Uponor Multilayer Composite pipe system for tap water and heating

Technical information - UK

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1 Uponor MLC Tap water and heating

1.1 System description

Whether for a drinking water installation or for connecting a heating system, the Uponor Multilayer Composite pipe system is the perfect solution. The comprehensive system enables installation from the plant-room to the point-of-use. Installation of the Uponor Multilayer system is particularly fast, simple and economical.

Based on a core of an aluminium pipe, layered inside and out with Polyethylene, the pipe is extremely strong and 100% oxygen diffusion tight.

Available in sizes from 12-110mm, in either coils or straight lengths (coils up to 32mm), the pipe is ‘form-stable’ and can easily be modeled into the optimum profile for each installation. Reducing the number of connections required in a plumbing scheme is in the DNA of the MLC concept. Don’t add a connection, make a bend instead.

Using MLC for your installation offers a wide range of benefits. Old plumbing traditions are being replaced by systems more capable of adapting to the demands of modern buildings and designs.

Uponor composite pipe system

- Pipe dimensions from 12 to 110mm for any property size
- One pipe – many suitable fitting technologies for different installation tasks
- Form stable with low thermal expansion, similar to metal pipes
- Ideal for use with manifold installations
- No hot-works
- Ideal for surface and in-wall mounting
- Comprehensive, practical delivery program for every installation requirement

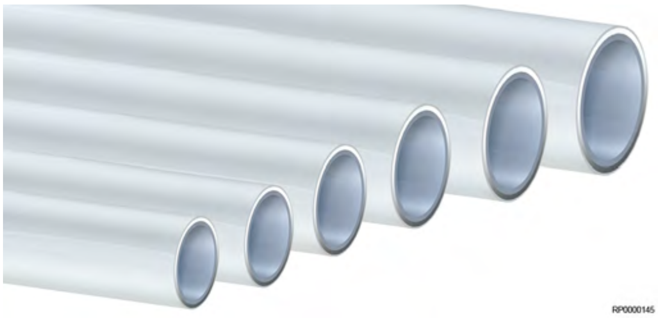
1.2 Component overview - pipes

Uponor Uni-Pipe PLUS

100% oxygen-diffusion-tight 5-layer composite pipe for drinking water distribution and heating applications

- Unique seamless aluminium layer using SAC technology WRAS and KIWA approved for drinking water distribution
- Removable hygienic pipe caps according to BS EN 806
- Minimum bending radii
- Pipe stiffness optimised for straight bars necessary when mounting on a wall surface
- Dimensions 14 – 32 mm

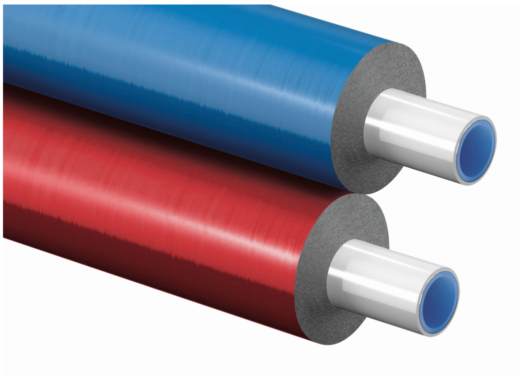
Uponor MLC composite pipe



100% oxygen-diffusion-tight 5-layer composite pipe for drinking water distribution and heating applications

- Safety-welded aluminium layer
- WRAS and KIWA approved for drinking water distribution
- Removable hygienic closure according to DIN EN 806
- Dimensions 12, 40 – 110 mm

Insulated Uponor Uni-Pipe PLUS pipes

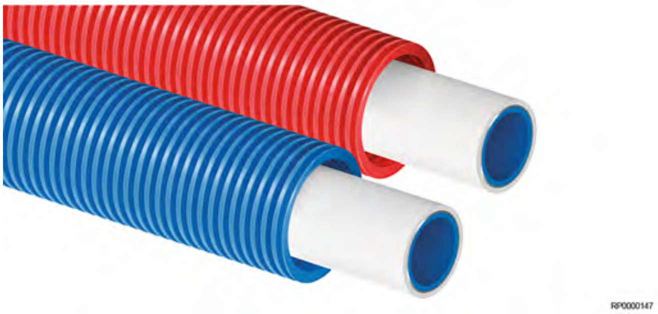


Uponor composite pipes pre-assembled with insulation at the factory

- Pipe assembled with a round extruded pipe insulation made of closed cell Polyethylene foam. Insulation is protected with a moisture proof, hard-wearing plastic foil coating
- S6 (6mm) blue, λ 0.035 W/m*K or 0.04 W/m*K
- S10 (10mm) blue, λ 0.035 W/m*K
- S13 (13mm) red and blue, λ 0.04 W/m*K

Details of reaction to fire classification available upon request

Uponor Uni-Pipe PLUS pipes in conduit



Uponor composite pipes pre-assembled at the factory with HDPE protective tubes.

- Colour differentiation between supply (red) and return heating (blue)
- Uponor Teck protective tubes are also available separately in blue, red and black

1.3 Component overview - jointing technology

Uponor S-Press PLUS fittings

Press fitting for Uponor Uni-Pipe PLUS composite pipes for tap water and heating installations

- Fitting body made of dezincification resistant brass or PPSU
- Flow-efficient design for low pressure loss (zeta values)
- Fixed stainless steel sleeve with press jaw guides
- Unpressed 'leak-path' test safety
- Foil on stainless steel sleeve with 4-way function: Press indicator, size identification, colour coding and printed QR code for additional information
- Dimensions 16 – 32 mm

Uponor S-Press fittings

Press fitting for Uponor MLC composite pipes in tap water and heating installations

- Fitting made of brass or PPSU
- Fixed stainless steel sleeve
- Unpressed l'eak-path' test safety
- Dimension-specific colour coding using coloured stop rings
- Dimensions 14 mm, 40 – 75 mm

Uponor RTM fittings

RP0000150

Fitting made of PPSU or brass with integrated tool-free pressing function, press indicator and colour coding. Dimensions 16 – 25 mm

Uponor RS fitting system

RP0000151

Modular fitting system consisting of base parts and press adapters for distribution and riser pipes 63 – 110 mm.

Uponor S-Press/S-Press PLUS system adapters

RP0000152

For the easy adaption from traditional copper and stainless steel pipes, Uponor S-Press/S-Press PLUS side with fixed press sleeve, test reliability "unpressed leak-path" as well as press indicator and colour coding. Stainless steel/copper side processed according to the specifications of the specific metal system supplier.

Uponor Uni

RP0000153

For screw screw connections to system accessories and system components with ½" (Uni-C) or ¾" (Uni-X) threaded connections.

1.4 Component overview - tools

Tools for installation of composite pipe

Pressing tools and press jaws as well as cutting, bending and calibration tools for installing the Uponor composite pipe system in tap water and heating installations.

2 Uponor composite pipes

2.1 Uponor Uni-Pipe PLUS


PH000064

Uponor Uni-Pipe PLUS is the unique composite pipe with no weld seam, which permits increased fixing distances and reduces the bending radii by up to 40% compared to conventional composite pipes. This special pipe construction means fewer pipe fixing points are required and forming bends in the pipe is much easier and makes the system more adaptable to suit the installation - saving time and money by reducing the number of fittings and pipe clamps required.

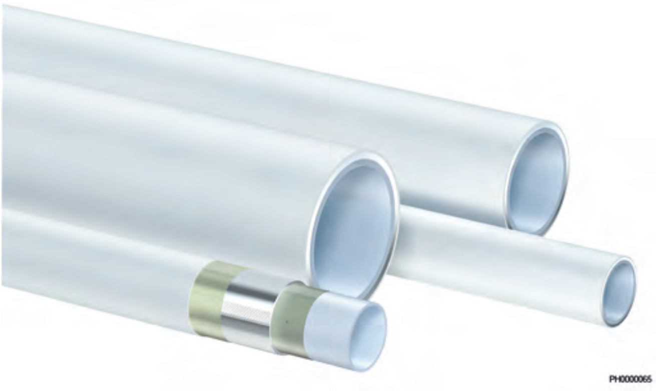
Uponor Uni Pipe PLUS

- Seamless construction for maximum safety
- High form stability and minimal thermal expansion
- Improved bending properties
- 100% oxygen-tight
- Low weight
- Dimensional range 14 – 32 mm
- Large mounting distances without clips

Technical data and delivery dimensions

Pipe dimension [mm]	14 x 2.0	16 x 2.0	20 x 2.25	25 x 2.5	32 x 3.0
Inner diameter ID [mm]	10	12	15.5	20	26
Coil length [m]	200	10/25/100/120/200/500	25/100/500	50	50
Bar length [m]	-	3/5	3/5	3/5	3/5
Outer diameter of coil [cm]	80	80/80/78/78/80/114	80/80/114	114	114
Weight of coil/bar [g/m]	91/-	111/119	161/171	233/247	364/394
Weight of coil/bar with water at 10 °C [g/m]	170/-	224/232	350/360	547/560	895/926
Weight per coil [kg]	18.2	1.1/2.8/11.1/14.3/23.8/59.5	4/16.1/80.5	11.65	18.2
Weight per bar [kg]	-	0.35/0.59	0.52/0.86	0.74/1.24	1.18/1.97
Water volume [l/m]	0.079	0.113	0.189	0.314	0.531
Pipe roughness k [mm]	0.0004	0.0004	0.0004	0.0004	0.0004
Thermal conductivity λ [W/mK]	0.40	0.40	0.40	0.40	0.40
Coefficient of expansion a [m/mK]	25×10^{-6}	25×10^{-6}	25×10^{-6}	25×10^{-6}	25×10^{-6}

2.2 Uponor MLC pipe



The Uponor MLC composite pipe is used as distribution and riser pipes in drinking water distribution and heating/cooling applications. Uponor MLC (Multilayer Composite) pipes are easy to process, corrosion-free and can be used for a variety of installation tasks, particularly in large residential and commercial properties.

Uponor MLC

- Safety-welded aluminium layer
- High form stability
- Corrosion-free and sound-absorbing
- Fast installation without soldering or welding
- 100 % oxygen-tight
- Dimensional range 12, 40 – 110 mm

Technical data and dimensions

Pipe dimension [mm]	**12 x 1.6**	**40 x 4.0**	**50 x 4.5**	**63 x 6.0**	**75 x 7.5**	**90 x 8.5**	**110 x 10.0**
Inner diameter ID [mm]	8.8	32	41	51	60	73	90
Coil length [m]	-	-	-	-	-	-	-
Bar length [m]	-	3/5	3/5	3/5	5	5	5
Outer diameter of coil [cm]		-	-	-	-	-	-
Weight of coil/bar [g/m]		-/508	-/745	-/1224	-/1788	-/2545	-/3597
Weight of coil/bar with water at 10 °C [g/m]		-/1310	-/2065	-/3267	-/4615	-/6730	-/9959
Weight per coil [kg]		-	-	-	-	-	-
Weight per bar [kg]	-	1.52/2.54	2.24/3.73	3.67/6.12	8.94	12.73	17.99
Water volume [l/m]	0.061	0.800	1.320	2.040	2.827	4.185	6.362
Pipe roughness k [mm]	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Thermal conductivity λ [W/mK]	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Coefficient of expansion a [m/mK]	25 x 10^{-6}	25 x 10^{-6}	25 x 10^{-6}	25 x 10^{-6}	25 x 10^{-6}	25 x 10^{-6}	25 x 10^{-6}

2.3 Temperature ranges (Operating Conditions)

• **Domestic services** - 10°C to 70°C where the water temperature does not continuously exceed 70ºC, 10 bar (Conditions to application Class 2 - BS EN ISO 21003- 1:2008). The maximum short-term malfunction temperature is 95ºC for an accumulative 100 hours over the working life of the system.

• **Heating systems (high temperature radiators)** - where the water temperature does not continuously exceed 80ºC, 10 bar (Conditions to application Class 5 - BS EN ISO 21003-1:2008). The maximum short-term malfunction temperature is 100ºC for an accumulative 100 hours over the working life of the system.

• **Chilled water** - -10°C to 10°C at a maximum pressure of 10 bar. If risk of damage from freezing, a suitable anti-freeze additive must be used. Any additive must be suitable for use with Polyethylene, PPSU, EPDM and CW625N brass

Uponor multi-layer pipe can be used for DHW recirculating systems, provided the operating temperatures and pressures do not exceed the maximum conditions detailed under ‘Domestic Services’

2.4 Uponor pre-insulated Multilayer composite pipe coils

Uponor composite pipes are available from the factory pre-assembled with thermal insulation to prevent heat losses or unwanted heat gain.

The round extruded pipe insulation is made of closed cell polyethylene foam and is encapsulated within a hard-wearing plastic foil coating. This plastic coating can be in either red or blue colours to make an easier identification of each type of service pipe.

Uponor factory insulated pipes offer distinct advantages over bare pipes which require insulation to be added on site. On the one hand, they ensure rapid installation progress whilst keeping the insulation unbroken from the point of supply to the point of use. The good thermal resistant properties of the insulation materials maintains small outside pipe diameters whilst providing optimum thermal properties.

Pre-insulated pipes consist of three components - the Multilayer pipe, the foam insulation and the plastic foil protective barrier.

The foam insulation is available in two classes to BS EN 13501-1: 2018 *Fire classification of construction products and building elements Classification using data from reaction to fire tests*, either Class E or class BL-S2-D0,

Full details of classifications using reaction to fire test data are available upon request.

Pre-insulated composite pipes

- Seamless or OWC-technology for highest level of safety
- Time savings compared to on-site insulation of bare pipes
- Robust and hard-wearing plastic foil coating to protect against damage and moisture

Pre-insulated Uponor Uni-Pipe PLUS composite pipes

Insulation class WLS 040

Pipe OD x material thickness [mm]	In all-round insulation, thickness [mm]										In asymmetrical insulation, thickness [mm]				In conduit
	4	OD1)	6	OD1)	9	OD1)	10	OD1)	13	OD1)	9	W x H2)	26	W x H2)	
14 x 2.0			•	26											
16 x 2.0	•	24	•	28	•	34			•	42					
20 x 2.25	•	28	•	32	•	38			•	46					
25 x 2.5	•	33	•	37	•	43			•	51					
32 x 3.0	•	40			•	50									

1) Outer diameter (OD) [mm]

2) Width x height [mm]

Insulation class WLS 035

Pipe OD x material thickness [mm]	In all-round insulation, thickness [mm]										In asymmetrical insulation, thickness [mm]				In conduit
	4	OD1)	6	OD1)	9	OD1)	10	OD1)	13	OD1)	9	W x H2)	26	W x H2)	
16 x 2.0			•	28			•	36							
20 x 2.25			•	32			•	40							
25 x 2.5			•	37			•	45							

1) Outer diameter (OD) [mm]

2) Width x height [mm]

3 Joint technologies for Uponor composite pipes

3.1 Fitting systems - overview

Differing installation situations and different applications demand customised and adapted fitting design concepts. This is why Uponor develops and produces not only pipes, but also the appropriate fitting systems tailored to the respective application. The Uponor fitting range with couplings, elbows, T-joints and a large number of practical system components creates the perfect range for fast, safe and practical installation and exceeds the requirements placed on hygienic drinking water distribution and modern heating systems.

Overview of the Uponor composite pipe fitting systems

Uponor fitting system			Press fitting, metal				Press fitting, composite		RTM fitting	Uni-C ½"	Uni-X ¾"
			S-Press PLUS	S-Press		RS	S-Press PLUS	S-Press			
Colour code/ dimension		Pipe type	A	B	C	D	E	F	G	H	I
	12	MLC								•	
⬛	14	Uni Pipe PLUS		•						•	•
🟫	16	Uni Pipe PLUS	•			•	•		•	•	•
🟧	20	Uni Pipe PLUS	•			•	•		•	•	•
🟥	25	Uni Pipe PLUS	•			•	•		•		•
🟩	32	Uni Pipe PLUS	•			•	•				
🟦	40	MLC			•	•		•			
🟨	50	MLC			•	•		•			
🟩	63	MLC			•	•		•			
⬜	75	MLC			•	•		•			
🟪	90	MLC				•					
🟧	110	MLC				•					

Properties

Uponor fitting system	Press fitting, metal				Press fitting, composite		RTM fitting	Uni-C ½"	Uni-X ¾"
	S-Press PLUS	S-Press		RS	S-Press PLUS	S-Press			
	A	B	C	D	E	F	G	H	I
Dimension-specific colour coding	•	•	•	•	•	•	•		
Inspection window for checking insertion depth	•	•	•	•	•	•	•		

Uponor fitting system	Press fitting, metal				Press fitting, composite		RTM fitting	Uni-C ½"	Uni-X ¾"
	S-Press PLUS	S-Press		RS	S-Press PLUS	S-Press			
	A	B	C	D	E	F	G	H	I
Press indicated by detachment of the foil from the press sleeve	•				•				
Press indicated by removal of the stop ring		•		•[1]					
Press indicated by press imprint on press sleeve	•		•	•[2]	•	•			
Assembly without deburring	•	•		•[1]	•		•	•	•
Mounting without calibration	•	•	•	•	•	•		•	•
Connector unpressed, untight	•	•	•	•	•	•			
Integrated pressing function							•		
Modular fitting system				•					

[1] *Up to a dimension of 32 mm*

[2] *Dimension 40 mm and up*

3.2 Uponor S-Press PLUS - a new generation of fittings

Sturdy press sleeves made of stainless steel

Corrosion resistant stainless steel press sleeves protect the O-rings from damage and give the finished connection high pull-out and bending resistance.

High-quality materials

Fittings are either made made of dezincification resistant brass according to the 4MS positive list, or are alternatively made of the high-performance plastic PPSU allowing unrestricted use in tap water and heating installations.

Precise press jaw location and pipe insertion control

The special shape of the press sleeves, and the newly designed stop rings, ensure risk-free, precise positioning of the Uponor press jaws. Inspection windows in the stainless steel press sleeves make it easy to check that the pipe has been inserted to the correct depth before pressing the connection.

Dimension-specific colour coding

The size colour coding and clearly legible figures of the different dimensions are easy to recognise from a great distance and even in difficult lighting conditions.

Unique pressing control and test safety

The stainless steel press sleeves are sheathed with a colour-coded foil depending on the dimension of the fitting. This foil is released when the fitting is pressed and can be easily removed identifying that the connection has been completed. A second safety feature is the unpressed "leak-path" function.

Flow-optimised design

The streamlined design provides low pressure loss (zeta values) and ensures an optimal flow performance giving the best system performance.

Fast and simple installation

Just three steps to complete the connection without the need to deburr or calibrate the pipe: Cut the pipe, add the fitting and press. The slim design of the finished connection also makes adding insulation easier.

100 % compatible with existing Uponor components

Uponor S-Press PLUS fittings are matched to the existing Uponor composite pipe systems and tools.

Simple adjustment

The flexible pipes can still be adjusted to suit the installation until completion of the press. However, even after the pressing process, with care, the pipes can still be formed until the start of the pressure test.

Online information available via QR code

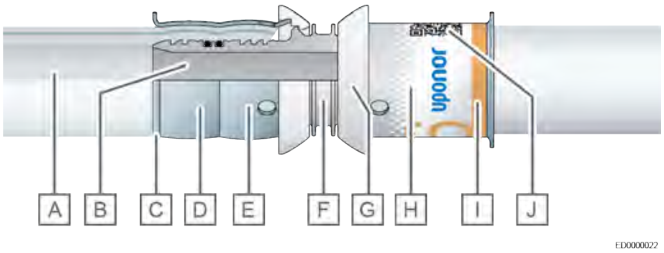
The printed QR code provides 24/7 access to installation support, project database, item lists and on-line orders.

Certifications - a few examples

- WRAS
- KIWA KUKReg4
- DVGW

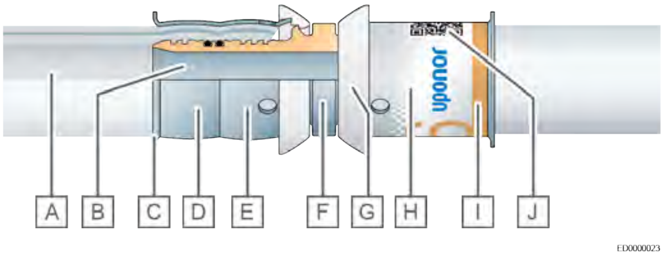
3.3 Uponor S-Press PLUS - design

Uponor S-Press PLUS composite fittings made of PPSU



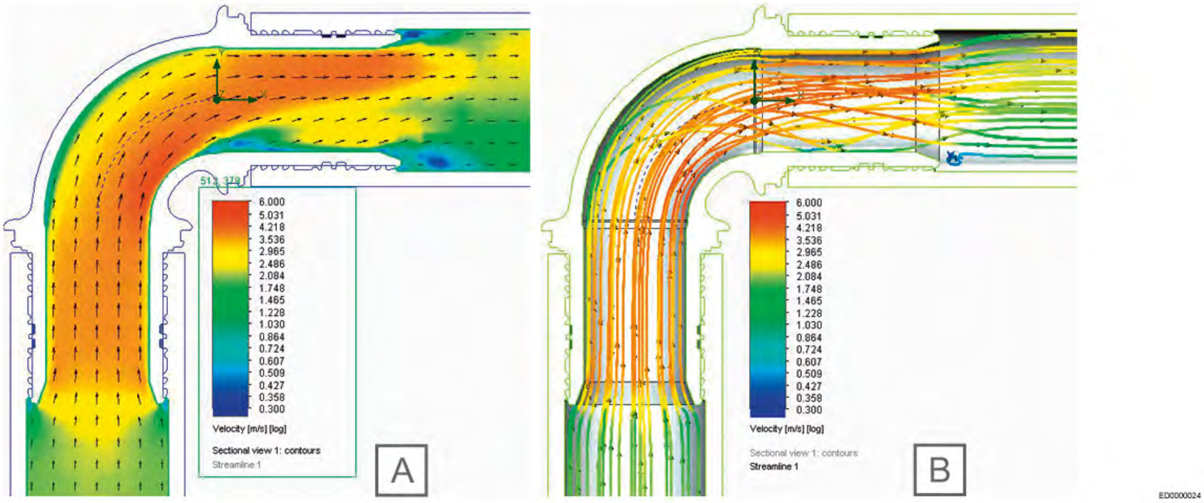
Item	Description
A	Uponor MLC or Uni-Pipe PLUS composite pipe 16-32mm
B	Flow-optimised design
C	Sleeve collar for press jaw centring
D	Stainless steel press sleeve
E	Inspection window for insertion depth
F	Fitting body made of PPSU
G	Press jaw stop
H	Press indicator film
I	Colour-coded dimensional marking
J	QR code for additional information

Uponor S-Press PLUS made of dezincification resistant brass



Item	Description
A	Uponor MLC or Uni Pipe PLUS composite pipe 16-32mm
B	Flow-optimised design
C	Sleeve collar for press jaw centring
D	Stainless steel press sleeve
E	Inspection window for insertion depth
F	Fitting body made of dezincification resistant brass
G	Press jaw stop
H	Press indicator film
I	Colour-coded dimensional marking
J	QR code for additional information

Flow-optimised fitting design



Velocity [m/s] [log], View	Value
A	Sectional view 1: contours
B	Streamline 1

The S-Press PLUS radial press jointing technology is designed to be free of dead space, avoiding any risk of contamination due to stagnating water inside the fitting. Proven by microbiological tests at the Institute for Environmental Hygiene and Toxicology in Gelsenkirchen, Germany.

3.4 Uponor S-Press PLUS - fitting/tool combinations

Item	Description
A	Manual pressing tool
B	Interchangeable inserts
C	UP 110, battery tool
D	UP 75 EL, electrical tool 230 V
E	UPP1, pressing jaw

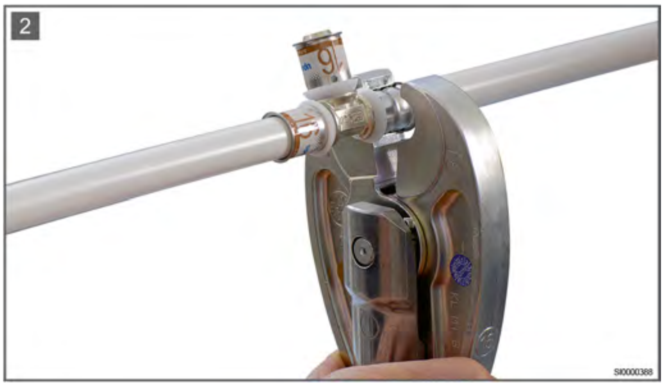
Item	Description
F	Mini32, battery tool
G	Mini KSP0, pressing jaw
H	S-Press PLUS/S-Press PLUS PPSU fitting dimensions in mm

3.5 Uponor S-Press PLUS - fitting assembly

Insert the Uponor composite pipe into the fitting

Insert the Uponor composite pipe into the fitting. The pipe end does not have to be deburred or calibrated beforehand.

Apply the press jaw



Apply the press jaw, with the same colour coding as the fitting, to the press jaw guide in the stainless steel press sleeve.

Once the press has been completed the indicator foil is easily removed

After pressing, the press indicator foil can easily be removed and a clear deformation of the stainless steel press sleeve is visible.

Unpressed connections are reliably detected

Unpressed connections are quickly detected during the leak test due to the unpressed 'leak-path' function. An unpressed fitting also stands out clearly due to the indicator foil still being present on the stainless steel press sleeve.

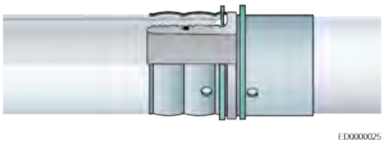
3.6 Uponor S-Press PPSU fittings up to 75 mm

We have extended the dimensional range of our Uponor S-Press PPSU fittings with 63 mm and 75 mm, especially for economical drinking water distribution and heating installations in commercial buildings. Uponor S-Press composite fittings made of the high performance plastic PPSU are light, impact resistant and have very low stress crack sensitivity.

For the direct thread transition there are also 40 — 75 mm tin-plated S-Press adapter sleeves and S-Press adapter nipples made of dezincification resistant brass.

As a supplement to the modular Uponor RS fitting system and in conjunction with the tried and tested Uponor MLC composite pipes, it is now possible to realise pipe networks, including distribution and riser pipes, that are easy to install and cost-effective.

Uponor S-Press PPSU fitting 40 — 75 mm

Dimensional range	Description/properties	Material	Colour code/ dimension
 **40 — 75 mm**	• Unpressed 'leak-path' test safety. • Dimension-specific colour coding of the stop rings. • Press sleeve firmly connected to the fitting protects the O-rings from damage. • Press sleeve with observation windows to easily check the insertion depth of the pipe both before and after pressing. • The flexible pipes can still be adjusted to suit the installation until completion of the press. However, even after the pressing process, with care, the pipes can still be formed until the start of the pressure test. • High pull-out and bending strength for the finished connection.	• Fitting made of PPSU • Press sleeve made of stainless steel • Coloured plastic stop elements	🟦 40 🟧 50 🟩 63 🟪 75

Uponor S-Press PPSU 40 — 75 mm - fitting/tool combinations

Item	Description
A	UP 110, battery tool
B	UPP1, pressing jaw
C	UP 75 EL, electrical tool 230 V
D	Base adapter jaw with press chain
E	S-Press PPSU fitting dimensions in mm

Uponor S-Press PPSU - fitting assembly with press chain

Insert the deburred composite pipe end

Insert the deburred composite pipe end into the fitting until fully located. Check that the pipe is visible in the observation windows, and place the appropriate press chain (same dimension and same colour code as fitting) around the press sleeve up to the coloured stop.

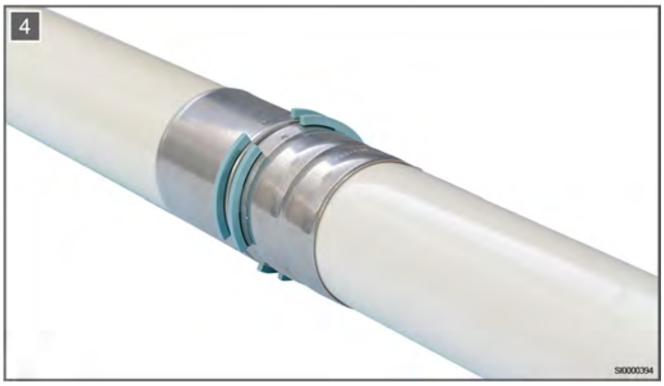
Attach the base adapter onto the press chain

Locate the base press adapter onto the press chain and complete the pressing cycle.

A clear deformation of the press sleeve

After pressing, remove the pressing chain and the successful pressing is visible by a clear deformation of the press sleeve (visual inspection).

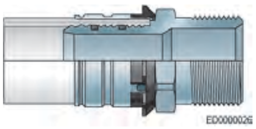
An unpressed connection leaks

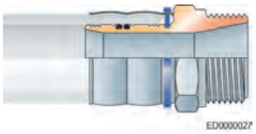


For additional safety, an unpressed connection leaks under pressure load (unpressed 'leak-path' function).

3.7 Other fittings for Uponor composite pipes

Uponor S-Press metal fittings, dimension overview

Dimensional range	Description/properties	Material	Colour code/ dimension
 **14 mm**	• Unpressed 'leak-path' test safety. • Dimension-specific colour coding of the stop rings. • Pressing indicator by means of coloured stop rings, which detach during the pressing process. • Press sleeve firmly connected to the fitting protects the O-rings from damage. • Press sleeve with observation windows to easily check the insertion depth of the pipe both before and after pressing. • The pipe can be aligned after pressing (until the start of the pressure test). • High pull-out and bending strength for the finished joint. • Assembly without deburring.	• Brass, tin-plated • Profiled aluminium press sleeve • Dimension-specific colour coded stop rings	⬛ 14

Dimensional range	Description/properties	Material	Colour code/ dimension
 **40 — 75 mm**	• Unpressed 'leak-path' test safety. • Dimension-specific colour coding of the stop rings. • Press sleeve firmly connected to the fitting protects the O-rings from damage • Press sleeve with observation windows to easily check the insertion depth of the pipe both before and after pressing. • The flexible pipes can still be adjusted to suit the installation until completion of the press. However, even after the pressing process, with care, the pipes can still be formed until the start of the pressure test. • High pull-out and bending strength for the finished connection.	• Brass, tin-plated • Press sleeve made of stainless steel • Dimension-specific colour coded stop rings	🟦 40 🟧 50 🟩 63 🟪 75

Uponor S-Press and S-Press PLUS system adapters

Note

When connecting to a third-party system, the connection specifications of the specific manufacturer or system supplier must be observed.

The Uponor S-Press/S-Press PLUS system adapters are the ideal solution for a transition from Uponor Multilayer to an existing metallic pipe system, particularly when it comes to a renovation or a system extension. The fitting side for connecting to metal pipes is processed according to the manufacturer's specifications using the correct pressing tool and press jaw (M or V profile). The Uponor S-Press/S-Press PLUS side is simply and securely connected to the Uponor composite pipe using the approved Uponor press tool and press jaw.

Copper tail adapters are suitable for use with press connections, and compression fittings to BS EN 1254-2.

Uponor RS fitting system for distribution lines and risers

The Uponor modular RS fitting system, for distribution and riser pipes, lets you make all required press connections safely and easily on the workbench.

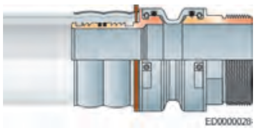
On site, the pre-assembled composite pipe sections are then inserted and locked in to the base fittings without the need for tools. This ensures a fast and safe installation even under the most difficult spatial conditions. Difficult work with heavy pressing tools in cramped construction site situations, or in overhead positions, is a thing of the past.

Uponor RS is a unique fitting system for risers and other supply lines used in tap water and heating/cooling applications. Thanks to the modular concept, hundreds of fitting variants can be produced with only a few system components.

