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1 System technology

1.1 Introduction

Geberit Mapress is one of the leading pressfitting systems worldwide and has proven its performance over the past 35 years. To be able to cover an extensive range of applications, Geberit Mapress is offered in the materials stainless steel, carbon steel and CuNiFe.

Today, deliveries are made to 35 countries around the world from the production facility in Langenfeld. The most important markets are Europe, the countries of the Arabic Gulf and the USA (for shipbuilding).

Thanks to numerous international approvals, Geberit Mapress is used not only in domestic engineering (sanitary, heating, refrigeration and cooling) but also in industry.

1.2 System overview Geberit Mapress

Geberit Mapress comprises the pressfitting systems:

- Mapress Stainless Steel
- Mapress Carbon Steel (non-alloy steel)
- MapressCuNiFe (copper-nickel alloy)

Geberit Mapress comprises the pipe dimensions d 12 - 108 mm depending on the pressfitting system.

Geberit Mapress comprises the system components:

- Mapress pressfittings
 - Mapress Stainless Steel
 - Mapress Carbon Steel
 - MapressCuNiFe
- Mapress system pipes
 - Mapress Stainless Steel
 - Mapress Carbon Steel
 - MapressCuNiFe
- Mapress system valves
- Mapress pressing tools
 - AFP 101
 - ECO 201, ACO 201
 - EFP 2
 - ECO 301, ACO 3
 - HCPS

1.2.1 Mapress press connection

When the system pipe is pressed together with the pressfitting, a permanent, tight-fitting connection is established which withstands longitudinal forces and torsion moments.

Pressing

The pressfitting and system pipe are pressed on two levels:

1. Stability level: The pressfitting and the system pipe are deformed. The mechanical strength of the connection is achieved as a result.
2. Tightness level: The seal is inserted in the flange-shaped end of the sleeve. The seal ring is distorted when the end of the sleeve is pressed. The elastic retroactivity of the seal ring ensures permanent tightness of the connection.



Figure 1: Mapress press connection before pressing



Figure 2: Mapress press connection after pressing

System technology

System overview Geberit Mapress – Approvals

Pressing contour

The press connection is established with pressing jaws or pressing collars depending on the pipe dimension. This results in different pressing contours.

The pipe dimensions d 12 - 35 mm are pressed with pressing jaws. If pressing jaws are used, a hexagonal pressing contour is formed.

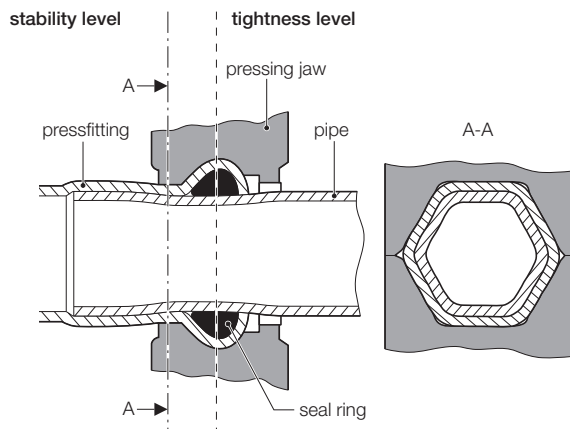


Figure 3: Cross-section of a Mapress press connection with applied pressing jaw d 12 - 35 mm and hexagonal pressing contour

The pipe dimensions d 42 - 108 mm are pressed with pressing collars and the corresponding intermediate jaws. When using pressing collars, a pressing contour is formed which is referred to as a "lemon shape contour".

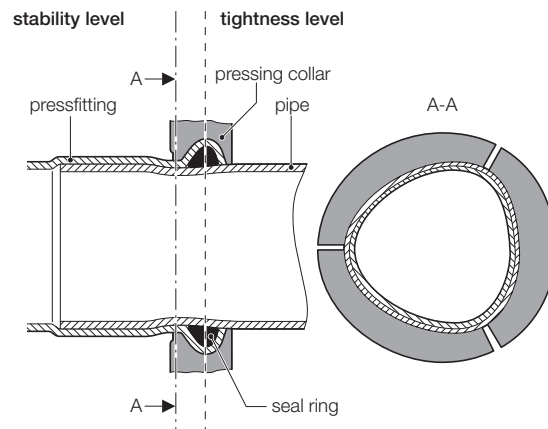


Figure 4: Cross-section of a Mapress press connection with applied pressing collar d 42 - 108 mm and lemon shape contour

1.2.2 Approvals

Table 1: Approvals for Geberit Mapress

System	Application	Testing guidelines / Codes of practice (extracts)	Approval mark (extracts)
Mapress Stainless Steel	<ul style="list-style-type: none"> ■ Drinking water ■ Extinguishing water ■ Rainwater ■ Treated water ■ Heating water ■ Open and closed water circuits ■ Compressed air ■ Solar systems ■ Heating oil EL ■ Oily media ■ Technical gases ■ Saturated steam ■ Sprinkler (wet and dry) 	<ul style="list-style-type: none"> ■ DVGW W 270 ■ DVGW W 534 ■ SVGW W/TPW 132 ■ TRbF 231 ■ VdS guidelines 	<ul style="list-style-type: none"> ■ DW 8501AT2552 (DVGW) ■ SVGW 8503-1663 ■ ÖVGW-W 1.088 ■ TÜV.A.271-07 ■ DIBt ■ VdS G-4910039
Mapress Carbon Steel	<ul style="list-style-type: none"> ■ Closed water heating systems ■ Closed water circuits ■ Dry compressed air ■ Heating oil EL ■ Sprinkler (only wet) 	<ul style="list-style-type: none"> ■ DVGW W 534 ■ TRbF 231 ■ VdS guidelines 	<ul style="list-style-type: none"> ■ TÜV.A.271-07 ■ DIBt ■ VdS G-4990013
Mapress Stainless Steel Gas	<ul style="list-style-type: none"> ■ Natural gases ■ Natural gases ■ Liquefied gases 	<ul style="list-style-type: none"> ■ DVGW VP 614 ■ ÖVGW G1-TR Gas 	<ul style="list-style-type: none"> ■ DG 4550BL0118 (DVGW) ■ ÖVGW G 2.663

1.3 System components

1.3.1 Mapress system pipes

System overview

Mapress system pipes are provided in the following versions:

- Mapress Stainless Steel system pipes (1.4401 and 1.4301)
- Mapress Carbon Steel system pipes (plastic-coated, zinc-plated on the outside, zinc-plated on the inside and outside)
- MapressCuNiFe system pipe (CuNi10Fe1.6Mn)

All Mapress system pipes are DIN- / DVGW approved and certified system pipes.

Works standards guarantee additionally increased requirements to:

- The quality of the weld seam
- Dimensional precision
- Surface quality
- Bending capability
- Resistance to corrosion

All Mapress system pipes are checked for tightness in the factory.

Transport and storage

During transportation and storage, Mapress system pipes are protected against dirt ex-factory using plugs and appropriate packaging material until they are processed.

Mapress Stainless Steel system pipes

The delivery conditions of the external and internal surfaces of the Mapress Stainless Steel system pipes are:

- Free from annealing colours
- Metallically bright
- Free from oil / grease
- Free from corrosion-promoting / unhygienic substances

When required, paint coatings or priming coats can be applied to the Mapress Stainless Steel system pipes.

The Mapress Stainless Steel system pipe are also used for stainless steel gas pressfittings.

Mapress Stainless Steel system pipe (1.4401)

Product material

Table 2: Material of the Mapress Stainless Steel system pipes (1.4401)

Material designation	Abbreviation (DIN EN 10088-2)	Material no.	
		EN	AISI
Austenitic stainless steel	X5CrNiMo17-12-2	1.4401	316

Physical characteristics

Table 3: Physical characteristics Mapress Stainless Steel system pipe (1.4401)

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	16.5·10 ⁻⁶	m/(m·K)
Thermal conductivity λ at 20 °C	15	W/(m·K)
Specific thermal capacity c at 20 °C	500	J/(kg·K)
Pipe roughness k	0.001	mm

Mapress Stainless Steel system pipes (1.4401) are longitudinal welded, non-combustible pipes. The assignment to material classes is based on country specific regulations.

System technology

System components – Mapress system pipes

Mechanical characteristics

Heat treatment condition: Solution annealed and quenched

Table 4: Mechanical characteristics Mapress Stainless Steel system pipe (1.4401)

Designation	Value	Unit
Tensile strength R_m	510 - 710	N/mm ²
0.2%-Expansion limit $R_{p0.2}$	≥ 220	N/mm ²
Breaking elongation A_5	> 40	%

Pipe data

Table 5: Technical data Mapress Stainless Steel system pipe (1.4401)

Nominal width DN	Pipe dimension d x s [mm]	Internal diameter di [mm]	Pipe weight m [kg/m]	Water volume V [l/m]	Recommended bending radius r [mm]
12	15 x 1.0	13	0.351	0.133	≥ 3.5·d
15	18 x 1.0	16	0.426	0.201	
20	22 x 1.2	19.6	0.626	0.302	
25	28 x 1.2	25.6	0.806	0.515	
32	35 x 1.5	32	1.260	0.804	
40	42 x 1.5	39	1.523	1.195	
50	54 x 1.5	51	1.974	2.043	
65	76.1 x 2.0	72.1	3.715	4.083	–
80	88.9 x 2.0	84.9	4.357	5.661	–
100	108 x 2.0	104	5.315	8.495	–

Supplied pipe form: Pipes each 6 m long

Marking

Mapress Stainless Steel system pipes are marked on the surface. The following table explains the marks using a d 54 mm pipe as an example.

Table 6: Marking Mapress Stainless Steel system pipe (1.4401)

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
S	Manufacturer's mark as agreed
325420	Melt number according to 3.1 Acceptance test certificate
54 x 1.5	Pipe dimension [mm]
1.4401 / 316	Material number EN / AISI
MPA NRW	Inspection authority
DVGW DW-8501AT2552	DVGW test mark with registration number
DVGW DG-4550BL0118 GAS	
67-768 ATEC 14/02-768	CSTB and ATEC marks (approval in France)
KIWA K7304	KIWA mark (approval in the Netherlands)
ATG 2495	ATG mark (approval in Belgium)
SITAC 1422 3571/90	SITAC mark (approval in Sweden)
ÖVGW W 1.088 - 16 bar / 95 °C - TW	ÖVGW mark (approval in Austria)
W WMKA20008	SAI-Global Watermark (approval in Australia)
TÜV AR 271-02	VdTÜV component mark
◁ FM ▷	FM mark (approval USA, d 22 - 108 mm)

Mapress Cr-Ni Steel system pipe (1.4301)

Product material

Table 7: Material of the Mapress Cr-Ni Steel system pipes (1.4301)

Material designation	Abbreviation (DIN EN 10088-2)	Material no.	
		EN	AISI
Austenitic stainless steel	X5CrNi18-10	1.4301	304

Physical characteristics

Table 8: Physical characteristics Mapress Cr-Ni Steel system pipe (1.4301)

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	$16 \cdot 10^{-6}$	m/(m·K)
Thermal conductivity λ at 20 °C	15	W/(m·K)
Specific thermal capacity c at 20 °C	500	J/(kg·K)
Pipe roughness k	0.0015	mm

Mapress Cr-Ni Steel system pipes (1.4301) are longitudinal welded, non-combustible pipes. The assignment to material classes is based on specific national regulations.

Mechanical characteristics

Heat treatment condition: Solution annealed and quenched

Table 9: Mechanical characteristics Mapress Cr-Ni Steel system pipe (1.4301)

Designation	Value	Unit
Tensile strength R_m	500 - 700	N/mm ²
0.2%-Expansion limit $R_{p0.2}$	≥ 220	N/mm ²
Breaking elongation A_5	> 40	%

Pipe data

Table 10: Pipe data of Mapress Cr-Ni Steel system pipe (1.4301)

Nominal width DN	Pipe dimension d x s [mm]	Internal diameter di [mm]	Pipe weight m [kg/m]	Water volume V [l/m]	Recommended bending radius r [mm]
12	15 x 1.0	13	0.351	0.133	$\geq 3.5 \cdot d$
15	18 x 1.0	16	0.426	0.201	
20	22 x 1.2	19.6	0.626	0.302	
25	28 x 1.2	25.6	0.806	0.515	
32	35 x 1.5	32	1.260	0.804	
40	42 x 1.5	39	1.523	1.195	
50	54 x 1.5	51	1.974	2.043	
65	76.1 x 1.5	72.1	3.715	4.083	–
80	88.9 x 1.5	84.9	4.357	5.661	–
100	108 x 2.0	104	5.315	8.495	–

Supplied pipe form: Pipes each 6 m long



Mapress Cr-Ni Steel system pipes (1.4301) are pressed using Mapress Stainless Steel pressfittings

System technology

System components – Mapress system pipes

Marking

Mapress Cr-Ni Steel system pipes are marked on the surface.
The following table explains the marks using a d 54 mm pipe as an example.

Table 11: Marking of Mapress Cr-Ni Steel system pipe (1.4301)

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
S	Manufacturer's mark as agreed
325420	Melt number according to 3.1 Acceptance test certificate
54 x 1.5	Pipe dimension [mm]
1.4301 / 304	Material number EN / AISI

Mapress Carbon Steel system pipes

Mapress Carbon Steel system pipe, zinc-plated on the outside

Material

Table 12: Product material of Mapress Carbon Steel system pipe, externally galvanized

Material designation	Abbreviation (DIN EN 10305)	Material no.	
		EN	AISI
Non-alloy steel	E195 (RSt 34-2)	1.0034	1009

Table 13: Galvanizing characteristics of the Mapress Carbon Steel system pipe, externally galvanized

Type of galvanization	Coating version (DIN 50961)	Coating thickness [μm]
Galvanically zinc-plated, blue passivated	FeZn8	8

Physical properties

Table 14: Physical characteristics of Mapress Carbon Steel system pipe, externally galvanized

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	$12 \cdot 10^{-6}$	m/(m·K)
Thermal conductivity λ at 20 °C	60	W/(m·K)
Specific thermal capacity c at 20 °C	500	J/(kg·K)
Pipe roughness k	0.01	mm

Mapress Carbon Steel system pipes, externally galvanized, are longitudinal welded, non-combustible pipes. The assignment to material classes is based on country specific regulations.

Mechanical properties

Heat treatment condition: Unannealed

Table 15: Mechanical strength of Mapress Carbon Steel system pipe, externally galvanized

Designation	Value	Unit	d [mm]
Tensile strength R_m	290 - 420	N/mm ²	≤ 22
	310 - 440		≥ 28
Expansion limit R_{eH}	< 260	N/mm ²	≤ 22
	260 - 360		≥ 28
Breaking elongation A_5	> 25	%	–

Table 16: Maximum allowable bending moment of Mapress Carbon Steel system pipe, externally galvanized

Designation	Value	Unit	d x s [mm]
Maximum allowable bending moment	80	Nm	12 x 1.2
	100		15 x 1.2
	160		18 x 1.2
	280		22 x 1.2
	300		22 x 1.5

System technology

System components – Mapress system pipes

Pipe data

Table 17: Pipe data of Mapress Carbon Steel system pipe, externally galvanized

Nominal width DN	Pipe dimension d x s [mm]	Internal diameter di [mm]	Pipe weight m [kg/m]	Water volume V [l/m]	Recommended bending radius r [mm]
12	15 x 1.2	12.6	0.408	0.125	≥ 3.5·d
15	18 x 1.2	15.6	0.497	0.191	
20	22 x 1.5	19	0.758	0.284	
25	28 x 1.5	25	0.980	0.491	
32	35 x 1.5	32	1.239	0.804	
40	42 x 1.5	39	1.498	1.195	
50	54 x 1.5	51	1.942	2.043	
65	76.1 x 2.0	72.1	3.655	4.083	–
80	88.9 x 2.0	84.9	4.286	5.661	–
100	108 x 2.0	104	5.228	8.495	–

Supplied pipe form: Pipes each 6 m long

Marking

Mapress Carbon Steel system pipes, externally galvanized, are marked on the surface. The following table explains the marks using a d 54 mm pipe as an example.

Table 18: Marking of Mapress Carbon Steel system pipe, externally galvanized

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
S	Manufacturer's mark as agreed
325420	Melt number according to 3.1 Acceptance test certificate
54 x 1.5	Pipe dimension [mm]
1.0035	Material number EN
◁ FM ▷	FM mark (USA approval, d 22 - 54 mm)

Mapress Carbon Steel system pipe, plastic coated

Product material

Table 19: Product material of Mapress Carbon Steel system pipe, plastic coated

Material designation	Abbreviation (DIN EN 10305)	Material no.	
		EN	AISI
Non-alloy steel	E195 (RSt 34-2)	1.0034	1009

Table 20: Plastic coating of Mapress Carbon Steel system pipe, plastic coated

Type of plastic	Colour
Polypropylene (PP)	Cream (RAL 9001)

Physical properties

Table 21: Physical characteristics of Mapress Carbon Steel system pipe, plastic coated

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	$12 \cdot 10^{-6}$	m/(m·K)
Thermal conductivity λ at 20 °C	60	W/(m·K)
Specific thermal capacity c at 20 °C	500	J/(kg·K)
Pipe roughness k	0.01	mm

Mapress Carbon Steel system pipes, plastic coated, are longitudinal welded, non-combustible pipes. The assignment to material classes is based on country specific regulations.

