KELOX

THE ZETA-OPTIMISED
PIPING SYSTEM

KE KELIT

KELOX

The zeta-optimised multilayer pipe system

KE KELIT
INNOVATIVE PIPE SYSTEMS

Contents

Note:

To keep up with ongoing developments, we may update these documents on a regular basis. Visit our web site at www.kekelit.com to view the currently applicable version.

Before use, always find out whether the manual is the most up-to-date version and get information about valid guidelines on areas of application and processing

KE KELIT quality targets

1. Our quality targets extend beyond the quality of the products themselves and include all the areas required by ÖNORM EN ISO 9001.

2. Suppliers and customers are integrated into the order-related quality assurance system to ensure that errors are prevented at this early stage.

3. Every employee is responsible for the quality of their own work. and should be highly motivated to perform continuous self-assessment.

4. We consider meeting specific market and customer demands as a precondition for highest customer satisfaction.

5. A responsible attitude towards the environment, both now and in the future, is the driving force that pushes us to manufacture long-lasting products using environmentally friendly processes.

Senator Karl Egger
Chairman of the Board

Dip.Ing./ M.Sc. Karl Egger
CEO

Approval - Registration - System testing

Both the individual parts and the entire system are subject to basic and regular tests. The safety factors below are complied with to achieve specified quality targets.

Certified quality assurance system by Quality Austria
ÖNORM EN ISO 9001 – Reg. no. AT 00366/0
ÖNORM EN ISO 14001 – Reg. no. AT 02097/0
ÖNORM EN ISO 10005 – Reg.no. AT 00001/0
ÖNORM EN ISO 50001– Reg.no. AT 0126/0

Self-monitoring in the KE KELIT quality laboratory, e.g.:

- Raw material parameters
- Dimensions and tolerances
- Processing quality, surfaces
- Pipe marking

Third-party monitoring by authorized testing authorities, e.g.:

- System testing, material identity
- Fittings tests

The ÖVGW quality mark with the registration number W1.235 is awarded for the combination of self-monitoring and third-party monitoring.
FW Vienna Approval dated 30th April 1996

ÖNORM registration according to EN ISO 21003
Registration numbers 96345 & 97500
ÖNORM EN 806 Series and ÖNORM B 2531
Dimensioning according to DIN 1988-300
Suitability for drinking water as per ÖNORM B 5014-1 and -3

Reg. No.: R-15.2.1-21-17156
Reg. No.: R-15.2.3-21-17154
Reg. No.: R-15.2.1-21-17155

CodeMark No *)
CM70042

Watermark No *)
WM-022381

*)depending on the product

Technical regulations

DVGW Worksheet W 534, Quality Standard QS-W 301

Threaded fittings

- Tapered male thread and straight female thread conform to ÖNORM EN 10226
- Cylindrical connections where pressure-tight joints are not made on the threads conforming to ISO 228-1

Patents

International property rights:
Austrian Patent 410 706
European Patent 1150 056

KELOX multilayer pipes

The structure
All five layers are fabricated and joined together in a single process. The metal stabilising pipe is welded with low heat exposure.

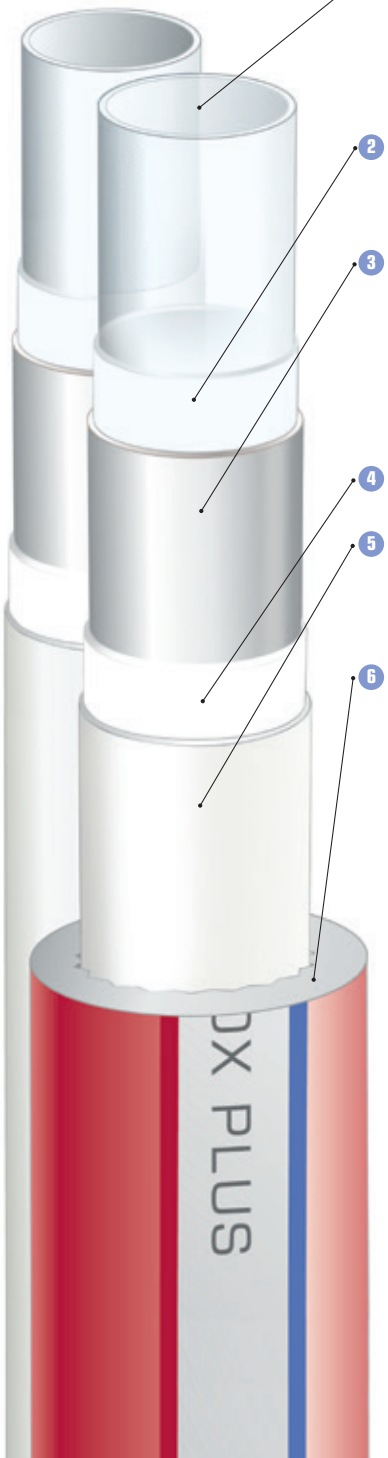
Properties
- Minimal residual stress
- Can be modulated
- Virtually endless (up to 200 m/roll), but also available in straight lengths (5 m)
- Completely oxygen-tight, 100% water-vapour-diffusion-tight
- Electrically locatable when concealed
- Low thermal expansion (α): 0.025 mm/mK
- Thermal conductivity (λ): 0.45 W/mK
- Smooth inner wall (pipe roughness: 0.007 mm)

Benefits
- Well-engineered integrated system
- Universal use
- Pipe range: 16, 20, 25, 32, 40, 50, 63 and 75mm
- Option of screw, press-fit and push fittings

Area of application
- Drinking water installation: Class 2 according to ÖNORM EN ISO 21003
  Operating temperature: 70 °C – t_{max} 80 °C / 10 bar
- Radiator connection: Class 5 according to ÖNORM EN ISO 21003
  Operating temperature: 80 °C – t_{max} 90 °C / 10 bar
- Cold water: **0–20 °C / 16 bar** – with KELOX press fittings ONLY
- Compressed air application: **10 bar** max., residual oil content purity class 0-3
  as per ISO 8573-1:2010 - ONLY EVER with KELOX press fittings
- Vacuum to **-0.6 bar** With KELOX press fittings ONLY
- Inert gases, technical fluids on request

Quality assurance
We perform rigorous quality testing to meet the requirements of national and international standards and regulations.

Third-party monitoring by authorized testing authorities:
- System testing
- Internal pressure creep behaviour
- Expansion testing
- Peel test of the composite
- Hygienic/toxicological suitability
- Oxygen-tightness
- Pipe connector testing:
  compared to vacuum,
  tensile loading,
  in a thermal cycling test,
  flexural fatigue test
- In each case, testing is carried out based on ÖNORM EN ISO 21003



1 Inside layer
PE -RT: hygienic, physiologically harmless, smooth and seamless.
The unmistakable structure of KELOX multilayer pipes is for your safety!
Colour: transparent

2 Internal adhesive layer
Temperature-resistant, non-ageing, force-transmitting intermediate layer made from special material.

3 Stabilisation pipe
Seam welded metal foil pipe made from aluminium (elongation at break approx. 12%), responsible for the exceptional compressive strength, low thermal expansion, mechanical stability.
E-module: $70 \cdot 10^3$ N/mm²
gas- and steam-tight

4 External bonding agent
same material as 2

5 External protective layer
same material as internal layer. Stable against all construction chemicals. Mechanically resistant, UV-stabilised.
Colour: white

6 Insulation
100% closed cell,
Fire behaviour according to ÖNORM EN 13501-1, environmentally friendly: CFC-free foam

KELOX Plus pipe KM134, KM130 and KM133:
Thermal conductivity (λ) at:
20 °C : 0.038 W/mK
40 °C : 0.040 W/mK
KELOX Lambda Plus pipe KM138:
Thermal conductivity (λ) at:
10 °C : 0.031 W/mK
50 °C : 0.035 W/mK
Other properties of the pre-insulation:
PE electron crosslinked,
100% closed cell,
Density: ~ 30 kg/m³,
Water vapour diffusion coefficient of friction (μ) = 7.000,
effective vapour barrier,
dimpled structure for sound insulation,
tear-proof,
Can be pushed back in the press fitting area sleeve film made from polyolefins and aluminium.

KELOX-ECO multilayer pipes

The structure

The layers are fabricated using inline extrusion procedures in one operation. PE-RT Type 2 has outstanding mechanical properties due to its special molecular structure.

Properties
- Increased flexibility
- Very high impact resistance
- Long-term stability
- Good chemical resistance
- Thermal conductivity (λ): 0.4 W/mK
- Thermal expansion (a): 0.19 mm/mK
- Smooth internal wall, surface roughness Ra 0.069 µm
- Colour: White with 4 thin blue stripes

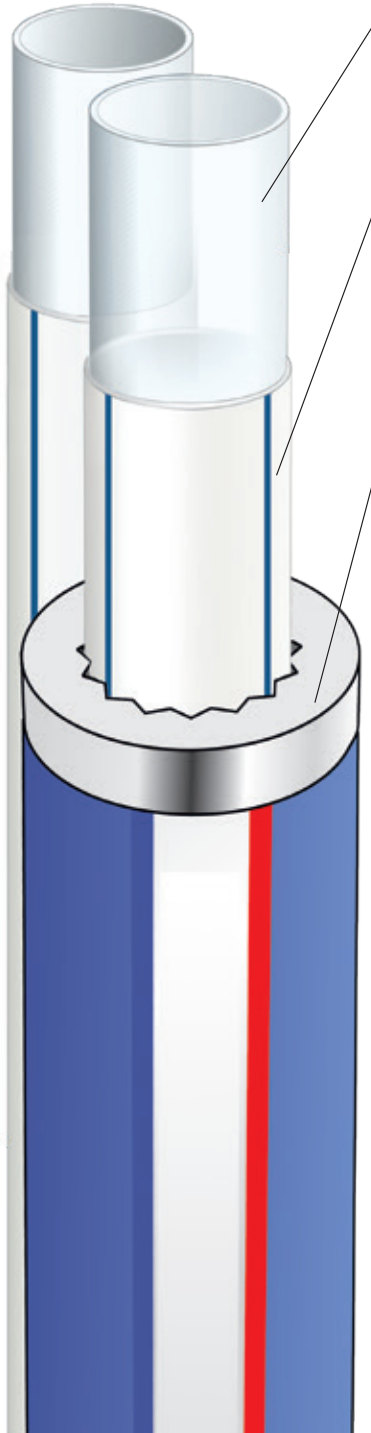
Benefits
- Exceptional stability
- Universal use
- Option of screw, press-fit and plug-in connections

Area of application
- Cold water: 20° / 10 bar
- Hot water: 60° / 6 bar
- Dimension range: d16, 20, 25 mm (up to 200m/roll)
- Drinking water: Class 1 according to ÖNORM EN ISO 22391

Quality assurance
We perform rigorous quality testing to meet the requirements of national and international standards and regulations:

Self-monitoring in the KE KELIT quality laboratory:
- Raw material parameters
- Measurements
- Processing quality
- Internal compressive strength
- Marking

Third-party monitoring by authorized testing authorities:
Annual inspection of fitness for purpose in accordance with the ÖNORM EN ISO 22391 Series.



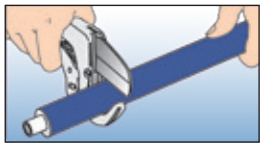
1 Inside layer
PE-RT: hygienic, physiologically harmless, smooth and seamless.
Colour: transparent

2 Outside protective layer
Same material as internal layer, stable against all construction chemicals, mechanically resistant, UV-stabilised.
Colour: White with 4 thin blue stripes

3 Insulation
Closed-cell foam, PE electron-crosslinked. Dimpled structure for sound insulation, site-capable, tear-resistant, can be pushed back in the press fitting area, sleeve film made from polyolefins and aluminium.
Thermal conductivity (λ) at:
20°C: 0.036 W/mK
40°C: 0.038 W/mK
Water vapour diffusion resistance (µ):
≥ 7.000 µ = effective vapour barrier complying with EU Directive 2011/65/EU CFC-free foam.

Processing

1. Cut KELOX ECO with heat insulation to length according to the installation instructions.
2. Push the insulation back to expose the medium pipe for processing.
3. You carry out processing as per the installation instructions.



KELOX heat-insulated multilayer pipe

KELOX Plus pipe KM134

Structure	
Medium pipe:	KELOX multilayer pipe
Size:	d16, 20, 25, 32
Insulation:	PEX soft foam
Insulation thickness:	**4mm**
Jacket:	Polyethylene film, waterproof, robust
Colour:	**Blue**

Benefits
- No water absorption
- Suitable for construction site use
- Robust
- Moderate heat insulation

KELOX Plus pipe KM130

Medium pipe:	KELOX multilayer pipe
Size:	d16, 20, 25, 32
Insulation:	PEX soft foam
Insulation thickness:	**9mm**
Jacket:	Polyethylene film, waterproof, robust
Colour:	**Red**

- High level of heat insulation
- No water absorption
- Suitable for construction site use
- Robust

KELOX Plus pipe KM133

Medium pipe:	KELOX multilayer pipe
Size:	d16, 20, 25, 32
Insulation:	PEX soft foam
Insulation thickness:	**13mm**
Jacket:	Polyethylene film, waterproof, robust
Colour:	**Orange**

- High level of heat insulation
- No water absorption
- Suitable for construction site use
- Robust

KELOX Lambda Plus pipe KM138

Medium pipe:	KELOX multilayer pipe
Size:	d16, 20, 25, 32
Insulation:	PEX soft foam
Insulation thickness:	**16mm**
Jacket:	Polyethylene film, waterproof, robust
Colour:	**silver**

- High level of heat insulation
- No water absorption
- Suitable for construction site use
- Robust

KELOX Pro pipe KM140

Medium pipe:	KELOX multilayer pipe
Size:	d16, 20
Jacket:	Corrugated, impermeable PE HD pipe
Colour:	**blue**

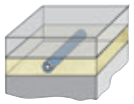
- Adequate heat insulation against condensation
- Protection against damage
- Waterproof jacket pipe

KELOX Pro Plus pipe KM144

Medium pipe:	KELOX multilayer pipe
Size:	d16, 20
Jacket:	Corrugated, impermeable PE HD pipe
Insulation:	**4mm** similar to KM134
Colour:	**Blue**

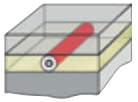
- Optimised heat insulation against condensation
- Protection against damage
- Waterproof jacket pipe

Heat emission in watts/m in floor area at a room temperature of 20°C



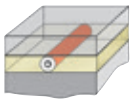
15°C used as calculation basis

KM134	Insul.	Medium temperature				
mm x s	mm	40°C	60°C	70°C	80°C	90°C
16x2	4	3.7	7.0	8.5	10.1	11.7
20x2.25	4	4.1	7.6	9.4	11.1	12.9
25x2.5	4	5.0	9.1	11.2	13.3	15.4
32x3	4	5.8	10.8	13.6	15.8	18.2



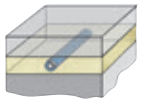
15°C used as calculation basis

KM130	Insul.	Medium temperature				
mm x s	mm	40°C	60°C	70°C	80°C	90°C
16x2	9	3.4	6.5	8.0	9.4	10.9
20x2.25	9	4.0	7.1	8.8	10.4	12.1
25x2.5	9	4.5	8.4	10.3	12.2	14.2
32x3	9	5.4	10.2	12.5	14.9	17.2



15°C used as calculation basis

KM133	Insul.	Medium temperature				
mm x s	mm	40°C	60°C	70°C	80°C	90°C
16x2	13	3.4	6.3	7.9	9.2	10.6
20x2.25	13	3.8	7.1	8.7	10.4	12.0
25x2.5	13	4.3	8.1	10.0	11.9	13.8
32x3	13	5.2	9.9	12.2	14.6	16.9



15°C used as calculation basis

KM140	Corr. pipe	Medium temperature				
mm x s	ADmm	40°C	60°C	70°C	80°C	90°C
16x2	25	4.2	7.8	9.6	11.4	13.6
20x2.25	28	5.0	9.1	11.2	13.3	15.9

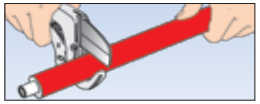
Due to the off-centre positioning of the medium pipe within the corrugated pipe, an extra 10% has been included in the calculation!