Uponor RS fitting system - benefits

- Innovative plug-in connection of adapters in to the base bodies for Uponor multilayer pipes up to 110 mm
- Just 40 components will make over 400 different fitting configurations
- Efficient stocking due to only 40 items
- Adjustable until completion of the leak test
- Dimension-specific colour coded stop rings

Uponor RS fittings, dimension overview

Dimensional range	Description/properties	Material	Colour code/ dimension
 63 — 110 mm	• Unpressed 'leak-path' test safety. • Dimension-specific colour coding of the stop rings. • Modular range of fittings, consisting of matching base bodies and press adapters. • Press adapters with fixed stainless steel press sleeves can be conveniently pressed on to the Uponor composite pipes away from the installation location, e.g. at the workbench. • In the second step, the pre-assembled pipe lengths are inserted into the respective base bodies and fastened using a locking element for a secure connection.	• Brass, tin-plated • Press sleeve made of stainless steel • Coloured plastic stop element • Plastic locking element	🟩 63 🟪 75 🟥 90 🟧 110

Flexible main manifold structure

Modular manifold structure – with the modular fitting system, RS spacers and RS adapters, manifolds of different sizes can be assembled quickly in just a few simple steps.

Flexible angles

Flexible angles – walls and ceilings are often not perpendicular to each other, especially in old buildings. Using an RS spacer (5 mm) in conjunction with two 45° angle base bodies, adjustable angles can be achieved just by rotating the components.

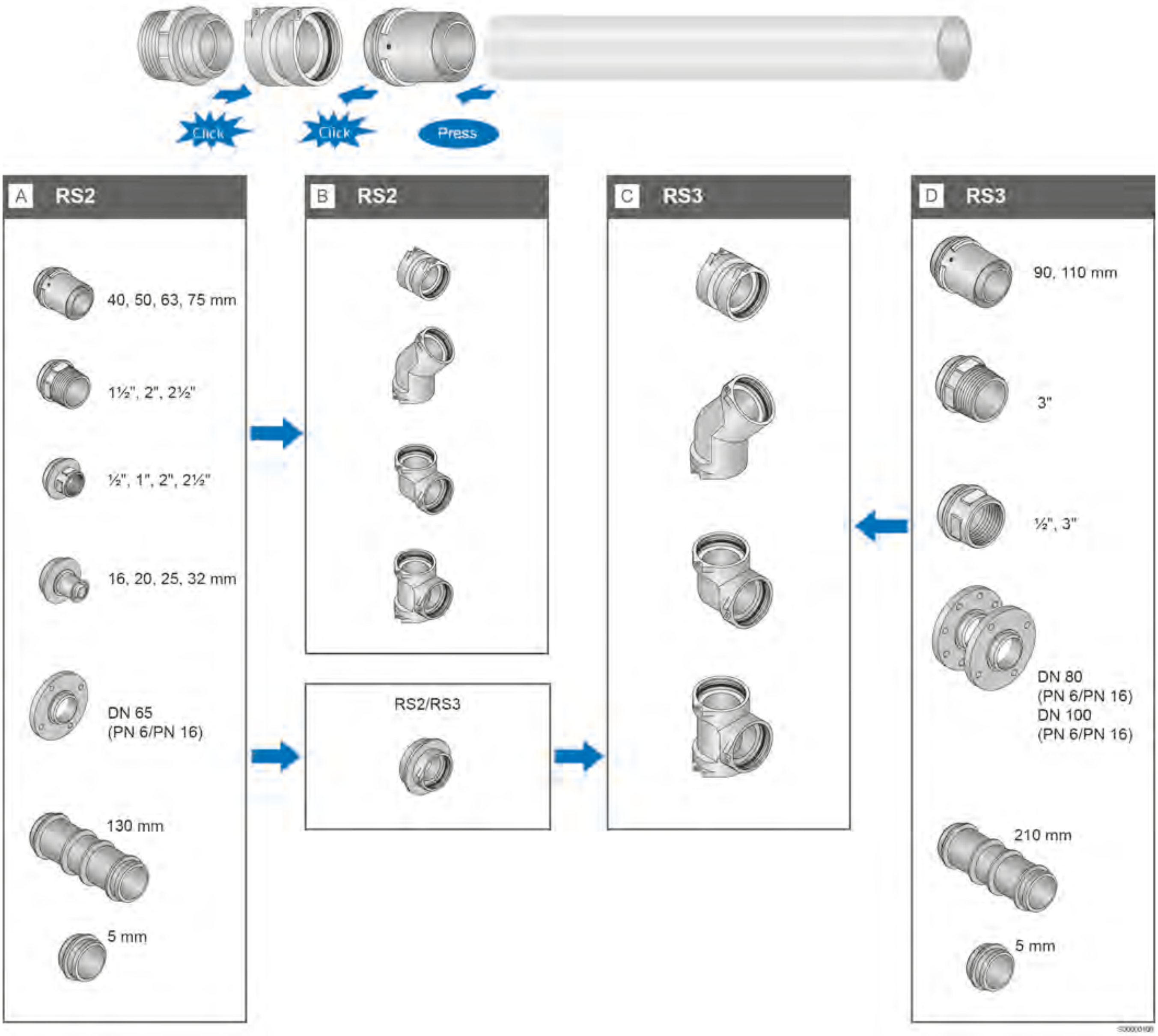
Distance adapters

Simple and quick changes to pipeline levels – using RS spacers in combination with a 45° angle base body, system branches can quickly be made avoiding parallel pipe runs or obstructions.

Fixed points

Fixing points are often required in pipeline systems with long supply sections. RS2 and RS3 spacers allow these fixing points to be created quickly and easily. The bracket guide in the center of the spacer provide a sturdy fixing point for the fastening of the clamps.

The RS modular principle

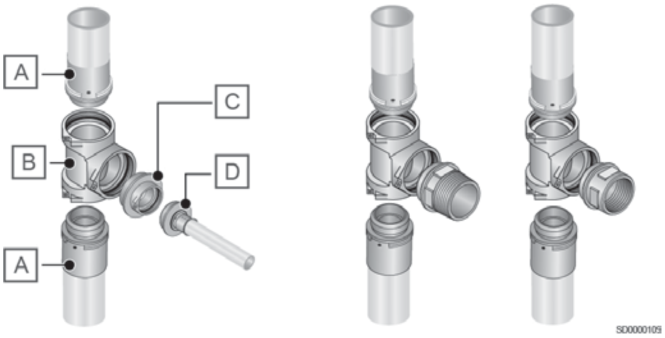


Item	Description
A	RS2 Adapter
B	RS2 Base Body

Item	Description
C	RS3 Base Body
D	RS3 Adapter

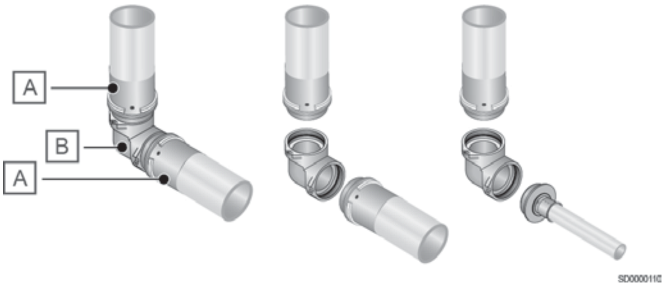
Configuration examples

T-piece with outlets 90 x 16 x 90



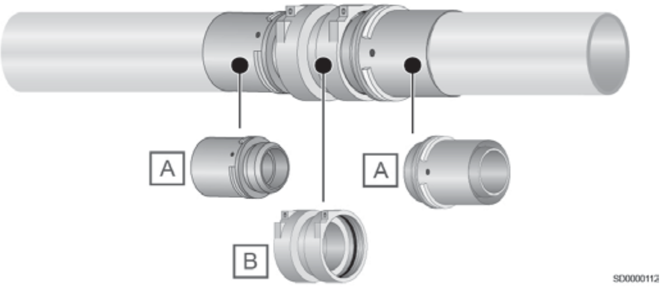
Item	Description
A	RS3 Press adapter
B	RS3 T-base body
C	Reducer RS3 - RS2
D	RS2 Press adapter 16

Angle 90° or 45°



Item	Description
A	RS Press adapter
B	RS angle 90°

Couplings



Item	Description
A	RS Press adapter
B	RS coupling

Processing steps for Uponor RS fitting

Attach press adapter

First the press adapter is inserted on to a composite pipe that has been cut off square and deburred.

Pressing

A permanent connection is established using the press chain and the base press unit corresponding to the pipe size being pressed

Connect with base body

Innovative plug-in technology connects the press adapter and base body to one other.

Locking

Finally, slide the locking pin into the opening of the base body until the locking tooth engages in to the socket

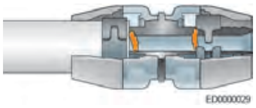
Uponor RTM fittings

Uponor RTM offers a comprehensive range of fittings for Uponor multilayer pipes, which do not require any expensive assembly tools to create the connection. RTM fittings are quick to install and offer a high level of safety and security, both in drinking water distribution and in heating/cooling applications.

RTM fitting benefits

- Integrated pressing function
- Dimension-specific colour coding
- No special tools necessary
- Review capability of the successful connection
- Fast and simple to process

Uponor RTM fittings, dimension overview

Dimensional range	Description/properties	Material	Colour code/ dimension
 **16 — 25 mm**	• One-piece fitting with integrated pressing function (Ring Tension Memory). • The pressing process is initiated by the inserting the pipe; no additional tools are required for pressing. • Audible and visual confirmation of a successful connection • Dimension-specific colour coding of the safety locking device. • The flexible pipes can still be adjusted to suit the installation until completion of the press. However, even after the connection is made, with care, the pipes can still be formed until the start of the pressure test.	• High-performance PPSU plastic or brass • Press ring made of high-strength, specially coated carbon steel	🟫 16 🟧 20 🟥 25

Processing steps for Uponor RTM fittings

Cut the pipe

Cut the pipe perpendicular to the length using aUponor pipe cutting tool.

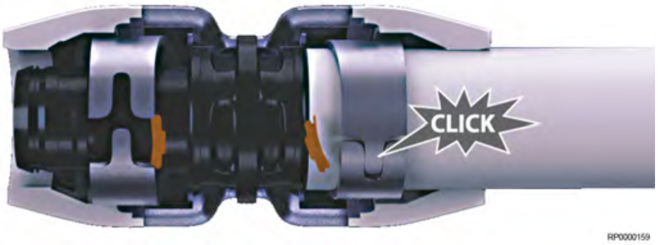
Calibrate

The pipe MUST be calibrated using the RTM calibration tool

Pressing

Insert the pipe in to the fitting until the audible click is heard

Insert the pipe until it clicks



The released safety lock can be seen through the 360° viewing window. It does three things: It holds the press ring in tension until it is pressed, it contains the colour coding for the dimension and it also indicates that the pressing process has been completed.

Uponor Uni

Uponor Uni includes a selection of connections and fittings for use with ½" adapters and ¾" euro-cone connectors/ compression adapters which can be used for both drinking water distribution and heating/cooling applications.

- Simple transitions to other systems and system components
- High flexibility to suit many applications
- Can be connected using conventional tools

Manifolds can be non-valved or with valves on each outlet to allow isolation of each service or heating loop.

The valved manifolds come with Identification discs with pictograms of outlet types to distinguish each service on each port and the cover disc can be swapped for red or blue to identify hot and cold services.

Manifolds come with either 2, 3 or 4 ports and can be assembled together to make the required number of outlets 3, 4, 5, 6, 7, 8, 9, etc

- Manifolds with or without valved zone control for drinking water and heating applications
- Uponor Uni manifolds can be joined together to make the desired number of outlets

Uponor Uni screw connection for Multilayer pipes, dimension overview

Dimensional range	Description/properties	Material
 ED0000030 **14 — 20 mm (Uni-C)** **12 — 25 mm (Uni-X)**	• Two-part screw connection made of brass, with tin-plated union nut and pressure sleeve. • For the direct connection of Uponor composite pipes to ½" Uponor fittings, manifolds and sanitary connections. • The ¾" variant allows connection to ¾" euro-cone moulded parts.	• Union nut, brass - tin-plated • Pressure sleeve - brass, plated

4 Drinking water distribution

4.1 System description

Special Uponor tap water conections enable a economical and simple installation, as well as hygienic solution once the system is in operation. The multi-functional concept means that fewer components are required for the system making the installation quicker and cheaper.

For example, Uponor wall brackets can be used equally well on mounting plates, mounting rails or directly on the wall. Uponor tap water components allow all common connection designs to be installed, from T-joint installation to hygienic loop or series installation.

Drinking water distribution with the Uponor composite pipe system

- Wide range of mounting options with only a few components
- Strong, torsion proof connection of wall brackets and mounting rail
- Wall bracket can be used both on the wall and on metal stud rail
- Flow-optimised U-shaped tap mounting connections for lower pressure losses in loop installations
- Matched system with mounting rails, wall brackets, sound insulation and waste water connection
- Proven Uponor press and RTM fitting connection technology

4.2 The tap water connection system from Uponor

Functional and practical

Uponor tap water components in the multilayer pipe system are the result of further refinement of our innovative products. The perfectly coordinated product range enables you to carry out cost-effective, simple assembly even in areas with restricted access..

More options with fewer components

The multi-functional concept means you need fewer components for your installation. For example, Uponor press wall brackets can be used equally on mounting plates, mounting rails and directly on the wall. The refined design is adapted to all practical requirements.

Optimal design

The Uponor tap water connection system is designed for a fast, easy and practical installation. Features like the fastening screw with "fall arrest", make your work easier and ensure that assembly is carried out quickly and without unnecessary loss of time.

Time savings with prefabrication

The Uponor tap water connection system also includes prefabricated assemblies for common installation requirements - saving you valuable time during installation.

Sophisticated fixing system

Pre-formed mounting rails as well as mounting plates and wall brackets provide the designer and installer many options for each installation.

Practical accessories

Accessories like the Uponor sound kit and waste water kit complete our delivery programe to ensure that nothing is missing on the construction site that is required for professional installation.

4.3 Main tap water components

Uponor wall brackets – quick and professional installation

Note

For an even greater variety of connection types, Uponor S-Press PLUS U wall brackets are now also available with a single-sided reduced connection (16-Rp½"-20 and 20-Rp½"-16 as well as 25-Rp½"-20 and 20-Rp½"-25).

Uponor S-Press PLUS U wall brackets with reduced connection on one side

Uponor wall brackets together with the matching mounting plates, rails and angles enable quick and versatile connections. The guide pin, which is simply inserted into the back of the mounting rail, allows the tap connector fiitting to be easily locked in the desired position (-45°/90°/+45°). The fixing screws ensure a stable and torsion-proof connection between wall plate and rail.

Uponor tap elbows

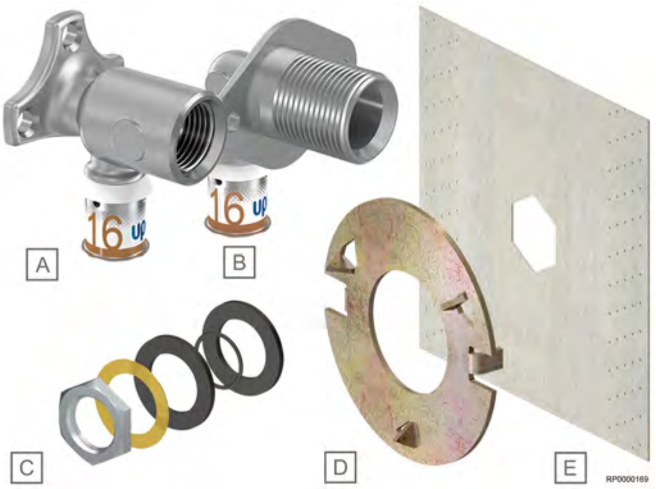
- Made of tin-plated brass
- Can be used either for surface mounting or for use with the Uponor mounting brackets or mounting plates
- Different designs and dimensions for U-shaped, single or double connection
- Available with pressed, RTM or threaded connections

Feed-throughs for loop and series installation in drywall construction

Uponor wall penetrations with female thread, according to BS EN 10226-1, provide technically perfect, torsion-proof penetrations through walls made from drywall, for both new build and renovation projects. As an option, LWC wall brackets with U-tap connections provide a torsion-proof connection combined with improved hygiene when used within a loop or series installation. Upon request, Uponor feed-throughs are available in lengths for installation depths from 25-35mm. Uponor feed-throughs are available with high performance Uponor S-Press PLUS connections

- Connections for common cisterns, taps and outlet fittings

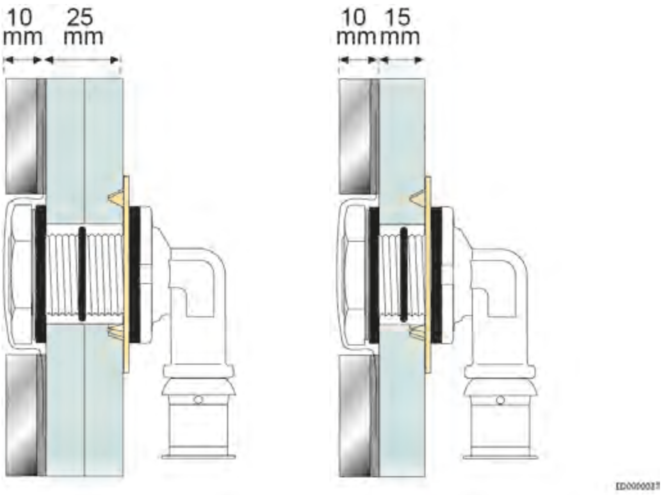
Uponor drywall feed-through



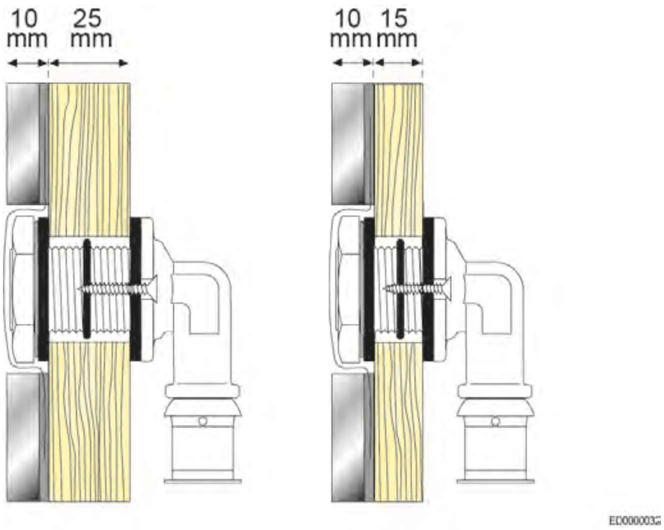
Item	Description
A	Uponor S-Press PLUS U corner wall seal LWC for optimum installation for series or loop installations in walls made from drywall
B	Uponor S-Press PLUS corner wall seal LWC for individual connection
C	Uponor mounting kit LWC
D	Uponor anti-twist device LWC
E	Uponor sealing flange LWC

- Variable installation depths of 25 or 35 mm for use in gypsum dry-wall or wooden wall construction
- Also available with optional sound insulation
- Minimum installation depth, can also be used with low cavity wall depths of only 40 mm
- Torsion resistance guaranteed during installation

Mounting options



Torsion-proof installation in a plasterboard wall with Uponor anti-twist device LWC



Torsion-proof installation in wood panels secured with wood screws

Loop fittings for hygienic drinking water distribution

Uponor U-tap elbows and equipment connections enable hygienic loop and series installations

5 Design principles for water distribution

5.1 General information

Drinking water is our most important foodstuff

Drinking water intended for human consumption must be free from pathogens, fit for human consumption and pure. Its quality must be such that it does not adversely affect human health even long after consumption. This is why the strictest demands are made on the quality of drinking water. No other foodstuff is checked as regularly or frequently.

Protection of drinking water

The protection of drinking water is the responsibility of the government's Drinking Water Inspectorate. However, water undertakers, architects, designers, installers and even property owners also bear the responsibility to ensure that drinking water at every tap complies with the chemical and microbiological requirements (parameters) of the regulations.

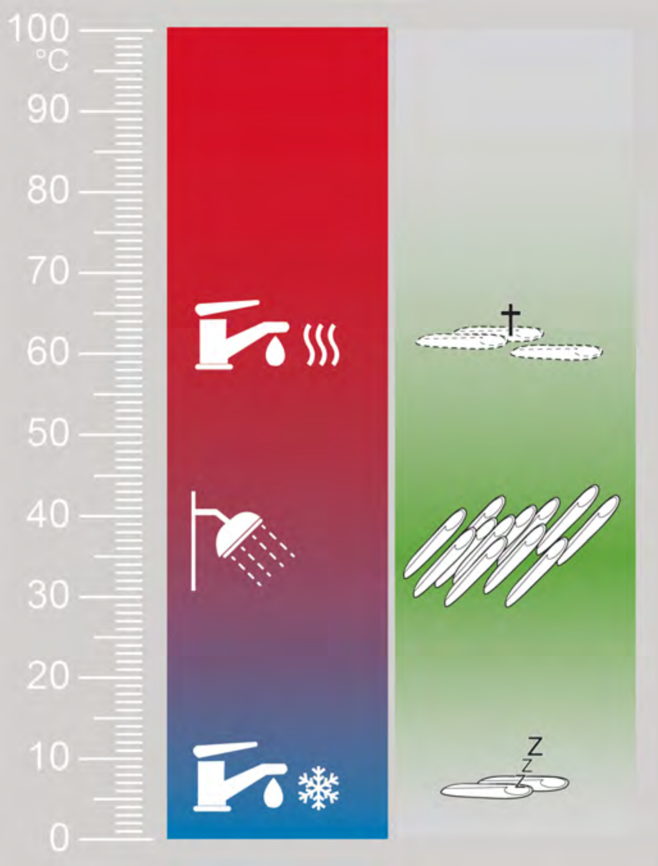
Measures to reduce Legionella growth

Legionella pneumophila

If left untreated, Legionella can propagate in both the both hot and cold drinking water systems. Care must be taken that each system design should make considerations to use principals that prevent a concentration of Legionella that can be hazardous to health.

Legionella are rod-shaped bacteria which occur naturally in small amounts in fresh water, e.g. in lakes, rivers and occasionally also in tap water. The group of Legionella includes some 40 known forms. Some Legionella species can cause infections by the inhalation of contaminated aerosols (fine water droplets) into the lungs, for example while showering or from humidifiers in ventilation systems.

In a person with health limitations such as a weakened immune system or chronic bronchitis, this can lead to pneumonia (Legionella pneumonia or Legionnaires' disease) or Pontiac fever.



Influence of water temperature on Legionella proliferation

According to the government's HSE ACOP L8 document, the risk of infection is directly related to the temperature of the tap water within the drinking water distribution system and the length of time that the water stays in the system. The temperature range at which Legionella growth occurs is between 20°C and 45°C. The code of practice describes the technical measures needed to reduce Legionella growth in drinking water distribution systems, based on the current state of knowledge.

When planning and sizing drinking water pipes, the following points are important from a hygienic (microbiological) point of view:

- The shortest possible pipelines and the smallest, but hydraulically sufficient, pipe diameters should be used in order to achieve the shortest possible time of the tap water remaining in the system.
- Stagnation of tap water in parts of the system that have not had water flowing through should be avoided.
- The heating of cold tap water distribution systems by environmental influences must be avoided.
- Unused parts of the network must be emptied and disconnected.

Generally recognised engineering practices

The code of practice as well as other laws and guidelines often refer to "generally recognised engineering practices". These include national standards and guidelines (L8, BS, CIBSE, etc) or international standards (BS EN, ISO) and technical data sheets from the relevant associations. These documents are used by observers to assess whether an installation is designed, built and operated in accordance with generally accepted engineering practices.

The generally accepted engineering practices for the construction and operation of drinking water distribution systems are laid down in the European basic standards BS EN 806: 1 - 5, BS EN 1717 and the national supplementary standards BS 8558 "Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. (Complementary guidance to BS EN 806)"

European standards with national supplements

European basic standards	National supplementary standards
BS EN 1717 Protection against pollution of potable water	Water Supply (Water fittings) Regulations
BS EN 806 Part 1: General info	-
Part 2: Planning	BS 8558 Planning
Part 3: Pipe sizing	BS 8558 Pipe sizing
Part 4: Installation	BS 8558 Installation
Part 5: Operation and maintenance	-

European basic standards with national supplementary standards for the planning and construction of drinking water distribution systems

Intergrated, property-specific planning is important

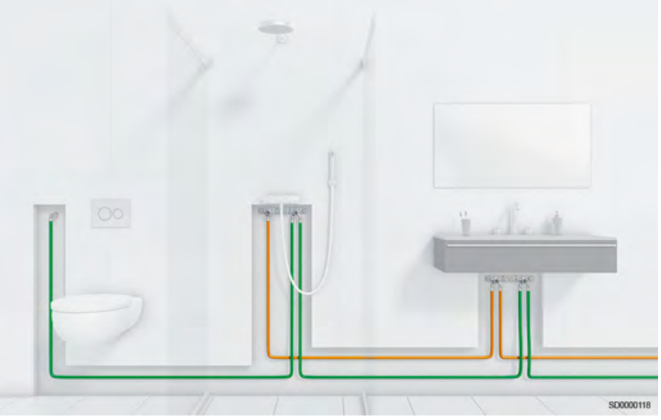
The planning stage already sets the course for hygienic and energy-efficient drinking water distribution. A modern drinking water distribution system must not only comply with current engineering practices to ensure tap water hygiene, it should also be energy-efficient and prevent waste of wholesome water. The demands on the comfort of drinking water distribution have also risen significantly. Modern plumbing fittings with low flow rates combined with strict requirements for hot water output times (e.g. HSE L8, CIBSE TM13) or if specification presents a specific hot water delivery time, can be a challenge for the designer.

In order to meet all requirements, detailed planning involving all the trades concerned is necessary. In these situations a detailed design specification should be presented by the system designer. This should include at least the following specifications:

- a detailed description of the equipment or outlets to be installed
- specifications for intended use including expected flow/loading units
- the concept for drinking water distribution with pipe routing and outlet points
- Expected times for hot water delivery

5.2 Installation options

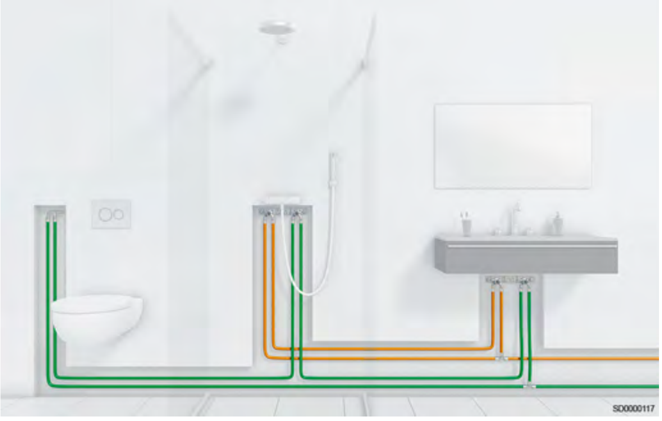
Series installation



In a series installation, the tapping points are connected to the Uponor S-Press PLUS U-tap connections and the pipes are then joined to each outlet in the 'series'. In this way, when the last outlet on the 'series' is opened, water is drawn through all of the other outlets connected to that pipe 'series'. Therefore, ideally, the most frequently used outlet should really be the last outlet of the series, for example the toilet flush or the washbasin, should be at the end of the series.

This type of plumbing scheme is a simple way to prevent stagnation and dead-legs within a system as long as the last outlet on the system is used.

Loop installation



In a 'loop' installation, the tapping points are connected in a similar way to a series installation. However, the line from the last outlet 'loops' back to the starting point. Regardless of what outlet on the 'loop' is opened, the water flows through each of the outlets on the system preventing stagnation and ensuring that all dead legs are removed from the circuit thus protecting the hygiene of the water.

As the outlets are supplied from both sides, the plumber can use a single, smaller dimension pipe throughout the whole 'loop' as each outlet is simultaneously supplied from either side. As well as making the installation easier due to the smaller pipe sizes, this feature also reduces the pressure loss to each outlet.

T-installation

In a T-installation, all outlets are individually connected to the supply lines via T-joints. The installation is usually started with a larger pipe dimension, which is then reduced progressively until the last tapping point. This type of plumbing scheme does sometimes help to minimise pipe lengths. However, in T-installations there is a risk that water will stagnate in dead-legs and these can be the cause of an unhealthy system providing water that could be unhygienic. For this reason, a T-installation should only be used where all outlets are in regular use.

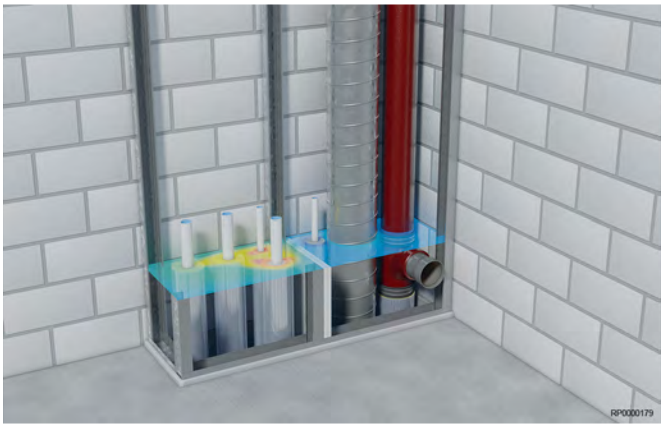
5.3 DHW Circulation systems

These systems (known as recirculating, secondary hot circulation, return or ring main systems) carry continuously pumped hot potable water to outlets where the temperature is between 55°C to 70°C (always check latest government regulations or the project's specification) and is replenished by an incoming water supply to replace the water drawn to outlets. These systems are very different from intermittent systems for hot water distribution, which only pass hot water to the outlets when water is drawn. These intermittent systems can sometimes take considerable time to pass hot water to an open outlet and can often be a cause of an unhealthy system.

Requirements

The entire hot water distribution system should be operated in such a way that the hot water leaves the water heater at a temperature of at least 60°C and flows back into the heater with a temperature loss of 5°K at the most.

Protection of cold water pipes from heating pipes



Thermally isolated cold water line (DCW / BCWS) separated in an installation shaft to prevent unwanted heat transfer from hot water pipes.

If installed in close proximity to cold water pipes, hot water circulation systems can have a negative effect on tap water hygiene. For example if hot water circulation lines are installed together with cold water lines in shafts or cavities the danger here is that the water in the cold water pipe could warm-up to a point above the permissible value of 25 °C the point at which bacteria such as Legionella will propagate.

To minimise the risk for cold potable water pipes to be exposed to unwanted thermal gain from other hot water services, designers should follow some simple rules, for example:

- Install warm (heating and DHW) and cold water pipes (DCW / BCWS) separately
- Allow for sufficient insulation of both the hot and cold water lines (BS 5422:2009)
- Reduce the amount of hot water recirculation pipes in a construction by installing decentralised hot tap water generation (heat interface units)

Calculations

For cold and hot water pipes in buildings with up to six apartments, without circulation lines, the simplified design method described in BS EN 806-3 can be used for calculations.

Alternatively, the Uponor HSE calculation software is available for calculations using the differentiated calculation method.

5.4 Use of trace heating

Caution!

The pressure increase in a system due to the use of a trace heating cable must be considered. Suitable safety measures must be provided to ensure pressure compensation for thermal expansion of the water .The installation guidelines and instructions of the trance heating cable manufacturer must be followed.

Uponor composite pipes are generally suitable for the use of trace heating.

Electric heat tracing, heat tape or surface heating, is a system used to maintain or raise the temperature of pipes and vessels.

Trace heating takes the form of an electrical heating element run in physical contact along the length of a pipe. The pipe is usually covered with thermal insulation to retain heat losses from the pipe. Heat generated by the element then maintains the temperature of the pipe.

Trace heating may be used to protect pipes from freezing, to maintain a constant flow temperature in hot water systems, or to maintain process temperatures for piping that must transport substances that solidify at ambient temperatures.