Mechanical properties

Heat treatment condition: Unannealed

Table 22: Mechanical strength of Mapress Carbon Steel system pipe, plastic coated

Designation	Value	Unit	d [mm]
Tensile strength R_m	290 - 420	N/mm ²	≤ 22
	310 - 440		≥ 28
Upper elastic limit R_{eH}	< 260	N/mm ²	≤ 22
	260 - 360		≥ 28
Breaking elongation A_5	> 25	%	–

Table 23: Maximum allowable bending moment of Mapress Carbon Steel system pipe, plastic coated

Designation	Value	Unit	d x s [mm]
Maximum allowable bending moment	80	Nm	12 x 1.2
	100		15 x 1.2
	160		18 x 1.2
	280		22 x 1.2
	300		22 x 1.5

System technology

System components – Mapress system pipes

Characteristics of the plastic coating

Table 24: Characteristics of the plastic coating of Mapress Carbon Steel system pipe, plastic coated

Designation	Value	Unit
Material	–	–
Density ρ	0.95 (non porous, waterproof)	g/cm ³
Thermal conductivity λ	0.22	W/(m·K)
Operating temperature _{max}	120	°C
Colour	RAL 9001 cream	–

Mapress Carbon Steel system pipes, plastic coated, can be painted using a standard primer for plastic.

Pipe data

Table 25: Pipe data of Mapress Carbon Steel system pipe, plastic coated

Nominal width	Pipe dimension	Outside diameter (with plastic coating)	Inside diameter	Pipe weight with plastic coating	Water volume	Recommended bending radius
DN	d x s [mm]	d [mm]	di [mm]	m [kg/m]	V [l/m]	r [mm]
12	15 x 1.2	17	12.6	0.434	0.125	≥ 3.5·d ¹
15	18 x 1.2	20	15.6	0.536	0.191	
20	22 x 1.5	24	19	0.824	0.284	
25	28 x 1.5	30	25	1.052	0.491	
32	35 x 1.5	37	32	1.320	0.804	
40	42 x 1.5	44	39	1.620	1.195	
50	54 x 1.5	56	51	2.098	2.043	

¹ Bendable to -10 °C

Supplied pipe form: Pipes each 6 m long

Marking

Mapress Carbon Steel system pipes, plastic coated, are marked on the surface. The following table explains the marks using a d 54 mm pipe as an example.

Table 26: Marking of Mapress Carbon Steel system pipe, plastic coated

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
54 x 1.5	Pipe dimension [mm]

Mapress Carbon Steel system pipes, zinc-plated on the inside and outside

Product material

Table 27: Product material of Mapress Carbon Steel system pipe, internally and externally galvanized

Material designation	Abbreviation (DIN EN 10305)	Material no.	
		EN	AISI
Non-alloy steel	E220	1.0215	1009

Table 28: Galvanizing characteristics of the Mapress Carbon Steel system pipe, internally and externally galvanized

Type of galvanization	Coating version (DIN EN 10326)	Coating thickness [μm]
Hot-dip coating	Z275	20

Physical properties

Table 29: Physical characteristics of Mapress Carbon Steel system pipe, internally and externally galvanized

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	$12 \cdot 10^{-6}$	m/(m·K)
Thermal conductivity λ at 20 °C	60	W/(m·K)
Specific thermal capacity c at 20 °C	500	J/(kg·K)
Pipe roughness k	0.01	mm

Mapress Carbon Steel system pipes, longitudinal welded, internally and externally galvanized, are non-combustible pipes. The assignment to material classes is based on country specific regulations.

Mechanical properties

Heat treatment condition: Unannealed

Table 30: Mechanical characteristics of Mapress Carbon Steel system pipe, internally and externally galvanized

Designation	Value	Unit
Tensile strength R_m	≥ 310	N/mm ²
Breaking elongation A_5	> 25	%

Pipe data

Table 31: Pipe data of Mapress Carbon Steel system pipe, internally and externally galvanized

Nominal width	Pipe dimension	Internal diameter	Pipe weight	Water volume	Recommended bending radius
DN	d x s [mm]	di [mm]	m [kg/m]	V [l/m]	r [mm]
20	22 x 1.5	19	0.758	0.284	$\geq 3.5 \cdot d$
25	28 x 1.5	25	0.980	0.491	
32	35 x 1.5	32	1.239	0.804	
40	42 x 1.5	39	1.498	1.195	
50	54 x 1.5	51	1.942	2.043	
65	76.1 x 2.0	72.1	3.655	4.083	–
80	88.9 x 2.0	84.9	4.286	5.661	–
100	108 x 2.0	104	5.228	8.495	–

Supplied pipe form: Pipes each 6 m long

System technology

System components – Mapress system pipes

Marking

Mapress Carbon Steel system pipes, internally and externally galvanized, are marked on the surface. The following table explains the marks using a d 54 mm pipe as an example.

Table 32: Marking of Mapress Carbon Steel system pipe, internally and externally galvanized

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
S	Manufacturer's mark as agreed
325420	Melt number according to 3.1 Acceptance test certificate
54 x 1.5	Pipe dimension [mm]
1.0215	Material number EN
◁ FM ▷	FM mark (USA approval, d 22 - 54 mm)

MapressCuNiFe system pipes

Product material

Table 33: Product material MapressCuNiFe system pipes

Material designation	Abbreviation	Material no.
Copper-nickel forging alloy	CuNi10Fe1.6Mn	2.1972.11 (according to product material performance sheet WL 2.1972)

Physical properties

Table 34: Physical properties MapressCuNiFe system pipe

Designation	Value	Unit
Thermal expansion coefficient α at 20 - 100 °C	$17 \cdot 10^{-6}$	m/(m·K)
Thermal conductance λ at 20 °C	50	W/(m·K)
Specific thermal capacity c at 20 °C	377	J/(kg·K)

MapressCuNiFe system pipes are seamless drawn, non-combustible pipes. The assignment to material classes is based on country specific regulations.

Mechanical properties

Heat treatment condition: Solution annealed and quenched

Table 35: Mechanical properties MapressCuNiFe system pipe according to DIN 86019, strength F 30 (soft)

Designation	Value	Unit
Tensile strength R_m	300 - 400	N/mm ² (MPa)
0.2%-Expansion limit $R_{p0.2}$	100 - 180	N/mm ² (MPa)
Breaking elongation A_5	≥ 30	%

Pipe data

Table 36: Pipe data MapressCuNiFe system pipe (according to DIN 86019)

Nominal width	Pipe dimension	Internal diameter	Pipe weight	Water volume	Recommended bending radius
DN	d x s [mm]	di [mm]	m [kg/m]	V [l/m]	r [mm]
12	15 x 1.0	13	0.390	0.133	≥ 3.5·d
20	22 x 1.0	20	0.590	0.314	
20	22 x 1.5	19	0.860	0.284	
25	28 x 1.5	25	1.110	0.491	
32	35 x 1.5	32	1.410	0.804	
40	42 x 1.5	39	1.700	1.195	
50	54 x 1.5	51	2.210	2.043	
65	76.1 x 2.0	72.1	4.140	4.083	–
80	88.9 x 2.0	84.9	4.870	5.661	–
100	108 x 2.5	103	7.380	8.332	–

Supplied pipe form: Sections each 5 - 6 m long

System technology

System components – Mapress system pipes

Marking

MapressCuNiFe system pipes are marked on the surface. The following table explains the marks using a d 54 mm pipe as an example.

Table 37: Marking MapressCuNiFe system pipe

Marking	Explanation
■ GEBERIT Geberit Mapress	Geberit trademark
060201-II	Date of production and shift (01.02.2006, afternoon shift)
Eucaro 10	Manufacturer's mark as agreed
325420	Melt number according to 3.1 Acceptance test certificate
54 x 1.5	Pipe dimension [mm]
CuNi10Fe1.6Mn	Abbreviation

1.3.2 Mapress pressfittings

System overview

The basic element for the press connection is that of a plastic moulding designed pressfitting. Mapress pressfittings are provided in the following versions:

- Mapress Stainless Steel
- Mapress Stainless Steel Gas
- Mapress Carbon Steel
- MapressCuNiFe

Transport and storage

The pressfittings are appropriately packed in plastic bags in the factory.

Substances that constrain from painting

All system pipes and pressfittings without pressing socket (e. g. bend with plain ends) as well as all pressfittings made of non-alloy steel are always supplied free of substances that constrain from painting (LABS-free).

As standard, pressfittings are not supplied free of substances that constrain from painting. LABS-free components must be ordered separately.

Mapress Stainless Steel pressfitting

Material



Table 38: Product material Mapress Stainless Steel pressfitting

Material designation	Abbreviation (DIN EN 10088-2)	Material no.	
		EN	AISI
Austenitic stainless steel	X5CrNiMo17-12-2	1.4401	316

Marking

Mapress Stainless Steel pressfittings are marked on the surface. The following table explains the marks using a d 28 mm fitting as an example.

Table 39: Marking of Mapress Stainless Steel pressfitting

Marking	Explanation
DVGW	DVGW approval
	Logo Geberit Mapress
28	Outside diameter [mm]
	FM mark (approval USA, d 22 - 108 mm)
VdS	VdS approval d 22 - 108 mm
BF	Production code

System technology

System components – Mapress pressfittings

Mapress Stainless Steel LABS-free pressfitting

Material



Table 40: Product material Mapress Stainless Steel LABS-free pressfitting

Material designation	Abbreviation (DIN EN 10088-2)	Material no.	
		EN	AISI
Austenitic stainless steel	X5CrNiMo17-12-2	1.4401	316

Marking

Mapress Stainless Steel LABS-free pressfittings are marked on the surface. The following table explains the marks using a d 28 mm fitting as an example.

Table 41: Marking of Mapress Stainless Steel LABS-free pressfitting

Marking	Explanation
Blue colour marking	LABS-free design
DVGW	DVGW approval
	Logo Geberit Mapress
28	Outside diameter [mm]
	FM mark (approval USA, d 22 - 108 mm)
VdS	VdS approval d 22 - 108 mm
BF	Production code

Mapress Stainless Steel Gas pressfitting

Material


Table 42: Product material Mapress Stainless Steel Gas pressfitting

Material designation	Abbreviation (DIN EN 10088-2)	Material no.	
		EN	AISI
Austenitic stainless steel	X5CrNiMo17-12-2	1.4401	316

Marking

Mapress Stainless Steel gas pressfittings are marked on the surface. The following table explains the marks using a d 28 mm fitting as an example.

Table 43: Marking of Mapress Stainless Steel gas pressfitting

Marking	Explanation
Yellow colour marking	Only for gas installations
DVGW	DVGW approval
	Logo Geberit Mapress
28	Outside diameter [mm]
GT / 5	HTB approval up to 5 bar
PN 5	Maximum operating pressure 5 bar
BF	Production code

Mapress Carbon Steel pressfitting

Material

Table 44: Product material of Mapress Carbon Steel pressfitting

Material designation	Abbreviation (DIN EN 10305)	Material no.	
		EN	AISI
Non-alloy steel	E195 (RSt 34-2)	1.0034	1009

Table 45: Galvanizing characteristics of the Mapress Carbon Steel pressfitting

Type of galvanization	Coating version (DIN 50961)	Coating thickness [µm]
Galvanically zinc-plated, blue passivated	FeZn8	8

Marking

Mapress Carbon Steel pressfittings are marked on the surface. The following table explains the marks using a d 28 mm fitting as an example.

Table 46: Marking of Mapress Carbon Steel pressfitting

Marking	Explanation
Ⓜ	Geberit Mapress logo
28	Outside diameter [mm]
◁ FM ▷	FM mark (USA approval, d 22 - 54 mm)
VdS	VdS approval d 28 - 54 mm
BF	Production code
Red colour marking	Marking of Carbon Steel, galvanized

MapressCuNiFe pressfitting

Material

Table 47: Product material MapressCuNiFe pressfitting

Material designation	Abbreviation	Material no.
Copper-nickel forging alloy	CuNi10Fe1.6Mn	2.1972.11 (according to product material performance sheet WL 2.1972)

Marking

MapressCuNiFe pressfittings are marked on the surface. The following table explains the marks using a d 28 mm fitting as an example.

Table 48: Marking of MapressCuNiFe pressfitting

Marking	Explanation
Ⓜ	Geberit Mapress logo
28	Outside diameter [mm]
BF	Production code

System technology

System components – Mapress system seal rings

1.3.3 Mapress system seal rings

Operating conditions - seal rings

Table 49: Technical data and applications of the Mapress seal rings

	Seal ring CIIR black	Seal ring HNBR yellow	Seal ring FPM green	Seal ring FPM red	Seal ring FEPM
Technical abbreviation	CIIR	HNBR	FPM	FPM	FEPM
Material	Butyl rubber	Hydrogenated acrylonitrile-butadiene rubber	Fluor-polymer	Fluor-polymer	Tetrafluoroethylene/propylene rubber
Colour	black	yellow	green	red	light green
Minimum operating temperature	-30 °C	-20 °C	-30 °C	-30 °C	-10 °C
Maximum operating temperature	120 °C	70 °C	180 °C	180 °C (oils)	180 °C
Maximum operating pressure	16 bar*	5 bar	16 bar	16 bar*	10 bar
Tests	<ul style="list-style-type: none"> ■ KTW recommendation ■ VdS Approval for wet systems ■ VdTÜV Approval 	HTB test for high thermal loads	–	<ul style="list-style-type: none"> ■ VdS Approval for wet and dry sprinkler systems ■ VdTÜV Approval ■ DIBt Approval for water-polluting substances 	–
Mapress system	<ul style="list-style-type: none"> ■ Mapress Stainless Steel ■ Mapress Carbon Steel ■ MapressCuNiFe 	Mapress Stainless Steel Gas	Is used by fitters for solar system applications	Is used by fitters for various applications	Is used by fitters for saturated steam applications
Applications	<ul style="list-style-type: none"> ■ Drinking water installations ■ Extinguishing water pipes ■ Rainwater ■ Treated water ■ Water heating systems ■ Water circuits ■ Oil-free compressed air ■ Inert gases (non-toxic / non-explosive) 	Gas installations with natural gases (NG) and liquefied gases (LPG)	Solar systems	<ul style="list-style-type: none"> ■ Stationary water extinguishing systems (wet and dry systems) ■ Oil-free and oiled compressed air ■ Technical liquids ■ Fuels ■ Mineral oil ■ Heating oil EL 	<ul style="list-style-type: none"> ■ Saturated steam applications up to 10 bar / 180 °C (open circuits) ■ Condensates
Other media or applications	Upon request	–	Upon request	Upon request	–

* - higher pressures possible upon consultation with Geberit

1.3.4 Mapress pressing tools

System overview

Mapress pressing tools are provided in the following versions:

- AFP 101
- EFP2, ECO 201, ACO 201
- ECO 301, ACO 3
- HCPS

General information

Mapress pressfitting systems are pressed using the corresponding Mapress pressing tool. In doing so, no difference can be distinguished between Mapress Stainless Steel, Mapress Carbon Steel and MapressCuNiFe. The pressing contour of the pressing jaws and pressing collars has been adapted precisely to the fitting's bead and geometrie.

Maintenance

The pressing tool must be checked and maintained on a regular basis in the scope of the warranty and functional safety of the pressed joint. This is described in detail in the operating instructions for the pressing tool.











Service

The pressing contours of the pressing jaw / pressing collar must be free of dirt and deposits.

The respective operating instructions for the pressing tool must be observed.




Pressing tools

Mapress pressing tools can be used as follows:

Compatibility class	Pressing devices	Pressing jaws / pressing collars	Adapters for pressing collars
1	AFP 101	 d 12 - 28 mm	–
2	MFP 2, EFP 2, ECO 201, ACO 201, PFP 2, PWH 75, ECO 1, ACO 1	 d 12 - 35 mm	–
2	MFP 2, EFP 2, ECO 201, ACO 201, PFP 2, PWH 75, ECO 1, ACO 1	 d 12 - 35 mm	–
2	MFP 2, EFP 2, ECO 201, ACO 201, PFP 2, PWH 75, ECO 1, ACO 1	 d 42 - 54 mm	 ZB 201
3	ECO 301, ACO 3	 d 12 - 35 mm	–
3	ECO 3, ECO 301, ACO 3	 d 42 - 54 mm	 ZB 302
3	ECO 3, ECO 301	 d 76.1 - 88.9 mm	 ZB 321

System technology

Laying techniques – Fitting situation

Compatibility class	Pressing devices	Pressing jaws / pressing collars	Adapters for pressing collars
3	ECO 3, ECO 301	 d 108 mm	 ZB 321 + ZB 322
–	HCPS	 d 76.1 - 108 mm	–

Pressing jaws d 42 - 54 mm are not permitted for gas applications.