Processing

1 Cut KELOX ECO with heat insulation to length according to the installation instructions.

2. Push back the insulation or use a WZ514 special stripping knife to expose the medium pipe for processing.

3. Carry out processing of the medium pipe as per the installation instructions.



KELOX-ULTRAX press fitting

Requirements for the KELOX-ULTRAX pressing

- Permanently leakproof
- Compact design
- Longitudinally friction-locked
- DVGW (W534) approval for flush-mounted installations
- “leak before pressed” in sizes d16-75mm
- U-profile pressing

The material

- Stress-relief-annealed brass
- Non-porous metallized
- Stainless steel pressing sleeve
- Synthetic, ageing-resistant EPDM O-rings

The solution

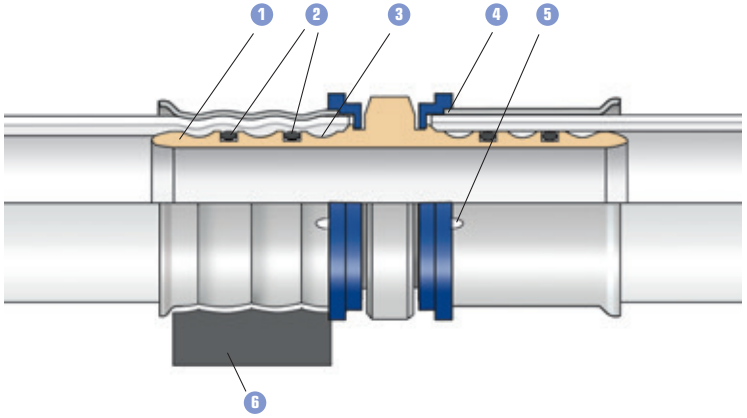
- The tried and tested KELOX-ULTRAX KMU press connection for “leak before pressed” d16-75mm pipes
- Zeta-value optimised fittings d16-25mm

Application

For surface- and flush-mounted use

Material and structure

1. Body made of high-quality brass, additionally non-porous metallized
2. Two EPDM O-rings
3. Special “leak before pressed” profile
4. Stainless steel pressing sleeve with double pressing jaw guide
5. Viewing window as an insertion aid
6. U-profile pressing jaws



Attention: Use the same U-press tools for all KELOX press-fitting types!

KELOX-PPSU press fitting

Requirements for KELOX-PPSU pressing

- Permanently leakproof
- Suitably robust for construction site conditions
- Compact design
- Longitudinally friction-locked
- halogen-free
- Oxygen diffusion-resistant
- DVGW (W534) approval for flush-mounted installations
- KWX-W in white in sizes d16–50mm
- U-profile pressing
- “leak before pressed” in sizes d16-50mm
- **NEVER use liquid sealing medium for sealing threaded unions!**
- **To seal KELOX PPSU fittings, only ever use hemp in conjunction with an approved sanitary sealant! For KELOX PPSU fittings, you must not use ANY chemical sealants like liquid sealants, 1- or 2- component adhesives, for example! In the case of KELOX fittings made from PPSU with a male thread, you MUST NOT use thread sealing cords!**

The solution

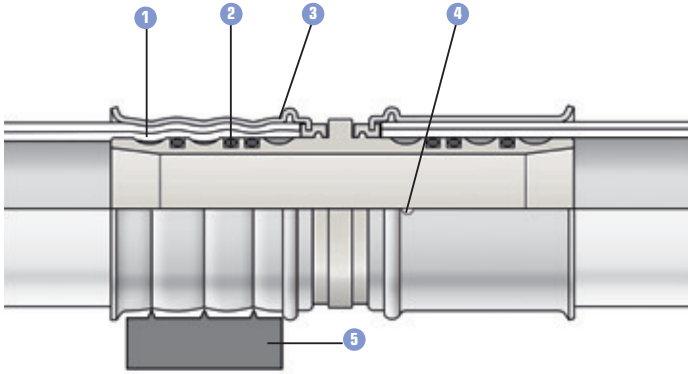
The tried and tested KELOX-PPSU press connection for d16–50mm pipes

Application

For visible and concealed installations

Material and structure

1. Body made of high-pressure-moulded PPSU
2. EPDM O-rings
3. Stainless steel pressing sleeve with pressing jaw guide
4. Viewing window as an insertion aid
5. U-profile pressing jaws



Attention: Use the same U-press tools for all press-fitting types!

KELOX-PROTEC CLIX push fitting

Requirements for the KELOX-PROTEC push fitting

- Permanently leakproof
- non-detachable push fitting
- Longitudinally friction-locked
- diffusion-resistant
- DVGW (W534) approval for flush-mounted installations
- Insertion block for uncalibrated pipes

The solution

- The tried and tested KELOX-PROTEC CLIX push fitting for d16–32mm pipes
- Zeta-optimised fittings d16-25mm

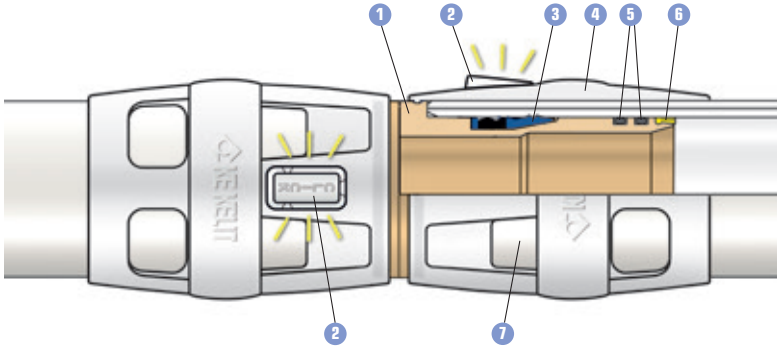
Application

For sanitary and heating applications, surface- and flush-mounted. Not suitable for compressed air or vacuum applications!

Material and structure

1. Body of the fittings made of high quality, dezincification-resistant brass (DZR) d16–32mm

   In addition, you can choose from couplings, 90° elbows, tee pieces, wall bracket fittings and adapters of sizes d16–25mm made of high-quality PPSU
2. Patented safety mechanism - Safety in three senses: Listening, feeling, seeing
3. 2K GRAB RING holding component made of glass fibre-reinforced polyamide and elastomer
4. Push-on sleeve made of transparent polyamide
5. Two synthetic, ageing-resistant EPDM O-rings
6. Protector ring made of high-strength plastic prevents the insertion of uncalibrated pipes
7. Closed viewing window



The fittings have protective caps to prevent contamination!

KELOX Eurocone fitting

Requirements for the KELOX compression fitting:

- Longitudinally friction-locked
- Detachable compression fitting, but non-detachable pipe connection
- Prevention of electrochemical dipoles
- No contact between medium water and aluminium layer

The solution

The multiple sealing KELOX compression fitting for pipes d16–25mm.

Application

For connections to manifolds, radiators and surface-mounted KELOX screw parts

Tightening torques

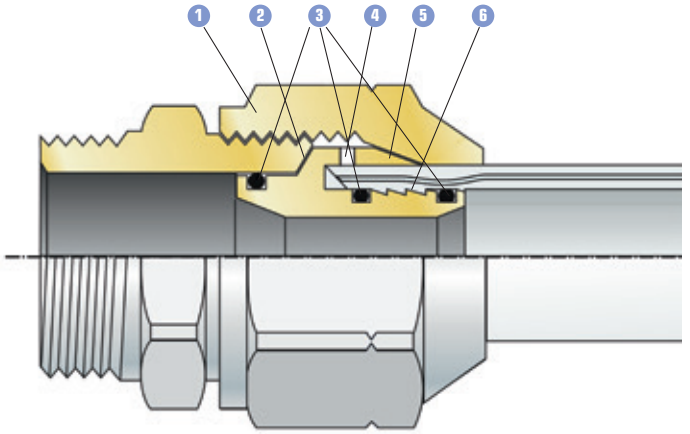
d16 - 18mm: 40 Nm
d20mm: 45 Nm
d25mm: 60 Nm

Use a torque wrench!

The torques apply at temperatures of approximately 10-30°C (ambient temperature)

Material and structure

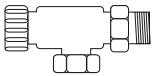
1. Nut made of high-quality brass, additionally non-porous metallized
2. Metal conical sealing surface
3. Three EPDM O-rings
4. Viewing window as an insertion control for d16-20mm
5. Compression sleeve made of high-quality brass, additionally non-porous metallized
6. Interlocking hook for longitudinal friction locking

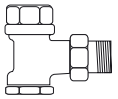


Assignment of KELOX screw connections

KM210 **KELOX connecting set** Art.no. 7701020

Non-porous metallized brass for connecting to HK valves and HK-RL screw connections 1/2" female thread according to DIN or EN 215; including clamping screw. Male thread support sleeve with O-rings and clamping ring
Dim. d16mm

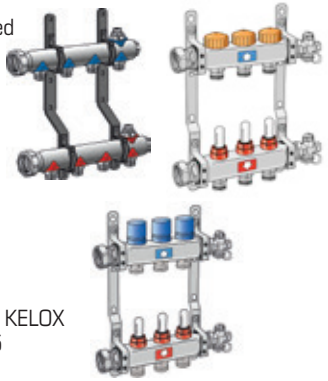




KM212 KELOX Connecting set

KM220 **KELOX Euro screw connection**

Non-porous metallized brass for connecting to installation components with a 3/4" male Eurocone complying with EN 215, including female nut, support sleeve with O-rings and clamping ring
Dim. d16-25mm



Attention! You **cannot** use the d25 x 3/4" KM220 KELOX Euro thread fitting in conjunction with the KM595 QUATTROX HK radiator block.

KM220 **KELOX Euro screw connection**

Non-porous metallized brass for connecting to KELIT components with a 3/4" male Eurocone complying with EN 215, including female nut, support sleeve with O-rings and clamping ring
Dim. d16-25mm

Typical examples of screw fitting

suitable for

KM210 - Danfoss	KM210 - Herz	KM210 - Oventrop
With 1/2" female thread RA-N RA-UN RLV	With 1/2" female thread 7723 7724 7728 3923 3924 Series D with DIN connection thread	With 1/2" female thread Series A Series A2 Series AV6 Series F

suitable for

KM212 - Heimeier
With 1/2" female thread standard valves V-exact, F-exact Valves with low resistance Mikrotherm Regulux Regulux N

suitable for

Danfoss	Herz	Oventrop	Heimeier	Simplex	Stelrad
with 3/4" male thread RLV-K RLV-KS VHS	with 3/4" male thread 1-7724-37 7733 7745 7746 7748 3937 3948 7173 7175 Herz 3000	with 3/4" male thread Multiflex V Multiflex F	with 3/4" male thread Standard valves Valves with low resistance E-Z System Vekolux N Regulux	with 3/4" male thread Male/N Male/M Radiator block D1 E1, D2, E2, D22, N2, FE2, U2 and D5	with 3/4" male thread MHD34 2MAD34 MHE34 2MAD34 MSV 2MHS

suitable for

KELOX screw fittings

KM310E
Art.no. 7706520

KM320E
Art.no. 7706720

KM340E
Art.no. 7706920

KM355E
Art.no. 7706620

KM365E
Art.no. 7706760

KM366E
Art.no. 7706770

Installation instructions for KELOX compression fittings

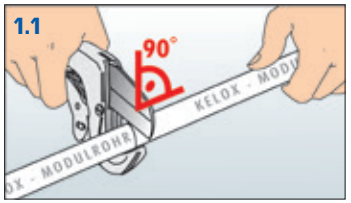
Only for trained installation specialists!

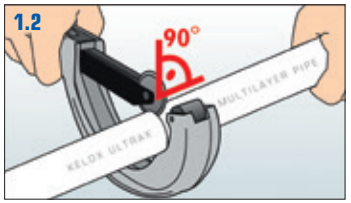
Easy steps for a leakproof KELOX compression fitting

1. Cut to length
Always cut at right angles – this means that you must straighten coils before cutting!

1.1 Cut to length using WZ932 pipe cutter for d14-20mm or WZ130 pipe shears for d14-25mm

1.2 Optionally, cut to length using the WZ935 pipe cutter for d25mm





2. Calibrate and chamfer. Always turn in and out clockwise!

2.1 Click the universal handle onto the WZ915 calibration mandrel and turn it as far as it will go clockwise.

As an option, you can use the WZ916 or WZ916A multi-calibration mandrel.

2.2 Alternatively, you can use an electric drill or a cordless screwdriver running at a slow speed (maximum of 500 rpm). Remove the handle in this case.

This achieves the following:

- Cutting angle is corrected to 90°
- Inner pipe wall is calibrated
- Outside is deburred
- Circumferential inside chamfer at the end of the pipe with a depth of approx. 1mm – **perform a visual check!**

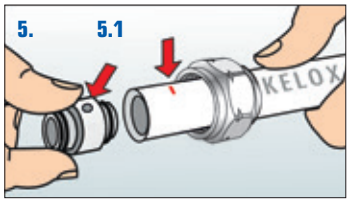
3. Mark the insertion depth for compression fittings
On the protective housing, every calibration mandrel has a corresponding option for marking the correct insertion depth of the screwable nozzle onto the pipe. (The marking becomes visible after the compression fitting has been tightened)

3.1 The WZ916A multi-calibration mandrel with detachable protective sleeves is available to calibrate heating circuit connections.

4. The plastic/aluminium chips must be removed from the calibration tool and/or protective cage after each calibration process.

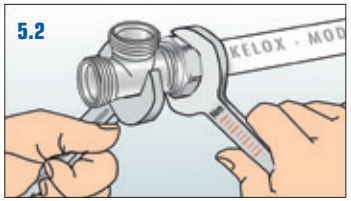
5. Push the nut and the nozzle onto the end of the KELOX pipe.

5.1 Check the correct insertion depth in the viewing windows of the d14-25mm screw connections!



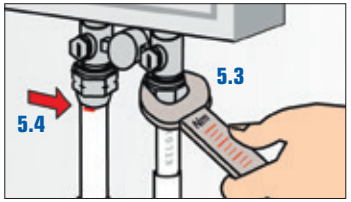
5.2 Tightening
Important:
The torques apply at ambient temperatures of approximately 10–30°C

Size	Tightening torques
d 14 – 18	40 Nm
d 20	45 Nm
d 25	60 Nm



5.3 The nut is tightened onto a mating component (3/4" Eurocone) using a torque wrench. This presses the KELOX pipe, whichmakes it resistant to longitudinal traction and all the edge seals start to function.