In order for these electric trace heating systems to be used on a Uponor Multilayer composite pipe installation, the following conditions should be followed:

- The maximum permissible operating temperature for the trace heating must not exceed 60°C. Thermostatic control, independent to control provided by a self limiting heating element, must be used to ensure that temperatures are never able to exceed the maximum permissible temperature of 60°C.
- Fixing of the trace heating system should follow the manufacturer’s guidelines for connections to MLC systems. Certain adhesives may contain products that could be damaging to the MLC materials. Connection to the Uponor MLC pipe must have no detrimental effect on the materials and connections within the MLC system.
- Supplementary heating can cause an increase in pressure localised to the area being treated by the trace heating tape. Care must be taken not to exceed the maximum designed operating pressure of the MLC system. If there is potential for pressure to exceed the maximum operating pressure, safety equipment such as expansion vessels and pressure release valves should be added the system.

5.5 Connections

Connection to instantaneous, flow water heaters

Due to their design, hydraulically controlled electric and gas-fired or electric instantaneous, flow water heaters can build up unacceptably high temperatures during normal operation and in the event of a fault, these excessive high temperatures can cause damage to the multilayer composite pipes and connections.

Uponor multi-layer pipes should not be directly connected to boilers or heaters, which have a higher constant temperature of 70°C (malfunction temperature 95°C for 100h) for tap water and constant higher temperature of 80°C (malfunction temperature of 100°C for 100h) for heating: Please also seek advice from the boiler or heater equipment manufacturer.

When using electronically controlled devices for tap water heating, the manufacturer's instructions must be observed.

Connection to hot water cylinder

In general, when connecting to hot water storage tanks (especially directly fired hot water storage tanks, solar storage tanks and special designs), it must be ensured that in both normal operating conditions, and in the event of a malfunction, the maximum operating limits of Uponor multilayer composite pipes are not exceeded. This applies in particular to the maximum hot water outlet temperature, which must be checked during commissioning or the details must be requested from the manufacturer.

In the case of any doubt, suitable safety measures (such as the installation of a thermostatic service water mixing valve) must be installed.

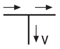
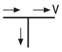
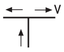
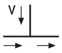
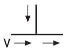
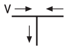
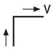
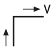
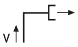
Fitting connections

Fitting connections must always be mounted so as to be twist-proof to protect the pipe connections, the building fabric and the equipment that the fitting is connected to.

6 Pipe network calculations

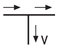
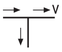
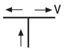
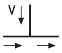
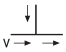
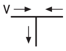
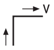
6.1 Data for pipe network calculations

Uponor S-Press PLUS – zeta values*

Single resistance			**S-Press PLUS fittings**				**S-Press PLUS composite fittings made of PPSU**			
			Zeta values ζ				**Zeta values ζ**			
			DN 12	**DN 15**	**DN 20**	**DN 25**	**DN 12**	**DN 15**	**DN 20**	**DN 25**
			Pipe outer diameter OD mm				**Pipe outer diameter OD mm**			
			16	**20**	**25**	**32**	**16**	**20**	**25**	**32**
T-joint branch for current separation	TA		7,4	5,2	4,7	3,4	16,5	8,8	7,4	5,8
T-joint passage for current separation	TD		2,3	1,2	1,1	0,7	4,4	2,8	2,4	1,2
T-joint counter-flow for current separation	TG		7,6	5,4	5	4,1	17,1	9,1	7,9	6,2
T-joint branch for current merging	TVA		13,2	8,1	7,7	6,7	29,1	15,7	15,6	10,6
T-joint passage for current merging	TVD		26,4	21,2	17,1	14,7	58,2	32,7	30,4	20,9
T-joint counter-flow for current merging	TVG		18	12,1	10,6	7,9	36	18,3	16,2	11,5
Bend 90°	B90		4,1	2,6	2,2	1,6	—	—	—	—
Angle 90°	W90		7,1	5,1	4,2	3,3	10,4	5,1	4,1	3,1
Angle/Bend 45°	W45		—	—	2,3	1,3	—	—	—	—
Reduction	RED		1,6	0,7	1,1	—	—	—	—	—
Wall bracket	WS		6,5	4,3	3,4	—	—	—	—	—
Double wall bracket passage	WSD		6,3	4,2	3,9	—	—	—	—	—
Double wall bracket branch	WSA		4,3	4,2	5,5	—	—	—	—	—
Coupling/sleeve	K		1,9	1	0,8	0,5	3,4	1,7	1,6	0,8

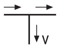
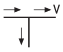
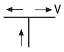
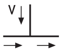
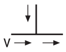
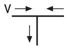
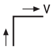
** Product-related Uponor resistance coefficients according to DIN 1988-300 point 4.3 Individual resistances. The resistance coefficients (ζ values) cited by the manufacturers as calculated in accordance with DVGW Worksheet W 575 or equivalent procedures shall be taken into account.*

Uponor S-Press – zeta values*

Single resistance			S-Press fittings		S-Press composite fittings made of PPSU			
			Zeta values ζ		Zeta values ζ			
			DN 32	DB 40	DB 32	DN 40	DN 50	DN 65
			Pipe outer diameter OD mm		Pipe outer diameter OD mm			
			40	50	40	50	63	75
T-joint branch for current separation	TA		4,1	3,1	5,5	4,4	5,2	5,0
T-joint passage for current separation	TD		0,7	0,4	1,0	0,7	1,2	1,2
T-joint counter-flow for current separation	TG		4,1	3,1	6,1	4,8	6,7	6,3
T-joint branch for current merging	TVA		7,8	5,6	12,1	9,4	12,6	11,8
T-joint passage for current merging	TVD		13,8	11,4	22,8	18,8	25,5	26,0
T-joint counter-flow for current merging	TVG		12,2	10,9	12,4	9,7	13,5	12,7
Angle 90°	W90		2,4	1,8	5,1	4,3	4,4	3,8
Angle/Bend 45°	W45		1,3	1,2	2,1	2,0	1,7	1,7
Reduction	RED		1,2	1,0	0,9	1,3	1,2	1,0
Coupling/sleeve	K		0,5	0,3	0,8	0,6	0,,6	0,6

** Product-related Uponor resistance coefficients according to DIN 1988-300 point 4.3 Individual resistances. The resistance coefficients (ζ values) cited by the manufacturers as calculated in accordance with DVGW Worksheet W 575 or equivalent procedures shall be taken into account.*

Uponor RS – zeta values*

			Zeta values ζ					
			DN 32	DN 40	DN 50	DN 65	DN 80	DN 100
			Pipe outer diameter OD mm					
			40	50	63	75	90	110
T-joint branch for current separation	TA		1,0	1,4	2,5	3,2	2,8	2,8
T-joint passage for current separation	TD		0,7	0,5	1,0	0,7	0,2	0,2
T-joint counter-flow for current separation	TG		3,5	3,0	3,1	4,1	4,0	4,0
T-joint branch for current merging	TVA		5,5	4,5	4,0	3,5	3,5	3,5
T-joint passage for current merging	TVD		10,0	9,0	8,0	7,0	6,0	6,0
T-joint counter-flow for current merging	TVG		8,0	7,0	6,0	5,0	5,0	5,0
Angle 90°	W90		—	—	2,3	3,1	2,4	2,4
Angle/Bend 45°	W45		—	—	1,0	1,0	1,0	1,5
Reduction	RED		0,6	0,5	0,5	0,3	0,0	—
Coupling/sleeve	K		—	—	0,8	0,6	0,0	0,0

** Product-related Uponor resistance coefficients according to DIN 1988-300 point 4.3 Individual resistances. The resistance coefficients (ζ values) cited by the manufacturers as calculated in accordance with DVGW Worksheet W 575 or equivalent procedures shall be taken into account.*

** Product-related Uponor resistance coefficients according to DIN 1988-300 point 4.3 Individual resistances. The resistance coefficients (ζ values) cited by the manufacturers as calculated in accordance*

Dimensioning of sections (design tables)

The selection of the pipe dimension for a particular part of a system section can be determined from the following pipe friction pressure gradient tables described as functions of peak flow rate for cold tap water (10 °C), or from the pressure loss diagram.

The required rules for the dimensioning of pipes, the required minimum flow pressures and calculated flows can be found in DIN 1988-300.

Pipe dimensions 14 — 20 mm

OD x s (ID) — V/l	14 x 2 mm (10 mm) — 0.078 l/m		16 x 2 mm (12 mm) — 0.11 l/m		20 x 2,25 mm (15,5 mm) — 0.19 l/m	
$\dot{V}_s$ — l/s	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**
0.01	0.13	0.51	0.09	0.22	0.05	0.07
0.02	0.25	1.61	0.18	0.69	0.11	0.21
0.03	0.38	3.19	0.27	1.36	0.16	0.41
0.04	0.51	5.21	0.35	2.21	0.21	0.66
0.05	0.64	7.62	0.44	3.23	0.26	0.97
0.06	0.76	10.43	0.53	4.41	0.32	1.32
0.07	0.89	13.59	0.62	5.75	0.37	1.72
0.08	1.02	17.12	0.71	7.23	0.42	2.16
0.09	1.15	20.99	0.80	8.86	0.48	1.91
0.10	1.27	25.20	0.88	10.63	0.53	3.17
0.15	1.91	51.07	1.33	21.49	0.79	6.39
0.20	2.55	84.56	1.77	35.52	1.06	10.54
0.25	3.18	125.23	2.21	52.55	1.32	15.56
0.30	3.82	172.79	2.65	72.43	1.59	21.41
0.35	4.46	227.01	3.09	95.07	1.85	28.07
0.40	5.09	287.69	3.54	120.39	2.12	35.52
0.45	5.73	354.68	3.98	148.33	2.38	43.72
0.50	6.37	427.86	4.42	178.83	2.65	52.67
0.55	7.00	507.11	4.86	211.85	2.91	62.35
0.60	-	-	5.31	247.33	3.18	72.74
0.65	-	-	5.75	285.24	3.44	83.84
0.70	-	-	6.19	325.56	3.71	95.64
0.75	-	-	6.63	368.25	3.97	108.13
0.80	-	-	7.07	413.27	4.24	121.29
0.85	-	-	-	-	4.50	135.12
0.90	-	-	-	-	4.77	149.62
0.95	-	-	-	-	5.03	164.77
1.00	-	-	-	-	5.30	180.57
1.05	-	-	-	-	5.56	197.02
1.10	-	-	-	-	5.83	214.11
1.15	-	-	-	-	6.09	231.84
1.20	-	-	-	-	6.36	250.19
1.25	-	-	-	-	6.62	269.17
1.30	-	-	-	-	6.89	288.77
1.35	-	-	-	-	7.15	308.99

$\dot{V}_s$ = Peak flow rate in litres/second according to DIN 1988-300

R = Pipe friction pressure gradient in millibar/metre (1 mbar ˆ= 1 hPa)

v = Flow velocity in metres/second

Correction factors for other water temperatures

Water temperature [°C]	10	15	20	25	30	35	40	45	50	55	60
Conversion factor	1.000	0.983	0.967	0.952	0.938	0.933	0.918	0.904	0.890	0.873	0.861

Pipe dimensions 25 — 50 mm

OD x s (ID) — V/l	**25 x 2,5 mm (20 mm) — 0.31 l/m**		**32 x 3 mm (25 mm) — 0.53 l/m**		**40 x 4 mm (32 mm) — 0.80 l/m**		**50 x 4,5 mm (40 mm) — 1.32 l/m**	
$\dot{V}_s$ — l/s	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**
0.10	0.32	0.95	0.19	0.28	0.12	0.10	0.08	0.03
0.20	0.64	3.15	0.38	0.91	0.25	0.34	0.15	0.11
0.30	0.95	6.38	0.57	1.84	0.37	0.69	0.23	0.21
0.40	1.27	10.55	0.75	3.03	0.50	1.13	0.30	0.35
0.50	1.59	15.62	0.94	4.48	0.62	1.67	0.38	0.52
0.60	1.91	21.55	1.13	6.17	0.75	2.30	0.45	0.71
0.70	2.23	28.30	1.32	8.10	0.87	3.01	0.53	0.93
0.80	2.55	35.86	1.51	10.25	0.99	3.81	0.61	1.17
0.90	2.86	44.20	1.70	12.63	1.12	4.69	0.68	1.44
1.00	3.18	53.30	1.88	15.22	1.24	5.65	0.76	1.73
1.10	3.50	63.16	2.07	18.02	1.37	6.69	0.83	2.05
1.20	3.82	73.76	2.26	21.03	1.49	7.80	0.91	2.39
1.30	4.14	85.08	2.45	24.24	1.62	8.99	0.98	2.76
1.40	4.46	97.12	2.64	27.66	1.74	10.25	1.06	3.14
1.50	4.77	109.88	2.83	31.28	1.87	11.59	1.14	3.55
1.60	5.09	123.33	3.01	35.09	1.99	13.00	1.21	3.98
1.70	-	-	3.20	39.10	2.11	14.48	1.29	4.43
1.80	-	-	3.39	43.30	2.24	16.03	1.36	4.90
1.90	-	-	3.58	47.69	2.36	17.65	1.44	5.40
2.00	-	-	3.77	52.27	2.49	19.34	1.51	5.91
2.10	-	-	3.96	57.04	2.61	21.10	1.59	6.45
2.20	-	-	4.14	61.99	2.74	22.92	1.67	7.00
2.30	-	-	4.33	67.13	2.86	24.82	1.74	7.58
2.40	-	-	4.52	72.45	2.98	26.78	1.82	8.18
2.50	-	-	4.71	77.96	3.11	28.81	1.89	8.79
2.60	-	-	4.90	83.64	3.23	30.90	1.97	9.43
2.70	-	-	5.09	89.50	3.36	33.06	2.05	10.09
2.80	-	-	-	-	3.48	35.28	2.12	10.76
2.90	-	-	-	-	3.61	37.57	2.20	11.46
3.00	-	-	-	-	3.73	39.93	2.27	12.17
3.50	-	-	-	-	4.35	52.65	2.65	16.04
4.00	-	-	-	-	4.97	66.93	3.03	20.37
4.50	-	-	-	-	5.60	82.73	3.41	25.17
5.00	-	-	-	-	-	-	3.79	30.41
5.50	-	-	-	-	-	-	4.17	36.09
6.00	-	-	-	-	-	-	4.54	42.22
6.50	-	-	-	-	-	-	4.92	48.77
7.00	-	-	-	-	-	-	5.30	55.74
7.50	-	-	-	-	-	-	5.68	63.13
8.00	-	-	-	-	-	-	6.06	70.94
8.50	-	-	-	-	-	-	6.44	79.16
9.00	-	-	-	-	-	-	6.82	87.78

$\dot{V}_s$ = Peak flow rate in litres/second according to DIN 1988-300

R = Pipe friction pressure gradient in millibar/metre (1 mbar ˆ= 1 hPa)

v = Flow velocity in metres/second

Pipe dimensions 63 — 110 mm

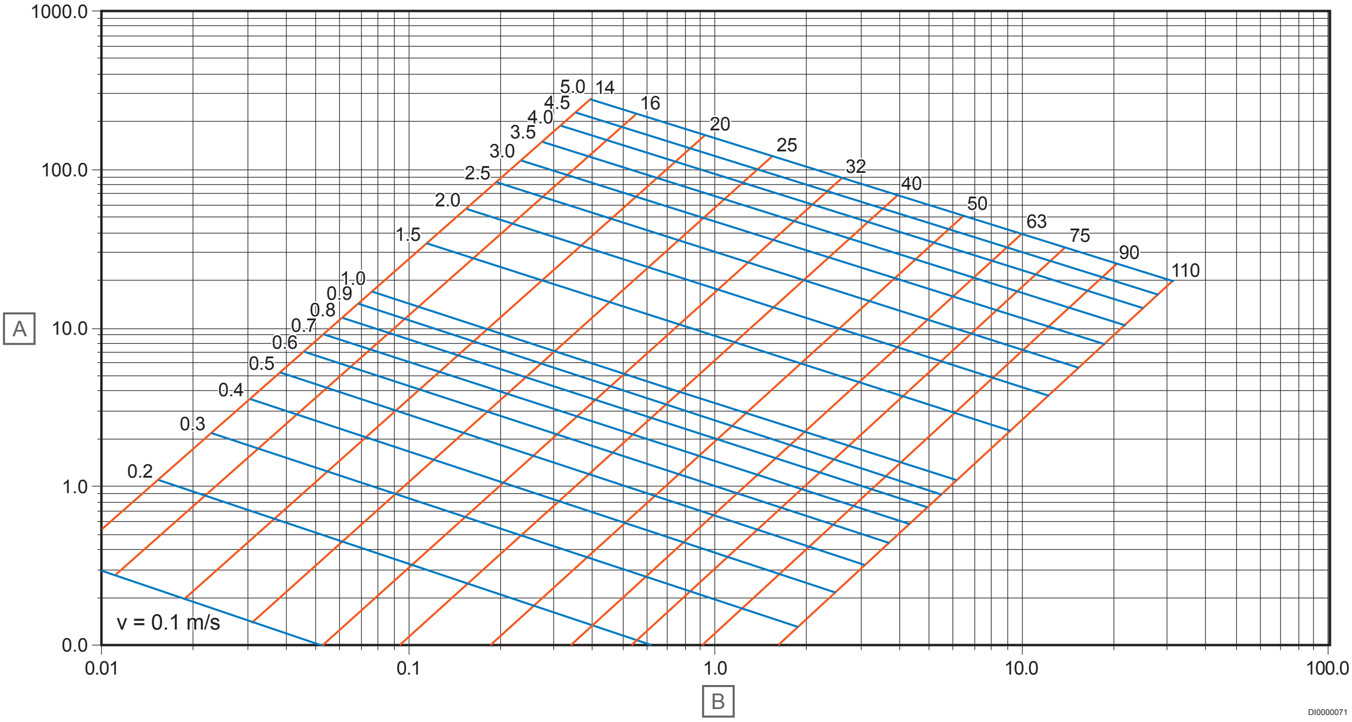
OD x s **(ID) — V/l**	**63 x 6 mm** **(51 mm) — 2.04 l/m**		**75 x 7,5 mm** **(60 mm) — 2.83 l/m**		**90 x 8,5 mm** **(73 mm) — 4.18 l/m**		**110 x 10 mm** **(90 m) — 6.36 l/m**	
$\dot{V}_s$ — l/s	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**	**v — m/s**	**R — mbar/m**
1.00	0.49	0.61	0.35	0.28	0.24	0.11	0.16	0.04
1.25	0.61	0.91	0.44	0.42	0.30	0.17	0.20	0.06
1.50	0.73	1.25	0.53	0.58	0.36	0.23	0.24	0.08
1.75	0.86	1.65	0.62	0.76	0.42	0.30	0.28	0.11
2.00	0.98	2.08	0.71	0.96	0.48	0.38	0.31	0.14
2.25	1.10	2.57	0.80	1.18	0.54	0.46	0.35	0.17
2.50	1.22	3.10	0.88	1.43	0.60	0.56	0.39	0.21
2.75	1.35	3.67	0.97	1.69	0.66	0.66	0.43	0.24
3.00	1.47	4.28	1.06	1.97	0.72	0.77	0.47	0.28
3.25	1.59	4.94	1.15	2.27	0.78	0.89	0.51	0.33
3.50	1.71	5.64	1.24	2.59	0.84	1.01	0.55	0.37
3.75	1.84	6.38	1.33	2.93	0.90	1.15	0.59	0.42
4.00	1.96	7.16	1.41	3.29	0.96	1.29	0.63	0.47
4.25	2.08	7.98	1.50	3.66	1.02	1.43	0.67	0.53
4.50	2.20	8.84	1.59	4.06	1.08	1.59	0.71	0.58
4.75	2.33	9.73	1.68	4.47	1.13	1.75	0.75	0.64
5.00	2.45	10.67	1.77	4.90	1.19	1.92	0.79	0.70
6.00	2.94	14.80	2.12	6.79	1.43	2.65	0.94	0.97
7.00	3.43	19.53	2.48	8.95	1.67	3.49	1.10	1.28
8.00	3.92	24.84	2.83	11.38	1.91	4.44	1.26	1.63
9.00	4.41	30.71	3.18	14.07	2.15	5.49	1.41	2.01
10.00	4.90	37.15	3.54	17.01	2.39	6.63	1.57	2.43
11.00	5.38	44.13	3.89	20.20	2.63	7.87	1.73	2.88
12.00	-	-	4.24	23.63	2.87	9.21	1.89	3.37
13.00	-	-	4.60	27.31	3.11	10.63	2.04	3.89
14.00	-	-	4.95	31.23	3.34	12.16	2.20	4.45
15.00	-	-	5.31	35.38	3.58	13.77	2.36	5.03
16.00	-	-	5.66	39.77	3.82	15.47	2.52	5.65
17.00	-	-	6.01	44.39	4.06	17.27	2.67	6.31
18.00	-	-	-	-	4.30	19.15	2.83	6.99
19.00	-	-	-	-	4.54	21.12	2.99	7.71
20.00	-	-	-	-	4.78	23.17	3.14	8.46
21.00	-	-	-	-	5.02	25.31	3.30	9.24
22.00	-	-	-	-	5.26	27.54	3.46	10.05
23.00	-	-	-	-	5.50	29.86	3.62	10.89
24.00	-	-	-	-	5.73	32.25	3.77	11.77
25.00	-	-	-	-	-	-	3.93	12.67
26.00	-	-	-	-	-	-	4.09	13.60
27.00	-	-	-	-	-	-	4.24	14.57
28.00	-	-	-	-	-	-	4.40	15.56
29.00	-	-	-	-	-	-	4.56	16.58
30.00	-	-	-	-	-	-	4.72	17.63

$\dot{V}_s$ = Peak flow rate in litres/second according to DIN 1988-300

R = Pipe friction pressure gradient in millibar/metre (1 mbar ˆ= 1 hPa)

v = Flow velocity in metres/second

Pressure loss diagram, cold tap water (10 °C)



Item	Description
A	Pipe friction pressure gradient R [mbam/m]

Item	Description
B	Volume flow rate V̇s [l/s]

Correction factors for other water temperatures

Water temperature [°C]	10	15	20	25	30	35	40	45	50	55	60
Conversion factor	1.000	0.983	0.967	0.952	0.938	0.933	0.918	0.904	0.890	0.873	0.861

7 Leak test, initial filling and commisioning

7.1 Pressure and leak testing

Note

Legal notice:

Pressure testing should only be carried out by a trained, competent person

Pressure tests are ancillary services under a work contract and are often part of the Contractor's contractual performance, even if not explicitly mentioned in the description of services.

According to current standards a pressure test must be carried out before the system is put into operation.

It is a requirement of The Water Supply (Water fittings) Regulations 1999 for any water distribution system to undergo, a pressure test in accordance with BS EN 806-4 or an equivalent national standard.

Before the pressure test, it must be ensured that all components of the installation are freely accessible and visible, for example in order to locate incorrectly installed fittings. If the pipeline system is to remain unfilled after a pressure test (for example because regular water replacement cannot be guaranteed within seven days after the pressure test procedure), a pressure test with compressed air or inert gases is recommended.

Leak test with compressed air or inert gas

After a leak test with water, residual water can remain in some sections of the pipe network despite thorough emptying of the system – in case of prolonged stagnation, this is an ideal breeding ground for bacteria. For this reason, leak testing with oil-free compressed air or inert gas (usually nitrogen or carbon dioxide) is recommended, especially in buildings with high hygiene requirements such as hospitals, retirement homes or sport facilities. Once the system has been tested, the system can remain empty until the first fill with potable water shortly before the commissioning of the installation.

A pressure test with compressed air or inert gases is carried out in two steps, the tightness test and the load test, taking recognised engineering practices into consideration.

For both tests (air or water), it is important to wait for a period of time to allow the system temperature to equalise to provide a steady-state condition after the pressure build-up. Appliances, drinking water heaters, fittings or pressure vessels must be isolated from the pipelines before a pressure test with air if their volume can affect safety and testing accuracy. All lines must be directly sealed using metal plugs, metal washers or blind flanges which can withstand the test pressure. Closed shut-off valves are not advised to be used as tight shut-offs.

Leak test

Before the leak test, all pipe connections must be visually inspected. The manometer used in the test must have a corresponding accuracy of 1 mbar and have suitable scale of accuracy for the pressures to be measured. The system is subjected to a test pressure of 150 mbar (150 hPa). For a system volume of up to 100 liters, the test time must be at least 120 minutes. The required time must be extended by a further 20 minutes per additional 100 litres. No leakage must occur at the connectors during the duration of the test.

Load test

Following the leak test, the load test is carried out. Here the pressure is increased to max. 3 bar (for pipe size OD ≤ 63 mm) or max. 1 bar (for pipe size OD > 63 mm). For a system volume of up to 100 litres, the test time must be at least 10 minutes.

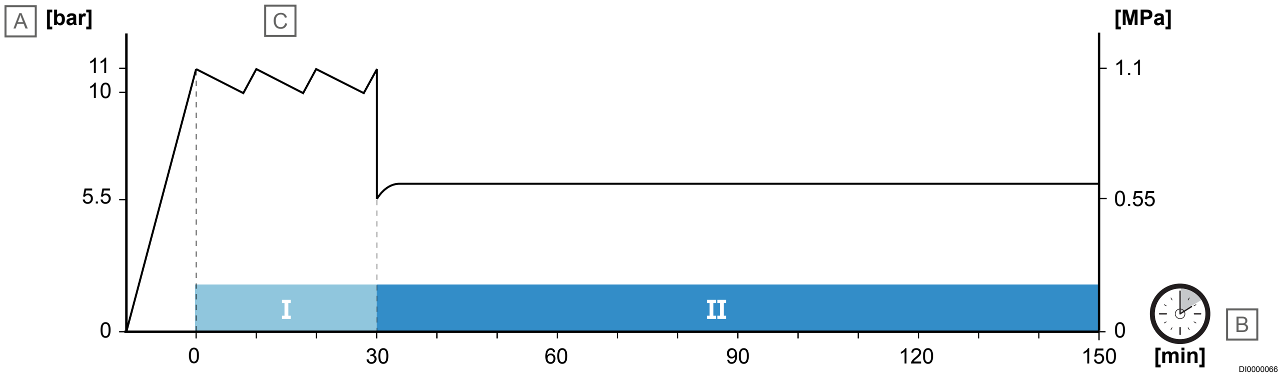
Leak test report

The leak test must be documented in a leak test report by the responsible specialist, taking into account the materials used. The tightness of the system must be verified and confirmed.

This report is available at the Uponor services download center.

https://www.uponor.com/doc/1120118

Leak test with water



Item	Description
A	Test pressure [bar]
B	Test time [minutes]
C	Maintain pressure, pump

Preparing for the leak test

Before performing a leak test with water, a visual inspection of all pipe connections should be completed before the pipes are concealed within walls, ceilings, floors and screeds. If possible, the pressure gauge should be connected to the lowest point of the installation. Only pressure gauges which are accurate enough to determine a pressure change of 0.1 bar should be used.

The system must be filled with filtered tap water (particle size ≤ 150 µm), vented and protected from freezing. Heat sources, equipment and storage tanks should be isolated from the system so that the test pressure is kept away from the rest of the installation being tested.

If there are significant differences (>10 K) between ambient temperature and the water temperature, wait 30 minutes after applying system test pressure to allow temperature equalisation. The pressure must be maintained for at least 10 minutes. There must be no drop in pressure and no visible indication of leakage.

Uponor fittings with unpressed-untight (leak-path) function

In order to detect a leaking unpressed connection, Uponor fittings with unpressed 'leak-path' function must be tested at 3 bar for 15 minutes before the actual leak test.

Carrying out the leak test

The pipe network must first be subjected to a test pressure 1.1 times the system's designed operating pressure (relative to the lowest point of the system). The maximum operating pressure according to BS EN 21003 is 10 bar (1 MPa). Accordingly, a maximum test pressure of 11 bar (1.1 MPa) is required. Following the test, an inspection of the pipe system must be carried out in order to detect possible leaks.

After 30 minutes test time, by draining water, reduce the pressure to 5.5 bar (0.55 MPa), corresponding to half the initial test pressure. The test time at this pressure is 120 minutes. No leakage should be detected during this test period. The test pressure at the manometer must remain constant (Δp = 0). If a pressure drop occurs during the test period, there is a leak in the system. Maintain pressure and locate the leak. The defect must be repaired and then the leak test must be repeated.

Leak test report

The leak test must be documented in a leak test report by the responsible specialist, taking into account the materials used. The tightness of the system must be verified and confirmed.

This report is available at the Uponor services download center.

https://www.uponor.com/doc/1120119

PDF

7.2 Flushing of Uponor drinking water distribution

Note

Uponor tap water lines must be flushed with the local supply pressure and in accordance with BS EN 806-4, Section 6.2.2, unless a different flushing procedure is contractually agreed or required.

The tap water used for flushing must be filtered (filter according to BS EN 13443-1).

Flushing must only take place immediately before the actual start-up of the system.

To ensure the system operates flawlessly, the flushing process must remove contaminants and residues that may have entered the system during installation. This process protects tap water quality, prevents corrosion damage and also prevents malfunctions of valves and equipment.

Flushing with air and water

The procedure is based on a pulsating current of water and air and is described in more detail in the technical rules for drinking water distribution systems, BS EN 806-4 Section 6.2.3. Suitable flushing equipment must be used for this purpose. The flushing procedure should be used when a sufficient flushing effect cannot be expected when flushing with water alone.

Flushing method with water

Uponor tap water lines must be flushed to the local supply pressure using the water flushing procedure in accordance with BS EN 806-4, Section 6.2.2, unless another flushing procedure is contractually agreed or required.

The tap water used for flushing must be filtered (filter according to BS EN 13443-1).

Points to consider:

- Sensitive fittings (such as solenoid valves, flush valves, thermostatic fittings etc.) and apparatus (such as water heaters) should only be installed after flushing which prevents damage caused by contaminants and assembly residues.
- Aerators, jet regulators, flow-limiters, shower heads and hand showers must be removed from a system during flushing if valves are already installed.
- For in-wall thermostatic fittings and other sensitive fittings which cannot be removed during flushing, the installation instructions of the manufacturer must be followed.
- All maintenance fittings, floor shut-offs and preliminary shut-offs (such as corner valves) must be fully open.
- Any built-in pressure reducers must be fully open and are only adjusted after flushing.
- Built-in fine strainers in front of fittings that cannot be removed or bridged must be cleaned after flushing.

Depending on the size of the system and the installed scheme, flushing may be carried out in sections.

Always maintain one flushing direction away from the main inlet valve, flushing each section line by line (from nearest to the most distant).

Starting from the riser, flushing is carried out floor by floor. Fully open the outlets (see table in the following flushing protocol for the minimum number) and the associated supply pipework for at least 5 minutes each, one after the other, starting at the outlet furthest from the riser.

After a flushing time of 5 minutes at the last opened outlet, the taps are now closed one after the other in reverse order.

Flushing protocol

The flushing process must be documented by the responsible specialist in a flushing protocol.

This report is available at the Uponor services download center.

https://www.uponor.com/doc/1120120

PDF

8 Handover and documentation

On completion of the construction project, design and construction teams are typically contracted to deliver a structured information handover package to support a client’s asset operations and maintenance.

When they are handed the keys at the end of a construction project, what a facilities manager (FM) will be typically given is an information package, be it electronic or physical, filled with information and data. That information should contain explanations on building maintenance, equipment warranties, security operating instructions and asset lists among other things. This information may be in all kinds of formats, including paper and digital media like CDs and memory sticks.

BIM is now growing in it's use, and provides unprecedented levels of information and detail for the building operator and owner. Uponor Multilayer composite systems are available as BIM ready files

The plumbing system, including the heating system and the drinking water system, will be no different to the rest of the building and these detailed records should contain manufacturer details, system information, operating information, commissioning results and expected design performance.


