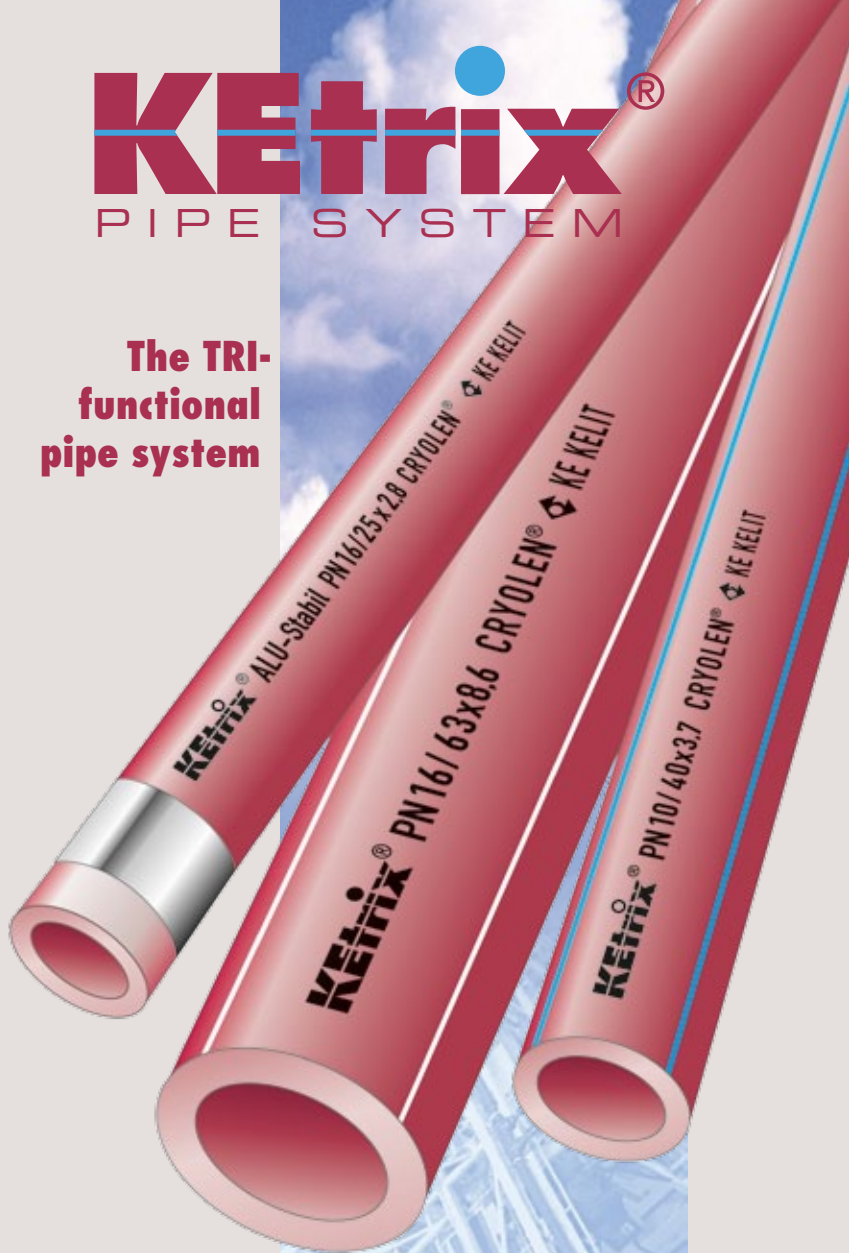


# KEtrix®

PIPE SYSTEM

**The TRI-  
functional  
pipe system**



**Cold water | Compressed air | Cooling**



**Handbook 2014**

Please read the information contained in this handbook before you use KETRIX for the first time, especially the information about how to make the joints.

## Index

Quality targets; approvals; registration	3
Drinking water supply (cold), operating conditions	4–5
Introduction – Compressed air; cooling	6–7
Raw materials; the polymer	
Metal thread fittings	8–9
Pipe types; service life	10–11
CX-Pipes; PE pipes; heat loss	12–13
The six methods of joining	14–15
<b>Installation</b>	
Polyfusion welding, saddle fitting welding	16–17
Table welding machine	18–19
Overhead welding machine	20–21
Butt welding machine	22–23
E-uni socket welding	24–25
Glycol brine pipelines, pressure loss in KETrix® drinking water pipes	26–27
Pipe sizing to DIN 1988-300 the complementary pipe system	28–31
Pipe sizing – PN10; ALU-composite and PN16	32–33
Compressed air technology; compressed air network	34–35
Pipe sizing graphs for compressed air systems	36–37
Expansion; force of expansion; compensation	38–39
Compensation for expansion in practice; pipe supports	40–41
Pressure testing for drinking water with water	42–43
Pressure testing for drinking water with air	44–45
Pressure testing for chilled water and compressed air	46–47
Installation guidelines	48–49
Product range	50–69
Agencies worldwide	70–71

Note: please read the chapters concerning installation and joint technology before using KETrix® for the first time

## KE KELIT's Quality targets

1. Our quality targets are not confined to the product.  
They include all areas covered by ÖNORM EN ISO 9001: 2000
2. Suppliers and customers are integrated into the quality assurance system to ensure that mistakes are prevented.
3. Every employee is responsible for the quality of his own work and should be highly motivated to continually assess his work.
4. Customer satisfaction can only be achieved by responding to the requirements of the customer and the market.
5. A responsible attitude to the environment can be achieved by manufacturing long-life products by environment-friendly processes.



Karl Egger eh.  
Managing Director

## Approvals Registration

**TCM**

Testing on the basis of  
ÖNORM B5174  
Test report: 18886

Test for  
impact resistance  
to – 30°C  
Test no. 19149

**ofi**

**Foodstuff approval**  
to ÖNORM B5014/1  
Test no. 45.403

**Permeability to water vapour**  
to ASTM F 1249-90  
Test report no. 45.565

## Drinking water (cold)

### The problems

#### Corrosion

- The concentration of ions is increasing. The following ions are a particular risk for metal materials:  
Chlorides: stainless steel  
Sulphates: galvanised steel  
Nitrates: copper
- Even more problematic sources of water are being used for drinking water supplies
- Acid rain lowers the pH value of surface water and spring water to below 7 (=neutral). External corrosive attacks from new building materials, insulating materials and installation techniques
- Disinfectants (chlorine, ozone) are particularly aggressive on copper, releasing poisonous copper ions into the water supply.

#### Deposits

- Hard water leads to the formation of deposits on the inside walls of metal materials.

#### This results in:

- Higher friction losses
- Reduced flow rate
- Blockages
- Expensive repairs
- Time-consuming renovation
- Acute supply problems

**A secure supply of drinking water is an essential factor for a high quality of life**



Internal Corrosion - Copper



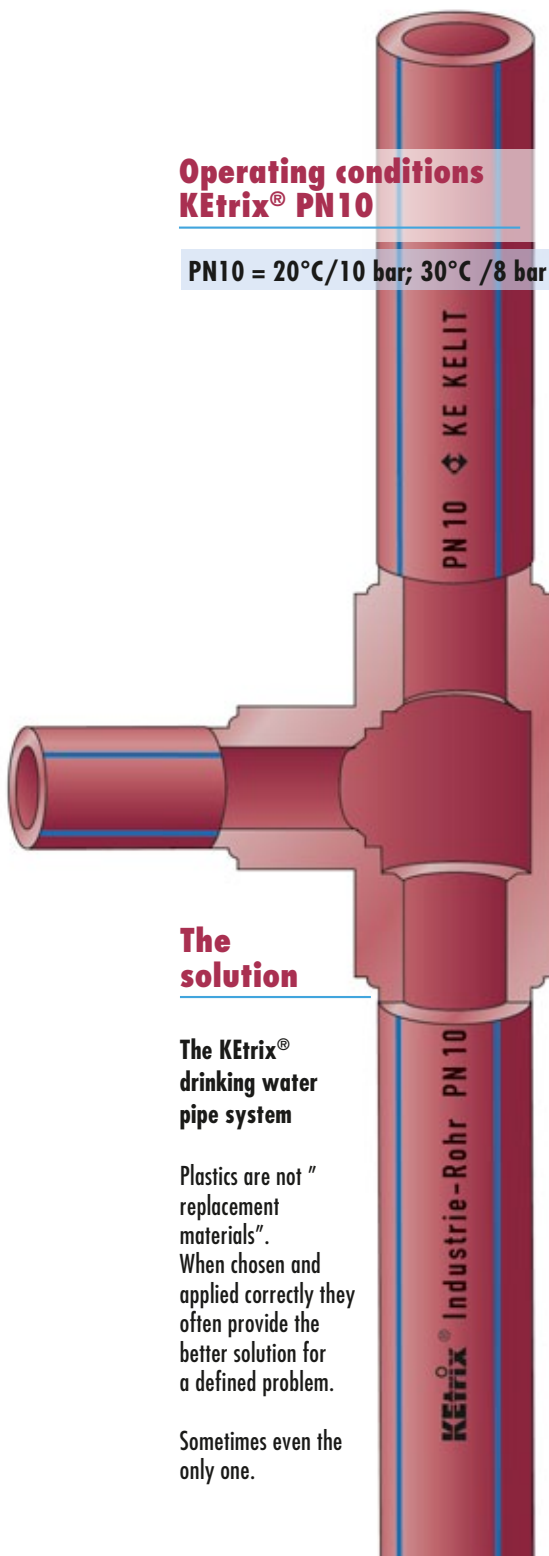
External Corrosion - Galvanised Steel



Calcite Deposits

### Operating conditions KEtrix® PN10

PN10 = 20°C/10 bar; 30°C / 8 bar



### The solution

#### The KEtrix® drinking water pipe system

Plastics are not "replacement materials". When chosen and applied correctly they often provide the better solution for a defined problem.

Sometimes even the only one.

### The result

The KEtrix® pipe system with many advantages for new building and renovation projects:

- Range of pipes and fittings for cold water applications: d20–d160
- Pressure rating PN10 d20–d160  
Resistant to both internal and external corrosion from all ions found in water and building materials
- No crystallisation points for mineral deposits
- Secure joint technology which requires no additional materials
- Suitable for contact with potable water  
Conforms to foodstuff regulations
- Low pressure losses as a result of smooth bore
- Low noise level
- Low thermal conductivity  
Comparison of  $\lambda$ -values  
KEtrix® 0,24 W/m°C  
Copper 320,00 W/m°C
- Easy to install,
- High resistance to impact
- Saves on labour costs
- No demountable embedded joints
- System can be easily drained
- Stringent testing and monitoring of quality
- Long service life
- Pre-insulated pipes can be located in the wall

For hot water systems use the KELEN® pipe system

**"No more corrosion in the third millennium"**



## Compressed air technology PN16

Compressed air is now an integral part of the manufacturing and processing industries.

There are numerous tasks and the solution is often simple. However, the quality of the piping and its long term properties play a decisive role in the safety and the costs.

**The polyfusion welding technology assures clean, leak-free, secure and homogeneous joints.**  
**Pressure rating: PN16**

## Applications

- Driving medium for tools such as drilling machines, hammer-drive screws, grinding machines, pressure cylinders ...
- Pneumatic control systems for machines
- Driving force for regulating fittings, solenoid valves, shut-off devices, valves ...
- Purification air at the workplace

## Advantages

- Range: d20 – d125  
All the necessary fittings and adaptors
- High chemical resistance to compressor oils
- No corrosion. This ensures that the quality of the compressed air is maintained
- No energy loss caused by leakage through dried seals
- The smooth surface means there are low friction losses and no narrowing of the cross-section in the fitting. As a result of this and the elasticity of the material there is a low noise transmission

## Cooling technology

### Chilled water

Pipe systems for chilled water cooling systems must be safe to use, flexible in design and quick to install.

**KETRIX® meets all these requirements:**

- The highly secure welding joint technology with a safety factor > 3
- Resistant to chemicals, aqueous solutions and water hammer, also at cold temperatures
- Resistant to corrosion, even at points where there is unwanted condensation
- Complete fitting programme which has been adapted for each application  
Range: d20–160mm
- The low weight and easy handling means that many joints can be pre-manufactured in the workshop. This saves time and costs
- KE KELIT pre-manufactures fitting components which are required in large numbers

### Refrigerants

There are only a few types of plastic which are resistant to hammer from refrigerants, resistant to corrosion and which have a favourable price to quality ratio.

**CRYOLEN® is a polypropylene alloy (POB = polyolefine blend) and has the following properties:**

- Resistant to temperatures down to –30°C
- Resistant to all concentrations of glycol brines
- Resistant to corrosion even at points which have fallen below the temperature of dew point, and at the aggressive temperature of + – 0°
- No pre-treatment or painting of the pipes is necessary
- Secure welded joint which is very quick compared to steel/copper/stainless steel
- Flange connection with EPDM O ring seal is resistant to freezing or flat flange for fittings with integrated sealing surface

### Insulation

- In most cases with cooling systems a specialist insulating contractor will install the insulation with a suitable and approved elastomer foam and will ensure that it is sealed to stop diffusion
- Straight lengths of pipes are also available with polyurethane insulation (see pages 12 and 13)

## The raw materials

### The polymer

**KEtrix® is made of CRYOLEN® Polyolefine blend (POB).**

**A polypropylene alloy with excellent properties.**

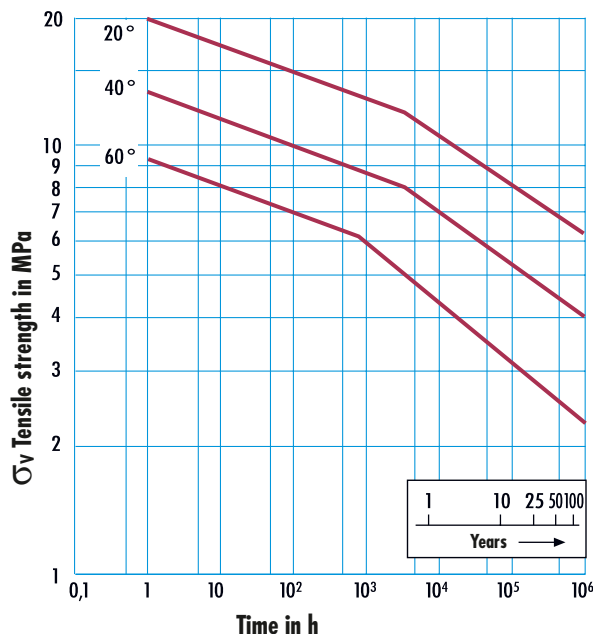
#### Remarkable properties

- Elastic despite high rigidity
- Excellent chemical resistance for defined operating conditions
- The raw materials conform to foodstuff regulations (LMG 1975)  
ÖN B5014
- Colour: burgundy red  
**KEtrix® is unmistakable**
- Colour of the stripes:  
PN10 = blue, PN16 = white

Density:	0,9 g/cm <sup>3</sup>
Melting point:	~ 140°C
Tensile strength:	40N/mm <sup>2</sup>
Elongation at tear:	800%
E-module (20°C):	1500 N/mm <sup>2</sup>
Spec. heat:	2kJ/kg°C
Heat conductivity:	0,24 W/m°C
Spec. heat expansion:	0,14 mm/m°C
Impact resistance:	- 30°C

CRYOLEN® is a heterogeneous material but for the purpose of testing is classified as a type of PP-B in accordance with ÖNORM B5174

### Long-term creep curve CRYOLEN nature



The following formula is used to calculate the tensile stress

$$\sigma_v = p \cdot \frac{(d - s)}{2s}$$

$p$  = in N/mm<sup>2</sup>  
(1 bar = 0,1 N/mm<sup>2</sup>)

The expected service life can be read off the graph

## Metal thread fittings

Special attention has been paid to the **choice and quality control** of the metal threads.

### Special quality properties:

- Dezincification resistant brass (CW 724 R) for all parts which transport water ensures a high resistance to aggressive water. They are coated with non-porous metall plating. This prevents stress crack corrosion. Both male and female threads in straight and elbow designs are available.
- MS 58 brass with pore-free plating is used for metal components not in contact with water
- The threads are designed to be resistant to torsion and are suitable for the building site.
- Threads conform to DIN 16962



## Plastic threads

Adaptor threads in sizes 1/2" and 3/4" are manufactured from modified strong CRYOLEN® material (see list of parts).

### Advantage:

Socket side: easy to weld  
Thread side: seal with PTFE tape!

