



REHAU®

Unlimited Polymer Solutions



TECHNICAL INFORMATION

SYSTEM GUIDELINES, PIPING AND CONNECTION
PLANNING AND ASSEMBLY

www.rehau.com

Valid from January 2013

Subject to technical modifications

Construction

Automotive

Industry

This Technical Information
System guidelines, piping and connection
is valid from January 2013.

Its publication means that the previous Technical Information 850624 (as of September 2012) is no longer valid.

Our current technical documentation can be found at www.rehau.no or www.rehau.dk for download.

The documentation is protected by copyright.
The rights justified by this, especially those of translation, reproduction, the drawing of illustrations, broadcasting, and rendering on photomechanical or by similar means as well as the storage in data processing systems, are reserved.

All measures and weights are approximate values.
Errors and changes excepted.



TECHNICAL INFORMATION

System guidelines, piping and connection

Guidelines	6
Pipes	11
Fittings and compression sleeves	18
Installation tools: RAUTOOL, Pipe cutters and expanding tools	28
Jointing technique	36
Planning and assembly.	42
Standards, regulations and guidelines	57

TABLE OF CONTENTS

1	Information and safety advice	6	10.3.	Expanding the pipe with the expander	37
2	Component overview	8	10.4.	Inserting the fitting into the expanded pipe	38
3	Material testing at REHAU	9	10.5.	Inserting the joint into the clamping tool	39
4	Transport and storage	10	10.6.	Pushing the compression sleeve up to the fitting collar	39
4.1	Handling the pipes and system components	10	11.	Detaching the compression sleeve joint	40
5	Pipes	11	11.1.	Cutting out the joint	40
5.1	PE-X materials	11	11.2.	Usability of cut-out joints	40
5.2	Material – Pipe (overview)	11	11.3.	Detaching the cut-out joint from drinking water and heating installations	41
5.3	Areas of application: Pipes	12	11.3.1.	Heating the joint to be detached	41
5.4	Areas of application: Pipes in underfloor heating/cooling	12	11.3.2.	Pulling off the compression sleeves	41
5.5	Universal pipe RAUTTAN stabil	13	12.	Bending the pipes	42
5.6	Universal pipe RAUTTAN flex	14	12.1.	Bending the universal pipe RAUTTAN stabil	42
5.7	Heating pipe RAUTHERM S	15	12.2.	Bending the universal pipe RAUTTAN flex	43
5.8	Technical data of pipes	16	12.3.	Bending the heating pipe RAUTHERM S	45
6	Fittings and compression sleeves	18	13.	Pipe support channel	46
6.1	Differentiating the fittings and compression sleeves	18	13.1.	Benefits of using the pipe support channel	46
6.2	Fittings and compression sleeves of the RAUTTAN system	19	13.2.	Functionality	46
6.2.1	Fittings	20	13.3.	Assembly of the pipe support channel	46
6.2.2	Compression sleeves	21	14.	Pipe fastening	48
6.3	Fittings and compression sleeves for the heating pipe RAUTHERM S	22	14.1.	Pipe clamps	48
6.3.1	Fittings for the heating pipe RAUTHERM S	22	14.2.	Fixed point installation	48
6.3.2	Compression sleeves for the heating pipe RAUTHERM S	22	14.3.	Pipe clamp intervals	48
6.4	Transition to other pipe materials	23	14.4.	Laying in visible areas	48
6.5	Connection to fittings	26	15.	Thermal length changes	50
6.6	Installation notes for connection components	26	15.1.	Guidelines	50
7	Installation tools RAUTOOL	28	15.2.	Benefits	50
7.1	RAUTOOL M1	30	15.3.	Calculation of length changes	50
7.2	RAUTOOL H2	30	16.	Deflection legs	51
7.3	RAUTOOL A3	30	16.1.	Calculation of deflection leg length	52
7.4	RAUTOOL A-light2	30	16.2.	Calculation examples	52
7.5	RAUTOOL E3	31	17.	Fundamental regulations on laying pipes	53
7.6	RAUTOOL G2	31	17.1.	Laying on the raw floor	53
7.7	RAUTOOL M-light	31	17.2.	Inadmissible heating of pipes	53
7.8	RAUTOOL K10 x 1.1	31	17.3.	External installation	54
7.9	RAUTOOL K12 x 2.0	31	17.4.	Laying exposed to UV radiation	54
7.10	RAUTOOL K14 x 1.5	31	17.5.	Light transmission	54
8	Pipe cutters	32	17.6.	Laying on bitumen sheeting and bitumen coatings	55
8.1	Pipe cutters 16/20 RAUTTAN	33	17.7.	Auxiliary heating	55
8.2	Pipe cutters 25	33	17.8.	Laying under hot asphalt screed	55
8.3	Pipe cutters 40 stabil	33	17.9.	Potential compensation	55
8.4	Pipe cutters 63	33	18.	Advices about system components until 2005	56
9	Expanding tools	34	18.1.	Advices about the system RAUTHERM SL	56
9.1	Expander heads and expander bits for pipes	34	19.	Standards, regulations and guidelines	57
9.2	Expander bits	35			
9.3	Safety advice on the expander heads	35			
10.	Making the compression sleeve joint	36			
10.1.	Cutting the pipe	36			
10.2.	Pushing the compression sleeve over the pipe	37			



1 INFORMATION AND SAFETY ADVICE

Notes on this Technical Information

Validity

This Technical Information is valid for Denmark & Norway.

Further applicable Technical Informations

- RAUTITAN – THE NEW GENERATION
- Underfloor Heating and Cooling

Navigation

A detailed table of contents is included at the beginning of this Technical Information with the hierarchical titles and the corresponding page numbers.

Definitions

- **Supply lines or piping** consist of pipes and their joints (e.g. compression sleeves, fittings, threads, or similar). This applies to gas piping, drinking water and heating piping and all other pipes in this Technical Information.
- **Piping systems, installations, systems**, etc. consist of the pipes and the necessary components.
- **Connection components** consist of fittings with the corresponding compression sleeves and pipes as well as seals and screw connections.

Illustration

Illustrations for individual subsystems are listed in the corresponding pipe, fitting and compression sleeve colours.

Illustrations, which apply system-wide for drinking water, heating installation or underfloor heating/cooling, are illustrated with grey piping and white fittings/compression sleeves.

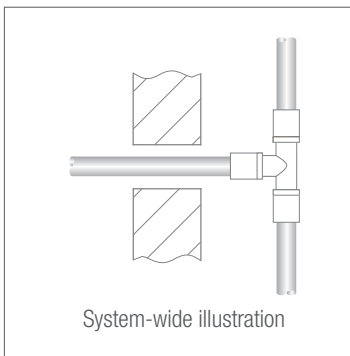


Fig. 1-1 Example: System-wide illustration for multiple sub-systems

Explanation of symbols



Safety information



Legal information



Important information, which needs to be taken into account



Information on the Internet



Your benefits/advantages



Updated Technical Information

For your own safety and the correct use of our products, check regularly whether the Technical Information which you have is available in a latest version.

The date of issue of your Technical Information is always printed on the bottom left of the cover.

- The latest Technical Information can be found at your REHAU sales office, specialist wholesaler or online for download at www.rehau.no or www.rehau.dk.

Safety advice and operating instructions

- For your own safety and other's, read the safety instructions and the operating instructions carefully and completely before beginning installation.
- Store the operating instructions in a safe place and make sure it is available when needed.
- In case you did not understand the safety advice or the individual assembly situations, or if they are not clear to you, please contact your REHAU sales office.
- **Failure to observe the safety information/instructions can result in damage to property and persons.**

Intended use

The system components and compression sleeve jointing technique must only be planned, installed and operated as described in this Technical Information. Any other use that does not fall within the intended use of the system is prohibited.



Observe the applicable national and international regulation on installation, accident prevention and safety when installing piping systems, as well as the instructions in this Technical Information.

Also observe the applicable laws, standards, guidelines and regulations (e.g. DIN, EN, ISO, DVGW, TRGI, VDE and VDI) as well as regulations on environmental protection, provisions of professional associations and regulations of the local public utility companies.

Areas of application not contained in this Technical Information (special applications) require consultation with our Applications Department. For detailed advice, please contact your REHAU sales office.

The design and installation instructions related solely to the specific REHAU product. Occasionally, references are made to parts of applicable standards and directives.

Always observe the current version of any guidelines, standards or directives. Further directives, regulations and guidelines related to the design, installation and operation of drinking water, heating and buildings services systems must also be referred but these do not form part of this Technical Information.



Staff requirements

- Only allow authorised and trained persons to install our systems.
- Only allow work on electrical systems or conductors to be carried out by suitably trained and authorised people.

General safety precautions

- Keep your workplace clean and free of obstructions.
- Ensure adequate lighting at your workplace.
- Keep children, household pets and unauthorised people away from tools and the installation places. This applies particularly to refurbishment in occupied places.
- Only use those components in the corresponding piping system, which have been generally approved by REHAU. Using components which are not part of the system or tools which do not originate from the respective REHAU installation system can lead to accidents or other hazards.

Work clothing

- Wear eye protection, adequate work clothing, protective shoes, a helmet and a hair net if you have long hair.
- Do not wear loose clothing or jewellery which can be caught by moving parts.
- A safety helmet has to worn during installations work at face level or overhead.



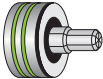




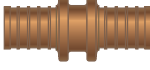
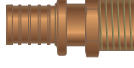
Follow the assembly instructions


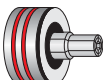
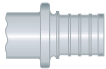
- Always read and observe the available operating instructions of the REHAU installation tool.
- Incorrect handling of tools can cause cuts and crushing or sever limbs.
- Incorrect handling of tools can damage connection components and bring about leaks.
- The REHAU pipe cutters have sharp blades. Store and handle them in such a way that they will not create any risk of injury.
- When cutting the pipes, keep a safety distance between the holding hand and the cutting tool.
- When cutting do not reach into the cutting zone of the tool or near its moving parts.
- After the expansion process, the expanded end of the pipe returns to its original shape (memory effect). During this time, do not put any other objects into the expanded end of the pipe.
- Keep your hands away from movable parts or the tools pressing area during jointing.
- Before the joint is completed, the fitting may fall out of the pipe. Danger of injury!
- Always disconnect the power from a tool prior to carrying out maintenance work, changing over any moveable parts (e.g. compression jaws) or when moving the tool to a new location on site.

Operating parameter

- If the operating parameters are exceeded, the pipes and joints may become overstrained. Not adhering to the operating parameters is thus not allowable. Keeping within the operating parameters must be ensured by safety/control equipment (e.g. pressure reducers, safety valves, etc.).

2 COMPONENT OVERVIEW

RAUTITAN – THE NEW GENERATION			
	Size 16–40	Size 50–63	Tool
RAUTITAN universal system for drinking water and heating			
Pipe	 Universal pipe RAUTITAN stabil  Universal pipe RAUTITAN flex		RAUTOOL
Compression sleeve	 RAUTITAN PX PVDF	 RAUTITAN MX Brass	
Fitting	 RAUTITAN PX PPSU  RAUTITAN RX Gunmetal  RAUTITAN SX Stainless steel	 RAUTITAN RX Gunmetal  RAUTITAN RX Gunmetal	

REHAU system for underfloor heating/cooling			
	Size 10–32		Tool
Underfloor heating/cooling			
Pipe	 Heating pipe RAUTHERM S		RAUTOOL
Compression sleeve	 Compression sleeve for heating pipe RAUTHERM S Brass with silver surface finish		
Fitting	 Fitting for heating pipe RAUTHERM S Brass with silver surface finish		

3 MATERIAL TESTING AT REHAU

At REHAU, all types of pipes are subjected to constant quality assurance and pass through numerous short and long-term tests to ensure the quality of the REHAU pipes. Several standard tests conducted in the REHAU test laboratory are described below. For polymer pipe materials subjected to thermal and mechanical loads, it must be observed that deformation and the strength depend on the temperature and the exposure time. To determine the permissible conditions for long-term loads, it is necessary to investigate the mechanical behaviour over a long period and at different temperatures. This also applies to pipes subjected to internal pressure.

Burst pressure test

In the burst pressure test, the pipes are subjected to a rising pressure in a test apparatus until the pipe ruptures. The burst pressure at room temperature is approximately seven times the maximum operating pressure.



Fig. 3-1 Results of a burst pressure test with the universal pipe RAUTTAN flex

Notch impact test

The resistance of the pipes to the effects of impact is tested in a notch impact testing device. A hammer-shaped pendulum strikes the tested pipe under controlled conditions. Pipes made of crosslinked polyethylene have a very high resistance to these severe mechanical effects. The depicted test example (see Fig. 3-2) shows a notch impact strength of the pipe without breaking at a temperature of -30°C .



Fig. 3-2 Universal pipe RAUTTAN flex in the notch impact testing device

Tension test

In a tension testing machine, the pipes are pulled longitudinally at high force under controlled conditions until they break. Pipes made of crosslinked polyethylene show an extremely high extensibility in comparison with metal pipes. The length of the extended pipe can be several times the original pipe length. The compression sleeve jointing technique cannot pull out under operating conditions: The pipe is not pulled out of the joint.



Fig. 3-3 Procedure of a tension test

Long-term test

The use of pipes in domestic installations requires a service life of 50 years or more. To determine the long-term effects, e.g. by temperature fluctuations, pressure and mechanical loads, the pipes are subjected to extreme conditions of temperature and pressure in long-term tests and are tested periodically by the test methods described above. The pipes are then photo-optically examined.



Fig. 3-4 Pipes in a long-term test (under pressure in a water bath)

The necessary parameters were developed on the basis of over 25 years of experience in the laboratory and in practice with numerous trials and extensive tests on pipes made of high-pressure crosslinked polyethylene. The pipes in the background with brown surfaces (see Fig. 3-4) have been tested since production began at REHAU in a test bath at 95°C and 10 bar. Other tests are conducted according to the applicable standards and regulations. E.g. these are the measurement of the degree of crosslinking, shrinkage tests, ageing tests, temperature cycling tests, pulsing tests and many more.

4 TRANSPORT AND STORAGE

4.1 Handling the pipes and system components

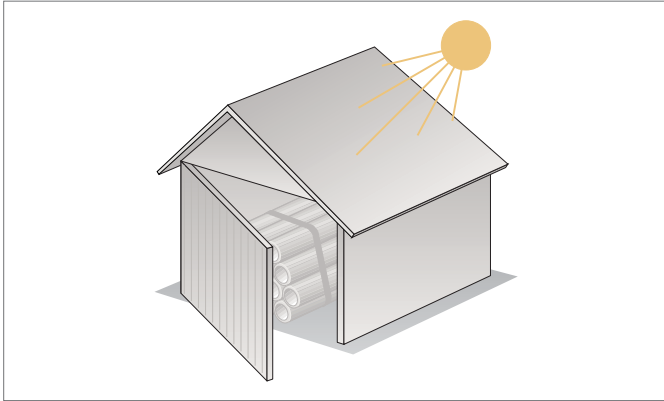


Fig. 4-1 Protect pipes against sunlight

Store and transport pipes and components protected against UV radiation.

Avoid damaging the pipes and system components:

- Load and unload with due care.
- Convey suitably for the materials.
- Do not drag over floors or concrete surfaces.
- Store on a flat surface with no sharp edges.
- Protect against mechanical damage.
- Protect against dirt, drilling dust, mortar, grease, oil, paint, solvents, chemicals, humidity, etc.
- Protect against sunlight, e.g. with an opaque film or similar material.
- Protect against long sunlight during the building phase.
- Only unpack shortly before laying.
- Note the hygienic requirements (e.g. sealing of pipe ends, protection of the fittings, compliance with VDI 6023 - Hygiene-conscious planning, execution, operation and installation of drinking water systems).

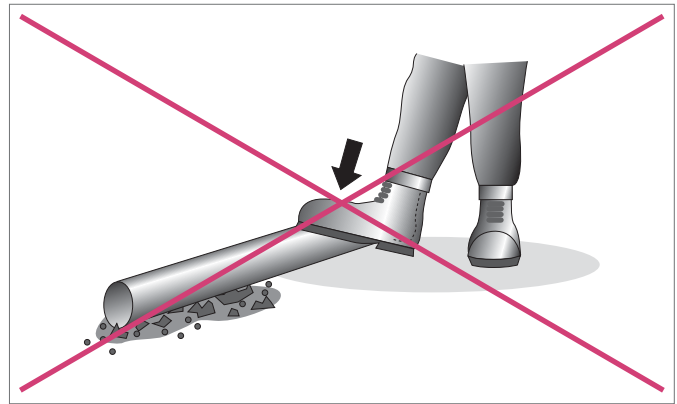


Fig. 4-2 Do not store pipes on sharp-edged surfaces

5 PIPES

5.1 PE-X materials

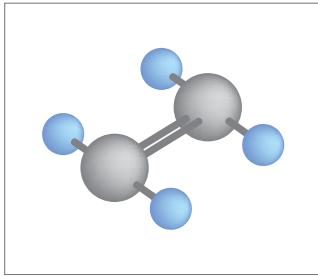


Fig. 5-1 Ethylene

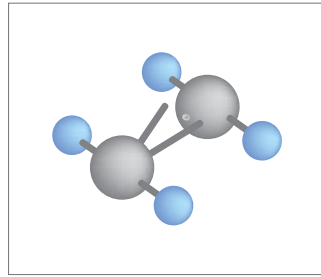


Fig. 5-2 Ethylene, detaching double bond

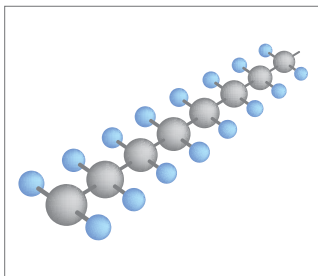


Fig. 5-3 Polyethylene (PE)

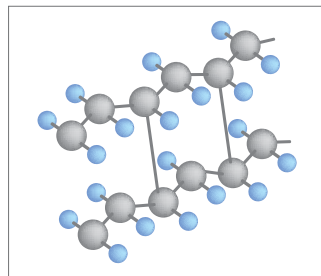


Fig. 5-4 Crosslinked polyethylene (PE-X)



- Corrosion resistance of the pipes: No pitting
- No tendency to deposits
- Polymer pipe material reduces sound transmission along the pipe
- Good resistance to abrasion
- Toxicologically and physiologically harmless
- All RAUTITAN pipes with DVGW registration comply with the KTW guidelines

Peroxide-crosslinked polyethylene

Peroxide-crosslinked polyethylene is designated PE-Xa. This method of crosslinking is conducted at high temperatures and pressure with the aid of peroxides. Here, the individual molecules of the polyethylene combine to form a three-dimensional network. This high-pressure crosslinking is characterised by crosslinking in the melt away from the crystallite melting point. Crosslinking occurs during the moulding of the pipe in the tool. This method of crosslinking ensures an even and very high degree of crosslinking over the entire cross-section of even thick-walled pipes.

Radiation crosslinked polyethylene

Radiation crosslinked polyethylene is designated PE-Xc. Crosslinking is conducted after the production of the pipes under the effects of high-energy radiation.