Only use pressing devices which have been approved by Geberit .

1.4 Laying techniques

1.4.1 Fitting situation

Creation of expansion space

There are different types of pipe laying:

- On the wall
- In installation ducts
- Concealed
- Under cast plaster floors

There is room for expansion on the wall or in installation ducts. When pipes are concealed it must be ensured that they are surrounded by an elastic padding layer of fibre insulation material, such as glass wool or rock wool, or in closed-cell foam. This also meets acoustic insulation requirements.

Pipes installed under cast plaster floors are fitted in the impact insulation layer and can expand freely. The vertical pipe exits from the floor should be paid particular attention: Branches in the area of the plaster cast floor must be fitted with an elastic sleeve. The same applies for pipe openings in walls and ceilings, where padding ensures freedom of movement in all directions.

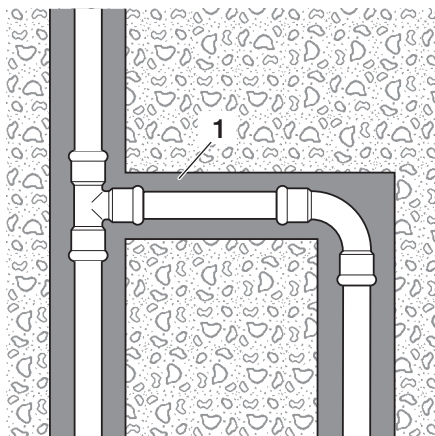


Figure 5: Concealed pipe

1 Elastic padding

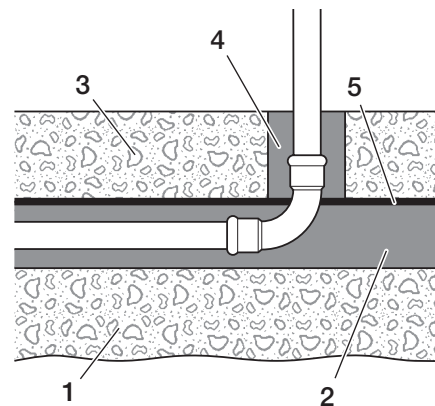


Figure 6: Pipe under cast plaster floor

- 1 Solid ceiling
- 2 Insulation layer
- 3 Cast plaster floor
- 4 Elastic sleeve
- 5 Cover

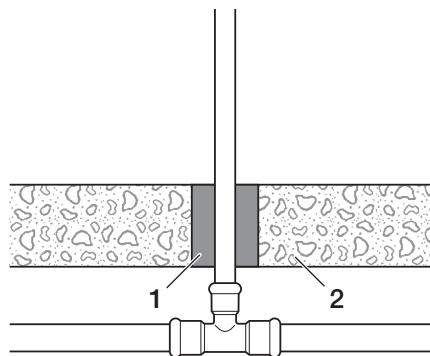


Figure 7: Pipe under ceiling openings

- 1 Elastic padding
- 2 Ceiling

Installation under cast plaster floor

Installation of Geberit pressfitting systems on an uncovered concrete ceiling inside the insulation layer of a cast plaster floor is possible without any noteworthy negative influence on the insulating properties of the cast plaster floor.

The impact noise protection of the ceiling with such a pipe installed in a cast plaster floor is sufficient for the higher noise insulation requirements in residential buildings.

Extract from DIN 18560, Cast plaster floors in building applications: **"Pipes which are installed on supporting underlying surfaces must be specified. Compensation measures are necessary to create a flat surface for accommodating the insulation layer or at least an impact noise insulation layer. The necessary construction height must be included in plans. Loose layers of natural or crushed sand may not be used for compensation."**

Installation under cast asphalt floors

When installing Mapress Carbon Steel under cast asphalt, the thermal effects of the asphalt layer can negatively influence the strength and cause excessive stress on the seal ring. Mapress Carbon Steel can be cast in asphalt if the following protection is provided:

- Inner cooling of the pipes with running water
- Covering of all pipes with bitumen, corrugated cardboard or similar, whereby the pipes are often installed in loose insulation layers

1.4.2 Expansion compensation

Expansion compensation in general

Pipes expand differently due to thermal effects depending on the product material.

This should be considered when installing:

- Creation of expansion space
- Installation of expansion compensations
- Positioning fixed points and sliding points:

The bending and torsional stress occurring during the operation of a pipe are reliably absorbed, taking the expansion compensation into account.

The following affect the expansion compensation:

- Material
- Building conditions
- Operating conditions

Slight changes in length of pipes can be accommodated by the elasticity of the pipe network.

In larger pipe networks, the pipe expansion must be accommodated using expansion compensators.

Expansion compensators used are:

- Pipe leg
- U bend
- Compensators

The following figures show the principle assembly of the pipe leg and U bend.

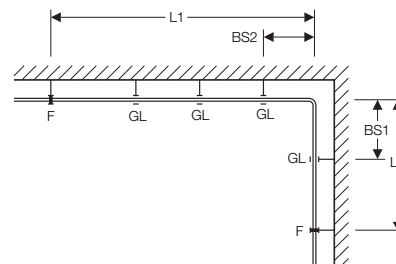


Figure 8: Expansion compensation by pipe leg

BS: Bending leg
F: Fixed point
GL: Sliding point
L: Pipe length

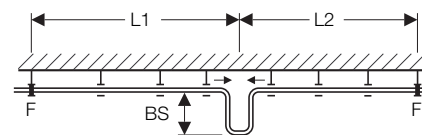


Figure 9: Expansion compensation by U bends

BS: Bending leg
F: Fixed point
L: Pipe length

The following figures show commercially available compensators that can be used for absorbing the pipe expansions:

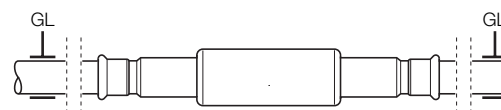


Figure 10: Mapress axial compensator

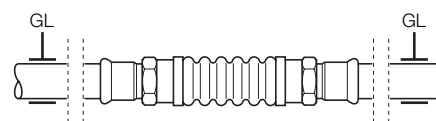


Figure 11: Commercially available axial compensator with female thread and Mapress adapter with male thread

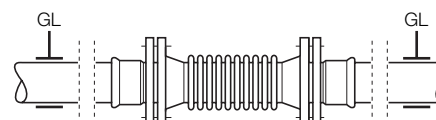


Figure 12: Commercially available axial compensator with flange connection

Expansion compensation through the Mapress Stainless Steel bending leg

The expansion of pipes also depends on the type of product material. Material dependant settings must be considered when calculating the length of the bending leg. The following table lists the settings for Mapress Stainless Steel.

Table 50: Material dependant settings for calculating the bending leg length of Mapress Stainless Steel

Material of pipe	System pipe	Coefficient of thermal expansion α [$10^{-6}K^{-1}$]	Material constant	
			C	U
Cr-Ni-Mo steel material no. 1.4401	Mapress Stainless Steel	16.5	45	25
Cr-Ni steel material no. 1.4301	Mapress Cr-Ni Steel	16.0	45	25

The calculation of the bending leg length comprises of the following steps:

- Calculation of the change in length Δl
- Calculation of the bending leg length

Calculation of the change in length Δl

The change in length is determined with the following formula:

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

Δl : Change in length [m]

L: Pipe length [m]

ΔT : Temperature differential (operating temperature - ambient temperature at time of installation) [K]

α : Coefficient of thermal expansion [m/(m·K)]

Given:

- Material: Cr-Ni-Mo steel material no. 1.4401
- $\alpha = 0.0000165 \text{ m/(m·K)}$
- L = 5 m
- $\Delta T = 50 \text{ K}$

The following section shows example values for calculating the bending leg length L_W and L_U for Mapress Stainless Steel.

Required:

- Change in length Δl of the pipe [mm]

Solution:

$$\Delta l = L \cdot \alpha \cdot \Delta T \left[\frac{\text{m} \cdot \text{m} \cdot \text{K}}{\text{m} \cdot \text{K}} = \text{m} \right]$$

$$\Delta l = 5 \text{ m} \cdot 0.0000165 \frac{\text{m}}{(\text{m} \cdot \text{K})} \cdot 50 \text{ K}$$

$$\Delta l = 0.0041 \text{ m}$$

Table 51: Change in length Δl for Mapress Stainless Steel system pipe

Pipe length L [m]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
Change in length Δl [mm]										
1	0.17	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.65
2	0.33	0.66	0.99	1.32	1.65	1.98	2.31	2.64	2.97	3.30
3	0.50	0.99	1.49	1.98	2.48	2.97	3.47	3.96	4.46	4.95
4	0.66	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60
5	0.83	1.65	2.48	3.30	4.13	4.95	5.78	6.60	7.43	8.25
6	0.99	1.98	2.97	3.96	4.95	5.94	6.93	7.92	8.91	9.90
7	1.16	2.31	3.47	4.62	5.78	6.93	8.09	9.24	10.40	11.55
8	1.32	2.64	3.96	5.28	6.60	7.92	9.24	10.56	11.88	13.20
9	1.49	2.97	4.46	5.94	7.43	8.91	10.40	11.88	13.37	14.85
10	1.65	3.30	4.95	6.60	8.25	9.90	11.55	13.20	14.85	16.50

Calculation of the bending leg length

The calculation of the bending leg length depends on the type of bending leg:

- Expansion compensation through pipe leg / for branch pipe: Calculation of the bending leg length L_B
- Expansion compensation by U bends: Calculation of the bending leg length L_U

Calculation of the bending leg length L_B

The bending leg length L_W to be calculated is defined as follows with expansion compensation through pipe legs and for branch pipes:

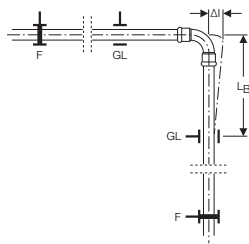


Figure 13: Expansion compensation by pipe leg

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

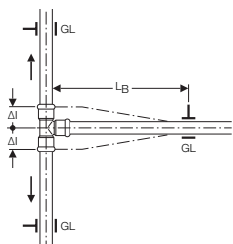


Figure 14: Expansion compensation for branching pipe

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

The bending leg length L_B is determined with the following formula:

$$L_B = C \cdot \sqrt{d \cdot \Delta l}$$

L_B : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

C: Material constant (see table 50 „Material dependant settings for calculating the bending leg length of Mapress Stainless Steel“ on page 24.)

L: Pipe length [m]

Given:

- Material: Cr-Ni-Mo steel material no. 1.4401
- C = 45
- d = 54 mm
- $\Delta l = 0.030$ m

Required:

- L_B [m]

Solution:

$$L_B = C \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{m \cdot m} = m]$$

$$L_B = 45 \cdot \sqrt{0.054 \cdot 0.030}$$

$$L_B = 1.81 \text{ m}$$

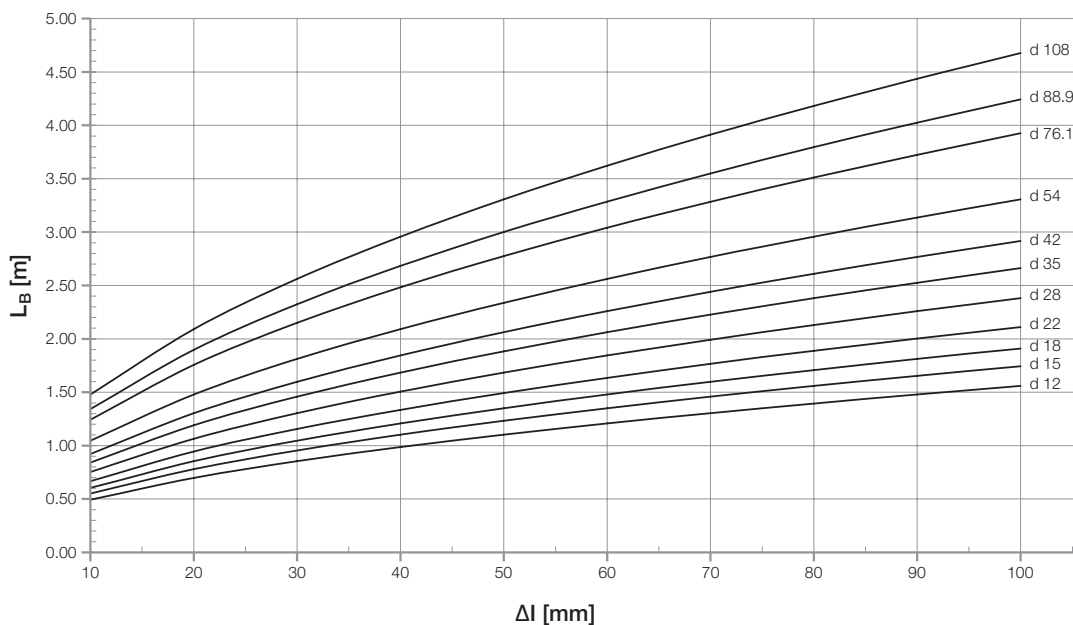


Figure 15: Determination of the bending leg length L_B for Mapress Stainless Steel

System technology

Laying techniques – Expansion compensation

Calculation of the bending leg length L_U

The bending leg length L_U to be calculated is defined with the following formula:

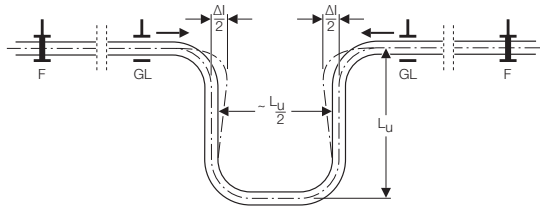


Figure 16: U bend expansion compensation from bent pipe

F: Fixed point
GL: Sliding point
 L_U : Length of the bending leg

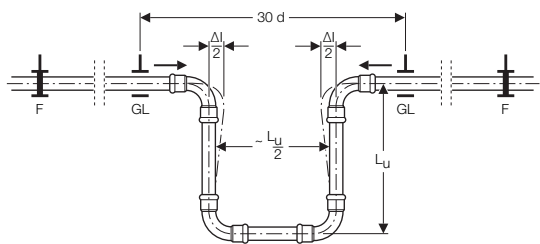


Figure 17: U bend expansion compensation with pressfittings

F: Fixed point
GL: Sliding point
 L_U : Length of the bending leg

The bending leg length L_U is determined with the following formula:

$$L_U = U \cdot \sqrt{d \cdot \Delta l}$$

L_U : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

Material constant (see table 50 „Material dependant settings for calculating the bending leg length of Mapress Stainless Steel“ on page 24.)

L: Pipe length [m]

Given:

■ Material: Cr-Ni-Mo steel material no. 1.4401

■ $U = 25$

■ $d = 54$ mm

■ $\Delta l = 0.030$ m

Required:

■ L_U [m]

Solution:

$$L_U = U \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{m \cdot m} = m]$$

$$L_U = 25 \cdot \sqrt{0.054 \cdot 0.030}$$

$$L_U = 1.01 \text{ m}$$

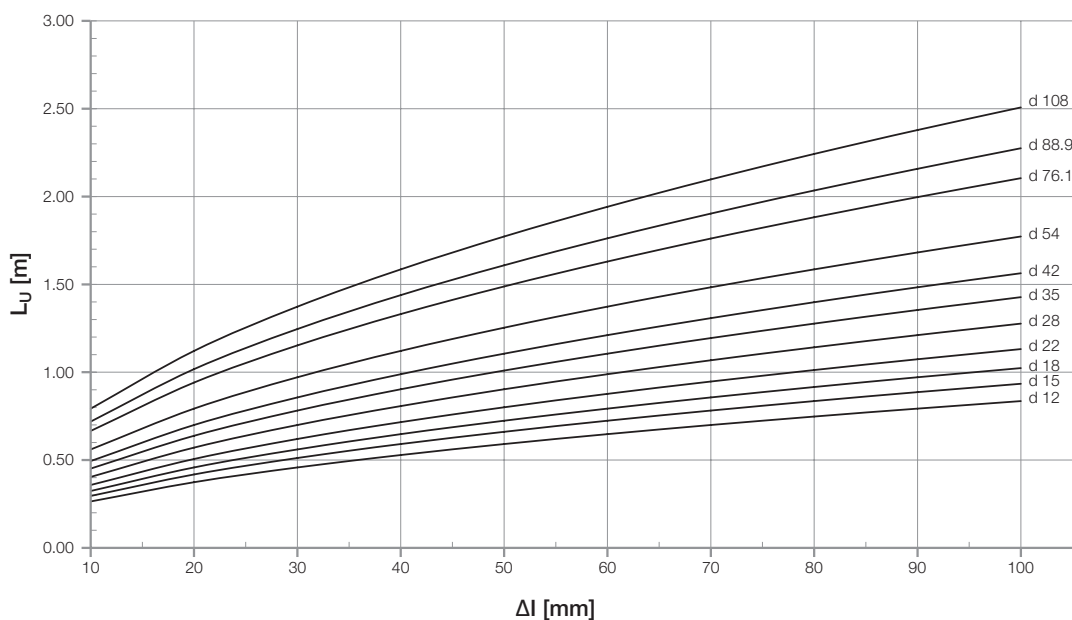


Figure 18: Determination of the bending leg length L_U for Mapress Stainless Steel

Expansion compensation through the bending leg Mapress Carbon Steel

The expansion of pipes depends, amongst others, on the type of product material. Material dependant parameters must be considered when calculating the length of the bending leg. The following table lists the parameters for Mapress Carbon Steel.