## Pipe system

TRI 02 KETrix® pipe	PN10 SDR 11
d x s	Flow rate L/m
20 x 1,9 mm	0,21
25 x 2,3 mm	0,33
32 x 2,9 mm	0,54
40 x 3,7 mm	0,83
50 x 4,6 mm	1,31
63 x 5,8 mm	2,07
75 x 6,8 mm	2,96
90 x 8,2 mm	4,25
110 x 10,0 mm	6,36
125 x 11,4 mm	8,20
160 x 14,6 mm	13,44

TRI 08 KETrix® pipe	PN16 SDR 7,4
d x s	Flow rate L/m
20 x 2,8 mm	0,16
25 x 3,5 mm	0,25
32 x 4,4 mm	0,42
40 x 5,5 mm	0,66
50 x 6,9 mm	1,03
63 x 8,6 mm	1,65
75 x 10,3 mm	2,32
90 x 12,3 mm	3,36
110 x 15,1 mm	5,00
125 x 17,1 mm	6,48

TRI 01 KETrix® ALU composite pipe Oxygen barrier	PN16
d x s	Flow rate L/m
20 x 2,3 mm	0,19
25 x 2,8 mm	0,30
32 x 3,6 mm	0,48
40 x 4,5 mm	0,75
50 x 5,6 mm	1,18
63 x 7,1 mm	1,87
75 x 8,4 mm	2,66
90 x 10,1 mm	3,83

**Dimensions:** as specified by  
**ÖNORM EN ISO 15874-2**

**Colour:** Burgundy red. 3 co-extruded blue lines (90° apart) help the plumber to align pipe and fitting

**Standard length:** 4 m

Other lengths can be produced on request subject to minimum quantities

**Resistance to impact:** -30°C

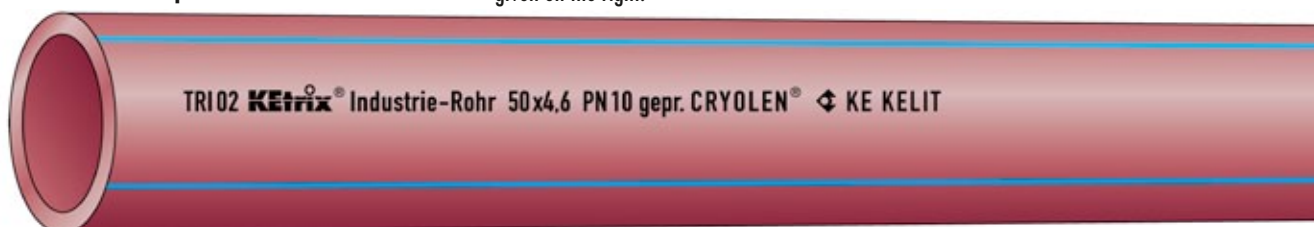
**Operating conditions as specified by ÖNORM:**

**PN10:** 20°C/10 bar  
**From** -30°C to +30°C/8 bar

**Safety factor:** Taking into account the properties of the raw material ÖNORM B5174 includes a safety factor of (SF=1,25) in the operating conditions given on the right.

**Operating pressure in relation to service life and temperature**

Temperature (°C)	Pressure (bar)	Service life (years)
10	13,4	50
20	10,9	50
30	8,7	50



**Dimensions:** as specified by  
**ÖNORM EN ISO 15874-2**

**Colour:** Burgundy red. 3 co-extruded blue lines (90° apart) help the plumber to align pipe and fitting

**Standard length:** 4 m

Other lengths can be produced on request subject to minimum quantities

**Resistance to impact:** -30°C

**Operating conditions as specified by ÖNORM:**

**PN16:** 20°C/16 bar  
**From** -30°C to +40°C/10 bar

**Safety factor:** Taking into account the properties of the raw material ÖNORM B5174 includes a safety factor of (SF=1,25) in the operating conditions given on the right.

Temperature (°C)	Pressure (bar)	Service life (years)
10	21,2	50
20	17,2	50
30	13,8	50
40	10,9	50



**Colour:** medium pipe and protective layer are burgundy red.

**Standard length:** 4 m

A layer of aluminium is bonded to the medium pipe by a coupling agent. This bonding reduces the expansion considerably.

**Operating conditions as specified by ÖNORM:**

**PN16:** 20°C/16 bar  
**From** -30°C to +40°C/10 bar

**Safety factor:** As a result of the aluminium layer a PN 12,5 medium pipe can withstand the same operating conditions as a standard PN16 pipe.

Temperature (°C)	Pressure (bar)	Service life (Jahre)
10	21,2	50
20	17,2	50
30	13,8	50
40	10,9	50



## KEtrix®-CX: The modern solution for the problem of expansion

### Common applications:

Pipes in the cellar, garages, risers, industrial pipes in buildings

### Function:

The KEtrix® raw material has a very low elasticity module compared to steel. This means that the expansion can be restrained to "zero" using very little force and at the same time provide excellent insulation against heat loss or heat gain.

### Fittings:

Pre-insulated elbows and tees are available on request.

In general only non-insulated fittings are used which are then insulated at a later point by specialist companies.

## Advantages

- Practically no linear expansion of exposed KEtrix®CX pipes
- Pipes can be clamped without the need to remove insulation
- High mechanical strength protects against damage
- Excellent heat insulation provided by evenly distributed PUR foam

## Design

### Protective jacket:

Spiral pipe made of galvanised steel (0,6mm). The fold is on the inside, so the outside surface is smooth OD 80 – 250 mm

### Insulation:

Polyurethane hard foam, closed cell, CFC-free, compression-proof  
Insulation thickness meets or exceeds the requirements of. ÖNORM M 7580

### Medium pipe:

The surface of the pipe is pre-treated to enable bonding  
d20 – d90 ALU composite pipe PN16  
d20 – d160 KEtrix® pipe PN10  
d20 – d125 KEtrix® pipe PN16  
Length of pipe: 6 m

### Important:

Any remains of PUR foam on pipes which have been cut to size must be completely removed mechanically before the fusion welding can be done!

## KEtrix®PE: The pre-insulated pipe for below ground installations

### Common application:

Underground cooling pipelines

## Design

### Protective jacket:

Smooth, black HDPE pipe  
OD 90 – 250 mm

### Insulation:

PUR foam, CFC-free  
l-value: 0,030 W/ m°C

### Medium pipe:

d20 – d90 ALU composite pipe PN16  
d20 – d160 KEtrix® pipe PN10  
d20 – d125 KEtrix® pipe PN16  
Length of pipe: 6 m

## KEtrix®-PE-Fittings

### KEtrix®PE fittings

KEtrix® Elbow  
d20 – d160, 90° and 45°

### KEtrix® Tees

d20 – d160  
equal tee and reducer tees  
are in our product range  
(not in stock)

The K2S socket ensures a water-proof joint. Each individual socket contains detailed installation instructions. Please follow these instructions.

## The thermal dynamics of PUR insulated pipes

### Heat loss: QR (W/m)

There will always be a transfer of heat between two warm media (either heat gain or heat loss)

The formula below is used to make the calculation

$$Q_R = \frac{\pi (t_1 - t_2)}{\left( \frac{1}{C_{K_1} \cdot d_{i_{med}}} \right) + \left( \frac{\ln \left( \frac{d_{a_{med}}}{d_{i_{med}}} \right)}{2\lambda_{med}} \right) + \left( \frac{\ln \left( \frac{d_{i_{ext}}}{d_{a_{med}}} \right)}{2\lambda_{pur}} \right) + \left( \frac{\ln \left( \frac{d_{a_{ext}}}{d_{i_{ext}}} \right)}{2\lambda_{ext}} \right) + \left( \frac{1}{C_{K_2} \cdot d_{a_{ext}}} \right)}$$

### QR for KEtrix®CX

#### Exposed pipes in buildings

Heat loss at an ambient temp. t2=20°C

Medium pipe Spiral jacket		t1	t1	t1
mm	mm	-20°C	0°C	30°C
d 20	80	4,6	2,3	1,1
d 25	80	5,4	2,7	1,3
d 32	80	6,7	3,3	1,7
d 40	80	8,6	4,3	2,2
d 50	100	8,8	4,4	2,2
d 63	125	9,0	4,5	2,3
d 75	160	8,3	4,2	2,1
d 90	180	9,1	4,5	2,3
d 110	200	10,4	5,2	2,6
d 125	225	10,7	5,3	2,7
d 160	250	13,8	6,9	3,5

### QR for KEtrix®PE

Takes into account reduction of losses as a result of installation 0,7m under the ground

Heat loss when the earth temperature t2=8°C

Medium pipe Spiral jacket		t1	t1	t1
mm	mm	-20°C	0°C	30°C
d 20	90	3,1	0,9	2,4
d 25	90	3,6	1,0	2,8
d 32	90	4,4	1,3	3,5
d 40	110	4,5	1,3	3,5
d 50	110	5,7	1,6	4,5
d 63	125	6,5	1,9	5,1
d 75	160	5,9	1,7	4,6
d 90	200	5,6	1,6	4,4
d 110	225	6,2	1,8	4,9
d 125	225	7,4	2,1	5,8
d 160	250	9,5	2,7	7,5



## The six ways of joining the pipes

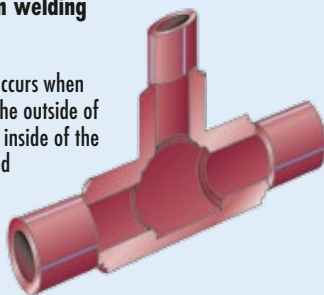
A wide range of safe and secure fittings for joining the pipes is essential for a pipe system.

**KE KELIT** has a comprehensive range of fittings for each method of joining

### 1. Polyfusion welding

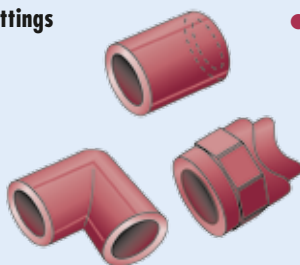
#### Principle:

Fusion welding occurs when a large area of the outside of the pipe and the inside of the socket are welded together.



A wide range of fittings is available

Sizes: d20 – d125



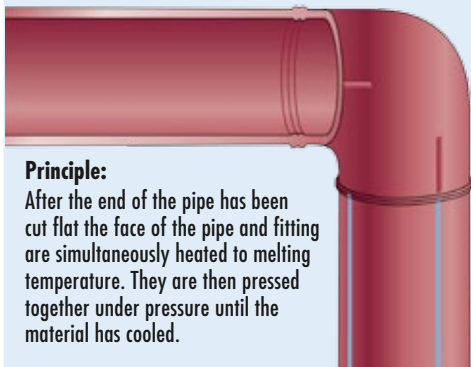
#### Advantages:

- Pipe and fitting are made of the same material. No additional materials are required.
- Welded joints are not a weak point in the system
- Pipe can only enter the fitting after they have been heated on the welding machine (important safety feature)
- The weld does not cause a reduction in the flow at the joint

### 2. Butt welding

#### Principle:

After the end of the pipe has been cut flat the face of the pipe and fitting are simultaneously heated to melting temperature. They are then pressed together under pressure until the material has cooled.



#### Advantages:

- Pipe and fitting are made of the same material. No additional materials are required.
- Welded joints are not a weak point in the system
- The weld does not cause a reduction in the flow at the joint

Size: d160

All KEtrix® fittings d20–d125 meet the requirements of pressure rating PN20 and can be used with both PN10 and PN16 pipes.

### 3. Threaded adaptor fittings

Sizes: d20 x ½" – d75 x 2 ½"

The threads conform to DIN 16962 and are made of dezincification resistant brass (CW 724 R). They are metal-plated to protect against stress corrosion cracking. Male and female threads are available as both straight and elbow fittings.



#### Advantages:

- Wide range of fittings
- Female thread is a straight thread
- Male thread is tapered and roughened
- Thread is firmly anchored in the fitting. High resistance to twisting strain

### 4. Flange connection

Sizes: d40 – d160

The solution for flanged fittings. Backing ring conforms to pipe sizes d20 – d125: fusion welding d160: butt welding



#### Advantages:

- Can be detached at any time
- Plastic EPDM seal
- Dimensions conform to DIN 2501-PN16

### 5. Detachable union fittings

Sizes:

d20 x ½" – d90 x 3"

3 types:

#### Advantages:

- Detachable fittings
- Plastic EPDM fittings
- TRI57 fitting for connecting to appliances



TRI55-POB



TRI56-POB



TRI57-POB

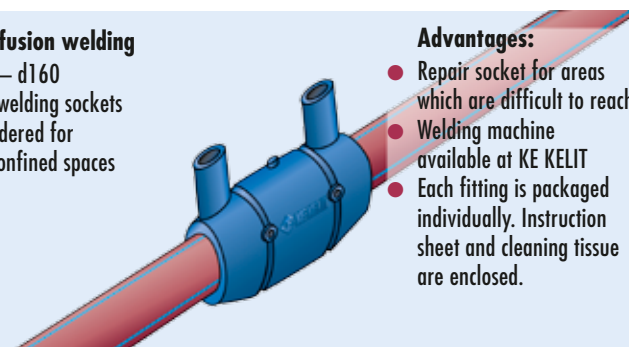
### 6. Electrofusion welding

Sizes: d20 – d160

KELIT E-uni-welding sockets can be considered for welding in confined spaces

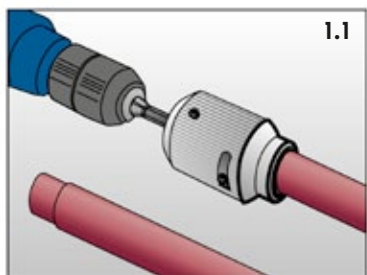
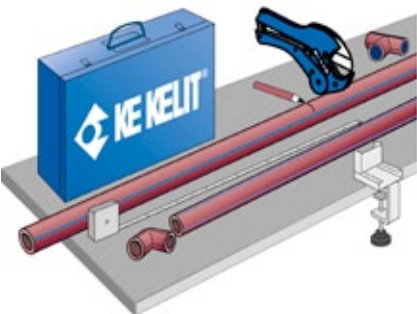
#### Advantages:

- Repair socket for areas which are difficult to reach
- Welding machine available at KE KELIT
- Each fitting is packaged individually. Instruction sheet and cleaning tissue are enclosed.

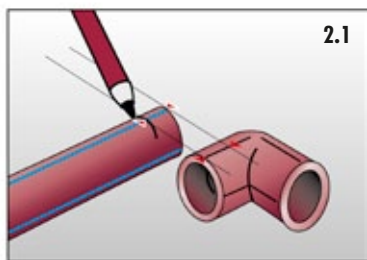




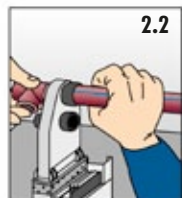
## KEtrix® polyfusion welding with the hand welding machine



1.1



2.1



2.2



2.4

1. The pipes and fittings are joined by polyfusion welding at 260°C. The welding machines and tools are self-regulating. Just connect to the electricity supply (230V) and wait:  
The **red** light indicates that the machine is connected to the electricity supply. When the **green** light goes out the welding temperature has been reached. Work can begin.

**Measure the length of the pipe required** (including the length of pipe required to weld into the sockets).

**1.1** Before welding the **ALU composite pipe** sufficient aluminium must be removed by the peeler to allow the pipe to be welded to the full depth of the socket.

**Important:** There should be no aluminium in the welding area. Make a visual check before welding!

The pipe can then be welded to the fittings in the same way as the standard **KEtrix®** pipe.

### The welding procedure

2. Ensure that the surface of the pipes are clean and free of grease.

**2.1** Measure the depth of the socket and mark the insertion depth accordingly.

**2.2** The heating time (see table) begins when the full insertion depth of the pipe and the whole of the socket in the fitting have been pushed on to the welding tools.

**2.3** The heating time varies according to the pipe size (see table). Once the heating time has elapsed push the pipe and fitting together smoothly and evenly without delay. The result is a homogenous and strong joint.

**2.4** Three lines on the pipe (90° apart) act as a guide for making a straight joint.

**2.5** The position of the fitting can be adjusted for a few seconds (see table) immediately after the pipe and fitting have been joined. A short time later (see table) the joint is capable of withstanding operating conditions.

3. The low weight and high flexibility of the material makes it possible to weld whole sections of the piping at the work bench. Take advantage of this and save a lot of time.

4. The pipes should be insulated according to the relevant national standards.

Pipe OD mm	Heating time sec	Adjustment sec	Cooling time min
20	5	4	2
25	7		
32	8		
40	12	6	4
50	18		
63	24		
75	30	8	6
90	40		
110	50	10	8
125	60		

## Welding KEtrix® saddle fittings

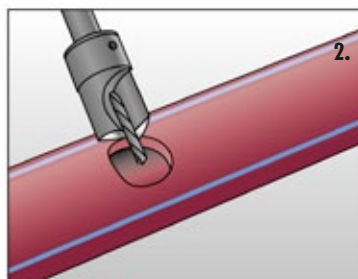
1. The surface of the pipes and saddle fittings should be free of grease, clean and dry.

2. A hole is drilled in the pipe using a 24 mm saddle drill.

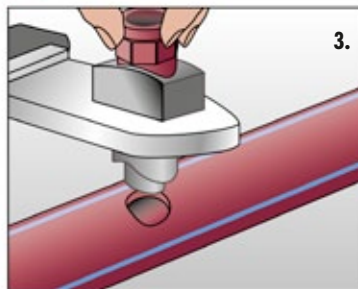
3. If the saddle fitting is being connected to an ALU composite pipe use the peeling tool to remove the aluminium layer.

**3.1** A wide range of fittings are available in different sizes.

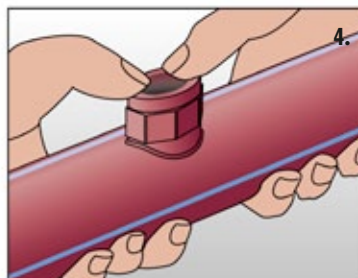
4. Once the heating time is over the saddle fitting is immediately pushed into the pipe wall (do not twist!) and pressed for approx. 30 sec. The melting of both the pipe wall and the pipe surface ensures a strong homogenous joint. After approx. 10 minutes the joint can be subjected to operating conditions.



2.



3.



4.

## Table welding machine

1. Screw the required heating elements to the welding plate. The length of the heating plate varies according to the size of the pipe and the section of pipe to be welded.

2. One side of the fitting clamps can be used for small pipe sizes (d20–d40). For larger sizes (d50–d90) the clamps should be turned around.

3. The same principle applies for the pipe clamps.

See pages 14 and 15 for welding times and instructions on preparing pipes and fittings for welding.

4. Set the pipe diameter switch to the required size. This switch regulates the length of the pipe that will be welded into the socket.