Inliner universal pipe RAUTITAN stabil

The interior pipe in the universal pipe RAUTITAN stabil, which comes into contact with the flowing medium, is known as inliner. This inliner is made of cross-linked polyethylene (PE-X).

5.2 Material – Pipe (overview)

Composition / Material	Pipe
<ul style="list-style-type: none"> - Self-supporting PE-X inliner, pressure-resistant and crosslinked - Aluminium layer - Polyethylene outer layer 	Universal pipe RAUTITAN stabil
<ul style="list-style-type: none"> - RAU-PE-Xa - Adhesive agent - Oxygen diffusion barrier 	Universal pipe RAUTITAN flex Heating pipe RAUTHERM S

Tab. 5-1 Pipe composition/material (composition from interior to exterior)

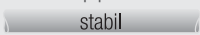

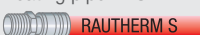
5.3 Areas of application: Pipes

The RAUTITAN universal system for drinking water and heating can be used extensively in the following:

- Drinking water installation
- Heating installation
- Radiator connection from the wall
- Radiator connection from the floor
- Radiator connection from the skirting (only with RAUTITAN stabil)
- Underfloor heating/cooling

For underfloor heating and cooling, we recommend the REHAU systems with the red heating pipe RAUTHERM S.

- Larger inside pipe diameter
- Various laying systems
- Optimum wall thicknesses for flexible installation

Pipe	Size	Pipe material	Area of application			
			Drinking water installation	Heating installation	Radiator connection from the skirting	Underfloor heating/cooling
Universal pipe RAUTITAN stabil 	16–40	Metal plastic composite pipe	++	++	++	+
Universal pipe RAUTITAN flex 	16–63	PE-Xa with oxygen diffusion barrier	++	++	–	+
Heating pipe RAUTHERM S 	10–32	PE-Xa with oxygen diffusion barrier	–	–	–	++

++ Use permitted + Use permitted with limitation – Use not permitted

5.4 Areas of application: Pipes in underfloor heating/cooling

Installation system	Pipe		
	Universal pipe RAUTITAN stabil	Universal pipe RAUTITAN flex	Heating pipe RAUTHERM S
Studded panel Varionova - impact noise insulation 30–2 - thermal insulation 11 mm	16.2 x 2.6 mm	16 x 2.2 mm	14 x 1.5 mm / 17 x 2.0 mm
Studded panel Varionova without impact sound insulation	16.2 x 2.6 mm	–	14 x 1.5 mm
Stapler system	16.2 x 2.6 mm	16 x 2.2 mm / 20 x 2.8 mm	14 x 1.5 mm / 17 x 2.0 mm / 20 x 2.0 mm
RAUFIX rail for 12/14	–	–	14 x 1.5 mm
for 16/17/20	16.2 x 2.6 mm	16 x 2.2 mm	17 x 2.0 mm / 20 x 2.0 mm
Pipe grid	–	16 x 2.2 mm / 20 x 2.8 mm	14 x 1.5 mm / 16 x 2.0 mm / 17 x 2.0 mm / 20 x 2.0 mm
Dry fit system	16.2 x 2.6 mm	16 x 2.2 mm	16 x 2.0 mm
Base plate TS–14	–	–	14 x 1.5 mm
Cooling ceiling	–	–	10.1 x 1.1 mm
Acoustic chilled ceiling	–	–	10.1 x 1.1 mm
Wall heating/cooling in drywall construction	–	–	10.1 x 1.1 mm
Wall heating/cooling in wetwall construction	–	–	10.1 x 1.1 mm
Modernisation system for the floor	–	–	10.1 x 1.1 mm

5.5 Universal pipe RAUTITAN stabil



Fig. 5-5 Universal pipe RAUTITAN stabil

- Metal/plastic composite pipe with the following structure from the inside outwards:
 - Self-supporting inliner (pressure-resistant inner tube) made of crosslinked polyethylene (PE-X) according to DIN EN ISO 15875 and DIN 16892
 - Oxygen-diffusion tight aluminium layer
 - Polyethylene outer layer
- Areas of application
 - Drinking water installation, see:
 - Technical Information "RAUTITAN – THE NEW GENERATION"
 - Heating installation, see:
 - Technical Information "RAUTITAN – THE NEW GENERATION"
 - Technical Information "Underfloor heating/cooling"

Delivery make-up

d [mm]	s [mm]	Content [l/m]	Make-up
16.2	2.6	0.095	Cut length / Coil
20	2.9	0.158	Cut length / Coil
25	3.7	0.243	Cut length / Coil
32	4.7	0.401	Cut length
40	6.0	0.616	Cut length

Tab. 5-2 Delivery make-up, universal pipe RAUTITAN stabil

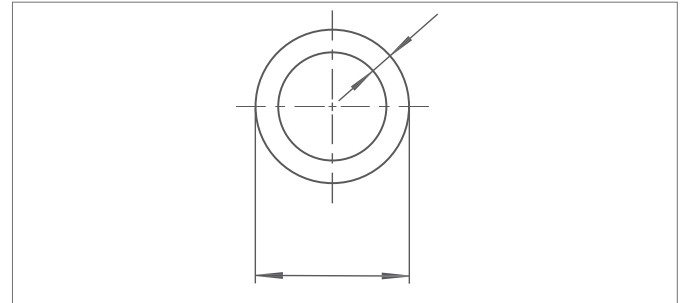


Fig. 5-6 Diameter/Wall thickness

Approvals for Germany and quality certificates

- DVGW registration for universal pipe RAUTITAN stabil and compression sleeve jointing technique from REHAU with RAUTITAN connection components
- System approvals for sizes 16–40: DVGW DW-8501AU2346
- Self-supporting inliner (pressure-resistant inner tube) made of crosslinked polyethylene complies with DIN EN ISO 15875 and DIN 16892

Approvals outside of Germany

National approvals outside Germany may differ from the German approvals in the respective countries. If the RAUTITAN system is used in other countries, consult your REHAU sales office.

5.6 Universal pipe RAUTITAN flex



Fig. 5-7 Universal pipe RAUTITAN flex

- Pipe made from RAU-PE-Xa
 - Peroxide-crosslinked polyethylene (PE-Xa)
 - With oxygen diffusion barrier
 - Oxygen-tight according to DIN 4726
 - Complies with DIN EN ISO 15875
- Areas of application
 - Drinking water installation, see:
 - Technical Information "RAUTITAN – THE NEW GENERATION"
 - Heating installation, see:
 - Technical Information "RAUTITAN – THE NEW GENERATION"
 - Technical Information "Underfloor heating/cooling"

Delivery make-up

d [mm]	s [mm]	DN	Content [l/m]	Make-up
16	2.2	12	0.106	Cut length / Coil
20	2.8	15	0.163	Cut length / Coil
25	3.5	20	0.254	Cut length / Coil
32	4.4	25	0.423	Cut length / Coil
40	5.5	32	0.661	Cut length
50	6.9	40	1.029	Cut length
63	8.6	50	1.633	Cut length

Tab. 5-3 Delivery make-up, universal pipe RAUTITAN flex

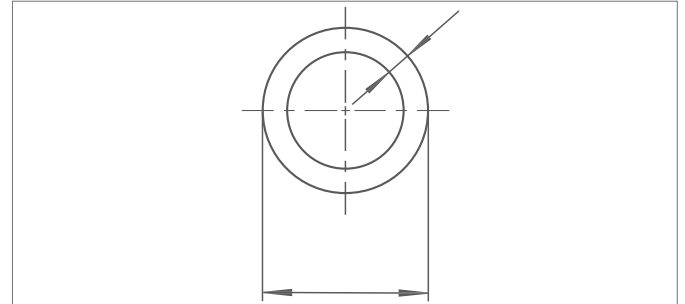


Fig. 5-8 Diameter/Wall thickness

Approvals for Germany and quality certificates

- DVGW registration for universal pipe RAUTITAN flex and compression sleeve joining technique from REHAU with RAUTITAN connection components
- System approval for the sizes 16–63: DVGW DW-8501AU2200
- The universal pipe RAUTITAN flex complies with DIN EN ISO 15875
- DIN CERTCO registration confirms the suitability of the pipes for use in the heating installation to DIN 4726/DIN EN ISO 15875 - application class 5 and the necessary tightness against oxygen diffusion

Approvals outside of Germany

National approvals outside Germany may differ from the German approvals in the respective countries. If the RAUTITAN system is used in other countries, please consult your REHAU sales office.

5.7 Heating pipe RAUTHERM S



Fig. 5-9 Heating pipe RAUTHERM S

- Pipe made from RAU-PE-Xa
 - Peroxide-crosslinked polyethylene (PE-Xa) according to DIN EN ISO 15875 and DIN 16892
 - With oxygen diffusion barrier
 - Oxygen-tight according to DIN 4726
- Area of application
 - Underfloor heating/cooling, see:
 - Technical Information "Underfloor heating/cooling"
 - Technical Information "RAUTITAN – THE NEW GENERATION"
 - Heating installation in buildings. The safety equipment of the heaters must comply with DIN EN 12828

Approvals for Germany and quality certificates

- The heating pipe RAUTHERM S complies with DIN 16892 and DIN 4726
- DIN CERTCO registration for the sizes 10.1 / 14 / 17 / 20 and 25 confirms the suitability of the pipes and the corresponding compression sleeve jointing technique in the heating installation according to DIN 4726/ DIN EN ISO 15875 - application class 5 and the necessary tightness against oxygen diffusion

Approval outside of Germany

National approvals outside Germany may differ from the German approvals in the respective countries. If the heating pipe RAUTHERM S is used in other countries, consult your REHAU sales office.

Delivery make-up

d [mm]	s [mm]	Content [l/m]	Make-up
10.1	1.1	0.049	Coil
12	2.0	0.050	Coil
14	1.5	0.095	Coil
16	2.0	0.113	Coil
17	2.0	0.133	Cut length / Coil
20	2.0	0.201	Cut length / Coil
25	2.3	0.327	Cut length / Coil
32	2.9	0.539	Cut length

Tab. 5-4 Delivery make-up, heating pipe RAUTHERM S

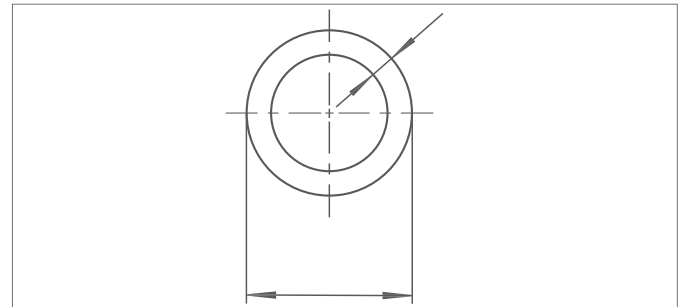


Fig. 5-10 Diameter/Wall thicknesses



The heating pipe RAUTHERM S may not be used in the drinking water installation!


5.8 Technical data of pipes



A simultaneous load at the pressure and temperature limits during operation of drinking water and heating systems is not allowed (e.g. 95 °C at 10 bar in continuous working).

Technical data	Unit	Pipe	
		Universal pipe RAUTITAN stabil stabil	Universal pipe RAUTITAN flex flex
Material	–	PE-X/Al/PE	PE-Xa EVAL-sheathed
Colour (surface)	–	Silver	Silver
Notch impact strength at 20 °C	–	No fracture	No fracture
Notch impact strength at –20 °C	–	No fracture	No fracture
Average coefficient of expansion when laying with pipe support channel Size 16–40 Size 50 and 63	[mm/(m·K)]	0.026 – –	0.15 0.04 0.1
Thermal conductivity	[W/(m·K)]	0.43	0.35
Pipe roughness	[mm]	0.007	0.007
Operating pressure (maximum)	[bar]	10	10
Operating temperature Maximum Minimum	[°C]	95 –	90 –
Short-term maximum temperature (malfunction)	[°C]	100	100
Oxygen diffusion (to DIN 4726)	–	Oxygen-tight	Oxygen-tight
Material constant C	–	33	12
Building material class acc. DIN 4102-1 Construction product class acc. DIN EN 13501-1	–	B2 E	B2 E
Maximum/Minimum laying temperature	[°C]	+50/–10	+50/–10
Minimum bending radius without tools d = Pipe diameter	–	5 x d	8 x d
Minimum bending radius with spiral spring/tool d = Pipe diameter	–	3 x d	–
Minimum bending radius with pipe bend brackets d = Pipe diameter	–	–	3–4 x d Plumbing 5 x d Plumbing/Heating
Available sizes	[mm]	16 – 40	16 – 63

Tab. 5-5 Technical data of pipes/approximate values

Heating pipe RAUTHERM S	
	
PE-Xa EVAL-sheathed	
Red	
No fracture	
No fracture	
0.15	
–	
–	
0.35	
0.007	
6	
90	
–	
100	
Oxygen-tight	
12	
B2 E	
+50/–10	
5 x d (At > 0 °C laying temperature)	
–	
5 x d	
10 – 32	






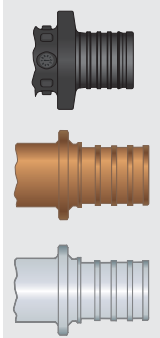

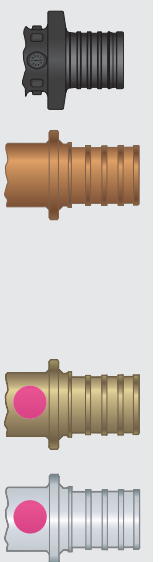

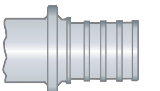



It can happen that singular cases of blistering may occur during operation on the pipe surface of the universal pipe RAUTITAN stabil. Also when using concrete core tempering, blistering can occur as an exception on the pipe surface of RAUTHERM S pipes during pressure testing with pressurised air and longer test durations. This blistering does not represent any reduction in quality or in usability and is not critical.

6 FITTINGS AND COMPRESSION SLEEVES

6.1 Differentiating the fittings and compression sleeves

It needs to be differentiated between the fittings/compression sleeves RAUTITAN and the fittings/compression sleeves of the REHAU systems for underfloor heating/cooling.

Areas of application of the fittings and compression sleeves					
Drinking water installation		Heating installation		Underfloor heating/cooling	
 stabil  flex		 stabil  flex		 RAUTHERM S	
Fitting	Compression sleeve	Fitting	Compression sleeve	Fitting	Compression sleeve
					

Tab. 6-1 Areas of application of the fittings and compression sleeves



Only push polymer RAUTITAN PX compression sleeves onto polymer RAUTITAN PX fittings.

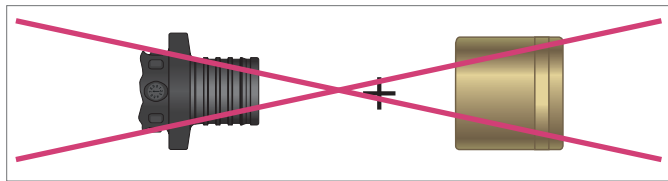


Fig. 6-1 Unapproved combination RAUTITAN PX with brass compression sleeves



- Application in plumbing and heating installation
- Permanently sealing compression sleeve jointing technique according to DIN EN 806, DIN 1988, DVGW-worksheet W 534
- Approved for flush-mounted installation in accordance with DIN 18380 (VOB)
- Robust jointing technique, highly suitable for the building site
- Without o-ring (pipe material seals itself)
- Easy optical monitoring
- Can be immediately pressurised
- By expanding the pipe, the internal diameters of the pipes and fittings are hydraulically adjusted to each other
- RAUTITAN RX fittings, through which drinking water flows, are made of gunmetal according to DIN EN 12164 and DIN EN 1982
- No risk of confusion with uniform compression sleeves for all pipe types in the RAUTITAN universal system for drinking water and heating
- DVGW registration (all sizes)
 - For the RAUTITAN pipes in the drinking water installation
 - For the REHAU compression sleeve jointing technique
- Manufacture of the compression sleeve joint with RAUTOOL
 - Especially coordinated with the RAUTITAN and RAUTHERM S systems
 - Development and supervision directly from REHAU



- Only use the fittings and compression sleeves RAUTITAN PX, RAUTITAN RX or RAUTITAN SX in the drinking water and heating installation.
- Only push RAUTITAN PX compression sleeves onto RAUTITAN PX fittings.
- Do not confound the RAUTITAN connection components with the connection components of the heating pipe RAUTHERM S (underfloor heating/cooling) (e.g. stainless steel RAUTITAN SX system adapters or radiator elbow connection sets RAUTITAN).
Do not combine fittings and compressions sleeves from different ranges with each other.
- Do not insert any fittings from the heating installation (with pink marking or marked correspondingly on the packaging) in the drinking water installation.
- Please note the measurements of the fittings and compression sleeves.
- You can find the precise allocation of the connection components in the current price list.



Information on the current drinking water ordinance and on DIN 50930, part 6 can be found in the Technical Information "RAUTITAN – THE NEW GENERATION".

6.2 Fittings and compression sleeves of the RAUTITAN system



Fig. 6-2 Fittings RAUTITAN PX made from PPSU



Fig. 6-3 Fitting RAUTITAN RX (gunmetal)



Fig. 6-4 Fitting RAUTITAN SX (stainless steel)

The fittings and the compression sleeves RAUTITAN are downward compatible with all RAUTITAN pipes SDR 7,4. This especially applies to existing plumbing installations in which pearl white drinking water pipes RAUTITAN his/RAUHIS or pink heating pipes RAUTITAN pink/RAUPINK have been already laid.

For detailed information about the compatibility of the fittings and compression sleeves with existing pipes, please contact your REHAU sales office.

Size designation of the fittings and compression sleeves for the RAUTITAN system


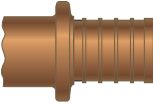
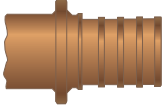
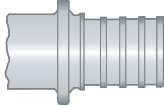
- 16 x 2.2
- 20 x 2.8
- 25 x 3.5
- 32 x 4.4
- 40 x 5.5
- 50 x 6.9
- 63 x 8.6



Fig. 6-5 RAUTITAN compression sleeves

6.2.1 Fittings

Fittings for drinking water and heating

Fittings for plumbing and heating installations		
Threadless fittings	Size 16–40 	Size 50–63 
Material	RAUTITAN PX PPSU	RAUTITAN RX Gunmetal
Fittings for screwing, soldering, clamping	Size 16–63 	
Material	RAUTITAN RX Gunmetal	
	Size 16–40 	
Material	RAUTITAN SX Stainless steel	

Tab. 6-2 Fittings for plumbing and heating installations



Advices about RAUTITAN fittings contours, which were available until 1997 can be found in chapter „18 Advices about system components until 2005“ page 80.