Table 52: Material dependant parameters for calculating the bending leg length of Mapress Carbon Steel

Material of pipe	System pipe	Coefficient of thermal expansion α [$10^{-6}K^{-1}$]	Material constant	
			C	U
Non-alloy steel, material no. 1.0034	Mapress Carbon Steel	12.0	45	25

The calculation of the bending leg length comprises of the following steps:

- Calculation of the change in length Δl
- Calculation of the bending leg length

Calculation of the change in length Δl

The change in length is determined with the following formula:

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

Δl : Change in length [m]

L: Pipe length [m]

ΔT : Temperature differential (operating temperature - ambient temperature at time of installation) [K]

α : Coefficient of thermal expansion [m/(m·K)]

Given:

- Material: Non-alloy steel, material no. 1.0034
- $\alpha = 0.0000120$ m/(m·K)
- L = 35 m
- $\Delta T = 50$ K

The following section shows example values for calculating the bending leg length L_W and L_U for Mapress Carbon Steel.

Required:

- Change in length Δl of the pipe [mm]

Solution:

$$\Delta l = L \cdot \alpha \cdot \Delta T \left[\frac{m \cdot m \cdot K}{m \cdot K} = m \right]$$

$$\Delta l = 35m \cdot 0.000012 \frac{m}{(m \cdot K)} \cdot 50K$$

$$\Delta l = 0.021m$$

Table 53: Change in length Δl for Mapress Carbon Steel system pipe

Pipe length L [m]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
Change in length Δl [mm]										
1	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20
2	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92	2.16	2.40
3	0.36	0.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60
4	0.48	0.96	1.44	1.92	2.40	2.88	3.36	3.84	4.32	4.80
5	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00
6	0.72	1.44	2.16	2.88	3.60	4.32	5.04	5.76	6.48	7.20
7	0.84	1.68	2.52	3.36	4.20	5.04	5.88	6.72	7.56	8.40
8	0.96	1.92	2.88	3.84	4.80	5.76	6.72	7.68	8.64	9.60
9	1.08	2.16	3.24	4.32	5.40	6.48	7.56	8.64	9.72	10.80
10	1.20	2.40	3.60	4.80	6.00	7.20	8.40	9.60	10.80	12.00

Calculation of the bending leg length

The calculation of the bending leg length depends on the type of bending leg:

- Expansion compensation through pipe leg / for branch pipes: Calculation of the bending leg length L_B
- Expansion compensation by U bends: Calculation of the bending leg length L_U

Calculation of the bending leg length L_B

The bending leg length L_B to be calculated is defined as follows with expansion compensation through pipe legs and for branch pipelines:

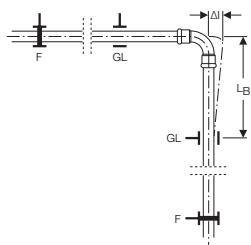


Figure 19: Expansion compensation by pipe leg

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

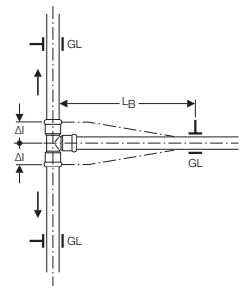


Figure 20: Expansion compensation for branching pipe

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

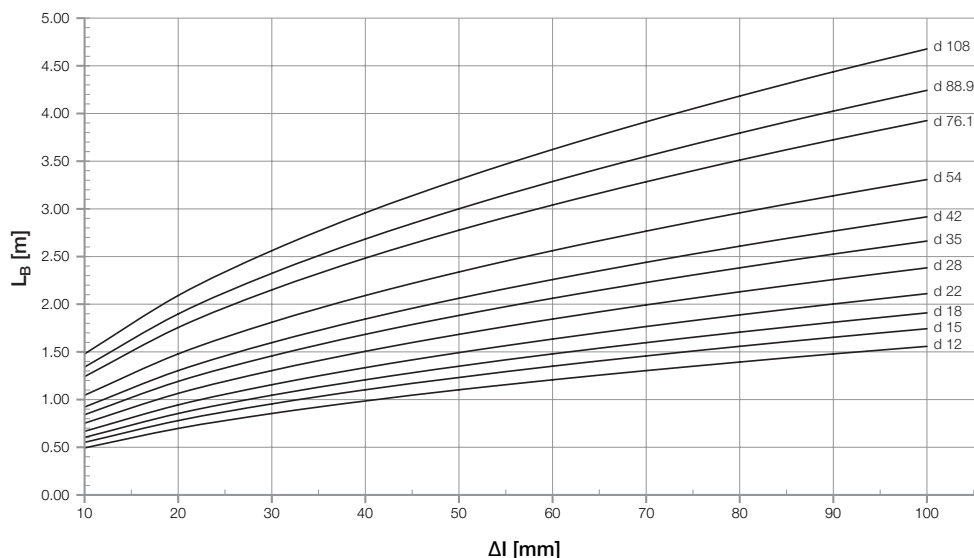


Figure 21: Calculation of the bending leg length L_B for Mapress Carbon Steel system pipe

The bending leg length L_B is determined with the following formula:

$$L_B = C \cdot \sqrt{d \cdot \Delta l}$$

L_B : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

C: Material constant (see table 52 „Material dependant parameters for calculating the bending leg length of Mapress Carbon Steel“ on page 27.)

L: Pipe length [m]

Given:

■ Material: Non-alloy steel, material no. 1.0034

■ $C = 45$

■ $d = 54$ mm

■ $\Delta l = 0.021$ m

Required:

■ L_B [m]

Solution:

$$L_B = C \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{m \cdot m} = m]$$

$$L_B = 45 \cdot \sqrt{0.054 \cdot 0.021}$$

$$L_B = 1.52 \text{ m}$$

Calculation of the bending leg length L_U

The bending leg length L_U to be calculated is defined with the following formula:

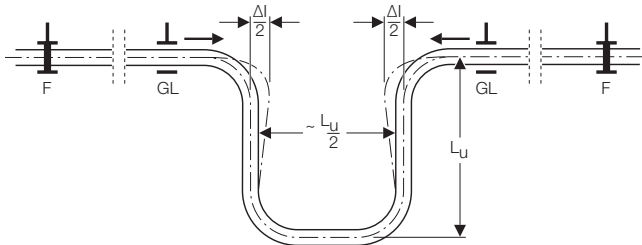


Figure 22: U bend expansion compensation from bent pipe

F: Fixed point

GL: Sliding point

L_U : Length of the bending leg

The bending leg length L_U is determined with the following formula:

$$L_U = U \cdot \sqrt{d \cdot \Delta l}$$

L_U : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

U: Material constant (see table 52 „Material dependant

parameters for calculating the bending leg length of Mapress Carbon Steel“ on page 27.)

L: Pipe length [m]

Given:

■ Material: Non-alloy steel, material no. 1.0034

■ $U = 25$

■ $d = 54$ mm

■ $\Delta l = 0.021$ m

Required:

■ L_U [m]

Solution:

$$L_U = U \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{m \cdot m} = m]$$

$$L_U = 25 \cdot \sqrt{0.054 \cdot 0.021}$$

$$L_U = 0.84\text{m}$$

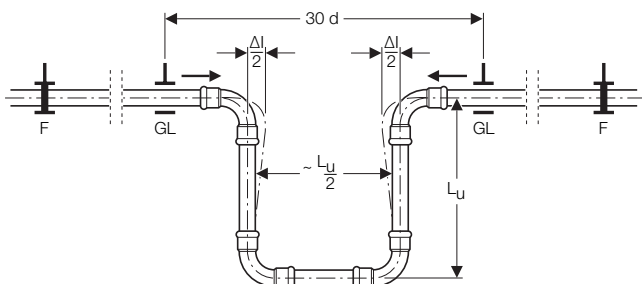


Figure 23: U bend expansion compensation with pressfittings

F: Fixed point

GL: Sliding point

L_U : Length of the bending leg

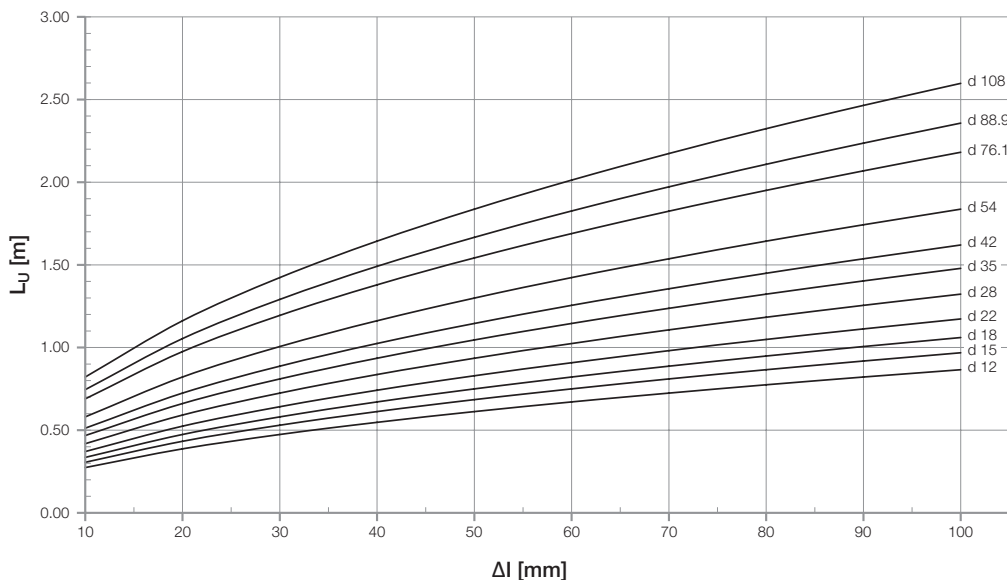


Figure 24: Calculation of the bending leg length L_U for Mapress Carbon Steel system pipe

Expansion compensation through the bending leg MapressCuNiFe

The expansion of pipes depends, amongst others, on the type of product material. Material dependant parameters must be considered when calculating the length of the bending leg. The following table lists the parameters for MapressCuNiFe.

Table 54: Material-dependant parameters for calculating the bending leg length of MapressCuNiFe

Material of pipe	System pipe	Coefficient of thermal expansion α [10 ⁻⁶ K ⁻¹]	Material constant	
			C	U
Copper-nickel forging alloy 2.1972.11	MapressCuNiFe	17	54	31

The calculation of the bending leg length comprises the following steps:

- Calculation of the change in length Δl
- Calculation of the bending leg length

Calculation of the change in length Δl

The change in length is determined with the following formula:

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

Δl : Change in length [m]

L: Pipe length [m]

ΔT : Temperature differential (operating temperature - ambient temperature at time of installation) [K]

α : Coefficient of thermal expansion [m/(m·K)]

Given:

- Material: CuNi, material no. 2.1972.11
- $\alpha = 0.0000170 \text{ m/(m·K)}$
- L = 5 m
- $\Delta T = 50 \text{ K}$

The following section shows example values for calculating the bending leg length L_W and L_U for MapressCuNiFe.

Required:

- Change in length Δl of the pipe [mm]

Solution:

$$\Delta l = L \cdot \alpha \cdot \Delta T \left[\frac{\text{m} \cdot \text{m} \cdot \text{K}}{\text{m} \cdot \text{K}} = \text{m} \right]$$

$$\Delta l = 5 \text{ m} \cdot 0.0000170 \frac{\text{m}}{(\text{m} \cdot \text{K})} \cdot 50 \text{ K}$$

$$\Delta l = 0.0043 \text{ m}$$

Table 55: Change in length Δl for MapressCuNiFe system pipe

Pipe length L [m]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
Change in length Δl [mm]										
1	0.17	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70
2	0.34	0.68	1.02	1.36	1.70	2.04	2.38	2.72	3.06	3.40
3	0.51	1.02	1.53	2.04	2.55	3.06	3.57	4.08	4.59	5.10
4	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80
5	0.85	1.70	2.55	3.40	4.25	5.10	5.95	6.80	7.65	8.50
6	1.02	2.04	3.06	4.08	5.10	6.12	7.14	8.16	9.18	10.20
7	1.19	2.38	3.57	4.76	5.95	7.14	8.33	9.52	10.71	11.90
8	1.36	2.72	4.08	5.44	6.80	8.16	9.52	10.88	12.24	13.60
9	1.53	3.06	4.59	6.12	7.65	9.18	10.71	12.24	13.77	15.30
10	1.70	3.40	5.10	6.80	8.50	10.20	11.90	13.60	15.30	17.00

Calculation of the bending leg length

The calculation of the bending leg length depends on the type of bending leg:

- Expansion compensation through pipe leg / for branch pipes: Calculation of the bending leg length L_B
- Expansion compensation by U bends: Calculation of the bending leg length L_U

Calculation of the bending leg length L_B

The bending leg length L_W to be calculated is defined as follows with expansion compensation through pipe legs and for branch pipelines:

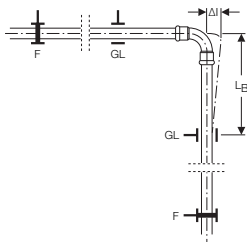


Figure 25: Expansion compensation by pipe leg

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

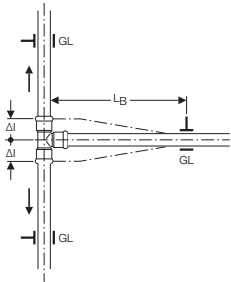


Figure 26: Expansion compensation for branching pipe

F: Fixed point

GL: Sliding point

L_B : Length of the bending leg

The bending leg length L_B is determined with the following formula:

$$L_B = C \cdot \sqrt{d \cdot \Delta l}$$

L_B : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

C: Material constant (see table 54 „Material-dependant parameters for calculating the bending leg length of MapressCuNiFe“ on page 30.)

L: Pipe length [m]

Given:

- Material: CuNi, material no. CW 352H
- C = 54
- d = 54 mm
- Δl = 0.043 m

Required:

- L_B [m]

Solution:

$$L_B = C \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{\text{m} \cdot \text{m}} = \text{m}]$$

$$L_B = 54 \cdot \sqrt{0.054 \cdot 0.043}$$

$$L_B = 2.60\text{m}$$

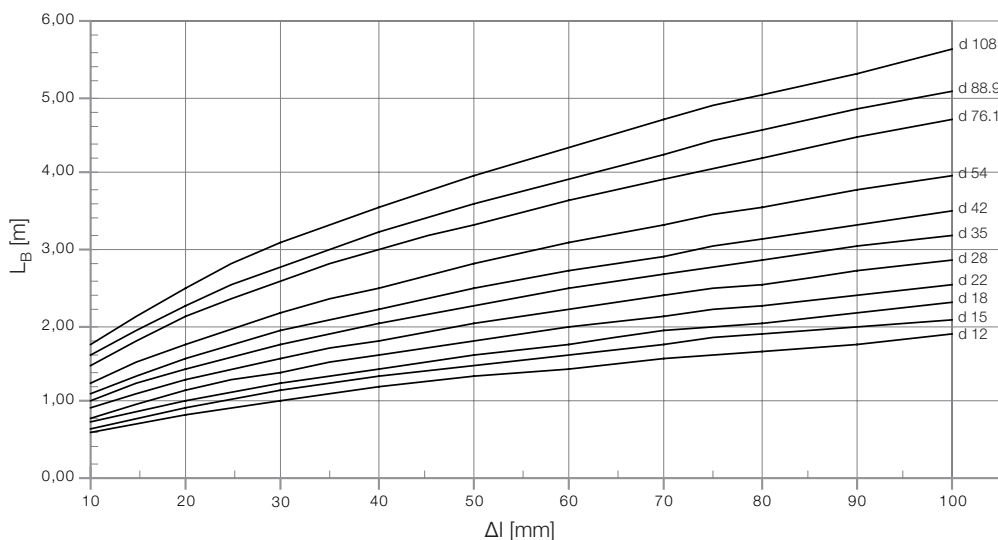


Figure 27: Calculation of the bending leg length L_B for MapressCuNiFe system pipe

System technology

Laying techniques – Expansion compensation

Calculation of the bending leg length L_U

The bending leg length L_U to be calculated is defined with the following formula:

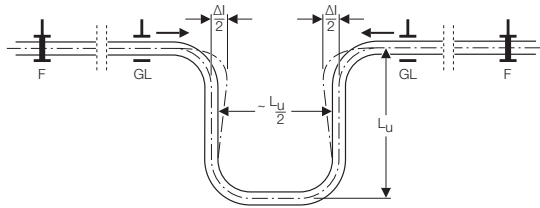


Figure 28: U bend expansion compensation from bent pipe

F: Fixed point
GL: Sliding point
 L_U : Length of the bending leg

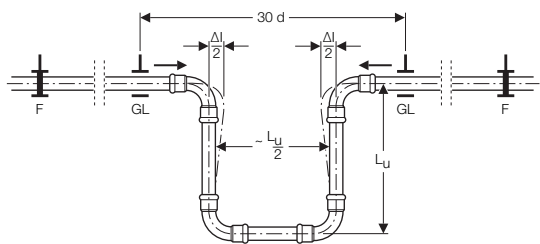


Figure 29: U bend expansion compensation with pressfittings

F: Fixed point
GL: Sliding point
 L_U : Length of the bending leg

The bending leg length L_U is determined with the following formula:

$$L_U = U \cdot \sqrt{d \cdot \Delta l}$$

L_U : Length of the bending leg [m]

d: Outside pipe diameter [mm]

Δl : Change in length [m]

Material constant (see table 54 „Material-dependant parameters for calculating the bending leg length of MapressCuNiFe“ on page 30.)