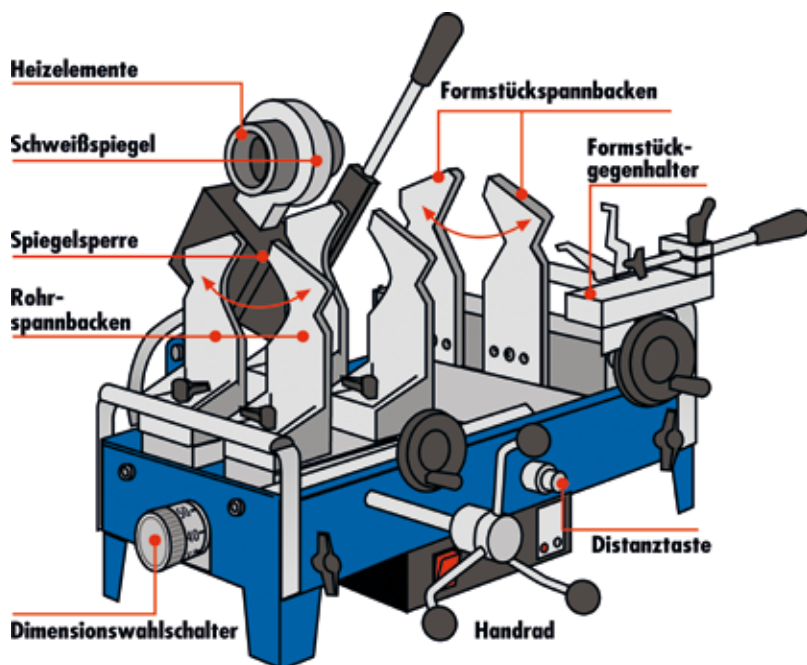
### 5. Spacing button

Press the button to fix the distance between the two sliding blocks which will enable the appropriate section of pipe and the complete socket of the fitting to be heated on the welding elements.

**Note: The machine is available in two sizes:**

Type 1: d20–d90 mm

Type 2: d25–d125 mm



## The welding procedure:

1. Fix the fitting in the clamp and the fitting holder. **Ensure that the face of the fitting is flat against the clamp.**

1.1 Put the pipe in the pipe clamp.

**Do not tighten the clamp.**

1.2 Hold down the spacing button and move the sliding blocks together using the hand wheel until the pipe is touching the fitting or the sliding blocks can no longer move.

1.3 Release the spacing button.

**Only now fix the pipe in the clamp.**

2. Move the sliding blocks apart and pull down the welding plate.

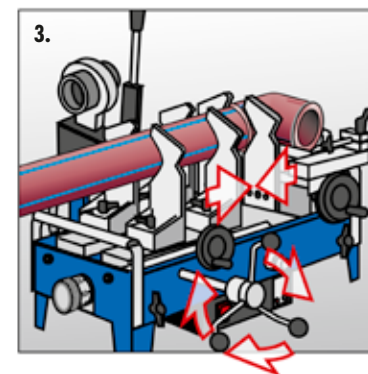
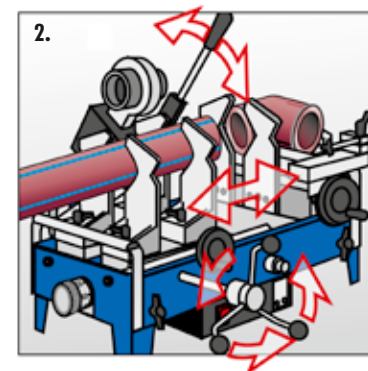
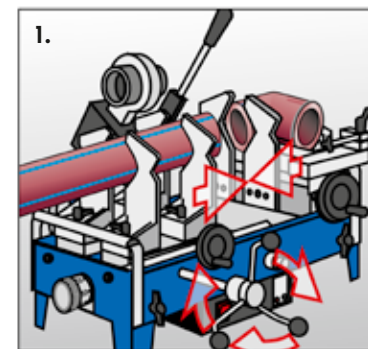
2.1 Move the sliding blocks together until they are stopped by the lock.

2.2 When the heating time has elapsed move the sliding blocks apart briskly and **remove the welding plate.**

3. Push the **sliding blocks** together briskly until the pipe diameter switch catches.

3.1 Never cool the welded joint abruptly. After a while loosen the clamp and the finished joint can be removed from the machine.

3.2 Once the cooling time has elapsed the joint can be subjected to operating conditions.



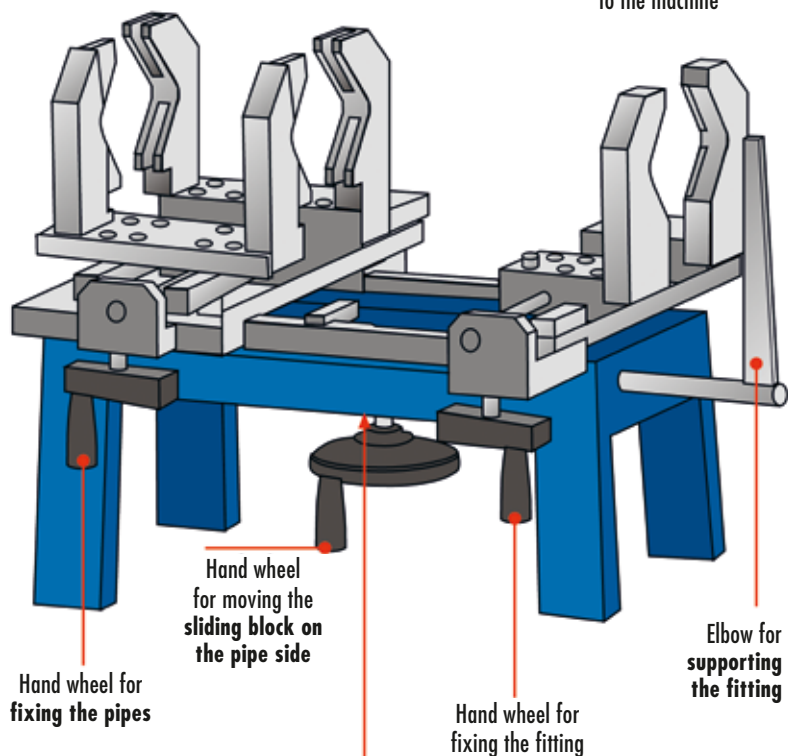
Pipe OD mm	Heating time sec	Adjustment time sec	Cooling time min
20	5	4	2
25	7		
32	8	6	4
40	12		
50	18		
63	24	8	6
75	30		
90	40		
110	50	10	8
125	60		

## Overhead welding machine

It is recommended to use the overhead welding machine for exposed piping in confined areas (d50 – d110)

Adjustable pipe clamps (d50 – d110) are mounted on sliding blocks

Adjustable fitting clamps (d50 – d110) are fixed to the machine



1. Fix the pipe clamps to a pipe that has already been installed. The machine will hang at the end of the pipe.

1.1 To provide extra support the pipe should be clamped close to a pipe bracket

1.2 A pole can be placed under the centre of gravity to support the machine if necessary.

1.3 The pipe should protrude far enough out of the pipe clamp to ensure that the pipe can be fully welded into the socket of the fitting but also allow enough space for the welding plate.

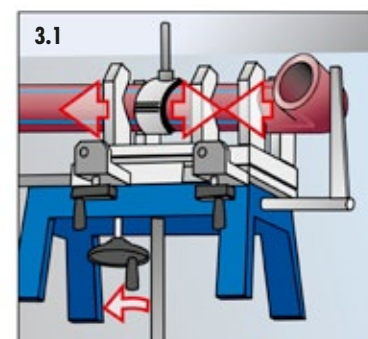
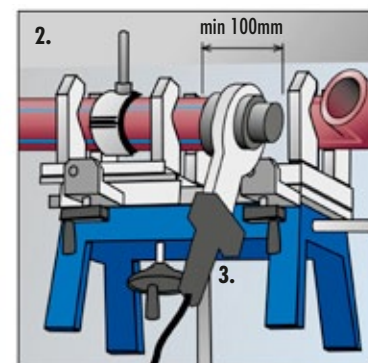
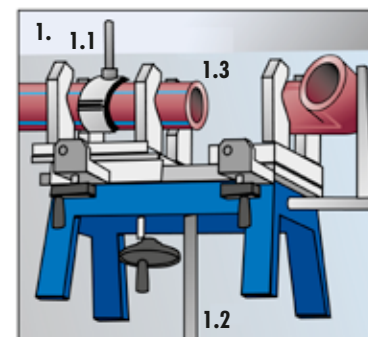
The space between the pipe and the fitting when the sliding block has been completely rolled back should be approx. 100 to 150 mm.

2. Put the fitting in the clamp and support the fitting with the fixing elbow. The fitting must have sufficient room to move sideways so that the whole of the socket can be welded.

3. Put the welding plate between the pipe and fitting. Turn the hand wheel to move the pipe and fitting. Heat the pipe and fitting.

3.1 When the heating time is over remove the welding plate and push the pipe and fitting together briskly to weld the joint.

3.2 When the cooling time is over the joint can be subjected to operating conditions.



Pipe OD mm	Heating time sec	Adjusting time sec	Cooling time min
50	18	6	4
63	24		
75	30	8	6
90	40		
110	50	10	8



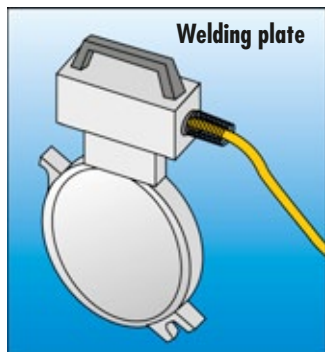
## Butt welding machine for KEtrix® pipes

The table below is valid for the KELIT butt welding machine WZ115.

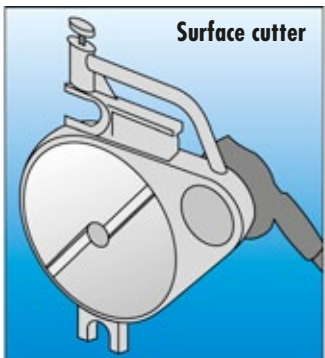
If you use other welding machines then follow the operating instructions for that machine.

Pipe	SDR-series	Joining pressure	Height of bead	Heating pressure	Heating time	Max. change over	Time to build up	Welding pressure	Cooling time
dxs		bar	mm	bar	sec	sec	sec	bar	min
160 x 14,6	11	27	1,0	3	277	8	13	27	24

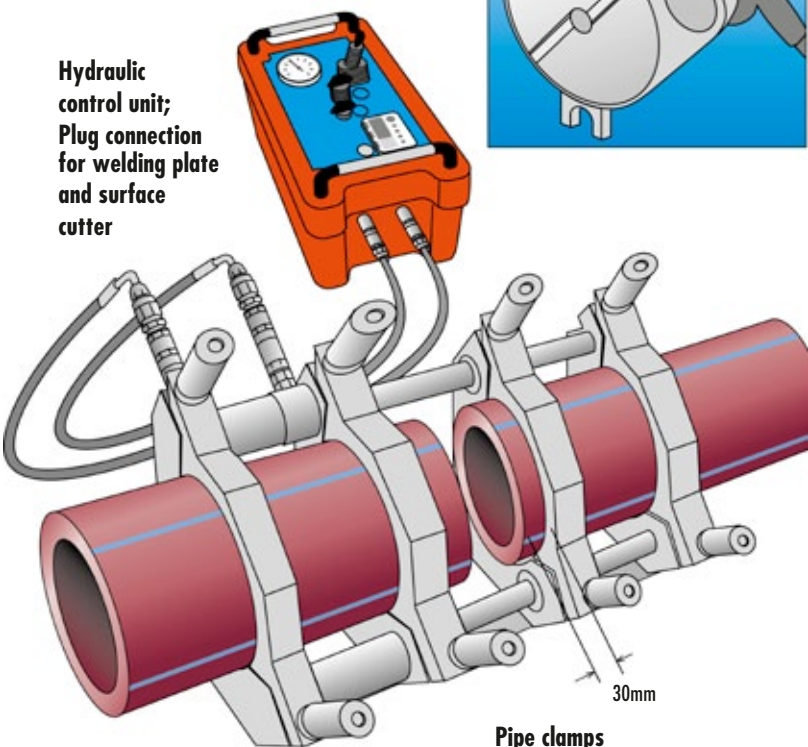
Hydraulic control unit;  
Plug connection  
for welding plate  
and surface  
cutter



Welding plate



Surface cutter



Pipe clamps

1. Loosen the screws and fit the required reducers in the clamps.

1.1 The end of the pipes should protrude from the clamps by no more than 30 mm.

2. Put the surface cutter between the pipe ends. Move the pipes together and remove the oxide layer on the welding surface by cutting away 0,2 mm of the surface. Ensure that the ends of the pipes are vertically parallel to each other (maximum deviation: 0,3 mm). The maximum deviation horizontally is 0,5 mm.

3. The welding procedure (see table on the left for welding criteria)

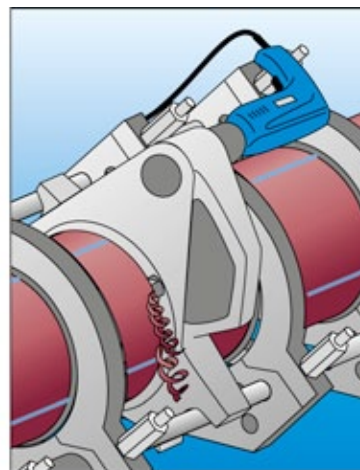
3.1 Before welding begins read off the manometer the **pressure** required to bring the pipes together. This pressure must be **added** to the joining pressure given in the table.

3.2 Insert the heating element (temp: approx. 210°C). Press the pipe ends on the heating element and **apply the pressure** as defined in 3,1 until a **bead** forms around the complete circumference of the pipe. During the **heating time** the pressure must be reduced to the **heating pressure**. Once the heating time is over move the sliding blocks apart rapidly and remove the heating element.

3.3 The **change over time** (time between removing the heating element and welding the pipes) should be as short as possible.

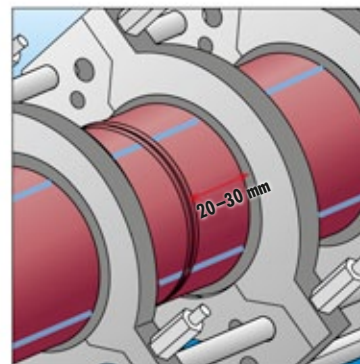
3.4 The **welding pressure** should be built up as smoothly as possible during the time given in the table (minimum: 0,15 N/mm²).

3.5 The welding pressure must be maintained during the **cooling time**.



### IMPORTANT:

The pipes cannot be touched and must be welded immediately. If this is impossible and the welding has to be done later then the welding surface has to be cleaned and any grease removed.



**Never** cool the joint abruptly. If the weld has been done correctly a double bead should be visible around the whole circumference of the pipe.



## KELIT® E-Uni welding socket

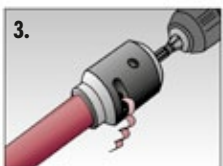
Subject to the regulations DVS 2207-11



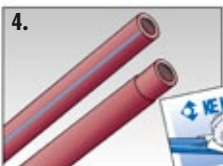
1. Cut the KELEN® pipe at right angles.



2. Scrape the surface of the KELEN® pipe with a suitable tool, e.g. a blade (DO NOT use sandpaper). A thin layer must be removed from the pipe. At the same time the diameter should not be reduced below its nominal value.



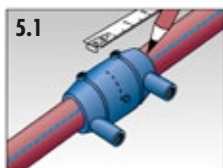
3. Alu peelers are available for removing the aluminium layer from the Alu pipes (please note that more aluminium has to be removed for an electrofusion socket than for a standard socket).



4. Remove any grease from the end of the pipes and the electrofusion sockets where the weld is going to be made. This should be done with the cleaning tissue (soaked in isopropyl alcohol) which is enclosed with the E-socket. No oil-based solvents (e.g. paint thinner) should be used to clean the socket.



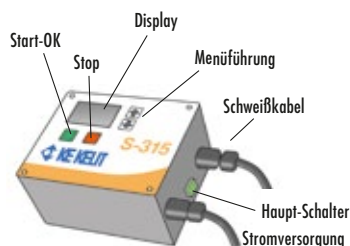
5. By cutting out the buffer in the middle of the socket the e-socket can be pushed completely over the pipe.



5.1 In order to guarantee the central position of the weld, mark the welding depth of the socket on the pipe. For pipes which are being installed horizontally try to ensure that the tracers point upwards.

**Check the electricity supply before using the electrofusion welding machine for the first time.**

Turn on the main switch to **position "1"** Press the arrow key to choose the language and press **"OK"**. Use the arrow and OK keys to set the time and date and confirm by pressing **"OK"**. This information only needs to be entered when the machine is being used for the first time



6.1 Check that the electricity supply is 230V +/- 10% and 50/60 Hz. Switch the main switch to **position "1"**

6.2 Take the **orange** adapter cable for **d20–110mm sockets** and connect the socket to the welding cable, adapter cable and welding machine

6.3 Using the arrow key confirm the correct socket type **"KE KELIT"** by pressing **"OK"**

6.4 Using the arrow key select the required diameter size and confirm by pressing **"OK"** **The display will show that the correct size has been selected**

6.5 Press **"OK"** to start the welding procedure. The welding machine automatically calculates the welding time. The voltage, welding time and ambient temperature will appear on the display.

6.6 There is a sound to indicate when the welding time is over. Then press **"STOP"** to end the welding. Check whether the tracers are protruding from the socket.

