. Connection to L-bend (Δl small)




4. Connection to L-bend (Δl large)



5. Connection to Z-bend

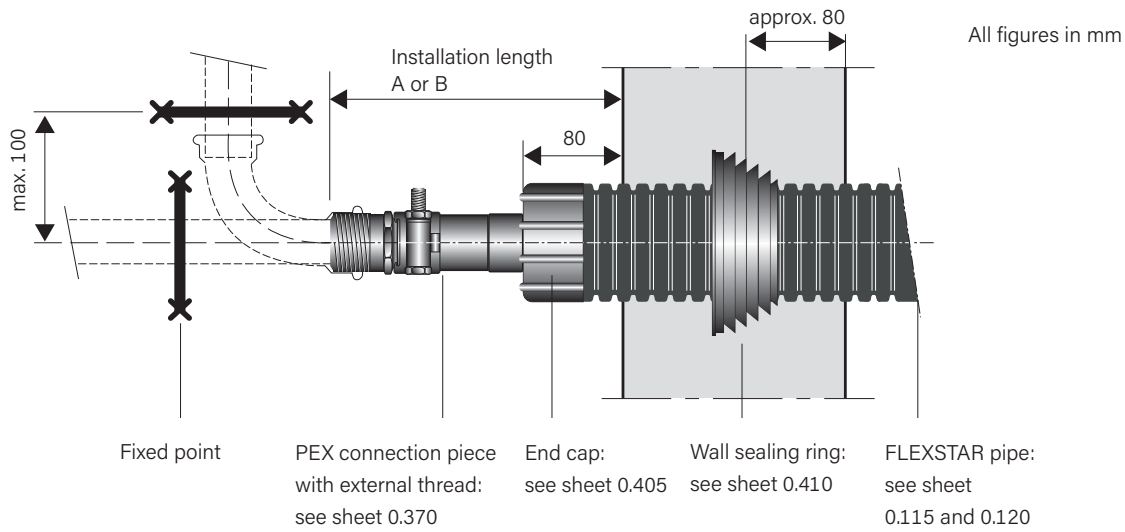


Comments:

1. Thermal elongation Δl of the KMR system that is transferred to the centre of the connector  must be less than: axial 3 mm
2. Grey = expansion pad for the KMR system, designed in line with the state of the art

Building connection - screw connection/press fitting

Shaft entry



Screw connector



Press fitting



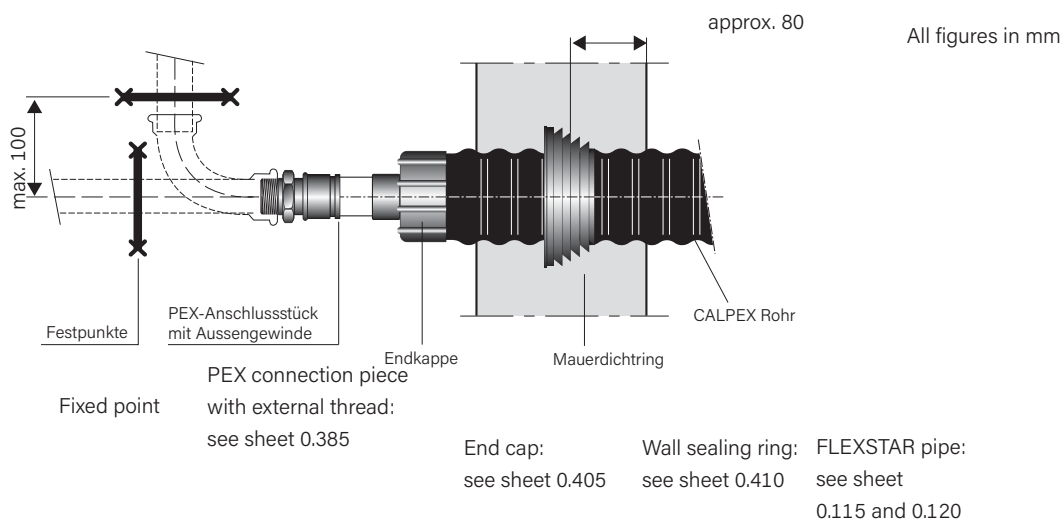
| FLEXSTAR | | |
|----------------|----------------------|-----|
| Heating, 6 bar | Installation lengths | |
| PEX pipe | A | B |
| mm | mm | mm |
| 25 x 2.3 | 190 | 190 |
| 32 x 2.9 | 195 | 190 |
| 40 x 3.7 | 200 | 200 |
| 50 x 4.6 | 205 | 210 |
| 63 x 5.8 | 225 | 215 |

| FLEXSTAR | | |
|----------------|----------------------|-----|
| Heating, 6 bar | Installation lengths | |
| PEX pipe | A | B |
| mm | mm | mm |
| 25 x 2.3 | 260 | 250 |
| 32 x 2.9 | 260 | 250 |
| 40 x 3.7 | 270 | 260 |
| 50 x 4.6 | 270 | 270 |
| 63 x 5.8 | 320 | 310 |