L: Pipe length [m]

Given:

■ Material: CuNi, material no. 2.1972.11

■ $U = 31$

■ $d = 54$ mm

■ $\Delta l = 0.043$ m

Required:

■ L_U [m]

Solution:

$$L_U = U \cdot \sqrt{d \cdot \Delta l} \quad [\sqrt{m \cdot m} = m]$$

$$L_U = 31 \cdot \sqrt{0.054 \cdot 0.043}$$

$$L_U = 1.49m$$

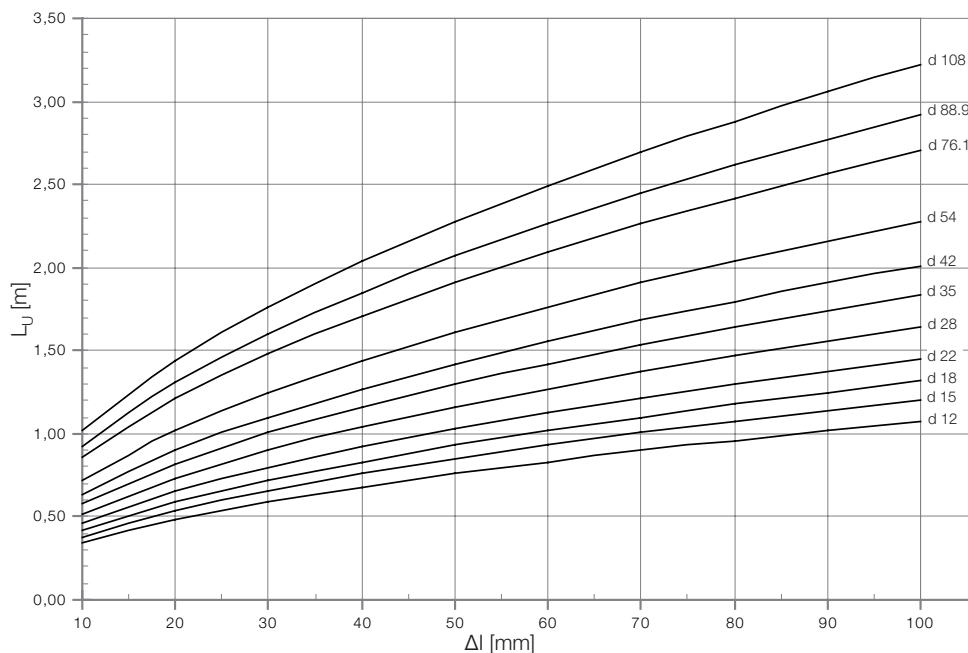


Figure 30: Calculation of the bending leg length L_U for MapressCuNiFe system pipe

1.4.3 Fastening of pipes

Pipe fastenings

Pipe fastenings fulfil various functions: Apart from supporting the pipe they also direct the temperature-related changes in length in the required direction.

Pipe fastenings are categorised according to the purpose they serve:

- **Fixed point** = rigid fixture of the pipe
- **Sliding point** = axially movable pipe bracket



Sliding points must be set so that they do not become unwanted fixed points during operation.

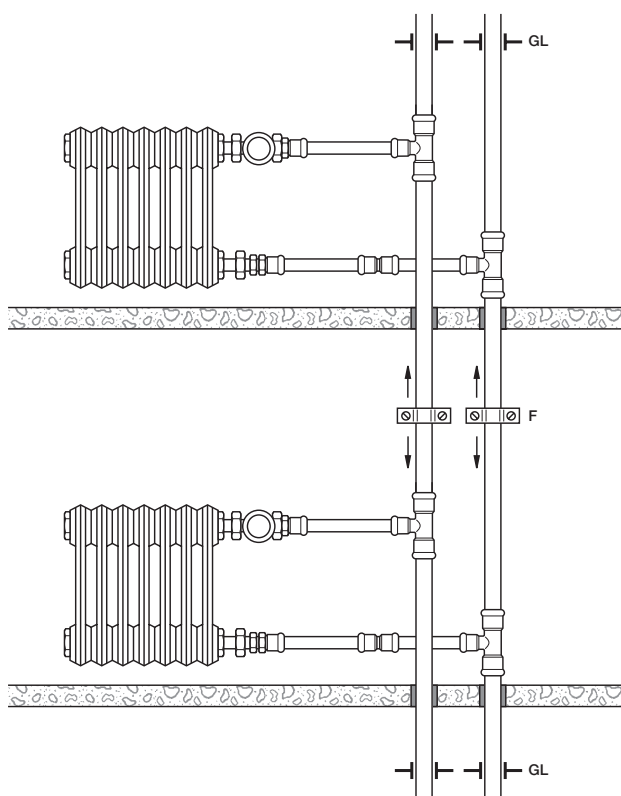


Figure 31: Fastening of continuous, long pipes

GL Sliding points
F Fixed points

Connection pipes (e.g. to radiators) must be sufficiently long to accommodate the changes in length occurring in the pipe system.

In the case of branch pipes or changes in direction, when mounting the first sliding point, the minimum spacing is determined by the bending leg resulting from the change in length (L_B / L_U).

A pipe run which is not interrupted by a change in direction or does not contain any expansion compensation should only be installed with a fixed point. On long pipe runs it is recommended, for example, to set a fixed point in the middle of the pipe run in order to direct the expansion in two directions.

This situation exists, for example, if there are vertical sections extending over several intermediate floors without any expansion compensation.

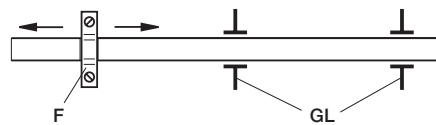


Figure 32: Fastening of continuous pipes with only one fixed point

GL Sliding points
F Fixed points

Due to the fact that the riser section should be fastened in the middle, the thermal expansion is directed in two directions and the strain on the branch fittings is reduced.

Pipe bracket spacing

Commercially available pipe brackets can be used for fastening the pipes. The necessary pipe bracket spacing is listed in the following table.

Table 56: Pipe bracket spacing according to DIN 1988, Part 2 for Mapress Carbon Stahl system pipes (DIN EN 10305)

DN	d x s [mm]	Pipe bracket spacing [m]	Pipe bracket spacing recommended by Geberit [m]
12	15 x 1.2	1.25	1.50
15	18 x 1.2	1.50	1.50
20	22 x 1.2	2.00	2.50
25	28 x 1.5	2.25	2.50
32	35 x 1.5	2.75	3.50
40	42 x 1.5	3.00	3.50
50	54 x 1.5	3.50	3.50
65	76.1 x 2.0	4.25	5.00
80	88.9 x 2.0	4.75	5.00
100	108 x 2.0	5.00	5.00

Pipe brackets with rubber liners should be used for acoustically insulating the pipe from the building structure.

1.4.4 Heat dissipation

Heat emission, general

In addition to transporting the heat conveying medium (water, steam etc.), pipes also emit heat due to physical laws. This effect can also be reversed.

Pipes can therefore be used for heat emission (floor heating, heating ceilings, heating walls etc. and also for absorbing heat (cooling water systems, concrete core activation, geothermal heat storage etc.).

Heat emission Mapress Stainless Steel

Calculative determination of the heat emission

The calculative determination of the heat emission comprises of the following steps:

- Calculation of the thermal transfer coefficient k_r :
- Calculation of the thermal emission \dot{Q}_R

Calculation of the thermal transfer coefficient k_r :

– General calculation

Assumptions for general calculation:

- Surface-mounted
- Stationary air

The thermal transfer coefficient k_r is determined in the general calculation with the following formula:

$$k_r = \frac{\pi}{\frac{1}{\alpha_i \cdot d_i} + \frac{1}{2 \cdot \lambda} \cdot \ln\left(\frac{d_a}{d_i}\right) + \frac{1}{\alpha_a \cdot d_a}}$$

α_i : Heat transfer coefficient, inside [W/(m²·K)]

α_a : Heat transfer coefficient, outside [W/(m²·K)]

d_a : Outside diameter [mm]

d_i : Inside diameter [mm]

λ : Thermal conductivity [W/(m·K)]

Value for Mapress Stainless Steel:

- $\alpha_i = 23.2$ W/(m²·K)
- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 15$ W/(m·K)

– Simplified calculation

Assumptions for the simplified calculation:

- Surface-mounted
- Stationary air
- Radiation not taken into account

The thermal transfer coefficient k_r is calculated in the simplified calculation with the following formula:

$$k_r = \frac{\pi}{\alpha_a \cdot d_a}$$

α_a : Heat transfer coefficient, outside [W/(m²·K)]

Value for Mapress Stainless Steel:

- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 60$ W/(m·K)

Calculation of the thermal emission \dot{Q}_R

The thermal emission is determined with the following formula:

$$\dot{Q}_R = (T_i - T_a) \cdot k_r$$

\dot{Q}_R : Heat flow for 1 m pipe [W/m]

k_r : Heat transfer coefficient [W/m·K]

T_i : Water temperature in the pipe

T_a : Room temperature

Tabulation calculation of the heat emission

The values of the thermal flow \dot{Q}_R in the following table are based on the general calculation of the thermal transfer coefficients k_r .

Table 57: Heat emission Mapress Stainless Steel

d x s [mm]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
	Heat flow \dot{Q}_R [W/m]									
15 x 1.0	3.2	7.4	12.2	17.4	22.9	28.7	34.8	41.2	47.7	54.5
18 x 1.0	3.7	8.6	14.1	20.1	26.5	33.2	40.3	47.6	55.2	63.1
22 x 1.2	4.3	10.0	16.5	23.5	31.0	38.9	47.2	55.8	64.7	73.9
28 x 1.2	5.2	12.2	20.0	28.5	37.5	47.1	57.1	67.5	78.3	89.5
35 x 1.5	6.2	14.5	23.8	34.0	44.8	56.2	68.2	80.7	93.6	107.0
42 x 1.5	7.2	16.8	27.6	39.3	51.8	65.0	78.8	93.3	108.2	123.8
54 x 1.5	9.0	20.8	34.2	48.7	64.3	80.7	97.8	115.8	134.4	153.7
54 x 2.0	8.9	20.8	34.2	48.7	64.2	80.6	97.8	115.7	134.3	153.5
76.1 x 2.0	11.6	26.9	44.2	63.0	83.1	104.3	126.5	149.7	173.9	198.9
88.9 x 2.0	13.1	30.5	50.0	71.3	94.0	118.1	143.2	169.5	196.9	225.3
108 x 2.0	15.4	35.6	58.4	83.3	109.8	137.9	167.4	198.1	230.1	263.3

Graphical calculation of the heat emission

The values of the thermal flow \dot{Q}_R that can be calculated from the following figure are based on the general calculation of the thermal transfer coefficients k_r .

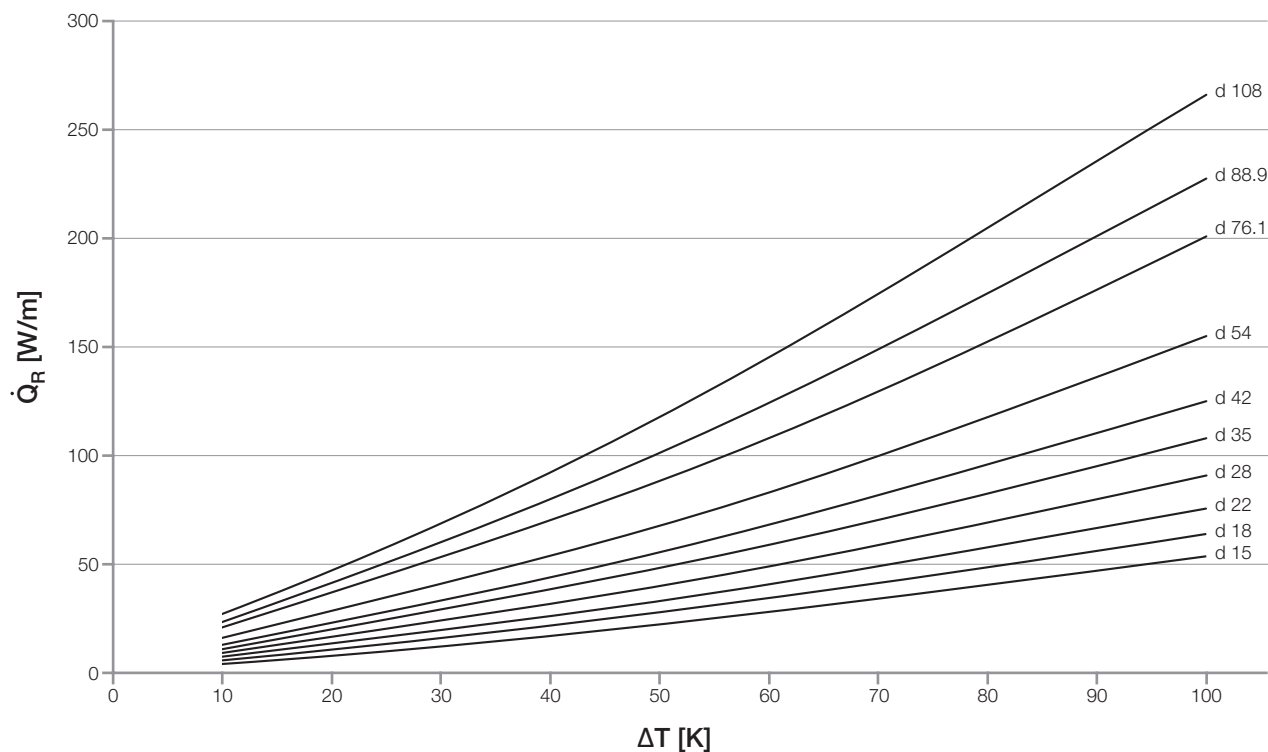


Figure 33: Heat emission Mapress Stainless Steel

\dot{Q}_R : Heat flow for 1 m pipe
 ΔT : Temperature differential

Heat emission of Mapress Carbon Steel

Calculative determination of the heat emission

The calculative determination of the heat emission comprises of the following steps:

- Calculation of the thermal transfer coefficient k_r ;
- Calculation of the thermal emission \dot{Q}_R

Calculation of the thermal transfer coefficient k_r :

– General calculation

Assumptions for general calculation:

- Surface-mounted
- Stationary air

The thermal transfer coefficient k_r will be determined in the general calculation with the following formula:

$$k_r = \frac{\pi}{\frac{1}{\alpha_i \cdot d_i} + \frac{1}{2 \cdot \lambda} \cdot \ln\left(\frac{d_a}{d_i}\right) + \frac{1}{\alpha_a \cdot d_a}}$$

α_i : Heat transfer coefficient, inside [W/(m²·K)]

α_a : Heat transfer coefficient, outside [W/(m²·K)]

d_a : Outside diameter [mm]

d_i : Inside diameter [mm]

λ : Thermal conductivity [W/(m·K)]

Value for Mapress Carbon Steel:

- $\alpha_i = 23.2$ W/(m²·K)
- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 60$ W/(m·K)

Tabulation calculation of the heat emission

The values of the thermal flow \dot{Q}_R in the following table are based on the general calculation of the thermal transfer coefficients k_r .