Planning in a new dimension.
Endless possibilities.
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O&M information

- Construction with description of use and concept of the drinking water distribution system
- Leak test and flushing results
- Commissioning and instruction information
- Protocol for regulating the hot water system
- Test results for the cold and hot water installation
- Inspection and maintenance plan (BS EN 806, part 5)
- Manufacturer's documents, assembly and operating documents
- System design and floor plans of the building with schematic diagram
- If applicable, information on water treatment systems
- Maintenance and hygiene plan
- After commissioning, the following documents must also be submitted to the responsible health authority:
  - Flushing protocols
  - Protocols for regulating the hot water installation
  - Test results of sampling

9 Heating installation

9.1 System description

The versatile range of radiator connections from Uponor includes everything that is required for a safe and quick connection from the heat source to the radiator. Uponor offers a complete range of products for all radiator connection variants - from the traditional single-pipe system with thermostatic valves to a complex distribution system with zone control.

With the Uponor Multilayer composite pipe system, all common radiator connections can be used whether from the floor level, or through the wall. The system also includes special components for the radiator connection from the baseboard, an important aspect in some renovation projects. In addition, pipes and components pre-insulated at the factory, such as the Uponor Smart radi crossing connection encapsulated in insulation, enable rapid installation and with a high level of system perfomance and safety.

Heating installation

- Wide range of components for different installation options
- Simple planning, low pressure loss
- Simple pressure drop determination and pipe sizing

9.2 Uponor main components for heating (overview)

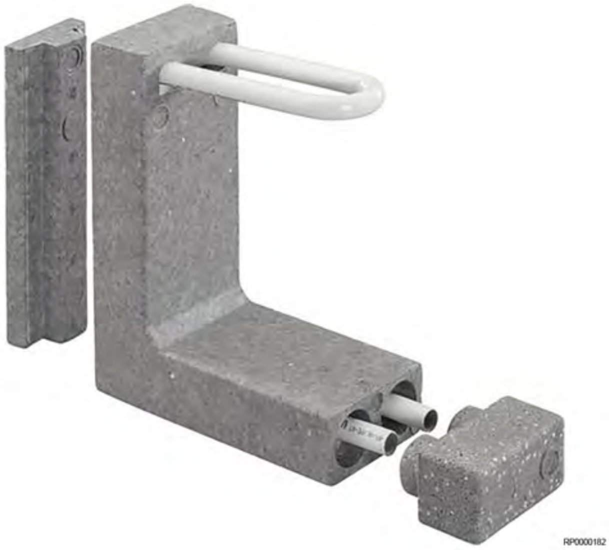
Uponor radiator adapters and T-joints

Tin-plated brass fittings with Uponor S-Press PLUS connection and either a coated or bare copper pipe 15 x 1 mm in lengths 250 and 1000 mm. Optionally for Uponor composite pipes 12,14,16 and 20mm, radiator connection via Uponor Smart radi compression adapter Cu, or standard copper compression fitting to BS EN 1254-2

Uponor radiator crossover fitting in insulation box

Uponor Smart Radi Crossings are available either with or without insulation sets. Made of coated brass with Uponor S-Press PLUS joint technology these fittings enable a crossover-free connection of radiators on an unfinished floor or within a tight void. Two-part insulation box made of EPP (expanded polypropylene) with 13 mm insulation. .

Uponor Smart radi connection block



Wall connection cut out with polystyrene thermal insulation and removable protective cap. Insulation box in fire class E according to BS EN 13501-1. Suitable for valve radiators. Insulation box width: 100 mm

Uponor radiator mounting plate

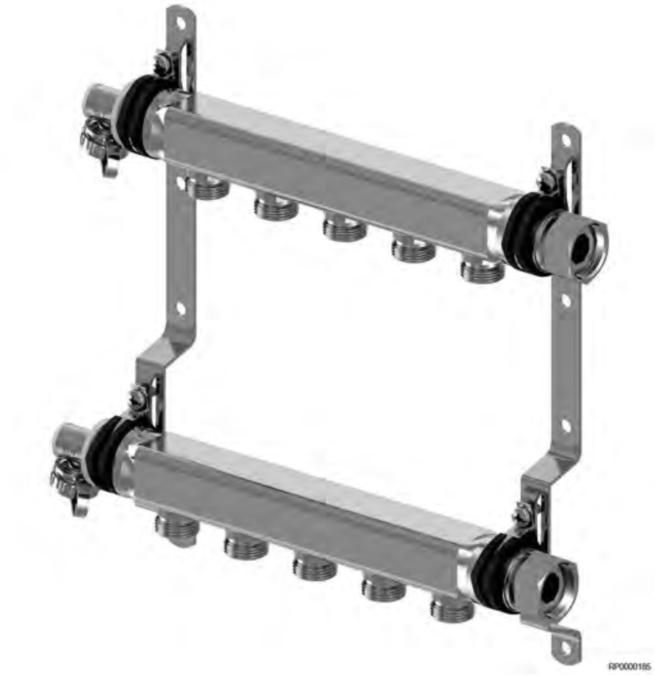
Factory pre-fabricated unit for radiator connection consisting of two Uponor S-Press PLUS threaded elbows with wall bracket.

16 — Rp½", mounted with anti-torsion connections on a plated steel mounting plate, with either a 35 or 50 mm center distance.

Uponor baseboard adapter

Connection kit made of coated brass and Uponor S-Press PLUS connection for baseboard installation without the need to chisel out the wall. Connections with Uponor composite pipes with 16 or 20 mm outer diameter or with Uponor Smart Base angle kit.

Uponor manifold



Complete stainless steel manifold for the connection of between 2 and 12 radiators circuits. Primary connections 1" FT with flat seal. Heating circuit connections ¾" male thread with euro-cone type connections.

Uponor Uni fittings and transitions

Fittings range for ½" (Uni-C) or ¾" (Uni-X) thread transitions. Suitable for use with 12, 14 and 16mm Multilayer composite pipes combined with compression adapter type connections

Uponor Smart radi connection kits

Plated brass fitting. Pressure screw with MT and insert with sleeve and clamping ring, O-ring made of EPDM. Suitable connection kits for Heimeier, Danfos or Oventrop radiator valves

Uponor Smart radi accessories

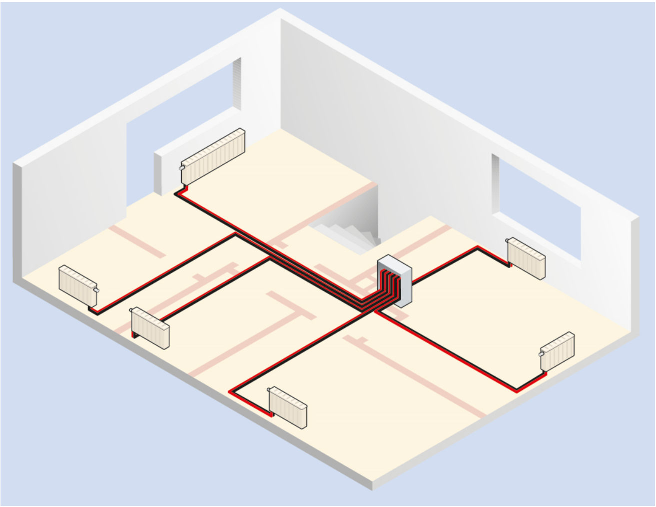
Fixing and assembly components for installing the Uponor Smart radi system

9.3 Planning principles for heating installations

Connection options

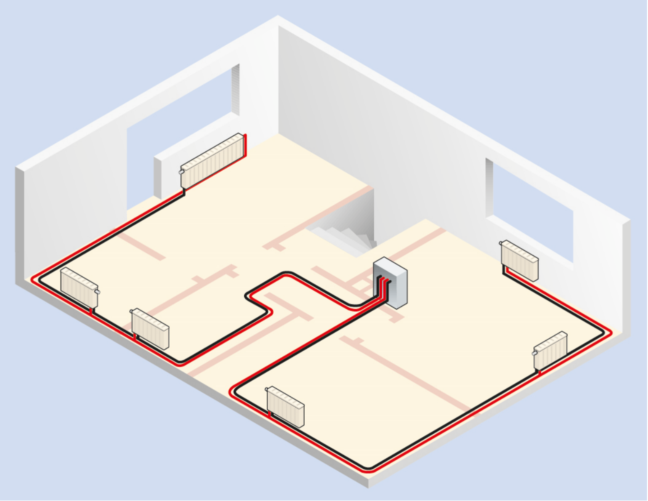
Uponor installation systems contain all the components required for heating systems, including radiator systems. The most common connection options are shown below. When installing each system, the system-specific special features and installation guidelines must be followed. These can be found in the respective system technical descriptions in this manual and in the associated installation instructions.

Two-pipe system with central heating manifold



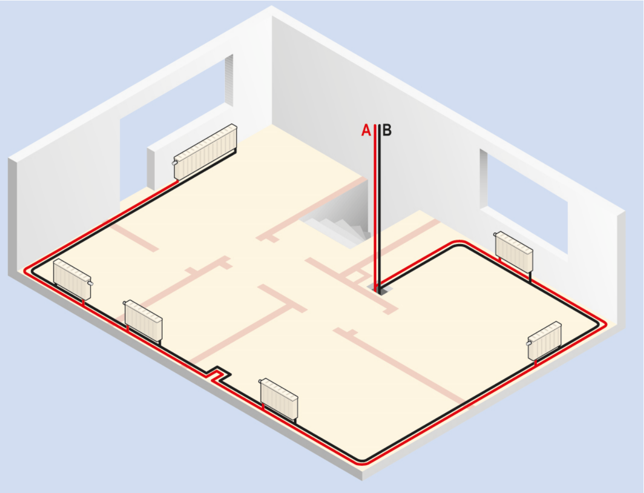
With the two-pipe system with centralised heating manifold, each radiator is connected individually. If required, a heat meter can be mounted on the heating manifold, allowing heat to be measured for each zone or apartment.

Two-pipe system with T-joint and elbow radiator connection



Using the two-pipe system with T-joint radiator connection, loop lines with one or more radiators are connected individually from a central manifold or heat source. Again, if required, a heat meter can be mounted on the heating manifold, allowing heat to be measured for each zone or apartment.

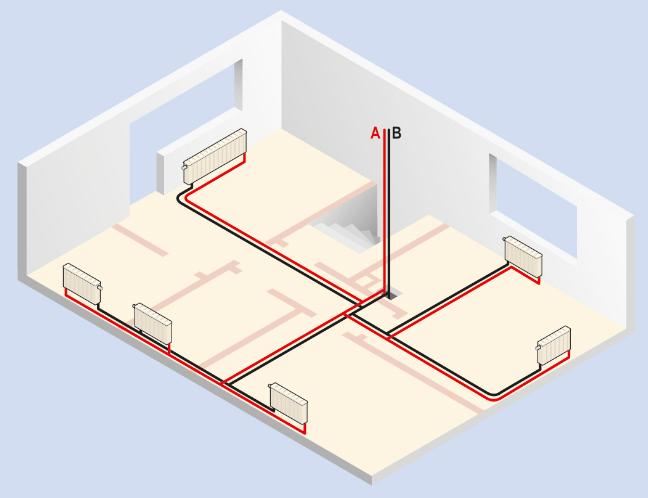
Two-pipe system as loop line



Item	Description
A	Supply
B	Return

With the two-pipe system as a loop line, the pipe routing for connecting the radiators to the riser, or supply, begins and ends at exactly the same point.

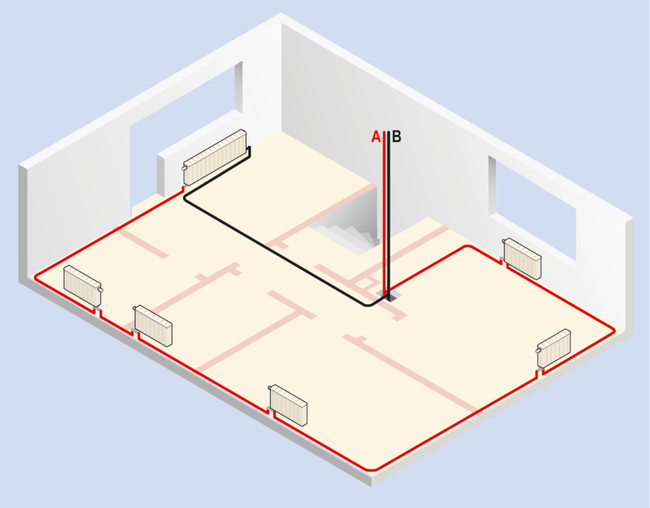
Two-pipe system as classic distribution system



Item	Description
A	Supply
B	Return

In the two-pipe system as a classic 'feed and return' distribution system with T-joints, almost all pipe layouts and combinations are possible. Pipe layout for connecting the radiators begins and ends at the riser, or the supply.

Single-pipe loop system



Item	Description
A	Supply
B	Return

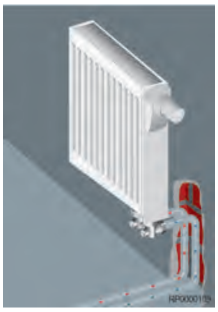
In the single-pipe system, the pipe routing for connecting the radiators begins and ends at the riser or the supply.

9.4 Examples of radiator connections

With the Uponor composite pipe system, all common radiator connections can be used – both from the floor and also from the wall. The system also includes special components for the radiator connection from the baseboard, an important aspect in renovation projects. The most common connection variants are shown below with the components required for each radiator.

Two-pipe heating with manifold system

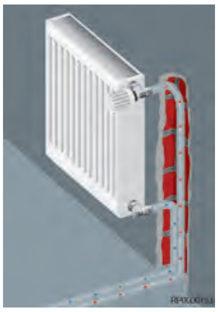
Uni-X screw connection MLC from the wall

	Number	Designation	Dimension
	**Uponor Uni-X screw connection MLC**		
	2 units	 • Two-part screw connection made of brass, with tin-plated union nut and pressure sleeve • For the direct connection of Uponor composite pipes, Uni Pipe PLUS and MLC, to ¾ FT moulded euro-cone parts as well as manifold H • Internal thread according to BS EN ISO 228-1 • Connect without deburring	14-¾"FT Euro 16-¾"FT Euro 20-¾"FT Euro

Uponor S-Press adapter nipple from the wall

	Number	Designation	Dimension
	**Uponor S-Press PLUS adapter nipple**		
	2 units	 • Flow optimised fitting • Made of tin-plated, dezincification resistant brass, according to 4MS positive list	14-R½"MT 16-R½"MT 20-R½"MT

Uponor Smart radi connection kit from the wall

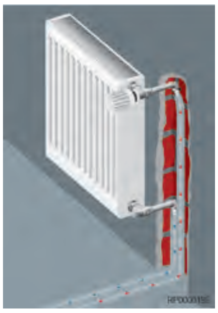
	Number	Designation	Dimension
	**Uponor Smart radi connection kit Danfoss**		
	2 units	 • Brass coated • Pressure screw with MT and insert with sleeve and clamping ring. Suitable for Danfoss radiator valves with female thread • O-ring made of EPDM	16-G½"MT
	Uponor Smart radi connection kit Heimeier		
	2 units	 • Brass coated • Pressure screw with MT and insert with sleeve and clamping ring. Suitable for Heimeier radiator valves with female thread • O-ring made of EPDM	16-G½"MT
	Uponor Smart radi connection kit Oventrop		
	2 units	 • Brass coated • Pressure screw with MT and insert with sleeve and clamping ring. Suitable for Oventrop radiator valves with female thread • O-ring made of EPDM	16-G½"MT

Radiator with Uponor S-Press PLUS radiator elbow adapter from the wall

Option 1

	Number	Designation	Dimension
	**Uponor S-Press PLUS radiator elbow adapter**		
	2 units	 • Flow optimised fitting • Made of brass and coated copper tube • The 15 mm copper pipe can be connected to the radiator using the Uponor Smart radi Cu compression adapter, or a standard brass compression fitting to BS EN 1254-2	14-15CU l=350mm 16-15CU l=350mm 16-15CU l=1000mm
	Uponor Smart radi compression adapter Cu		
	2 units	 • Eurocone G¾, elastic sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block, radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

Option 2, similar to option 1, but optional connection

	Number	Designation	Dimension
	**Uponor Smart radi connecting nipple**		
	2 units	 • Brass coated • Self-sealing • For connecting radiators with ½ IG connections, ¾ MT euro-cone for connecting Cu pipe 15 x 1 mm with Uponor compression adapter Cu with ¾ euro-cone	G¾"MT- G½"MT

Valve radiator with Uponor S-Press PLUS radi mounting plate and Uponor Smart radi connecting pipes from the wall

	Number	Designation	Dimension
	**Radi mounting plate**		
	1 unit	 • Prefabricated unit, consisting of two Uponor press wall brackets 16 -Rp½, pre-assembled at the factory on a Uponor mounting plate 35/50 mm with torsion proof connections	16-Rp½"FT c/c 35 mm 16-Rp½"FT c/c 50 mm
	Radi connection pipe		
	2 units	 • Made of coated copper tube • Copper pipe 15 x 1 mm with self-sealing thread for radiator connection • Suitable for all Uponor press wall brackets and press tap elbows / wall brackets with internal thread Rp½ • Connection to valve block, radiator or Uponor radiator connecting nipple is possible using the Uponor Cu compression adapter with euro-cone, or a standard brass compression fitting to BS EN 1254-2	G½"MT - 15CU l=350mm

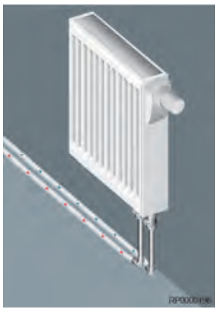
	Number	Designation	Dimension
	Radi compression adapter Cu		
	2 units	 • Eurocone G¾, elastic sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block, radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

Valve radiator with Uponor Smart radi connection block from the wall

	Number	Designation	Dimension
	**Uponor Smart radi connection block**		
	1 unit	 • Made of polystyrene with removable protective cap • Insulation box in fire class E according to BS EN 13501-1 • Suitable for all common valve radiators	16 h = 215 mm 16 h = 240 mm
	Uponor S-Press PLUS coupling		
	2 units	 • Flow optimised fitting • Made of dezincing resistant brass, according to UBA positive list, tin-plated	16-16
	Uponor S-Press PLUS coupling		
	2 units	 • Two-part screw connection made of brass, with tin-plated union nut and pressure sleeve • For the direct connection of Uponor composite pipes, Uni Pipe PLUS and MLC, to ¾ MT moulded euro-cone parts as well as manifold H • Internal thread according to BS EN ISO 228-1 • Connect without deburring	16-¾"FT Euro

Radiator with Uponor S-Press PLUS radiator elbow adapter from the floor

Variant 1

	Number	Designation	Dimension
	**Uponor S-Press PLUS radiator elbow adapter**		
	2 units	 • Made of brass and coated copper tube • The 15 mm copper pipe can be connected to the radiator using the Uponor Smart radi Cu compression adapter.	14-15CU l=350 mm 16-15CU l=350 mm 16-15CU l=1000 mm
	Uponor Smart radi compression adapter Cu		
	2 units	 • Eurocone G¾, elastic sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block, radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

Variant 2, like variant 1, but additionally

	Number	Designation	Dimension
	**Uponor Smart radi connecting nipple**		
	2 units	 • Brass coated • Self-sealing • For connecting radiators with ½ IG connections, ¾ MT euro-cone for connecting Cu pipe 15 x 1 mm with Uponor compression adapter Cu with ¾ euro-cone	G¾"MT- G½"MT

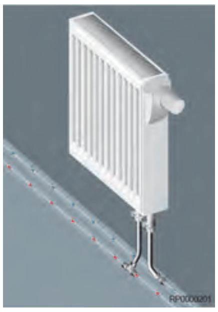
Valve radiator with Uponor Uni-X screw MLC connection and Uponor Smart radi connection kit

	Number	Designation	Dimension
	**Uponor Smart radi connection kit**		
	1 unit	 • Made of plastic • For quick, clean fixing of Uponor composite pipes 16 x 2 mm to the radiator • Comprising: bottom bracket, pipe holder for different valve spacings (centre distance: 50, 45, 40, 35 mm) and cut-to-length, height-adjustable protective tubes	16
	Uponor Uni-X screw connection MLC		
	2 units	 • Two-part screw connection made of brass, with tin-plated union nut and pressure sleeve • For the direct connection of Uponor composite pipes, Uni Pipe PLUS and MLC, to ¾ MT moulded euro-cone parts as well as manifold H • Internal thread according to BS EN ISO 228-1 • Connect without deburring	14-¾"FT Euro 16-¾"FT Euro 20-¾"FT Euro

Two-pipe heating with loop line, radiator connections from below

Valve radiator with Uponor S-Press PLUS radiator connection T-adapter

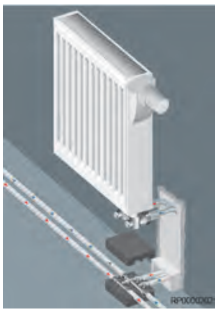
Variant 1

	Number	Designation	Dimension
	**Uponor S-Press PLUS radiator T-adapter**		
	2 units	 • Made of brass and offset coated copper tube • The 15 mm copper pipe can be connected to the radiator using the Uponor Smart radi Cu compression adapter, or a standard brass compression fitting to BS EN 1254-2	16-15CU-16 l=350 mm 20-15CU-20 l=350 mm
	Uponor Smart radi compression adapter Cu		
	2 units	 • Eurocone G¾, elastic sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

Variant 2, like variant 1, but additionally

	Number	Designation		Dimension
	Uponor Smart radi connecting nipple			
	2 units		• Brass coated • Self-sealing • For connecting radiators with ½ IG connections, ¾ MT euro-cone for connecting Cu pipe 15 x 1 mm with Uponor compression adapter Cu with ¾ euro-cone	G¾"MT- G½"MT

Valve radiator with the Uponor Smart radi connection block from the wall

	Number	Designation		Dimension
	**Uponor Smart radi connection block**			
	1 unit		• Made of polystyrene with removable protective cap • Insulation box in fire class E according to BS EN 13501-1 • Suitable for all common valve radiators	16 h = 215 mm 16 h = 240 mm
	Uponor S-Press PLUS radiator cross fitting insulated with insulation box			
	1 unit		• Made of tin-plated brass • For crossing-free, pre-insulated connection of a radiator on the unfinished floor • Including EPP insulation box, two-part 13 mm insulation, thermal conductivity 0.035 W/(m*K). • Dimensions of the insulation box (L x W x H): 115 x 115 x 55 mm	16-16-16 20-16-16 20-16-20 20-20-20
	Uponor Uni-X screw connection MLC			
	2 units		• Two-part screw connection made of brass, with tin-plated union nut and pressure sleeve • For the direct connection of Uponor composite pipes, Uni Pipe PLUS and MLC, to ¾ MT euro-cone parts as well as manifold H • Internal thread according to BS EN ISO 228-1 • Connect without deburring	16-¾"FT Euro

Connection of a radiator valve using the Uponor Smart radi connection block within the wall and the supply connections in the floor using the Uponor S-Press PLUS Smart Radi cross fitting with insulation box

Two-pipe heating from the baseboard - connections from below

Radiator valve connections with Uponor S-Press PLUS baseboard connection kit, adapter and Uponor Smart Base baseboard adapter

	Number	Designation		Dimension
	**Uponor S-Press PLUS connection kit adapter**			
	1 pair		• For the installation of base board connections without chiselling out the wall. For connection of Uponor composite pipes MLC/Uni Pipe PLUS to radiators with valves • Thread according to BS EN ISO 228-1	16-G½" MT-16 16-G½" MT-20 16-G½" MT-0 20-G½" MT-16 0-G½" MT-16 20-G½" MT-20
	Uponor Smart Base angle baseboard			

	Number	Designation	Dimension
	1 pair	 • For connection to the radiator during base installation, in conjunction with the Uponor S-Press PLUS baseboard connection kit. The coated copper pipe, 15 x 1 mm, can be connected to the radiator using the Uponor Cu compression adapter.	15 x 1
	Uponor Smart radi compression adapter Cu		
	2 units	 • With G¾ euro-cone elastically sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block, radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

Single-pipe heating with loop line, radiator connections from below

Radiator and single-pipe valve fitting using Uponor Uni screw MLC connection from the floor

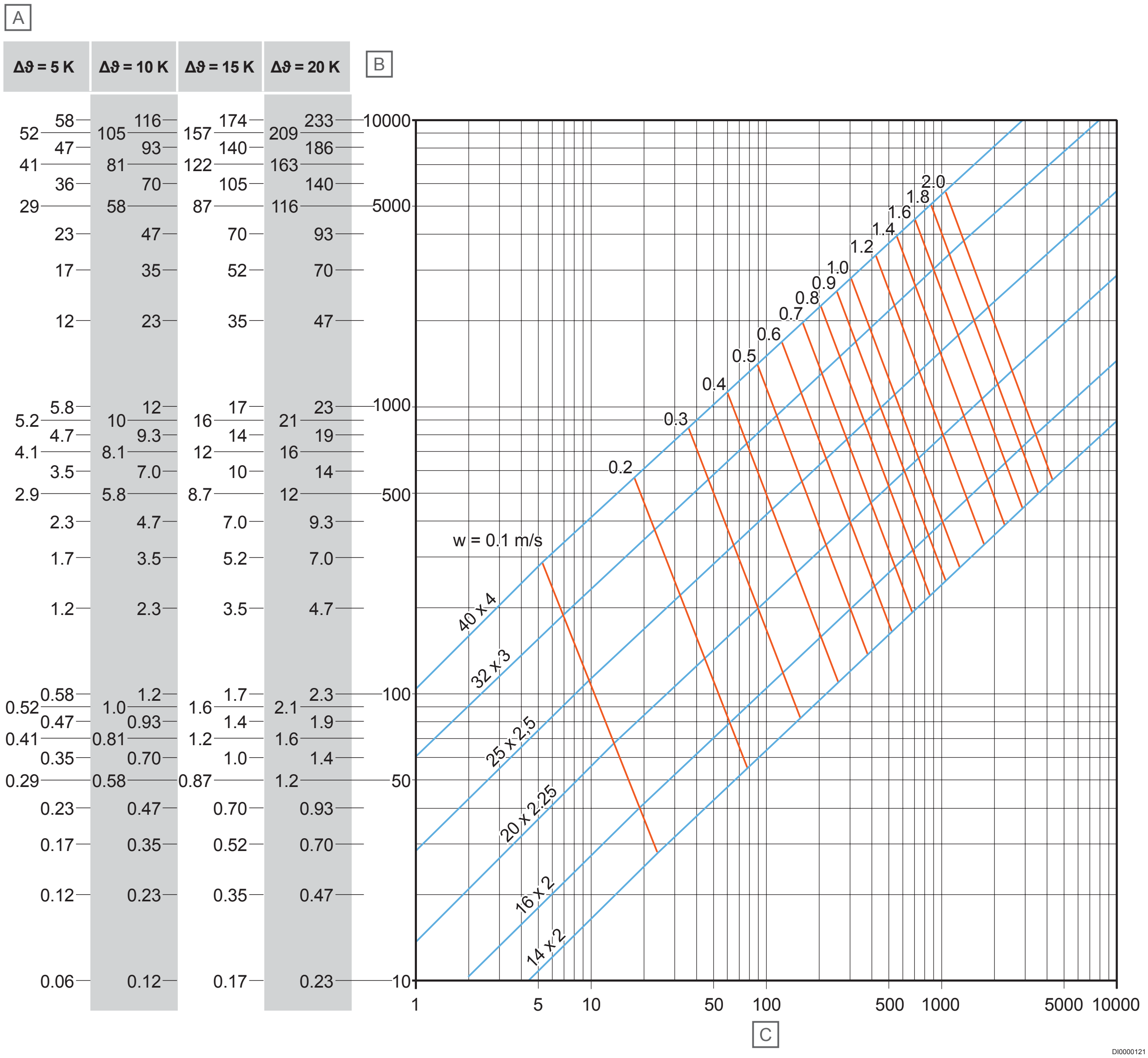
	Number	Designation	Dimension
	Option 1		
	Uponor Uni-C screw connection MLC		
	2 units	 • Two-part brass screw connection, with union nut and pressure sleeve • For the connection of Uponor composite pipes MLC/Uni Pipe PLUS to MT- Uponor fittings, sanitary connections and Uni-C manifolds S • Internal thread according to BS EN ISO 228-1 • Connect without deburring	14-½"FT Euro 16-½"FT Euro 20-½"FT Euro
	Option 2		
	Uponor Uni-C screw connection MLC		
	2 units	 • Two-part brass screw connection, with union nut and pressure sleeve • For the connection of Uponor composite pipes MLC/Uni Pipe PLUS to MT- Uponor fittings, sanitary connections and Uni-C manifolds S • Internal thread according to BS EN ISO 228-1 • Connect without deburring	14-¾"FT Euro 16-¾"FT Euro 20-¾"FT Euro 25-¾"FT Euro

Valve radiator and single-pipe connection block using the Uponor S-Press PLUS radiator connection elbow from the floor

	Number	Designation	Dimension
	**Uponor S-Press PLUS radiator connection elbow**		
	2 units	 • Made of brass and coated copper tube • The 15 mm copper pipe can be connected to the radiator using the Uponor Smart radi Cu compression adapter, or a standard brass compression fitting to BS EN 1254-2	14-15CU l=350 mm 16-15CU l=350 mm 16-15CU l=1000 mm
	Uponor Smart radi compression adapter Cu		
	2 units	 • With G¾ euro-cone elastically sealing for the connection of coated copper pipes 15 x 1 mm of Uponor elbow adapters/T-joints to a tap block, radiator or Uponor radiator connecting nipple with G¾ MT euro-cone • Union nut brass coated, clamping ring brass bright and EPDM sealing cone • Ribbed union nut with wrench size 30	15CU-¾" Euro

9.5 Data for pipe network calculations

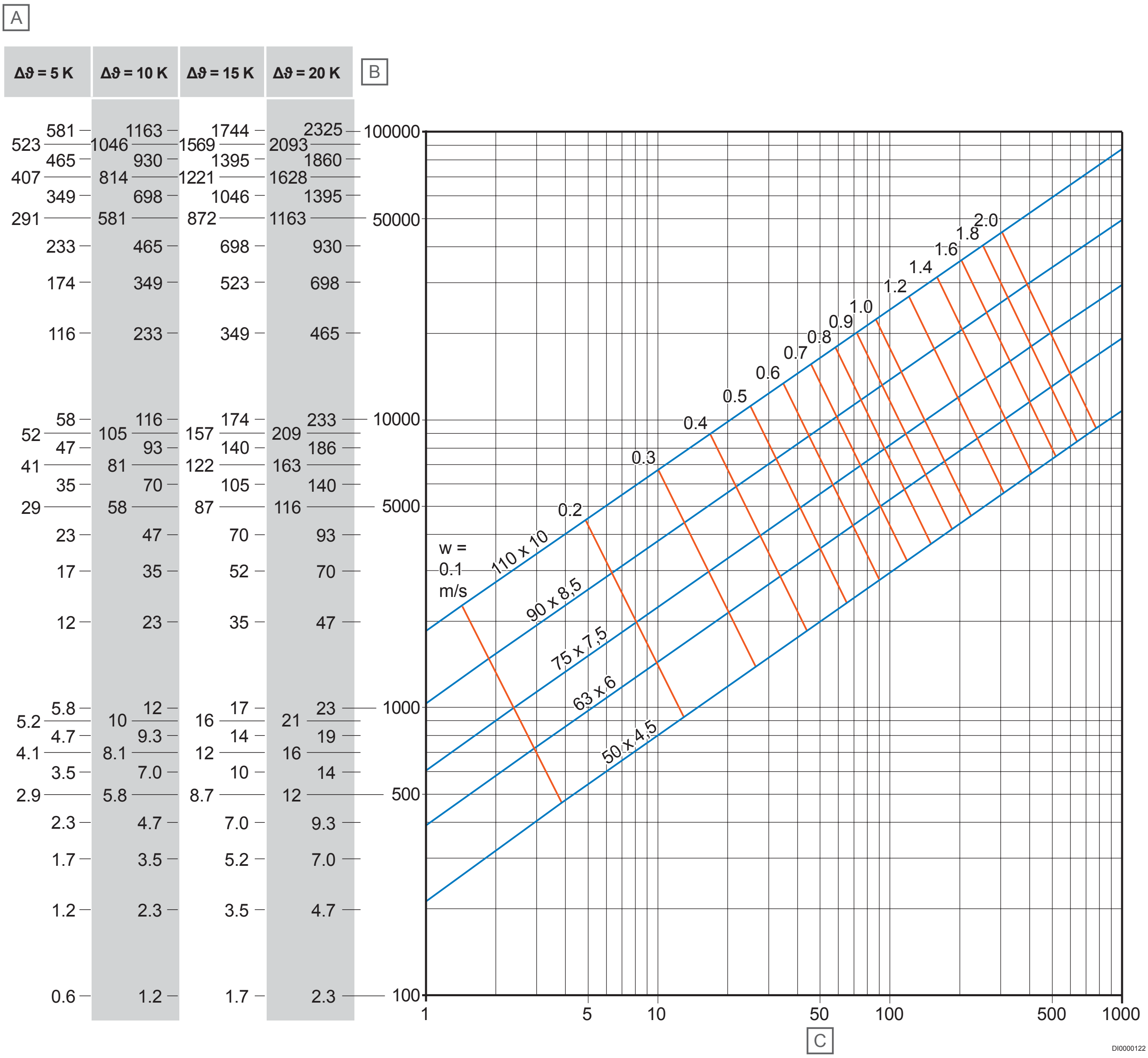
Pipe friction pressure gradient for Uponor composite pipes 14 — 40 mm



Item	Description
A	Power Q kW
B	Mass flow m kg/h
C	Pipe friction pressure gradient R PA/m

Pipe friction pressure gradient for Uponor Multilayer composite pipes in heating installations as a function of mass flow at an average water temperature of 60 °C

Pipe friction pressure gradient for Uponor composite pipes 50 — 110 mm



Pipe friction tables for heating/cooling

The following tables describe the pipe friction pressure gradient (heating or cooling mode) for water as a function of heat or mass flow. Conditions for the respective results are given at the top of each table.