5.4 After tightening, you can see the insertion depth mark at the end of the nut.



Connections **NOT** screwed together may be leakproof during a pressure test due to the O-rings, and may particularly pose a risk during an air pressure test when the pipe and fitting may slide apart.
The longitudinal friction lock is only achieved when the compression fitting is tightened.
A visual check must therefore be performed on ALL connections!
Observe the tightening torques!

Installation instructions for KELOX-ULTRAX press fitting

Only for trained installation specialists!

Easy steps for a leakproof KELOX-ULTRAX press fitting

1. Cut to length
Always cut at right angles – this means that you must straighten coils before cutting!

1.1. Cut to length using the WZ932 pipe cutter for d16-20mm or the WZ130 pipe shears for d16-25mm

1.2. Cut to length using the WZ935 pipe cutter for d32-75mm

2. Calibrate and chamfer. Always turn in and out clockwise!

2.1. d16-32mm
Click the universal handle onto the WZ915 calibration mandrel and turn it as far as it will go clockwise.

2.2. d40-75 mm
Turn the WZ913 deburring tool as far as it will go clockwise.

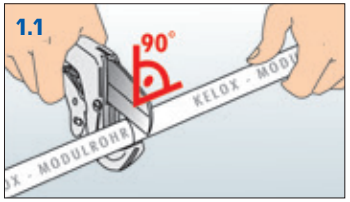
2.3. Alternatively, you can use an electric drill or a cordless screwdriver running at a slow speed (maximum of 500 rpm).

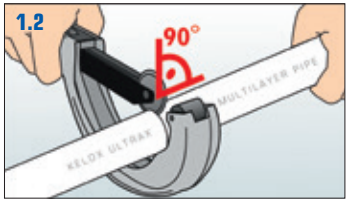
To do this, remove the handle.

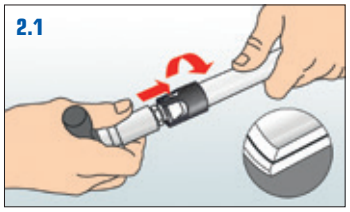
This achieves the following:

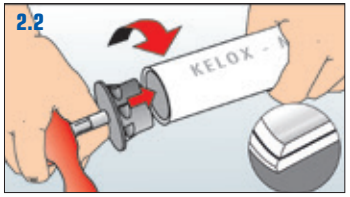
- Cutting angle corrected to 90°
- Inner pipe wall is calibrated
- Outside is deburred
- Circumferential inside chamfer at the end of the pipe with a depth of approx. 1mm –
  carry out a visual inspection!
  Pipes that have already been inserted into a fitting must **NOT** turn during calibration! Use WZ939 KELOX pipe-holding pliers, if required!

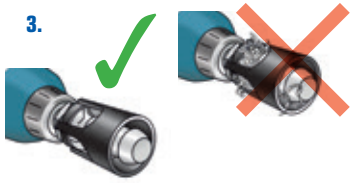
3. The plastic/aluminium chips must be removed from the calibration tool after each calibration process.











4. Push on the press fittings
WITHOUT exercising any force!
Push the press fitting straight **WITHOUT** tilting all the way onto the calibrated pipe end.

4.1. Check the correct insertion depth in the viewing windows of the press fittings! Carry out pressing immediately after joining the pipe connection!

5. Pressing KELOX-ULTRAX
Fit the KELOX-compatible pressing tool with KELOX pressing jaws (U-profile) of the correct size.

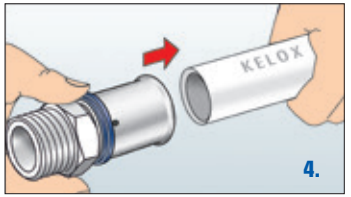
The pressing sleeves of the moulded parts are fitted with a double stop mechanism, which ensures that the pressing jaw is positioned correctly (U-profile) even in difficult installation situations.

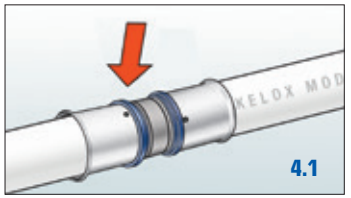
Additional testing security
"leak before pressed" does not replace the visual check. Thanks to the design, in conjunction with the special profile geometry, it is possible to reliably identify and localize unpressed fittings of d16-75mm at functional testing.
– Just press – and done!

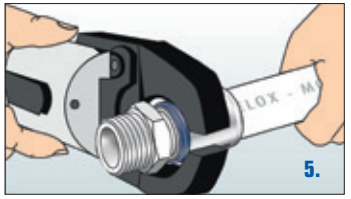
5.1. The pressing procedure is complete once the pressing jaws are completely closed. Open the pressing jaws and lift the pressing tool off the pressed part. Never perform the pressing process more than once.

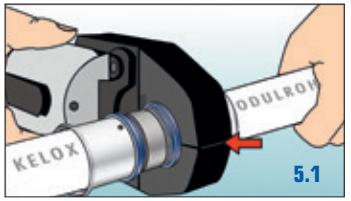
Proceed in the same way when using the WZ983 manual pressing tool.

Connections that were **NOT** pressed can pose a risk, especially during an air-pressure test, because the pipe and fitting may slide apart. The longitudinal friction lock is only achieved through pressing.









A visual check must therefore be performed on ALL connections!

A maximum of one rotation is allowed for installation corrections after pressing!

Installation instructions
KELOX-PPSU press fitting

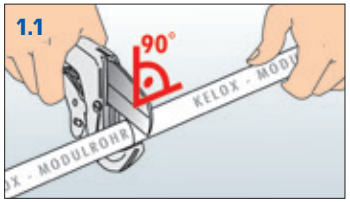
Only for trained installation specialists!

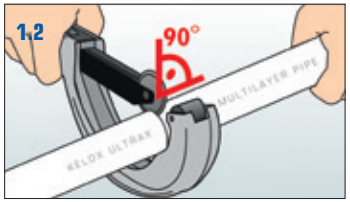
Easy steps for a leakproof KELOX-PPSU press fitting

1. Cut to length
Always cut at right angles – this means that you must straighten coils before cutting!

1.1 Cut to length using the WZ932 pipe cutter for d16–20mm
or the WZ130 pipe shears for d16–25mm

1.2 Cut to length using the WZ935 pipe cutter for d32-50mm

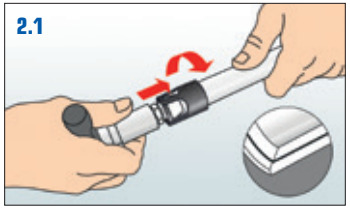




2. Calibrate and chamfer always turning the chamfering tool clockwise both going into and out of the pipe!

2.1 d16-32mm

Click the universal handle onto the WZ915 calibration mandrel and turn it as far as it will go clockwise.



2.2 d40 - 50mm

Turn the WZ913 deburring tool as far as it will go clockwise.

2.3 Alternatively, you can use an electric drill or a cordless screwdriver running at a slow speed (maximum of 500 rpm).

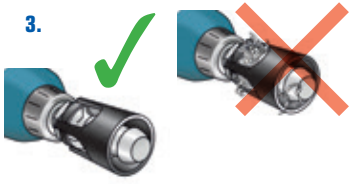
Remove the handle in this case.

This achieves the following:

- Cutting angle is corrected to 90°
- Inner pipe wall is calibrated
- Outside is deburred
- Circumferential inside chamfer at the end of the pipe with a depth of approx. 1mm – **perform a visual check!**

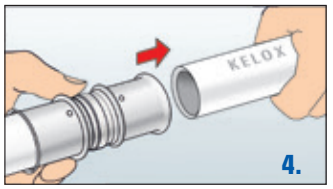
Pipes that have already been inserted into a fitting must **NOT** turn during calibration! Use WZ939 KELOX pipe-holding pliers, if required!

3. The plastic/aluminium chips must be removed from the calibration tool after each calibration process.



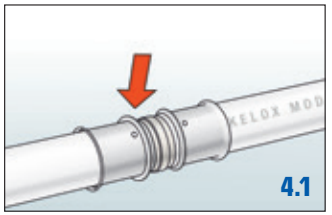
4. Push on the press fittings WITHOUT exercising any force!
Push the press fitting straight **WITHOUT** tilting all the way onto the calibrated pipe end.

4.1 Check the correct insertion depth in the viewing windows of the press connection! Carry out pressing immediately after joining the pipe connection!

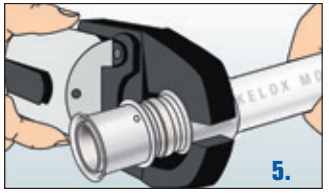


5. Pressing KELOX-PPSU
Fit the KELOX-compatible pressing tool with KELOX pressing jaws (U-profile) of the correct size.

Pressing KELOX-PPSU fittings – Position the pressing jaws in the centre of the pressing sleeve and carry out pressing.



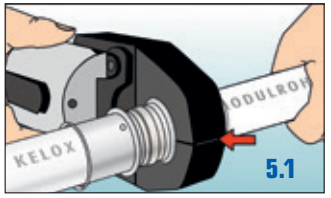
Additional testing security
"leak before pressed" does not replace the visual check. Thanks to the design, in conjunction with the special profile geometry, it is possible to reliably detect and localize unpressed fittings at functional testing.
– Just press – and done!



5.1 The pressing procedure is completed when the pressing jaws are completely closed. Open the pressing jaws and lift the pressing tool off the pressed part.
Never perform the pressing process more than once.

Proceed in the same way when using the WZ983 manual pressing tool.

Connections that were **NOT** pressed may pose a risk particularly during an air-pressure test because the pipe and fitting may slide apart. The longitudinal friction lock is only achieved through pressing.



A visual check must therefore be performed on ALL connections!

The connections are rotatable even after processing should installation adjustments be required!

Our KELOX-PROTEC CLIX Design Concept Your benefits

Easy
No complex costly assembly tools are required; we offer a homogeneous fitting concept for sizes d16-32mm

Safe
A NON-detachable connection with the sealing function taking priority. The pipe and fitting are fastened on the inside of the pipe with a grab ring. Inserting NON-calibrated pipes is effectively prevented by the protector ring, which protects the O-rings from damage. Correctly processed fittings create a pull-out-resistant, permanently leakproof connection.
The viewing window check ensures your safety! The patented safety mechanism ensures safety in three senses – listening, feeling and seeing.

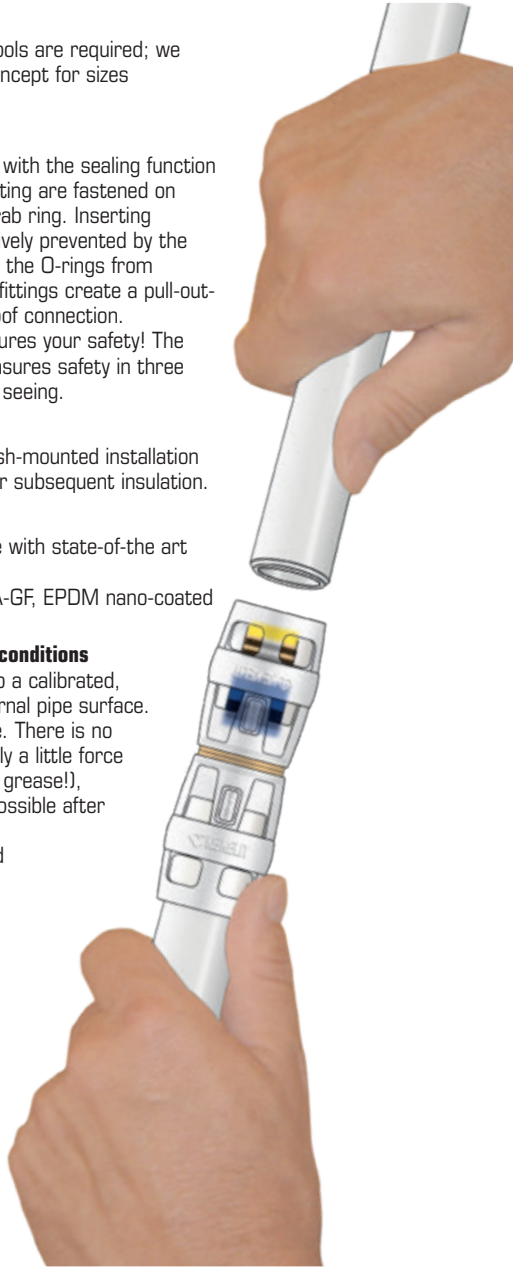
Easy to handle
Optimized body size makes flush-mounted installation easy; the slim design allows for subsequent insulation.

Robust
The material selection is in line with state-of-the art technology:
Brass or PPSU, polyamide, PA-GF, EPDM nano-coated …

Suitable for construction site conditions
The sealing function is linked to a calibrated, checked and clean KELOX internal pipe surface. EPDM O-rings are grease-free. There is no contamination-problem and only a little force is required (do not apply extra grease!), rotation and adjustment are possible after assembly.
A cap protects the holding and sealing components.

Tested
The fittings are subjected to a comprehensive testing programme:
Pressure surge, temperature change, high pressure, tensile strength….
DVGW and ÖVGW-certified

KE KELIT patent
All product-relevant fitting components are protected by patent law. Licenses have been granted to well-known European partners.



Installation instructions for KELOX-PROTEC CLIX push fittings

1. Cut to length
Always cut at right angles – this means that you must straighten coils before cutting!

1.1 Cut to length using the WZ932 pipe cutter for d16-20mm or the WZ130 pipe shears for d16-25mm

1.2 Cut to length using the WZ935 pipe cutter for d32mm

2. Calibrate and chamfer. Always turn in and out clockwise!

2.1 Snap the universal handle onto the WZ915 calibration mandrel and turn it as far as it will go clockwise.

2.2 Alternatively, you can use an electric drill or a cordless screwdriver running at a slow speed (maximum of 500 rpm). To do this, remove the handle.
This achieves the following:
- Cutting angle is corrected to 90°
- Inner pipe wall is calibrated
- Outside is deburred
- Circumferential inside chamfer at the end of the pipe with a depth of approx. 1mm –
  carry out a visual inspection!
  Pipes that have already been inserted into a fitting must **NOT** turn during calibration!
  Use WZ939 KELOX pipe-holding pliers, if required!

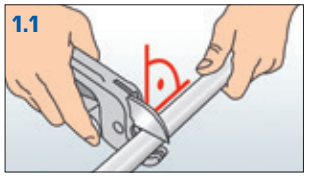
3. The plastic/aluminium chips must be removed from the calibration tool after each calibration process.

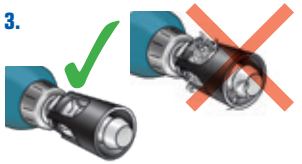
4. Push the push fitting straight WITHOUT tilting all the way onto the calibrated pipe end.

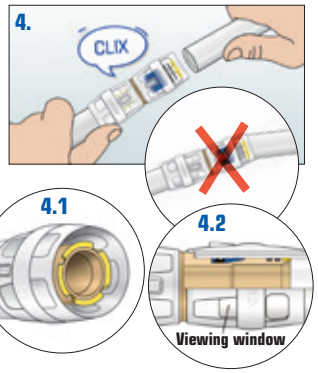
4.1 An intact protector ring prevents NON-calibrated pipes from being inserted into the fitting!
This results in:
- A permanently leakproof connection
- A longitudinal friction lock via the grab ring
- Check insertion on the push fitting!