Table 58: Heat emission of Mapress Carbon Steel

d x s [mm]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
	Heat flow \dot{Q}_R [W/m]									
15 x 1.2	4.7	10.7	17.5	24.9	32.8	41.2	50.2	59.6	69.5	79.9
18 x 1.2	5.5	12.5	20.4	29.0	38.2	48.1	58.5	69.5	81.1	93.2
22 x 1.5	6.3	14.3	23.3	33.1	43.6	54.8	66.8	79.3	92.6	106.5
28 x 1.5	7.8	17.6	28.7	40.7	53.7	67.5	82.2	97.7	114.0	131.2
35 x 1.5	9.5	21.5	34.9	49.5	65.3	82.1	100.0	118.9	138.8	159.8
42 x 1.5	11.2	25.2	40.8	58.0	76.4	96.1	117.0	139.2	162.5	187.1
54 x 1.5	14.4	32.3	52.5	74.5	98.2	123.6	150.5	178.9	209.0	240.6
76.1 x 1.5	19.2	43.1	69.8	99.0	130.5	164.2	200.0	237.9	278.0	320.2
88.9 x 2.0	22.0	49.3	79.9	113.3	149.3	187.8	228.7	272.2	318.1	366.5
108 x 2.0	26.1	58.4	94.6	134.1	176.7	222.2	270.8	322.2	376.7	434.1

– Simplified calculation

Assumptions for the simplified calculation:

- Surface-mounted
- Stationary air
- Radiation not taken into account

The thermal transfer coefficient k_r will be calculated in the simplified calculation with the following formula:

$$k_r = \frac{\pi}{\alpha_a \cdot d_a}$$

α_a : Heat transfer coefficient, outside [W/(m²·K)]

Value for Mapress Carbon Steel:

- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 60$ W/(m·K)

Calculation of the thermal emission \dot{Q}_R

The thermal emission is determined with the following formula:

$$\dot{Q}_R = (T_i - T_a) \cdot k_r$$

\dot{Q}_R : Heat flow for 1 m pipe [W/m]

k_r : Heat transfer coefficient [W/m·K]

T_i : Water temperature in the pipe

T_a : Room temperature

Graphical calculation of the heat emission

The values of the thermal flow \dot{Q}_R that can be calculated from the following figure are based on the general calculation of the thermal transfer coefficients k_r .

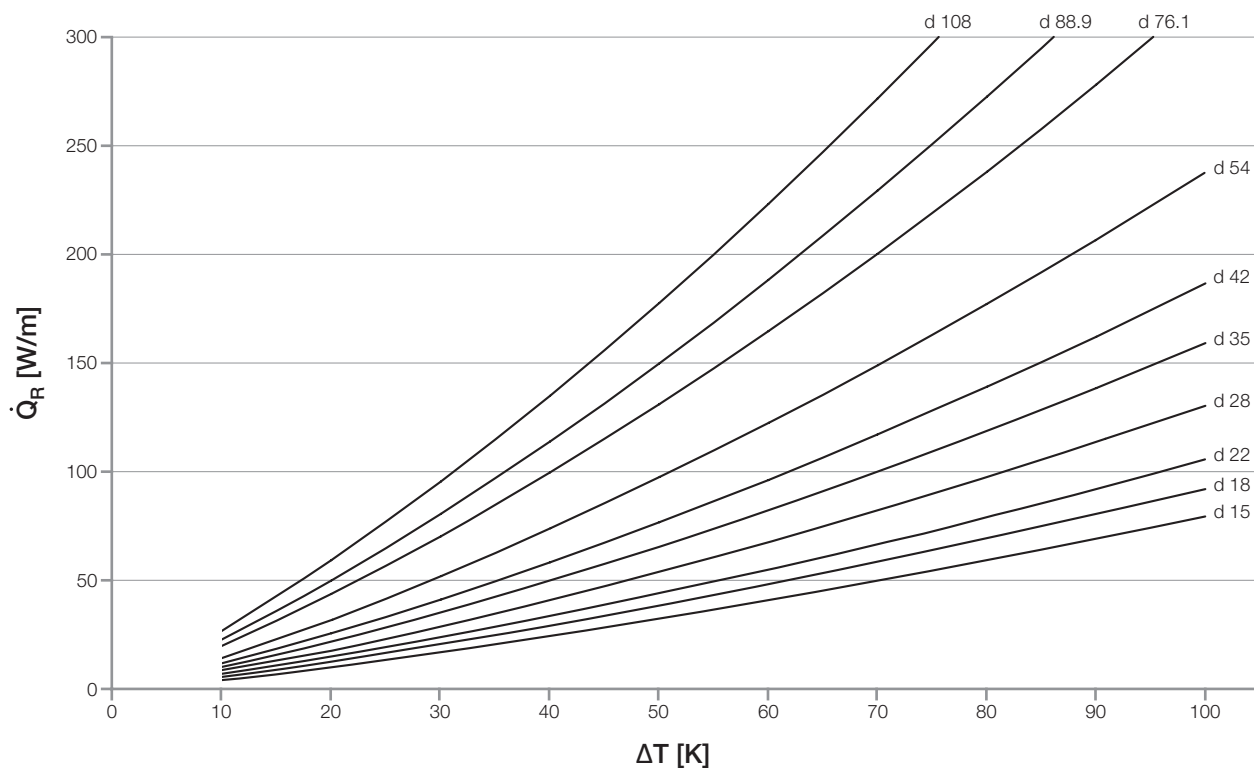


Figure 34: Heat emission of Mapress Carbon Steel

\dot{Q}_R : Heat flow for 1 m pipe
 ΔT : Temperature differential

Heat emission MapressCuNiFe

Calculative determination of the heat emission

The calculative determination of the heat emission comprises the following steps:

- Calculation of the thermal transfer coefficient k_r
- Calculation of the thermal emission \dot{Q}_R

Calculation of the thermal transfer coefficient k_r

– General calculation

Assumptions for general calculation:

- Surface-mounted
- Stationary air

The thermal transfer coefficient k_r will be determined in the general calculation with the following formula:

$$k_r = \frac{\pi}{\frac{1}{\alpha_i \cdot d_i} + \frac{1}{2 \cdot \lambda} \cdot \ln\left(\frac{d_a}{d_i}\right) + \frac{1}{\alpha_a \cdot d_a}}$$

α_i : Heat transfer coefficient, inside [W/(m²·K)]

α_a : Heat transfer coefficient, outside [W/(m²·K)]

d_a : Outside diameter [mm]

d_i : Inside diameter [mm]

λ : Thermal conductivity [W/(m·K)]

Values for MapressCuNiFe:

- $\alpha_i = 23.2$ W/(m²·K)
- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 50$ W/(m·K)

Tabulation calculation of the heat emission

The values of the thermal flow \dot{Q}_R in the following table are based on the general calculation of the thermal transfer coefficients k_r .

Table 59: Heat emission MapressCuNiFe

d x s [mm]	Temperature differential ΔT [K]									
	10	20	30	40	50	60	70	80	90	100
	Heat flow \dot{Q} [W/m]									
15 x 1.0	4.6	10.3	16.8	23.8	31.3	39.4	47.8	56.8	66.1	76.0
22 x 1.0	6.3	14.3	23.2	33.0	43.4	54.5	66.3	78.7	91.8	105.5
28 x 1.0	7.8	17.6	28.5	40.4	53.3	66.9	81.4	96.7	112.7	129.6
35 x 1.0	9.5	21.3	34.5	49.0	64.5	81.0	98.6	117.1	136.6	157.1
42 x 1.5	11.1	24.9	40.4	57.2	75.4	94.7	115.3	137.0	159.8	183.9
54 x 1.5	13.9	31.2	50.7	71.8	94.6	118.9	144.7	171.9	200.7	230.9
76.1 x 2.0	18.6	41.6	67.3	95.4	125.7	158.0	192.3	228.6	267.0	307.4
88.9 x 2.0	21.3	47.6	77.1	109.3	144.0	181.0	220.3	262.0	306.1	352.5
108 x 2.5	25.3	56.5	91.4	129.4	170.5	214.3	261.0	310.4	362.6	417.8

– Simplified calculation

Assumptions for the simplified calculation:

- Surface-mounted
- Stationary air
- Radiation not taken into account

The thermal transfer coefficient k_r will be calculated in the simplified calculation with the following formula:

$$k_r = \frac{\pi}{\alpha_a \cdot d_a}$$

α_a : Heat transfer coefficient, outside [W/(m²·K)]

Values for MapressCuNiFe:

- $\alpha_a = 8.1$ W/(m²·K)
- $\lambda = 50$ W/(m·K)

Calculation of the thermal emission \dot{Q}_R

The thermal emission is determined with the following formula:

$$\dot{Q}_R = (T_i - T_a) \cdot k_r$$

\dot{Q}_R : Heat flow for 1 m pipe [W/m]

k_r : Heat transfer coefficient [W/m·K]

T_i : Water temperature in the pipe

T_a : Room temperature

Graphical calculation of the heat emission

The values of the thermal flow \dot{Q}_R that can be calculated from the following figure are based on the general calculation of the thermal transfer coefficients k_r .

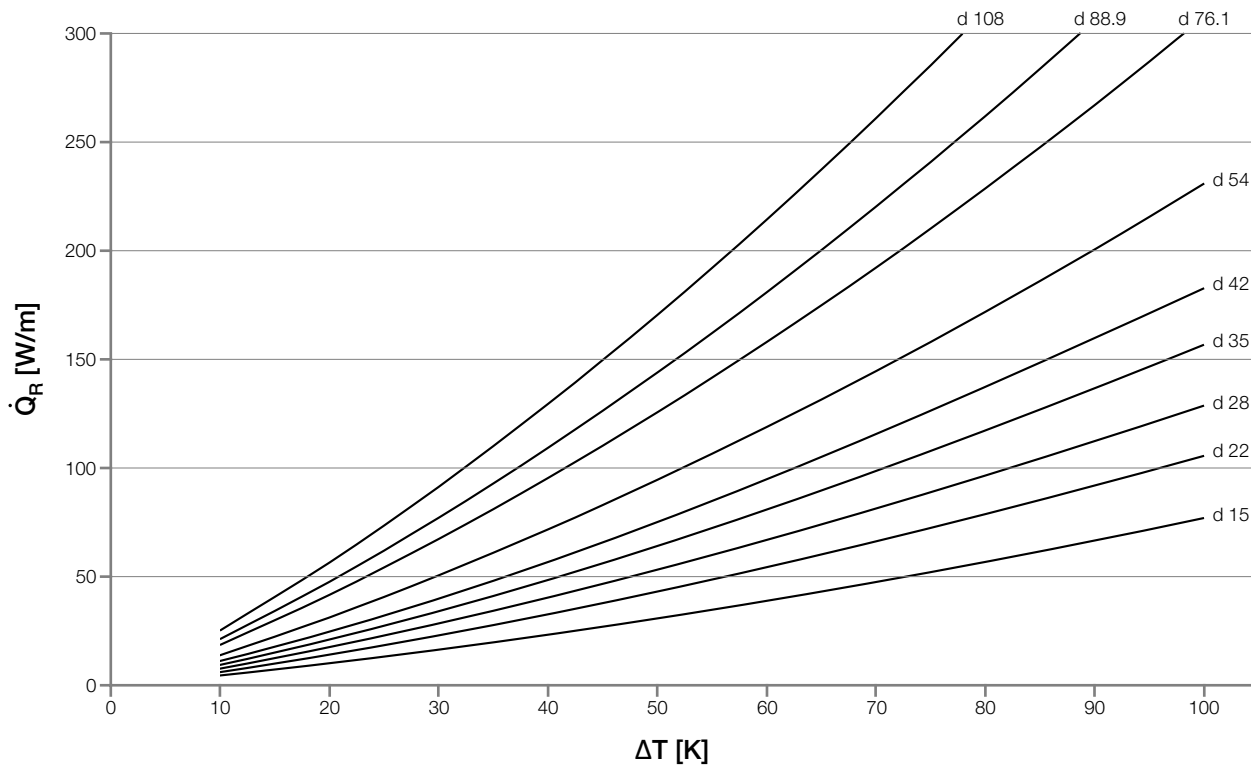


Figure 35: Heat emission MapressCuNiFe

\dot{Q}_R : Heat flow for 1 m pipe

ΔT : Temperature differential

1.4.5 Pressure loss tables

Pressure loss tables for the different applications of the Mapress pressfitting systems can be accessed in the Internet under www.international.geberit.com.

1.5 Installation

1.5.1 Mapress Stainless Steel

Making a Mapress press connection

A Mapress press connection is made as follows:

- Prepare the pipe and fitting for the pressing operation
- Make the connection with the threaded fitting
- Optional: With d 54 - 108 mm fit the mounting device MH 1
- Press the fitting



CAUTION Risk of corrosion

- ▶ Keep cutting tools and deburring tools free from C-steel chips
- ▶ Do not use cutting wheels to cut the pipes and fittings to length
- ▶ Only use cutting tools that are suitable for working with stainless steel



CAUTION Leaking press connection caused by damaged seal ring

- ▶ Deburr the outside and inside of the pipe ends completely
- ▶ Remove foreign bodies from the seal ring
- ▶ Do not tilt the pipe into the pressfitting
- ▶ Push the pressfitting onto the pipe, turning the pipe slightly
- ▶ Only use lubricants which are free from oil and grease

Prepare the pipe and fitting for the pressing operation

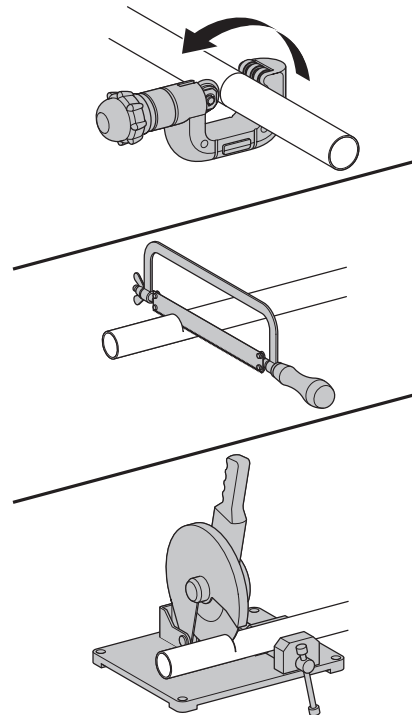
1. Check that the pipe and fitting are clean, undamaged and free from scoring or dents
2. Determine the pipe length

3.

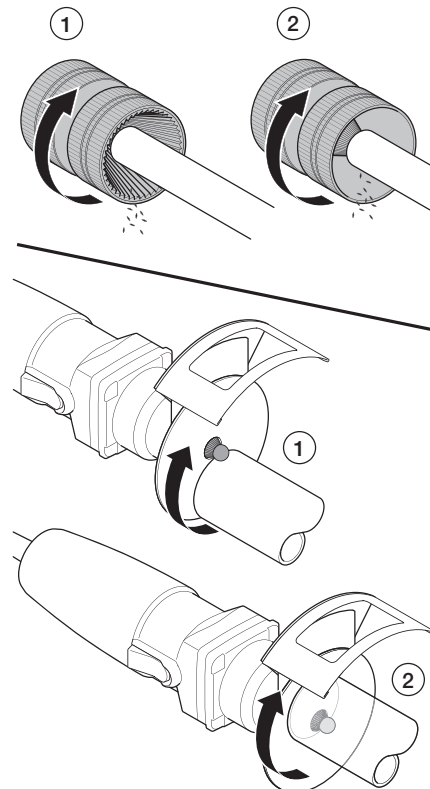


Only shorten the fittings with plain ends up to the maximum permissible shortening dimension k .

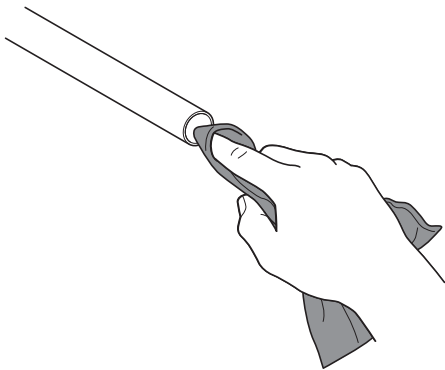
Cut the pipe to the correct length



4. Deburr the pipe ends



5. Clean chips from the pipe ends



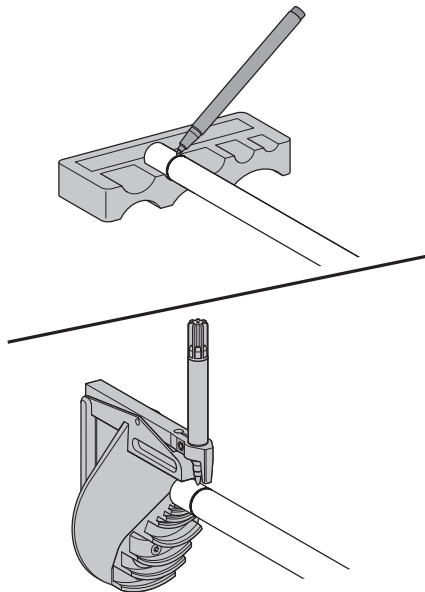
6.a



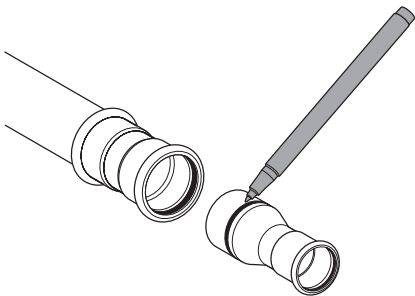
CAUTION
Insufficient mechanical strength

► Comply with the specified insertion distance

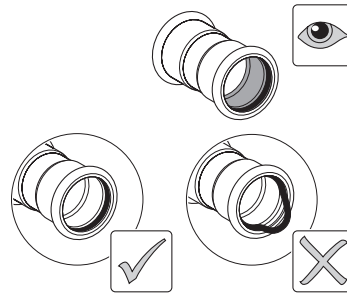
Mark the insertion distance



- 6.b On fittings with a plain end mark the insertion distance on the end



7. Check the seal ring

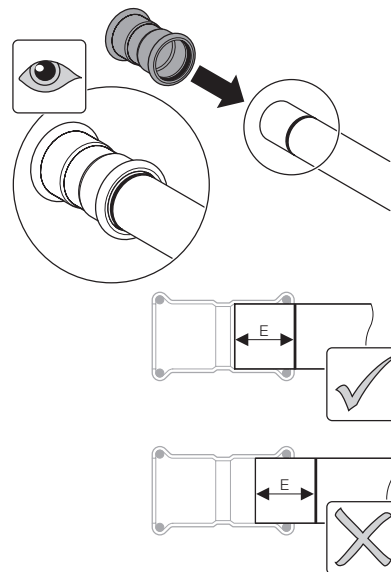


8.