Material

- RAUTITAN PX: Polyphenyl sulphone
Material marking: PPSU
- RAUTITAN RX: Gunmetal according to DIN EN 1982
Material marking: Rg
- RAUTITAN SX: Stainless steel (material designations 1.4404/1.4408)
The fittings are manufactured according to DIN EN 10088, part 3

Differences of the fittings for the heating installation

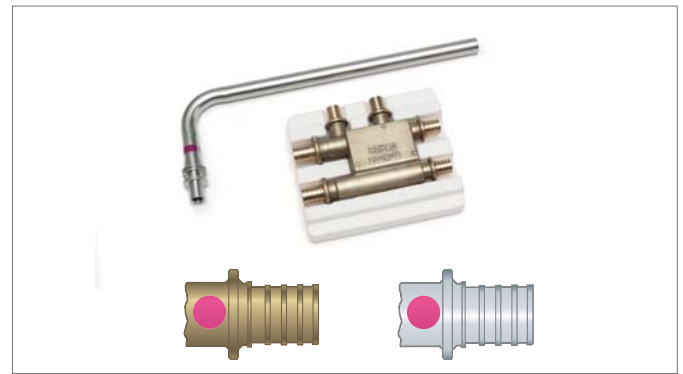


Fig. 6-6 Fittings for the heating installation only



- Only use fittings of the RAUTITAN system in the heating installation with RAUTITAN (e.g. radiator elbow connection sets, radiator tee connection sets, cross fittings) if they are marked in pink or are identified as heating fittings on the packaging,
- You can find the precise allocation of the connection components in the current price list.

6.2.2 Compression sleeves


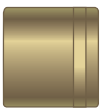
Compression sleeves for the RAUTITAN universal system for drinking water and heating



Fig. 6-7 RAUTITAN PX
compression sleeve



Fig. 6-8 RAUTITAN MX
compression sleeve

	RAUTITAN PX	RAUTITAN MX
		
Size	16 x 2.2 mm 20 x 2.8 mm 25 x 3.5 mm 32 x 4.4 mm 40 x 5.5 mm	50 x 6.9 mm 63 x 8.6 mm
Material	PVDF (Polyvinylidene fluoride)	Thermally annealed brass to DIN EN 1254-3
Characteristic features	- Can be pushed onto the fitting from both sides - Black	- Can only be pushed onto the fitting from one side - Brass finish - An encircling groove

Tab. 6-3 RAUTITAN compression sleeves

- Can be used for all pipe types of the RAUTITAN universal system for drinking water and heating
- Permanently sealing compression sleeve jointing technique
 - According to DIN EN 806, DIN 1988 and DVGW worksheet W 534
 - Approved for flush-mounted installation according to DIN 18380 (VOB)
- No risk of confusion with uniform compression sleeves for all pipe types of the RAUTITAN universal system for drinking water and heating
- Existing RAUTITAN brass compression sleeves can still be laid with RAUTITAN fittings made from brass, gunmetal or stainless steel.

6.3 Fittings and compression sleeves for the heating pipe RAUTHERM S



- Do not confound the fittings and compression sleeves for the heating pipe RAUTHERM S (underfloor heating/cooling) with the RAUTITAN fittings and compression sleeves (e.g. RAUTITAN SX system adapters or radiator elbow connection sets RAUTITAN).
- Please note the measurements of the fittings and compression sleeves.
- You can find the precise allocation of the connection components in the current price list.

6.3.1 Fittings for the heating pipe RAUTHERM S



Fig. 6-9 Compression sleeve fitting for the heating pipe RAUTHERM S

Fittings for the heating pipe RAUTHERM S	
Size	10.1 x 1.1 mm 12 x 2.0 mm 14 x 1.5 mm 16 x 2.0 mm 17 x 2.0 mm 20 x 2.0 mm 25 x 2.3 mm 32 x 2.9 mm
Material	Brass with silver surface finish

Tab. 6-4 Fittings for heating pipe RAUTHERM S



Permanently sealing compression sleeve jointing technique approved according to DIN 18380 (VOB) for flush-mounted installation without inspection opening as soon as for pipelines within the floating screed and concrete.

6.3.2 Compression sleeves for the heating pipe RAUTHERM S



Fig. 6-10 Compression sleeve for the heating pipe RAUTHERM S

Characteristic features

Size	Characteristic features
10.1 x 1.1	One encircling groove, brass with silver surface finish
12 x 2.0	One encircling groove, brass without silver surface finish
14 x 1.5	Two encircling grooves, brass with silver surface finish
16 x 2.0	One encircling groove, brass with silver surface finish
17 x 2.0	
20 x 2.0	Two encircling grooves, brass with silver surface finish
25 x 2.3	
32 x 2.9	



Compression sleeves for underfloor heating/cooling can only be pushed onto the fitting from one side.

6.4 Transition to other pipe materials



Fig. 6-11 RAUTITAN RX (gunmetal) fittings



Fig. 6-12 RAUTITAN SX (stainless steel) fitting

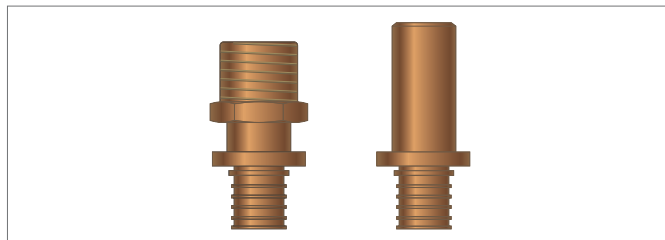


Fig. 6-14 RAUTITAN fittings for transitions to other materials



Water piping

- Only make joints after the soldering process.
- Let the solder cool down fully.
- A direct screwed connection of threaded fittings RAUTITAN MX made of special dezincification-resistant brass to threaded fittings RAUTITAN SX made of stainless steel is not allowed.
We recommend the use of a transition piece made of gunmetal between both fittings.
- A direct connection thread between the fitting RAUTITAN SX made of stainless steel and fittings made of galvanised steel is according to DIN EN 806-4 not allowed.
We recommend for that the use of a non ferrous metal transition fitting (e.g. gunmetal).
- To extend the thread fittings RAUTITAN we recommend the use of thread pieces made of gunmetal.

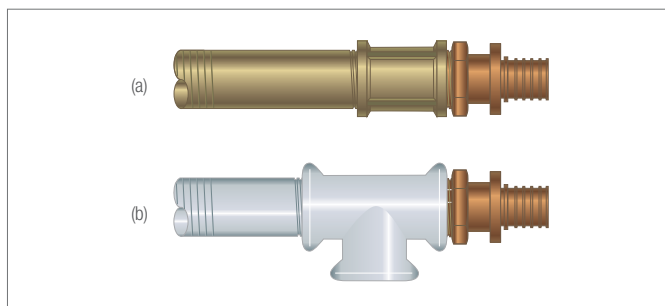


Fig. 6-15 Adapter with RAUTITAN male thread screwed into:
(a) Brass fittings
(b) Systems with galvanised pipes and fittings

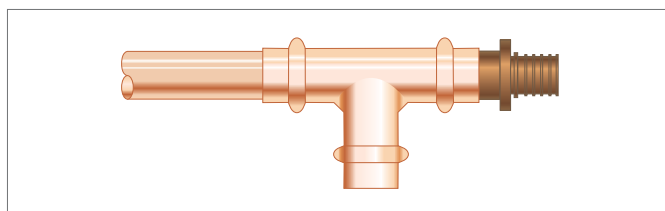


Fig. 6-16 Soldering/Pressing adapter RAUTITAN RX with copper pressing system

E.g. if repairs or piping network extensions make a system change to the RAUTITAN system or to the REHAU systems for underfloor heating/cooling necessary, a threaded joint must always be used to preserve the guarantee and as a clear division between the different systems.

An exception to this rule is the use of the soldering/pressing adapter RAUTITAN RX and the RAUTITAN SX stainless steel system pressing adapter.

For transitions from the RAUTITAN system to soldering or metal compression systems (radial compression joints to DVGW worksheet W 534), use the soldering/pressing adapter RAUTITAN RX, e.g. with the materials copper or mild steel (heating installation).

When using with metal compression systems, ensure that the surfaces of the soldering/compression end are free of grooves and deformations.

Observe the instructions of the metal compression system manufacturers.

Use suitable solder and flux for soft-soldering and hard-soldering.



Use soft-soldering methods only in the drinking water installation.



Fig. 6-13 Adapter with male thread and soldering/pressing adapter

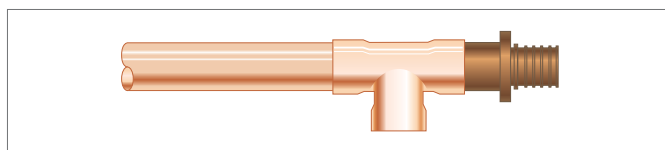


Fig. 6-17 Soldering/Pressing adapter RAUTITAN RX soldered into a copper piping system

Transition to stainless steel systems



Fig. 6-18 System adapter with stainless steel RAUTITAN SX male thread and stainless steel RAUTITAN SX system pressing adapter

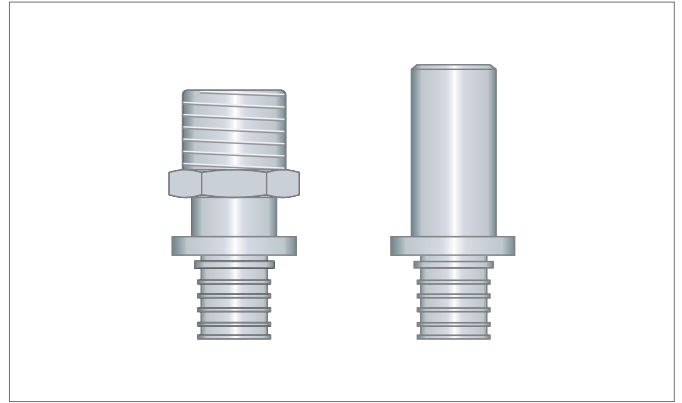


Fig. 6-19 System adapter with stainless steel RAUTITAN SX male thread and stainless steel RAUTITAN SX



System adapter made of stainless steel

- To connect installation systems made of stainless steel, only use the system pressing adapters RAUTITAN SX and system adapters with male threads RAUTITAN SX, both in stainless steel.
- Do not confuse the RAUTITAN SX fittings with the fittings with silver surfaces, which are used to connect the heating pipe RAUTHERM S (underfloor heating/cooling).
- Please note the measurements of the fittings.

Threaded fittings made of stainless steel

- Do not use sealing tape or sealants (e.g. Teflon) which release chloride ions soluble in water.
- Use sealants which do not release chloride ions soluble in water (e.g. hemp).
- To avoid a crevice corrosion of the fittings RAUTITAN SX we recommend the use of hemp as thread sealant.

If the RAUTITAN system is connected to other systems made of stainless steel by interconnecting fittings (e.g. flush-mounted valves or water meters), it is unnecessary to use the RAUTITAN SX adapters.

The material combination of brass with stainless steel has been acknowledged in technical rules for a long time. However, the direct transition point to other systems is not explicitly regulated by the manufacturer's warranty guidelines of stainless steel system suppliers.

To avoid a loss of warranty for the user of the REHAU system, uniform materials must be used at the system transition to stainless steel systems.

REHAU specifies only the system pressing adapters RAUTITAN SX and RAUTITAN SX system adapters with male threads (both in stainless steel) for direct system connections to stainless steel installation systems.

The same fitting directions apply for the RAUTITAN SX system pressing adapters as for the RAUTITAN RX soldering/pressing adapters.

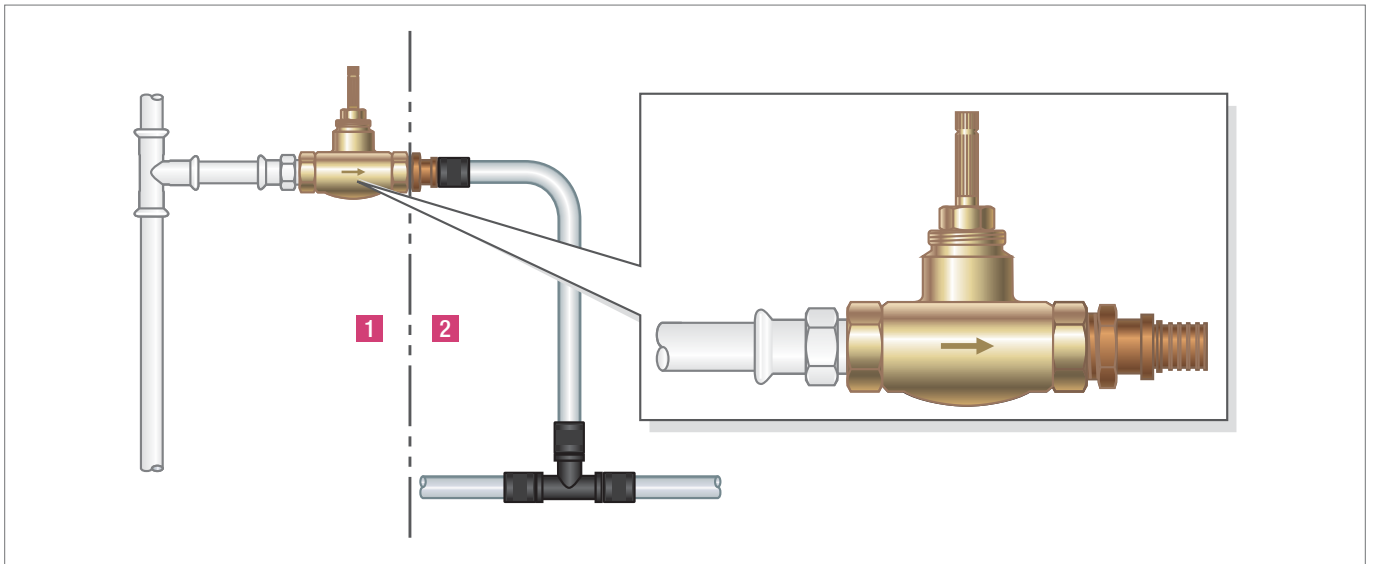


Fig. 6-20 Installation situation of a system adapter to a flush mounted valve (example)

1 Stainless steel system with flush-mounted valve

2 RAUTITAN system with RAUTITAN RX thread adapters

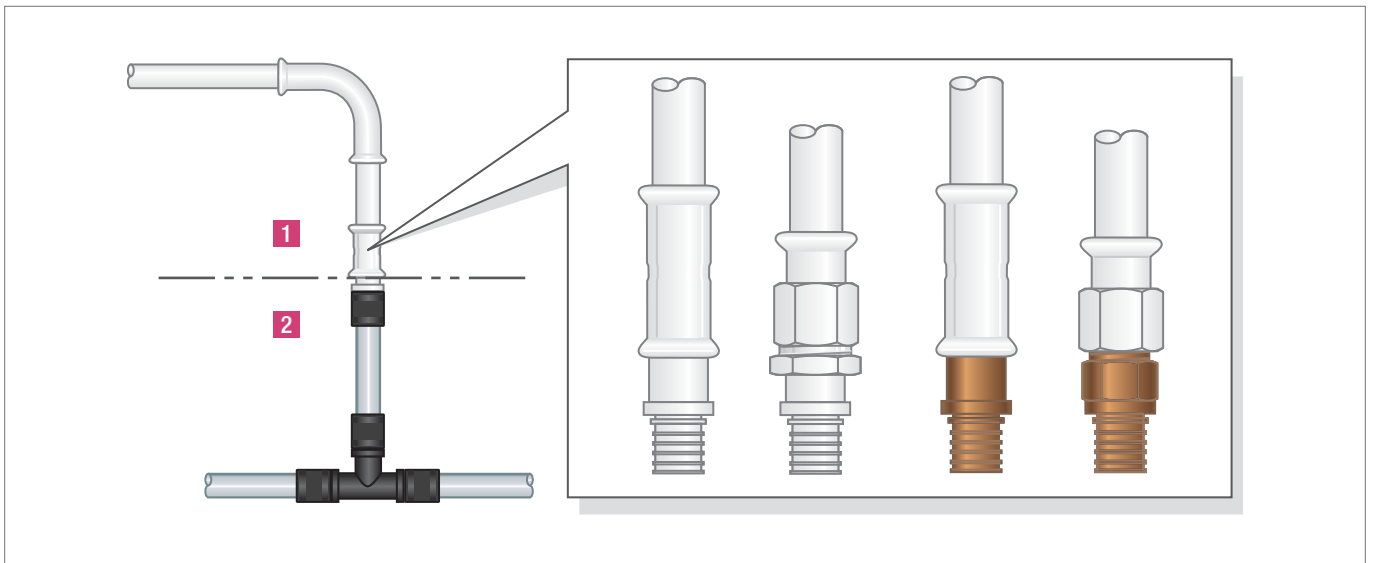


Fig. 6-21 Direct transition from stainless steel systems to the RAUTITAN system up to size 32 or with threads up to R1/Rp1

1 Stainless steel system

2 RAUTITAN system with RAUTITAN SX adapters (stainless steel) and RAUTITAN RX (gunmetal)

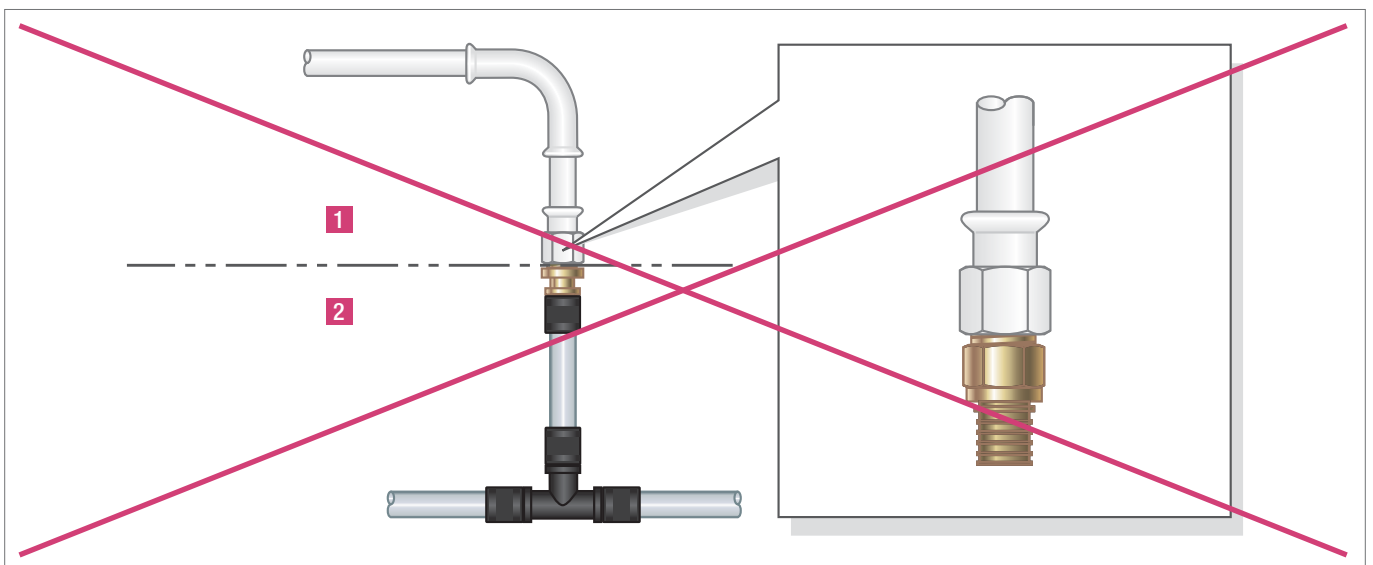


Fig. 6-22 No direct transition from stainless steel systems to RAUTITAN MX

1 Stainless steel system

2 RAUTITAN system with RAUTITAN MX (brass) adapters

6.5 Connection to fittings



Fig. 6-23 Adapter with RAUTITAN union nut

Equipment and fittings can be easily connected by using adapters with union nuts.