4.2 The pipe end must **NOT** be visible in the viewing window after the pressure test and during operation!

Only for trained installation specialists!







A maximum of one rotation is allowed for installation corrections after pressing!

When processing KELOX, consider the following points:

1. When KELOX connections are processed correctly and with care, they are problem-free and extremely safe!
2. This means that it is crucial for qualified tradesmen to install pipes.
3. Installing the pipes incorrectly or ignoring elementary regulations for pipe laying cannot be compensated for even by subsequent pressure testing.
4. The recommended pressure tests cannot provide a guarantee against installation errors.
5. Each pressure test represents a snapshot of the actual situation of an installation process.
6. Continuous-use properties are specified in the corresponding standards and authorised testing institutions monitor them throughout the production process!
7. The quality of installation is mainly dependent on the care that YOU take.

This is why you should invest 5 seconds per pipe fitting for your safety

3 seconds:

Check visually that each pipe end has been chamfered across the whole of its circumference.

This ensures that:

- The pipe is correctly calibrated.
- O-rings cannot be shifted and damaged;
- pipes can be joined without excessive force.

2 seconds:

Visually check the insertion depth.

This ensures that:

- Subsequent pressing or compression fitting ensures a full longitudinal friction lock.
- The grab ring is activated for the push fittings, the longitudinal friction lock is ensured.

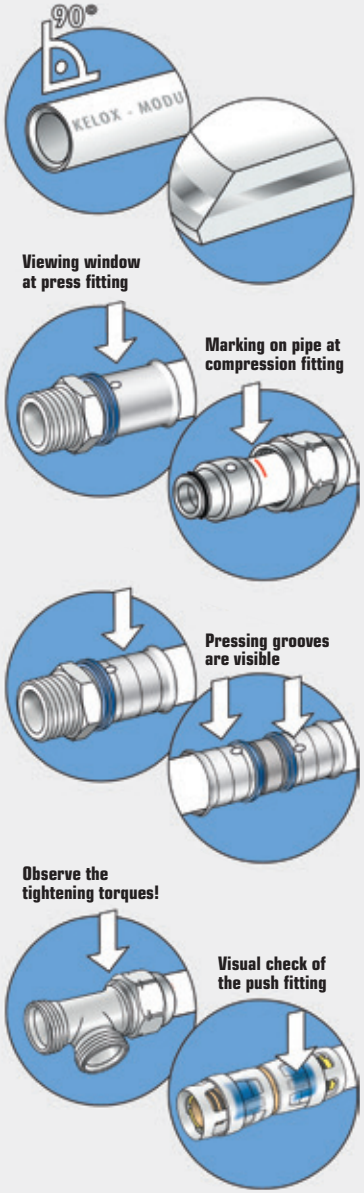
0 seconds:

Whenever possible, leave as little time as possible between insertion and pressing/screwing together.

This ensures that:

- Pressing is not forgotten.
- Screwing together is not forgotten.
- the serviceability of the push fitting is ensured when the pipe has been fully pushed in.

"Push and it's leakproof!"



Installation instructions

KM598V KELOX stabiliser

1. Install the radiator. Adjust the top edge of the plastic holders to the screed height using a height-adjustable comb.

2. Insert the plastic holders into the appropriate slots, insert the installation gauge into the plastic holders and screw them to the radiator connections. Fasten the metal bracket to the floor.

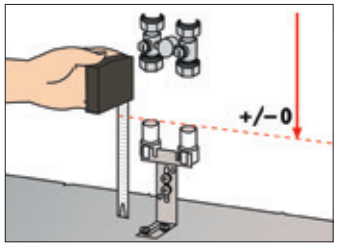
2.1 Sound decoupling: Insulate the bracket and the comb by winding or install them completely in the underfloor heating insulation space.

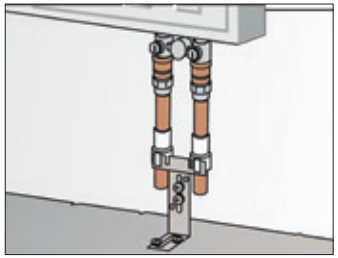
3. Use KELOX pipe shears to cut to length the stabilising pipe starting from the bottom edge of the screw fittings to the shoulder of the plastic holders.

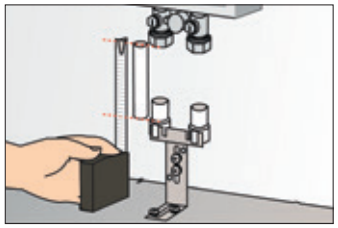
4. Prepare the KELOX multilayer pipes as per the installation instructions. Push the plastic holders and stabilising pipes across the connecting pipes.

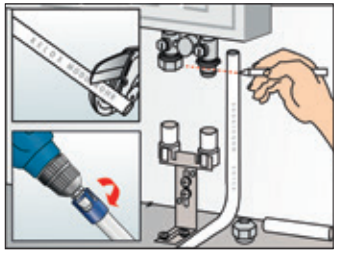
5. Push the plastic holders onto the comb use KELOX screw fittings to install the KELOX multilayer pipes on the valve group.

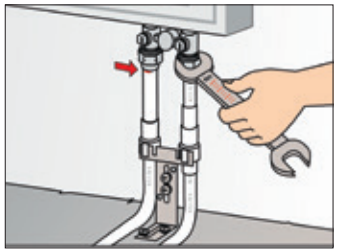
6. Before screeding, push back the stabilising pipes to the screw fitting.











The stabilising pipes protect the exposed radiator connecting pipes from being damaged, they increase the lateral stability of the KELOX multilayer pipes and provide a perfect optical solution.

KELOX

Installation instructions

KM597 block for insulated walls, KM595 QUATTROX radiator block
KM595Z two-pipe radiator block

1. Determine the installation space and radiator type; subsequent changes to the connections are NOT possible.

1.1 Fit the bottom edge of the KELOX blocks for insulated walls in the masonry at the finished floor height or at least flush with the building structure.

1.2 The punched tapes are for fastening temporarily on the WZ954 assembly aid; final fastening is the masonry is carried out by walling in or using installation foam.

2. The push-on tubes for the connecting pipes protrude from the masonry. Protect all the ends of the pipes from contamination.

2.1 QUATTROX: With d16 and d20 sizes, it is advisable to install the pipes without crossing as shown in the illustration.

2.2 With size d20, keep the radii of the push-on tubes as large as possible.

2.3 Plastering work can be finished. Before feeding in the pipes, the masonry must have dried out completely.

3. Installing radiators

3.1 Cut off the push-on tube level with the plaster.

3.2 Install the radiator such that the radiator block is positioned axially relative to the push-on tube ends.

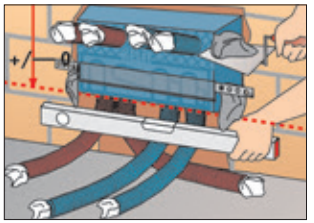
3.3 Unscrew radiator block off the radiator.

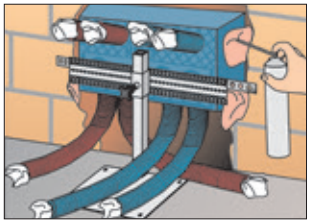
3.4 Pull in the KELOX multilayer pipes using pull-through spring WZ955 and leave an appropriate length protruding.

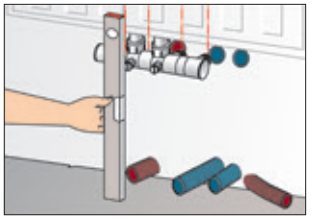
3.5 Cut off 2mm from the deformed end pieces of the KELOX multilayer pipes, calibrate and continue with preparations according to the installation instructions (compression fittings) for tightening.

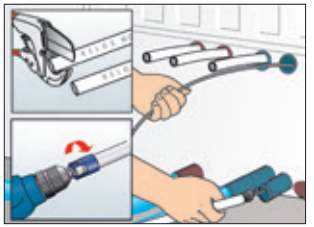
3.6 Connect valve group with the KELOX screw connections already installed on the KELOX pipes and push these back into the wall to match the radiator spacing.

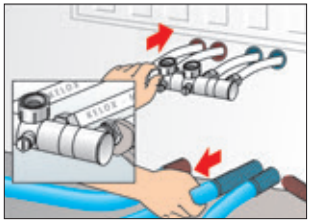
4. Mount the radiator block on the radiator.











Attention! You **cannot** use the d25 x 3/4" KM220 KELOX Euro thread fitting in conjunction with the KM595 QUATTROX HK radiator block.

Attention! When using commercially available mounting templates, it is not possible to mount radiators until the painting work has been done.

The radiator block and insulatedwall components make it possible to carry out professional connections from the walls without any connections in the floor area and without wall chasing after plastering.

Installation example: KM597P4 and KM595

Two-pipe heating system with a central manifold

Economically sensible performance conditions

Due to the short connection pipes from the manifold to the individual radiators and taking into account the additional individual resistances (e.g. valves …), it is possible to calculate using a pressure drop of **250-400 Pa/m**.

The "spaghetti system" – optimum installation and convenience

Benefits

- only one pipe dimension from the manifold
- no connection points at all in the floor
- each radiator feed is handled separately
- when radiators are at a standstill, there is no circulation in the piping system (power-saving)

The two-pipe heating system in its classical form

Economically sensible performance conditions

Due to the overall length of the pipe network that enters the pressure drop, and taking into account the additional individual resistances (e.g. valves …), it is possible to calculate using a pressure drop of **100-200 Pa/m.**

The "standard variant" – recognized and proven

Benefits

- consistent temperature of all the radiators = the source of well-being
- a recognized system for collecting heating expenses
- typical of old-building renovation
- suitable for skirting boards

The single-pipe heating system

Economically sensible performance conditions

Due to the overall length of the main pipe that enters the pressure drop with single-pipe heating systems, pressure drop of **100-200 Pa/m** should be calculated taking into account the additional individual resistances (secondary pipes branching from the main pipe or the Z values of 4-way valves).

The "economy variant" – fast and favourably priced

Benefits

When using 4-way valves

- no connection points at all in the floor
- extremely quick pipe installation
- only one pipe dimension from the line connection

Heat insulation for heating system and hot water pipes in accordance with ÖNORM H 5155

ÖNORM H 5155 applies to insulation of building service installations to standardise and simplify the design, installation and maintenance of insulation systems.

ÖNORM H 5155 specifies a Lambda value (λ) of 0.047 W/mK for the heating and hot water pipes application, at an average temperature of 50 °C and an external heat transfer coefficient of 6 W/m²K.

Since factory pre-insulated KELOX Plus pipes have improved Lambda values, the insulation widths required in ÖNORM can be implemented with the following pre-insulated KELOX Plus and Lambda Plus pipes:

Thermal conductivity Plus - 0.038 W/mK at 20 °C - 0.040 W/mK at 40 °C
Insulation thickness: 9 mm corresponds to 10 mm according to ÖNORM H 5155

Thermal conductivity Lambda Plus - 0.031 W/mK at 10 °C - 0.035 W/mK at 50 °C
Insulation thickness: 16 mm corresponds to 20 mm according to ÖNORM H 5155

Minimum insulation thickness (d) for heating pipes and their components with a medium temperature of a maximum of 40 °C

Outer pipe diameter (d) Multilayer pipe in mm The nominal diameters given in DN/D in the ÖNORM H 5155 have been converted to the sizes of the KELOX pipes.	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**75**
	Minimum insulation thickness (mm)							
Flush-mounted in conditioned and unconditioned zones (pipeline is freely installed or accessible, e.g. false ceiling, raised floor, shaft)	20	20	20	20	30	40	50	60
Flush-mounted in conditioned and unconditioned zones (pipeline is not accessible, e.g. in the wall or floor)	10	10	10	10	15	20	20	30
Outside the building	40	40	40	40	50	50	60	80
In the ground	The insulation thickness is to be chosen taking account of economic framework conditions[a]							
a Examples of economic framework conditions: Heat losses, civil engineering costs								

Minimum insulation thicknesses (d) for heating, hot water, hot water circulation and solar pipes and their components with a medium temperature over 40 °C and a maximum of 90 °C

Outer pipe diameter (d) Multilayer pipe in mm The nominal diameters given in DN/D in the ÖNORM H 5155 have been converted to the sizes of the KELOX pipes.	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**75**
	Minimum insulation thickness (mm)							
Flush-mounted in conditioned and unconditioned zones (pipeline is freely installed or accessible, e.g. false ceiling, raised floor, shaft)	20	20	20	30[a]	40	50	60	80
Flush-mounted in conditioned and unconditioned zones (pipeline is not accessible, e.g. in the wall or floor)	10[b]	10[b]	10[b]	15[bc]	15	20	30	40
Pipelines from thermal solar energy systems within the building[d]	20	20	20	30	40	50	60	80
Outside the building	40	40	40	40	50	50	60	80
In the ground	The insulation thickness is to be chosen taking account of economic framework conditions[e].							
a For pipelines pre-insulated at the factory, the insulation thickness may be reduced to 20 mm.								
b The required insulation thickness for a pipe-in-pipe system is 5 mm								
c For pipelines pre-insulated at the factory, the insulation thickness may be reduced to 10 mm.								
d The operating temperature of pipelines in thermal solar energy systems within the building can also be higher than 90 °C								
e Examples of economic framework conditions: Heat losses, civil engineering costs								

Sizing and pressure loss for KELOX heating pipes

For information on calculating individual resistances, refer to the manual too.

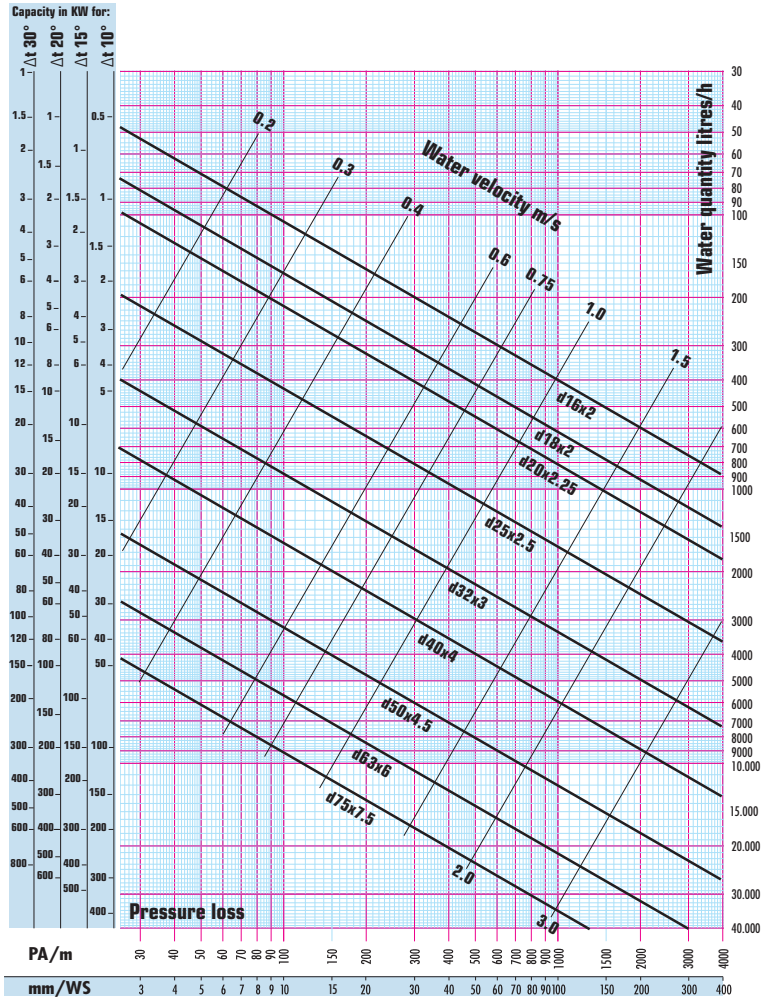
KELOX multilayer pipe d: 16, 18 20, 25, 32, 40, 50, 63, 75

The pressure losses are calculated according to the Nikuradse formula:

$$R = 3.62315 \cdot 10^{3} \cdot \dot{m}^{1.70651} \cdot di^{-4.64237}$$

Pipe roughness: 0.007mm

R = pipe friction pressure gradient	(Pa/m)
$\dot{M}$= Mass flow	(l/h)
di = internal pipe diameter	(mm)



Pressure test report for heating systems

KE KELIT recommends carrying out a leak test based on the "Pressure tests for integrated radiator installations" in accordance with ÖNORM EN 14336. Attention: Before every pressure test, ensure that all the steps in the installation instructions have been carried out conscientiously.