7. Ensure that the electrofusion socket is axial to the pipe and is not subjected to stress or strain during welding.

7.1 If necessary use the E-UNI socket holder (WZ146)

8. Ensure that no moisture is present inside or outside of the weld zone during welding. The ambient temperature should be between  $-10^{\circ}\text{C}$  and  $+45^{\circ}\text{C}$


9. Ensure that the weld is not subject to stress, impact, moisture or any other strain during the cooling period (allow at least 10 minutes for cooling)


10. Wait for at least one hour before pressure testing or subjecting to operating conditions.

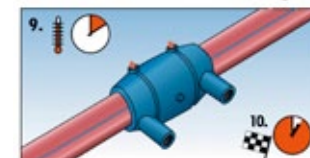
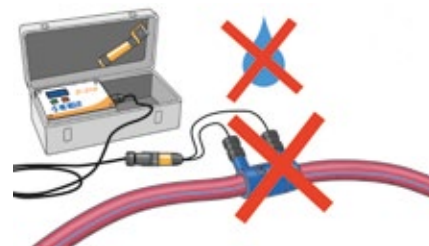
11. The warning codes are as follows:

- ⚠ 05: Electricity supply not OK
- ⚠ 10: Frequency (50/60 Hz) not OK
- ⚠ 20: Ambient temperature outside the permitted range ( $-10$  to  $+45^{\circ}\text{C}$ )
- ⚠ 30: Welding voltage outside the permitted range
- ⚠ 35: Machine overheated
- ⚠ 45: Maximum welding voltage exceeded new electrofusion socket required
- ⚠ 50: Minimum welding current not attained new electrofusion socket is required
- ⚠ 55: Welding cycle interrupted by operator new electrofusion socket required
- ⚠ 60: Short circuit – new electrofusion socket required
- ⚠ 65: Interruption of electricity supply new electrofusion socket required.
- ⚠ 70–75: Hardware defect

Should one of these codes appear during welding follow the instructions in the manual.

If the  symbol appears it is recommended to get the machine checked by the manufacturer or an authorised service centre.

Press **"STOP"** if you temporarily wish to remove the symbol. The  symbol will reappear the next time the machine is switched on.



## Pipe sizing for glycol brine solutions

The KEtrix® pipe system is resistant to water/glycol fluids. Standard products contain inhibited **ethylene glycol** or **propylene glycol** (for foodstuff).

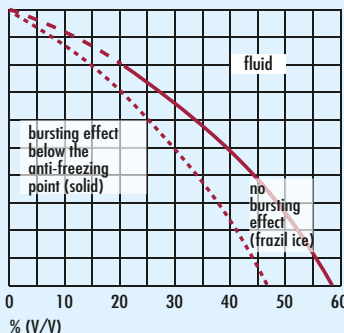
The following charts can be used for sizing the pipes.

■ Ethylen glykol-water fluids  
■ Propylen glykol-water fluids

### Anti-freezing

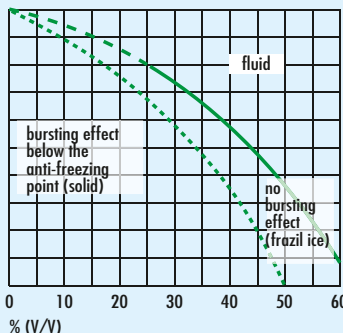
of **ethylene glycol** -water fluids

(crystallisation point according to DIN 51 782)



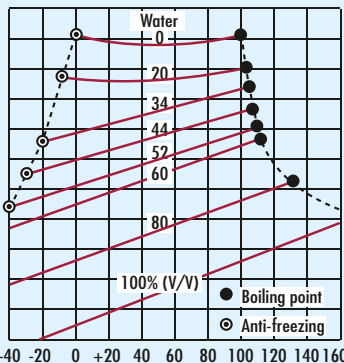
of **propylene glycol** -water fluids

(crystallisation point according to DIN 51 782)

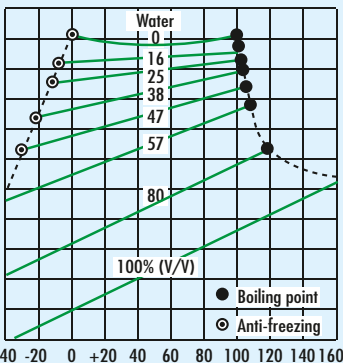


### Specific heat

**Ethylene glycol**-water fluids



**Propylene glycol**-water fluids

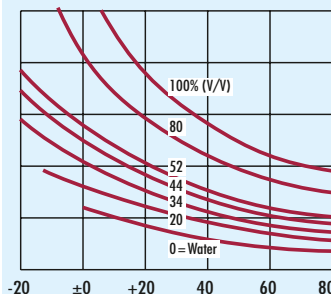


The viscosity of glycol water fluids is much higher than water. The pressure losses must be adjusted by the factors in the following charts and as a result the required pipe sizes are larger. (see pages 32 and 33).

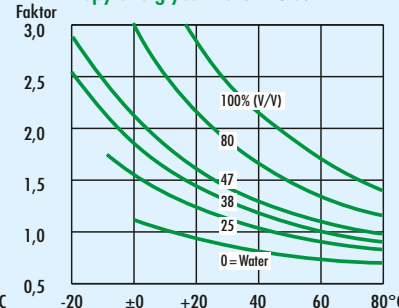
For other cooling brine solutions (e.g. potassium formate or acetate with corrosion inhibitors) the data will vary according to the product. Please follow the instructions given by the manufacturer.

**Relative pressure loss in comparison to water (+10°C) when there is turbulent flow**

**Ethylene glycol**-water fluids



**Propylene glycol**-water fluids



## Pressure loss in KEtrix® drinking water pipes

The total pressure loss ( $\Delta p$ ) of the KEtrix® pipe system is calculated by multiplying the friction loss ( $R$ ) by the length of the piping ( $l$ ) plus the sum ( $\sum$ ) of the friction loss for the individual fittings ( $Z$ ).

**Total pressure loss  $\Delta p$**

$$\Delta p = (l \cdot R + \sum Z) \text{ in Pa}$$

**The choice of pipe size for the water supply is dependent on the following factors:**

- The available water pressure
- Geodetic difference in height
- Pressure losses through system components
- Minimum flow pressure through faucets
- Pressure losses in the pipes
- The individual pressure losses of the fittings
- Type, number and simultaneous use of the draw-off points
- Flow velocity

**Calculation of the pressure loss ( $Z$ ) for the standard fittings:**

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

Fitting	Symbol	Coefficient $\zeta$
Elbow 90°		1,3
Elbow 45°		0,4
Tee-flow		0,3
Tee-flow separation		1,3
Tee-reverse flow		1,5
Reducer		0,4
stop valve		
d20		10,0
d25		8,5
d32		8,5
Slanted seat valve		
d20		3,5
d25		2,5
d32-63		2,0

## Guidelines for drinking water pipe sizing DIN 1988-300

### The partner system

For hot water systems use the KELEN® pipe system in either PN16 or PN20 pressure rating, made of grey PP-R material.

#### 1. Determining the calculated flow rate and minimum flow pressures of the outlet fittings

The calculated flow rate  $\dot{V}_R$  is an adopted outlet fitting flow value in the calculation rate. The guidance values of the calculated flow rates of common fixtures are included in the table.

The calculated flow rate  $\dot{V}_R$  (as an average value) is obtained from the following equation:

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

#### 2. Determining total flows and allocating them to the sections

The calculated flow rates are to be added contrary to the flow direction – always at the farthest sampling point and ending at the supply line – the total flow rates achieved in this way are then to be allocated to the corresponding sections. The part route in question begins with the mold piece on which the cumulative flow or the diameter changes.

**The total flow rates (cold and hot water) are to be added to the cold water line branch point which heads to the drinking water heater.**

#### 3. Application of the conversion curve from the total flow to the peak flow

During calculation of the line systems, it is absolutely necessary that all sampling points be applied with their calculated flow rates.

An exception to this is when a second sink, a bathtub with a shower unit, a bidet, a urinal or nozzles in toilet facilities vestibules are included in a usage unit (NE). These are not taken into account in the total flow.

#### 4. Simultaneity depending on building type

The calculation of the peak flow depends on the total flow; the simultaneity of the water outlet depends on how the building is used (e.g. flats, hotels etc.).

Generally it is not expected that all connected outlets will ever be fully open at once.

On Pages 40 and 41 you will find the conversion curves for the various building types.

#### 5. Select pipe diameter

Pipe diameters and pipe friction pressure gradients and all corresponding calculated flow rates must be determined. (Pressure loss diagrams: Page 37 to 39).

#### 6. Pressure loss compared with available pressure

The total pressure loss for the determined pipe diameter should reach the existing pressure difference, but not exceed it.

#### 7. Minimum flow pressures and calculated flow rates (VR: l/s) of common drinking water extraction points

Min. flow-pressure bar	Drinking water extraction type	Dimension	$\dot{V}_R$ : l/s
0,5 0,5 0,5 1,0 1,0	<b>Outlet valves</b> Without aerator <sup>a</sup>	DN 15	0,30
		DN 20	0,50
		DN 25	1,00
	With aerator	DN 10	0,15
		DN 15	0,15
1,0 1,0 1,0 1,0 1,0	<b>Mixing valves b,c for</b> Shower tubs Bathtubs Kitchen sinks Washbasins Bidets	DN 15	0,15
		DN 15	0,15
		DN 15	0,07
		DN 15	0,07
		DN 15	0,07
0,5 0,5	<b>Household machines</b> Dishwasher Washing machine	DN 15	0,07
		DN 15	0,15
1,0 1,2 0,5	<b>WC basins and urinals</b> Urinal flush valve manual or automatic Flush valve for WC Cistern according to EN 14124	DN 15	0,30
		DN 20	1,00
		DN 15	0,13

a) Without connected appliances (e.g. sprinklers)

b) The indicated calculation flow is to be included in the cold and warm water calculations

c) Angle valves for e.g. basin taps and shower hose connections are to be regarded as individual resistors or recognised with the outlet fitting minimum flow pressure.

#### Important note:

The valves manufacturers must specify the minimum flow pressure and the fittings flow rates calculations (VR). The manufacturer's information absolutely must be considered when measuring the pipe diameter – if it lies above the values listed in the table, then the drinking water installation must be sized according to the manufacturer's instructions.

#### Notes:

Equal-type outlets and devices not included in the table with flow rates or minimum flow pressures that are greater than those listed must also be taken into account according to the manufacturer's instructions.

#### 8. Maximum flow velocity according to DIN 1988-300

Type of pipe run	Maximum design flow velocity for a given pipe run	
	≤ 15 min m/s	>15 min m/s
Service pipes	2	2
Supply mains: Pipe runs with low head loss in-line valves ( $\zeta < 2.5$ )	5	2
In-line valves with greater loss factor	2,5	2

## Excerpt from DIN 1988-300

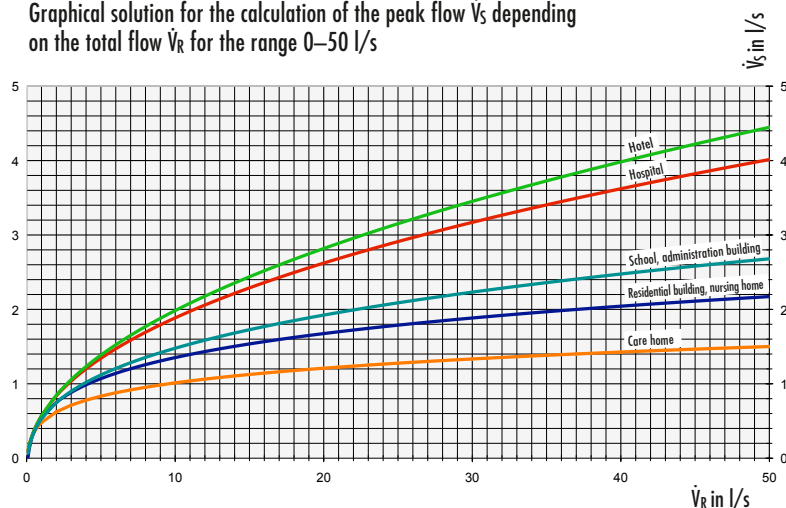
For the building types indicated in the table, the peak flow ( $\dot{V}_S$ ) is calculated with the following scope:

Depending on the building type, the peak flow ( $\dot{V}_S$ ) is calculated with the constants included in the table on Page 33 as follows:

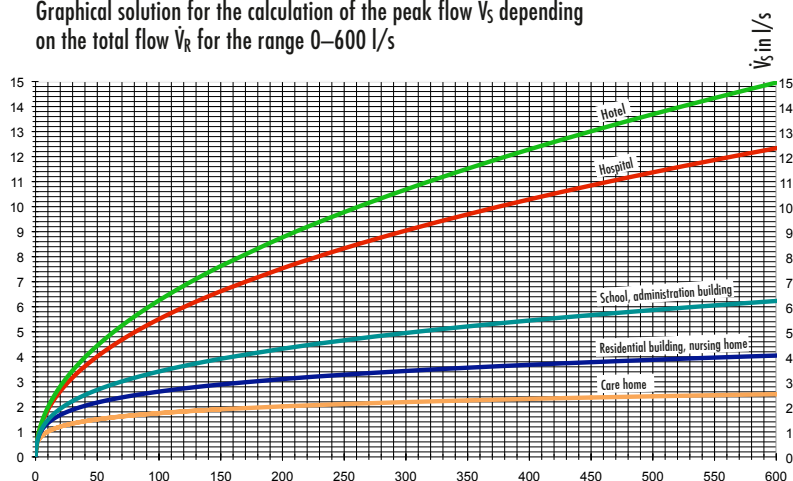
$$\Sigma \dot{V}_R: 0,2 \text{ bis } \leq 500 \text{ l/s}$$

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

Graphical solution for the calculation of the peak flow  $\dot{V}_S$  depending on the total flow  $\dot{V}_R$  for the range 0–50 l/s



Graphical solution for the calculation of the peak flow  $\dot{V}_S$  depending on the total flow  $\dot{V}_R$  for the range 0–600 l/s



## Peak flow constants (a, b, c) for each building type

Building type	Constants		
	a	b	c
Residential building	1,48	0,19	0,94
Assisted living facility, nursing home	1,48	0,19	0,94
Bed house in hospital	0,75	0,44	0,18
Hotel	0,70	0,48	0,13
School and administration building	0,91	0,31	0,38
Care home	1,40	0,14	0,92

## Exceptions with calculation of the peak flow $\dot{V}_S$

### Usage units (NE)

A room with outlets in residential buildings (e.g. bath, kitchen, utility room) or in non-residential buildings (in the event that the recognised use is similar to that of a flat).

Experience has shown that the flows of the flow direction up to the end of the strand cable and in the floor distribution of NE's are too high; this is because, normally, no more than two outlets are open at the same time e.g. in a bath.

Therefore, the peak flow in each leg of a NE is, at maximum, equal to the total flow of the two biggest outlets installed in the leg (also applies in cases within an NE where the calculation indicates a smaller flow).

If a second NE is attached to a leg (e.g. in the riser), then the values of the peak rates of the two NEs shall be added (if the resulting peak flow is smaller than the value calculated according to the calculation). Otherwise, the peak flow must be determined according to the respective equation.

### Permanent consumers

The flow of permanent consumers is added to the peak flow of the other outlets. Permanent consumers are defined as water outlets which last longer than 15 min e.g. garden blast valve.

### Series equipment

The total flow is the basis for the calculation. The simultaneity of the water outlet is to be defined with the operator. The multiple peak flow rates of the series system must be added up if they could both occur at once.

## Special buildings, commercial and industrial facilities

With special buildings (other than those indicated above), including industry buildings, agriculture buildings, gardening buildings, slaughterhouses, dairies, shops, laundries, large kitchens, public baths etc. the peak flow must be determined from the total flow in co-operation with the facilities operator. The peak flows of the sub-zones of the drinking water installation must be added up if they coincide.



## Pipe sizing and pressure losses for the KEtrix® pipe system PN10

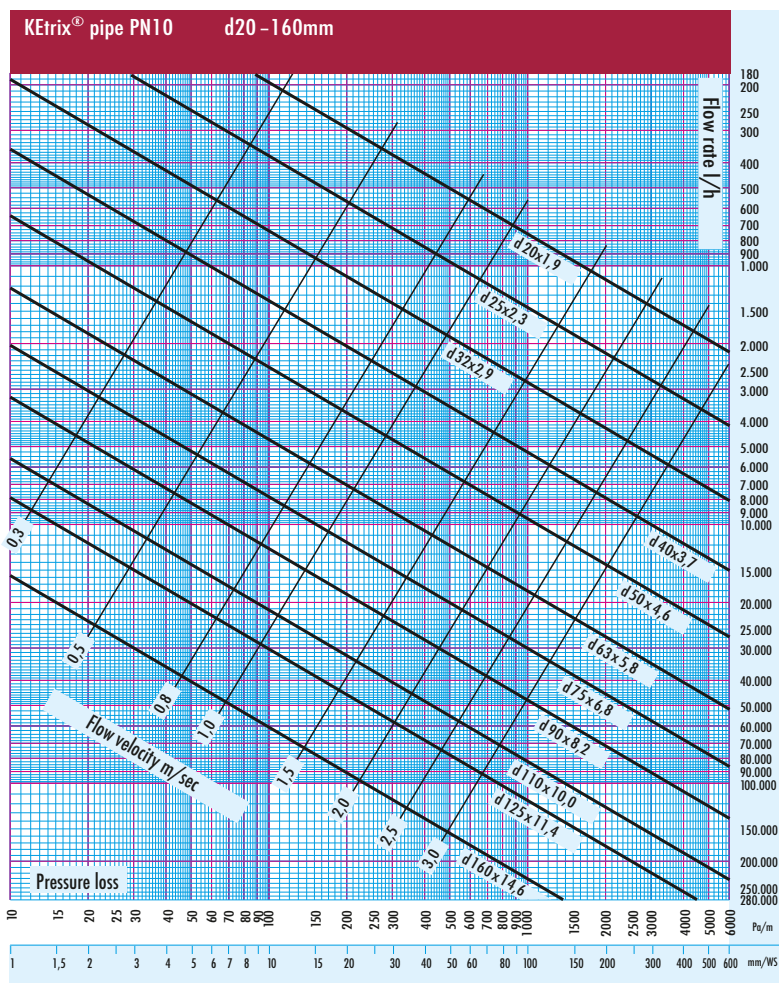
R = pressure loss [mbar/m]  
m = mass flow [l/s]  
di = pipe inside diameter [mm]  
1 mbar = 100 Pa

The pressure losses for water (10°C) are calculated according to the "Nikuradse" formula:

$$R = 9,87161 \cdot 10^7 \cdot m^{1,75580} \cdot di^{-4,80112}$$

Surface roughness: 0,007 mm

If glycol brines are the medium then the extra factors described on pages 26 and 27 must also be accounted for.