When Multilayer composite pipes are used for cooling, possible condensation must be taken into account. If necessary, suitable measures must be taken for condensate drainage and insufficiently insulated cold water pipes can lead to condensation on the surface of the insulation layer. Unsuitable materials can become damp and this could effect the thermal resistant properties of the insulation and may also shorten the lifespan of the insulation itself. Closed cell or comparable insulation materials with a high water vapour diffusion resistance should be used. All joints, cuts, seams and ends must be sealed and made water/vapour-tight.

Heating mode: Δϑ = 20 K (80 °C/60 °C) - 14 — 16 mm

OD x s (ID) — V/l		**14 x 2 mm (10 mm) — 0.08 l/m**		**16 x 2 mm (12 mm) — 0.11 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
400	17	0.06	10	0.04	4
600	26	0.09	20	0.06	9
800	34	0.12	33	0.09	14
1000	43	0.16	48	0.11	21
1200	52	0.19	66	0.13	28
1400	60	0.22	86	0.15	26
1600	69	0.25	108	0.17	26
1800	78	0.28	132	0.19	56
2000	86	0.31	159	0.22	67
2200	95	0.34	187	0.24	79
2400	103	0.37	218	0.26	92
2600	112	0.41	250	0.28	105
2800	121	0.44	284	0.30	120
3000	129	0.47	321	0.32	135
3200	138	0.50	359	0.35	151
3400	146	0.53	399	0.37	168
3600	155	0.56	441	0.39	186
3800	164	0.59	484	0.41	204
4000	172	0.62	530	0.43	223
4200	181	0.65	577	0.45	243
4400	189	0.69	626	0.48	263
4600	198	0.72	677	0.50	284
4800	207	0.75	729	0.52	306
5000	215	0.78	783	0.54	329
5200	224	0.81	839	0.56	353
5400	233	0.84	897	0.58	377
5600	241	0.87	956	0.61	401
5800	250	0.90	1017	0.63	427
6000	258	0.93	1079	0.65	453
6200	267	0.97	1143	0.67	480
6400	276	1.00	1209	0.69	507
6600	284			0.71	536
6800	293			0.74	564
7000	301			0.76	594
7200	310			0.78	624
7400	319			0.80	655
7600	327			0.82	687
7800	336			0.84	719
8000	344			0.87	751
8500	366			0.92	836
9000	388			0.97	925
9500	409			1.03	1018
10000	431				
10500	452				
11000	474				
11500	495				
12000	517				
12500	538				
13000	560				
13500	581				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 20 K (80 °C/60 °C) - 20 — 32 mm

OD x s (ID) — V/l		20 x 2,25 mm (15,5 mm)— 0.19 l/m		25 x 2,5 mm (20 mm) — 0.31 l/m		32 x 2 mm (26 mm) — 0.53 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
1000	43	0.06	6	0.04	2	0.02	1
2000	86	0.13	20	0.08	6	0.05	2
3000	129	0.19	66	0.12	12	0.07	4
4000	172	0.026	98	0.16	20	0.09	6
5000	215	0.32	134	0.19	29	0.12	8
6000	258	0.45	176	0.23	40	0.14	12
7000	301	0.52	222	0.27	52	0.16	15
8000	344	0.58	273	0.31	66	0.18	19
9000	388	0.65	329	0.35	81	0.21	23
10000	431	0.71	389	0.39	98	0.23	28
11000	474	0.78	454	0.43	116	0.25	33
12000	517	0.84	523	0.47	135	0.28	39
13000	560	0.91	596	0.51	155	0.30	44
14000	603	0.97	673	0.55	177	0.32	51
15000	646	1.04	755	0.58	200	0.35	57
16000	689			0.62	224	0.37	64
17000	732			0.66	249	0.39	71
18000	775			0.70	275	0.41	79
19000	818			0.74	303	0.44	87
20000	861			0.78	332	0.46	95
21000	904			0.82	362	0.48	103
22000	947			0.86	393	0.51	112
23000	990			0.90	425	0.53	122
24000	1033			0.93	459	0.55	131
25000	1077			0.97	493	0.58	141
26000	1120			1.01	529	0.60	151
27000	1163			1.05	566	0.62	161
28000	1206			1.09	603	0.65	172
29000	1249			1.13	642	0.67	183
30000	1292			1.17	682	0.69	195
32000	1378			1.25	766	0.74	218
34000	1464			1.32	853	0.78	243
36000	1550			1.40	945	0.83	269
38000	1636			1.48	1041	0.88	296
40000	1722			1.56	1140	0.92	325
42000	1809					0.97	354
44000	1895					1.01	385
46000	1981					1.06	417
48000	2067					1.11	449
50000	2153					1.15	483
52000	2239					1.20	519
54000	2325					1.24	555
56000	2411					1.29	592
58000	2498					1.34	630
60000	2584					1.38	670
62000	2670					1.43	710
64000	2756					1.48	752
66000	2842					1.52	795
68000	2928					1.57	838
70000	3041					1.61	883

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: ∆ϑ = 20 K (80 °C/60 °C) - 40 — 63 mm

OD x s (ID) — V/l		40 x 4 mm (32 mm) — 0.80 l/m		50 x 4,5 mm (41 mm) — 1.32 l/m		63 x 6 mm (51 mm) — 2.04 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
5000	215	0.08	3	0.05	1	0.03	1
10000	431	0.15	10	0.09	3	0.06	1
15000	646	0.23	21	0.14	7	0.09	2
20000	861	0.30	35	0.19	11	0.12	4
25000	1077	0.38	52	0.23	16	0.15	6
30000	1292	0.46	72	0.28	22	0.18	8
35000	1507	0.53	95	0.32	29	0.21	10
40000	1722	0.61	120	0.37	37	0.24	13
45000	1938	0.68	148	0.42	45	0.27	16
50000	2153	0.76	179	0.46	55	0.30	19
55000	2368	0.84	212	0.51	65	0.33	23
60000	2584	0.91	248	0.56	76	0.36	27
65000	2799	0.99	286	0.60	87	0.39	31
70000	3014	1.07	326	0.65	100	0.42	35
75000	3230	1.14	369	0.70	113	0.45	40
80000	3445	1.22	414	0.74	126	0.48	44
85000	3660	1.29	462	0.79	141	0.51	50
90000	3876	1.37	512	0.83	156	0.54	55
95000	4091	1.45	564	0.88	172	0.57	60
100000	4306	1.52	619	0.93	188	0.60	66
105000	4522			0.97	206	0.63	72
110000	4737			1.02	223	0.66	78
115000	4952			1.07	242	0.69	85
120000	5167			1.11	261	0.72	92
125000	5383			1.16	281	0.75	99
130000	5598			1.20	302	0.78	106
135000	5813			1.25	323	0.81	113
140000	6029			1.30	345	0.84	121
145000	6244			1.34	367	0.87	129
150000	6459			1.39	390	0.90	137
160000	6890			1.48	438	0.96	154
170000	7321			1.58	489	1.02	171
180000	7751					1.08	190
190000	8182					1.14	209
200000	8612					1.20	230
210000	9043					1.26	251
220000	9474					1.32	273
230000	9904					1.38	295
240000	10335					1.44	319
250000	10766					1.50	343
260000	11196					1.56	368
270000	11627					1.62	394
280000	12057					1.68	421
290000	12488					1.74	449
300000	12919					1.80	477
310000	13349					1.86	506
320000	13780					1.92	536
330000	14211					1.98	567
340000	14641					2.04	599
350000	15072					2.10	630

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 20 K (80 °C/60 °C) - 75 — 110 mm

OD x s (ID) — V/l		75 x 7,5 mm (60 mm) — 2.83 l/m		90 x 8,5 mm (73 mm) — 4.18 l/m		110 x 10 mm (90 mm) — 6.36 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
60000	2584	0.26	12	0.18	5	0.12	2
80000	3445	0.35	20	0.23	8	0.15	3
100000	4306	0.43	30	0.29	12	0.19	4
120000	5167	0.52	42	0.35	16	0.23	6
140000	6029	0.61	55	0.41	22	0.27	8
160000	6890	0.69	70	0.47	28	0.31	10
180000	7751	0.78	87	0.53	34	0.35	12
200000	8612	0.87	105	0.58	41	0.38	15
220000	9474	0.95	125	0.64	49	0.42	18
240000	10335	1.04	146	0.70	57	0.46	21
260000	11196	1.13	169	0.76	66	0.50	24
280000	12057	1.21	193	0.82	75	0.54	28
300000	12919	1.30	218	0.88	85	0.58	31
320000	13780	1.38	245	0.94	96	0.62	35
340000	14641	1.47	274	0.99	107	0.65	39
360000	15502	1.56	304	1.05	118	0.69	43
380000	16364	1.64	335	1.11	130	0.73	48
400000	17225	1.73	367	1.17	143	0.77	52
420000	18086	1.82	401	1.23	156	0.81	57
440000	18947	1.90	437	1.29	170	0.85	62
460000	19809	1.99	473	1.34	184	0.88	67
480000	20670			1.40	199	0.92	73
500000	21531			1.46	214	0.96	78
520000	22392			1.52	230	1.00	84
540000	23254			1.58	246	1.04	90
560000	24115			1.64	263	1.08	96
580000	24976			1.70	280	1.12	102
600000	25837			1.75	298	1.15	109
620000	26699			1.81	316	1.19	115
640000	27560			1.87	335	1.23	122
660000	28421			1.93	354	1.27	129
680000	29282			1.99	374	1.31	136
700000	30144					1.35	144
720000	31005					1.38	151
740000	31866					1.42	159
760000	32727					1.46	167
780000	33589					1.50	175
800000	34450					1.54	183
820000	35311					1.58	192
840000	36172					1.62	200
860000	37033					1.65	209
880000	37895					1.69	218
900000	38756					1.73	227
920000	39617					1.77	236
940000	40478					1.81	245
960000	41340					1.85	255
980000	42201					1.89	265
1000000	43062					1.92	275
1020000	43923					1.96	285
1040000	44785					2.00	295

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heading mode: Δϑ = 20 K (70 °C/50 °C) - 14 — 16 mm

OD x s (ID) — V/l		14 x 2 mm (10 mm) — 0.08 l/m		16 x 2 mm (12 mm) — 0.11 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
200	9	0.03	3	0.02	1
400	17	0.06	11	0.04	5
600	26	0.09	21	0.06	9
800	34	0.12	34	0.09	15
1000	43	0.15	50	0.11	21
1200	52	0.19	68	0.13	29
1400	60	0.22	89	0.15	38
1600	69	0.25	112	0.17	47
1800	78	0.28	137	0.19	58
2000	86	0.31	114	0.22	69
2200	95	0.34	194	0.24	82
2400	103	0.37	225	0.26	95
2600	112	0.40	258	0.28	109
2800	121	0.43	294	0.30	124
3000	129	0.46	331	0.32	140
3200	138	0.50	370	0.34	156
3400	146	0.53	411	0.37	173
3600	155	0.56	454	0.39	192
3800	164	0.59	499	0.41	210
4000	172	0.62	546	0.43	230
4200	181	0.65	595	0.45	250
4400	189	0.68	645	0.47	271
4600	198	0.71	697	0.50	293
4800	207	0.74	751	0.52	316
5000	215	0.77	807	0.54	339
5200	224	0.81	864	0.56	363
5400	233	0.84	923	0.58	388
5600	241	0.87	984	0.60	414
5800	250	0.90	1046	0.62	440
6000	258	0.93	1111	0.65	467
6200	267	0.96	1177	0.67	494
6400	276	0.99	1244	0.69	522
6600	284	1.02	1313	0.71	551
6800	293			0.73	581
7000	301			0.75	611
7500	323			0.81	690
8000	344			0.86	773
8500	366			0.91	860
9000	388			0.97	651
9500	409			1.02	1046
10000	431				
10500	452				
11000	474				
11500	495				
12000	517				
12500	538				
13000	560				
13500	581				
14000	603				
14500	624				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: Δϑ = 20 K (70 °C/50 °C) - 20 — 32 mm

OD x s (ID) — V/l		20 x 2,25 mm (15,5 mm) — 0.19 l/m		25 x 2,5 mm (20 mm) — 0.31 l/m		32 x 2 mm (26 mm) — 0.53 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
1000	43	0.06	6	0.04	2	0.02	1
2000	86	0.13	21	0.08	6	0.05	2
3000	129	0.19	42	0.12	13	0.07	4
4000	172	0.26	68	0.15	21	0.09	6
5000	215	0.32	101	0.19	30	0.11	9
6000	258	0.39	138	0.23	41	0.14	12
7000	301	0.45	181	0.27	54	0.16	16
8000	344	0.52	229	0.31	68	0.18	120
9000	388	0.58	281	0.35	84	0.21	24
10000	431	0.64	338	0.39	101	0.23	29
11000	474	0.71	400	0.43	119	0.25	34
12000	517	0.77	466	0.46	139	0.28	40
13000	560	0.84	537	0.50	160	0.30	46
14000	603	0.90	612	0.54	182	0.32	52
15000	646	0.97	692	0.58	205	0.34	59
16000	689	1.03	755	0.62	230	0.37	66
17000	732			0.66	256	0.39	73
18000	775			0.70	283	0.41	81
19000	818			0.74	311	0.44	89
20000	861			0.77	341	0.46	98
21000	904			0.81	372	0.48	106
22000	947			0.85	404	0.50	115
23000	990			0.89	437	0.53	125
24000	1033			0.93	471	0.55	135
25000	1077			0.97	506	0.57	145
26000	1120			1.01	543	0.60	155
27000	1163			1.05	580	0.62	166
28000	1206			1.08	619	0.64	177
29000	1249			1.12	659	0.66	185
30000	1292			1.16	700	0.69	200
32000	1378			1.24	785	0.73	224
34000	1464			1.32	875	0.78	249
36000	1550			1.39	969	0.83	276
38000	1636			1.47	1067	0.87	304
40000	1722			1.55	1169	0.92	333
42000	1809					0.96	363
44000	1895					1.01	395
46000	1981					1.05	427
48000	2067					1.10	461
50000	2153					1.15	496
52000	2239					1.19	532
54000	2325					1.24	569
56000	2411					1.28	607
58000	2498					1.33	646
60000	2584					1.38	686
62000	2670					1.42	728
64000	2756					1.47	770
66000	2842					1.51	814
68000	2928					1.56	859
70000	3041					1.60	905

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heading mode: Δϑ = 20 K (70 °C/50 °C) - 40 — 63 mm

OD x s (ID) — V/l		40 x 4 mm (32 mm) — 0.80 l/m		50 x 4,5 mm (41 mm) — 1.32 l/m		63 x 6 mm (51 mm) — 2.04 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
10000	431	0.15	11	0.09	3	0.06	1
15000	646	0.23	22	0.14	7	0.09	2
20000	861	0.30	36	0.18	11	0.12	4
25000	1077	0.38	54	0.23	17	0.15	6
30000	1292	0.45	74	0.28	23	0.18	8
35000	1507	0.53	97	0.32	30	0.21	11
40000	1722	0.61	123	0.37	38	0.24	13
45000	1938	0.68	152	0.41	47	0.27	16
50000	2153	0.76	184	0.46	56	0.30	20
55000	2368	0.83	217	0.51	67	0.33	23
60000	2584	0.91	254	0.55	78	0.36	27
65000	2799	0.98	293	0.60	89	0.39	32
70000	3014	1.06	334	0.65	102	0.42	36
75000	3230	1.13	378	0.69	115	0.45	41
80000	3445	1.21	425	0.74	130	0.48	46
85000	3660	1.29	473	0.78	144	0.51	51
90000	3876	1.36	524	0.83	160	0.54	56
95000	4091	1.44	578	0.88	176	0.57	62
100000	4306	1.51	633	0.92	193	0.60	68
105000	4522			0.97	211	0.63	74
110000	4737			1.01	229	0.66	80
115000	4952			1.06	248	0.69	87
120000	5167			1.11	267	0.71	94
125000	5383			1.15	288	0.74	101
130000	5598			1.20	309	0.77	108
135000	5813			1.24	330	0.80	116
140000	6029			1.29	353	0.83	124
145000	6244			1.34	376	0.86	132
150000	6459			1.38	399	0.89	140
160000	6890			1.47	448	0.95	157
170000	7321			1.57	500	1.01	175
180000	7751					1.07	194
190000	8182					1.13	214
200000	8612					1.19	235
210000	9043					1.25	256
220000	9474					1.31	279
230000	9904					1.37	302
240000	10335					1.43	326
250000	10766					1.49	351
260000	11196					1.55	377
270000	11627					1.61	403
280000	12057					1.67	431
290000	12488					1.73	459
300000	12919					1.79	488
310000	13349					1.85	518
320000	13780					1.91	548
330000	14211					1.97	579
340000	14641					2.03	612
350000	15072					2.09	644
360000	15502					2.14	678

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: Δϑ = 20 K (70 °C/50 °C) - 75 — 110 mm

OD x s (ID) — V/l		75 x 7,5 mm (60 mm) — 2.83 l/m		90 x 8,5 mm (73 mm) — 4.18 l/m		110 x 10 mm (90 mm) — 6.36 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
70000	3014	0.30	17	0.20	6	0.13	2
90000	3876	0.39	26	0.26	10	0.17	4
110000	4737	0.47	37	0.32	14	0.21	5
130000	5598	0.56	50	0.38	19	0.25	7
150000	6459	0.65	64	0.44	25	0.29	9
170000	7321	0.73	80	0.49	31	0.33	12
190000	8182	0.82	98	0.55	38	0.36	14
210000	9043	0.90	118	0.61	46	0.40	17
230000	9904	0.99	138	0.67	54	0.44	20
250000	10766	1.08	161	0.73	63	0.48	23
270000	11627	1.16	185	0.79	72	0.52	26
290000	12488	1.25	210	0.84	82	0.55	30
310000	13349	1.33	237	0.90	92	0.59	34
330000	14211	1.42	265	0.96	103	0.63	38
350000	15072	1.51	295	1.02	115	0.67	42
370000	15933	1.59	326	1.08	127	0.71	46
390000	16794	1.68	359	1.13	140	0.75	51
410000	17656	1.76	392	1.19	153	0.78	56
430000	18517	1.85	428	1.25	167	0.82	61
450000	19378	1.94	464	1.31	181	0.86	66
470000	20239	2.02	503	1.37	196	0.90	71
490000	21100			1.42	211	0.94	77
510000	21962			1.48	227	0.98	83
530000	22823			1.54	243	1.01	89
550000	23254			1.60	260	1.05	95
570000	24545			1.66	277	1.09	101
590000	25407			1.72	295	1.13	108
610000	26268			1.77	313	1.17	114
630000	27129			1.83	332	1.21	121
650000	27990			1.89	352	1.24	128
670000	28852			1.95	372	1.28	136
690000	29713			2.01	392	1.32	143
710000	30574					1.36	151
730000	31435					1.40	158
750000	32297					1.43	166
770000	33158					1.47	174
790000	34019					1.51	183
810000	34880					1.55	191
830000	35742					1.59	200
850000	36603					1.63	209
870000	37464					1.66	218
890000	38325					1.70	227
910000	39187					1.74	236
930000	40048					1.78	246
950000	40909					1.82	255
970000	41770					1.86	265
990000	42632					1.89	275
1010000	43493					1.93	285
1030000	44354					1.97	296
1050000	45215					2.01	306

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: ∆ϑ = 15 K (70 °C/55 °C) - 14 — 16 mm

OD x s (ID) — V/l		14 x 2 mm (10 mm) — 0.08 l/m		16 x 2 mm (12 mm) — 0.11 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
200	11	0.04	5	0.03	2
400	23	0.08	17	0.06	7
600	34	0.12	34	0.09	14
800	46	0.17	55	0.11	24
1000	57	0.21	81	0.14	34
1200	69	0.25	111	0.17	47
1400	80	0.29	145	0.20	61
1600	92	0.33	182	0.23	77
1800	103	0.37	223	0.26	94
2000	115	0.41	268	0.29	113
2200	126	0.46	316	0.32	133
2400	138	0.50	367	0.34	155
2600	149	0.54	422	0.37	178
2800	161	0.58	480	0.40	202
3000	172	0.62	542	0.43	228
3200	184	0.66	606	0.46	255
3400	195	0.70	674	0.49	284
3600	207	0.74	745	0.52	313
3800	218	0.79	819	0.55	344
4000	230	0.83	896	0.57	377
4200	241	0.87	976	0.60	410
4400	253	0.91	1060	0.63	445
4600	264	0.95	1146	0.66	481
4800	276	0.99	1235	0.69	518
5000	287	1.03	1327	0.72	557
5200	299			0.75	597
5400	310			0.78	638
5600	322			0.80	680
5800	333			0.83	723
6000	344			0.86	767
6200	356			0.89	813
6400	367			0.92	860
6600	379			0.95	908
6800	390			0.98	957
7000	402			1.01	1007
7200	413				
7400	425				
7600	436				
7800	448				
8000	459				
8200	471				
8400	482				
8600	494				
8800	505				
9000	517				
9200	528				
9400	540				
9600	551				
9800	563				
10000	574				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 15 K (70 °C/55 °C) - 20 — 32 mm

OD x s (ID) — V/l		**20 x 2,25 mm (15,5 mm) — 0.19 l/m**		**25 x 2,5 mm (20 mm) — 0.31 l/m**		**32 x 2 mm (26 mm) — 0.53 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
1000	57	0.09	10	0.05	3	0.03	1
1500	86	0.13	21	0.08	6	0.05	2
2000	115	0.17	34	0.10	10	0.06	3
2500	144	0.22	50	0.13	15	0.08	4
3000	172	0.26	68	0.16	20	0.09	6
3500	201	0.30	89	0.18	27	0.11	8
4000	230	0.34	112	0.21	33	0.12	10
4500	258	0.39	137	0.23	41	0.14	12
5000	287	0.43	165	0.26	49	0.15	14
5500	316	0.47	195	0.28	58	0.17	17
6000	344	0.52	227	0.31	68	0.18	19
6500	373	0.56	261	0.34	78	0.20	22
7000	402	0.60	298	0.36	89	0.21	25
7500	431	0.65	336	0.39	100	0.23	29
8000	459	0.69	376	0.41	112	0.24	32
8500	488	0.73	419	0.44	124	0.26	36
9000	517	0.78	463	0.47	138	0.28	40
9500	545	0.82	509	0.49	151	0.29	43
10000	574	0.86	558	0.52	166	0.31	48
10500	603	0.90	608	0.54	180	0.32	52
11000	632	0.95	660	0.57	196	0.34	56
11500	660	0.99	714	0.59	212	0.35	61
12000	689	1.03	770	0.62	228	0.37	65
12500	718			0.65	245	0.38	70
13000	746			0.67	263	0.40	75
13500	775			0.70	281	0.41	80
14000	804			0.72	300	0.43	86
14500	833			0.75	319	0.44	91
15000	861			0.78	339	0.46	97
16000	919			0.83	380	0.49	109
17000	976			0.88	423	0.52	121
18000	1033			0.93	468	0.55	134
19000	1091			0.98	515	0.58	147
20000	1148			1.03	564	0.61	161
22000	1263			1.14	668	0.67	191
24000	1378			1.24	780	0.73	222
26000	1493			1.34	900	0.80	256
28000	1608			1.45	1027	0.86	293
30000	1722			1.55	1161	0.92	331
32000	1837					0.98	371
34000	1952					1.04	413
36000	2067					1.10	458
38000	2182					1.16	504
40000	2297					1.22	552
42000	2411					1.29	603
44000	2526					1.35	655
46000	2641					1.41	709
48000	2756					1.47	766
50000	2871					1.53	824
52000	2986					1.59	884

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 15 K (70 °C/55 °C) - 40 — 63 mm

OD x s (ID) — V/l		**40 x 4 mm (32 mm) — 0.80 l/m**		**50 x 4,5 mm (41 mm) — 1.32 l/m**		**63 x 6 mm (51 mm) — 2.04 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
8000	459	0.16	12	0.10	4	0.06	1
10000	574	0.20	18	0.12	5	0.08	2
12000	689	0.24	24	0.15	8	0.10	3
14000	804	0.28	32	0.17	10	0.11	3
16000	919	0.32	40	0.20	12	0.13	4
18000	1033	0.36	50	0.22	15	0.14	5
20000	1148	0.40	60	0.25	18	0.16	7
22000	1263	0.44	71	0.27	22	0.17	8
24000	1378	0.48	83	0.30	25	0.19	9
26000	1493	0.53	95	0.32	29	0.21	10
28000	1608	0.57	108	0.34	33	0.22	12
30000	1722	0.61	123	0.37	38	0.24	13
32000	1837	0.65	137	0.39	42	0.25	15
34000	1952	0.69	153	0.42	47	0.27	17
36000	2067	0.73	170	0.44	52	0.29	18
38000	2182	0.77	187	0.47	57	0.30	20
40000	2297	0.81	204	0.49	63	0.32	22
42000	2411	0.85	223	0.52	68	0.33	24
44000	2526	0.89	242	0.54	74	0.35	26
46000	2641	0.93	263	0.57	80	0.37	28
48000	2756	0.97	283	0.59	86	0.38	30
50000	2871	1.01	304	0.62	93	0.40	33
55000	3158	1.11	361	0.68	110	0.44	39
60000	3445	1.21	422	0.74	129	0.48	45
65000	3732	1.31	487	0.80	148	0.52	52
70000	4019	1.41	556	0.86	169	0.56	60
75000	4306	1.51	629	0.92	192	0.60	67
80000	4593			0.98	215	0.64	76
85000	4880			1.05	240	0.68	84
90000	5167			1.11	266	0.72	93
95000	5455			1.17	293	0.76	103
100000	5742			1.23	321	0.80	113
105000	6029			1.29	351	0.84	123
110000	6316			1.35	381	0.87	134
115000	6603			1.42	413	0.91	145
120000	6890			1.48	446	0.95	156
125000	7177			1.54	480	0.99	168
130000	7464					1.03	180
140000	8038					1.11	206
150000	8612					1.19	233
160000	9187					1.27	262
170000	9761					1.35	292
180000	10335					1.43	324
190000	10909					1.51	357
200000	11483					1.59	392
210000	12057					1.67	428
220000	12632					1.75	466
230000	13206					1.83	505
240000	13780					1.91	545
250000	14354					1.99	587

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: ∆ϑ = 15 K (70 °C/55 °C) - 75 — 110 mm

OD x s (ID) — V/l		**75 x 7,5 mm (60 mm) — 2.83 l/m**		**90 x 8,5 mm (73 mm) — 4.18 l/m**		**110 x 10 mm (90 mm) — 6.36 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
40000	2297	0.23	10	0.16	4	0.10	1
50000	2871	0.29	15	0.19	6	0.13	2
60000	3445	0.34	21	0.23	8	0.15	3
70000	4019	0.40	27	0.27	11	0.18	4
80000	4593	0.46	35	0.31	14	0.20	5
90000	5167	0.52	43	0.35	17	0.23	6
100000	5742	0.57	52	0.39	20	0.26	7
110000	6316	0.63	61	0.43	24	0.28	9
120000	6890	0.69	72	0.47	28	0.31	10
130000	7464	0.75	83	0.50	32	0.33	12
140000	8038	0.80	95	0.54	37	0.36	14
150000	8612	0.86	107	0.58	42	0.38	15
160000	9187	0.92	120	0.62	47	0.41	17
170000	9761	0.98	134	0.66	52	0.43	19
180000	10335	1.03	148	0.70	58	0.46	21
190000	10909	1.09	164	0.74	64	0.49	23
200000	11483	1.15	180	0.78	70	0.51	26
220000	12632	1.26	213	0.85	83	0.56	30
240000	13780	1.38	249	0.93	97	0.61	36
260000	14928	1.49	288	1.01	112	0.66	41
280000	16077	1.61	329	1.09	128	0.72	47
300000	17225	1.72	373	1.16	145	0.77	53
320000	18373	1.84	419	1.24	163	0.82	60
340000	19522	1.95	468	1.32	182	0.87	67
360000	20670	2.07	519	1.40	202	0.92	74
380000	21818			1.48	223	0.97	81
400000	22967			1.55	244	1.02	89
420000	24115			1.63	267	1.07	97
440000	25263			1.71	290	1.12	106
460000	26411			1.79	315	1.17	115
480000	28560			1.86	340	1.23	124
500000	28708			1.94	366	1.28	134
520000	29856			2.02	393	1.33	143
540000	31005					1.38	154
560000	32153					1.43	164
580000	33301					1.48	175
600000	34450					1.53	186
620000	35598					1.58	197
640000	36746					1.63	209
660000	37895					1.69	221
680000	39043					1.74	233
700000	40191					1.79	246
720000	41340					1.84	259
740000	42488					1.89	272
760000	43636					1.94	286
780000	44785					1.99	299
800000	45933					2.04	314
820000	47081					2.09	328
840000	48230					2.15	343
860000	49378					2.20	358

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: ∆ϑ = 10 K (55 °C/45 °C) - 14 — 16 mm