Functional test when using "leak before pressed" fittings

For temperature differences (> 10 K) between ambient temperature and fill water temperature, a waiting time of 30 minutes must be adhered to after filling the system with drinking water so the temperature can equalize.

Test pressure: 0.05 MPa (0.5 bar) up to max. 0.2 MPa (2 bar)

Test duration: 15 minutes after temperature equalisation between the pipe and the test medium.

Test differential pressure: 0.0 bar

A visual check must then be performed on all pipe connections.

If a pressure test is performed using air or inert gases following the pressure test for drinking water systems, you can omit the functional test!

Pressure test

Check the pipe network at 1.3 times the system pressure. If possible, the pressure gauge should be positioned at the lowest point in the system.
The temperature equalization between ambient temperature and fill water temperature must be taken into account after applying the test pressure by waiting an adequate amount of time. After the waiting time, the test pressure must be reapplied, if required.
For the period of the pressure test, you must disconnect from the system to be tested all the containers, devices and fittings that are not suitable for the test pressure. The system is filled with filtered water and fully bled of air. A visual check of the pipe fittings has been performed during the test.

KELIT recommends a testing period of 30 minutes.

Calculated test pressure: ..... bar

Testing period ..... hr

☐ NO pressure loss was observed during the testing period.

☐ The system contains ..... as the antifreeze:

☐ The system does NOT contain any antifreeze, which means that it has been emptied completely for safety reasons.

Location: .....

Property: .....

System pressure: .....

Confirmation

Responsible person: .....

Date: ..... Time: from ..... to .....

Client: .....

Signature/stamp

Drinking water installation

The KELOX multilayer pipe system is ÖNORM-tested and ÖVGW-registered and -approved. In addition, ÖNORM EN 21003 specifies the criteria below for this application case:

- Maximum operating temperature 70°C – briefly 80°C
- Permanent pressure resistance of 10 bar
- Suitable for drinking water in conformity with ÖNORM B 5014/1 for pipes and fittings
- Permanently leakproof connections in concealed installations
- Connections are resistant to pressure surges
- The KELOX system does an outstanding job of meeting these criteria.

Benefits

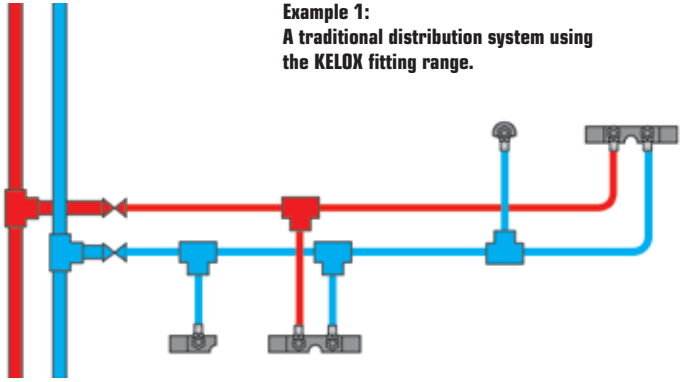
- Pipe straight from the roll with practically zero waste
- Pipe by the roll is thermally insulated at the factory
- Straight lengths for uncovered installations
- A well-balanced range of sizes from d16-75mm
- Fast pipe installation
- No deposits on the smooth inner surface
- Minimal longitudinal expansion, comparable to metal pipes
- solid-plastic system when using PPSU fittings
- KELOX-PROTEC CLIX push-fit system

Practical information about ÖNORM B 1921

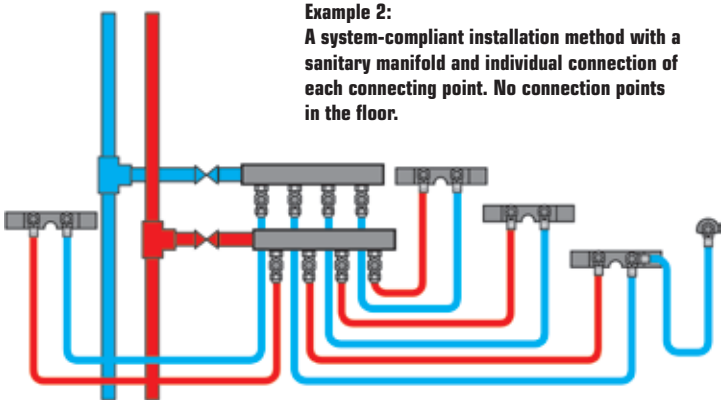
In the interests of meeting hygiene requirements, please pay attention to the following information:

- Size all pipes correctly. Follow the rule of thumb: As small as possible, but as large as necessary
- Ensure that system components remain clean during delivery, storage, and installation.
- Correct insulation; drinking water pipelines must be insulated correctly in accordance with the latest standards
- The temperatures of cold and hot water are to be adjusted in accordance with the applicable guidelines as well as depending on the building type and type of hot water treatment
- Eliminate all dead legs by disconnecting line sections that have been removed from service.
- Install monitors and drains at easily accessible locations.
- Pressure test: In drinking water systems that are not put into service immediately after installation, carry out a leakage test using oil-free compressed air or inert gases.
- Note the following for flushing and placing pipes into service:
- When putting a drinking water system into service, flush the entire network thoroughly with hygienically flawless drinking water.
- Draw up system documentation

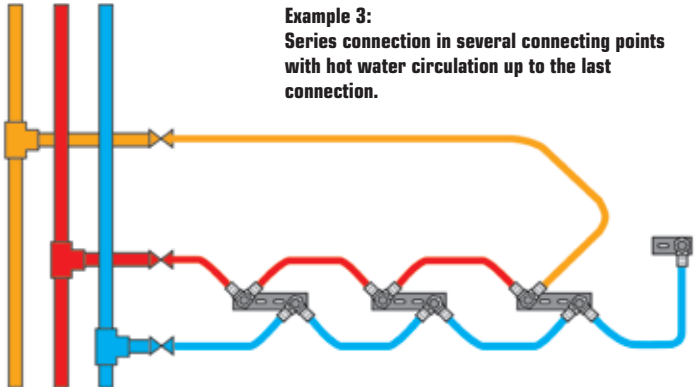
Installation variants



Example 1:
A traditional distribution system using the KELOX fitting range.



Example 2:
A system-compliant installation method with a sanitary manifold and individual connection of each connecting point. No connection points in the floor.



Example 3:
Series connection in several connecting points with hot water circulation up to the last connection.

Sizing and pressure loss for KELOX multilayer pipes

The total pressure loss (Δp) for a KELOX system is calculated by multiplying the length of the pipeline (l) by the pipe friction pressure gradient (R), plus the total (Σ) of the individual resistances (Z).

Total pressure loss Δp: $\Delta p = (l \cdot R + \Sigma Z)$ **in Pa**

The selection of pipe size for the water lines depends on:

- The available water pressure and geodetic height difference
- The pressure loss from instruments and minimum flow pressure (fittings)
- The pipe friction pressure gradient and flow velocities
- The individual resistance values of the fittings
- The type, number and simultaneous operation of the points of use

Permissible flow velocities according to DIN 1988-300

Calculated flow velocity in m/s of a flow duration of line section	< 15 min	> 15 min
Consumption lines: Partial sections with resistance coefficients of $\zeta < 2.5$ for the individual resistance values[a]	5 m/s	2 m/s
Consumption lines: Partial sections with resistance coefficients $\zeta > 2.5$ for individual resistance values[b]	2.5 m/s	2 m/s

[a] e.g. piston valve, ball valve, slanted-seat valves [b] e.g. globe valve

- According to DIN 1988-200, cold drinking water at < 25 °C must flow out of the point of use after a discharge time of 30 seconds at the latest. Below this temperature, it is assumed that no critical growth of micro organisms takes place with a normal exchange of water.

Guidelines for circulation pipes according to DIN 1988-300

The circulation system should be designed such that the temperature difference between the inlet and outlet of the drinking water storage tank does not exceed 5 K. The temperature of the hot water may not fall below 55°C at any point within the system. For economic reasons, the flow velocity in circulation systems should be approximately 0.2-0.5 m/s; in exceptional cases, up to a maximum of 1.0 m/s.

In many cases, an optimised zeta value offers considerable benefits. Due to the lower resistance, pumps that allow water to circulate in the system need less energy. This reduces investment and operating costs. The effectivity of circulation pumps is also increased considerably. Reducing the pipe dimension due to flow optimisation can provide an additional cost reduction.

Determination of individual resistance values (Z) for typical fittings:

$$Z = \zeta \cdot \frac{v^2 \varrho}{2}$$

ϱ = density kg/m³
v = calculated flow velocity
ζ = loss coefficient

Size d (mm)	16	20	25	32	40	50	63	75
Coefficient for friction losses	ζ							
KELOX PROTEC/ULTRAX coupling	4.3	2.4	1.7	0.7	0.6	0.4	0.5	0.5
KELOX ULTRAX-W/WINDOX-W coupling	2.3	1.3	0.8	0.3	0.4	-	-	-
KELOX PROTEC/ULTRAX elbow 90°	17.3	10.1	7.1	4.5	3.3	2.5	2.4	2.4
KELOX ULTRAX-W/WINDOX-W 90° elbow	6.4	5.0	3.7	3.0	3.1	-	-	-
KELOX-ZETA elbow 90°	7.1	2.8	2.5	-	-	-	-	-
KELOX PROTEC/ULTRAX elbow 45°	-	-	2.0	1.5	1.3	1.0	1.0	1.0
KELOX PROTEC/ULTRAX Run tee with diverging flow	5.9	3.3	2.3	1.1	0.8	0.4	1.1	1.1
KELOX ULTRAX-W/WINDOX-W Run tee with diverging flow	2.4	1.4	0.8	0.6	0.5	-	-	-
KELOX ZETA run tee with diverging flow	5.9	2.4	1.9	-	-	-	-	-
KELOX PROTEX/ULTRAX Tee bore with diverging flow	17.9	10.0	8.4	4.8	3.4	2.5	2.5	2.5
KELOX ULTRAX-W/WINDOX-W Tee bore with diverging flow	6.9	5.0	3.9	3.2	3.1	-	-	-
KELOX ZETA tee bore with diverging flow	9.6	4.8	4.0	-	-	-	-	-
KELOX PROTEC/ULTRAX Wall plate	12.9	9.8	-	-	-	-	-	-
KELOX ULTRAX-W/WINDOX-W Wall plate	5.5	5.5	-	-	-	-	-	-
KELOX-ZETA wall plate	6.7	2.9	-	-	-	-	-	-
Euro screw fitting	3.4	2.8	5.0	-	-	-	-	-

Due to lower zeta values, you can use smaller pipe sizes if rated correctly. This saves you material costs and improves hygiene values due to faster flow velocities and lower pipe fill contents. Even though the fittings have been optimised, we have not changed or weakened any of the tried and tested components like O-rings or the wall thicknesses of bodies, for example. This guarantees longevity and safety and are always the primary focus.

Excerpt from DIN 1988-300

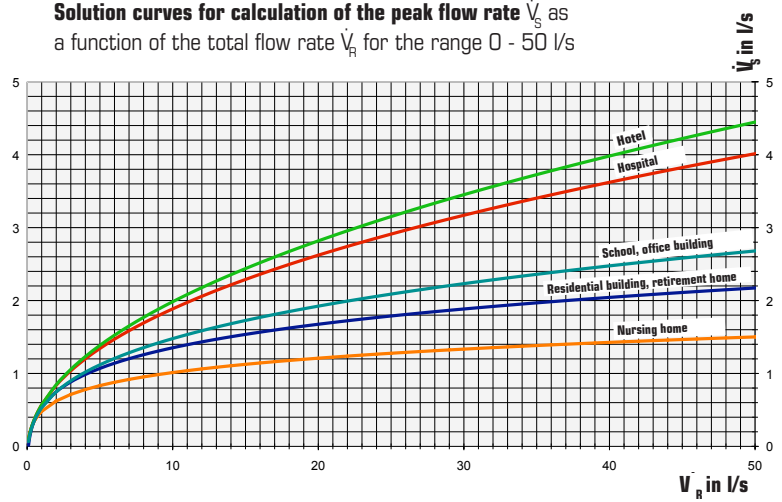
For the building types indicated in the table, the peak flow rate $\dot{V}_S$ is calculated within the following scope:

$$\Sigma \dot{V}_R: 0.2 \text{ to} \leq 500 \text{ l/s}$$

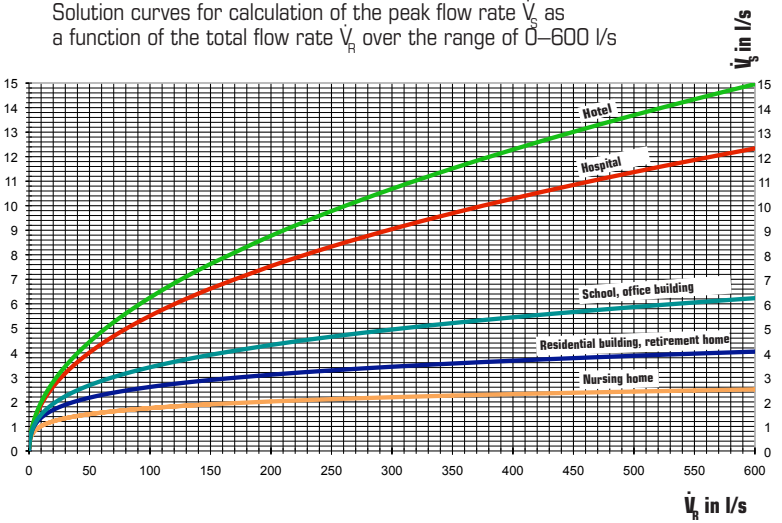
The peak flow rate ($\dot{V}_S$) is calculated based on the building type using the constants from the table on the next page as follows:

$$\dot{V}_S: a\,(\Sigma \dot{V}_R)^b - c$$

Solution curves for calculation of the peak flow rate $\dot{V}_S$ as a function of the total flow rate $\dot{V}_R$ for the range 0 - 50 l/s



Solution curves for calculation of the peak flow rate $\dot{V}_S$ as a function of the total flow rate $\dot{V}_R$ over the range of 0–600 l/s



Constants (a, b, c) for peak flow rate by building type

Building type	Constant		
	a	b	c
Residential building	1.48	0.19	0.94
Assisted-living facility, retirement home	1.48	0.19	0.94
Patient ward in hospital	0.75	0.44	0.18
Hotel	0.70	0.48	0.13
School and office building	0.91	0.31	0.38
Nursing home	1.40	0.14	0.92

Exceptions to the calculation of the peak flow rate $\dot{V}_S$

Utilization units (UUs)

A room that contains points of use and is located within a residential building (e.g., bathroom, kitchen, housekeeping room), or in a non-residential building where it can be assumed that usage is residential in nature. Experience has shown that, in the direction of flow towards the end of the branch line and in the floor distribution of UUs, the flow rates from the calculation are too high, since in most cases no more than two points of use are ever open at the same time, e.g., in a bathroom.
For this reason, the peak flow rate in each partial section of a UU is set to no more than the total flow rate of the two largest points of use installed on the partial section (also applies to single-UU situations where the calculation results in a lower flow rate).
If a second UU is connected to a partial section (e.g. in the riser), the peak flow rates of both UUs are added together, provided that the resulting peak flow rate is less than the value calculated using the equation. Otherwise, the peak flow rate must be determined using the respective equation.