Building connection – press fitting

Fixed-point forces

Connection with external thread



Acting fixed-point forces FLEXSTAR (heating, 6 bar)

Maximum acting fixed-point forces **per pipe** at:

Op. temp. = 60 °C, op. pres. = 6 bar

Op. temp. = 90 °C, op. pres. = 6 bar

| Type | Fmax [N] | Fmax [N] |
|--------|----------|----------|
| 25/ 70 | 640 | 924 |
| 32/ 70 | 1036 | 1493 |
| 40/ 90 | 1639 | 2367 |
| 50/ 90 | 2553 | 3686 |
| 63/105 | 4013 | 5782 |

Fixed points



Building connection installation



1 Mark the sheath the distance (x, y, z) +1 cm from the end of the pipe.



2 Cut through the sheath with a saw.



3 Cut the sheath open lengthways. Do not insert the blade more than 5 mm deep.
Caution: Do not damage the medium pipe.



4 Peel off the sheath.



5 Cut back/remove the insulation along the length (x, y, z).
Caution: Do not damage the medium pipe.



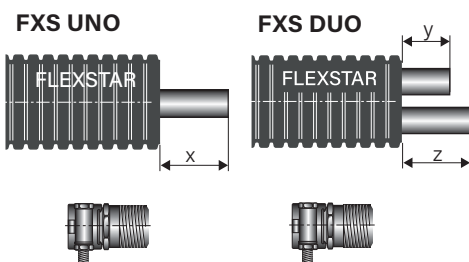
6 Install the wall sealing ring.



7 Carefully shrink the pipe end cap in line with the enclosed Raychem DHEC installation instructions.



8 Install the fitting in line with the enclosed installation instructions.

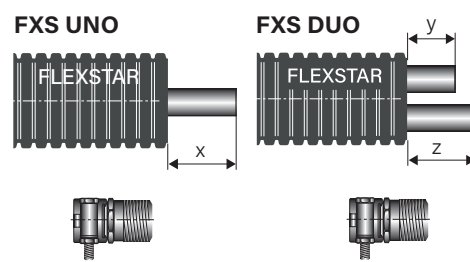


UNO screw connection

Building connection:

Ø 20- 75: X = **90 mm**

Ø 90-110: X = **110 mm**



UNO press fitting

Building connection:

Ø 20- 50: X = **140 mm**

Ø 63-125: X = **180 mm**

Shrink-on sleeves:

Ø 20- 50: X = **110 mm**

Ø 63-110: X = **140 mm**

Ø 125-160: X = **150 mm**

DUO press fitting

Building connection:

Ø 20-50: Y, Z = **140 mm**

Ø 63-75: Y, Z = **160 mm**

Shrink-on sleeves:

Ø 20-50: Y, Z = **110 mm**

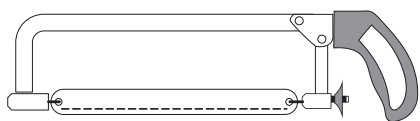
Ø 63-75: Y, Z = **140 mm**

Caution: Install the CPX clip shells in line with the enclosed installation instructions.

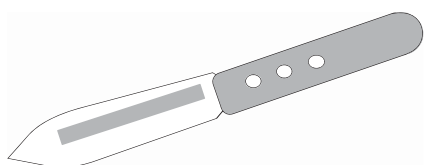
Installation tool

General and for screw connection

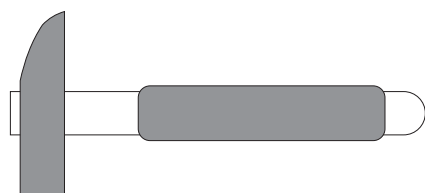
Cutting to length and removing insulation