OD x s (ID) — V/l		**14 x 2 mm (10 mm) — 0.08 l/m**		**16 x 2 mm (12 mm) — 0.11 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
200	17	0.06	11	0.04	5
300	26	0.09	22	0.06	9
400	34	0.12	36	0.09	15
500	43	0.15	52	0.11	22
600	52	0.19	71	0.13	30
700	60	0.22	93	0.15	39
800	69	0.25	116	0.17	49
900	78	0.28	142	0.19	60
1000	86	0.31	171	0.21	72
1100	95	0.34	201	0.24	85
1200	103	0.37	234	0.26	99
1300	112	0.40	268	0.28	113
1400	121	0.43	305	0.30	129
1500	129	0.46	343	0.32	145
1600	138	0.49	384	0.34	162
1700	146	0.52	427	0.36	180
1800	155	0.56	471	0.39	199
1900	164	0.59	517	0.41	218
2000	172	0.62	566	0.43	238
2100	181	0.65	616	0.45	259
2200	189	0.68	668	0.47	281
2300	198	0.71	722	0.49	304
2400	207	0.74	777	0.51	327
2500	215	0.77	835	0.54	351
2600	224	0.80	894	0.56	376
2700	233	0.83	955	0.58	402
2800	241	0.86	1018	0.60	428
2900	250	0.89	1082	0.62	455
3000	258	0.93	1148	0.64	483
3200	276	0.99	1286	0.69	540
3400	293	1.05	1430	0.73	601
3600	310			0.77	664
3800	327			0.81	730
4000	344			0.86	799
4200	362			0.90	870
4400	349			0.94	945
4600	396			0.99	1021
4800	413			1.03	1101
5000	431				
5200	448				
5400	465				
5600	482				
5800	500				
6000	517				
6200	534				
6400	551				
6600	568				
6800	586				
7000	603				
7200	620				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 10 K (55 °C/45 °C) - 20 — 32 mm

OD x s (ID) — V/l		20 x 2,25 mm (15,5 mm) — 0.19 l/m		25 x 2,5 mm (20 mm) — 0.31 l/m		32 x 2 mm (26 mm) — 0.53 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
500	43	0.06	7	0.04	2	0.02	1
1000	86	0.13	22	0.08	7	0.05	2
1500	129	0.19	43	0.12	13	0.07	4
2000	172	0.26	71	0.15	21	0.09	6
2500	215	0.32	104	0.19	31	0.11	9
3000	258	0.39	143	0.23	43	0.14	12
3500	301	0.45	188	0.27	56	0.16	16
4000	344	0.51	237	0.31	71	0.18	20
4500	388	0.58	291	0.35	87	0.21	25
5000	431	0.64	350	0.39	104	0.23	30
5500	474	0.71	414	0.42	123	0.25	35
6000	517	0.77	482	0.46	143	0.27	41
6500	560	0.83	555	0.50	165	0.30	47
7000	603	0.90	632	0.54	188	0.32	54
7500	646	0.96	714	0.58	212	0.34	61
8000	689	1.03	800	0.62	237	0.37	68
8500	732			0.66	264	0.39	76
9000	775			0.69	292	0.41	84
9500	818			0.73	321	0.43	92
10000	861			0.77	352	0.46	101
10500	904			0.81	383	0.48	110
11000	947			0.85	416	0.50	119
11500	990			0.89	450	0.52	129
12000	1033			0.93	486	0.55	139
12500	1077			0.96	522	0.57	149
13000	1120			1.00	560	0.59	160
13500	1163			1.04	598	0.62	171
14000	1206			1.08	638	0.64	182
14500	1249			1.12	679	0.66	194
15000	1292			1.16	721	0.68	206
16000	1378			1.23	809	0.73	231
17000	1464			1.31	901	0.78	257
18000	1550			1.39	997	0.82	285
19000	1636			1.47	1098	0.87	313
20000	1722			1.54	1203	0.91	343
21000	1809					0.96	374
22000	1895					1.00	406
23000	1981					1.05	440
24000	2067					1.10	474
25000	2153					1.14	510
26000	2239					1.19	547
27000	2325					1.23	585
28000	2411					1.28	624
29000	2498					1.32	665
30000	2584					1.37	706
31000	2670					1.41	749
32000	2756					1.46	792
33000	2842					1.51	837
34000	2928					1.55	883
35000	3014					1.60	930

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 10 K (55 °C/45 °C) - 40 — 63 mm

OD x s (ID) — V/l		40 x 4 mm (32 mm) — 0.80 l/m		50 x 4,5 mm (41 mm) — 1.32 l/m		63 x 6 mm (51 mm) — 2.04 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
2000	172	0.06	2	0.04	1	0.02	1
4000	344	0.12	8	0.07	2	0.05	1
6000	517	0.18	15	0.11	5	0.07	2
8000	689	0.24	25	0.15	8	0.09	3
10000	861	0.30	38	0.18	12	0.12	4
12000	1033	0.36	52	0.22	16	0.14	6
14000	1206	0.42	68	0.26	21	0.17	7
16000	1378	0.48	86	0.29	26	0.19	9
18000	1550	0.54	106	0.33	32	0.21	11
20000	1722	0.60	127	0.37	39	0.24	14
22000	1895	0.66	151	0.40	46	0.26	16
24000	2067	0.72	176	0.44	54	0.28	19
26000	2239	0.78	203	0.48	62	0.31	22
28000	2411	0.84	231	0.51	71	0.33	25
30000	2584	0.90	261	0.55	80	0.36	28
32000	2756	0.96	293	0.59	90	0.38	32
34000	2928	1.02	327	0.62	100	0.40	35
36000	3100	1.08	362	0.66	111	0.43	39
38000	3273	1.14	398	0.70	122	0.45	43
40000	3445	1.20	437	0.73	133	0.47	47
42000	3617	1.27	476	0.77	145	0.50	51
44000	3789	1.33	518	0.81	158	0.52	56
46000	3962	1.39	561	0.84	171	0.55	60
48000	4134	1.45	605	0.88	185	0.57	65
50000	4306	1.51	651	0.92	199	0.59	70
55000	4737			1.01	235	0.65	83
60000	5167			1.10	275	0.71	97
65000	5598			1.19	317	0.77	112
70000	6029			1.28	362	0.83	127
75000	6459			1.38	410	0.89	144
80000	6890			1.47	461	0.95	162
85000	7321			1.56	514	1.01	180
90000	7751					1.07	200
95000	8182					1.13	220
100000	8612					1.19	241
105000	9043					1.25	263
110000	9474					1.30	286
115000	9904					1.36	310
120000	10335					1.42	335
125000	10766					1.48	360
130000	11196					1.54	387
135000	11627					1.60	414
140000	12057					1.66	442
145000	12488					1.72	471
150000	12919					1.78	500
155000	13349					1.84	531
160000	13780					1.90	562
165000	14211					1.96	594
170000	14641					2.02	627
175000	15072					2.08	661

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 10 K (55 °C/45 °C) - 75 — 110 mm

OD x s (ID) — V/l		75 x 7,5 mm (60 mm) — 2.83 l/m		90 x 8,5 mm (73 mm) — 4.18 l/m		110 x 10 mm (90 mm) — 6.36 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
40000	3445	0.34	22	0.23	8	0.13	3
50000	4306	0.43	32	0.29	13	0.17	5
60000	5167	0.51	44	0.35	17	0.21	6
70000	6029	0.60	58	0.41	23	0.25	8
80000	6890	0.69	74	0.46	29	0.29	11
90000	7751	0.77	92	0.52	36	0.33	13
100000	8612	0.86	111	0.58	43	0.36	16
110000	9474	0.94	131	0.64	51	0.40	19
120000	10335	1.03	153	0.69	60	0.44	22
130000	11196	1.11	177	0.75	69	0.48	25
140000	12057	1.20	202	0.81	79	0.52	29
150000	12919	1.29	229	0.87	89	0.55	33
160000	13780	1.37	257	0.93	100	0.59	37
170000	14641	1.46	287	0.98	112	0.63	41
180000	15502	1.54	318	1.04	124	0.67	45
190000	16364	1.63	351	1.10	137	0.71	50
200000	17225	1.71	385	1.16	150	0.75	55
210000	18086	1.80	420	1.22	164	0.78	60
220000	18947	1.88	457	1.27	178	0.82	65
230000	19809	1.97	495	1.33	193	0.86	71
240000	20670	2.06	535	1.39	208	0.90	76
250000	21531			1.45	224	0.94	82
260000	22392			1.50	241	0.98	88
270000	23254			1.56	258	1.01	94
280000	24115			1.62	275	1.05	101
290000	24976			1.68	293	1.09	107
300000	25837			1.74	312	1.13	114
310000	26699			1.79	331	1.17	121
320000	27560			1.85	350	1.21	128
330000	28421			1.91	371	1.24	135
340000	29282			1.97	391	1.28	143
350000	30144			2.03	412	1.32	150
360000	31005					1.36	158
370000	31866					1.40	166
380000	32727					1.43	175
390000	33589					1.47	183
400000	34450					1.51	192
410000	35311					1.55	200
420000	36172					1.59	209
430000	37033					1.63	218
440000	37895					1.66	228
450000	38756					1.70	237
460000	39617					1.74	247
470000	40478					1.78	257
480000	41340					1.82	267
490000	42201					1.86	277
500000	43062					1.89	287
510000	43923					1.93	298
520000	44785					1.97	308
530000	45646					2.01	319

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 5 K (50 °C/45 °C) - 14 — 16 mm

OD x s (ID) — V/l		**14 x 2 mm (10 mm) — 0.08 l/m**		**16 x 2 mm (12 mm) — 0.11 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
200	34	0.12	36	0.09	16
250	43	0.15	53	0.11	23
300	52	0.18	72	0.13	31
350	60	0.22	94	0.15	40
400	69	0.25	118	0.17	50
450	78	0.28	144	0.19	61
500	86	0.31	173	0.21	73
550	95	0.34	203	0.24	86
600	103	0.37	236	0.26	100
650	112	0.40	271	0.28	115
700	121	0.43	308	0.30	130
750	129	0.46	347	0.32	146
800	138	0.49	388	0.34	164
850	146	0.52	431	0.36	182
900	155	0.55	476	0.39	201
950	164	0.59	523	0.41	220
1000	172	0.62	571	0.43	241
1050	181	0.65	622	0.45	262
1100	189	0.68	674	0.47	284
1150	198	0.71	729	0.49	307
1200	207	0.74	785	0.51	330
1250	215	0.77	843	0.53	355
1300	224	0.80	902	0.56	380
1350	233	0.83	964	0.58	406
1400	241	0.86	1027	0.60	432
1450	250	0.89	1092	0.62	459
1500	258	0.92	1159	0.64	487
1550	267	0.96	1227	0.66	516
1600	276	0.99	1298	0.68	546
1650	284	1.02	1370	0.71	576
1700	293			0.73	607
1750	301			0.75	638
1800	310			0.77	670
1850	319			0.79	703
1900	327			0.81	737
1950	336			0.83	771
2000	344			0.86	806
2100	362			0.90	878
2200	379			0.94	953
2300	396			0.98	1030
2400	413			1.03	1111
2500	431				
2600	448				
2700	465				
2800	482				
3900	500				
3000	517				
3100	534				
3200	551				
3300	568				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: Δϑ = 5 K (50 °C/45 °C) - 20 — 32 mm

OD x s (ID) — V/l		**20 x 2,25 mm (15,5 mm) — 0.19 l/m**		**25 x 2,5 mm (20 mm) — 0.31 l/m**		**32 x 2 mm (26 mm) — 0.53 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
400	69	0.10	15	0.06	5	0.04	1
600	103	0.15	30	0.09	9	0.05	3
800	138	0.21	49	0.12	15	0.07	4
1000	172	0.26	72	0.15	22	0.09	6
1200	207	0.31	98	0.18	29	0.11	9
1400	241	0.36	128	0.22	38	0.13	11
1600	276	0.41	162	0.25	48	0.15	14
1800	310	0.46	199	0.28	59	0.16	17
2000	344	0.51	239	0.31	71	0.18	21
2200	379	0.56	282	0.34	84	0.20	24
2400	413	0.62	329	0.37	98	0.22	28
2600	448	0.67	378	0.40	113	0.24	32
2800	482	0.72	431	0.43	128	0.26	37
3000	517	0.77	486	0.46	145	0.27	42
3200	551	0.82	545	0.49	162	0.29	47
3400	586	0.87	606	0.52	180	0.31	52
3600	620	0.92	670	0.55	199	0.33	57
3800	655	0.97	737	0.59	219	0.35	63
4000	689	1.03	807	0.62	240	0.36	69
4200	723			0.65	261	0.38	75
4400	758			0.68	283	0.40	81
4600	792			0.71	306	0.42	88
4800	827			0.74	330	0.44	95
5000	861			0.77	355	0.46	102
5200	896			0.80	380	0.47	109
5400	930			0.83	407	0.49	116
5600	965			0.86	434	0.51	124
5800	999			0.89	461	0.53	132
6000	1033			0.92	490	0.55	140
6500	1120			1.00	564	0.59	161
7000	1206			1.08	643	0.64	184
7500	1292			1.16	727	0.68	208
8000	1378			1.23	815	0.73	233
8500	1464			1.31	908	0.77	259
9000	1550			1.39	1005	0.82	287
9500	1636			1.46	1107	0.87	316
10000	1722			1.54	1213	0.91	346
10500	1809					0.96	377
11000	1895					1.00	410
11500	1981					1.05	443
12000	2067					1.09	478
12500	2153					1.14	514
13000	2239					1.18	551
13500	2325					1.23	590
14000	2411					1.28	629
14500	2498					1.32	670
15000	2584					1.37	712
15500	2670					1.41	755
16000	2756					1.46	799
16500	2842					1.50	844

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: ∆ϑ = 5 K (50 °C/45 °C) - 40 — 63 mm

OD x s (ID) — V/l		40 x 4 mm (32 mm) — 0.80 l/m		50 x 4,5 mm (41 mm) — 1.32 l/m		63 x 6 mm (51 mm) — 2.04 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
4000	689	0.24	26	0.15	8	0.09	3
5000	861	0.30	38	0.18	12	0.12	4
6000	1033	0.36	52	0.22	16	0.14	6
7000	1206	0.42	68	0.26	21	0.17	7
8000	1378	0.48	87	0.29	27	0.19	9
9000	1550	0.54	107	0.33	33	0.21	12
10000	1722	0.60	128	0.37	39	0.24	14
11000	1895	0.66	152	0.40	47	0.26	16
12000	2067	0.72	177	0.44	54	0.28	19
13000	2239	0.78	204	0.48	63	0.31	22
14000	2411	0.84	233	0.51	71	0.33	25
15000	2584	0.90	264	0.55	81	0.36	28
16000	2756	0.96	296	0.59	90	0.38	32
17000	2928	1.02	329	0.62	101	0.40	36
18000	3100	1.08	365	0.66	111	0.43	39
19000	3273	1.14	402	0.70	123	0.45	43
20000	3445	1.20	440	0.73	134	0.47	47
22000	3789	1.32	522	0.81	159	0.52	56
24000	4134	1.44	610	0.88	186	0.57	66
26000	4478	1.56	704	0.95	215	0.62	76
28000	4823			1.03	245	0.66	86
30000	5167			1.10	277	0.71	97
32000	5512			1.17	311	0.76	109
34000	5856			1.25	347	0.81	122
36000	6201			1.32	384	0.85	135
38000	6545			1.39	423	0.90	149
40000	6890			1.47	464	0.95	163
42000	7234			1.54	506	0.99	178
44000	7579					1.04	193
46000	7923					1.09	209
48000	8268					1.14	226
50000	8612					1.18	243
52000	8957					1.23	261
54000	9301					1.28	279
56000	9646					1.33	298
58000	9990					1.37	317
60000	10335					1.42	337
62000	10679					1.47	358
64000	11024					1.52	379
66000	11368					1.56	400
68000	11713					1.61	422
70000	12057					1.66	445
72000	12402					1.71	468
74000	12746					1.75	492
76000	13091					1.80	516
78000	13435					1.85	541
80000	13780					1.90	566
82000	14124					1.94	592
84000	14469					1.99	618
86000	14813					2.04	645

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Heating mode: $\Delta\vartheta$ = 5 K (50 °C/45 °C) - 75 — 110 mm

OD x s (ID) — V/l		**75 x 7,5 mm (60 mm) — 2.83 l/m**		**90 x 8,5 mm (73 mm) — 4.18 l/m**		**110 x 10 mm (90 mm) — 6.36 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
20000	3445	0.34	22	0.23	9	0.15	3
25000	4306	0.43	32	0.29	13	0.19	5
30000	5167	0.51	45	0.35	18	0.23	6
35000	6029	0.60	59	0.40	23	0.27	8
40000	6890	0.69	75	0.46	29	0.30	11
45000	7751	0.77	92	0.52	36	0.34	13
50000	8612	0.86	112	0.58	44	0.38	16
55000	9474	0.94	132	0.64	52	0.42	19
60000	10335	1.03	155	0.69	60	0.46	22
65000	11196	1.11	178	0.75	70	0.49	26
700000	12057	1.20	204	0.81	80	0.53	29
75000	12919	1.28	231	0.87	90	0.57	33
80000	13780	1.37	259	0.93	101	0.61	37
85000	14641	1.45	289	0.98	113	0.65	41
90000	15502	1.54	321	1.04	125	0.68	46
95000	16364	1.63	353	1.10	138	0.72	50
100000	17225	1.71	388	1.16	151	0.76	55
105000	18086	1.80	423	1.21	165	0.80	60
110000	18947	1.88	460	1.27	179	0.84	66
115000	19809	1.97	499	1.33	194	0.87	71
120000	20670	2.05	539	1.39	210	0.91	77
125000	21531			1.45	226	0.95	83
130000	22392			1.50	242	0.99	89
135000	23254			1.56	260	1.03	95
140000	24115			1.62	277	1.06	101
145000	24976			1.68	295	1.10	108
150000	25837			1.73	314	1.14	115
155000	26699			1.79	333	1.18	122
160000	27560			1.85	353	1.22	129
165000	28421			1.91	373	1.26	136
170000	29282			1.97	394	1.29	144
175000	30144			2.02	415	1.33	152
180000	31005					1.37	159
185000	31866					1.41	168
190000	32727					1.45	176
195000	33589					1.48	184
200000	34450					1.52	193
205000	35311					1.56	202
210000	36172					1.60	211
215000	37033					1.64	220
220000	37895					1.67	229
225000	38756					1.71	239
230000	39617					1.75	248
235000	40478					1.79	258
240000	41340					1.83	268
245000	42201					1.86	279
250000	43062					1.90	289
255000	43923					1.94	300
260000	44785					1.98	310
265000	45646					2.02	321

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 6 K (6 °C/12 °C) - 14 — 16 mm

OD x s (ID) — V/l		14 x 2 mm (10 mm) — 0.08 l/m		16 x 2 mm (12 mm) — 0.11 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-100	14	0.05	12	0.04	5
-200	29	0.10	36	0.07	15
-300	43	0.15	69	0.11	30
-400	57	0.20	112	0.14	48
-500	72	0.25	162	0.18	69
-600	86	0.30	220	0.21	94
-700	100	0.36	286	0.25	122
-800	115	0.41	358	0.28	152
-900	129	0.46	437	0.32	186
-1000	144	0.51	523	0.35	222
-1100	158	0.56	615	0.39	261
-1200	172	0.61	714	0.42	303
-1300	187	0.66	818	0.46	347
-1400	201	0.71	929	0.49	394
-1500	215	0.76	1046	0.53	443
-1600	230	0.81	1169	0.56	495
-1700	244	0.86	1297	0.60	549
-1800	258	0.91	1432	0.63	605
-1900	273	0.96	1572	0.67	664
-2000	287	1.02	1717	0.71	726
-2100	301			0.74	789
-2200	316			0.78	855
-2300	330			0.81	923
-2400	344			0.85	994
-2500	359			0.88	1066
-2600	373			0.92	1141
-2700	388			0.95	1218
-2800	402			0.99	1297
-2900	416			1.02	1379
-3000	431				
-3100	445				
-3200	459				
-3300	474				
-3400	488				
-3500	502				
-3600	517				
-3700	531				
-3800	545				
-3900	560				
-4000	574				
-4100	589				
-4200	603				
-4300	617				
-4400	632				
-4500	646				
-4600	660				
-4700	675				
-4800	689				
-4900	703				
-5000	718				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 6 K (6 °C/12 °C) - 20 — 32 mm

OD x s (ID) — V/l		20 x 2,25 mm (15,5 mm) — 0.19 l/m		25 x 2,5 mm (20 mm) — 0.31 l/m		32 x 2 mm (26 mm) — 0.53 l/m	
Q, W	m, kg/h	v, m/s	R, Pa/m	v, m/s	R, Pa/m	v, m/s	R, Pa/m
-400	57	0.08	15	0.05	4	0.03	1
-600	86	0.13	28	0.08	9	0.05	3
-800	115	0.17	46	0.10	14	0.06	4
-1000	144	0.21	67	0.13	20	0.08	6
-1200	172	0.25	91	0.15	28	0.09	8
-1400	201	0.30	118	0.18	36	0.11	10
-1600	230	0.34	148	0.20	45	0.12	13
-1800	258	0.38	181	0.23	55	0.14	16
-2000	287	0.42	217	0.25	65	0.15	19
-2200	316	0.47	255	0.28	77	0.17	22
-2400	344	0.51	297	0.30	89	0.18	26
-2600	373	0.55	340	0.33	102	0.20	30
-2800	402	0.59	387	0.36	116	0.21	34
-3000	431	0.63	436	0.38	131	0.23	38
-3200	459	0.68	487	0.41	146	0.24	42
-3400	488	0.72	541	0.43	162	0.26	47
-3600	517	0.76	597	0.46	179	0.27	52
-3800	545	0.80	656	0.48	196	0.29	57
-4000	574	0.85	717	0.51	214	0.30	62
-4200	603	0.89	780	0.53	233	0.32	68
-4400	632	0.93	846	0.56	253	0.33	73
-4600	660	0.97	914	0.58	273	0.35	79
-4800	689	1.01	984	0.61	294	0.36	85
-5000	718			0.63	316	0.38	91
-5500	789			0.70	372	0.41	108
-6000	861			0.76	433	0.45	125
-6500	933			0.83	498	0.49	144
-7000	1005			0.89	567	0.53	163
-7500	1077			0.95	639	0.56	184
-8000	1148			1.02	715	0.60	206
-8500	1220			1.08	796	0.64	229
-9000	1292			1.14	879	0.68	253
-9500	1364			1.21	964	0.71	278
-10000	1435			1.27	1058	0.75	304
-10500	1507			1.33	1152	0.79	331
-11000	1579			1.40	1250	0.83	359
-11500	1651			1.46	1352	0.86	388
-12000	1722			1.52	1457	0.90	418
-12500	1794					0.94	449
-13000	1866					0.98	481
-13500	1938					1.01	514
-14000	2010					1.05	548
-14500	2081					1.09	583
-15000	2153					1.13	619
-16000	2297					1.20	693
-17000	2440					1.28	771
-18000	2584					1.35	853
-19000	2727					1.43	938
-20000	2871					1.50	1027
-21000	3014					1.58	1120

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: ∆ϑ = 6 K (6 °C/12 °C) - 40 — 63 mm

OD x s (ID) — V/l		40 x 4 mm (32 mm) — 0.80 l/m		50 x 4,5 mm (41 mm) — 1.32 l/m		63 x 6 mm (51 mm) — 2.04 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-4000	574	0.20	23	0.12	7	0.08	3
-6000	861	0.30	47	0.18	15	0.12	5
-8000	1148	0.40	77	0.24	24	0.16	9
-10000	1435	0.50	114	0.30	35	0.20	12
-12000	1722	0.60	156	0.36	48	0.23	17
-14000	2010	0.69	204	0.42	63	0.27	22
-16000	2297	0.79	258	0.48	79	0.31	28
-18000	2584	0.89	317	0.54	98	0.35	35
-20000	2871	0.99	382	0.60	117	0.39	42
-22000	3158	1.09	452	0.66	139	0.43	49
-24000	3445	1.19	527	0.73	162	0.47	57
-26000	3732	1.29	607	0.79	186	0.51	66
-28000	4019	1.39	692	0.85	212	0.55	75
-30000	4306	1.49	781	0.91	101	0.59	85
-32000	4593	1.59	876	0.97	269	0.62	95
-34000	4880			1.03	299	0.66	106
-36000	5167			1.09	331	0.70	117
-38000	5455			1.15	364	0.74	129
-40000	5742			1.21	399	0.78	141
-42000	6029			1.27	435	0.82	153
-44000	6316			1.33	472	0.86	167
-46000	6603			1.39	511	0.90	180
-48000	6890			1.45	551	0.94	194
-50000	7177			1.51	592	0.98	209
-52000	7464					1.02	224
-54000	7751					1.05	239
-56000	8038					1.09	255
-58000	8325					1.13	272
-60000	8612					1.17	289
-62000	8900					1.21	306
-64000	9187					1.25	324
-66000	9474					1.29	342
-68000	9761					1.33	360
-70000	10048					1.37	379
-72000	10335					1.41	399
-74000	10622					1.44	419
-76000	10909					1.48	439
-78000	11196					1.52	460
-80000	11483					1.56	481
-82000	11770					1.60	503
-84000	12057					1.64	525
-86000	12344					1.68	547
-88000	12632					1.72	570
-90000	12919					1.76	594
-92000	13206					1.80	618
-94000	13493					1.84	642
-96000	13780					1.87	666
-98000	14067					1.91	691
-100000	14354					1.95	717
-102000	14641					1.99	742

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 6 K (6 °C/12 °C) - 75 — 110 mm

OD x s (ID) — V/l		75 x 7,5 mm (60 mm) — 2.83 l/m		90 x 8,5 mm (73 mm) — 4.18 l/m		110 x 10 mm (90 mm) — 6.36 l/m	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-10000	1435	0.14	6	0.10	2	0.06	1
-15000	2153	0.21	12	0.14	5	0.09	2
-20000	2871	0.28	19	0.19	8	0.13	3
-25000	3589	0.35	28	0.24	11	0.16	4
-30000	4306	0.42	39	0.29	15	0.19	6
-35000	5024	0.49	51	0.33	20	0.22	7
-40000	5742	0.56	65	0.38	26	0.25	9
-45000	6459	0.63	80	0.43	31	0.28	12
-50000	7177	0.71	96	0.48	38	0.31	14
-55000	7895	0.78	114	0.52	45	0.34	16
-60000	8612	0.85	133	0.57	52	0.38	19
-65000	9330	0.92	153	0.62	60	0.41	22
-70000	10048	0.99	175	0.67	68	0.44	25
-75000	10766	1.06	197	0.71	77	0.47	28
-80000	11483	1.13	221	0.76	87	0.50	32
-85000	12201	1.20	246	0.81	97	0.53	36
-90000	12919	1.27	273	0.86	107	0.56	39
-95000	13636	1.34	300	0.91	118	0.60	43
-100000	14354	1.41	329	0.95	129	0.63	47
-105000	15072	1.48	359	1.00	141	0.66	52
-110000	15789	1.55	390	1.05	153	0.69	56
-115000	16507	1.62	422	1.10	165	0.72	61
-120000	17225	1.69	456	1.14	178	0.75	66
-125000	17943	1.76	490	1.19	192	0.78	70
-130000	18660	1.83	526	1.24	206	0.82	76
-135000	19378	1.90	563	1.29	220	0.85	81
-140000	20096	1.97	601	1.33	235	0.88	86
-145000	20813	2.05	640	1.38	250	0.91	92
-150000	21531			1.43	266	0.94	97
-160000	22967			1.52	298	1.00	109
-170000	24402			1.62	332	1.07	122
-180000	25837			1.72	368	1.13	135
-190000	27273			1.81	405	1.19	149
-200000	28708			1.91	444	1.25	163
-210000	30144			2.00	485	1.32	178
-220000	31579					1.38	193
-230000	33014					1.44	209
-240000	34450					1.50	226
-250000	35885					1.57	243
-260000	37321					1.63	261
-270000	38756					1.69	279
-280000	40191					1.76	298
-290000	41627					1.82	317
-300000	43062					1.88	337
-310000	44498					1.94	358
-320000	45933					2.01	379
-330000	47368					2.07	400
-340000	48804					2.13	422
-350000	50239					2.19	445
-360000	51675					2.26	468

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 3 K (17 °C/20 °C) - 14 — 16 mm

OD x s (ID) — V/l		**14 x 2 mm (10 mm) — 0.08 l/m**		**16 x 2 mm (12 mm) — 0.11 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-50	14	0.05	11	0.04	5
-100	29	0.10	33	0.07	14
-150	43	0.15	64	0.11	27
-200	57	0.20	103	0.14	44
-250	72	0.25	149	0.18	64
-300	86	0.31	203	0.21	86
-350	100	0.36	264	0.25	112
-400	115	0.41	332	0.28	141
-450	129	0.46	405	0.32	172
-500	144	0.51	485	0.35	206
-550	158	0.56	572	0.39	242
-600	172	0.61	664	0.42	281
-650	187	0.66	762	0.46	322
-700	201	0.71	866	0.49	366
-750	215	0.76	975	0.53	412
-800	230	0.81	1090	0.57	460
-850	244	0.86	1211	0.60	511
-900	258	0.92	1337	0.64	564
-950	273	0.97	1468	0.67	619
-1000	287	1.02	1605	0.71	677
-1050	301			0.74	736
-1100	316			0.78	798
-1150	330			0.81	862
-1200	344			0.85	928
-1250	359			0.88	996
-1300	373			0.92	1067
-1350	388			0.95	1139
-1400	402			0.99	1213
-1450	416			1.02	1290
-1500	431				
-1550	445				
-1600	459				
-1650	474				
-1700	488				
-1750	502				
-1800	517				
-1850	531				
-1900	545				
-1950	560				
-2000	574				
-2050	589				
-2100	603				
-2150	617				
-2200	632				
-2250	646				
-2300	660				
-2350	675				
-2400	689				
-2450	703				
-2500	718				

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 3 K (17 °C/20 °C) - 20 — 32 mm

OD x s (ID) — V/l		**20 x 2,25 mm (15,5 mm) — 0.19 l/m**		**25 x 2,5 mm (20 mm) — 0.31 l/m**		**32 x 2 mm (26 mm) — 0.53 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-200	57	0.08	13	0.05	4	0.03	1
-400	115	0.17	42	0.10	13	0.06	4
-600	172	0.25	84	0.15	25	0.09	7
-800	230	0.34	138	0.20	41	0.12	12
-1000	287	0.42	202	0.25	61	0.15	18
-1200	344	0.51	276	0.31	83	0.18	24
-1400	402	0.59	361	0.36	108	0.21	31
-1600	459	0.68	455	0.41	136	0.24	39
-1800	517	0.76	558	0.46	167	0.27	48
-2000	574	0.85	671	0.51	200	0.30	58
-2200	632	0.93	792	0.56	236	0.33	68
-2400	689	1.02	922	0.61	275	0.36	79
-2600	746			0.66	316	0.39	91
-2800	804			0.71	360	0.42	104
-3000	861			0.76	406	0.45	117
-3200	919			0.81	454	0.48	131
-3400	976			0.86	505	0.51	145
-3600	1033			0.92	559	0.54	161
-3800	1091			0.97	614	0.57	177
-4000	1148			1.02	672	0.60	193
-4200	1206			1.07	732	0.63	210
-4400	1263			1.12	794	0.66	228
-4600	1321			1.17	859	0.69	247
-4800	1378			1.22	926	0.72	266
-5000	1435			1.27	995	0.75	285
-5200	1493			1.32	1066	0.78	306
-5400	1550			1.37	1139	0.81	327
-5600	1608			1.42	1215	0.84	348
-5800	1665			1.47	1293	0.87	370
-6000	1722			1.53	1372	0.90	393
-6200	1780					0.93	417
-6400	1837					0.96	440
-6600	1895					0.99	465
-6800	1952					1.02	490
-7000	2010					1.05	516
-7200	2067					1.08	542
-7400	2124					1.11	569
-7600	2182					1.14	596
-7800	2239					1.17	624
-8000	2297					1.20	653
-8200	2354					1.23	682
-8400	2411					1.26	712
-8600	2469					1.29	742
-8800	2526					1.32	773
-9000	2584					1.35	804
-9200	2641					1.38	836
-9400	2699					1.41	868
-9600	2756					1.44	901
-9800	2813					1.47	935
-10000	2871					1.50	969

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: Δϑ = 3 K (17 °C/20 °C) - 40 — 63 mm