## Pipe sizing and pressure losses for the KEtrix® pipe system PN16

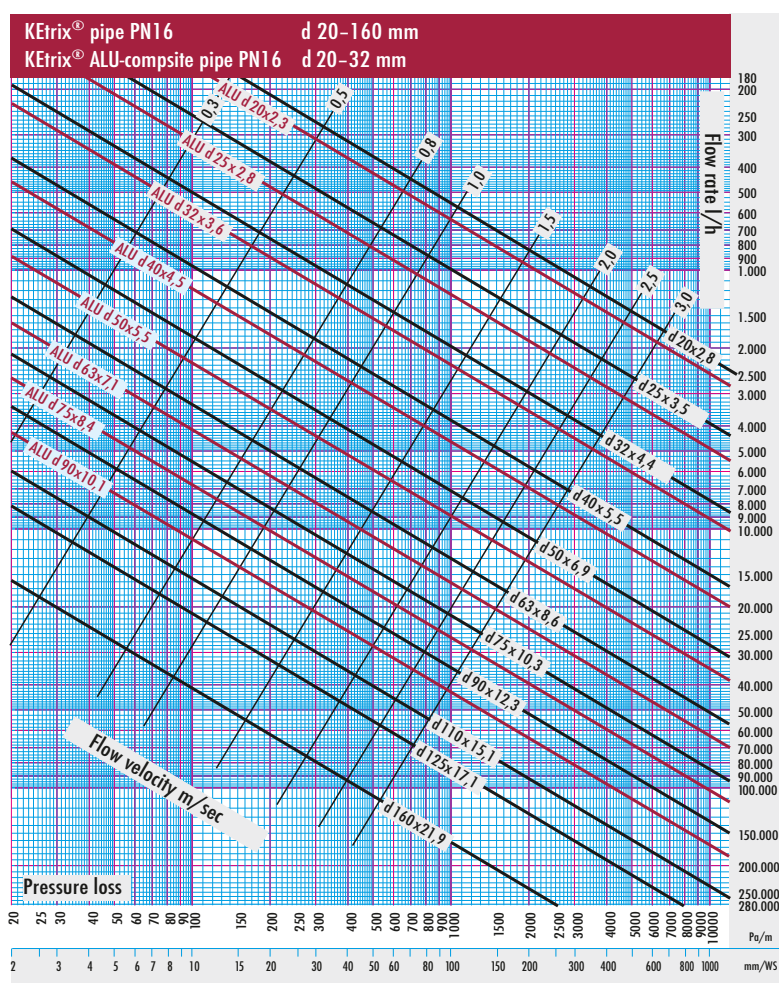
R = pressure loss [mbar/m]  
m = mass flow [l/s]  
di = pipe inside diameter [mm]  
1 mbar = 100 Pa

The pressure losses for water (10°C) are calculated according to the "Nikuradse" formula:

$$R = 9,87161 \cdot 10^7 \cdot m^{1,75580} \cdot di^{-4,80112}$$

Surface roughness: 0,007 mm

If glycol brines are the medium then the extra factors described on pages 26 and 27 must also be accounted for.



## Compressed air technology PN16

### The quality of compressed air

The compressed air can be divided into different quality categories which can be classified according to the application.

#### The pressure dew point

As a result of the compression of the air the water content in the compressed air rises greatly. Drying the air reduces the formation of condensation inside the system to the minimum possible. The pressure dew point is the temperature at which the water within the compressed air starts to condense and is categorized in different classifications.

#### The solids

Solid impurities found in the air are also present in compressed air and must be reduced by filtration. The particle sizes and concentrations are specified in different classifications.

#### The oil concentration

Compressors require at least some lubricating oil for the working process. Depending on the application various procedures must be undertaken to remove this oil from the compressed air. The oil concentration is also divided into different categories

The long-term advantage of compressed air technology is dependent on two factors:

- Compressed air
- Compressed air network

Class	Pressure dew point
1	− 70° C
2	− 40° C
3	− 20° C
4	+ 3° C
5	+ 7° C
6	+ 10° C

Class	max. size of particle mikro/m	Max. concentration of particle mg/m³
1	0,1	0,1
2	1	1
3	5	5
4	15	8
5	40	10

Class	Oil concentration mg/m³
1	0,01
2	0,1
3	1
4	5
5	25

### The type of flow

#### Laminar flow

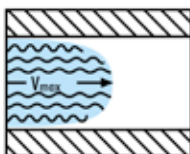
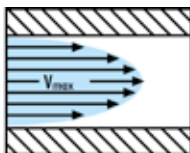
The laminar flow is an evenly distributed flow

- Low pressure loss
- Low heat transfer

#### Turbulent flow

The turbulent flow is an uneven flow. Small whirls are formed in the flow current

- High pressure loss
- High heat transfer



#### Conclusion:

The flow velocity of compressed air in pipelines is usually 2–3 m/sec and should not exceed 20 m/sec in order to avoid noise and turbulent flow.

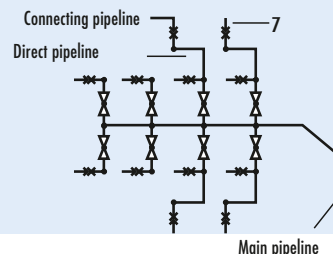
## The compressed air network PN16

If the compressed air is to be supplied centrally a pipe network will be required to supply the air to the individual units. In order to operate efficiently the network has to fulfil the following requirements:

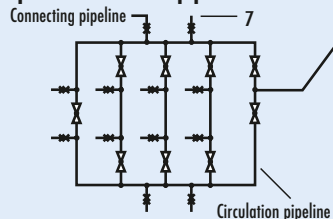
- Sufficient volume flow – for each unit
- Required working pressure – for each unit
- Quality of the compressed air – to ensure that system operates smoothly
- Pressure loss – as low as possible
- Operational liability – maintenance and repairs should not shut down the whole network
- Safety requirements – to prevent accidents

### The pipe network

#### Option: Direct pipeline



#### Option: Circulation pipeline



#### The main pipeline

The sum of the required supply to all of the distributor pipes

#### The distributor pipelines

The distributor pipelines transport the compressed air from the main pipeline to the connecting pipeline. If possible this pipeline should be a **circulation pipeline**.

The advantage of a circulation pipeline compared to a **direct pipeline**:

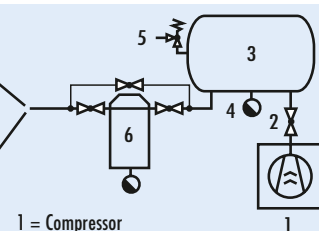
A circulation pipeline is a closed circuit.

It is possible to shut off sections of the pipe network without disrupting the supply of compressed air in other parts of the network. This will increase the economic efficiency and operational security of the system. In a circulation pipeline the compressed air has less distance to travel than in a **direct pipeline** system. This will mean a lower pressure drop;  $\Delta p$ .

**In a circulation pipeline the size of the pipe is calculated with half the flow volume of a direct pipeline.**

#### Connecting pipeline

The connecting pipelines branch off from the distributing pipelines. Since the outlets are all operated at different pressures a monitor unit including a pressure regulator is usually installed by the outlet.



- 1 = Compressor
- 2 = Shut-off valve
- 3 = Compressed air tank
- 4 = Steam trap
- 5 = Safety valve
- 6 = Compressed air dryer
- 7 = Compressed air connections

## Pipe sizing for compressed air systems PN16

For economic reasons it is important to calculate the pipe sizes accurately.

The main factors affecting the size of the pipe are as follows:

- $\dot{V}$  = Total volume flow [l/s]
- $l$  = Fluidic pipe length [m]  
The equivalent pipe lengths of the elbows, fittings or other units must be added.
- $p$  = operating pressure [bar]  
is dependant on the cut-in pressure of the compressor
- $\Delta p$  = pressure drop [bar]  
The max. pressure drop in the individual sections of piping should not exceed the following:  
Main pipeline: ≤ 0,04 bar  
Distributing pipeline: ≤ 0,04 bar  
Circulation pipeline: ≤ 0,04 bar  
Connecting pipeline: ≤ 0,03 bar  
The total pressure loss in the complete network should be ≤ 0,1 bar.

### Calculation of the inside diameter of the pipe

The required inside diameter ( $d_i$ ) can be calculated using the following formula:

$$d_i = \left( \frac{450 \times \dot{V}^{1,85} \times l}{\Delta p \times p} \right)^{0,2}$$

### Equivalent pipe lengths in m for compressed air systems

Size	d20	d25	d32	d40	d50	d63	d75	d90	d110	d125
Elbow 90°	0,8	0,9	1,2	1,5	1,9	2,5	3,0	3,5	4,3	5,2
Elbow 45°	0,2	0,3	0,3	0,4	0,5	0,7	0,8	1,0	1,2	1,3
Tee	0,9	1,2	1,5	1,8	2,3	2,9	3,4	4,1	5,1	6,3
Reducer	0	0	0	0,1	0,1	0,1	0,1	0,1	0,2	0,2
Ball valve	0,1	0,1	0,1	0,2	0,2	0,3	0,3	0,4	0,5	—

### Requirement for compressed air for tools

The volume flow must account for the requirements of all the tools and appliances.

Machine and tool manufacturers can provide information about the air requirements for their appliances.

Any calculation factors for simultaneous use are to be specified by the consultant or operator since there are no empirical values that can be considered a basis for calculation.

### Air requirement for compressed air tools

Blow-out gun	approx. 2–8 l/s
Colour spray-hobby	approx. 2–4 l/s
Colour spray-professional	approx. 3–6 l/s
Impact screw driver-hobby	approx. 4–6 l/s
Impact screw driver-professional	approx. 5–8 l/s
Right angle grinder	approx. 5–8 l/s
Eccentric grinder	approx. 3–5 l/s
Drill	approx. 4–6 l/s
Nibbler	approx. 2–5 l/s

### Equivalent pipe lengths

An important factor when calculating the sizes of the pipes is the length of the pipes. Elbows, valves and other fittings greatly increase the flow resistance in the pipes and must be accounted for.

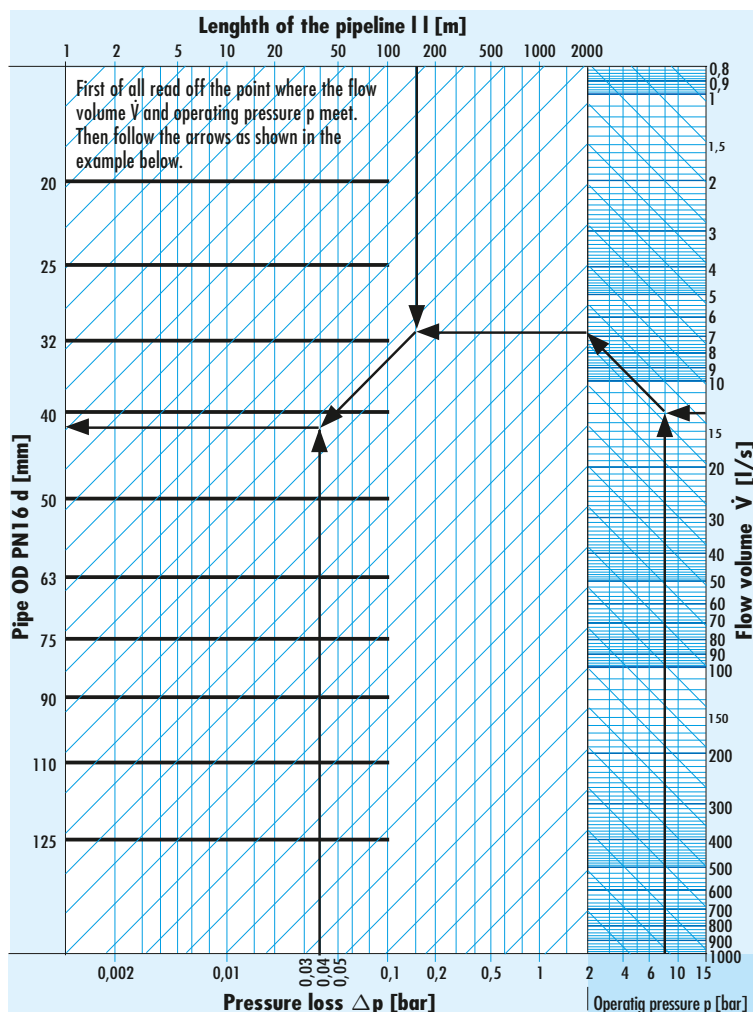
To make the calculation easier the flow resistance in the various fittings is converted into the equivalent pipe lengths. The table below shows the equivalent pipe length for the fittings in different sizes:

## Pipe sizing of PN16 pipes by using the graph

It is easier and quicker to calculate the pipe size by using the nomograph below. The determining factors are the same for both methods of calculating the pipe size.

### Example Main pipeline

$\dot{V}$ = flow volume:	13 l/s
$p$ = operating pressure:	8 bar
$l$ = fluidic pipe length:	150 m
$\Delta p$ = pressure drop:	0,04 bar
Pipe size PN16:	d 40



## Expansion behaviour of KETRIX pipes

### Linear heat expansion

Under heat conditions all materials increase in volume and/or length according to the following formula:

Calculation of the linear expansion:

$$\Delta l = l \cdot \Delta t \cdot \alpha$$

$l$  = length [m]

$\Delta t$  = difference between temperature at time of installation and operating temperature [°C]

$\alpha$  = coefficient of expansion [mm/m°C]

$\Delta l$  = expansion [mm]

The linear expansion is determined by the length of the pipe, the increase in temperature and the coefficient of expansion. It is not determined by the diameter of the pipe.

### Coefficients of expansion

Steel	$\alpha = 0,012 \text{ mm/m}^\circ\text{C}$
Copper	$\alpha = 0,016 \text{ mm/m}^\circ\text{C}$
KELOX®	$\alpha = 0,025 \text{ mm/m}^\circ\text{C}$
KEtrix® ALU	$\alpha = 0,030 \text{ mm/m}^\circ\text{C}$
KEtrix®	$\alpha = 0,140 \text{ mm/m}^\circ\text{C}$
PEX	$\alpha = 0,175 \text{ mm/m}^\circ\text{C}$

This means that when heated KETrix® will expand more than metal materials if the expansion is unhindered.

## Expansion arm for exposed piping

Compensation must be made for the expansion of KETrix® pipes under heat conditions. Even if the rise in temperature is only for a short time sufficient compensation must be made for this temperature difference. Compensation is always made between a fixed point and a change in direction of the piping (expansion arm).

Calculation of the expansion arm:

$$MS = 22 \cdot \sqrt{d \cdot \Delta l}$$

22 = coefficient for KETrix®

$\Delta l$  = change in length [mm]

$d$  = outside diameter of pipe [mm]

$MS$  = Minimum length of the expansion arm [mm] Length of pipe which branches off at 90° from the main pipe to the next fixed point.

**Example:**

A d50 pipe runs over a length of 15 m.

$\Delta t = 18^\circ\text{C}$ .

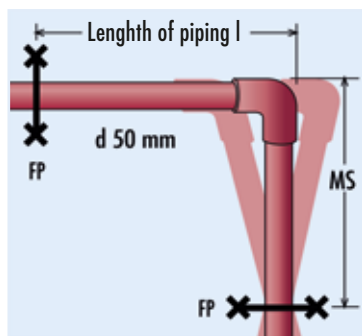
Question: How long does the expansion arm have to be to compensate for the expansion?

$$\Delta l = 15 \cdot 18 \cdot 0,14$$

$$\Delta l = 37,8 \text{ mm expansion}$$

$$MS = 22 \cdot \sqrt{50 \cdot 37,8}$$

$$MS = 956 \text{ mm expansion arm}$$



## Force of heat expansion

The force of linear expansion is different for each material. The specific force of heat expansion is calculated according to the following formula:

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

$E$  = E-module of KETrix® [N/mm²]

$A$  = Cross sectional surface area of pipe [mm²]

$\alpha$  = Coefficient of expansion [mm/m°C]

$\Delta t$  = Difference between temperature at time of installation and operating > temperature [°C]

$F_t$  = force of expansion [N]

The force of heat expansion (or cooling contraction) is dependant on the dimension of the pipe and the change of temperature but not on the length of piping.

An important factor is the rigidity of the material (E-module).

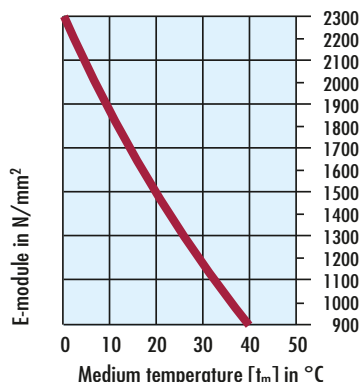
The E-module of Cryolen (like any other plastic) is dependent on the temperature (see graph below)

> Temperature < E-module

< Temperature > E-module

The force of heat expansion is therefore an important criteria when planning an installation.

**E-module of cryolen**



## Practical solutions for compensating expansion

The following methods can be used to control the linear expansion and the force of expansion.

- **Piping that is embedded in the floor or the wall is prevented from expansion by frictional force. No extra measures are required.**
- Every change in temperature will exert a force.  
An expansion force will occur when the temperature rises.  
A force of contraction will occur when the temperature falls.
- Suppliers of pipe clamps and brackets know the properties of the materials and offer a range of solutions.
- Pipe channels may be used to increase the stability of the pipe.  
The expansion is reduced to the same value as steel pipes.
- Compensation must be made for expansion of exposed piping.
- Think of the option of using KETrix® CX pipes. The expansion of exposed piping is effectively restricted and they provide excellent insulation against heat gain and heat loss.
- The expansion can be minimised by installing the Ketrax ALU pipes (d20–90mm). This pipe reduces the expansion by approx. 75%.