Permanent consumers

The flow rate of a permanent consumer is added to the peak flow rate of the other points of use. Water usage with a duration of more than 15 minutes, e.g. a garden sprinkler valve, are considered to be permanent consumption.

Series systems

Calculation here is based on the total flow rate. The degree of simultaneous water usage must be defined together with the system operator. If they can occur simultaneously, the peak flow rates of the series system must be added together.

Special buildings, commercial and industrial facilities

For special buildings (i.e. other than those indicated above), industrial plants, agricultural buildings, nurseries and market gardens, slaughterhouses, dairies, business establishments, commercial laundry facilities, catering companies, public baths, etc., the peak flow rate must be determined from the total flow rate in consultation with the facilities operator. If the peak flow rates for the sections of the drinking water installation occur at the same time, they must be added together.

Sizing guidelines
Excerpt from DIN 1988-300

1. Determine the calculation flow rates and minimum flow pressures of the point-of-use fittings
The calculation flow rate $\dot{V}_R$ is an assumed point-of-use flow rate for the calculation step. Refer to the table for the calculation flow rates of common fittings. The calculation flow rate== $\dot{V}_R$ is the mean value resulting from the following equation:

$$\dot{V}_R = \frac{\dot{V}_{min} + \dot{V}_{max}}{2}$$

2. Calculation of total flows and allocation to partial sections
Against the direction of flow – ending at the most distant point of use and at the supply line in each case – the calculation flows are added up and the total flow rates resulting from this must then be assigned to the corresponding line sections. The respective partial section begins with the fitting at which the total flow rate or the diameter changes. At the junction point of the cold water line for the drinking water heater, the total flow rates of the cold and hot water sides are added together.

3. Use of the conversion curve to convert total flow rate to peak flow rate
When calculating pipeline systems, always include all the points of use with their calculation flow rates.
The exception to this rule is the case where, in a single utilization unit (UU) a second sink, a shower in addition to a bathtub,
a bidet, a urinal, or taps in anterooms of toilet facilities are installed. These are not included in the total flow rate.

4. Simultaneous operation depending on building type
The peak flow rate is calculated as a function of the total flow. The simultaneousness of the water usage depends on the type of use for the building (e.g., in apartments, hotels, etc.)
It is generally assumed that not all the connected points of use are open completely at the same time.

5. Choose the pipe diameter
Calculate the pipe diameter and the pipe friction pressure gradient, as well as the associated calculated flow velocity.

6. Comparison of pressure loss with available pressure
The total pressure loss for the calculated pipe diameters should for the most part approximate the available pressure difference without exceeding it.

7. Minimum flow pressures and calculation flow rates $\dot{V}_R$ (l/s) of common drinking water extraction points

Minimum flow pressure bar	Type of drinking water point of use	Size	$\dot{V}_R$ (l/s)
	Spigots and faucets		
0.5	without aerator[a]	DN 15	0.30
0.5		DN 20	0.50
0.5		DN 25	1.00
1.0	with aerator	DN 10	0.15
1.0		DN 15	0.15
	Mixing valves[b, c] for		
1.0	Showers	DN 15	0.15
1.0	Bathtub	DN 15	0.15
1.0	Kitchen sink	DN 15	0.07
1.0	Bathroom vanity	DN 15	0.07
1.0	Bidets	DN 15	0.07
	Household appliances		
0.5	Dishwasher	DN 15	0.07
0.5	Washing machines	DN 15	0.15
	Toilets and urinals		
1.0	Flush valve for urinal (manual or electronic)	DN 15	0.30
1.2	Flush valve for toilet	DN 20	1.00
0.5	Toilet tank according to EN 14124	DN 15	0.13

a) With no devices connected (e.g. a lawn sprinkler)

b) The indicated calculation flow rate must be included in the calculation for the connection on the cold and warm water side.

c) Angle valves, e.g. for bathroom vanity fixtures and shower hose connections, should be included as individual resistances or in the minimum flow pressure of the point-of-use fitting.

Important information:

Fixture manufacturers are required to state the minimum flow pressure and calculation flow rates $\dot{V}_R$ for their fixtures. Always take the manufacturer's information into consideration when sizing the pipe diameter. If these values are greater than the ones provided in the table, the drinking water installation must be sized using the manufacturer's specifications.

Note:
Points of use not covered by the table as well as fittings and fixtures of the same type, or with fitting flow rates or minimum flow pressures greater than those stated, must also be included according to the manufacturer's specifications.

Sizing and pressure loss for KELOX plumbing lines

Information on calculating the individual resistance values can also be found in the manual.

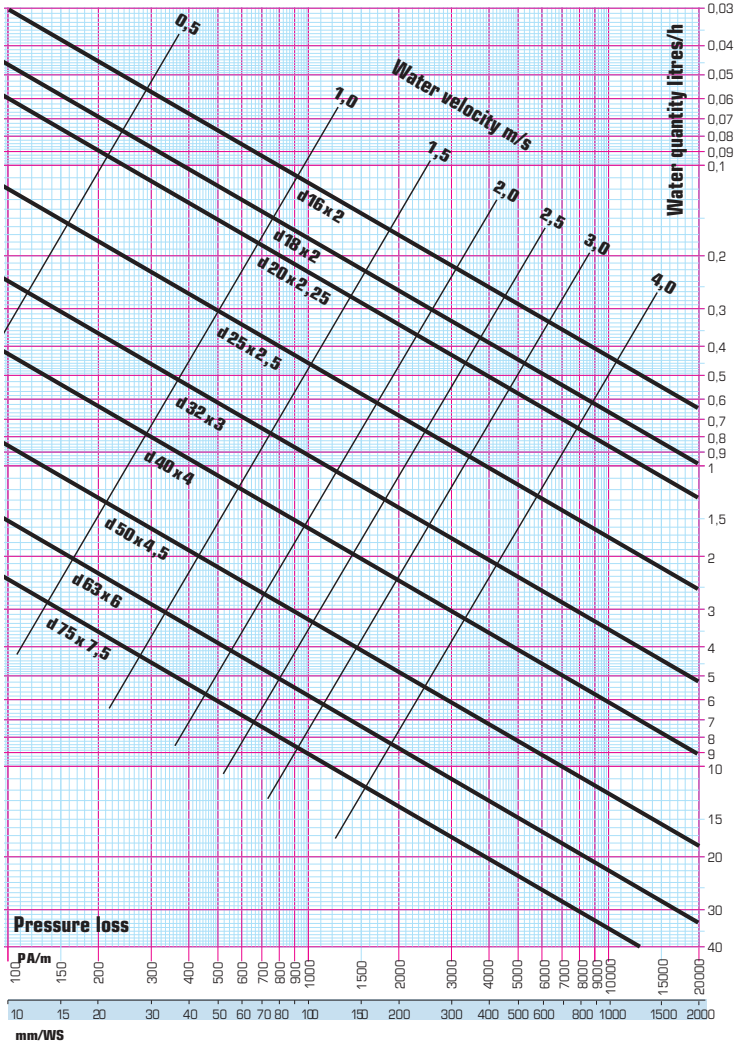
KELOX multilayer pipe d: 16, 18, 20, 25, 32, 40, 50, 63, 75

The pressure losses are calculated according to the Nikuradse formula:

$$R = 3.62315 \cdot 10^{3} \cdot \dot{m}^{1.70651} \cdot di^{-4.64237}$$

Pipe roughness: 0.007mm

R = pipe friction pressure gradient (Pa/m)
Ṁ= Mass flow (l/h)
di = internal pipe diameter (mm)



Heat insulation for cold water lines and cold water circulation in accordance with ÖNORM H 5155

ÖNORM H 5155 applies to insulation of building service installations to standardise and simplify the design, installation and maintenance of insulation systems.

- The purpose of ÖNORM H 5155 is to specify insulation thicknesses to minimise the transfer of heat from transport media to the surrounding environment and vice versa.
- ÖNORM H 5155 applies to the insulation of all components in heating and drinking water systems.
- Insulation also varies depending on the type of installation and the location of the lines (e.g., false-wall installations, false ceilings, heated rooms, etc. …)
- Please follow KE KELIT's recommendations, which also factor in comfort aspects such as noise reduction and more.

ÖNORM H 5155 specifies a lambda value (λ) of 0.036 W/mK, for cold water pipes at an average temperature of 0 °C and an external heat transfer coefficient of 9 W/m²K.

Since factory pre-insulated KELOX Plus pipes have improved Lambda values, the insulation widths required in ÖNORM can be implemented with the following pre-insulated KELOX Plus and Lambda Plus pipes:

Thermal conductivity Plus - 0.038 W/mK at 20 °C - 0.040 W/mK at 40 °C
Insulation thickness: 9 mm corresponds to 9 mm according to ÖNORM H 5155

Thermal conductivity Lambda Plus - 0.031 W/mK at 10 °C - 0.035 W/mK at 50 °C
Insulation thickness: 16 mm corresponds to 19 mm according to ÖNORM H 5155

Minimum insulation thicknesses d for cold water pipes, cold water circulation pipes and their components

Outer pipe diameter (d) Multilayer pipe in mm The nominal diameters given in DN/D in the ÖNORM H 5155 have been converted to the sizes of the KELOX pipes.	16	20	25	32	40	50	63	75
	Minimum insulation thickness (mm)							
Flush-mounted in conditioned and unconditioned zones (pipeline is freely installed or accessible, e.g. false ceiling, raised floor, shaft)	19	19	19	19	25	25	32	32
Flush-mounted in conditioned and unconditioned zones (pipeline is not accessible, e.g. in the wall or floor)	9[b]	9[b]	9[b]	9[b]	13	13	19	19
Outside the building	The insulation thickness is to be chosen so that the temperature specifications are observed for cold water pipes.							
In the ground	If heat insulation is required, it is to be selected based on economic framework conditions.[a]							

a Examples of economic framework conditions: Heat losses, heat input, civil engineering costs
b The required insulation thickness for a pipe-in-pipe system is 4 mm.

Country-specific standards and laws regarding pipe insulation must be taken into consideration and complied with.

Pressure test for drinking water systems with air or inert gases according to ÖNORM B 2531

The pressure test using air or inert gases is carried out in a two-stage process comprising a leak test, a load test and the system test with drinking water.

You can carry out the pressure test using air or inert gases on a section-by-section basis;
however, it is no replacement for a system test using drinking water!

The pressure test must be carried out with air or inert gases that are essentially oil- and dust-free and it is suitable for all pipe materials. Inert gas must be used when the pressure test is carried out in buildings with demanding hygienic requirements (e.g. in medical facilities). **Due to the compressibility of the medium, test pressures above 300 kPa (3 bar) must not be applied for safety reasons when using air or inert gases for the pressure test!**

Higher test pressures pose a higher safety risk and do not increase the testing accuracy.

Take necessary precautions to keep people and objects safe during the test. Splitting the pipeline into small pipe sections during the pressure test results in higher testing accuracy and therefore greater safety. All pipe openings must be closed tightly using plugs or blind flanges with enough strength to withstand the test pressure. When carrying out a pressure test using air or inert gases, the connections between the pipeline parts must be accessible and visible, and bleed valves must be available to ensure safe discharge of the test pressure. If leaks are found or a pressure drop is detected, you must check that all the connections are tight using suitable bubble-forming leak detectors. Once the leaks have been eliminated, the pressure test must be repeated.

Two-stage pressure test for all pipelines ≤ DN 50/OD 63

Consisting of a leak test and a load test

Leak test

Test pressure 15 kPa (150 mbar) – test duration 60 min. Display accuracy of the pressure gauge or standpipe 0.1 kPa (1 mbar)

Load test

Test pressure 300 kPa (3 bar) – test duration 10 min. display accuracy of the pressure gauge 10 kPa (100 mbar)

Two-stage pressure test for all pipelines > DN 50/OD 63

Consisting of a leak test and a load test

Leak test

Test pressure 15 kPa (150 mbar) – test duration 90 min., display accuracy of the pressure gauge or standpipe 0.1 kPa (1 mbar).

Load test

Test pressure 100 kPa (1 bar) – test duration 10 min., display accuracy of the pressure gauge 5 kPa (50 mbar)

System test after a pressure test was performed using air or inert gases

The system test with drinking water is performed to check the tensile strength of the connections and the static load capacity of the pipe fastenings. The system test is only permissible if a pressure test has already been performed using air or inert gases. The system test is to be performed using the available operating pressure. During this process, all points of use of the section being tested are to be kept closed.
During the system test, the water supply pipe is to be blocked and the test pressure is not permitted to drop for a **period of 10 minutes.**

Pressure test report for drinking water systems with air or inert gases according to ÖNORM B 2531

Test medium: Air or inert gases

Client:.....

Contractor: .....

Property: .....Test section:.....

Pipe materials and sizes: .....

Ambient temperature: .....Temperature equalization: ☐

Maximum system operating pressure, MDP:.....Visual inspection: ☐

Two-stage pressure test for all pipelines ≤ DN 50/OD 63:

Consisting of a leak test and a load test

Leak test ☐

Test pressure 15 kPa (150 mbar) – test duration 60 minutes

Load test ☐

Test pressure 300 kPa (3 bar) – test duration 10 minutes

Two-stage pressure test for all pipelines > DN 50/OD 63:

Consisting of a leak test and a load test

Leak test ☐

Test pressure 15 kPa (150 mbar) – test duration 90 minutes

Load test ☐

Test pressure 100 kPa (1 bar) – test duration 10 minutes

The pressure test using air or inert gases does not eliminate the need for the pressure test with drinking water required by ÖNORM EN 806-4. An additional system test must be performed immediately prior to commissioning the system

System test Test duration 10 min ☐

After a successful pressure test, we recommend drawing up a confirmed test report.