OD x s (ID) — V/l		**40 x 4 mm (32 mm) — 0.80 l/m**		**50 x 4,5 mm (41 mm) — 1.32 l/m**		**63 x 6 mm (51 mm) — 2.04 l/m**	
Q, W	**m, kg/h**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**	**v, m/s**	**R, Pa/m**
-2000	574	0.20	22	0.12	7	0.08	2
-3000	861	0.30	44	0.18	14	0.12	5
-4000	1148	0.40	72	0.24	22	0.16	8
-5000	1435	0.50	106	0.30	33	0.20	12
-6000	1722	0.60	146	0.36	45	0.23	16
-7000	2010	0.70	192	0.42	59	0.27	21
-8000	2297	0.79	243	0.48	75	0.31	26
-9000	2584	0.89	299	0.54	92	0.35	33
-10000	2871	0.99	360	0.61	110	0.39	39
-11000	3158	1.09	426	0.67	131	0.43	46
-12000	3445	1.19	497	0.73	152	0.47	54
-13000	3732	1.29	572	0.79	175	0.51	62
-14000	4019	1.39	653	0.85	200	0.55	71
-15000	4306	1.49	738	0.91	226	0.59	80
-16000	4593	1.59	828	0.97	253	0.63	89
-17000	4880			1.03	282	0.66	100
-18000	5167			1.09	312	0.70	110
-19000	5455			1.15	344	0.74	121
-20000	5742			1.21	376	0.78	133
-21000	6029			1.27	411	0.82	145
-22000	6316			1.33	446	0.86	157
-23000	6603			1.39	483	0.90	170
-24000	6890			1.45	521	0.94	183
-25000	7177			1.51	560	0.98	197
-26000	7464					1.02	211
-27000	7751					1.06	226
-28000	8038					1.10	241
-29000	8325					1.13	257
-30000	8612					1.17	273
-31000	8900					1.21	289
-32000	9187					1.25	306
-33000	9474					1.29	323
-34000	9761					1.33	341
-35000	10048					1.37	359
-36000	10335					1.41	378
-37000	10622					1.45	397
-38000	10909					1.49	416
-39000	11196					1.53	436
-40000	11483					1.56	456
-41000	11770					1.60	476
-42000	12057					1.64	497
-43000	12344					1.68	519
-44000	12632					1.72	541
-45000	12919					1.76	563
-46000	13206					1.80	585
-47000	13493					1.84	608
-58000	13780					1.88	632
-49000	14067					1.92	656
-50000	14354					1.96	680
-51000	14641					1.99	704

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Cooling mode: $\Delta\vartheta$ = 3 K (17 °C/20 °C) - 75 — 110 mm

OD x s (ID) — V/l		75 x 7,5 mm (60 mm) — 2.83 l/m		90 x 8,5 mm (73 mm) — 4.18 l/m		110 x 10 mm (90 mm) — 6.36 l/m	
Q, W	m, kg/h	v, m/s	R, Pa/m	v, m/s	R, Pa/m	v, m/s	R, Pa/m
-8000	2297	0.23	12	0.15	5	0.10	2
-10000	2871	0.28	18	0.19	7	0.13	3
-12000	3445	0.34	25	0.23	10	0.15	4
-14000	4019	0.40	33	0.27	13	0.18	5
-16000	4593	0.45	41	0.31	16	0.20	6
-18000	5167	0.51	51	0.34	20	0.23	7
-20000	5742	0.57	61	0.38	24	0.25	9
-22000	6316	0.62	72	0.42	28	0.28	10
-24000	6890	0.68	84	0.46	33	0.30	12
-26000	7464	0.73	97	0.50	38	0.33	14
-28000	8038	0.79	111	0.53	44	0.35	16
-30000	8612	0.85	125	0.57	49	0.38	18
-32000	9187	0.90	141	0.61	55	0.40	20
-34000	9761	0.96	157	0.65	61	0.43	23
-36000	10335	1.02	174	0.69	68	0.45	25
-38000	10909	1.07	191	0.73	75	0.48	28
-40000	11483	1.13	209	0.76	82	0.50	30
-42000	12057	1.19	228	0.80	89	0.53	33
-44000	12632	1.24	248	0.84	97	0.55	36
-46000	13206	1.30	269	0.88	105	0.58	39
-48000	13780	1.36	290	0.92	113	0.60	42
-50000	14354	1.41	312	0.95	122	0.63	45
-52000	14928	1.47	335	0.99	131	0.65	48
-54000	15502	1.53	358	1.03	140	0.68	51
-56000	16077	1.58	382	1.07	149	0.70	55
-58000	16651	1.64	407	1.11	159	0.73	58
-60000	17225	1.70	432	1.15	169	0.75	62
-62000	17799	1.75	459	1.18	179	0.78	66
-64000	18373	1.81	485	1.22	190	0.80	70
-66000	18947	1.86	513	1.26	200	0.83	74
-68000	19522	1.92	541	1.30	211	0.85	78
-70000	20096	1.98	570	1.34	223	0.88	82
-75000	21531	2.12	645	1.43	252	0.94	92
-80000	22967			1.53	283	1.00	104
-85000	24402			1.62	315	1.07	116
-90000	25837			1.72	349	1.13	128
-95000	27273			1.81	385	1.19	141
-100000	28708			1.91	422	1.26	155
-105000	30144			2.00	461	1.32	169
-110000	31579					1.38	183
-115000	33014					1.44	199
-120000	34450					1.51	215
-125000	35885					1.57	231
-130000	37321					1.63	248
-135000	38756					1.70	265
-140000	40191					1.76	283
-145000	41627					1.82	302
-150000	43062					1.88	321
-155000	44498					1.95	340
-160000	45933					2.01	360

Q = Power in Watt, v = Flow velocity in metres/second

R = Pipe friction pressure gradient in Pascal/Meter (100 Pa = 1 hPa = 1 mbar, 1 hPa ~ 10 mm WS)

Sample calculation

Note

For system-connected heating circuits (single-pipe heating) the entire circuit volume flow, including all of the radiators, must be taken into account!

The selection of the respective pipe dimension depends on the required mass flow (volume flow) for the respective pipe section. Depending on pipe dimension OD x s, the flow velocity v and the pipe friction pressure gradient R change. If the pipe is sized too small, the flow velocity v and the pipe friction pressure gradient R increase. This leads to a potential increase in noise relating to flow and higher power consumption of the circulation pump.

We therefore recommend that the following speed guide values are not exceeded when designing the pipe network:

- Radiator connection pipe: v ≤ 0.3 m/s
- Heating distribution pipes: v ≤ 0.5 m/s
- Heating riser and cellar pipes: v ≤ 1.0 m/s

The pipe network must be designed in such a way that the flow velocity from the boiler to the most distant radiator decreases evenly. The guide values for the flow velocity must be observed.

The following tables show the maximum transferable heat output QN, taking into account the maximum flow velocity, depending on the type of piping, the expansion $\Delta\vartheta$ and the pipe dimension OD x s.

Radiator connection pipe: v ≤ 0.3 m/s

Pipe OD x s [mm]	14 x 2	16 x 2	20 x 2.25	25 x 2.5	32 x 3
Mass flow $\dot{m}$ (kg/h)	85	122	204	339	573
Heat output Q_N (W) at $\Delta\vartheta = 5$ K	493	710	1185	1972	3333
Heat output Q_N (W) at $\Delta\vartheta = 10$ K	986	1420	2369	3944	6666
Heat output Q_N (W) at $\Delta\vartheta = 15$ K	1479	2130	3554	5916	9999
Heat output Q_N (W) at $\Delta\vartheta = 20$ K	1972	2840	4738	7889	13332
Heat output Q_N (W) at $\Delta\vartheta = 25$ K	2465	3550	5923	9861	16665

Heating distribution pipes: v ≤ 0.5 m/s

Pipe OD x s [mm]	14 x 2	16 x 2	20 x 2.25	25 x 2.5	32 x 3	40 x 4
Mass flow $\dot{m}$ (kg/h)	141	204	340	565	956	1448
Heat output Q_N (W) at $\Delta\vartheta = 5$ K	822	1183	1974	3287	5555	8414
Heat output Q_N (W) at $\Delta\vartheta = 10$ K	1643	2367	3948	6574	11110	16829
Heat output Q_N (W) at $\Delta\vartheta = 15$ K	2465	3550	5923	9861	16665	25243
Heat output Q_N (W) at $\Delta\vartheta = 20$ K	3287	4733	7897	13148	22219	33658
Heat output Q_N (W) at $\Delta\vartheta = 25$ K	4109	5916	9871	16434	27774	42072

Heating riser and cellar pipes: v ≤ 1.0 m/s

Pipe OD x s [mm]	14 x 2	16 x 2	20 x 2.25	25 x 2.5	32 x 3	40 x 4
Mass flow $\dot{m}$ (kg/h)	283	407	679	1131	1911	2895
Heat output Q_N (W) at $\Delta\vartheta = 5$ K	1643	2367	3948	6574	11110	16829
Heat output Q_N (W) at $\Delta\vartheta = 10$ K	3287	4733	7897	13148	22219	33658
Heat output Q_N (W) at $\Delta\vartheta = 15$ K	4930	7100	11845	19721	33329	50487
Heat output Q_N (W) at $\Delta\vartheta = 20$ K	6574	9466	15794	26295	44439	67316
Heat output Q_N (W) at $\Delta\vartheta = 25$ K	8217	11833	19742	32869	55548	84144

Example

Calculation of mass flow $\dot{m}$ (kg/h)	Where:
$\dot{m} = Q_N / [c_W \times (\vartheta_{VL} - \vartheta_{RL})]$	c_W = specific heat capacity of hot water ≈ 1.163 Wh/(kgK)
$\dot{m}$ = 1977 W/[1.163 Wh/(kg K) x (70 °C - 50 °C)]	ϑ_{VL} = Flow temperature in °C
$\dot{m}$ = 85 kg/h	ϑ_{RL} = Return flow temperature in °C
	Q_N = Rated power in W

10 Pressure and leak testing of Uponor heating installations

> **Note**
>
> **Pressure testing should only be carried out by a trained, competent person**
>
> Pressure tests are ancillary services under a work contract and are often part of the contractor's contractual performance, even if not explicitly mentioned in the description of service

The following procedures describe the pressure and leak test for Uponor Multilayer composite pipe installations for heating systems.

10.1 Leak test with water for heating installations

The heating engineer/installer must subject the heating pipes to a leak test after installation and before closing in the pipes with walls, ceilings, floors, screeds or another covering. As a rule, tap water can be used for the leak test. The water should meet the requirements as detailed by DWI. The heating system must be filled slowly and should be completely purged of any air.

If there is a risk of freezing, suitable measures must be taken (e.g. use of antifreeze or temperature control of the building). If frost protection is no longer required for the intended operation of the system, antifreeze agents must be removed by draining and flushing the system with at least three water changes.

Once filled and pressurised, a period should be allowed to permit the temperature compensation between the ambient temperature and the temperature of the filling water. Once this balancing period has finished, If necessary, restore the test pressure.

Only pressure gauges which are accurate enough to determine a pressure change of 0.1 bar should be used. If possible, the pressure gauge should be placed at the lowest point of the system.

The pipe system and water heating system must be tested at a pressure corresponding to the set pressure of the safety valve. Alternatively, 1.3 times the designed operating pressure can be used as the pressure for the test in accordance with BS EN 14336.

The test pressure must be maintained for two hours and may not drop by more than 0.2 bar. No leaks must occur during that time.

The leak test must be documented by the test engineer in a 'pressure test report' and this document should make a record of the equipment used, the duration of the test and the tightness of the system.

This report is available at the Uponor services download center.

https://www.uponor.com/doc/1120121

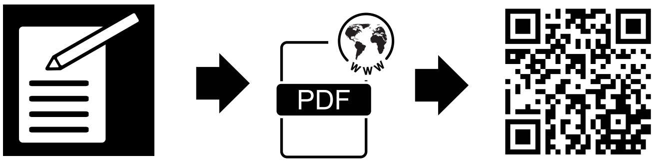
10.2 Leak test for heating installation with compressed air or inert gas

A pressure test for heating installations can be carried out with compressed air or inert gas in accordance with BS EN 14336 or in accordance with another recognised national standard.

To document the test, the "leak test protocol for Uponor drinking water distribution - test medium: Compressed air or inert gases" is applicable.

This report is available at the Uponor services download center.

https://www.uponor.com/doc/1120118



11 General planning principles

11.1 Fire protection requirements

Building regulations in the United Kingdom are statutory instruments or statutory regulations that seek to ensure that the policies set out in the relevant legislation are carried out. Building regulations approval is required for most building work in the UK.

In the UK, the requirements for fire protection are detailed in the relevant government documents :

England - Fire Safety, Approved Document B (fire safety volume 1: Dwellings, 2019 edition incorporating 2020 amendments **or** Fire Safety Approved Document B (fire safety volume 2: Buildings other than dwellings, 2019 edition incorporating 2020 amendments

Scotland - Building standards technical handbook 2019: domestic (2. Fire **or** Building standards technical handbook 2019: non-domestic (2.Fire

Wales - Welsh Building Regulations 2010, Volume 1 - Dwellinghouses, Approved Document incorporating 2010, 2016 and 2020 amendments **or** Welsh Building Regulations 2010, Volume 2 - Buildings other than Dwellinghouses, Approved Document incorporating 2010, 2013, 2016, 2017 and 2020 amendments

In modern buildings, there are strict regulations governing fire safety and the protection of all areas of a building.

It is sometimes necessary for pipes and other services to pass through fire-separating elements. If a fire-separating element is to be effective, every opening to allow services to pass through should be adequately protected by sealing with appropriate fire-stopping methods so that the fire resistance of the element is not impaired.

In order to guarantee preventive fire protection, the choice of the right building materials is very important. The selection of building materials is regulated and detailed in the above national standards and these standards also contain a list of technical building regulations which must be observed.

In addition to the relevant national standards, product information to the European standard BS EN 13501-1 'Fire Classification of Construction Products and Building Elements' and the British National standard BS 476 'Fire tests on building materials and structures - methods of test to determine the classification of the surface spread of flame of products' are also important information required by the projects' engineers.

With regards to Uponor pipe systems and the use fire stopping measures, our advice is to always follow the guidance from the project's engineers. If deemed suitable by the engineers, fire collars and fire bandages may be used as long as any adhesive or methods of application do not damage or compromise the materials of the Uponor system.

In many projects, intumescent sealants need to be applied. Unless the sealant has been approved by Uponor for use in direct contact with our products, we do not recommend they are applied directly onto our pipe systems. In some cases, these sealants can damage our pipe materials and may restrict movement.

In all instances, any fire-stopping solutions used must demonstrate the ability to provide the correct fire rating by means of certificated 3rd party fire test data.

In a fire situation, different types of plastics perform differently. Any fire stop solutions must therefore be tested on specific pipe types, and this performance testing can then provide engineers with the necessary evidence and information to maintain the correct fire rating for that specific sealing element.

Whatever system is to be used, in order to comply to the relevant regulations, every element must be 'installed as tested' and fire-stopping engineers must seek the correct certification and installation detail from the chosen products' manufacturer.

Caution!

All decisions relating to fire safety of any building must be the responsibility of the appointed, trained fire safety professional. Always seek advice from an appropriately qualified engineer.

11.2 Pipe insulation

Note

Insulation of the individual services must be added to ensure that the performance of the system is not adversely affected. Requirements for the insulation performance must follow the guidance of the project specification and should comply with the relevant national standard.

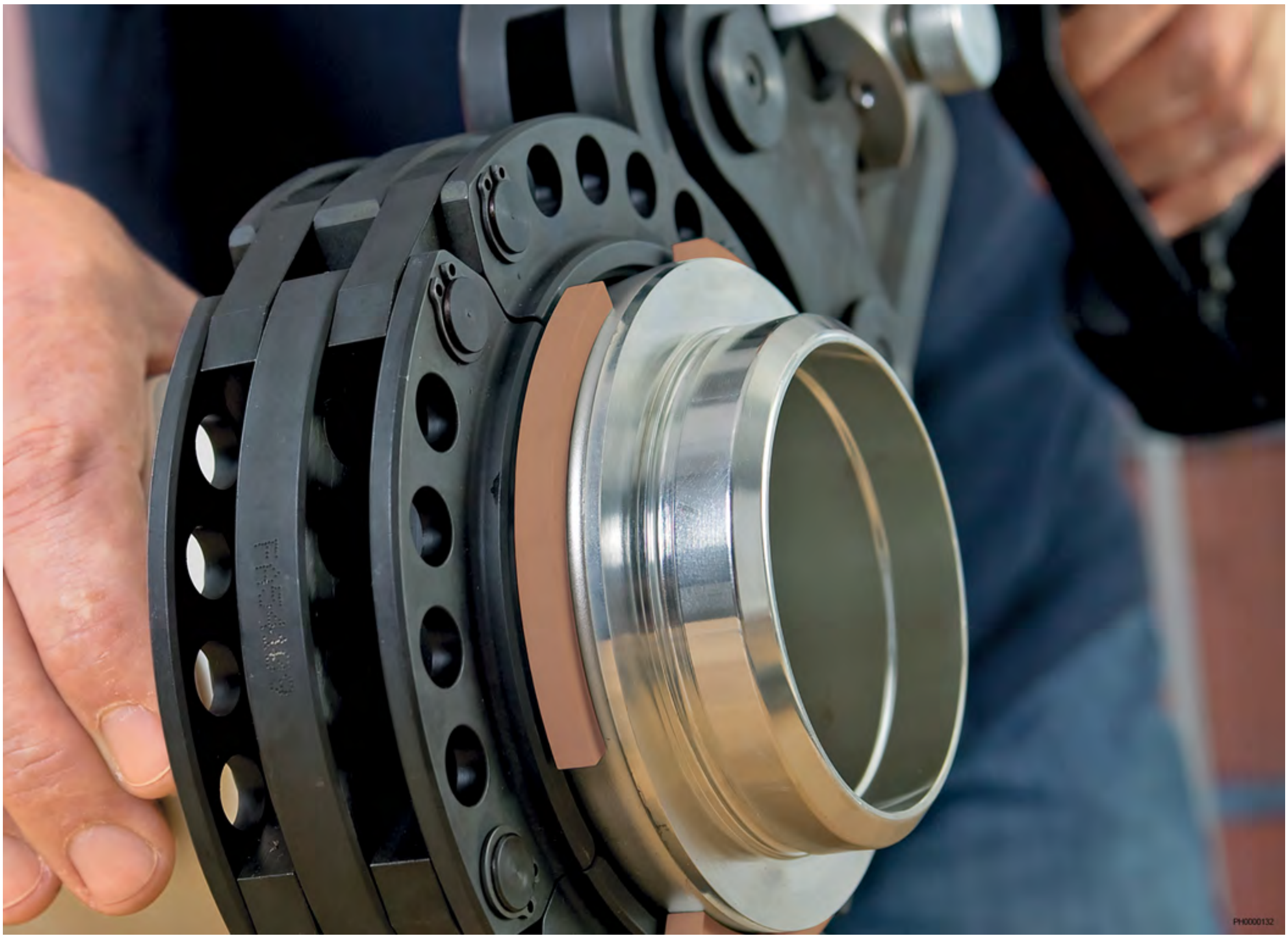
Insulation of pipelines is primarily used to reduce heat loss from DHW and LTHW systems and also to prevent unwanted thermal transfer that can heat cold drinking water in DCW/BCW pipes. However, insulation or cladding can also be useful, or even necessary, to avoid freezing, corrosion, condensation and sound transmission. The insulation requirements for new and existing buildings, for both hot and cold pipes, are described in various guidance standards such as BS 5422 and BS EN 806, and insulation must be applied as required by the Building regulations Part L 'Conservation of fuel and power' (or equivalent national standard for Scotland and Wales).

Factory assembled pre-insulated pipes offer distinct advantages over pipes which require insulation to be added on site. On the one hand, they ensure rapid installation progress whilst at the same time they provide an unbroken thermal insulation with good thermal resistance, with a sturdy colour coded vapour barrier to provide protection for the insulation.

With the need for project build times always being reduced, there is an ever increasing demand for a fast, high quality installation of the pipe system. Using Uponor pre-insulated pipes means that the installation can be completed by the pipe installation engineers and so there is no need for additional expense employing a specialist contractor to follow and add the insulation once the pipes are in-situ. This also leads to less trades on site, which makes a more safe working environment for everyone.

12 Pressing tools for fitting assembly

12.1 System description



The Uponor system concept is based on the perfect interaction of all individual system components. Everything fits together and has been tested and approved, not only by Uponor, but also to many internationally recognised standards. In addition to high-quality installation components such as pipes, fittings and assembly accessories, we also place a great importance to the use of the correct, high quality tools which have been designed for use with the Uponor fitting systems.

Accross the Uponor press range, the press jaws and press chains have the same dimension-specific colour coding as the Uponor press fittings so that nothing can be confused on the construction site.

Uponor pressing tools are an integral part of the Uponor declaration of liability and enable a fast, reliable, safe and uncomplicated assembly of the system.

- Uponor press machines and press jaws from renowned manufacturers
- Pressing machines can be either battery powered, mains 230V or manual press pliers
- Dimension-specific color coding of the press jaws and collars
- Use of the correct tool equipment is part of the Uponor declaration of liability

12.2 Uponor pressing tool concept

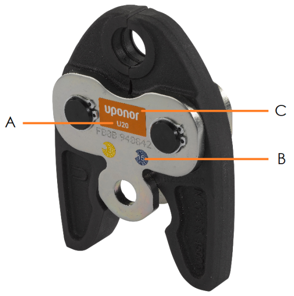
Caution!

'U' profile press jaws from a third party tool manufacturer are not accepted to be used on Uponor press systems. Their use will invalidate any connection warranty and could cause leaks.

Uponor press jaws MLC UPP1

Uponor press jaws MLC UPP1 with battery pressing machine UP 110 (as well as UP 75 and EL UP75)

Markings on the press jaw UPP1

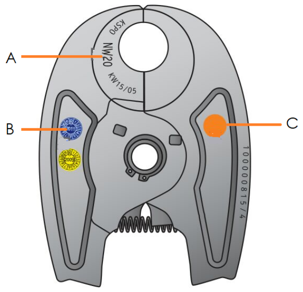


Item	Description
A	Dimension
B	Maintenance sticker
C	Colour code dimension-specific

Uponor press jaws MLC Mini KSP0

Uponor press jaws MLC Mini KSP0 with battery pressing machine Mini 32

Markings on the press jaw KSP0



Item	Description
A	Dimension
B	Maintenance sticker
C	Colour code dimension-specific

Dimension-specific colour coding

Colour coding of Uponor S-Press PLUS fittings 16 — 32 mm

The colour coding on the Uponor press fittings and also on the associated Uponor press jaws indicates the correct dimension of each of the components.

12.3 Overview tools for fitting assembly

Item	Description
A	Manual pressing tool + Interchangeable inserts
B	UP 110, battery tool or UP 75 EL, electrical tool 230 V + UPP1, pressing jaw
C	UP 110, battery tool or UP 75 EL, electrical tool 230 V + UPP1, pressing jaw
D	UP 110, battery tool or UP 75 EL, electrical tool 230 V + Basic press jaw with press chain
E	Mini 32, battery tool + Mini KSP0, pressing jaw
F	Fixed wrench
G	Hand installation, no tools required

	Uponor tools						
Uponor fittings	**A**	**B**	**C**	**D**	**E**	**F**	**G**
 S-Press PLUS S-Press PLUS PPSU	16 — 20	16 — 32	—	—	16 — 32	—	—
 S-Press	16 —20	14 — 32	—	—	14 — 32	—	—
 S-Press S-Press PPSU	—	—	40 — 50	63 — 75	—	—	—
 RS	—	 16 — 32	 40 — 50	 63 — 110	 16 — 32	—	—
 Uni	—	—	—	—	—	12 — 25	—
 RTM	—	—	—	—	—	—	16 — 25

12.4 List of approved tools

Caution!

Although there are number of tools that have been tested for use with Uponor press systems, ONLY press jaws and press collars supplied from Uponor can be used to press our connections

Caution!

Before using any press tool, please ensure you familiarise yourself with the correct handling procedures for that specific tool and if uncertain, please seek training for the safe use of the hydraulic press machine.

Caution!

'U' profile press jaws from a third party tool manufacturer are not accepted to be used on Uponor press systems. Their use will invalidate any connection warranty and could cause leaks.

Note

Installation and operation manuals are included with the products or can be downloaded from the Uponor website: www.uponor.co.uk. For details of Uponor's free, certificated, on-site installation training
please contact : enquiries.uk@uponor.com

Uponor UPP1 pressing jaws and pressing chain are specially designed for use in combination with the Klauke UP 110 (1083612), the UP 75 battery-powered pressing machine, the UP 75 EL electric pressing machine (1007082) and the Klauke Mini 32 KSP0 (1083674).

Uponor have undertaken stringent testing to prove the use of third party tools in combination with the Uponor jaws and collars. However, when using other brands of pressing machines, you should have their suitability, warranty and occupational safety confirmed by the respective manufacturer.

All Uponor press jaws and collars are subject to an inspection cycle as described in the operating instructions. For use in drinking water distribution and heating installations, we recommend an inspection of the press jaws and collars every 3 years.

Klauke press tools must also be inspected periodically to ensure that they are functioning correctly and safely. Please read the operating instructions to ensure that you are familiar with how to identify the correct inspection period.

Machine type (for Uponor UP 110 & UP 75)

Machine type (for Uponor UP 110 & UP 75)		**Uponor press jaw dimensions**		
Manufacturer	**Model No.**	**Type 14–32**	**Type 40–50**	**Type 63-110***
Viega Type 2	Type 2, serial number starting with 96; lateral linkage for bolt monitoring	yes	no	no
Mannesmann "Old"	Type EFP 1; head not rotatable	yes	no	no
Mannesmann "Old"	Type EFP 2; head rotatable	yes	no	no
Geberit "New"	Type PWH - 75; blue sleeve over press jaw holder	yes	no	no
Novopress	ECO 1 / ACO 1	yes	yes	no
	ACO 201 / ACO 202 / ACO 203	yes	yes	no
	ECO 201 / ECO 202 / ECO 203	yes	yes	no
	AFP 201 / EFP 201	yes	yes	no
	AFP 202 / EFP 202	yes	yes	no
Milwaukee	Milwaukee M18 HPT	yes	yes	no
	Milwaukee M18 BLHPT	yes	yes	no
Ridge Tool by Arx	Ridgid RP300 Viega PT2 H	yes	no	no
	Ridgid RP300 B Viega PT3 AH	yes	yes	no
	Viega PT3 EH	yes	yes	no
	Ridgid RP 10B	yes	yes	no
	Ridgid RP 10S	yes	yes	no
	Ridgid RP 330C Viega Pressgun 4E	yes	yes	no
	Ridgid RP 330B Viega Pressgun 4B	yes	yes	no
	Ridgid RP 340B/C	yes	yes	no
	Viega Pressgun 5B	yes	yes	no
Rems	REMS Akku-Press ACC (Art. No. 571004/571014)	yes	yes	no
	REMS Power-Press ACC (Art. No. 577000/577010)	yes	yes	no
	REMS Akku ACC 22V (not Mini-press)	yes	yes	no
Rothenberger	Romax 3000 AC	yes	no	no
	Romax 4000	yes	no	no
Klauke	UAP3L / UAP2 / UNP2	yes	yes	no
Hilti	NPR 032 IE-A22 (Inline) NPR 032 PE-A22 (Pistol)	yes	yes	yes

** with modular press chains*

Machine type (for Uponor Mini and Mini2)		**Uponor press jaw dimensions**		
Manufacturer	**Attributes**	**Type 14–32**	**Type 40–50**	**Type 63-110***
Klauke	MAP1 / MAP2L	yes	no	no

** with modular press chains*

13 General processing instructions

13.1 Installation instructions

Note

Installation must be performed by a competent person in accordance with national standards and regulations.

Note

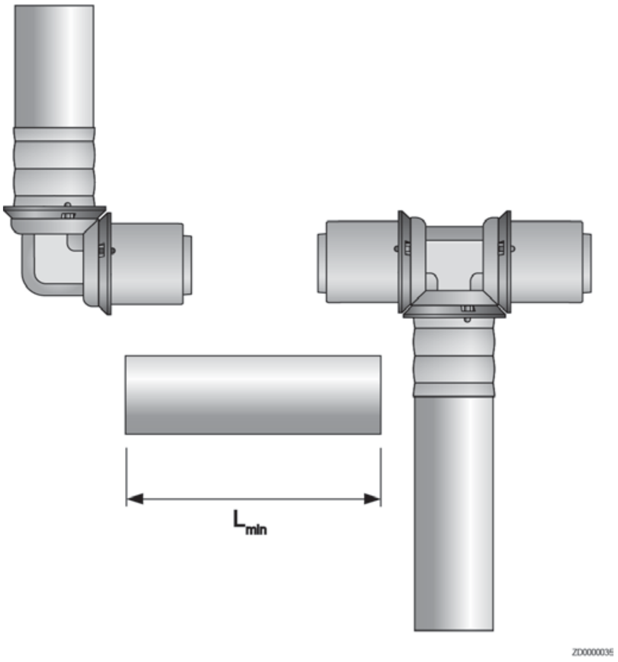
Installation and operation manuals are included with the products or can be downloaded from the Uponor website: www.uponor.co.uk. For details of Uponor's free, certificated installation training
contact : enquiries.uk@uponor.com

Before installation, the installer must check all components for possible transport damage and must also read, understand and observe the relevant installation and operating manuals.

For the professional use of the Uponor composite pipe system, the applicable technical guidance and the building regulations must be observed. The installation must be carried out in accordance with generally recognised engineering practices such as BS EN 806 or BS 8558:2015. In addition, all installation, accident prevention and safety regulations must be observed.