The force of expansion can be calculated for every installation. However, in general the force is just a fraction of the force which occurs with metal materials.



## Installing KEtrix

### Installing the pipes in the shaft

In practice the main risers can expand and contract laterally in the shaft between two floors if a **fixed point is located next to the pipe** that branches off from the main pipe. The distance between two fixed points should not exceed 3 m. Other methods can be used to accommodate expansion such as an expansion arm in the pipe branching off from the riser.

### Exposed piping

#### Preventing expansion by mechanical restraint d20–d50

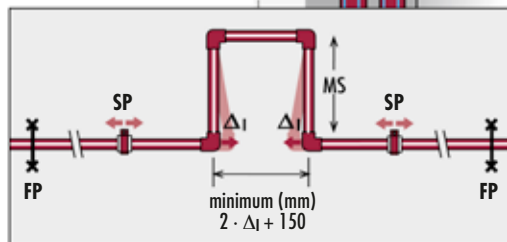
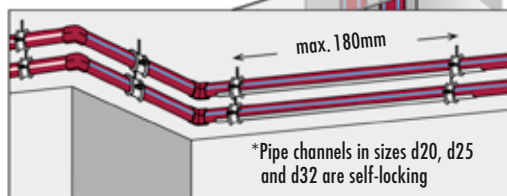
In order to achieve this stability all of the pipes must be supported by pipe channels and all of the brackets must be fastened tightly to the pipe to make them fixed points. In addition the channels are fixed to the pipe (e.g. using cable ties)\*. This method reduces the linear expansion to the same amount as steel.

Up to size d32  
KEtrix Alu composite pipes are usually preferred.

### Expansion loops d63–d160

All changes in the direction of the pipe can be used to accommodate the linear expansion. In some cases an expansion loop will be necessary.

The fixed points are arranged so that the piping is divided into sections and the expansion force can be guided in the desired direction. See page 38 for the calculation of the length of the expansion arm.



## Guidelines for distance between pipe support points

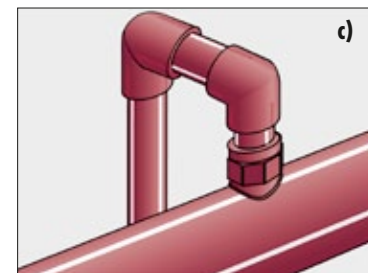
- The distances between the support points given below (in cm) prevent KEtrix pipes from sagging when they are filled with water and there are NO pipe channels.
- Pipes containing compressed air are subject to much greater changes in length than pipes filled with water when the temperature fluctuates as the medium has no cooling effect. Longer runs can be split up into expansion zones and the fixed points located accordingly.

Suppliers of pipe clamps and brackets know the properties of the materials and offer a range of solutions.

### Condensation

In order to prevent corrosion or disruptions in the operation of the system attention must be paid to any condensation that is formed:

- a) by effective air drying (zeolite, silica gel ...)
- b) by a water trap before the connections to the apparatus
- c) by installing a "swan's neck" joint to the connecting pipeline.



Size	KEtrix®PN10			KEtrix®PN16		
	0°C	20°C	30°C	0°C	20°C	40°C
d20	80	75	65	85	80	70
d20 ALU	-	-	-	130	120	110
d25	85	80	75	90	85	80
d25 ALU	-	-	-	140	130	120
d32	105	95	85	110	100	90
d32 ALU	-	-	-	150	140	130
d40	115	105	100	120	110	105
d40 ALU	-	-	-	170	160	150
d50	130	120	115	135	125	120
d50 ALU	-	-	-	180	170	160
d63	145	135	125	150	140	130
d63 ALU	-	-	-	190	180	170
d75	175	165	155	180	170	160
d75 ALU	-	-	-	200	190	180
d90	195	185	175	200	190	180
d90 ALU	-	-	-	210	200	190
d110	205	195	180	210	200	185
d125	215	210	195	220	215	200
d160	240	235	215	245	240	220

For sizes d20–32 we recommend the use of pipe channels. If pipe channels are used then we recommend a maximum distance of 180 cm between the support points

## Pressure test – drinking water systems with drinking water according to ÖNORM EN 806-4

The pressure test with drinking water is a combined leakage / load test and it must be performed for all lines in accordance with the specifications of ÖNORM EN 806-4. Pipes and other piping components are designed for maximum operating pressure (MDP) in accordance with the ÖNORM EN 805 or ÖNORM EN 806 series.

However, they must be designed to withstand at least a system operating pressure (MDP) / nominal pressure (PN) of 1000 kPa (10 bar).

**As the test pressure must be 1.1 x the maximum system operating pressure (in accordance with ÖNORM EN 806-4), the pressure test must be performed with at least 1100 kPa (11 bar) (recommended by KE KELIT 15 bar).**

The accuracy of the pressure gauge (positioned at the lowest possible point wherever possible) is to the nearest 0.02 MPa (0.2 bar).

**Depending on the pipe materials and dimensions, 3 different procedures can be applied in the leakage and load test.**

### Test procedure A – test time 10 minutes

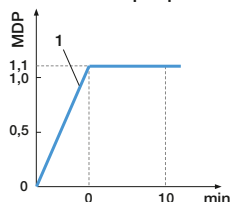
For all metal and multi-layer composite systems For all plastics (e.g. PP, PE, PEX, PB etc.)

≤ DN 50/OD 63

For all combined systems (metal systems/multi-layer composite systems with plastics)

≤ DN 50/OD 63

The test pressure (1) must be achieved with pumping and maintained for up to 10 minutes; during this time the test pressure must remain constant, and there must be no drop in pressure.



### Choice of test method B or C

#### Test procedure B – test time 60 minutes

For all plastics (e.g. PP, PE, PEX, PB etc.)

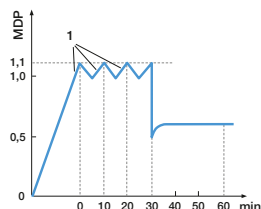
> DN 50/OD 63

For all combined systems (metal systems/multi-layer composite systems with plastics)

> DN 50/OD 63

The test pressure (1) must be achieved with pumping and maintained for 30 minutes by subsequent pumping, then the pressure must be reduced to 50% of the test pressure by draining it; then the drain valve must be closed. During the time of the additional 30 minutes the 50% test pressure must remain constant and there must be no drop in pressure.

In addition, it is necessary to perform a visual inspection of the connections.



#### Test procedure C – test time 180 minutes

For all plastics (e.g. PP, PE, PEX, PB etc.)

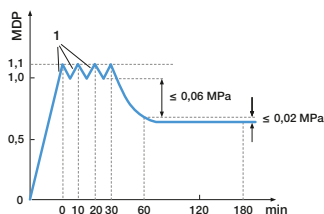
> DN 50/OD 63

For all combined systems (metal systems/multi-layer composite systems with plastics)

> DN 50/OD 63

The test pressure (1) must be achieved with pumping and maintained for 30 minutes by subsequent pumping, then the test pressure must be checked, and after another 30 minutes the pressure must be checked again. If after this period the pressure has dropped to less than 0.06 MPa (0.6 bar) then the test pressure must be continued with no further pumping.

The test period is an additional 120 minutes, during which the last recorded test pressure may not drop by more than 0.02 MPa (0.2 bar). In addition, it is necessary to perform a visual inspection of the connections.



## Pressure testing protocol according to ÖNORM EN 806-4 for KEtrix-Drinking water systems test medium: drinking water

Client: .....

Contractor: .....

Subject: ..... Test section: .....

Pipe materials and dimensions: .....

Ambient temperature: ..... System vents: ☐

Temperature compensation: ☐ Visual inspection: ☐

Maximum system operating pressure MDP: ..... Test pressure 1.1 x MDP: .....

Pipes: d 20 ..... m Pipes: d 50 ..... m Pipes: d 110 ..... m

Pipes: d 25 ..... m Pipes: d 63 ..... m Pipes: d 125 ..... m

Pipes: d 32 ..... m Pipes: d 75 ..... m Pipes: d 160 ..... m

Pipes: d 40 ..... m Pipes: d 90 ..... m

### Test procedure A – test time 10 minutes ☐

Metal and composite pipe systems – all sizes

Plastic systems and combined systems with plastics ≤ DN 50/OD 63

**Choice of test method B or C**

### Test procedure B – test time 60 minutes ☐

Plastic systems and combined systems with plastics > DN 50/OD 63

### Test procedure C – test time 180 minutes ☐

Plastic systems and combined systems with plastics > DN 50/OD 63

### Notes:

- Temperature fluctuations can affect the test pressure!
- Each pressure test is a snapshot survey of the actual condition and it cannot guarantee no installation faults.
- Following a successful pressure test, we would recommend the creation of a confirmed test protocol.

### Confirmation:

Clerk: .....

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

Client: .....

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

A pressure test with air or inert gases takes place using a two-step procedure consisting of the leak test and the load test.

For  $\leq$  DN 50/ OD 63 pipes the leak test can be carried out in 2 ways.

**The pressure test with light or inert gases can be carried out bit by bit, and may not replace the final pressure test with drinking water!**

The pressure test must be performed with light or inert gases that is / are largely free of oil and dust, and it is suitable for all pipe materials. In buildings with higher hygiene demands (e.g. medical establishments) inert gas must be used for the pressure test.

**Due to the compressibility of the medium, during a pressure test with light or inert gases no pressure test greater than 300 kPa (3 bar) may be applied, for safety reasons.**

Higher test pressures comprise a large safety risk and they do include the test accuracy. The safety of people and goods must be considered during the test.

During a pressure test, division into small line sections ensures a higher test accuracy and therefore a higher level of safety. A gradual increase in pressure is useful as an additional security measure.

All pipe openings must be well sealed against the test pressure (with sufficient strength) with plugs or blind flanges.

During a pressure test with light or inert gases, the connection parts of the pipe elements must be accessible and visible. Bleed valves are provided for the safe discharge of the test pressure.

If any leakage is detected, or a drop in pressure is noticed, then all connections must be tested for leaks using appropriate bubbling test equipment, and the pressure test must be repeated after the leaks have been eliminated.

### Two-step pressure test for all pipes $\leq$ DN 50/OD 63

#### Consisting of leak test (variant 1 or 2) and load test

##### Leak test – variant 1

Pressure test 15 kPa (150 mbar) – test time 60 minutes. Display accuracy of the pressure gauge or standpipe to the nearest 0.1 kPa (1 mbar)

##### Leak test – variant 2

Test pressure 100 kPa (1 bar) – test time 60 minutes. Display accuracy of the pressure gauge to the nearest 5 kPa (50 mbar); in addition, all connection points in the system must be checked for leakage with appropriate bubbling test equipment.

##### Load test

Test pressure 300 kPa (3 bar) – test time 10 minutes. Display accuracy of the pressure gauge to the nearest 10 kPa (100 mbar)

### Two-level pressure test for all pipes $>$ DN 50/OD 63

#### Consisting of leakage test and load test

##### Leakage test

Test pressure 15 kPa (150 mbar) – test time 90 minutes. Display accuracy of the measuring gauge or standpipe to the nearest 0.1 kPa (1 mbar); in addition, all connection points in the system must be checked for leakage with appropriate bubbling test equipment.

##### Load test

Test pressure 100 kPa (1 bar) – test time 10 minutes. Display accuracy of the pressure gauge to the nearest 10 kPa (100 mbar).

## Pressure testing protocol according to ÖNORM B 2531 for KETRIX-Drinking water systems test medium: air or inert gases

Client: .....

Contractor: .....

Subject: ..... Test section: .....

Pipe materials and dimensions: .....

Ambient temperature: ..... Temperature compensation: ☐

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

### Two-stage pressure test for all pipes $\leq$ DN 50/OD 63: consisting of leak test (variant 1 or 2) and load test

#### Leakage test – variant 1

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

#### Leakage test – variant 2

Test pressure 100 kPa (1 bar) – test time 60 minutes

In addition, all component points in the system must be checked for leakage using appropriate bubbling test equipment.

#### Load test

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

### Two-stage pressure test for all pipes $>$ DN 50/OD 63: consisting of Leak test and load test

#### Leak test

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

In addition, all component points in the system must be checked for leakage using appropriate bubbling test equipment.

#### Load test

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

#### Notes

- Following a successful pressure test, we would recommend the creation of a confirmed test protocol.
- In accordance with ÖNORM EN 806-4, a pressure test with light or inert gases cannot replace a pressure test; it must be performed immediately prior to the activation of the system.

#### Confirmation

Clerk: .....

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

Client: .....

## Pressure test report for chilled water system

Since there are no specific standards for testing chilled water pipe systems the pressure testing follows the guidelines of standard DIN 18380 or ÖNORM B 8131 for pressure testing of radiator systems.

Location: .....

Projekt: .....

Operating pressure: .....

### Pressure test

The testing pressure for the pipe system should be equal to 1,3 times the operating pressure and should also be a minimum of 1 bar above the operating pressure at each of the points in the system being tested. The manometer should be capable of reading changes in pressure of 0,1 bar and should be placed, if possible, at the lowest point of the section of piping being tested.

After the testing pressure has been obtained time must be allowed for temperature equalisation. Afterwards the pressure must be returned to the testing pressure to compensate for any drop in pressure which has occurred in the meantime.

All equipment and faucets which are not suited for the testing pressure should be removed from the system before testing. The system is filled with filtered water and the air completely removed. During the test there should be a visual check of each pipe joint.

The testing pressure must be maintained for 2 hours and should not drop by more than 0,2 bar. There should be no leakages.

Calculated test pressure: ..... bar

Testing time: ..... hours

☐ During the time of the test there was never a drop in pressure  $\geq 0,2$  bar.

The system contains the following anti-freeze agent: .....

☐ For safety reasons the system was therefore emptied completely.

### Confirmation

Person in charge: .....

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

Customer: .....

signature/stamp

## Pressure test report for compressed air systems

This test report is based on TRB 522 (technical rules for compressed air reservoirs). All pipes are to be closed off with metal stoppers, caps and blank flanges. Welded joints must have been completed at least one hour before the test. All pipe joints must be subjected to a visual check.

Location: .....

Projekt: .....

Operating pressure: .....

### Testing for leakages by gas pipe device (water head manometer)

The test pressure is 110mbar (1,1 m head of water)

The testing time is a minimum of 30 minutes for up to 100 litres volume. For every extra 100 litres of volume add 10 minutes to the testing time (see page 8 for volume).

Wait for approx. 15 minutes to allow for temperature equalization and for the air to settle.

The testing time can then begin.

Test pressur	..... mbar
Volum	..... litre
Ambient temperature	..... °C
Testing time	..... minutes

The compressed air pipeline was tested as ☐ one complete system ☐ in different sections  
☐ During the testing time there was NO drop in pressure.

### Strength testing at higher pressure

The strength test immediately follows the leakage test. The test pressure should be 1,1 times the maximum operating temperature. Two times during the following 30 minutes the pressure should be re-set at the testing pressure to compensate for any drop in pressure. After that the testing pressure should be held constant for 30 minutes.

Test pressure: ..... bar

☐ Während der Prüfzeit wurde KEIN Druckabfall  $\geq 0,1$  bar festgestellt

### Confirmation

Person in charge: .....

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

Customer: .....

signature/stamp



## Summary of the instruction guidelines



**1.** The KEtrix® pipe system is made of plastic and needs to be treated carefully to prevent shocks and impact on the pipe during transportation, storage and installation.



**2.** Protect the pipes, fittings and opponents from lengthy exposure to direct UV radiation from the sun.

The usual time required for storage and installation will have no effect on the material as it is stabilised against UV rays but the material is not resistant to long-term UV exposure



**3.** Follow the installation guidelines for the different methods of joining the pipes (see pages 16 – 25).

The welding times are based on an ambient temperature of 20°C. If the ambient temperature falls below 0°C the heating times may alter slightly.



**4.** Any corrections to the alignment of pipe and fitting up to a maximum of 5° must be made during the welding procedure. Any later adjustments would damage the joint (see pages 17, 19 and 21 for the permissible time for adjustments).



**5.** Do **NOT** screw any threaded pipes or any cast iron fittings into the female threads of the metal moulded fittings.

Only join to faucets and components with straight threads. The threaded joints can be sealed by the usual methods (hemp, paste, tape) Do not over-screw the threads.



**6.** The expansion of KEtrix® pipes is clearly defined and must be accounted for in the design and installation of the system.

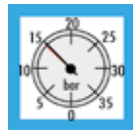
Please refer to pages 38–40 regarding the methods of accommodating the expansion of exposed piping. Pipes containing compressed air are subject to much greater changes in length than pipes filled with water when the temperature fluctuates as the medium has no cooling effect. Longer runs can be split up into expansion zones and the fixed points located accordingly. Suppliers of pipe clamps and brackets know the properties of the materials and offer a range of solutions.



**7.** Avoid using heat to bend the pipes (it is possible to bend the cold pipe to a radius of 12 x d). If the pipe has to be heated then only use hot air (max. 140°C). Never heat the pipe with a naked flame! On request KE KELIT can make an offer for manufacturing butt welded elbows up to 30° in various lengths for size d50 mm and above.



**8.** Try to make the joints for standard sections of piping at the work bench before they are installed. This saves time and increases the safety of the system.



**9.** Once the system has been installed it should be subjected to pressure testing.

You can copy pages 43 – 45 of the catalogue to make a test report.



**10.** The KEtrix® pipe system is designed for the applications described in this

handbook. Extra stress on the system caused by higher temperatures or pressure could reduce the service life and security of the system.



**11.** Pipelines must be clearly marked in accordance with existing standards (DIN 2403) to make aware of any dangers and prevent accidents.