RAUTITAN pipe size	RAUTITAN MX with flat-sealed Article description	Fittings with male threads for connection to metal pipe with thread to DIN 3546, Part 1
16	16 - G $\frac{1}{2}$	–
16	16 - G $\frac{3}{4}$	G $\frac{3}{4}$
20	20 - G $\frac{1}{2}$	–
20	20 - G $\frac{3}{4}$	G $\frac{3}{4}$
25	25 - G $\frac{3}{4}$	–
25	25 - G1	G1
32	32 - G1	–
32	32 - G1 $\frac{1}{4}$	G1 $\frac{1}{4}$
32	32 - G1 $\frac{1}{2}$	–
40	40 - G1 $\frac{1}{2}$	G1 $\frac{1}{2}$
40	40 - G2	–
50	50 - G1 $\frac{3}{4}$	G1 $\frac{3}{4}$
63	63 - G2 $\frac{3}{8}$	G2 $\frac{3}{8}$

Tab. 6-5 Allocation of adapter with RAUTITAN union nut to fittings with male threads

6.6 Installation notes for connection components

- Avoid overtightening threaded joints.
- Use open-end wrenches in the right size. Do not clamp fitting too tightly into the vice.
- Using pipe wrenches can cause damage to the fittings and compression sleeves.
- Do not apply excessive hemp to threaded joints. The thread tips must be visible.
- Do not subject fittings and compression sleeves to plastic deformation, e.g. by hammer blows.
- Only use threads according to ISO 7-1, DIN EN 10226-1 and ISO 228 standards.
Other thread types are not permitted.
- Make sure that the connection components are free of inadmissible stress during assembly and when in operation. Make sure that the piping has sufficient scope of movement (e.g. from deflection legs).
- Do not use dirty or damaged system components, pipes, fittings, compression sleeves or seals.
- When flat-sealed joints (or similar) are opened, check that the sealing surface is undamaged before reconnecting and insert a new seal if necessary.

Observe the following instructions when installing threaded fittings:

- Only use sealants approved for gas and water installation (e.g. DVGW-certified sealants).
- Do not extend the leverage of installation tools, e.g. with pipes.
- Screw the threaded joints together so that the thread end remains visible.
- Check if thread types ISO 7-1 and DIN EN 10226-1 are capable of being combined with the thread typ ISO 228 before screwing them together, e.g. tolerances, free movement.
Other thread types are not permitted.
- If using long threads, ensure the maximum possible screwing depth and sufficient thread depth in opposing parts with inside threads.
- Only use an appropriate G male connector with flat sealing thread fittings with G female thread.

The threads of fittings with thread adapters are executed as follows:

- Thread according to ISO 7-1 and DIN EN 10226-1:
 - Rp = cylindrical female thread
 - R = conical male thread
- Thread according to ISO 228:
 - G = cylindrical thread, non-sealing in the thread



Laying temperature

- Do not go below the minimum laying temperature of $-10\text{ }^{\circ}\text{C}$.
- Do not exceed the maximum laying temperature of $+50\text{ }^{\circ}\text{C}$.

Aligning the fittings

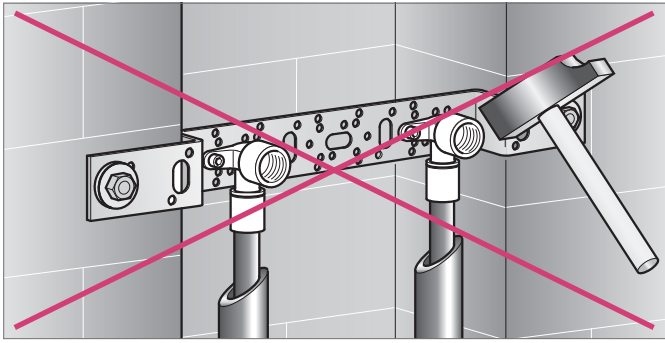


Fig. 6-24 Do not align using a hammer

Only align fittings with suitable tools, e.g. pipe nipples or open-end wrenches.

Protection against corrosion and damage

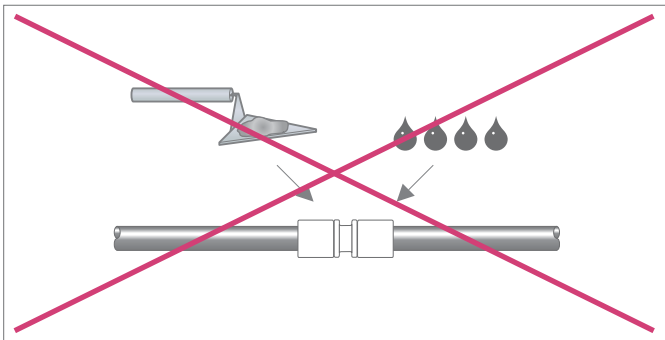


Fig. 6-25 Avoid the risk of corrosion

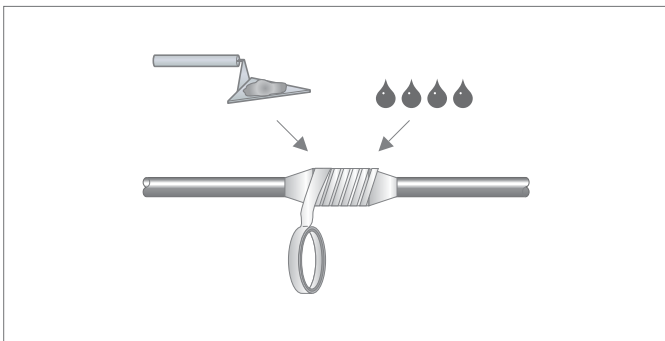


Fig. 6-26 Protect connection components against corrosion



- Use suitable sheathing to protect fittings and compression sleeves against contact with brickwork or with screed, cement, plaster, bonding agents, aggressive media and other materials and substances which can cause corrosion.
- Protect fittings, pipes and compression sleeves against humidity.
- Ensure that the employed sealants, cleaning agents, building foams, insulation, protective tape, adhesive tape or thread sealant etc. do not contain any components which cause stress cracking or corrosion, e.g. ammonia, ammonia-bearing, aromatic and oxygenated solvents (e.g. ketone and ether), chlorinated hydrocarbons or chloride ions which can leach.
- Protect fittings, pipes and compression sleeves against dirt, drilling dust, mortar, grease, oil, paint, lacquers, adhesive/protective primers, solvents, etc.
- In aggressive environments (e.g. farming, encased in concrete, sea water atmosphere, cleaning agents), protect piping and fittings against corrosion adequately and in such a way that they are sealed against diffusion (e.g. to aggressive gases, fermentation gases, chloride mediums).
- Protect fittings, pipes and compression sleeves against humidity.
- Protect systems against damage (e.g. during the construction phase, when in the area of vehicles, machines or farming, and from damage caused by game animals).

RAUTITAN PX

- Only use leak detection agents (e.g. foaming agents) with current DVGW certification, which were also approved by the respective manufacturer for the PPSU and PVDF materials
- Only use sealants, thread sealants, cleaning agents, building foams, insulation, protective tape, adhesive tape and flux, which were approved by the respective manufacturer for the materials PPSU and PVDF.
- When using the connection components, check the compatibility of materials for the corresponding area of application.
- Contact with aromatic and oxygenated solvents (e.g. ketone and ether) as well as halogenated hydrocarbons (e.g. chlorinated hydrocarbons) is not permitted.
- Contact with water-based acrylic paints and adhesive/protective primers is not permitted.

RAUTITAN SX

- Do not use sealing tape or sealants (e.g. Teflon) which release chloride ions soluble in water.
- Use sealants which do not release chloride ions soluble in water (e.g. hemp).
- To avoid a crevice corrosion of the fittings RAUTITAN SX we recommend the use of hemp as thread sealant.

Water additives

The piping can be damaged when using inhibitors, antifreeze agents or other heater water additives.

Approval must be obtained from the respective manufacturers and from our Applications Department.

In this case, please consult your REHAU sales office.

7 INSTALLATION TOOLS RAUTOOL



-
- Before using tools, fully read and observe the information in the operating instructions.
 - If these operating instructions are no longer present with the tool or are no longer available, order a copy or download them in internet.
 - Do not use damaged tools or tools limited in their function; send these for repair to your REHAU sales office.
-



Operating instructions can be downloaded online from www.rehau.no or www.rehau.dk













The scope of delivery of the RAUTOOL installation tools can be seen from the Building Technology price list.



-
- RAUTOOL installation tools are specially coordinated for functioning with REHAU programs.
 - Development and supervision directly from REHAU.
 - RAUTOOL installation tools are subject to constant improvements and further development.
 - Different drive methods of the RAUTOOL installation tools can be selected.
 - For joint sizes 16/20, 25/32 and 40:
 - Hydraulic or manual expansion possible.
 - For joint sizes 16–32:
 - Double compression jaws, 2 pipe sizes can be worked on without refitting the tool.
 - Flexible and good tool handling
 - Compact design.
 - Simple fitting, even in confined spaces (unfavourable fitting situations).
 - Separation of drive unit and clamping tools for hydraulic tools, RAUTOOL H1/H2, E2, E3 and G1/G2.
 - No calibration of the pipes necessary with the compression sleeve jointing technique from REHAU.
 - Cutting of the pipes is conducted for all sizes and requires little space and time with the REHAU pipe shears. The use of roller pipe cutters is unnecessary.
-

Notes on the compression jaws in size 40

Compression jaws for RAUTITAN PX compression sleeves, size 40				
Compression jaws, new Ø 40	Compression sleeves Ø 40	Compression jaws, old Ø 40	Compression sleeve RAUTITAN PX Ø 40	
Compression jaws set 40 (Black) 201801-001 201803-001 		 Compression jaws set 40 (Gold-yellow) 137805-001 138223-001  	  	
Compression jaws set M1 40 (Black) 201798-001 201804-001 	+ 	 Compression jaws set M1 40 (Gold-yellow) 137374-001 138333-001  	+ 	
Compression jaws set G1/G2 40 (Black) 201802-001 		 Compression jaws set G1/G2 40 (Gold-yellow) 137964-001  		

Tab. 7-1 Compression jaws for RAUTITAN PX compression sleeves, size 40

RAUTITAN PX compression sleeves in size 40 need to be compressed with the new black compression jaws of size 40.



Previous compression jaws (gold-yellow) of other sizes

- 16 x 2,2/20 x 2,8
 - 25/32
 - 50
 - 63
- can still be used.



- Only compress RAUTITAN PX compression sleeves, size 40, with the new RAUTOOL compression jaws (black) size 40.
 - You can find more information on exchanging your old compression jaws 40 (gold-yellow) for the new ones at your REHAU sales office.
 - Only make compression sleeve joints with RAUTOOL tools.
- If foreign tools are to be used when making the joint, these must be approved by the corresponding manufacturer for use with the RAUTITAN system and especially for use with the new RAUTITAN PX fittings and compression sleeves.

Compression sleeve tools: RAUTOOL

- For the RAUTITAN system
- For the REHAU systems for underfloor heating/cooling
- For special ranges, e.g. industrial piping systems from REHAU, RAUTHER-MEX range for local and remote heating supplies
- Various attachment sets and accessories (see price list for installation tools RAUTOOL)

7.1 RAUTOOL M1



Fig. 7-1 RAUTOOL M1

- Manual tool
- Area of application: Sizes 16–40



Only use the compression jaws M1 with the RAUTOOL M1.

7.2 RAUTOOL H2



Fig. 7-2 RAUTOOL H2

- Mechanical-hydraulic tool
- Area of application: Sizes 16–40
- Drive with foot/hand pump
- Ergonomic swivel joints on pressing cylinder

7.3 RAUTOOL A3



Fig. 7-3 RAUTOOL A3

- Battery hydraulic tool
- Area of application: Sizes 16–40
- Drive with a battery-operated hydraulic unit located directly at the tool cylinder
- The tool cylinder can be used optionally for hydraulic expansion.

7.4 RAUTOOL A-light2



Fig. 7-4 RAUTOOL A-light2

- Battery hydraulic tool
- Area of application: Sizes 16–40
- Drive with a battery-operated hydraulic unit located directly at the tool cylinder
- The tool cylinder can be used optionally for hydraulic expansion.



The hydraulic tools RAUTOOL H2, RAUTOOL E2/E3 and RAUTOOL A2/A3/A-light/A-light2 are compatible with each other and can be equipped with the same supplementary sets. Expanders and expander heads of the expanding system RO are compatible with each other for all tools up to size 32.

7.5 RAUTOOL E3



Fig. 7-5 RAUTOOL E3

- Electro-hydraulic tool
- Area of application: Sizes 16–40
- Drive with electro-hydraulic power unit connected by an electro-hydraulic hose to the tool cylinder
- The tool cylinder can be used optionally for hydraulic expansion.

7.6 RAUTOOL G2



Fig. 7-6 RAUTOOL G2

- Tool for the pipe sizes 50–63 (optionally available for size 40 x 5.5)
- Drive with an electro-hydraulic power unit (optionally with a foot pump)
- The tool cylinder can be used optionally for expansion and clamping.

7.7 RAUTOOL M-light



Fig. 7-7 RAUTOOL M-light

- Manual clamping tool for compression sleeves RAUTITAN PX - Sizes 16 and 20
- Not suitable for the connection of compression sleeves made of brass

7.8 RAUTOOL K10 x 1.1



Fig. 7-8 RAUTOOL K10 x 1.1

- Manual combination tool for expanding and clamping the heating pipe RAUTHERM S 10.1 x 1.1 mm
- Area of application: Size 10.1 x 1.1

7.9 RAUTOOL K12 x 2.0



Fig. 7-9 RAUTOOL K12 x 2.0

- Manual combination tool for expanding and clamping the heating pipe RAUTHERM S 12 x 2.0 mm
- Area of application: Size 12 x 2.0

7.10 RAUTOOL K14 x 1.5



Fig. 7-10 RAUTOOL K14 x 1.5

- Manual combination tool for expanding and clamping the heating pipe RAUTHERM S 14 x 1.5 mm
- Area of application: Size 14 x 1.5

8 PIPE CUTTERS












- Check the blade of the pipe cutters regularly for damage and replace the blade or the cutters as necessary. Damaged or blunt blades can cause burrs or notches on the pipe, which can tear when the pipe is expanded.
- Cut off improperly cut pipe ends.
- If cracks occur at the expanded zone, cut off the damaged pipe end and repeat the expanding procedure.

When cutting the pipes, observe the following:

- Use the correct pipe cutters for the corresponding pipe type only.
- Cut the pipe square and without burrs.
- Pipe cutters must be in perfect condition.

Spare blades for the pipe cutters can be re-ordered (except the pipe cutters 25).

Pipe size	16/20	25 to 40			
Universal pipe RAUTITAN stabil					
	Pipe cutters 16/20 RAUTITAN	Pipe cutters 40 stabil			
Pipe size	to 20	to 25	to 40	40 to 63	
Universal pipe RAUTITAN flex					
Heating pipe RAUTHERM S		Pipe cutters 16/20 RAUTITAN	Pipe cutters 25	Pipe cutters 40 stabil	Pipe cutters 63

Tab. 8-1 Selection of pipe cutters

8.1 Pipe cutters 16/20 RAUTITAN



Fig. 8-1 Cutting a universal pipe RAUTITAN stabil with the pipe cutters 16/20 RAUTITAN

For right-angled cutting of the universal pipe RAUTITAN stabil without burrs in sizes 16 and 20.



Only use pipe cutters 16/20 RAUTITAN when cutting universal pipe RAUTITAN stabil in sizes 16 and 20.



PE-X pipes can also be cut with the pipe cutters 16/20 RAUTITAN.



Fig. 8-2 Calibrating mandrel



When using the compression nut set, calibrate the universal pipe RAUTITAN stabil (pipe sizes 16 and 20) with the calibrating mandrel moulded onto the side of the pipe cutters 16/20 RAUTITAN.

8.2 Pipe cutters 25

To be used exclusively for burr-free cutting of PE-X pipes up to size 25 (see Tab. 8-1 Selection of pipe cutters).

8.3 Pipe cutters 40 stabil

To be used exclusively for burr-free cutting of PE-X-pipes up to size 40 and for RAUTITAN stabil in size 25 to size 40 (see Tab. 8-1 Selection of pipe cutters).

8.4 Pipe cutters 63

To be used exclusively for burr-free cutting of RAUTITAN pipes or PE-X-pipes in sizes 40–63 (see Tab. 8-1 Selection of pipe cutters).

9 EXPANDING TOOLS

9.1 Expander heads and expander bits for pipes

	Expander heads	Expander bits	Expander head for RAUTOOL G2
Pipe sizes 16/20/25/32 Universal pipe RAUTITAN stabil 		40 	
Pipe sizes 16/20/25/32 Universal pipe RAUTITAN flex 		40 	40/50/63 
Pipe sizes 17/20/25/32 Heating pipe RAUTHERM S 		 <p>The RAUTHERM S pipe 16 x 2.0 is expanded with the expander head 16 x 2.0 (blue colour code).</p>	

Tab. 9-1 Selection of expanding tools

Expander head for radiator connection sets RAUTITAN



Fig. 9-1 Expander head 15 x 1.0 RO

Stainless steel or copper pipes 15 x 1.0 of the radiator connection sets RAUTITAN.
 Using the expander head 15 x 1.0 RO is described in the Technical Information "RAUTITAN – THE NEW GENERATION" in the chapter on installation directions for radiator sets.

Expander set 16/20



Fig. 9-2 Expander set 16/20

The expander set 16/20 can be used in combination with the tools RAUTOOL H2/A2/A3/A-light/A-light2 and RAUTOOL E2/E3 to expand the pipes RAUTITAN flex and RAUTHERM S 16 x 2.0.

Difference between expander heads

- Expander head for universal pipe RAUTITAN stabil
 - Green colour code
 - Black retaining nuts in sizes 16–32
 - Expansion segments bevelled
- Expander head for universal pipe RAUTITAN flex
 - Blue colour code
 - Silver retaining nut in sizes 16–32
 - Expansion segments without bevelling
- Expander head for heating pipe RAUTHERM S
 - Red colour code
 - Silver retaining nut in sizes 17–32
 - Expansion segments without bevelling
- Expander head 15 x 1.0 RO for radiator connection sets RAUTITAN
 - No colour code
 - For expanding connection sets made from stainless steel or copper

9.2 Expander bits

When combined with the RAUTOOL tools H2, E2/E3, A2, A3, A-light and A-light2, the following expander bits can be used:

- Universal expander bit 25/32 system RO
- Expander bit 40 x 6.0 stabil
- Expander bit 40 x 5.5

Only expand universal pipe RAUTITAN stabil in size 40 with the expander bit 40 x 6.0.