The fitting can be pushed in more easily if oil and grease-free lubricant is applied or the fitting is immersed in water or soapy water.

Push the fitting onto the pipe up to the marked insertion distance



9. Align the pipe

System technology

Installation – Mapress Stainless Steel

Make the connection with the threaded fitting

1. Fix the pipe in position
- 2.



CAUTION
Leaking connection due to stress corrosion cracking

- ▶ Do not use Teflon for sealing

Seal in the threaded connection

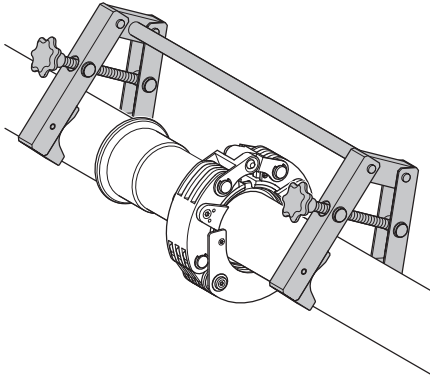
3. Insert the threaded fitting and screw into place, counterholding the threaded fitting

Optional: With d 54 - 108 mm fit the mounting aid MH 1



The installation dimensions are given in the operating instructions of the mounting aid.

- ▶ Clamp the pipes with the jaws of the mounting aid

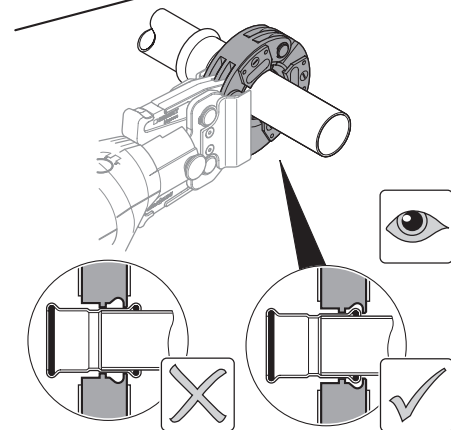
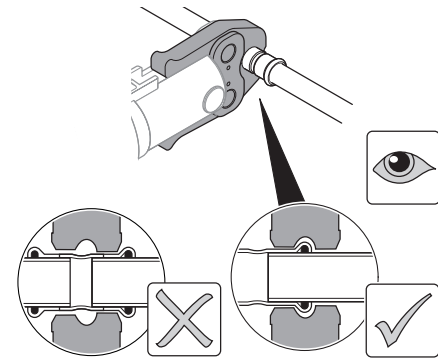


Press the fitting

Prerequisites

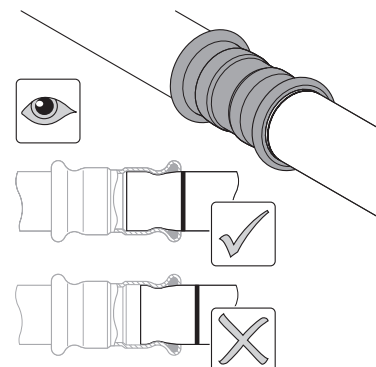
- The pipe or pre-assembled elements are aligned
- Threaded joints must be sealed in

1. Ensure that the diameter of the pressfitting matches the diameter of the pressing jaw or pressing collar
2. Press the fitting



Result

- The mark of the insertion distance is visible



1.5.2 Mapress Carbon Steel

Creating a Mapress press connection

A Mapress press connection is created as follows:

- Variant 1: Prepare the bare pipe and fitting for the pressing operation -or- version 2: Prepare the plastic coated pipe and fitting for the pressing operation
- Create the connection with the threaded fitting
- With d 54 - 108 mm: Mount the mounting aid MH 1
- Press the fitting



CAUTION

Risk of corrosion

- ▶ Do not use cutting wheels to cut the pipes and fittings to length
- ▶ Only use cutting tools that are suitable for working with carbon steel



CAUTION

Leaking press connection caused by damaged seal ring

- ▶ Deburr the outside and inside of the pipe ends completely
- ▶ Remove foreign bodies from the seal ring
- ▶ Do not tilt the pipe into the pressfitting
- ▶ Push the pressfitting onto the pipe, turning the pipe slightly
- ▶ Only use lubricants which are free from oil and grease

Variant 1: Prepare the bare pipe and fitting for the pressing operation

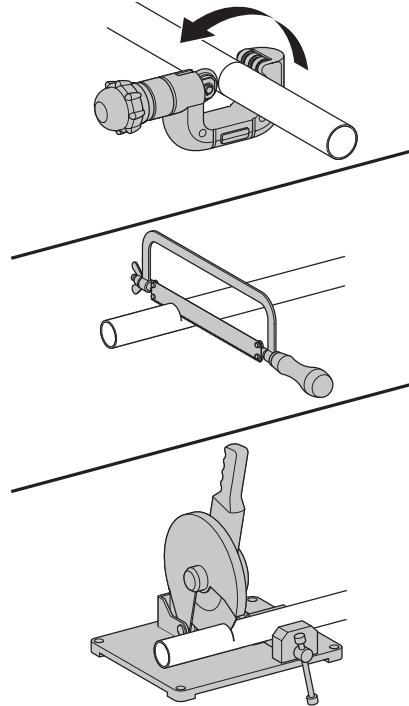
1. Check that the pipe and fitting are clean, undamaged and free from scoring or dents
2. Determine the pipe length

3.

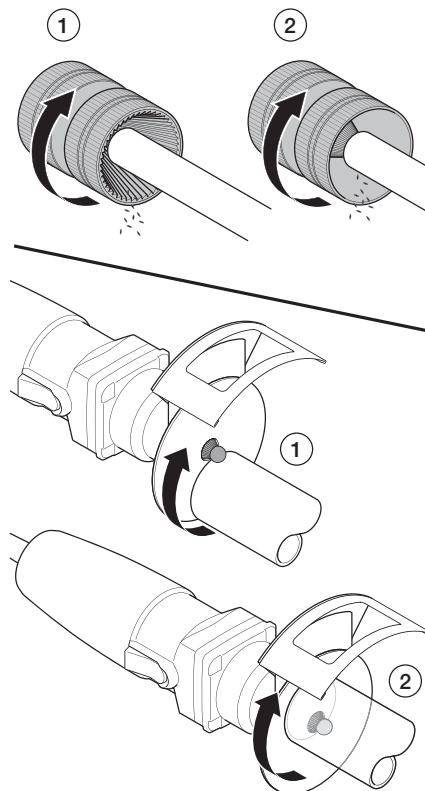


Only shorten the fittings with plain ends up to the maximum permissible shortening dimension k.

Cut the pipe to the correct length



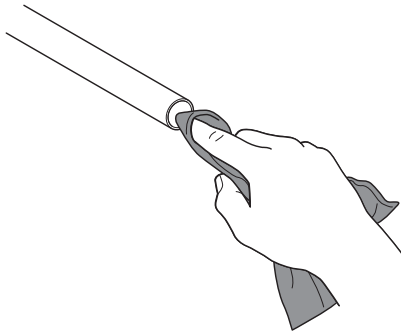
4. Deburr the pipe ends



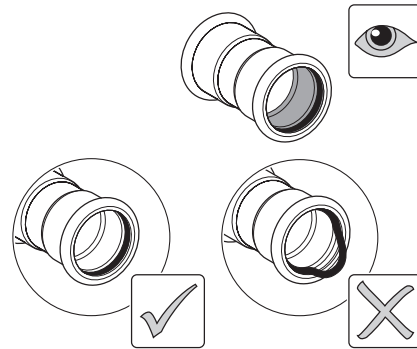
System technology

Installation – Mapress Carbon Steel

5. Clean chips from the pipe ends



7. Check the seal ring



6.a

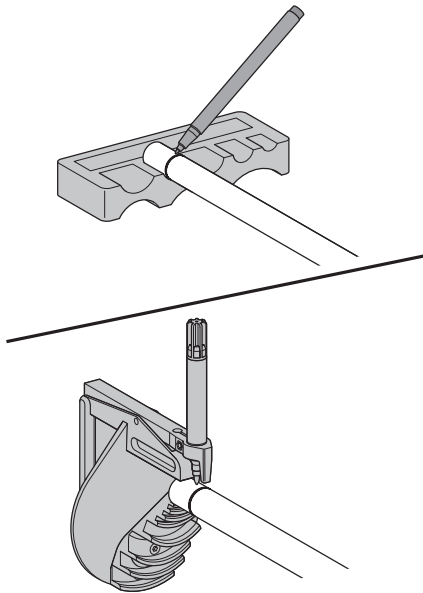


CAUTION

Insufficient mechanical strength

- ▶ Maintain the specified insertion distance

Mark the insertion distance

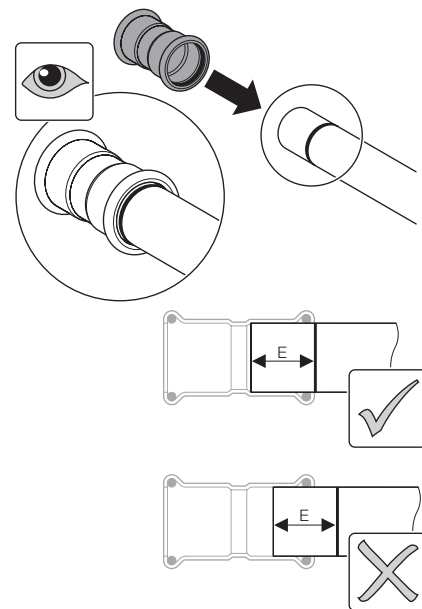


8.

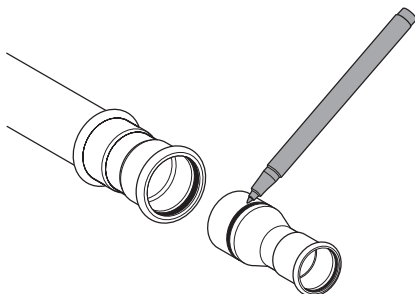


The fitting can be pushed in more easily if oil- and grease-free lubricant is applied or the fitting is immersed in water or soapy water.

Push the fitting onto the system pipe up to the marked insertion distance



- 6.b On fittings with a plain end, mark the insertion distance on the plain end



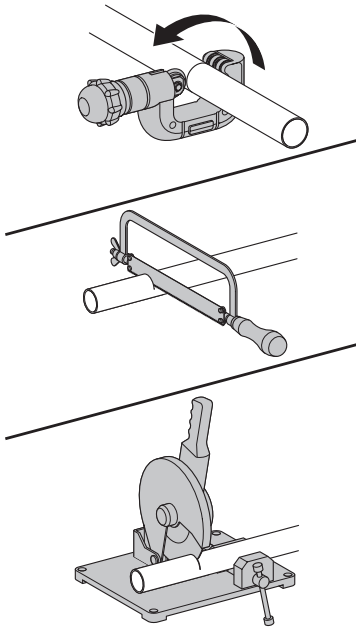
9. Align the pipe

Variant 2: Prepare the plastic coated pipe and fitting for the pressing operation

1. Check that the pipe and fitting are clean, undamaged and free from scoring or dents
2. Determine the pipe length
- 3.

i Only shorten the fittings with plain ends up to the maximum permissible shortening dimension k .

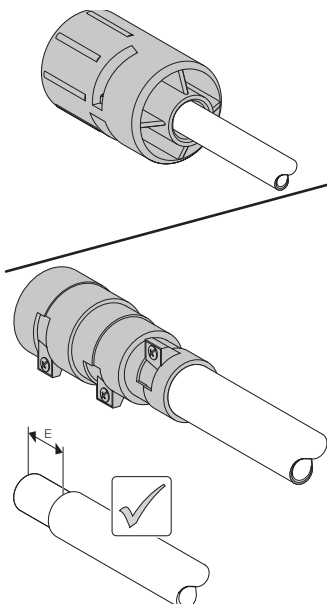
Cut the pipe to the correct length



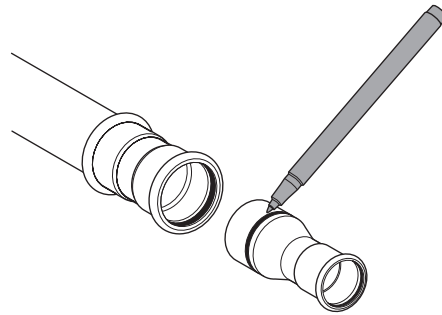
4.a

i If other tools are applied other than Mapress carbon steel stripping tools, the plastic coating must be stripped to the insertion distance.

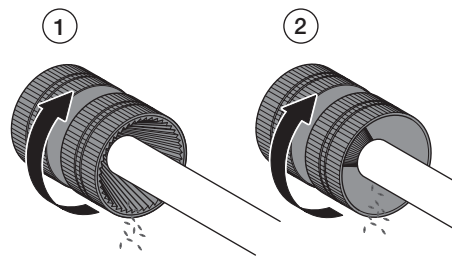
Strip the plastic coating and mark the insertion distance



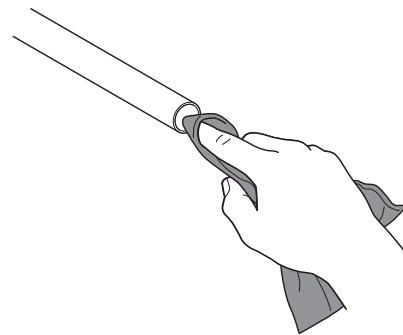
- 4.b On Mapress fittings with a plain end, mark the insertion distance on the plain end



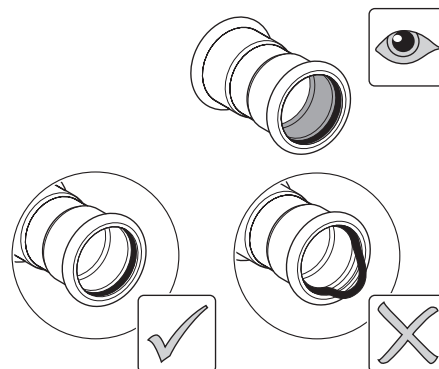
5. Deburr the pipe ends



6. Clean chips from the pipe ends



7. Check the seal ring



System technology

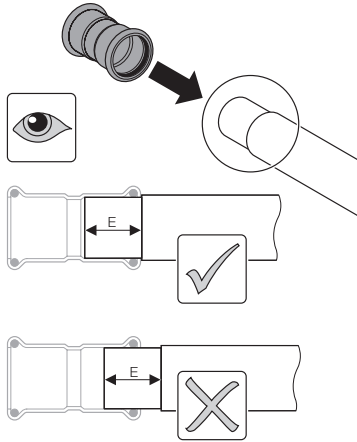
Installation – Mapress Carbon Steel

8.



The fitting can be pushed in more easily if oil- and grease-free lubricant is applied or the fitting is immersed in water or soapy water.

Push the fitting onto the system pipe up to the marked insertion distance



9. Align the pipe

Create the connection with the threaded fitting

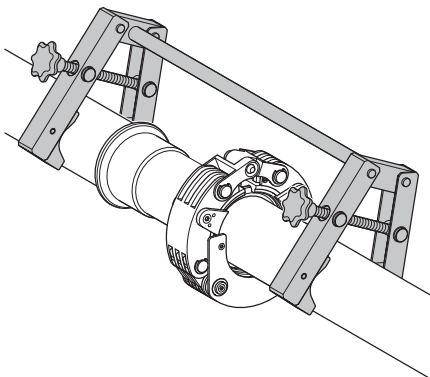
1. Fix the pipe in position
2. Seal in the threaded connection
3. Insert the threaded fitting and screw into place, counterholding the threaded fitting

Optional: With d 54 - 108 mm fit the mounting aid MH 1



The installation dimensions are given in the operating instructions of the mounting aid.