**12.** In order to qualify for guarantee cover each installation must use KEtrix® system parts only.



**13.** In order to install the KEtrix® pipe successfully a minimal amount of

expenditure is required for tools. For your own security we recommend that you use and maintain the tried and trusted tools.



**14.** If you are in doubt do not hesitate to consult our technicians. There is not always a perfect solution but we can always help.

## Product range

The **KEtrix®** pipe system is constantly being extended and updated to meet the requirements of the industry.

Please refer to the current **KEtrix®** price list for the complete product range.

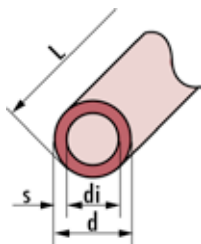
The abbreviated references (e.g. TRI02 = PN10 pipe or TRI30 = tee) simplify the administration. Please refer to the TRI numbers when you place your order.

### TRI01 KETrix® Alu composite pipe PN16

For chilled water, cooling and compressed air;  
Oxygen barrier

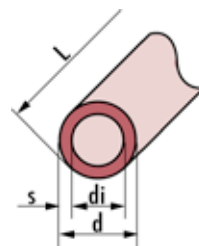


d mm	s mm	di mm	L m	wight kg/m	V l/m
20	2,3	15,4	4	0,18	0,19
25	2,8	19,4	4	0,29	0,30
32	3,6	24,8	4	0,45	0,48
40	4,5	31,0	4	0,64	0,75
50	5,6	38,8	4	0,94	1,18
63	7,1	48,8	4	1,47	1,87
75	8,4	58,2	4	1,93	2,66
90	10,1	69,8	4	3,01	3,83



### TRI02 KETrix® Pipe PN10

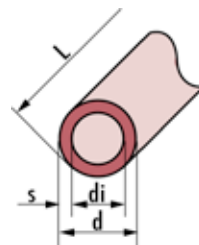
For chilled water and cooling;



d mm	s mm	di mm	L m	weight kg/m	V l/m
20	1,9	16,2	4	0,11	0,21
25	2,3	20,4	4	0,16	0,33
32	2,9	26,2	4	0,26	0,54
40	3,7	32,6	4	0,41	0,83
50	4,6	40,8	4	0,64	1,31
63	5,8	51,4	4	1,01	2,07
75	6,8	61,4	4	1,41	2,96
90	8,2	73,6	4	2,03	4,25
110	10,0	90,0	4	3,01	6,36
125	11,4	102,2	4	3,91	8,20
160	14,6	145,4	4	6,38	13,44

### TRI08 KETrix® Pipe PN16

For chilled water, cooling and compressed air;

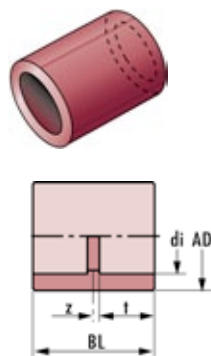


d mm	s mm	di mm	L m	weight kg/m	V l/m
20	2,8	14,4	4	0,15	0,16
25	3,5	18,0	4	0,23	0,25
32	4,4	23,2	4	0,37	0,42
40	5,5	29,0	4	0,58	0,66
50	6,9	36,2	4	0,90	1,03
63	8,6	45,8	4	1,41	1,65
75	10,3	54,4	4	2,01	2,32
90	12,3	65,4	4	2,87	3,36
110	15,1	79,8	4	4,30	5,00
125	17,1	90,8	4	5,53	6,48

## Polyfusion welding fittings

### TRI10

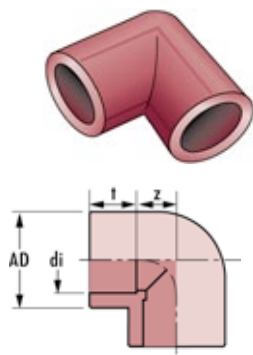
### Socket



di mm	z mm	t mm	AD mm	BL mm	VP Pcs
20	1,5	15	29	33	10
25	1,5	20	36	43	10
32	1,5	22	46	51	10
40	1,5	27	54	57	5
50	2	28	68	60	2
63	2	29	85	62	1
75	2,5	30	101	65	1
90	3	34	121	74	1
110	5,5	37	145	85	1
125	10	40	165	90	1

### TRI20

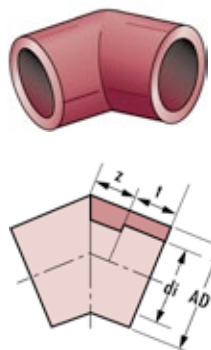
### Elbow 90°



di mm	z mm	t mm	AD mm	VP Pcs
20	11	15	29	10
25	16	20	36	10
32	20	22	46	10
40	25	27	54	5
50	30	28	68	2
63	36	29	85	1
75	41	30	102	1
90	50	34	122	1
110	58	37	145	1
125	84	40	165	1

### TRI70

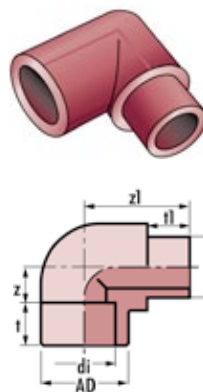
### Elbow 45°



di mm	z mm	t mm	AD mm	VP Pcs
20	12	15	29	10
25	13	20	36	10
32	15	22	46	10
40	19	27	53	5
50	23	28	68	2
63	32	29	85	1
75	37	30	101	1
90	48	34	122	1
110	53	37	137	1
125	62	40	165	1

### TRI26

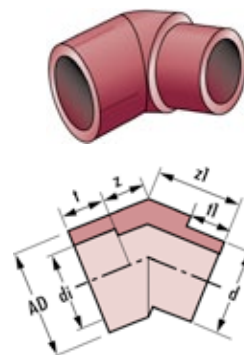
### Elbow 90° innen/außen



d/di mm	z mm	t mm	z1 mm	t1 mm	AD mm	VP Pcs
20	11	15	33	15	29	10
25	16	20	42	20	36	10
32	20	22	42	22	43	5

### TRI27

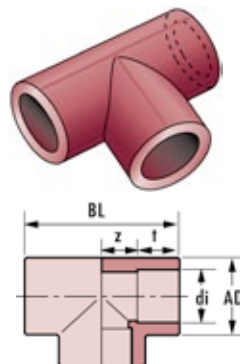
### Elbow 45° innen/außen



d/di mm	z mm	t mm	z1 mm	t1 mm	AD mm	VP Pcs
20	11	16	31	16	29	10
25	18	20	33	20	36	10

### TRI30

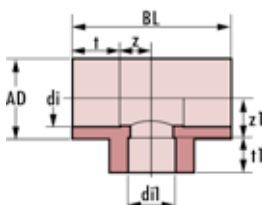
### Equal tee



di mm	z mm	t mm	AD mm	BL mm	VP Pcs
20	11	15	29	52	10
25	16	20	36	68	10
32	20	22	46	84	5
40	25	27	54	94	5
50	30	28	68	112	2
63	36	29	85	128	1
75	41	30	102	142	1
90	50	34	122	166	1
110	58	37	145	195	1
125	84	40	165	248	1

## TRI35

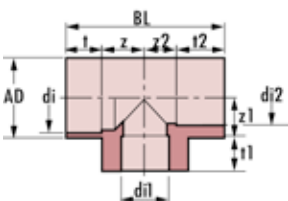
### Reducer tee



di mm	di1 mm	z mm	t mm	z1 mm	t1 mm	AD mm	BL mm	VP Pcs
25	20	16	20	16	15	36	68	10
32	20	20	22	26	15	46	84	5
32	25	20	22	22	20	46	84	5
40	20	25	27	27	15	54	94	5
40	25	25	27	24	20	54	94	5
40	32	25	27	26	24	54	94	5
50	20	30	28	32	15	68	112	2
50	25	30	28	28	20	68	112	2
50	32	30	28	30	24	68	112	2
50	40	30	28	29	27	68	112	2
63	25	36	29	40	20	85	128	1
63	32	36	29	36	24	85	128	1
63	40	36	29	37	27	85	128	1
63	50	36	29	36	28	85	128	1
75	32	41	30	42	24	102	142	1
75	40	41	30	41	27	102	142	1
75	50	41	30	40	28	102	142	1
75	63	41	30	39	29	102	142	1
90	63	50	34	54	29	122	166	1
90	75	50	34	50	30	122	166	1
110	63	58	37	70	29	145	195	1
110	75	58	37	68	30	145	195	1
110	90	58	37	65	34	145	195	1
125	75	84	40	74	30	165	248	1
125	90	84	40	72	34	165	248	1
125	110	84	40	73	37	165	248	1

## TRI36

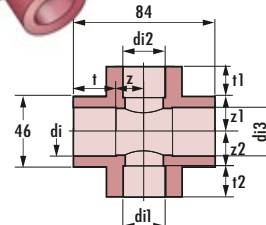
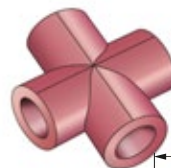
### Reducer tee



di mm	di1 mm	di2 mm	z mm	t mm	z1 mm	t1 mm	z2 mm	t2 mm	AD mm	BL mm	VP Pcs
20	25	20	16	15	16	20	16	15	36	68	10
25	20	20	16	20	18	15	18	15	36	68	10
25	25	20	16	20	16	20	18	15	46	84	10
32	20	25	20	22	26	15	22	20	46	84	5
32	25	20	20	22	22	20	26	15	46	84	5
32	25	25	20	22	22	20	22	20	46	84	5
32	32	20	20	22	20	24	26	15	46	84	5
32	32	25	20	22	20	24	22	20	46	84	5

## TRI39

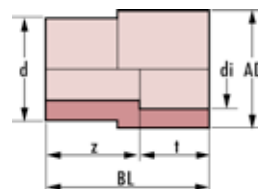
### Cross piece



di mm	di1 mm	di2 mm	di3 mm	z mm	t mm	z1 mm	t1 mm	z2 mm	t2 mm	VP Pcs
32	20	20	32	20	22	18	15	18	15	5
32	20	25	32	20	22	18	15	18	20	5
32	25	25	25	20	22	18	20	18	20	5
32	25	25	32	20	22	18	20	18	20	5
32	32	32	32	20	22	20	22	20	22	5

## TRI41

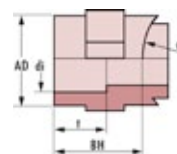
### Reducer (male/female)



d mm	di mm	z mm	t mm	AD mm	BL mm	VP Pcs
25	20	23	15	29	38	10
32	20	27	15	29	42	10
32	25	27	20	36	47	10
40	20	29	15	29	44	5
40	25	28	20	36	48	5
40	32	36	22	45	60	5
50	32	65	22	45	85	2
50	40	56	24	53	80	2
63	40	61	24	53	85	1
63	50	61	24	68	85	1
75	50	66	28	68	94	1
75	63	65	29	84	94	1
90	63	66	29	84	95	1
90	75	66	29	101	95	1
110	63	57	29	85	86	1
110	75	61	29	101	90	1
110	90	61	32	119	93	1

## TRI47

### Saddle fitting

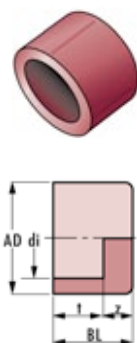


d mm	di mm	t mm	AD mm	BH mm	VP Pcs
40-63	20	15	36	29	5
40-63	25	20	36	29	5
75-125	20	15	36	29	5
75-125	25	20	36	29	5



## TRI60

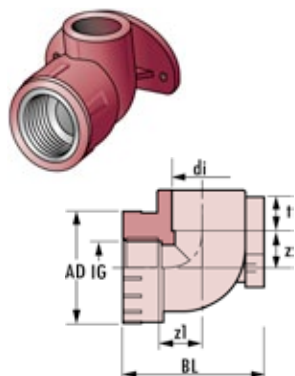
### End cap



di mm	z mm	t mm	AD mm	BL mm	VP Pcs
20	8	16	29	24	10
25	9	21	36	30	10
32	11	22	46	36	10
40	13	25	53	38	5
50	15	28	67	43	5
63	19	30	84	49	5
75	21	31	100	52	1
90	26	36	120	62	1
110	41	37	145	78	1

## TRI83

### Wall bracket 90° (female)



di mm	IG Zoll	z mm	z1 mm	t mm	AD mm	BL mm	VP Pcs
20	1/2"	13	21	15	41,5	48,5	10
20	3/4"	17	26	15	46	57	10
25	1/2"	17	26	20	46	57	10
25	3/4"	17	26	20	46	57	10

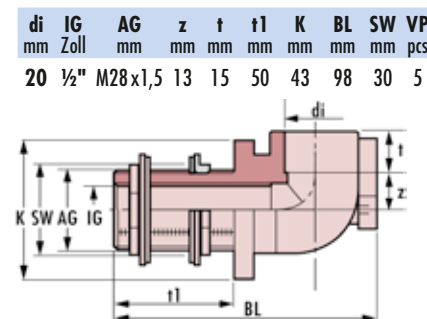
**DO NOT join to any threaded pipes or cast iron fittings!**

## TRI83HA

### Partition wall fitting 90° (female)



**DO NOT join to any threaded pipes or cast iron fittings!**

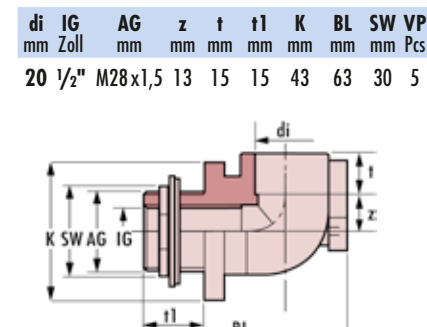


## TRI83SP

### Flush box fitting 90° (female)



**DO NOT join to any threaded pipes or cast iron fittings!**



## TRI11

### Male adaptor

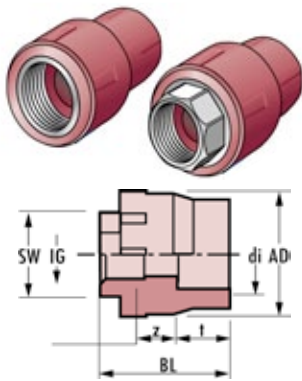


di mm	AG Zoll	z mm	t mm	AD mm	BL mm	SW mm	VP Pcs
20	1/2"	44	15	45	60	-	10
20	3/4"	44	15	45	60	-	10
25	1/2"	40	20	45	60	-	10
25	3/4"	40	20	45	60	-	10
32	3/4"	36	22	45	60	-	5
32	1"	59	22	60	83	39	5
40	5/4"	60	27	76	87	39	2
50	6/4"	66	28	82	92	52	1
63	2"	80	29	97	107	64	1
75	2 1/2"	90	30	123	120	80	1

**Please check the current price list for the availability of plastic thread fittings!**

### TRI13

### Female adapter

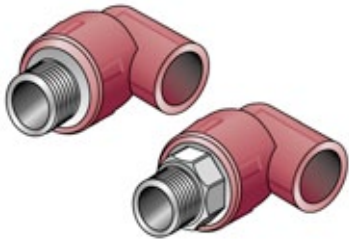


di mm	IG Zoll	z mm	t mm	AD mm	BL mm	SW mm	VP Pcs
20	1/2"	18	15	45	45	-	10
20	3/4"	18	15	45	45	-	10
25	1/2"	16	20	45	45	-	10
25	3/4"	16	20	45	45	-	10
32	1"	22	22	60	68	39	5
40	5/4"	26	27	76	71	48	2
50	6/4"	28	28	82	71	56	1
63	2"	38	29	97	86	70	1
75	2 1/2"	44	30	123	96	88	1

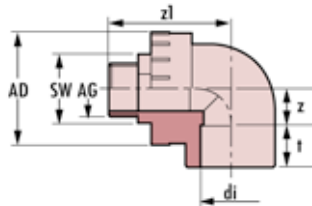
DO NOT join to any threaded pipes or cast iron fittings!

### TRI21

### Elbow adaptor 90° (male)



di mm	AG Zoll	z mm	t mm	z1 mm	AD mm	SW mm	VP pcs
20	1/2"	13	15	49	42	-	10
25	3/4"	17	20	52	46	-	10
32	1"	20	22	61	61	39	5



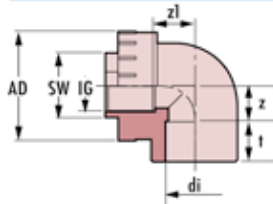
Please check the current price list for the availability of plastic thread fittings!

### TRI23

### Elbow adaptor 90° (female)



di mm	IG Zoll	z mm	t mm	z1 mm	AD mm	SW mm	VP Pcs
20	1/2"	13	15	21	42	-	10
25	1/2"	17	20	21	46	-	10
25	3/4"	17	20	21	46	-	10
32	1"	20	22	38	61	39	5



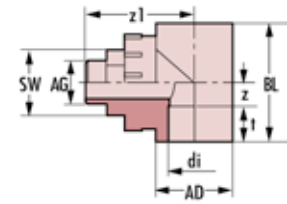
DO NOT join to any threaded pipes or cast iron fittings!

### TRI31

### Tee with male thread



di mm	AG Zoll	z mm	t mm	z1 mm	AD mm	BL mm	SW mm	VP Pcs
20	1/2"	13	15	49	29	54	-	10
20	1/2"BF	13	15	49	29	54	-	10
25	3/4"	17	20	60	36	66	-	10
32	1"	20	22	78	46	86	39	5

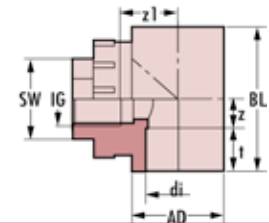


### TRI33

### Tee with female thread



di mm	IG Zoll	z mm	t mm	z1 mm	AD mm	BL mm	SW mm	VP Pcs
20	1/2"	13	15	23	30	56	-	10
20	1/2"BF	13	15	23	30	56	-	10
25	1/2"	17	20	32	37	66	-	10
25	3/4"	17	20	32	37	66	-	10
32	1"	20	22	42	46	84	39	5



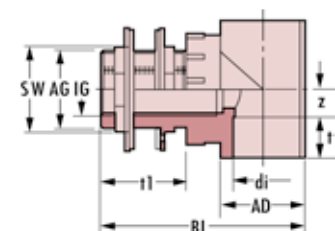
DO NOT join to any threaded pipes or cast iron fittings!