- Expansion only possible with RAUTOOL H2, E2, A2, A3, A-light and A-light2.
- Expansion not possible with RAUTOOL G1/G2 and M1.

9.3 Safety advice on the expander heads



- Do not use any defective segments or expander heads (e.g. bent, broken off, fractured).
- Ensure that expansion is even over the entire circumference of the pipe.
- Discard unevenly expanded pipe ends.
- Check the expander head for damage, if necessary carry out test expansion to test even expansion (e.g. no grooves, no local overstretching of the pipe material).
- Replace defective expander head.
- Do not apply grease or similar materials to the expansion segments.
- Apply grease to the cone of the expander.
- Do not use dirty or damaged expander heads, pipes or connection components.
- If cracks occur at the expanded zone or if the pipe ends were not expanded properly, cut off the damaged pipe end and repeat the expanding procedure.
- Observe the allocation of the expander heads to the respective pipe types and sizes.

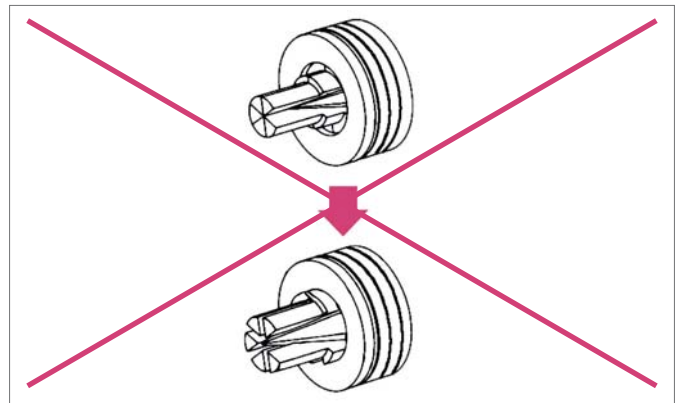


Fig. 9-3 Damage to the piping material by defective expander head



- Accessories (brush, lubricating grease, etc.) are included in the tool case.
- The universal pipe RAUTITAN flex and the heating pipe RAUTHERM S are equipped with an oxygen diffusion barrier. The oxygen diffusion barrier is not always as flexible as the crosslinked polyethylene base pipe. It could thus happen that the diffusion barrier tears slightly when the pipe is expanded at low temperatures. These tears do not have an effect on the pipe's performance and have no effect on the reliability of the compression sleeve joint. As the tears are located at the compression sleeve joint and are enclosed at both sides with the fitting or compression sleeve and they have no notable effect on the oxygen-tightness as specified in DIN 4726.

10 MAKING THE COMPRESSION SLEEVE JOINT



The REHAU compression sleeve jointing technique is described in the pages below by an example for sizes 16 – 32. Directions for tool handling and making the joint in other pipe sizes are described in the respective operating instructions.



- Only make compression sleeve joints with RAUTOOL tools. If foreign tools are to be used when making the joint, these must be approved by the corresponding manufacturer for use with the RAUTITAN system and especially for use with the new RAUTITAN PX fittings and compression sleeves.
- Only make the joint with the appropriate installation tools.
- Please consult the Technical Information and corresponding operating instructions and instruction leaflets for information on handling the tools and making joints.
- Do not use dirty or damaged connection components or tools.
- The battery and mains operated tools like A-light 2, A3, E3, G2 are not suitable for permanent operation. After approx. 50 consecutive clamping operations, a break of at least 15 min. is required to allow the tool to cool down.
- The exact allocation of the connection components can be found in the current price list.

Laying temperature

- Do not go below the minimum laying temperature of $-10\text{ }^{\circ}\text{C}$.
- Do not exceed the maximum laying temperature of $+50\text{ }^{\circ}\text{C}$.



Close to the minimum laying temperature ($-10\text{ }^{\circ}\text{C}$) we recommend using the installation tools RAUTOOL with hydraulic force transmission to simplify installation.



Operating instructions can be downloaded online from www.rehau.no or www.rehau.dk



- Uniform REHAU compression sleeve jointing technique
- Permanently sealed joint
- Without o-ring (piping material seals itself)
- Simple optical monitoring
- Can be immediately pressurised
- Pipe need not be calibrated or deburred
- Robust jointing technique, highly suitable for the building site

10.1 Cutting the pipe



The universal pipe RAUTITAN stabil 40 x 6.0 has shorter expansion lengths than the other RAUTITAN pipes in size 40.

When correctly expanded and pushed fully on, the expanded pipe section ends approx. 6 mm before the collar of the fitting.

Here, each Z-measurement extends by 4 mm. The entire pipe length, which is to be cut off, thus reduces by approx. 8 mm.

1. Before beginning work, ensure that the pipe cutters are in good condition.
2. Take note of the pipe type and use the appropriate pipe cutters.
3. Cut the pipe square and without burrs.

Maintain a safe distance between the holding hand and the pipe cutters.

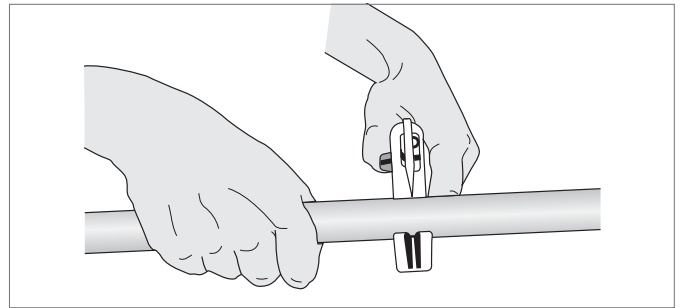


Fig. 10-1 Cut pipe at right angles

4. Make sure that jointing and additional processing are only carried out on straight pipe sections (without pipe elbows).

The straight pipe section must be at least three times the compression sleeve length and it shall be free from any pollution (e.g. lubricant, adhesive or adhesive tape).

10.2 Pushing the compression sleeve over the pipe

Push the compression sleeve onto the pipe:

- The **RAUTITAN PX compression sleeve** can be pushed onto the fitting from both ends, the push-on direction does not matter.
- **Brass compression sleeves** should be pushed onto the pipe in such a way that the inner bevel faces the joint.

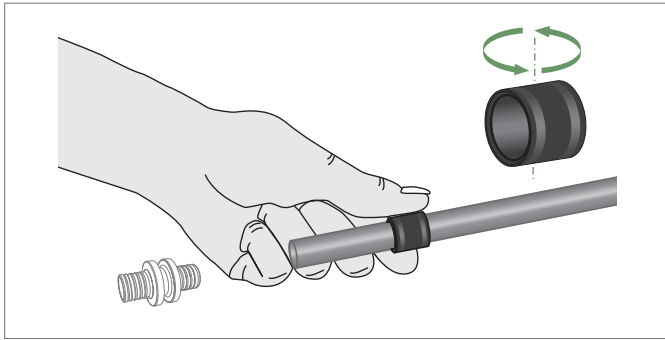


Fig. 10-2 Push the **RAUTITAN PX compression sleeve** over the pipe,

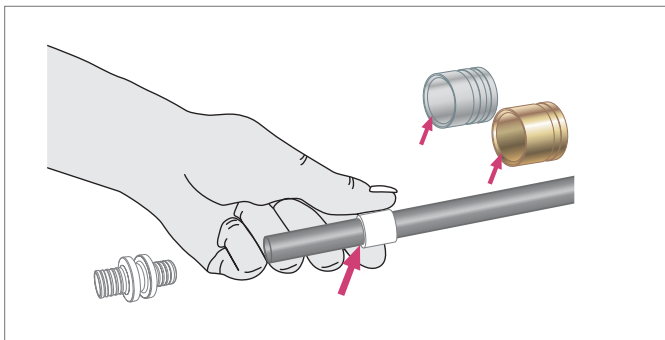


Fig. 10-3 Push the **brass compression sleeve** over the pipe, inner bevel (arrow) facing the joint

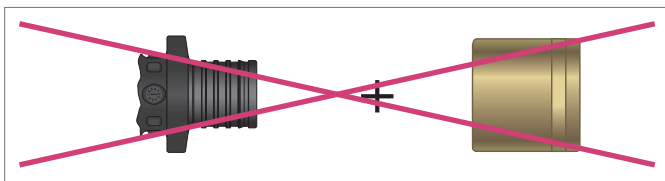


Fig. 10-4 Unapproved combination: **RAUTITAN PX** with **RAUTITAN MX** compression sleeves



Always push brass compression sleeves onto the pipe in such a way that the inner bevel faces the joint.

Here, the groove is to face away from the joint.

10.3 Expanding the pipe with the expander



- Follow the safety advice for the expander heads (see page 57).
- Check the expander heads for freedom of movement and dirt and clean, if necessary.
- Screw the expander heads fully onto the expansion tool (must not become detached when twisted in pipe).
- Maintain a minimum distance between the end of the pipe and the compression sleeve (at least twice the length of the compression sleeve).
- Expand the pipe when cold.

- Only push compression sleeve fittings from REHAU (not other objects) into the expanded end of the pipe.
- Expand pipes only with a complete and intact expander head.
- If cracks occur at the expanded zone or if the pipe ends were not expanded properly, cut off the damaged pipe end and repeat the expanding procedure. Check the blade of the pipe shears for damage and replace the blade or the shears as necessary.

The pipe to be expanded must have an even temperature. Avoid local heating (e.g. by inspection lamps, etc.).

Expand the pipe when cold and stress-free and push it onto the fitting.

1. Push the compression sleeve onto the pipe so that a distance of twice the length of the compression sleeve is free between the pipe end and the compression sleeve.

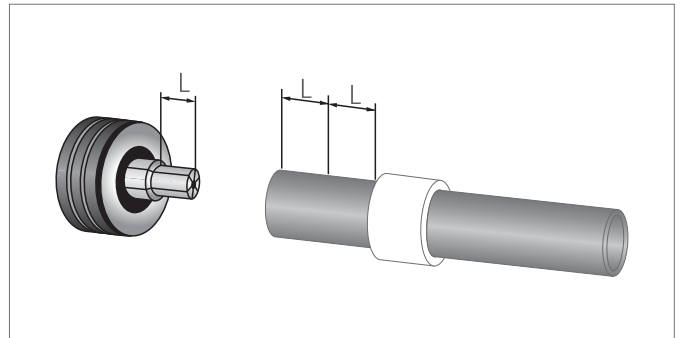


Fig. 10-5 Minimum distance: Pipe end – compression sleeve

2. Always push the segments of the expander head fully into the pipe. Avoid skewing the expander head.
3. Expand the pipe once.

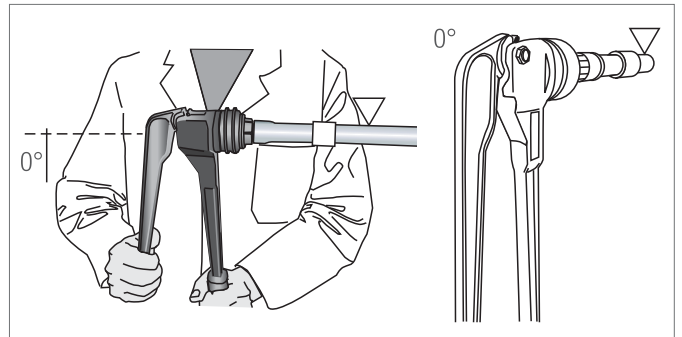


Fig. 10-6 Expand the pipe once

4. Turn the expanding tool approx. 30°. The pipe remains in position.
5. Expand the pipe end once again.

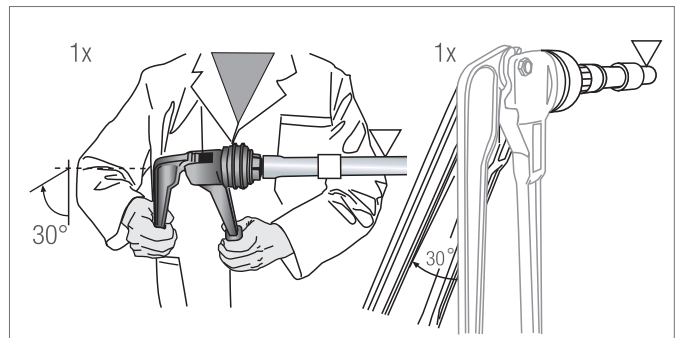


Fig. 10-7 Turn the expanding tool 30° at the same pipe position and expand the pipe once again.

10.4 Inserting the fitting into the expanded pipe

When the pipe has been correctly expanded, the fitting can be pushed into the expanded pipe without difficulty.

After a short time, the fitting is held firmly in the pipe, as the pipe contracts (memory effect).

Handle joints which are not clamped when inserting them into the tool and during clamping so that they cannot fall apart.

Push the fitting completely (as far as the end collar) into the expanded pipe after expanding.

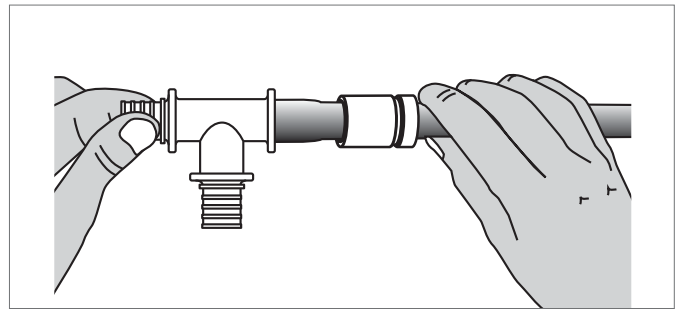


Fig. 10-8 Push the fitting into the expanded pipe

All sealing ribs must be covered by the pipe, as shown in table 10-1

An exception is when pushing the universal pipe RAUTITAN stabil onto the RAUTITAN PX fittings, size 40. Here, the last sealing rib may not be fully covered.

Correct position of the pipe on the RAUTITAN PX fitting				
Size		16–32	40	50–63
Universal pipe RAUTITAN stabil	stabil			—
Universal pipe RAUTITAN flex	flex			—
Correct position of the pipe on metal fittings				
Universal pipe RAUTITAN stabil	stabil			—
Universal pipe RAUTITAN flex	flex			—
Heating pipe RAUTHERM S				—

Tab. 10-1 Correct position of the pipe on the fitting

- A Fitting body
- B Fitting collar
- C End collar
- D Sealing rib

10.5 Inserting the joint into the clamping tool

Insert compression sleeve joint into the clamping tool.

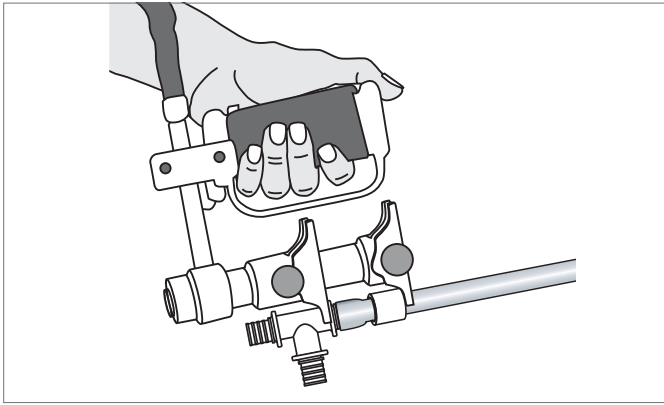


Fig. 10-9 Insert compression sleeve joint into the compression tool.



Avoid jamming. Place the tool over the entire surface and at a right angle.



Bulging of the metal compression sleeve does not impair the quality of the joint and usually occurs when older expander heads are used. When older expander heads are used with pipes made of RAU-PE-Xa (not for universal pipes RAUTITAN stabil, the pipe material may pull together during clamping. In this case, stop pushing on the brass compression sleeve shortly before the bulge (approx. 2 mm distance to the fitting collar).

10.6 Pushing the compression sleeve up to the fitting collar



- Only perform jointing on straight pipe sections (not on pipe elbows). The straight pipe section must be at least three-times the compression sleeve length.
- Do not jam joints which are not clamped when inserting them into the tool and always maintain full contact of the tool.
- Push the compression sleeve fully to the fitting collar.
- Do not use lubricants, water, etc. when making the compression sleeve joint.

1. Operate the pressure switch or pedal of the tool.
2. Push the compression sleeve fully to the fitting collar.
3. Carry out an optical check of the joint for damages and incomplete insertion of the compression sleeve.

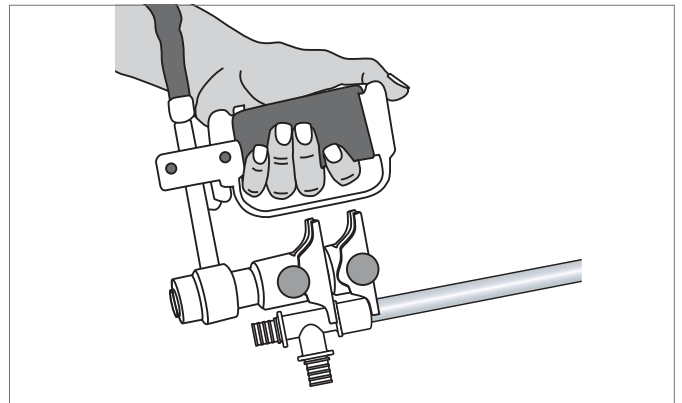


Fig. 10-10 Push on the compression sleeve

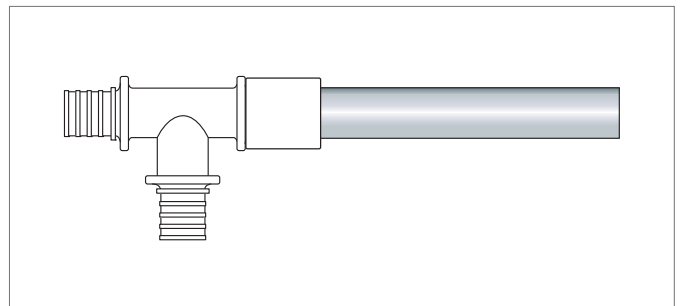


Fig. 10-11 Fully clamped compression sleeve joint

- Clean and oil the tool after use.
- Store the tool in a dry place.

11 DETACHING THE COMPRESSION SLEEVE JOINT



REHAU will not accept liability if these instructions are not followed (e.g. when heating up the compression sleeve joint when attached).

11.1 Cutting out the joint

Cut the joint to be detached completely out of the existing piping using the pipe shears. Maintain a safe distance between the holding hand and the pipe shears.