Confirmation

Responsible person: .....

Date:..... Time: from.....to.....

Client:.....

.....

Pressure test for drinking water systems using drinking water according to ÖNORM EN 806-4

When using "leak before pressed" fittings, a functional test must be performed according to the manufacturer's specifications
In the case of temperature differences (> 10 K)
between the ambient and fill water
temperatures, you must wait for 30 minutes after filling the system with drinking water so the temperature can equalize.

Test pressure: 0.05 MPa (0.5 bar) up to max. 0.2 MPa (2 bar)
Test duration: 15 minutes after temperature equalisation between the pipe and the test medium.

Test differential pressure: 0.0 bar
A visual check must then be performed on all pipe connections.

If a pressure test is carried out using air or inert gases, the functional test may be omitted!

Pressure test for drinking water systems in conformity with ÖNORM EN 806-4

The pressure test using drinking water is a combined leak and load test and, according to ÖNORM EN 806-4, must be performed on all pipes. Pipes and other pipeline parts must be rated for the highest system operating pressure (MDP) according to ÖNORM EN 805 or the ÖNORM EN 806 series.
However, they must be designed for at least a system operating pressure (MDP) or nominal pressure (PN) of 1.0 MPa (10 bar).

Because ÖNORM EN 806-4 requires that the test pressure be 1.1 times the highest system operating pressure, the pressure test must be conducted with at least 1.1 MPa (11 bar).

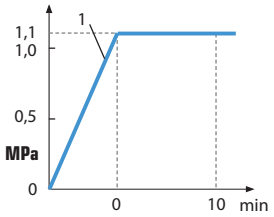
Display accuracy of the pressure gauge (preferably positioned at the lowest point): 0.02 MPa (0.2 bar).
Depending on the pipe materials and sizes, test method "A" is used for the leak and load test as per ÖNORM EN 806-4.

Test method A – test duration 10 minutes

- For all multilayer composite systems with **d14-75mm**
- For all metal pipe systems with **d12–108 mm**
- For all plastics (e.g. PP, PE, PEX, PB and others) ≤ **DN 50/OD 63**
- For all combined systems (metal and multilayer composite systems with plastics) **≤ DN 50/OD 63**

The system must be filled with water, all the air must be bled out, and all points of use must be closed.

The test pressure (1) is to be applied using pumps and be maintained for 10 minutes. During this time, the test pressure must remain constant without any pressure drops.



Pressure test report for drinking water systems using drinking water according to ÖNORM EN 806-4

Test medium: Drinking water

Test pressure according to ÖNORM EN 806-4 with 1.1 MPa (11 bar)

Client:.....

Property: .....Test section: .....

Pipe materials and sizes: .....

Functional test according to manufacturer's specifications
Test pressure: 0.05 MPa (0.5 bar) up to max. 0.2 MPa (2 bar)
Test duration: 15 minutes

Ambient temperature: .....Air bled from system ☐

Temperature equalization ☐ Visual inspection ☐

Functional test carried out: yes ☐ no ☐

Pressure test for drinking water systems with at least 1.1 MPa (11 bar)

Test pressure EN 806-4 with 11 bar

Pipe: d...../.....m	Pipe: d...../.....m	Pipe: d...../.....m
Pipe: d...../.....m	Pipe: d...../.....m	Pipe: d...../.....m
Pipe: d...../.....m	Pipe: d...../.....m	Pipe: d...../.....m
Pipe: d...../.....m	Pipe: d...../.....m	

Test method A – test duration 10 minutes

Metal systems and multilayer composite pipe systems – all sizes
Plastic systems and combined systems with plastics ≤ DN 50/OD 63

Visual inspection ☐ The system is tight ☐

- **Temperature fluctuations can affect the test pressure!**
- **Each pressure test is a snapshot of the actual situation and can provide no guarantee against installation errors.**
- **After a successful pressure test, we recommend drawing up a confirmed test report.**

Confirmation

Responsible person: .....

Date:.....Time: from.....to .....

Client:.....

.....

Expansion behaviour of KELOX pipes

Longitudinal thermal expansion

When heated, all materials experience an increase in volume or a change in length. In every piping network, the linear expansion specific to the installation system must be taken into consideration.

The linear expansion depends on the pipe length, the increase in temperature and the expansion coefficient, but does not depend on the pipe size.

Calculating the linear expansion:

$$\Delta_l = l \cdot \Delta_t \cdot \alpha$$

Δ_l = Specific linear expansion (mm)
l = pipe length, installation length (m)
Δ_t = temperature difference (K)
α = expansion coefficient (mm/mK)

This means: Under the influence of temperature, the KELOX multilayer pipe expands in a similar way to metal materials.

Material characteristics

Material	Expansion coefficient α mm/mK	E-modulus 60° N/mm²
Galv. steel	0.012	220,000
Stainless steel	0.015	200,000
Copper	0.016	130,000
KELOX	**0.025**	**4,240**
KELEN	0.150	300
PEX	0.175	540

Expansion bends of exposed pipes

When subjected to thermal expansion, KELOX pipes in exposed installations must undergo corresponding expansion compensation. This can be accounted for by providing expansion bends in combination with anchor points and bearings. Even if the temperature exposure is only brief, the expansion compensation must be designed to handle this temperature difference. Compensation always takes place between two anchor points, or between an anchor point and a change in direction (expansion bend).

Calculating the expansion bends:

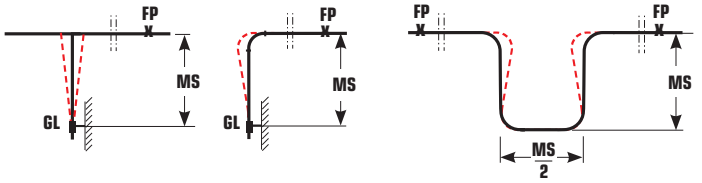
$$MS = 30 \cdot \sqrt{d \times \Delta_l}$$

d = outer pipe diameter (mm)
30 = KELOX material constant
MS = minimum bend length (mm)
e.g.: from 90° elbow to the next anchor point

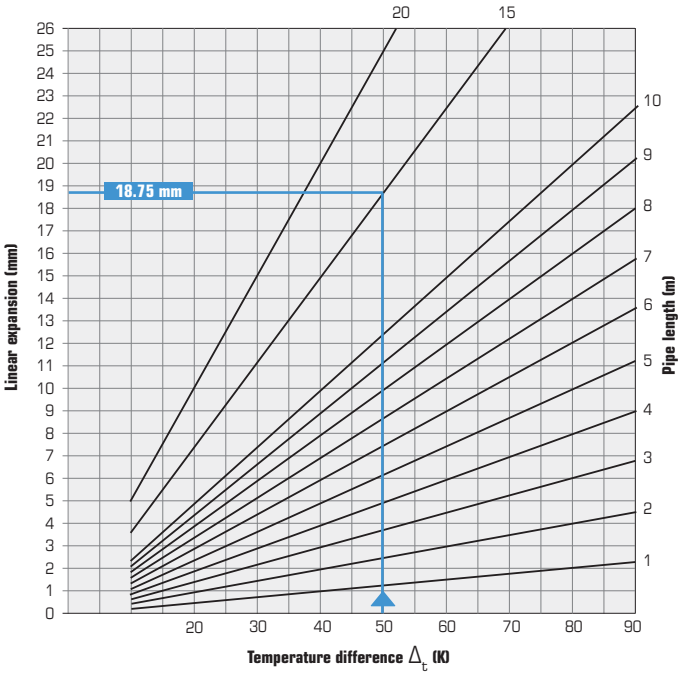
Example:

A pipe with d50mm is run over a length of 15 m. Δ_t = 50 K
Question: Which expansion bend should be used to compensate the expansion?

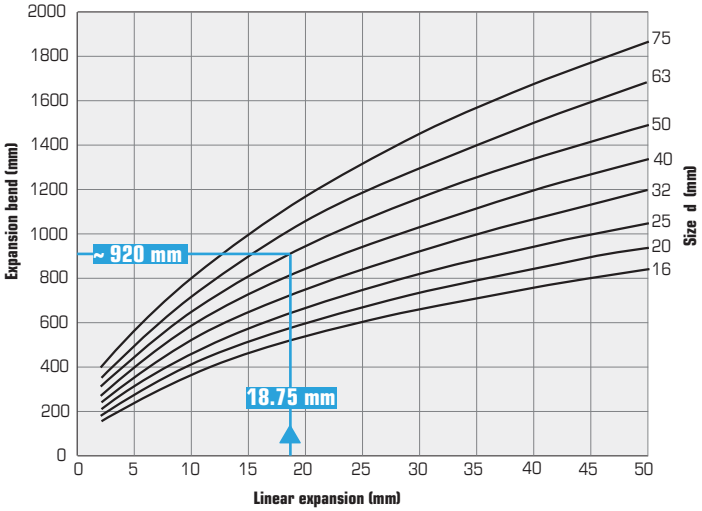
Δ_l = $15 \cdot 50 \cdot 0.025$
Δ_l = 18.75mm expansion
MS = $30 \cdot \sqrt{50 \cdot 18.75}$
MS = ~ 920mm bend length



Thermal linear change of KELOX multilayer pipes based on α = 0.025 mm/mK



Determining the expansion bend for KELOX multilayer pipes based on a material constant = 30



Thermal expansion forces of KELOX pipes

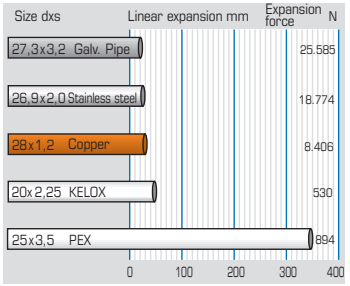
Material-specific forces are generated during linear expansion. The specific thermal expansion force is calculated in accordance with standard industry practice.

Thermal expansion forces depend on the size (cross-sectional area of the pipe) and the change in temperature, regardless of the pipe length.

Calculating the thermal expansion force:

$$F_t = \frac{E \cdot A \cdot \alpha \cdot \Delta_t}{1000}$$

F_t = expansion force (N)
E = E-modulus (N/mm²)
A = cross-sectional area of pipe (mm²)
α = thermal expansion coefficient (mm/mK)
Δ_t = temperature difference (K)



Example:

KELOX d 25x2.5	A	=	176.71 mm²
E-modulus	E	=	4240 N/mm²
Expansion coeff.:	α	=	0.025 mm/mK
Installation temp.:	tv	=	20 °C
Medium temp.:	tm	=	60 °C
Temperature diff.:	Δt	=	40 K

$$F_t = \frac{4240 \cdot 176.71 \cdot 0.025 \cdot 40}{1000}$$

F_t = ~ 750 N expansion force

Installation rules regarding linear expansion
During installation, always route the pipe appropriately while ensuring adequate opportunities for expansion. If necessary, suppliers of mounting clamps can provide solutions.

Flush-mount pipes
Pipes installed in masonry walls are prevented from expanding by the friction forces that occur. Insulated piping offers additional scope for expansion. Direct contact by in-wall pipes and fittings with the masonry, tiles, mortar, etc. should always be prevented through the use of suitable insulation.

Exposed pipelines
KELOX multilayer pipes are typically installed in a similar way to copper, as the high flexibility of the pipes facilitates deflection in the expansion bends. Exposed pipes (basement piping, risers, etc.) are installed based on the specific structural conditions and in accordance with generally accepted engineering practice. Anchor points should not be installed directly at fittings that cause a change in direction (see page 52 for expansion example). Vertical piping (risers, etc.) can normally be mounted solely using anchor points. In this case, the piping should be secured directly above or below the location where pipes branch off from the riser.

Pipes in raised floors
Multilayer pipes can move axially in the insulation, which is why the expected linear changes must be taken into consideration. Right-angle changes in direction in the insulation must be designed so that the linear expansion which occurs is compensated by the insulation in the area of the fitting. Because of their plastic deformability, pipes directly embedded in floor screed or concrete do not require compensation. However, the requirements for thermal and noise insulation must be observed.

KELOX

Flushing report in conformity with ÖNORM B 2531 for drinking water systems – drinking water flushing medium

Client: .....

Contractor: .....

Property: .....Test section: .....

Pipe material:.....Date: .....

To meet the requirements of ÖNORM EN 806-4, proceed as described below.

Standard values for the minimum number of points of use to be opened

Largest nominal width of line in section currently being flushed (DN)	20	25	32	40	50	65	80	100
Minimum number of points of use to be opened (Minimum flushing time 2 min.)	2	2	4	6	8	12	18	28
Opened for flushing:								

Note: Regardless of the flushing procedure, each point of use should be opened completely once during system commissioning.
According to ÖNORM EN 806-4, the pipes must be properly placed in service no later than 7 days after being flushed.
The flushing process with an air/water mixture is described in ÖNORM EN 806-4.

- ☐ The drinking water used for flushing was filtered (no particles greater than or equal to 150µm).
- ☐ The hot and cold water lines were flushed separately.
- ☐ Circulation lines were flushed in sections, directly prior to entry into the hot water heater.
- ☐ The minimum number of points of use was defined in conformity with ÖNORM.
- ☐ All the shut-off and control valves were open completely during the flushing process.
- ☐ Sensitive fittings (e.g. solenoid valves, flush valves, thermostatic fittings, control valves) and devices (e.g., drinking water heaters) were replaced with adapters or bypassed according to manufacturer specifications.
- ☐ The installation was flushed in sections, beginning with the first riser after the main shut-off.

Proper flushing of the system is hereby confirmed.

Installation company/fitter: .....

Client.....

Sound insulation

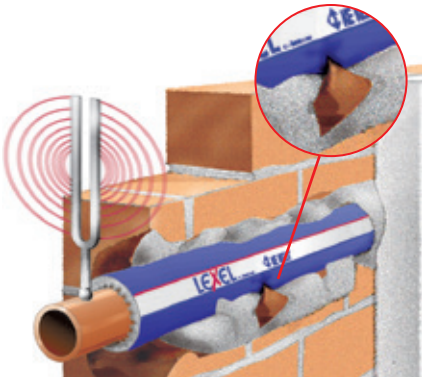
You must take into account all the noise-producing influencing variables in the acoustic assessment of a sanitary installation. The noise behaviour of drinking water installations affects the overall sound pressure level. This means that you must take into account specific principles and requirements of drinking water installations at both the planning and execution stages.

When choosing pipe routing, take particular care to avoid structure-borne noise. Pipelines can be stimulated to vibrate due to the media that flow in pipes or the fittings that are connected to them. If pipes are fixed rigidly to the building, the structure-borne noise is transferred to them and emitted as disruptive airborne noise. To avoid this, pipes and connections (e.g. wall plates) must be decoupled by taking appropriate measures (refer to KELOX accessories).

ÖNORM B 8115 defines the noise level for spaces requiring insulation.

- Constant noises, such as recirculating pumps, flow noises from drinking water or heating lines, etc. ≤ 25 dB (A)
- Temporary noises, such as toilet flushing, wastewater noises, elevators, etc. ≤ 30 dB (A)

Increases of the sound insulation by 5 dB (A) below the values required by ÖNORM B 8115 must always be arranged separately.



Attention! Damaged insulation or mortar residue between the pipelines, wall or floor screed can lead to noise bridges being formed which transmit noise unhindered. In the interests of effective sound insulation, this means that acoustic decoupling using pipe insulation should be as continuous as possible.