### TRI33HA

### Tee with female threads for partition walls



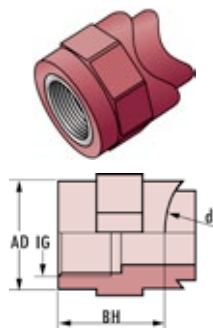
di mm	IG Zoll	AG mm	z mm	t mm	t1 mm	AD mm	BL mm	SW mm	VP Pcs
20	1/2"BF	M28x1,5	13	15	50	29	99	30	10



DO NOT join to any threaded pipes or cast iron fittings!

## TRI43

### Saddle fitting (female)

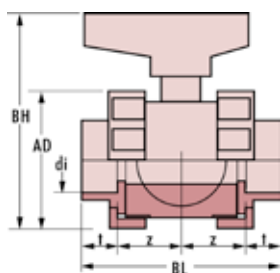


d mm	IG Zoll	AD mm	BH mm	VP Pcs
40-63	1/2"	36	29	5
75-125	1/2"	36	29	5
40-63	3/4"	36	29	5
75-125	3/4"	36	29	5

**DO NOT join to any threaded pipes or cast iron fittings!**

## TRI51P

### Plastic ball valve PN10



di mm	z mm	t mm	AD mm	BL mm	BH mm	VP Pcs
20	25	15	52	80	80	1
25	27	20	64	94	88	1
32	27	22	70	102	100	1
40	33	27	85	120	125	1
50	43	28	98	142	145	1
63	56	29	114	170	160	1
75	88	30	160	236	210	1
90	112	34	188	292	260	1
110	113	37	188	300	260	1

**CAREFUL!**

Not suited for compressed air  
(PN16 rated valve is required)  
Not suited for minus temperatures  
(PVC valve required)

Pressure stages:

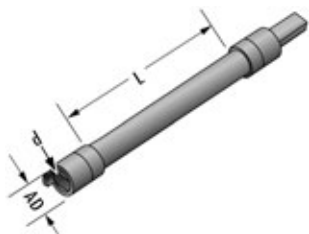
d20-63 - PN16

d75-90 - PN10

d110 - PN6

## TRI51V

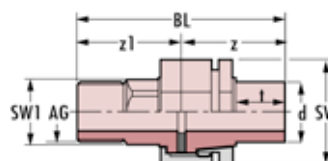
### Extension for TRI51P



d mm	L mm	AD mm	VP Pcs
20	130-300	34	1
25-32	130-300	34	1
40	130-300	34	1
50-63	130-300	34	1
75	130-300	34	1
90-110	130-300	34	1

## TRI55

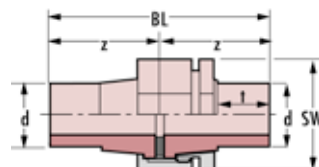
### Union (plastic-metal)



d mm	AG Zoll	z mm	t mm	z1 mm	BL mm	SW mm	SW1 mm	VP Pcs
20	1/2"	42	17	33	75	36	23	5
25	3/4"	49	20	40	89	46	30	5
32	1"	55	26	44	99	52	37	3
40	3/4"	85	50	52	137	66	45	2
50	6/4"	85	50	58	143	70	55	1
63	2"	85	50	65	150	86	66	1
75	2 1/2"	90	50	68	158	108	80	1
90	3"	90	50	73	163	122	94	1

## TRI56

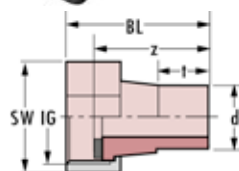
### Union (plastic-plastic)



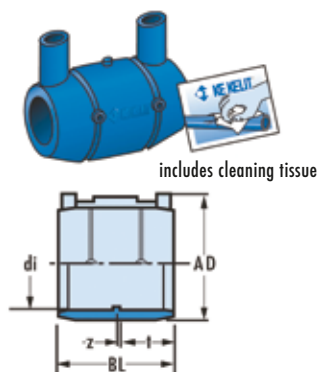
di mm	z mm	t mm	AD mm	BL mm	VP Pcs
20	42	17	84	36	5
25	49	20	98	46	5
32	55	26	110	52	3
40	85	50	170	66	2
50	85	50	170	70	1
63	85	50	170	86	1
75	90	50	180	108	1
90	90	50	180	122	1

## TRI57

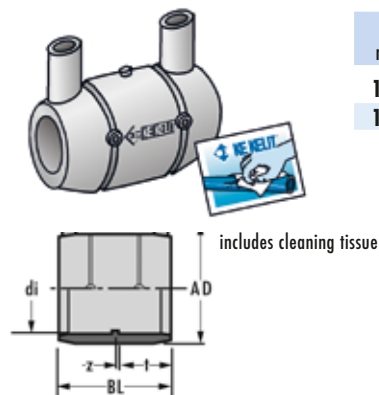
### Union with female thread



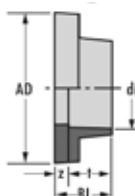
d mm	IG Zoll	z mm	t mm	BL mm	SW mm	VP Pcs
20	1"	44	17	53	36	5
25	5/4"	50	20	60	46	5
32	6/4"	56	26	67	52	3
40	2"	87	50	103	66	2
50	2 1/4"	87	50	103	70	1
63	2 3/4"	87	50	103	86	1
75	3 1/4"	93	50	114	108	1
90	3 3/4"	93	50	115	122	1

**K17**
**E-UNI welding socket**


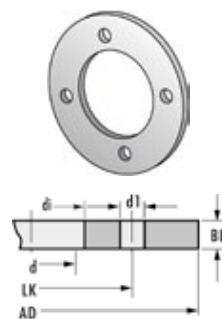
di mm	z mm	t mm	AD mm	BL mm	VP Pcs
20	1,5	26	48	55	1
25	1,5	26	54	55	1
32	1,5	25	62	53	1
40	1,5	25	70	53	1
50	1,5	25	80	53	1
63	1,5	30	94	63	1
75	2	33	107	70	1
90	2	36	121	76	1
110	2,5	41	143	87	1

**KE17**
**E-UNI welding socket PN10**


di mm	z mm	t mm	AD mm	BL mm	VP Pcs
125	3	82	164	165	1
160	3	89	200	177	1

**KE18**
**Backing ring PN10**


di mm	DN	z mm	t mm	BL mm	AD mm	VP Pcs
20	15	5	16	21	45	1
25	20	5	18	23	58	1
32	25	5	19	24	68	1
40	32	4	22	26	78	1
50	40	6	24	30	88	1
63	50	5	28	33	102	1
75	65	6	32	38	122	1
90	80	5	37	42	138	1
110	100	5	42	47	158	1
125	100	15	40	55	162	1

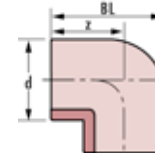
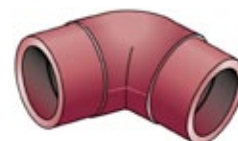
**K19**
**PP flange with steel insert**


d mm	DN	di mm	LK mm	d1 mm	Nr. of holes	BL mm	AD mm	VP Pcs
20	15	28	65	14	4	12	95	1
25	20	34	75	14	4	12	105	1
32	25	42	85	14	4	16	115	1
40	32	51	100	18	4	16	140	1
50	40	62	110	18	4	18	150	1
63	50	78	125	18	4	18	165	1
75	65	92	145	18	4	18	185	1
90	80	102	160	18	8	18	200	1
110	100	135	180	18	8	18	220	1
125	100	128	180	18	8	20	222	1

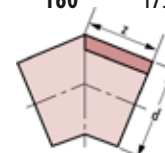
Dimensions conform to DIN 2501 PN16

**Butt welding fittings**
**TRI20ST**
**Elbow 90° PN10**

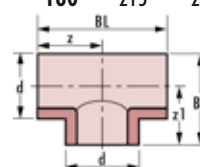

d mm	z Zoll	BL mm	VP Pcs
160	215	290	1


**TRI70ST**
**Elbow 45° PN10**


d mm	z Zoll	VP pcs
160	175	1


**TRI30ST**
**Equal tee PN10**


d mm	z mm	z1 mm	BL mm	BH mm	VP Pcs
160	215	215	430	300	1





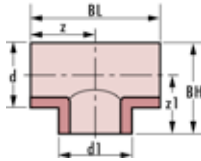
**TRI35ST**

**Reducer tee**

**PN10**



d mm	d1 Zoll	z mm	z1 mm	BL mm	BH mm	VP Pcs
160	90	215	190	430	260	1
160	110	215	200	430	280	1



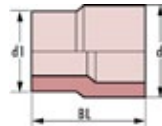
**TRI41ST**

**Reducer**

**PN10**



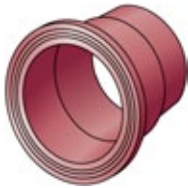
d mm	d1 mm	BL mm	VP Pcs
125	110	200	1
160	125	225	1



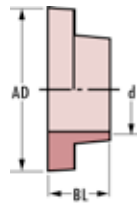
**TRI18ST**

**Welding neck**

**PN10**



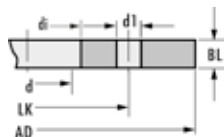
d mm	AD Zoll	BL mm	VP Pcs
160	212	202	1



**K19ST**

**PP Flange with steel insert**

d mm	DN mm	di mm	LK mm	d1 mm	Nr. of holes	BL mm	AD mm	VP Pcs
160	150	178	240	22	8	24	285	1

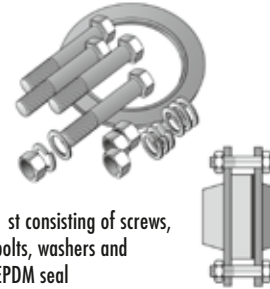


Dimensions conform  
to DIN 2501 PN16

**Accessories**

**K19A**

**Flange seal set KE18-steel flange**

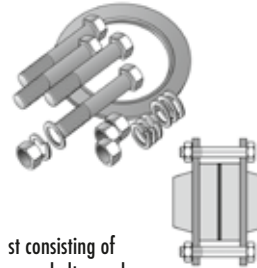


1 st consisting of screws,  
bolts, washers and  
EPDM seal

d mm	Nr. of holes	VP Pcs
20	4	1
25	4	1
32	4	1
40	4	1
50	4	1
63	4	1
75	4	1
90	8	1
110	8	1
125	8	1
160	8	1

**K19K**

**Flange seal set KE18-KE18**

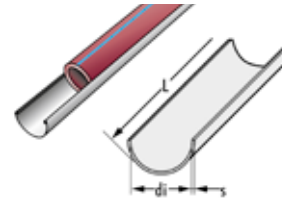


1 st consisting of  
screws, bolts, washers  
and EPDM seal

d mm	Nr. of holes	VP Stk
20	4	1
25	4	1
32	4	1
40	4	1
50	4	1
63	4	1
75	4	1
90	8	1
110	8	1
125	8	1
160	8	1

**K88**

**Pipe channel**

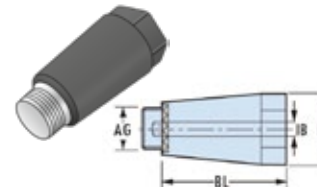


Galvanised steel –  
d20, d25 and d32 have clips  
to lock the pipe into the channel

di mm	s mm	L mm	VP Pcs
20	0,6	2000	20
25	0,6	2000	20
32	0,6	2000	20
40	0,6	2000	10
50	0,8	2000	10
63	0,8	2000	10
75	0,8	2000	10
90	0,8	2000	10
110	0,9	2000	10

**K95**

**Stopper**

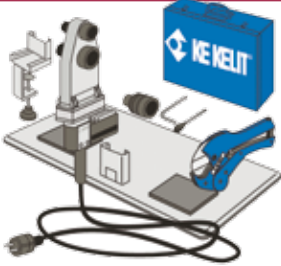


AG Zoll	BL mm	D mm	IB mm	VP Stk
1/2"	80	36	12	10
3/4"	80	42	12	10

## Tools

### WZ100

### Welding set



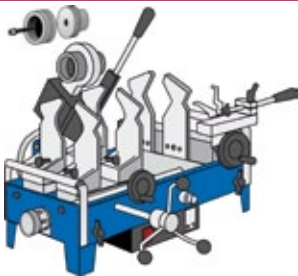
Pipe welding machine includes case, table clamp and floor rest and pipe cutter d16–40mm

**Heating elements: d20 – d32 mm**

**Heating elements: d20 – d40 mm**

### WZ110

### Pipe welding machine



Pipe welding machine. Includes case, heating elements **d20–d90 or d25–d125**

Pipe cutters: **d20–d75, d50–d140**

Special gloves and pipe rests

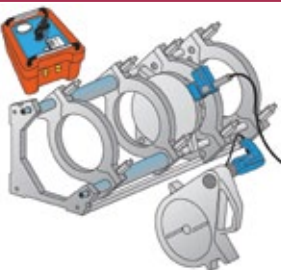
Packaged in transport crate

**d20–d90 machine**

**d25–d125 machine**

### WZ115

### Butt welding machine



Hydraulic butt welding machine 230 Volt, 1000 Watt.

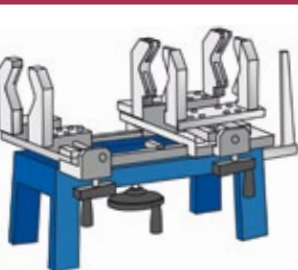
Includes plane cutter, welding plate

**d40–d160 welding inserts.**

Packaged in transport crate.

### WZ120

### Overhead welding machine



For making polyfusion joints in areas that cannot be accessed with the table welding machine.

Can be used for the pipe types **TRI 02 and TRI 08.**

Includes hand welding machine (1200 Watt)

**d50–d110 welding tools, d16–d75 and**

**d50–d140 pipe cutters, timer and special gloves.**

Packaged in transport crate.

**Weight of machine: approx. 12 kilos**

### WZ122

### Welding tools



Heating elements

d mm	VP Pcs
20	1
32	1
40	1
50	1
63	1
75	1
90	1
110	1
125	1

### WZ124

### Welding tools for saddle fittings



d mm	VP Pcs
40–63 x 20/25	1
75–125 x 20/25	1

### WZ125

### Drill for saddle fittings



d mm	VP Pcs
24	1

### WZ129

### Timer



For setting and checking the welding times of **d20–d125** pipes.

### WZ130

#### Pipe cutter



d mm	VP Pcs
16–40	1
Replacement blade	1

### WZ135

#### Wheel pipe cutter



d mm	VP Pcs
20–75	1
50–140	1
110–160	1
Replacement wheel: 20–75	1
Replacement wheel: 50–140	1
Replacement wheel: 110–160	1

### WZ140

#### E-socket welding machine

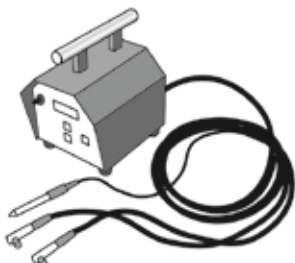


d mm	VP Pcs
20–110	1

For welding the E-UNI welding socket K17. Hand scraper included.

### WZ141

#### E-socket welding machine



d mm	VP Pcs
125–160	1

For welding the E-UNI welding socket KE17. Hand scraper included.

### WZ145

#### Pipe scraper



d mm	VP Pcs
Hand scraper d110–160mm	1

For shaving of the pipes before electrofusion welding

### WZ146

#### E-socket aligner



d mm	VP Pcs
20–63	1
63–160	1

For fixing the electrofusion socket

### WZ150

#### Alu peeler



d mm	VP Pcs
20	1
25	1
32	1
40	1
50	1
63	1
75	1
90	1

For peeling Alu composite pipes TRI01 before welding. Remove the screw to extend the peeling area if the pipe is going to be welded to an E-UNI socket K17. Peeler can be connected to a drill.



Please note that for technical printing reasons the numbers are written according to the common practice in the German speaking countries (i.e. the number and the decimals are separated by a comma).

Full technical back-up and support for the KEtrix-pipe system is provided by KE KELIT-Austria/Europe.

The network of sales partners, subsidiaries and agents is constantly being expanded. Please ask at the Austrian headquarters for the current status.

## **KE KELIT**

Kunststoffwerk GesmbH.  
Ignaz-Mayer-Straße 17  
A-4020 Linz  
Austria – Europe

Tel. +43 (0)5 0779

Fax +43 (0)5 0779 118

office@kekelit.com  
www.kekelit.com

The technical contents in this brochure are for your information and consultation. We are not liable for the contents. The application and installation of the products should be adapted to the individual requirements of each project. **KE KELIT** is constantly improving its products and retains the right to make technical changes in the course of these improvements. We are not liable for printing and spelling errors.  
© by KE KELIT, Ketrax Handbook 03/2014 engl.





Zertifiziertes Qualitätssicherungssystem  
durch ÖQS

ÖNORM EN ISO 9001:2000

Reg.Nr.366/0



Mitglied österreichischer Arbeitskreis  
KUNSTSTOFFROHR  
RECYCLING

ARA-Lizenz Nr.9087



Kunststoffwerk GesmbH.  
Ignaz-Mayer-Straße 17  
A-4020 Linz  
Austria – Europe

Tel. +43 (0)5 0779

Fax +43 (0)5 0779 118

office@kekelit.com

www.kekelit.com



**KE KELIT®**

INNOVATIVE PIPE SYSTEMS