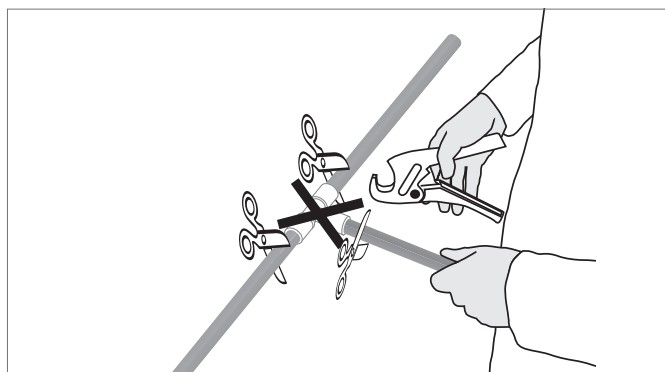


Fig. 11-1 Cutting out the joint

11.2 Usability of cut-out joints

Usability of the parts of a detached compression sleeve joint			
Reusable		Not reusable Dispose of together with all cut-out pipe parts	
RAUTITAN system	Fittings underfloor heating/cooling	Compression sleeves	Fittings RAUTITAN PX

Tab. 11-1 Usability of detached compression sleeve joints



Removed metal fittings from water installations

- Dispose of used RAUTITAN PX fittings and RAUTITAN PX compression sleeves.
- Only reuse removed metal fittings in perfect condition within the same installation type from which they were removed.
- Dispose of the detached compression sleeves with the detached pipe sections.

11.3 Detaching the cut-out joint from drinking water and heating installations

11.3.1 Heating the joint to be detached



Heating up the RAUTITAN PX compression sleeves to over 200 °C or direct flame exposure can lead to a build-up of toxic gases.

- Do not heat RAUTITAN PX compression sleeves to over 200 °C.
- It is not permitted to burn or apply a flame to the RAUTITAN PX compression sleeves.

1. Heat up the cut-out metal fitting with a hot air blower. Observe the safety advice in the operating instructions of the hot air blower.
2. On reaching a temperature of approx. 135 °C remove the compression sleeve from the fitting body (e.g. with pliers).

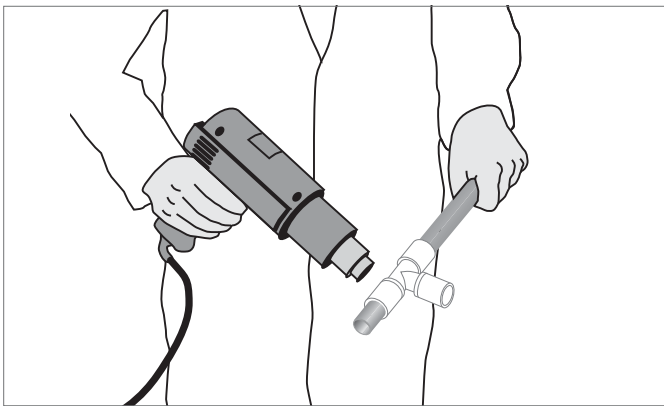


Fig. 11-2 Heating up the joint which is to be detached.

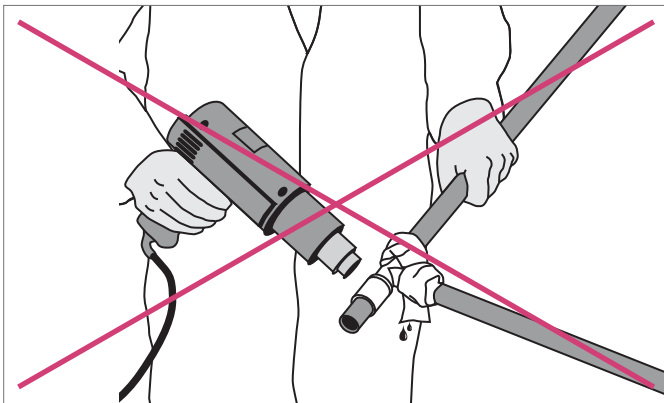


Fig. 11-3 Inadmissible actions



When the joint to be detached is heated, all joints of the heated fitting are no longer sealed.

Always separate the fitting to be heated completely from the piping!

11.3.2 Pulling off the compression sleeves

1. Remove pipe from fitting body.
2. Clean dirt from fitting.
 - When in perfect condition and cooled, the fitting can be reused.
 - Do not reuse detached compression sleeves and pipe sections.
3. Dispose of the compression sleeves with the detached pipe sections.

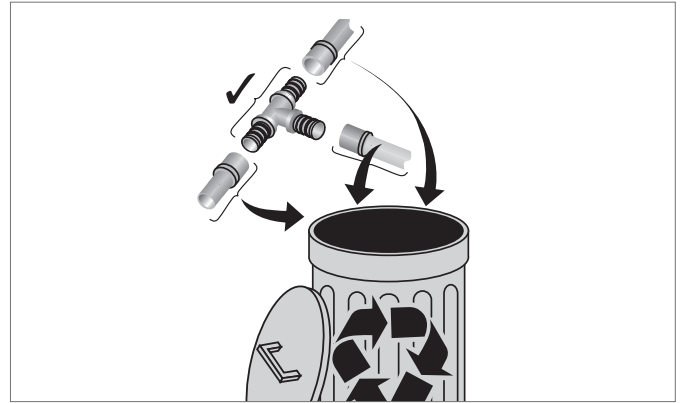


Fig. 11-4 Dispose of the compression sleeves with the detached pipe sections

12 BENDING THE PIPES

12.1 Bending the universal pipe RAUTITAN stabil

stabil



Fig. 12-1 Bent universal pipes RAUTITAN stabil

The universal pipe RAUTITAN stabil can be bent either by hand or by using a bending tool.

Minimum bending radius

- When bending without tools, the minimum bending radius is five times the outside pipe diameter.
- When bending with a spiral spring, the minimum bending radius is three times the outside pipe diameter.
- The minimum bending radius is in relation to the centre of the pipe.
- Make sure to comply with the specified minimum bending radii.
- After bending, ensure that there are no impressions, wrinkles or bulges and that the outer PE sheath and aluminium layer are undamaged.



At laying temperatures under 0 °C, pipe elbows must be over-bent more strongly.

Only cold bending of pipes RAUTITAN stabil is allowed.

Pipe	stabil		stabil	
	with bending tool (90°) 3 x d		bent by hand (90°) 5 x d	
Pipe sizes	Bending radius R [mm]	Arc B [mm]	Bending radius R [mm]	Arc B [mm]
16	48.6	76	81	127
20	60	94	100	157
25	75	118	125	196
32	96	151	160	251
40	120	188	200	314

Tab. 12-1 Minimum bending radii of universal pipe RAUTITAN stabil

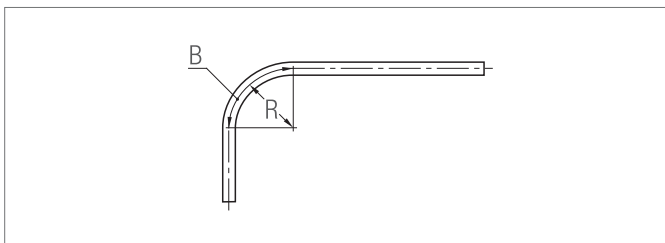


Fig. 12-2

R Bending radius

B Arc

Approved bending tools for universal pipe RAUTITAN stabil

Pipe size [mm]	Source Manufacturer	Model description	Material number	Article number
16/20	See price list REHAU sales office	Internal spiral spring 16 stabil		247484-001
		Internal spiral spring 20 stabil		247494-001
16/20	Hummel, D-79178 Waldkirch	External spiral spring 17	2901170203	
		External spiral spring 20	2901202503	
16/20/25	H. Wegerhoff /ALARM, D-42810 Remscheid	One-hand pipe bending tool	2501 00	
16/20/25	Roller, D-71332 Waiblingen	Roller Polo	153022	
16/20/25	CML Germany, D-73655 Plüderhausen	Ercolina Junior	0130G	
16/20/25	REMS, D-71332 Waiblingen	REMS Swing	153022	
16/20/25/32/40	CML Germany, D-73655 Plüderhausen	Ercolina Jolly	0101	
40	REMS, D-71332 Waiblingen	Curvo	580025	
40	Rothenberger, D-69779 Kelkheim	Robull MSR	5.7900	
40	Tinsel, D-73614 Schorndorf	UNI 42	–	
16/20/25/32	Tinsel, D-73614 Schorndorf	OB 85	–	

Tab. 12-2 Approved bending tools for the universal pipe RAUTITAN stabil (as of: 2008)

12.2 Bending the universal pipe RAUTITAN flex

flex



Fig. 12-3 Pipe bend bracket, plumbing (3–4 x d) - 90° or 45° for size 16–32



Fig. 12-5 Pipe bend bracket, plumbing (4 x d) - 90° and pipe bend bracket, plumbing/heating (5 x d) - 90° each in size 32



Fig. 12-4 Pipe bend bracket, plumbing/heating (5 x d) - 90° or 45° for size 16–25



Hot bending of universal pipes RAUTITAN flex can damage the oxygen diffusion barrier.

Only bend universal pipes RAUTITAN flex when cold.



Using elbows is not always required for sizes between 16 and 32. With pipe bend brackets, 90° and 45° elbows can be cold-bent quickly and easily.

For pipe sizes 40 to 63, we recommend using fittings.

Minimum bending radius

When bending by hand, the minimum bending radius is eight times the outside pipe diameter.

When laying with pipe bend brackets, the minimum bending radius in plumbing installations is three times and for heating installations five times the outside pipe diameter.

The minimum bending radius is in relation to the centre of the pipe.

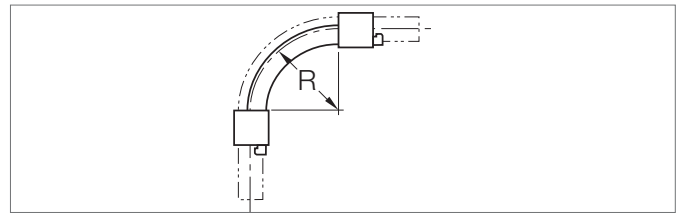


Fig. 12-6 Pipe bend bracket, plumbing 90 degrees, for size 16– 32 and pipe bend bracket plumbing/heating 5 x d 90 degree for size 32
R Bending radius

Pipe	Drinking water installation with pipe bend bracket plumbing 90°, approx. 3–4 x d		Drinking water with pipe bend bracket plumbing/heating 90°, 5 x d		Bend by hand (90°) 8 x d	
	flex		flex		flex	
Pipe sizes	Bending radius R	Arc B	Bending radius R	Arc B	Bending radius R	Arc B
16	48	75	80	126	128	201
20	60	94	100	157	160	251
25	75	118	125	196	200	314
32	112	176	160	251	256	402

Tab. 12-3 Minimum bending radii for RAU-PE-Xa pipes

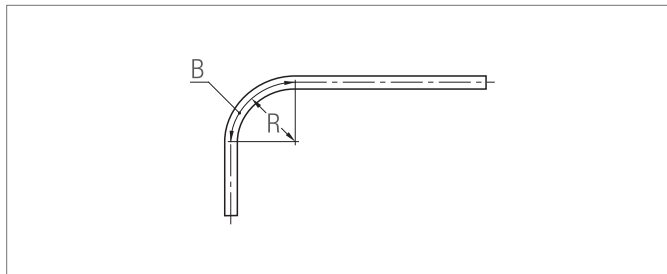


Fig. 12-7

R Bending radius
B Arc

12.3 Bending the heating pipe RAUTHERM S



More information about bending heating pipes RAUTHERM S and using the pipe bend brackets in conjunction with the underfloor heating/cooling systems can be found in the current calculation price list as well as in the Technical Information "Underfloor heating/cooling".



Hot bending heating pipes RAUTHERM S can damage the oxygen diffusion barrier.

- Only bend heating pipe RAUTHERM S when cold.
- Use the unwinding unit for cold and hot laying.

Bending by hand (90°)	5 x d (at > 0° C laying temperature)
Pipe bend bracket plumbing/Heating 90°	5 x d

Tab. 12-4 Minimum bending radii RAUTHERM S

13 PIPE SUPPORT CHANNEL

13.1 Benefits of using the pipe support channel



- Reduces thermal changes in length
- Clip effect increases the axial retaining force
- Stabilises pipes against sagging and sideways bending
- Increases rigidity
- Increases the pipe clamp interval to 2 m regardless of the pipe size
- Visually attractive installations in exposed areas with RAU-PE-Xa pipes
- Simple assembly
- Self-supporting
- Is clipped onto the pipe
- No additional fastenings (e.g. cable ties, insulating tape) required
- Offcuts of pipe support channels can be used.

13.2 Functionality

The pipe support channel encloses the pipe by about 60 % and is shaped to closely encase the pipe without additional fastenings. This strong clamping effect prevents the pipe from bending and reduces thermal changes in length.

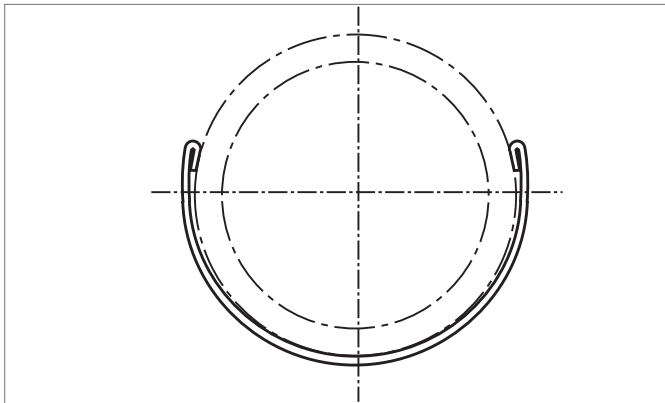


Fig. 13-1 Cross-section of pipe support channel

13.3 Assembly of the pipe support channel

Do not fit pipe support channels or pipe fasteners close to deflection legs to avoid preventing the piping from bending.

Pipe cover

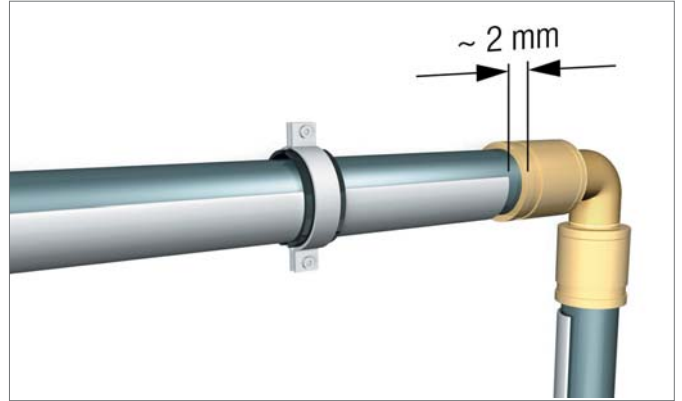


Fig. 13-2 Let the pipe support channel end approx. 2 mm before the compression sleeve

The pipe support channel must be fitted over the entire length of the piping up to 2 mm before the compression sleeve, as only this ensures reduction of the thermal change in length.

Pipe clamp intervals

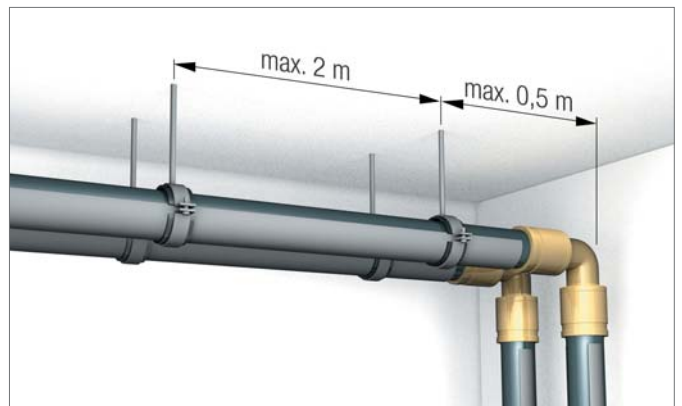


Fig. 13-3 Maximum pipe clamp intervals

The maximum pipe clamp interval when using the pipe support channel is 2 m for all sizes. The distance from the pipe end, or when changing the direction, to the first pipe fastener may not exceed 0.5 m. This way, pipe fastenings for pipe routing or in cellars can be attached in a uniform and rational manner.

Fitting cover

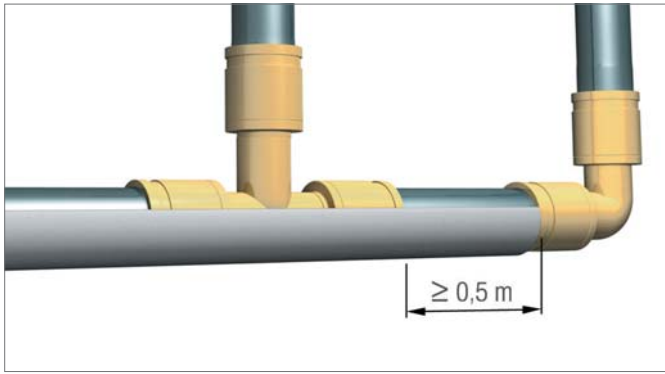


Fig. 13-4 Minimum overlapping of 0.5 m

Fittings with brass compression sleeves in sizes 50 and 63 can be clipped in the pipe support channel if the pipe support channel projects at least 0.5 m beyond the fitting. With this installation variant, cutting of the pipe support channel at the fitting is unnecessary.

When using RAUTITAN PX compression sleeves, clipping over the fittings is not possible.

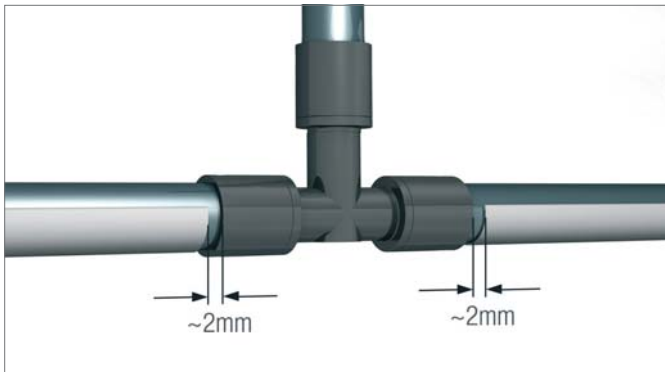


Fig. 13-5 Do not clip over RAUTITAN PX compression sleeves

Assembly of the pipe support channels

Reduced retaining force of the pipe support channel can cause greater thermal linear expansion of the pipe.

Do not lessen the retaining force of the pipe support channels by storing or assembling them improperly.

1. Cut off the pipe support channel with a metal saw (see Fig. 13-6). Maintain a safe distance between the holding hand and the cutting tool. Saw pipe support channels from the rounded rear side so that they are not bent open at their bordered ends.

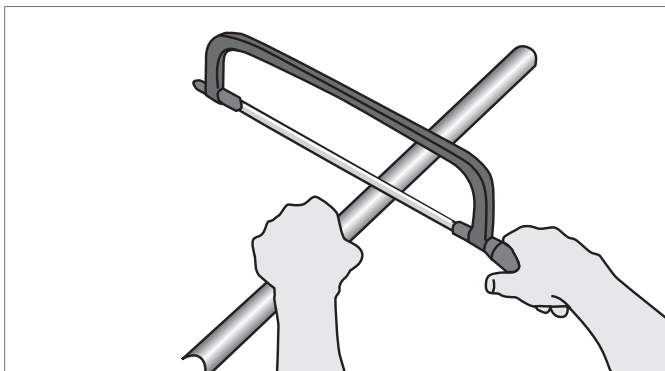


Fig. 13-6 Cutting off

2. If the pipe support channel has been bent inwards or outwards when it was cut to length, bend the pipe support channel back to its original shape.
3. Deburr the ends of the pipe support channel.