A single sound bridge is enough to negate virtually every other sound-protection measure taken.

The purpose of all sound insulation measures is to protect people from being disturbed by bothersome sound transmitted in common rooms. According to DIN 4109, rooms requiring insulation include living rooms, bedrooms, classrooms, offices and work areas, among other spaces.
DIN 4109 recommends the following measures:

- Use of low-noise fittings
- Acoustic decoupling on pipe mounts and wall plates, e.g. KELIT connection set
- Use of KE KELIT pipes that are insulated at the factory or sheathing with noise-suppressing insulation and simultaneous structure-borne sound isolation (e.g. LEXEL)
- Avoidance of high pressures and flow velocities
- Do not exceed the permissible resting pressure of 5 bar upstream of the points of use
- Use structure-borne noise insulating pipe mounts (e.g. rubber inserts)
- Paying special attention to spaces requiring insulation

DIN 4109, Table 4: Permissible sound pressure level in spaces requiring insulation from noises resulting from building services equipment and businesses

Source of noise	Characteristic sound pressure level dB(A) in living spaces and bedrooms	Characteristic sound pressure level in classrooms and workspaces
Water installations (water supply and waste water systems together)	<30[1,2]	<35[1]
Other building services equipment	<30[3]	<35[3]
Operating during the day between 6 a.m.and 10 p.m.	<35	<35[3]
Operating during the night from 10 p.m. to 6 a.m.	<25	<35

[1] You can ignore individual, short-term peaks that occur when fittings and devices are activated as per Table 6 of DIN 4109 (opening, closing, switching, interrupting, amongst other things).

[2] Contractual conditions to comply with the installation sound pressure level: The implementation documents must take into account the requirements of sound insulation, i.e. among other things the required sound insulation verification must be available. Apart from this, the responsible construction management must be nominated and consulted with before closing or encasing the installation. Any further details are regulated in the ZVSHK (German Central Plumbing, Heating, and Air Conditioning Association) specification sheet. It can be obtained from: Zentralverband Sanitär Heizung Klima (ZVSHK, Rathausallee 6, D-63757 Sankt Augustin Germany)

[3] With ventilation systems, values that are 5dB(A) higher are allowed if the continuous noise in question does not have any noticeable individual tones.

Spaces requiring insulation include:

- Living spaces including halls-cum-living-rooms
- Bedrooms
- Conference rooms in schools or universities, etc.
- Offices, consulting rooms, meeting rooms, etc.

Summary of the installation guidelines

1. The plastic KELOX multilayer pipe system must be handled carefully to avoid shocks, impacts, nicks and kinks. KELOX system components are well protected in their original packaging. However, all components (fittings and pipes) must still be protected against mechanical and weather-related damage.

2. Store and transport all KELOX system components with care. The external protective layer is stabilized against UV influences, but the pipes are not to be exposed to long-lasting, direct sunlight. Suitable measures must be taken to protect fully installed systems or system components against UV rays. This does not apply to typical storage and working times.

3. Please pay attention to the processing guidelines of the screw, press-fit and push fittings

Vitally important!

Always cut at right angles – perform precise calibration – fully slide on – press or screw on – pushed on = leakproof

4. With KELOX female thread fittings, KE KELIT recommends that you only ever use fittings and connections with a straight thread!
DO NOT join threaded pipe and malleable iron fittings!
We recommend using hemp in combination with an approved plumbing sealing compound (e.g., Fermit, Locherpaste thread sealant, etc.).

Only ever apply enough hemp for the thread tips to still be visible. Using too much hemp can potentially damage the female thread. Applying hemp shortly after the first thread turn can help prevent cross-threading.

Important:

To seal KELOX PPSU fittings, only ever use hemp in conjunction with an approved sanitary sealant! For KELOX PPSU fittings, you must not use **ANY** chemical sealants like liquid sealants, 1- or 2- component adhesives, for example! In the case of KELOX fittings made from PPSU with a male thread, you **MUST NOT** use thread sealing cords!
Always remember: Do not overtighten the threads.

5. According to ÖNORM B 2531, surface-mounted and concealed fittings installed on or in the wall run the risk of transferring heat to the fitting and the cold water when they are connected to circulating hot water systems. This risk can be reduced by connecting a non-circulating connecting line before the fitting.

6. Reference values for span widths: Buckling of water-filled, horizontally and vertically laid KELOX pipes is effectively prevented with the specified clamp spacing. At temperatures above 60°C, the span widths reduce by approximately 10%.

Pipe	Temperature	Horizontal cm	Vertical cm
d16	Up to 60°	120	155
d20	Up to 60°	130	170
d25	Up to 60°	150	195
d32	Up to 60°	160	210
d40	Up to 60°	170	220
d50	Up to 60°	200	260
d63	Up to 60°	220	285
d75	Up to 60°	240	310

7. KELOX multilayer pipes are protected against corrosion thanks to their design. However, they still require noise, condensation and thermal insulation that complies with the ÖNORM H 5155. By insulating the entire system, including the fittings, joints can be protected against dirt, debris, damage, and also against concrete slurry or other similar substances entering.

8. KELOX PPSU fittings should not come into direct contact with solvents or solvent-containing building materials such as lacquers, sprays, installation foams, glues (e.g. Armaflex 520 adhesive, etc.). Under unfavourable conditions, aggressive solvent components that may be present could damage the plastic material.

- When using PPSU fittings, it is possible to use **solvent-free** Armaflex SF990 adhesive when glueing insulations.
- Since ammonia, chloride and nitrate-containing substances can cause tension cracks, the used materials and auxiliary materials and the ambient conditions must be free from them to avoid impairment of the metal materials.
- Do not use installation foams or two-component grout based on methyl acrylate, isocyanate or acrylate when mounting the system parts.
- You must not use any cold-welding materials, such as those used to weld PVC protective film or that contain acetone or tetrahydrofuran (THF).

Product ranges	KELOX pipes	KMW	KWW/ KWU	KMU	KMP	KWP
Ethylene glycol < 35%	✓	✓	✓	✓	✓	✓
Hemp + Fermit	✓	✓	✓	✓	✓	✓
Loctite 55	✓	✓	✗	✓	✓	✗
Lacquers, sprays, (2-component) adhesives (like Armaflex 520, for example)	✓	✓	✗	✓	✓	✗
Cold welding compounds contain acetone or tetrahydrofuran (THF)	✓	✓	✗	✓	✓	✗
Compressed air system, based on oil-free systems complying with ISO 8573-1, Class 1	✓	✓	✓	✓	✗	✗
Osmosis water	✓	✗	✓	✗	✓	✓

Avoid using solvents that contain substances like ammonium chloride and nitrate, for example, which cause stress cracks.

9. NOTE! Damage to material due to impermissible leak detection agents
Impermissible leak detection agents can lead to material damage and leaks. As a result of this, water damage can occur.

- Only use leak detection agents that the manufacturer has approved for use on the PPSU material.
- Be sure to comply with the processing information of the respective manufacturer.

10. KELOX multilayer pipes have defined KELOX expansion properties. You must take them into consideration at the planning and installation stages. **Do not provide any expansion compensation in flush-mounted installations.**
For exposed pipes:

In longer piping sections, divide the line into different expansion zones by choosing anchor points on a purposeful basis. If necessary, suppliers of mounting clamps can provide suitable solutions (fixed points, sliding clamps, double clamps, ...).

11. Do not hot bend KELOX multilayer pipes! The pipes can be bent easily without spring back. Be sure to avoid kinks.
Never install pipes that have been damaged or handled/worked incorrectly. For tight radii, please use the following from the tools available: Bending spring or pipe bending tool.
Avoid tight bending radii directly after connections as this could result in damage to the pipe or fitting (cutting effect of the support sleeve, risk of breakage, etc.)

Permitted bending radii:

Pipe	By hand	with WZ925	with WZ920
d16	5 x d	3 x d	3 x d
d20	5 x d	3 x d	3 x d
d25	5 x d	3 x d	4 x d
d32	–	3.5 x d	–

12. Classification of operating conditions for KELOX multilayer pipe systems according to ÖNORM EN ISO 21003

Application class	Calculation temperature	Service life	tmax	Service life at tmax	Max. permiss. operating pressure
Class 2 Hot water supply	70°C	49 years	80°C	1 year	10 bar
Class 5 Radiator connection	20°C + cumulative 60°C + cumulative 80°C	14 years 25 years 10 years	90°C	1 year	10 bar
Cold water	20°C	50 years			10 bar
Cold water	20°C	50 years			16 bar*

* in conjunction with KELOX press fittings only

13. KELOX installation pipe systems should not be worked on at temperatures below -10°C. At low negative temperatures, we recommend storing the system components on temperature-controlled or heated premises directly prior to fitting work. .

14. Every water or heating system installation must be subjected to a pressure test in accordance with the standard. For this, the KELOX system provides KM258 stoppers for pressure testing and KM260 screw fittings for pressure testing.

When using "leak before pressed" fittings, a functional test must be performed according to KE KELIT.
Document the pressure test using the report form provided.

15. With regard to frost protection, KELOX can handle ethylene or propylene glycol up to a maximum concentration of 35% without any problems. If using alternative antifreeze additives, pay attention to the suitability and approval information as well as any application instructions provided by the supplier.

16. According to ÖNORM 21003 temporary loads of up to 80°C are not a problem for the KELOX multilayer pipe system. Avoid loads over longer periods and at higher temperatures. Comply with all applicable guidelines and standards.

- You must carry out disinfection of the drinking water piping system in accordance with the KE KELIT disinfection guideline, visit www.kekelit.com
- For disinfectants listed in ÖNORM B 5019 and B 5021 (e.g., chlorine, chlorine dioxide, ozone, etc.), comply with the respective concentrations and exposure times and do not exceed them under any circumstances.
  If disinfection is performed in contravention of KE KELIT's disinfection guideline and/or compliance with the concentrations and exposure times specified in the standards, damage to material cannot be ruled out.

According to ÖNORM B 5019, thermal disinfection is always preferable to chemical disinfection.

Metal ions, particularly copper ones, have a destabilizing effect and should be avoided in installations.

17. In accordance with ÖNORM H 5195-1, a heating system must be flushed with at least twice the amount of the water content of the system during initial commissioning. After this, the heating system is filled with fill water of appropriate quality.

The function of valves, regulating devices, etc. may be affected by the fill water quality. ÖNORM H 5195-1 specifies the ph value and water hardness (dH) of heating and refilling water in dependence on the system size.

18. Since KELOX installation pipe systems are not electrically conductive, they cannot be used for equipotential bonding, which means that you do not need to earth them.

19. To ensure warranty services (warranty agreement with the Federal Guild of Construction), you must only ever use KELOX system components in each installation case.

20. For perfect installation of the KELOX multilayer pipe system, you only need a small number of tools. For your safety, we recommend using our original tools which have been tried and tested multiple times in practice applications, and also that they be regularly serviced.

Please pay attention to the enclosed instructions for the respective presses!

ATTENTION! In the case of continuous pressing, there is a risk of overheating; refer to the manufacturer's instructions!

KE KELIT recommends servicing pressing tools annually to ensure proper function and to maintain the warranty. Please contact KE KELIT or the respective tool manufacturer directly!

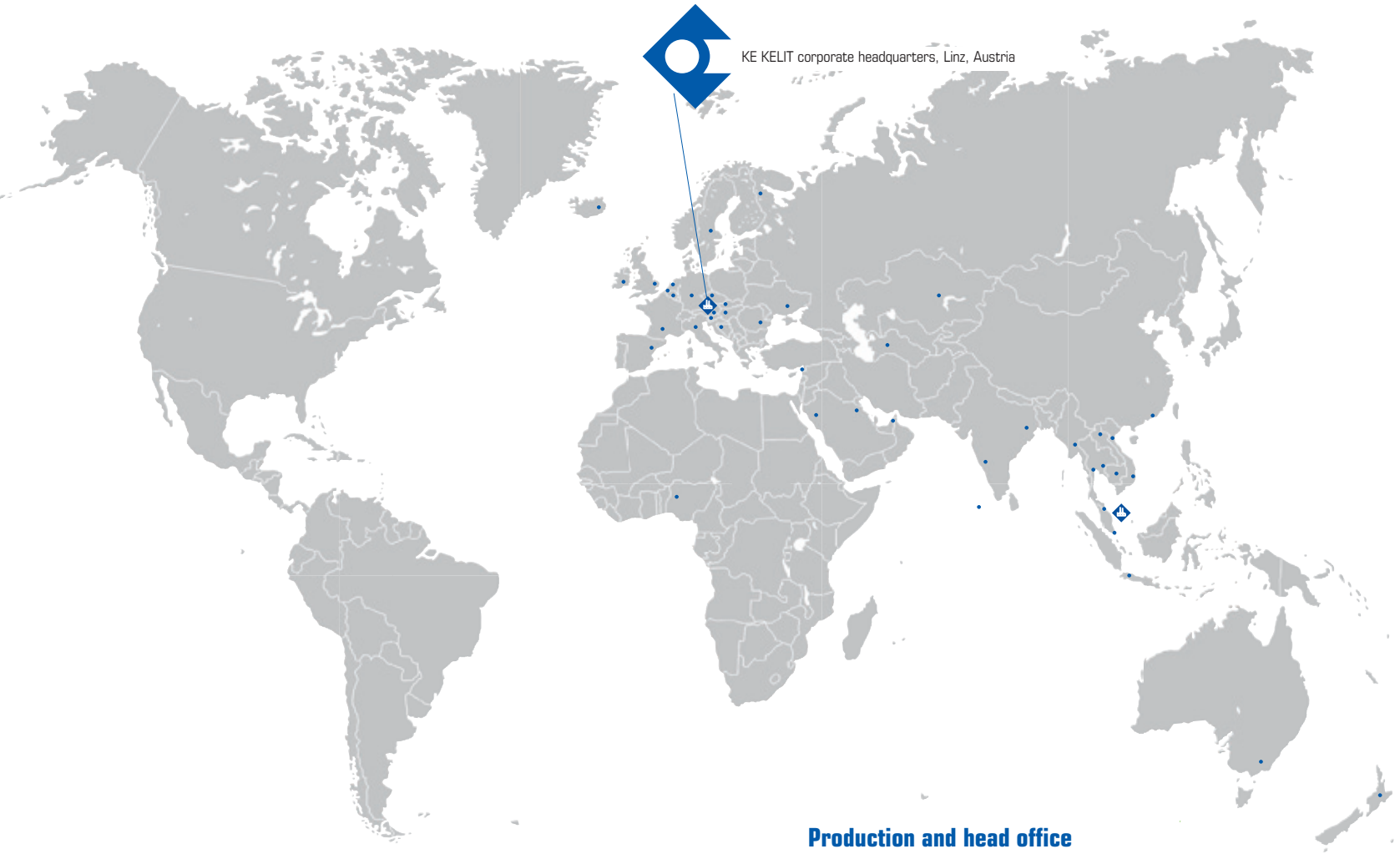
21. In case of doubt, do not hesitate to contact our application technicians. There may not be an optimum solution for every case, but we can always help.

22. Installation videos can be viewed using the KE KELIT QR code.

www.youtube.com/kekelit

KE KELIT locations

Regional products for the whole world!



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