The saw is used for cutting the sheath pipe and the insulation

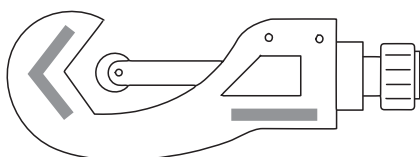


Blade for removing the insulation

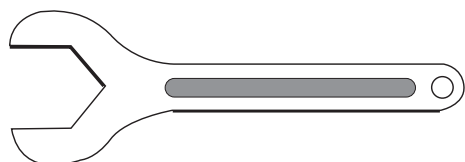


Hammer as an auxiliary tool

Cutting to length and removing insulation

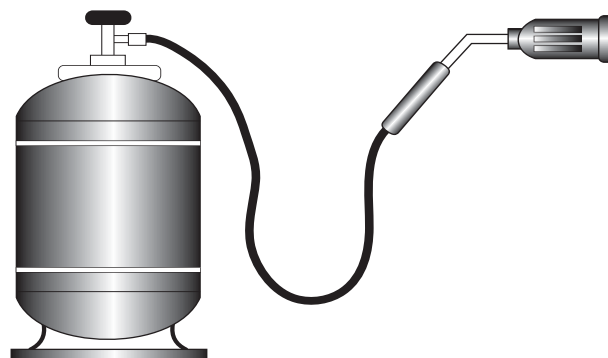


Pipe cutter for PEX pipe



Spanner

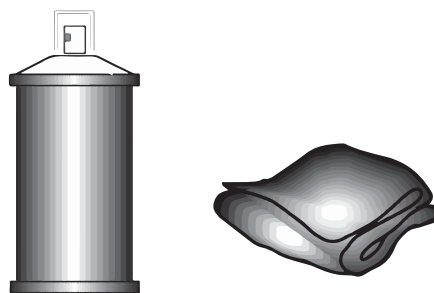
Shrinking



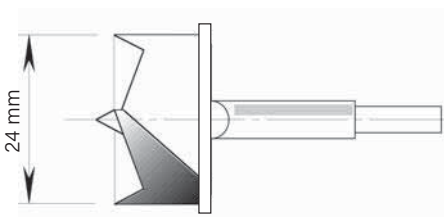
The gas burner is used to shrink hoses and sleeves



We recommend wearing gloves for shrinking work



Cleaning agents and cloths



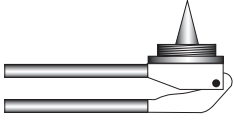
Knothole drill for foam filling hole in sleeves

Caution: Use drill with stop to avoid damage to the medium pipe.

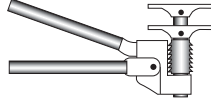
Installation tool

For connection to sliding sleeves

Manual tool for PEX Ø 20-40 mm (1 case)



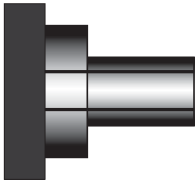
Expanding tool up to Ø 32 mm
(basic tool)



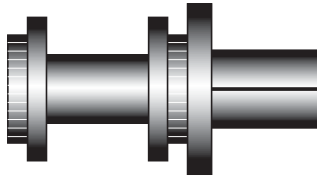
Crimping tool up to Ø 40 mm
Expanding tool for Ø 40 mm
(basic tool)



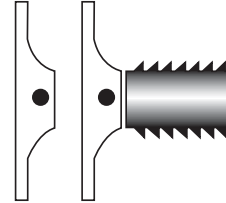
1 case with basic tool
incl. expander heads and yoke



Expander head up to Ø 32 mm

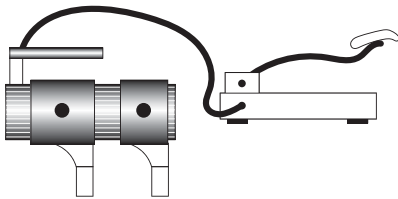


Expander head from Ø 40 mm



Press yoke Ø 20-40 mm

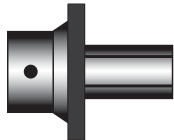
Hydraulic tool for PEX Ø 50-110 mm (2 cases)



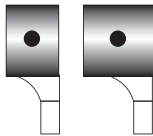
Hydraulic tool for crimping and expanding
Ø 50-110 mm including foot pump (basic tool)



Case with basic tool
(without expander heads and yoke)



Expander head
Ø 50-110 mm



Press yoke
Ø 50, 63 mm



Case with expander heads
and press yoke