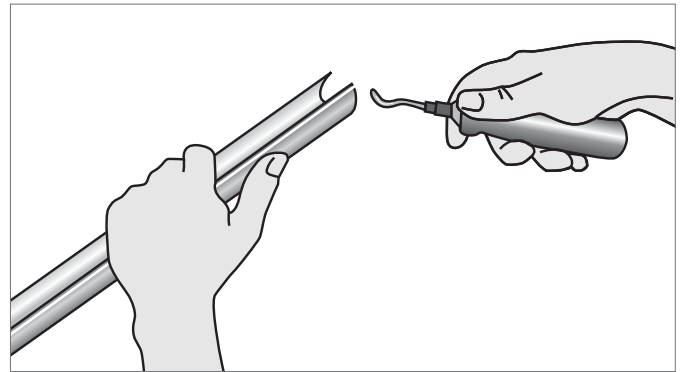


Fig. 13-7 Deburring

4. Clip the pipe support channel onto the pipe (by hand or using a pump or pipe wrench with plastic jaws). Do not overlap the pipe support channels when laying.

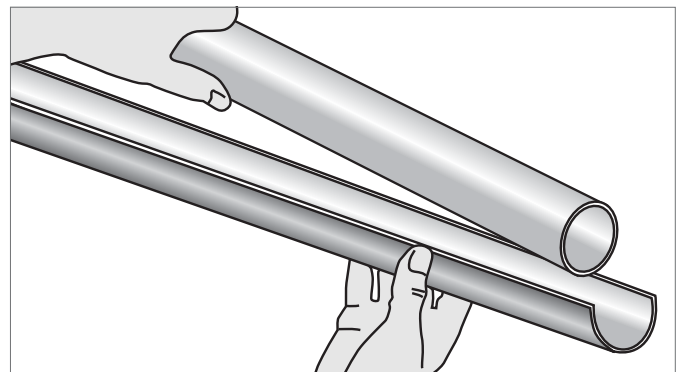


Fig. 13-8 Clipping in

5. Clip offcuts over the joints of the pipe support channels.

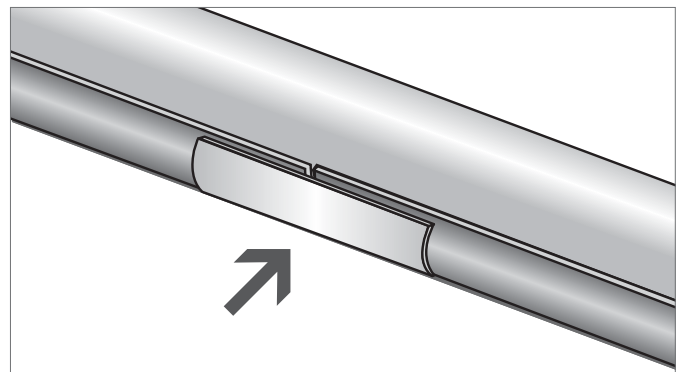


Fig. 13-9 Clipping over

Even short offcuts of the pipe support channel are suitable for clipping over joints and installation almost without cutting losses is possible.

14 PIPE FASTENING

14.1 Pipe clamps

Use only pipe clamps with the following properties:

- Suitable for plastic pipes
- Acoustically insulating pipe clamp inserts
- Matching size (for even sliding when installed and to prevent the pipe clamp inserts from pulling out)
- Free of burrs

14.2 Fixed point installation

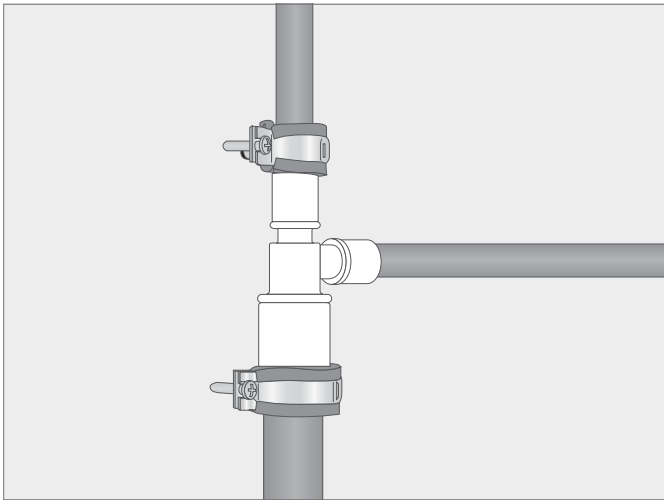


Fig. 14-1 Fixed point made with pipe clamps



- Observe the information from the manufacturer of the fastenings.
- The approximate values for the design and execution of the pipe fastenings (see Tab. 14-1) must be adapted to the circumstances in the building and the specifications of the manufacturers of the fastenings as necessary.
- Fixed points can be used to direct thermal changes in length in a desired direction.
- Longer lengths of piping can be subdivided into individual sections with fixed points.
- Fixed points can be made at tees, elbows or connectors. A pipe clamp is placed directly before each compression sleeve of the fitting for this purpose.



Do not install pipe clamps on the compression sleeves.

14.3 Pipe clamp intervals

Choose pipe clamp intervals according to the approximate values (see Tab. 14-1) for installation with or without pipe support channels.

14.4 Laying in visible areas

When laying piping in visible areas or long piping without changes in direction are laid, the use of the pipe support channel is recommended for the RAU-PE-Xa pipes.

- For installation without the pipe support channel, place the fixed points at intervals of 6 m.
- Ensure sufficient space for the piping to expand.



For installation of pipes made of RAU-PE-Xa without pipe support channel, sagging of the piping must be anticipated.

Pipe type	Pipe size [mm]	l = Maximum pipe clamp distance [m]	
		without pipe support channel	with pipe support channel
Universal pipe RAUTITAN stabil 	16	1	-
	20	1.25	-
	25	1.5	-
	32	1.75	-
	40	2	-
Universal pipe RAUTITAN flex 	16/17	1	2
	20	1	2
Heating pipe RAUTHERM S 	25	1.2	2
	32	1.4	2
	40	1.5	2
	50	1.5	2
	63	1.5	2

Tab. 14-1 Approximate values for pipe clamp intervals

15 THERMAL LENGTH CHANGES

15.1 Guidelines

Due to physical laws, all piping materials expand when heated and contract when cooled. This effect, which occurs regardless of the piping material, must be taken into account in the installation of drinking water, heating and gas pipes. This also applies to the piping of the RAUTITAN system.

The thermal change in length occurs mainly due to the different installation, ambient and operating temperatures. During installation, appropriate pipe routing with provisions for movement (e.g. at changes in direction) and corresponding space for expansion of the piping must always be taken into account. Additional deflection legs, e.g. U expansion bends or lyre loops, are usually only necessary for larger changes in length.

15.2 Benefits



- Low thermal length changes when laying with
 - Universal pipe RAUTITAN stabil
 - Drinking water pipe RAUTITAN his with pipe support channel
- Short deflection legs possible when the flexible RAU-PE-Xa pipes are used
- Simple installation of the pipe support channel

15.3 Calculation of length changes

The thermal change in length is calculated with the following equation:

$$\Delta L = \alpha \cdot L \cdot \Delta T$$

ΔL = Length change in mm

α = Coefficient of linear expansion in $\frac{\text{mm}}{\text{m}\cdot\text{K}}$

L = Length of the piping in m

ΔT = Temperature difference in K


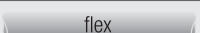

The coefficient of linear expansion must be chosen according to the employed pipe type and any additionally installed pipe support channel.

Determining the pipe length

The pipe length L used in the calculation results from the length of the piping installed by the customers. This can be subdivided by installing fixed points or additional deflection legs.

Determining the temperature difference ΔT

In the determination of the temperature difference ΔT , the laying temperature as well as the minimum and maximum temperatures of the pipe wall during operation (e.g. thermal disinfection) and when the system is out of service must be taken into account in the calculation.

Pipe type		Pipe size	Coefficient of linear expansion α [$\frac{\text{mm}}{\text{m}\cdot\text{K}}$]	Material constant C
Formula			$\Delta L = \alpha \cdot L \cdot \Delta T$	$L_{BS} = C \cdot \sqrt{d_a \cdot \Delta L}$
Universal pipe RAUTITAN stabil		16–40	0.026	33
Universal pipe RAUTITAN flex		16–63 without pipe support channel	0.15	12
		16–40 with pipe support channel	0.04	–
		50–63 with pipe support channel	0.1	–
Heating pipe RAUTHERM S		10–32 without pipe support channel	0.15	12

Tab. 15-1 Coefficients of linear expansion (approximate values) and material constants for deflection leg calculation (approximate values)

16 DEFLECTION LEGS

Thermal changes in length can be accommodated by deflection legs. RAU-PE-Xa pipes are particularly suitable for this due to their flexible material. A deflection leg is the freely moveable pipe length, which can take up the required length change. The length of the deflection leg is influenced mainly by the material (material constant C). Deflection legs result mostly from changes in direction of the piping. For long lengths of piping, additional deflection legs must be installed in the piping to compensate the thermal change in length.



Do not fit pipe support channels or pipe fastenings close to deflection legs to avoid preventing the piping from bending.

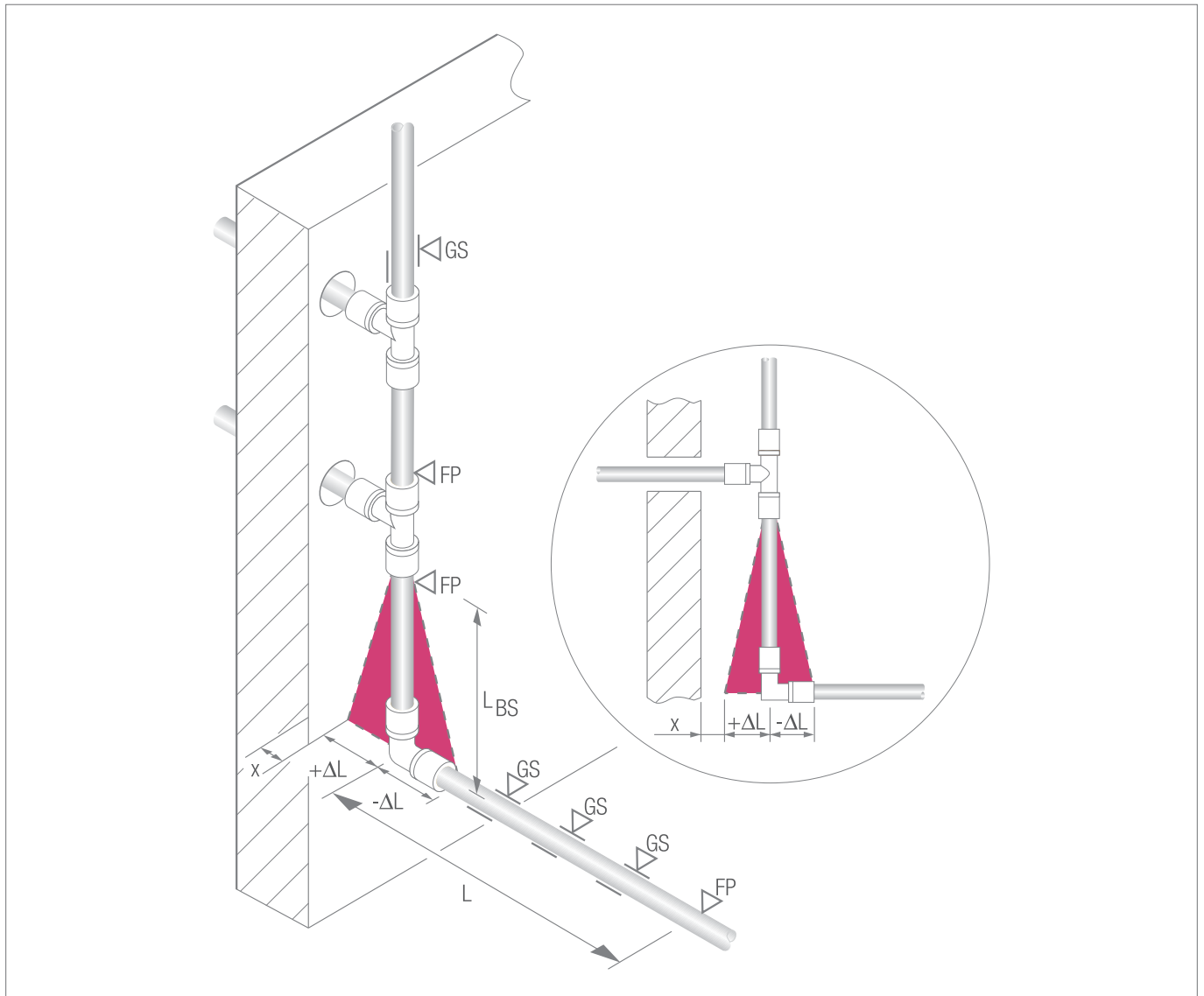


Fig. 16-1 Deflection legs

- L_{BS} Length of the deflection leg
- ΔL Thermal changes in length
- L Pipe length
- x Minimum distance of the pipe from the wall
- FP Fixed point clamp
- GS Slide clamp

16.1 Calculation of deflection leg length

The minimum length of deflection legs (BS) is calculated by the following formula:

$$L_{BS} = C \cdot \sqrt{d_a \cdot \Delta L}$$

L_{BS} = Length of the deflection leg in mm

d_a = Outside pipe diameter in mm

ΔL = Length change in mm

C = Material constant of the piping material

Approximate values for the material constant C see Tab. 15-1, page 74.



Do not fit pipe support channels or pipe fastenings close to deflection legs to avoid preventing the piping from bending.

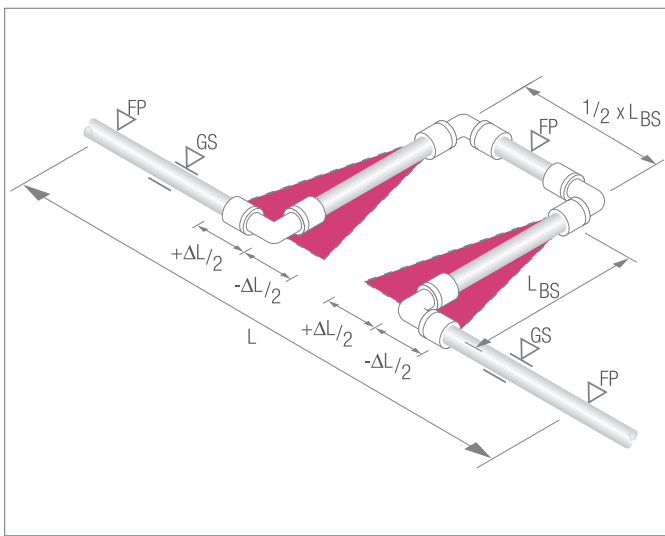


Fig. 16-2 U expansion bends

L_{BS} Length of the deflection leg

ΔL Thermal change in length

L Pipe length

FP Fixed point clamp

GS Slide clamp

16.2 Calculation examples

The piping length L , for which the thermal change in length is to be accommodated at a deflection leg, is 7 m.

The temperature difference between the minimum and maximum value (installation temperature and subsequent operating temperature) is 50 K.

The employed pipe has an outside diameter of 25 mm.

What length of deflection leg is required in dependency on the laid pipe type?

Calculation of the deflection leg length with the universal pipe RAUTITAN stabil

stabil

$$\Delta L = a \cdot L \cdot \Delta T$$

$$\Delta L = 0.026 \frac{\text{mm}}{\text{m} \cdot \text{K}} \cdot 7 \text{ m} \cdot 50 \text{ K}$$

$$\Delta L = 9.1 \text{ mm}$$

$$L_{BS} = C \cdot \sqrt{d_a \cdot \Delta L}$$

$$L_{BS} = 33 \cdot \sqrt{25 \text{ mm} \cdot 9.1 \text{ mm}}$$

$$L_{BS} = 498 \text{ mm}$$

Calculation of the deflection leg length with RAU-PE-Xa pipes mounted with pipe support channel

flex

$$\Delta L = a \cdot L \cdot \Delta T$$

$$\Delta L = 0.04 \frac{\text{mm}}{\text{m} \cdot \text{K}} \cdot 7 \text{ m} \cdot 50 \text{ K}$$

$$\Delta L = 14 \text{ mm}$$

$$L_{BS} = C \cdot \sqrt{d_a \cdot \Delta L}$$

$$L_{BS} = 33 \cdot \sqrt{25 \text{ mm} \cdot 14 \text{ mm}}$$

$$L_{BS} = 224 \text{ mm}$$

Assessment of the results

The universal pipe RAUTITAN stabil has a lower thermal change in length than a RAU-PE-Xa pipe due to its aluminium sheath. However, the required deflection leg length for the RAU-PE-Xa is smaller due to the flexible pipe material. For metallic pipe materials, a substantially larger deflection leg is required with the same operating parameters during installation, due to the significantly higher material constant (C), than for the pipes of the RAUTITAN system.



You can conduct deflection leg calculations and find calculation diagrams online at www.rehau.no or www.rehau.dk

17 FUNDAMENTAL REGULATIONS ON LAYING PIPES



Detailed information on planning, installation and execution of the REHAU systems for underfloor heating/cooling with the RAUTITAN pipes and the heating pipes RAUTHERM S is to be found in the Technical Information "Underfloor heating/cooling".

17.1 Laying on the raw floor

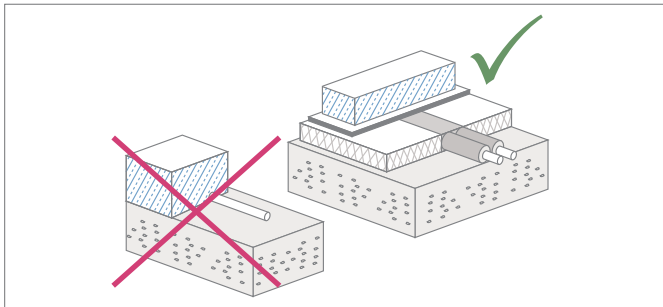


Fig. 17-1 Laying with a compensating layer

- Adhere to the advice and assembly instructions in this Technical Information. Details on protecting and insulating the piping can be found in the respective application sections.
- Always lay RAUTITAN piping in insulation in the drinking water and heating installation.
- Take note of the necessary height produced by the insulated piping in the planning phase.
- Fasten the pipes on the floor (take note of the specifications in DIN 18 560, Floor screeds in building construction).
- Lay piping in a suitable compensating layer to attain a flat surface to receive the insulating layer and impact sound insulation.