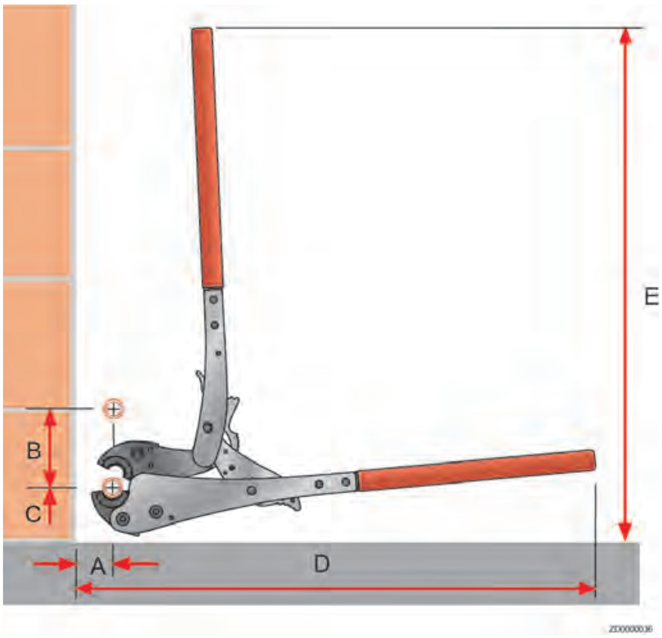
Installation dimensions: minimum requirements

Pipe length between two fittings



Pipe OD × s [mm]	Min. pipe length L_{min} between two	
	Press fittings [mm]	RTM fittings [mm]
14 x 2.0	50	—
16 x 2.0	50	50
20 x 2.25	55	55
25 x 2.5	70	60
32 x 3.0	70	—
40 x 4.0	100	—
50 x 4.5	100	—
63 x 6.0	150	—
75 x 7.5	150	—
90 x 8.5	160	—
110 x 10.0	160	—

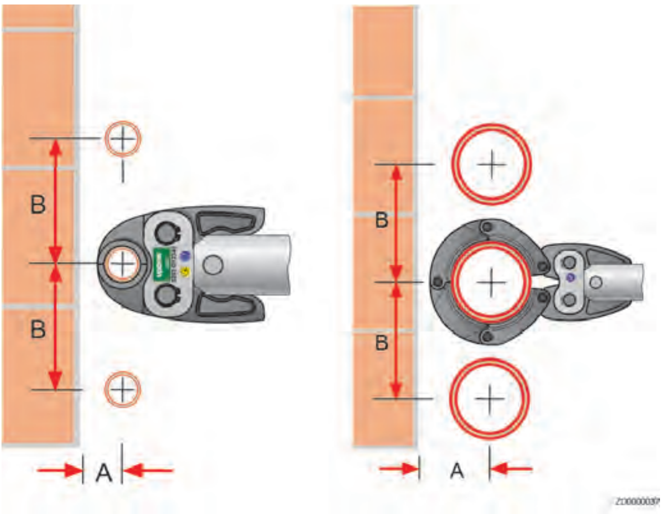
Minimum space requirement for manual pressing tool



Pipe OD × s [mm]	Dim. A [mm]	Dim. B* [mm]	Dim. C [mm]	Dim. D [mm]	Dim. E [mm]
14 × 2.0	25	50	55	510	510
16 × 2.0	25	50	55	510	510
20 × 2.25	25	50	55	510	510

** For equal pipe outer diameters*

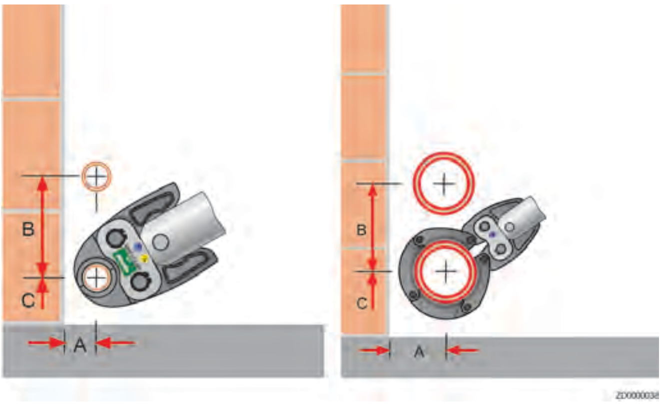
Pressing process with pressing machines (UP 110, UP 75, UP 75 EL, Mini2 and Mini 32)



Pipe OD × s [mm]	Dim. A [mm]	Dim. B* [mm]
14 x 2.0	15	45
16 x 2.0	15	45
20 x 2.25	18	48
25 x 2.5	27	71
32 x 3.0	27	75
40 x 4.0	45	105
50 x 4.5	50	105
63 x 6.0**	80	125
75 x 7.5 **	82	130
90 x 8.5**	95	140
110 x 10.0**	105	165

** For equal pipe outer diameters*

*** Modular RS-System, pressing on the working bench possible*



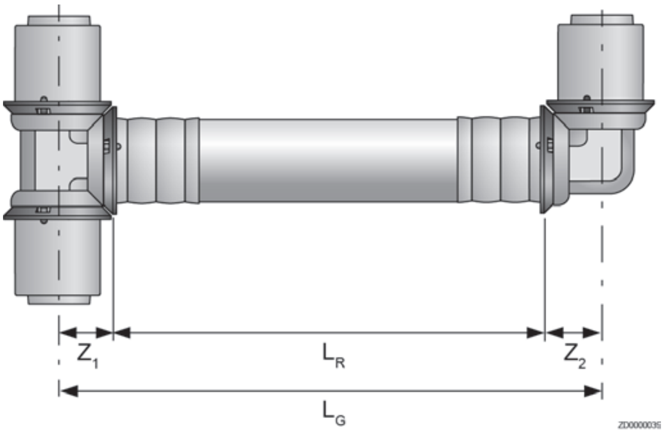
Pipe OD × s [mm]	Dim. A [mm]	Dim. B* [mm]	Dim. C [mm]
14 x 2.0	30	88	30
16 x 2.0	30	88	30
20 x 2.25	32	90	32
25 x 2.5	49	105	49
32 x 3.0	50	110	50
40 x 4.0	55	115	60
50 x 4.5	60	135	60
63 x 6.0	80	125	75
75 x 7.5	82	130	82
90 x 8.5	95	140	95
110 x 10.0	105	165	105

** For equal pipe outer diameters*

13.2 Installation according to Z dimension

Note

Z dimensions of the Uponor press fittings can be made available via the Uponor BIM files, or upon request.



As the basis for efficient planning, work preparation and prefabrication, the Z-measurement method makes work considerably easier and saves the installer money.

The principal for the Z-measurement method is using calculated uniform measurements. All the pipe sets to be created are recorded via the axial line by measuring from centre to centre (intersection of the axial lines). Using the Z-dimension data for Uponor S-Press and S-Press PLUS fittings, the installer can quickly and easily calculate the exact pipe length between fittings using a mathematical method.

(Example: $L_R = L_G - Z_1 - Z_2$).

By precise design of the pipe routing and coordination with the architect, planner and construction management in the run-up to the actual installation, large parts of the system can be cost-effectively pre-assembled.

13.3 Consideration of thermal length expansion

Due to the thermal expansion caused by the changing operating temperatures of the water medium, calculations must be made in order that suitable engineered expansion relief can be designed in to the system to prevent unnecessary stress and potential damage.

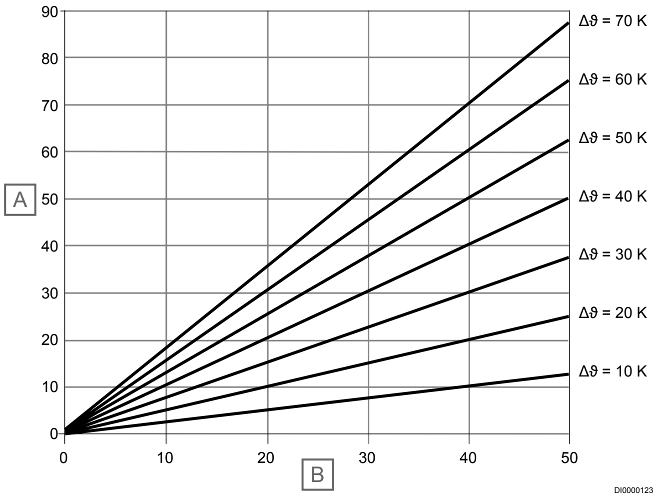
Thermal expansion can be compensated in the traditional ways such as Omega loops, expansion bellows, bending legs and changes of direction.

The change in length can be determined using a diagram or calculated using the following formula: **$\Delta L = a \times L \times \Delta\vartheta$**

Here:

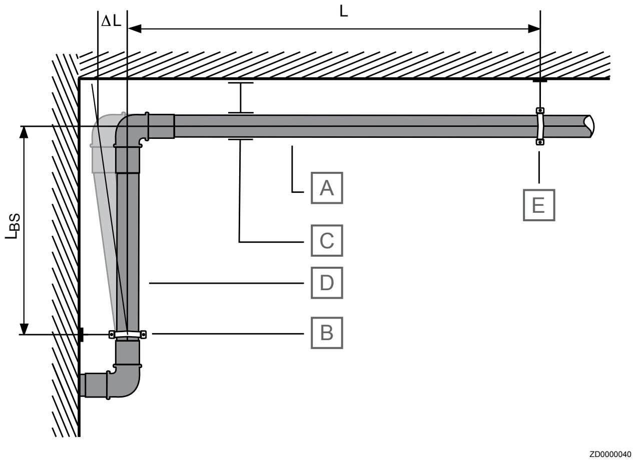
- ΔL = Linear expansion (mm)
- a = Linear expansion coefficient (0.025 mm/mK)
- L = Line length (m)
- $\Delta\vartheta$ = Temperature difference (K)

Length change diagram for Uponor composite pipes



Item	Description
A	Change in length ΔL [mm]
B	Line length L [m]

13.4 Expansion relief using a bending leg



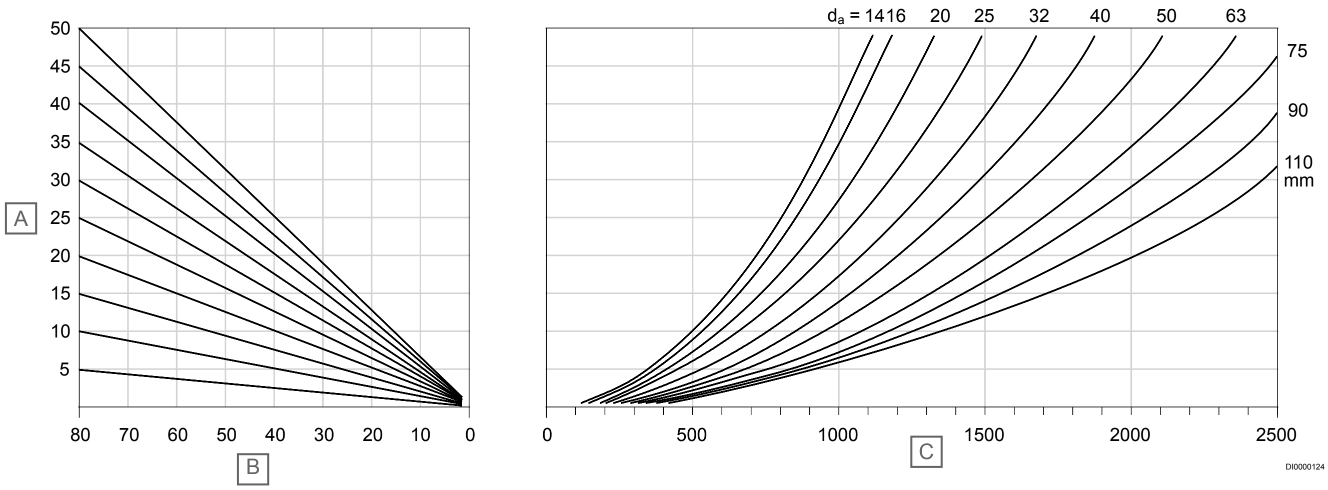
Item	Description
A	Expansion leg
B	Fixed point
C	Sliding clamp
D	Bending leg
E	Fixed point
L	Length of bending leg in m
L_{BS}	Bending leg length in mm

When planning expansion relief to be made by the use of a bending leg, the correct calculations must be made to ensure that the movement is sufficient to compensate the required expansion movement without placing too much stress on the system components or the building fabric.

Uponor multi-layer composite pipes that are to be used for any heated water service must not be installed rigidly (without expansion relief) between two fixed points. The change in length of the pipes must always be absorbed or guided.

Uponor multi-layer composite pipes which are exposed to full thermal expansion must be provided with a corresponding expansion compensation. This requires knowledge of the location of all fixed points. Compensation is always performed between two fixed points (FP) or changes in direction (bending leg).

13.5 Determination of the bending leg length



Item	Description
A	Length of expansion leg L (m)
B	Temperature difference $\Delta\vartheta$
C	Bending leg length L_{BS} [mm]

Reading example

Description	Value
Installation temperature	20 °C
Operating temperature	60 °C
Temperature difference $\Delta\vartheta$	40 K
Length of expansion leg	25 m
Pipe dimension OD x s	32 × 3 mm
Required bending leg length LBS	approx. 850 mm

Calculation formula:

Description	Value
L_{BS}	$k \cdot \sqrt{OD \cdot (\Delta\vartheta \cdot a \cdot L)}$
OD	Pipe outer diameter in mm
L	Length of bending leg in m
L_{BS}	Bending leg length in mm
a	Coefficient of linear expansion [0.025 mm/mK]
$\Delta\vartheta$	Temperature difference in K
k	30 (material constant)

13.6 Bending Uponor composite pipes

Caution!

The hot bending of Uponor composite pipes using open flames (e.g. soldering flame) or other heat sources (e.g. hot air gun, industrial hairdryer) is not permitted! Repeated bending around the same bending point is also prohibited!

Uponor composite pipes 12 – 32 mm can be bent by hand. Sizes 14 - 32mm can also be bent with a bending spring, either internal or external, or a suitable bending tool.

The minimum bending radii in the following table must be respected. For information regarding the bending of larger Uponor composite pipe dimensions, please contact Uponor for information. If narrower dimensions than the minimum bending radius are required (e.g. at the transition from the floor to the wall), we recommend installing flow-optimised Uponor S-Press PLUS bends or S-Press PLUS elbow fittings.

If an Uponor composite pipe is inadvertently kinked or otherwise damaged, it must be replaced immediately or an Uponor press or screw coupling installed to replace the damaged area.

Bending radii with/without auxiliary equipment

Caution!

Pipes routed through ceiling recesses and wall openings must never be allowed to be bent over edges!

Uponor Uni Pipe PLUS bending tool. Complete with case and bending segments 16 — 32 mm.

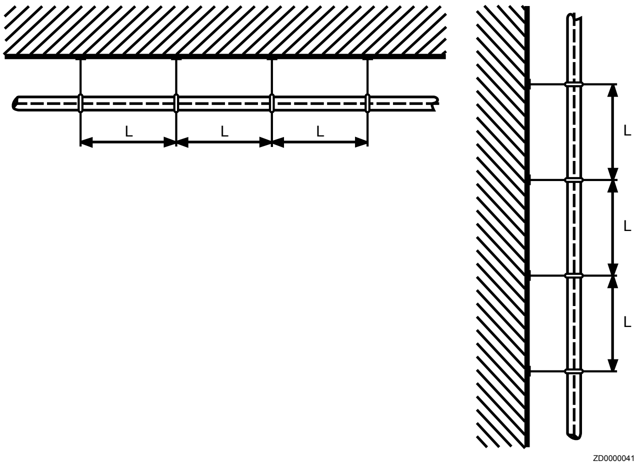
Pipe OD × s [mm]	**Pipe type**	**Min. bending radius without tools (by hand) [mm]**		**Min. bending radius with internal bending spring$^{2)}$ [mm]**		**Min. bending radius with external bending spring [mm]**		**Min. bending radius with bending tool$^{1)}$ [mm]**	
		Coil	**Bar**	**Coil**	**Bar**	**Coil**	**Bar**	**Coil**	**Bar**
12 × 1.6	Uni Pipe	60	—	—	—	—	—	—	—
14 × 2.0	Uni Pipe PLUS	70	—	56	—	56	—	46	—
16 × 2.0	Uni Pipe PLUS	64	64	48	48	48	48	32	32
20 × 2.25	Uni Pipe PLUS	80	80	60	60	60	60	40	40
25 × 2.5	Uni Pipe PLUS	125	125	75	75	75	75	62.5	62.5
32 × 3.0	Uni Pipe PLUS	160	—	96	—	—	—	80	80

1) Follow the operating instructions for the tools

2) Not recommended for hygienic reasons when using drinking water

Bending radii for Uponor composite pipes with and without auxiliary equipment

13.7 Fixing distances



Pipe OD × s [mm]	**Max. fastening distance between the pipe clamps L [m]**		
	Horizontal		**Vertical**
	Coil	**Bar**	
12 × 1.6	1.20	—	1.70
14 × 2.0	1.20	—	1.70
16 x 2.0	1.20	2.00	2.30
20 x 2.25	1.30	2.30	2.60
25 x 2.5	1.50	2.60	3.00
32 x 3.0	1.60	2.60	3.00
40 x 4.0	—	2.00	2.20
50 x 4.5	—	2.00	2.60
63 x 6.0	—	2.20	2.85
75 x 7.5	—	2.40	3.10
90 x 8.5	—	2.40	3.10
110 x 10.0	—	2.40	3.10

The above table shows the maximum fixing distance "L" between the individual pipe clamps for the different pipe dimensions (shorter fixing distances may need to be used in certain systems). Pipe fixing points must be laid out based on the total mass (weight of pipe + weight of medium + weight of insulation) and installed in accordance with recognised engineering practices. It is recommended to place the pipe supports as close as possible to the fittings.

Valve and device connections, as well as connections for measuring and control equipment, must always be torsion-proof. All pipelines must be routed in such a way that movement due to thermal expansion (heating and cooling) is not impeded. The change in length between two fixed points can be absorbed by expansion bellows, Omega loops, compensators or by changing the direction of the pipeline.

13.8 Pipeline laying on a concrete substrate

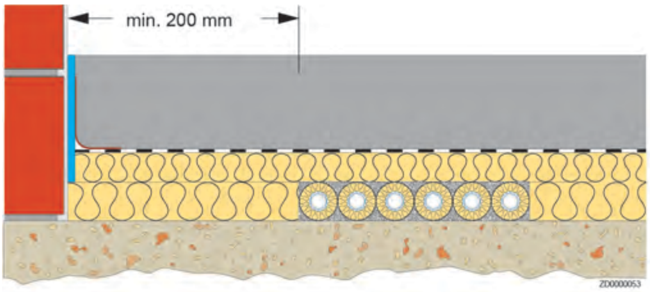
When laying pipelines on a raw concrete substrate, through a floor, or within a service duct recognised engineering practices must be observed. Where required by Part E The Building Regulations - Resistance To The Passage of Sound, Impact sound insulation must be installed to prevent unwanted noise transmission.

The thermal mobility of pipelines during thermal expansion must also be taken into account (see section "Thermal expansion"). If screeds are applied to insulation layers (floating screed), BS8204 "Screed bases and in situ floorings. Concrete bases and cementitious leveling screeds to receive floorings." guidance must be followed regarding the minimum depth for the screed type to be considered as suitably 'load-bearing'. Screeds with floor heating in floating screeds should follow guidance from BS1264 parts 1 - 4.

- The load-bearing substrate must be sufficiently dry to accommodate the floating screed and have an even surface. It must not have any point elevations, pipelines or the like which could lead to acoustic bridges and/or fluctuations in the thickness of the screed.
- For heated screeds made of prefabricated elements, the manufacturer's special requirements regarding the even surface of the load-bearing substrate must also be observed.
- If pipelines are laid on the load-bearing substrate, they must be fixed. A level surface for the absorption of the insulation layer - but at least for the impact sound insulation - must be created again by means of compensation. The construction height required for this must be planned in.
- Leveling layers must have a bonded form when installed. Bulk materials may be used if their suitability for the purpose has been proven. Pressure-resistant insulating materials may be used as leveling layers.
- Waterproofing against soil moisture and non-pressing water must be determined by the building planner and must be carried out before the screed is installed.

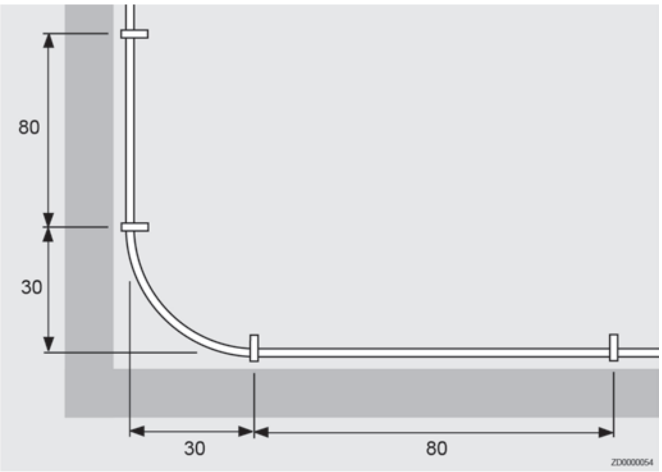
The installation of Uponor composite pipes on the unfinished concrete floor should be laid in a straight line, parallel to the axis and the wall and should be as free from cross-overs as possible. Preparation of a schematic plan before the actual installation of the pipes will make the overall installed quality much better and will also speed up the whole process.

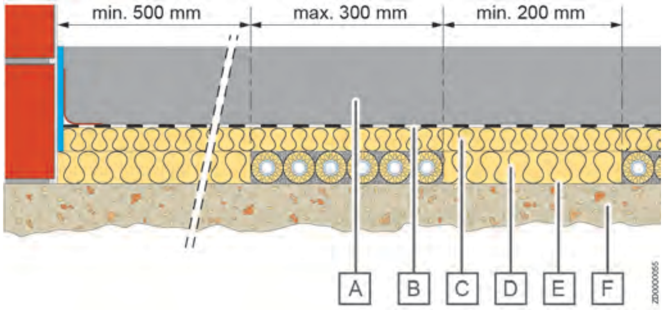
Fastening distances when laying pipelines



Distance from wall to pipe/pipe routes including insulation and screed in corridors

Pipe routing





Distance from wall to pipe/pipe routes including insulation and screed in rooms other than corridors

Item	Description
A	Screed
B	Moisture barrier
C	Step sound protection
D	Levelling material
E	Bound fill
F	Unfinished concrete ceiling

Pipes and other installations in the floor structure must be planned free of crossings. Pipes on the unfinished floor should be as straight as possible and parallel to the axis and wall. The following route dimensions for pipelines and other installations should be observed:

Application	Width or distance dimension
Route width of parallel pipelines including pipe insulation	≤ 300 mm

When installing Uponor composite pipes on an unfinished concrete floor, a fixing distance of 80 cm is recommended. Before and after each bend a fastener must be placed at a distance of 30 cm. Pipe crossings are to be fixed. Fastening can be carried out with the plastic dowel hooks for single or double pipe fixing. If perforated plastic or metal fixing strip is used for fastening, care must be taken to ensure that the Uponor multi-layer composite pipe remains free to move with/without protective tube or insulation. If the pipe is firmly fixed, noises can occur during the thermal expansion of the pipe. If the Uponor composite pipe system is laid directly in the screed, the fittings must be protected against corrosion (except S-Press PLUS). Joints must also be arranged above construction joints in the insulation layer and in the screed (expansion joints) to prevent damage to the screed and floor coverings.

Application	Width or distance dimension
Width of the support next to a route (with the narrowest possible pipe laying next to each other)	≥ 200 mm
Distance from wall to pipe/pipe route including insulation as support for screed in rooms other than corridors	≥ 500 mm
Distance from wall to pipe/pipe route including insulation as support for screed in corridors	≥ 200 mm

14 Transport, storage and processing conditions

14.1 General information

The Uponor composite pipe system is designed in such a way that maximum system safety is achieved when used as intended. All components of the system must be transported, stored and processed in such a way that proper functioning of the installation is guaranteed. The system components should be stored in a system-related manner to avoid confusion with components from other application areas. In addition to the following instructions, the guidance within the respective assembly instructions for the individual system components and tools must also be followed.

14.2 Processing temperatures

The permissible installation temperature for the Uponor multilayer composite pipe system (pipes and fittings) is between –10 °C and +40 °C. The permissible operating temperature ranges for the pressing tools can be found in the respective operating instructions of the devices.

14.3 Uponor composite pipes

Pipes must be protected from mechanical damage, dirt and direct sunlight (UV radiation) during transport, storage and during installation. The pipes should therefore be kept in their original packaging until they are to be processed and off-cuts intended for installation at a later time should be capped to protect hygiene and should placed back in to a safe storage until their installation. Pipe ends must be closed until processing to prevent dirt from entering the pipes. Damaged, bent or deformed pipes must not be used. Protective tubular cartons with ring bundles can be stacked up to a max. height of 2m. Straight lengths/bars must be transported and stored in such a way that they cannot be accidentally bent. The corresponding Uponor storage instructions must be observed.

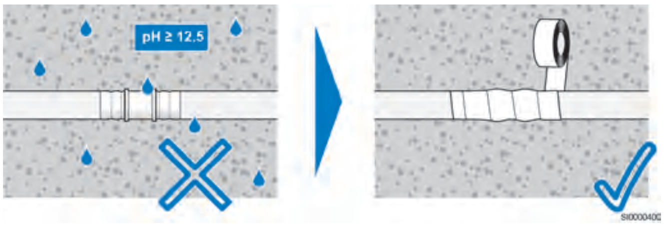
14.4 Uponor fittings

Uponor fittings are packaged in a way to protect them during transport and handling. However, care must be taken to ensure they are not dropped or damaged due to careless handling. Fittings should be kept in their original packaging until they are to be installed to prevent damage and contamination. Damaged fittings or fittings with damaged O-rings must not be used.

14.5 Installation in the ground and outdoors

Caution!

In the case of permanent exposure to moisture and a simultaneous pH value greater than 12.5, Uponor fittings must be protected with a suitable jacket (e.g. protective tape or shrink sleeve).



Uponor composite pipes can be laid in the ground or outdoors with the appropriate jointing technique, taking the following points into account:

- Pipelines laid in the ground must not be exposed to traffic loads.
- No coarse-grained, sharp-edged material may be used for backfilling the trench.
- When laying the pipes in the ground, care must be taken to ensure that the Uponor composite pipes are protected from mechanical influences.
- Fittings and the cut edges of the composite pipes must be protected from direct contact with the ground by means of suitable corrosion protection tape.
- For outdoor use above ground, Uponor composite pipes must be protected against direct, or increased, UV radiation and against mechanical influences. This is best done by using UV-protected corrugated protective tubes from Uponor, which are available in various dimensions to suit each pipe size.

15 System compatibility

In the history of Uponor, the composite pipe has been supplied in various variants:

- Red Unipipe F composite pipe (PE-MD/AL/PE-MD) for underfloor heating installation
- Brown Unipipe S composite pipe (PE-X/AL/PE-X) for drinking water distribution
- White Unipipe H composite pipe (PE-X/AL/PE-X) for heating installations

Since the beginning of 1997, the white Uponor MLC composite pipe (PE-RT/AL/PE-RT) has been supplied for all applications (sanitary, heating and surface heating installations).

In the event that systems with Uponor MLC composite pipes with dimensions of 16 – 32 mm are to be extended or repaired, the current Uponor S-Press/S-Press PLUS fittings can be used to switch to the current Uponor Uni Pipe PLUS composite pipe.

15.1 Transitions from Uni-pipe old installations

Old installation (until 1997)				**Fitting designation**	**New installation**	
Pipe designation	**Application**	**Colour**	**Dimension**		**Pipe designation**	**Application**
Unipipe F 	Underfloor heating	Red	16 mm	 Uponor Uni-X Reno transition MLC	Uponor Uni Pipe PLUS 	Drinking water, heating
Unipipe S 	Potable water	Brown	16 — 20 mm	 Uponor Uni-X Reno transition MLC	Uponor Uni Pipe PLUS 	Drinking water, heating
Unipipe H 	Heating	White	16 — 20 mm	 Uponor Uni-X Reno transition MLC	Uponor Uni Pipe PLUS 	Drinking water, heating

Old installation (1997 to 2020)				**Fitting designation**	**New installation**	
Pipe designation	**Application**	**Colour**	**Dimension**		**Pipe designation**	**Application**
Uponor MLC 	Potable water, heating	White	14 — 32 mm	 S-Press PLUS, S-Press, RTM, Uni-X, Uni-C	Uponor Uni Pipe PLUS 	Drinking water, heating

16 Risk of mixed installation

Note

Uponor Declaration of Warranty: Please contact Uponor UK Ltd at :

enquiries.uk@uponor.com

Note

Components from the different Uponor systems may only be mixed with one another if approved by Uponor and if the service conditions of either system is not exceeded

Opinions and interpretations vary relating to mixed installations. Different information exists in the marketplace regarding unrestricted compatibility with our products, so as a precautionary measure, Uponor states the following: Uponor offers no guarantee regarding the compatibility of the relevant third party products with our products. The use of third party items will affect the system warranty.

Documention available to Uponor from dealers/third-party manufacturers state that it is not apparent that the compatibility claimed by them is covered by a full warranty.

In cases of mixed installations, the 25-year Uponor Declaration of Warranty may be affected unless third party products are connected through a recognised connection technology (e.g. a flange, or a threaded connection) that is detailed in a recognised national standard. The legal warranty period will still apply.

16.1 Installation configurations

Note

In a mixed installation, the warranty provided by themanufacturer of the pipe only covers the pipe, whilst the warranty provided by the manufacturer of the fitting only covers the fitting iteself. Neither warranty covers the connection point nor do they cover the system in its entirety. When mixing a system, the responsibility to cover the warranty is borne solely by the installer.

Caution!

If third party products are used to connect directly on to an Uponor pipe, and not via a method as described in the note above, the installation will no longer be covered by hygiene approvals such as the WRAS Approved Product scheme and KIWA KukReg4.

Pipe	Fittings and tools	Uponor system approval
 Uponor MLC and Uni-Pipe PLUS	 Uponor fitting with Uponor press jaws	✓ Yes
 Uponor MLC and Uni-Pipe PLUS	 Fitting from a third party manufacturer	✗ No
 Multi-layer composite pipe from third party manufacturer	 Uponor fitting	✗ No
 Uponor MLC and Uni-Pipe PLUS	 Uponor fitting with third party jaw manufacturer	✗ No

17 Sustainability

17.1 General information

Since its foundation, Uponor acts responsibly and produces resource efficient products and solutions. Therefore, we always have three central themes in mind:

Increasing requirements for building and construction as well as tighter regulations call for rethinking how we use our resources more effectively, efficiently and responsibly.

- **Scarcity of water -** Clean freshwater is an essential ingredient for a healthy human life, but 1.1 billion people lack access to water and 2.7 billion experience water scarcity at least one month a year. By 2025, two-thirds of the world's population may be facing water shortages. When waters run dry, people can't get enough to drink, wash, or feed crops and economic decline may occur.
- **Circular economy and material efficiency -** The circular economy is an economic system in which materials are designed to be used, not used up. From the outset, products and the systems they sit within should be designed to ensure no materials are lost and the maximum use is achieved from every process, material and component. If applied correctly, the circular economy benefits society, the environment and the economy.
- **Climate change and carbon neutrality -** The UK and the EU aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions. This objective is at the heart of the European Green Deal and in line with the combined commitment to global climate action under the Paris Agreement.

  The transition to a climate-neutral society is both an urgent challenge and an opportunity to build a better future for all.

  All parts of society and economic sectors will play a role – from the power sector to industry, mobility, construction, efficient buildings, agriculture and forestry.

17.2 Uponor's sustainability agenda

Note

Uponor are members of the World Green Building Council and several other national green building councils

WORLD GREEN BUILDING COUNCIL

DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

Uponor As active members of the Worlds Green Building Council and several other national Green Building Councils, and also participants in the Carbon Disclosure Project (CDP). We aim to continually reduce our impact on the environment whilst working to enhance the positive effect that our products can have on the industry's drive towards achieving the Nett Zero

17.3 EPD's (Environmental Product Declarations)

Note

There are many myths about traditional pipe materials that claim to be 'environmentally friendly'. When making a decision which pipe material to use, engineers should seek independantly assesed environmental information that has been measured and reported to a recognised international test standard.

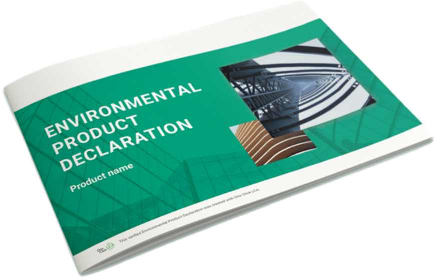
An Environmental Product Declaration, or EPD, is a document which transparently communicates the environmental performance or impact of any product or material over its lifetime.

Within the construction industry, EPDs support carbon emission reduction by making it possible to compare the impacts of different materials and products in order to select the most sustainable option.

Architects, engineers and designers are able to choose the most sustainable option for their project.

Manufacturers are able to optimise the impact of their products and market their carbon transparency.

An EPD is usually valid for five years, and is generated according to the relevant standards. Construction EPDs are based on the ISO 14040/14044, ISO 14025, BS EN 15804 or ISO 21930 standards.



Note

For information of EPD's regarding Uponor's Multilayer plumbing system please contact:

enquiries.uk@uponor.com

EPDs in construction projects and manufacturing are voluntary. However, their use is rapidly growing in line with awareness about environmental impacts. The public, designers and private stakeholders are increasingly demanding EPDs, and their use can offer a range of benefits:

- **Nett zero :** using EPDs will help you to present the environmental impacts of your project.
- **Regulation and legal requirements:** many public procurement bodies in the UK and the EU are required to use EPDs to assess the environmental footprint of products.
- **Credits and certification:** LCA credits are very cost-efficient and easy compared to other credits' requirements for your building's certifications and EPDs are also recognized by LEED and BREEAM, among other market-based systems.

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