17.2 Inadmissible heating of pipes

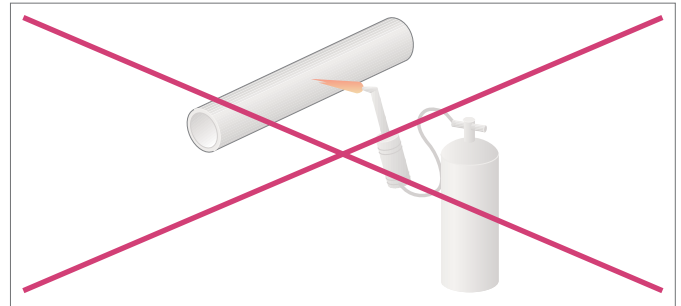


Fig. 17-2 Protect piping against inadmissible overheating

Make sure during the construction phase that piping, etc. is not exposed by other contractors to inadmissible temperatures (e.g. when sealing bitumen sheeting, or welding or soldering in the direct vicinity of unprotected piping).

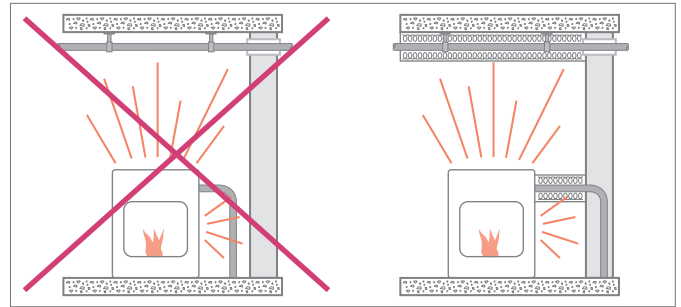


Fig. 17-3 Protection against thermal stress

Piping close to devices with high thermal emissions must be insulated sufficiently and permanently protected against inadmissible heating. Adhere to the maximum allowable operating pressure (e.g. operating temperature and duration).

17.3 External installation

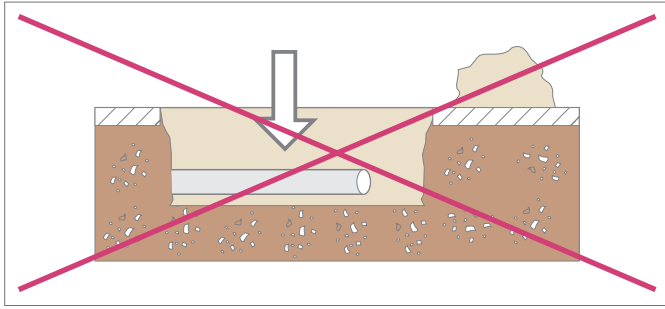


Fig. 17-4 Underground laying is inadmissible

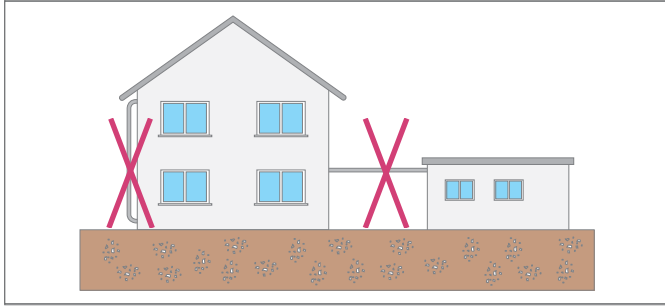


Fig. 17-5 Outside laying is inadmissible or only admissible for water piping if the corresponding protective measures have been taken.



- Piping:

- Do not use for laying in ground
- Protect against UV radiation
- Protect against frost
- Protect against high temperatures
- Protect against damage



When laying in ground, use the REHAU systems for groundworks.
Additional information on this can be found online at www.rehau.com or www.rehau.com/tiefbau.

17.4 Laying exposed to UV radiation

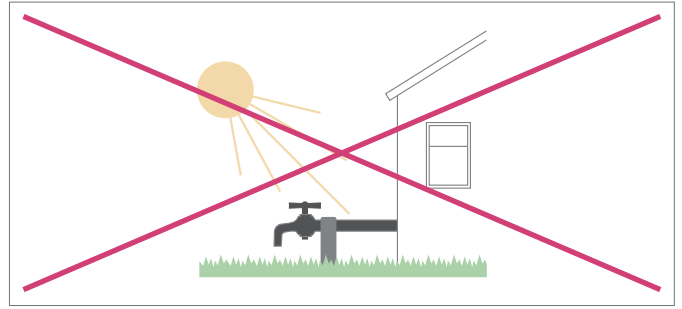


Fig. 17-6 Unprotected laying in areas exposed to UV radiation is not permitted
Example: Outdoors

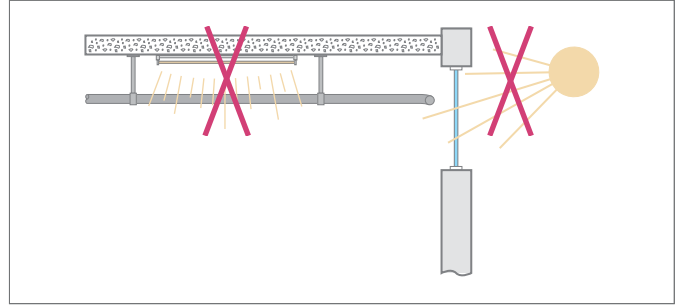


Fig. 17-7 Unprotected laying in areas exposed to UV radiation is not permitted
Example: Indoors



- Store and transport pipes protected against UV radiation.
- Protect piping from UV rays in areas where UV radiation can occur (e.g. sunlight, neon light).

17.5 Light transmission

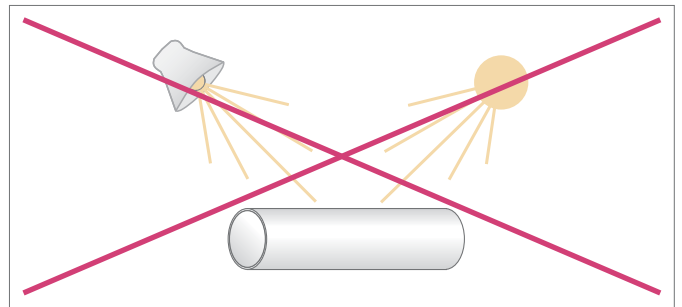


Fig. 17-8 Protect against exposure to light



The universal pipe RAUTITAN flex is permeable to light. Light exposure can be detrimental to the hygiene of the drinking water.
Protect pipes against exposure to light (e.g. close to windows and lamps).

17.6 Laying on bitumen sheeting and bitumen coatings

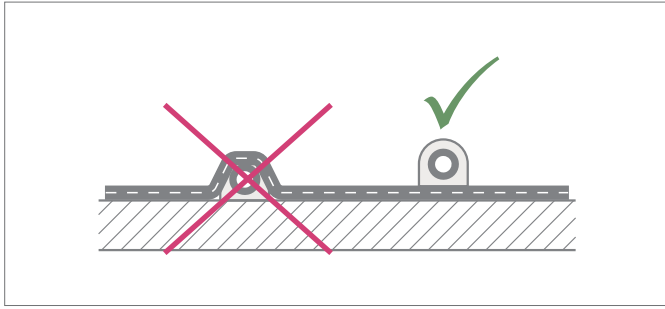


Fig. 17-9 Laying is permissible only on top of bitumen sheeting

Do not lay pipes under bitumen sheeting.

Laying under a bitumen sheeting can lead to damage to the piping or to the bitumen sheeting.

- Before laying on solvent-bearing bitumen sheeting or bitumen coatings, they must have dried thoroughly.
- Observe the setting time specified by the manufacturer.
- Before beginning laying, ensure that impairment of the piping and the drinking water is prevented.
- When laying pipes in the vicinity of bitumen sheeting to be heated with a torch, protect the piping sufficiently against heating.



Details on insulating and laying RAUTITAN piping in the drinking water and heating can be found in the Technical Information "RAUTITAN – THE NEW GENERATION"

17.7 Auxiliary heating

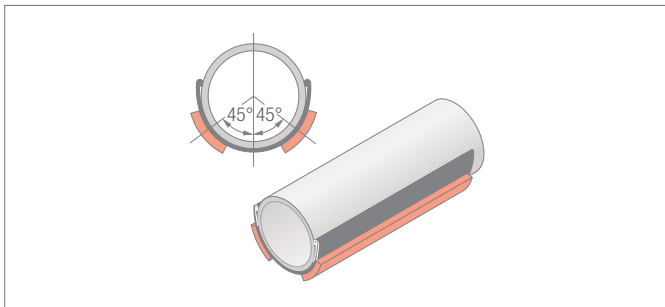


Fig. 17-10 Example of laying with auxiliary heating

- If pipes are laid with the pipe support channel, the heating strip must be attached to the outside of the pipe support channel.
- Take the appropriate measures to ensure that the piping and connection components do not at any point exceed 70 °C.
- When installing heating strips on pipes, observe the laying instructions of the auxiliary heating manufacturer.

17.8 Laying under hot asphalt screed

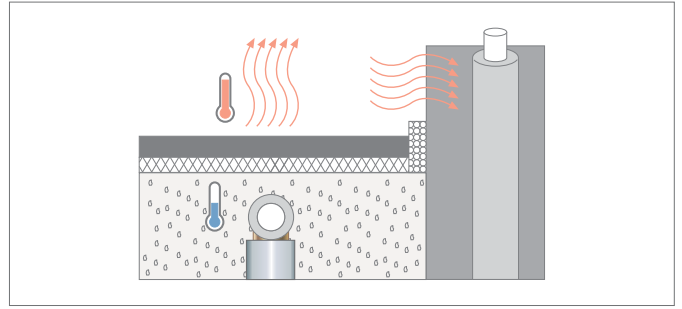


Fig. 17-11 Laying under hot asphalt screed

Hot asphalt screeds are laid at a temperature of approx. 250 °C in the building. To protect the piping from overheating, the proper steps need to be taken. Since these are dependent on the structural conditions and cannot be influenced by REHAU, these must be coordinated with and approved by the planner.



Agree with the contractor laying the hot asphalt screed on suitable insulating and protective measures for the installation and laying of the hot asphalt screed in order to prevent overheating of the piping.

17.9 Potential compensation

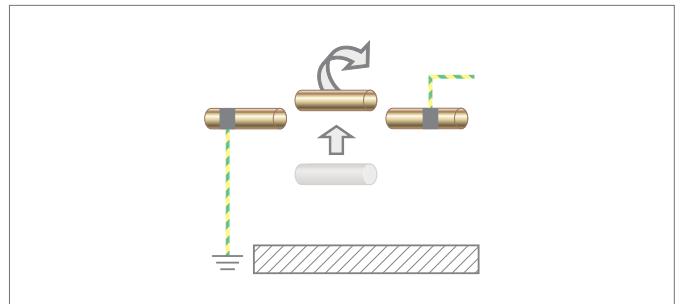


Fig. 17-12 Potential compensation when exchanging pipes



RAUTITAN piping must not be used as an earth conductor for electrical systems as per DIN VDE 0100.

After replacement of existing metal pipe installations with the RAUTITAN system, the function of potential compensation and the effectiveness of the electrical safety devices must be verified by an electrician.

18 ADVICES ABOUT SYSTEM COMPONENTS UNTIL 2005

Some system components, which has been produced and sold before 2005, are yet restrictively applicable or not applicable at all anymore.

Please following advices about the compatibility of the system components to each other have to be considered.

18.1 Advices about fitting contours when using the universal pipe RAUTITAN stabil, size: 16–32

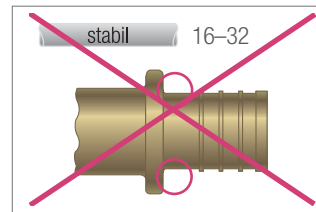


Fig. 18-1 Brass fitting without shaped end collars, size 16–32

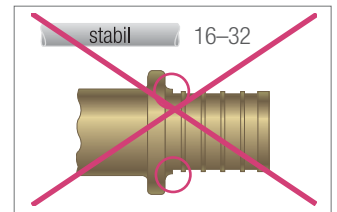


Fig. 18-2 Brass fitting with partially shaped end collars, size 16–32

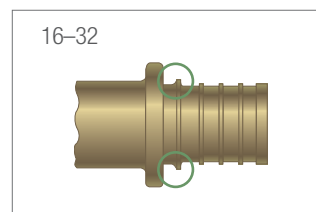


Fig. 18-3 Fitting with fully shaped end collar, size 16–32



With universal pipes RAUTITAN stabil and brass fittings, always use brass parts with fully shaped end collars. Since 1997, production at REHAU has been changed completely to incorporate fitting contours with end collars in sizes 16–32.

19 STANDARDS, REGULATIONS AND GUIDELINES



Observe the applicable national and international laying, installation, accident prevention and safety regulations when installing piping systems, as well as the instructions in this Technical Information.

Also observe the applicable laws, standards, guidelines and regulations (e.g. DIN, EN, ISO, DVGW, TRGI, VDE and VDI) as well as regulations on environmental protection, provisions of professional associations and regulations of the local public utility companies.

Areas of application not contained in this Technical Information (special applications) require consultation with our Applications Department. For detailed advice, consult your REHAU sales office.

The planning and installation instructions are directly connected with the respective REHAU product. References are made to excerpts from generally applicable standards and regulations.

Observe the respectively valid issues of the guidelines, standards and regulations.

Further standards, regulations and guidelines with regard to the planning, installation and operation of drinking water, heating and building technology systems must also be taken into account, but are not a part of this Technical Information.

The following standards, regulations and guidelines are referred to in the Technical Information (the current version is always valid):

- DIN 1045
Concrete, reinforced and prestressed concrete structures
- DIN 1055
Action on structures
- DIN 1186
Building plasters
- DIN 15018
Cranes
- DIN 16892
Crosslinked polyethylene (PE-X) pipes - General requirements, testing
- DIN 16893
Crosslinked polyethylene (PE-X) pipes - Dimensions
- DIN 18180
Gypsum plasterboards
- DIN 18181
Gypsum plasterboards for building construction
- DIN 18182
Accessories for use with gypsum plasterboards
- DIN 18195
Water-proofing of buildings
- DIN 18202
Tolerances in building construction
- DIN 18350
German Construction Contract Procedures (VOB) - Part C:
General Technical Specifications for Building Works - Plaster and stucco works
- DIN 18380
German Construction Contract Procedures (VOB) - Part C:
General Technical Specifications for Building Works - Systems for heating and central water heating
- DIN 18557
Works mortar
- DIN 18560
Floor screeds in building construction
- DIN 1988
Codes of practice for drinking water installations (TRWI)
- DIN 2000
Central drinking water supply - Guidelines regarding requirements for drinking water, planning, construction, operation and maintenance of plants

DIN 3546 Stop-valves for domestic water supply	DIN EN 12828 Heating systems in buildings – Design of water-based heating systems
DIN 4102 Fire behaviour of building materials and components	DIN EN 12831 Heating systems in buildings
DIN 4108 Thermal protection and energy economy in buildings	DIN EN 12831 Supplementary sheet 1 Heating systems in buildings – Method for calculation of the design heat load
DIN 4109 Sound insulation in buildings	DIN EN 13163 Thermal insulation products for buildings
DIN 4725 Warm water surface heating systems - Systems and components	DIN EN 13163 to DIN EN 13171 Thermal insulation products for buildings
DIN 4726 Warm water surface heating systems and radiator connecting systems - Plastic piping systems	DIN EN 13501 Fire classification of construction products and building elements
DIN 49019 Conduits for electrical installation	DIN EN 14037 Ceiling mounted radiant panels supplied with water at temperature below 120°C
DIN 49073 Metal boxes and boxes of insulating material for recessed mounting for accommodation of accessories and socket outlets	DIN EN 14240 Ventilation for buildings - Chilled ceilings
DIN 50916-2 Testing of copper alloys; stress corrosion and cracking test using ammonia; testing of components	DIN EN 14291 Foam producing solutions for leak detection on gas installations
DIN 50930-6 Corrosion of metals – Corrosion of metallic under corrosion load by water inside of tubes, tanks and apparatus - Part 6: Influence of the composition of drinking water.	DIN EN 14336 Heating systems in buildings
DIN 68 800 Protection of timber used in buildings	DIN EN 15377 Heating systems in buildings
DIN EN 1254-3 Copper and copper alloys - Plumbing fittings - Part 3: Fittings with compression ends for use with plastics pipes	DIN EN 1990 Eurocode: Basis of structural design
DIN EN 1264 Water based surface embedded heating and cooling systems	DIN EN 1991-1 Eurocode 1: Actions and structures
DIN EN 1982 Copper and copper alloys - Ingots and castings	DIN EN 1992-1 Eurocode 2: Design of concrete structures
DIN EN 10088 Stainless steels	DIN EN 1717 Protection against pollution of potable water installations and general requirements of devices to prevent pollution by backflow
DIN EN 10226 Pipe threads where pressure-tight joints are made on the threads	DIN EN 442 Radiators and convectors
DIN EN 12164 Copper and copper alloys – Rod for free machining purposes	DIN EN 520 Gypsum plasterboards
DIN EN 12165 Copper and copper alloys – Wrought and unwrought forging stock	DIN EN 60529 Degrees of protection provided by enclosures
DIN EN 12168 Copper and copper alloys - Hollow rod for free machining purposes	DIN EN 806 Codes of practice for drinking water installations
DIN EN 12502-1 Protection of metallic materials against corrosion – Guidance on the assessment of corrosion likelihood in water distribution and storage systems	DIN EN ISO 15875 Plastic piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X)
	DIN EN ISO 6509 Corrosion of metals and alloys – Determination of dezincification resistance of brass

DIN EN ISO 7730
Ergonomics of the thermal environment

DIN VDE 0100
(Summary)
Electrical systems in building
Setting up high-voltage current systems
Setting up low-voltage current systems
Guidelines for electrical systems

DIN VDE 0100-701
Low-voltage electrical installations - Requirements for special installations or locations - Part 701: Locations containing a bath or shower

DIN VDE 0298-4
Application of cables and cords in power installations

DIN VDE 0604-3
Trunking mounted on walls and ceilings for electrical installations; skirting board ducts

DVGW W 270
Reproduction of micro-organisms on materials for the drinking water area

DVGW W 291
Cleaning and disinfection of water distribution systems

DVGW W 534
Pipe connectors and connections in the drinking water installation

DVGW W 551
Drinking water heating and drinking water pipe systems

EnEV
German Energy Saving Ordinance

Council directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption

Council directive relating to machinery (89/392/EEC) including amendments

ISO 228
Pipe threads where pressure-tight joints are not made on the threads

ISO 7
Pipe threads where pressure-tight joints are not made on the threads

LBO
Regional building laws of the states of the Federal Republic of Germany

MBO
German Building Code for the states of the Federal Republic of Germany

MLAR
Sample Line Systems Guidelines

Muster-Feu-VO
Sample firing equipment regulation

TrinkwV
Drinking Water Ordinance

VDI 2035
Prevention of damage in water heating installations

VDI 2078
Cooling load calculation of air-conditioned rooms

VDI 4100
Noise control in dwellings

VDI 6023
Hygiene for drinking water supply systems

VOB
German Construction Contract Procedures

ZVSHK data sheets
German Central Association for Plumbing, Heating, Air-conditioning/Building and Energy Technology (ZVSHK/GED)