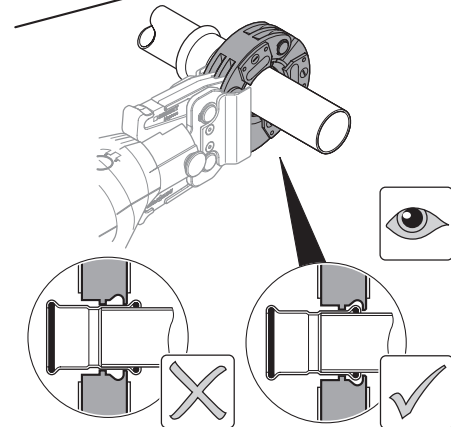
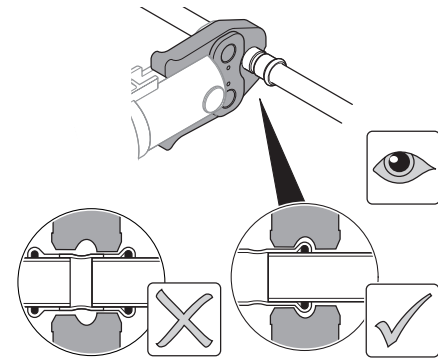
Clamp the pipes with the jaws of the mounting aid



Press the fitting

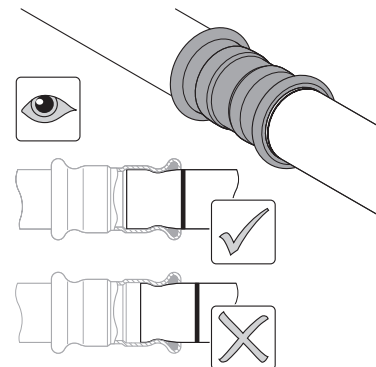
Prerequisites

- The pipe or pre-assembled elements are aligned
 - Threaded joints must be sealed in
1. Ensure that the diameter of the pressfitting matches the diameter of the pressing jaw or pressing collar
 2. Press the fitting



Result

- The mark of the insertion distance is visible



Perform a pressure test

The pressure test can be performed with water or air.

Perform the pressure test with air

1. Perform the tightness test
2. Perform the load test

Perform the pressure test with water



CAUTION

Pitting corrosion due to residual water in the pipe

- ▶ Leave the pipe full after the pressure test



Residual water in the pipe can increase the risk of corrosion due to concentration of chlorides.

- ▶ Perform a pressure test



You will find detailed information about pressure test on page 56.

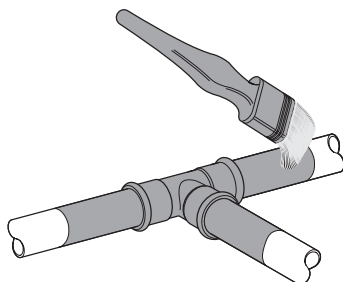
Mount the corrosion protection sleeve

1. Clean the pipe and fitting from dirt and humidity
- 2.



The primer does not have any resistance against corrosion. This is only used as a wash primer for the corrosion protection sleeve.

Now apply a coat of primer to the fitting and plastic coating of the pipe over a length of 20 mm



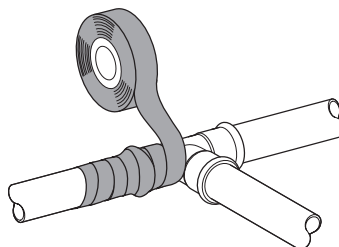
3. Let the primer dry

4.

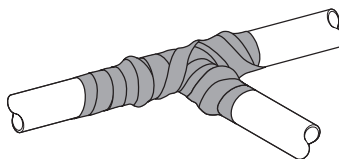


When applying the corrosion protection sleeve, make sure that there is an overlap of at least 15 mm and that the prepared part of the plastic coating is included.

Mount the corrosion protection sleeve



Result



System technology

Installation – Minimum distances and space requirements

1.5.3 Minimum distances and space requirements

Minimum distances between two pressed joints

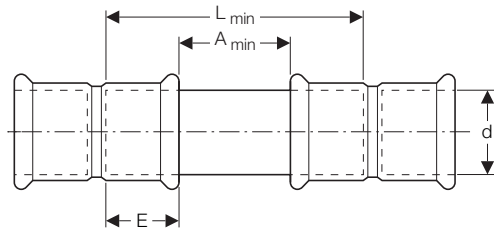


Figure 36: Minimum distance between two pressed joints

Table 60: Minimum distances between two pressed joints

d x s [mm]	A _{min} [cm]	L _{min} [cm]	E [cm]
15 x 1.6	1.0	4.4	1.7
15 x 1.0 / 1.2	1.0	5.0	2.0
18 x 1.0 / 1.2	1.0	5.0	2.0
22 x 1.2 / 1.5	1.0	5.2	2.1
28 x 1.2 / 1.5	1.0	5.6	2.3
35 x 1.5	1.0	6.2	2.6
42 x 1.5	2.0	8.0	3.0
54 x 1.5 / 2.0	2.0	9.0	3.5
76.1 x 2.0 / 1.5	2.0 / 3.0 ¹	13.6 / 12.6 ¹	5.3
88.9 x 2.0 / 1.5	2.0 / 3.0 ¹	15.0 / 14.0 ¹	6.0
108 x 2.0	2.0 / 3.0 ¹	18.0 / 17.0 ¹	7.5

¹ Dimension applies for pressing with a HCPS pressing device

Pipe depths in wall and ceiling outlets

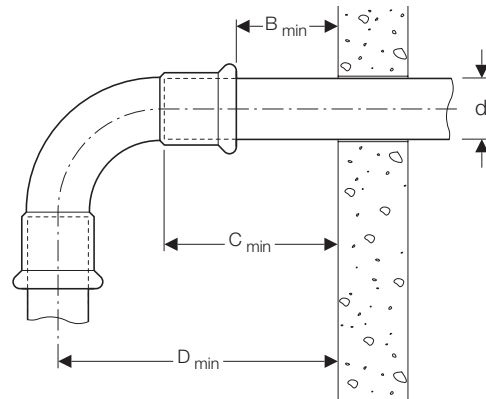


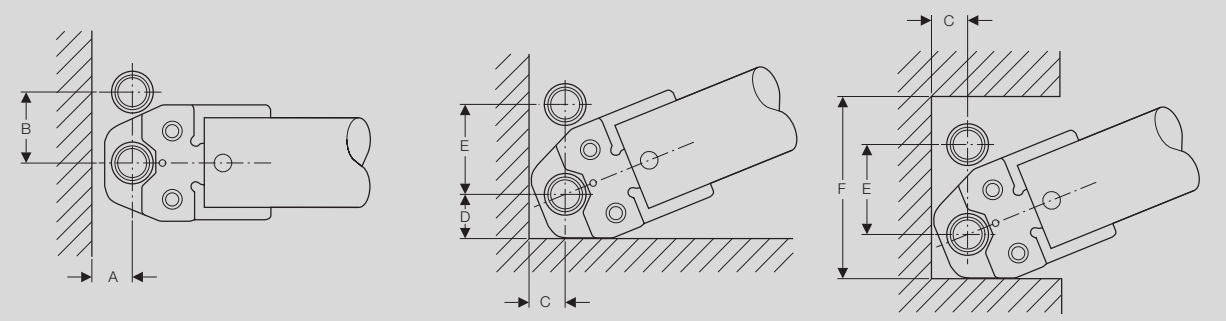
Figure 37: Pipe depths in wall and ceiling outlets

Table 61: Pipe depths in wall and ceiling outlets

d x s [mm]	B _{min} [cm]	C _{min} [cm]	D _{min} [cm]
15 x 1.6	3.5	5.2	7.7
15 x 1.0 / 1.2	3.5	5.5	8.5
18 x 1.0 / 1.2	3.5	5.5	8.9
22 x 1.2 / 1.5	3.5	5.6	9.5
28 x 1.2 / 1.5	3.5	5.8	10.7
35 x 1.5	3.5	6.1	12.1
42 x 1.5	3.5	6.5	14.7
54 x 1.5 / 2.0	3.5	7.0	17.4
76.1 x 2.0 / 1.5	7.5	12.8	22.3
88.9 x 2.0 / 1.5	7.5	13.5	24.9
108 x 2.0	7.5	15.0	29.2

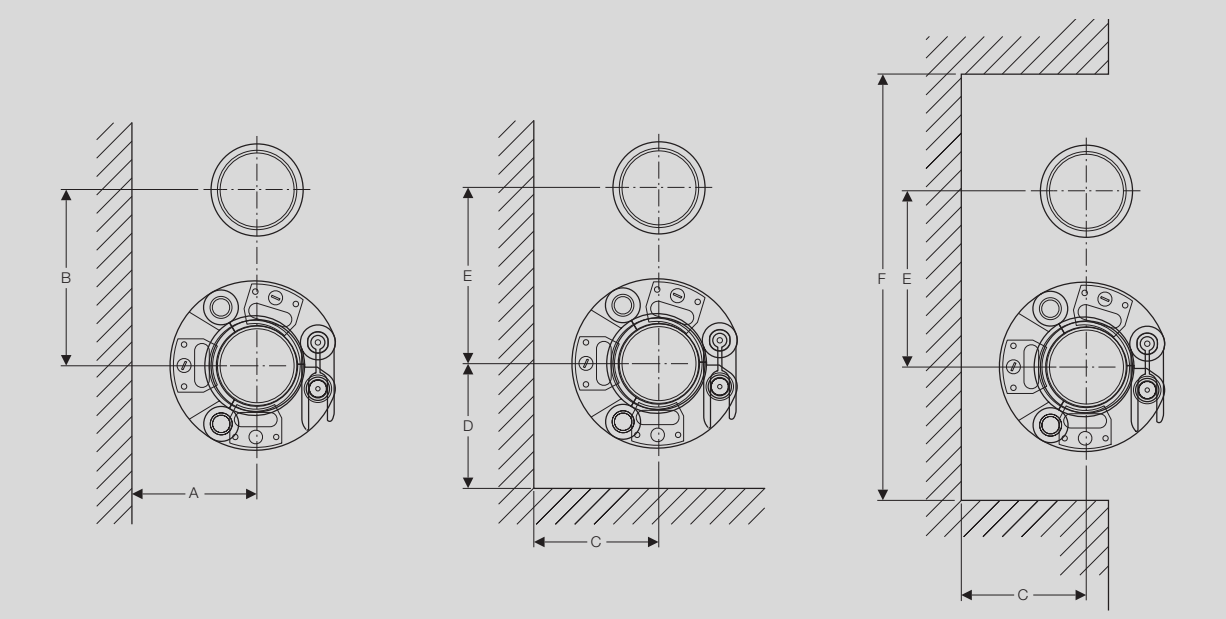
Space requirements when pressing with pressing tools

Table 62: Space requirements when pressing with pressing jaws for mounting on a smooth wall, in corners and in ducts



d [mm]	A [cm]	B [cm]	C [cm]	D [cm]	E [cm]	F [cm]
12 - 15	2.0	5.6	2.0	2.8	7.5	13.1
18	2.0	6.0	2.5	2.8	7.5	13.1
22	2.5	6.5	3.1	3.5	8.0	15.0
28	2.5	7.5	3.1	3.5	8.0	15.0
35	3.0	7.5	3.1	4.4	8.0	17.0

Table 63: Space requirements when pressing with pressing collars for mounting on a smooth wall, in corners and in ducts

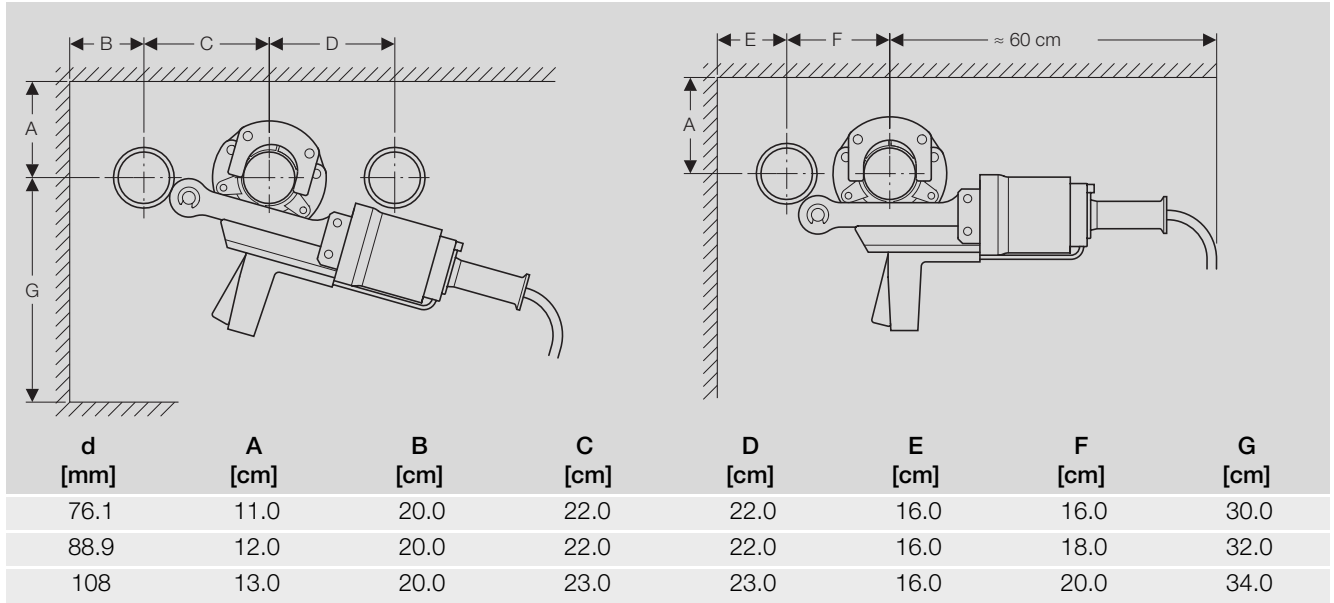


d [mm]	A [cm]	B [cm]	C [cm]	D [cm]	E [cm]	F [cm]
42	7.5	11.5	7.5	7.5	11.5	26.5
54	8.5	12.0	8.5	8.5	12.0	29.0
76.1	11.0	14.0	11.0	11.0	14.0	35.0
88.9	12.0	15.0	12.0	12.0	15.0	39.0
108	14.0	17.0	14.0	14.0	17.0	45.0

System technology

Installation – Minimum distances and space requirements

Table 64: Space requirements when pressing with a HCPS pressing device with complete pre-assembly and individual assembly of the individual system pipe sections



1.6 Corrosion

1.6.1 Corrosion Mapress Stainless Steel

Resistance to corrosion

Resistance to inner corrosion

Drinking water

Non-rusting Cr-Ni-Mo steels (material no. 1.4401) react passively to drinking water due to the chromium oxide protective layer.

Mapress Stainless Steel (Cr-Ni-Mo steel, material no. 1.4401) is therefore resistant to corrosion upon contact with all types of drinking water and ensures a high level of water quality.

Local corrosion effects such as pitting or crevice corrosion can only occur in drinking water or water which is similar to drinking water with non-permissible chloride contents.

Treated water and process water

Mapress Stainless Steel is resistant to corrosion with treated water such as:

- Demineralised water (decarbonised)
- Fully desalinated water (deionised, demineralised, distilled and pure condensates)
- Highest-grade water with a conductivity of <math>< 0.1 \mu\text{S}/\text{cm}</math> (Cr-Ni-Mo steel, material no. 1.4401)

All water treatment methods such as ion exchange or reverse osmosis are possible with Mapress Stainless Steel. Mapress Stainless Steel does not require any additional corrosion protection during water treatment.

Cooling water

The content of water-soluble chloride ions in cooling water should not exceed 250 mg/l

Resistance against external corrosion

Mapress Stainless Steel is resistant to corrosion of the atmosphere (ambient air).

The probability of corrosion is increased by contact with corrosion-promoting construction materials or by installation in corrosive atmospheres.

Resistance against bimetallic corrosion

Drinking water

The corrosion behaviour of non-rusting Cr-Ni-Mo steels (material no. 1.4401) is not influenced in mixed installations, irrespective of the flow direction of the water (no flow rule).

Colouring caused by deposits of other corrosive products does not indicate any risk of corrosion.

Corrosion protection

Protection against external corrosion

In areas at risk of corrosion, installation of pipes without corrosion protection should be avoided.

If there is the risk of corrosive substances (e. g. plaster, concrete, building materials containing chloride, nitrite or ammonium) acting on the pipes over prolonged periods, surface-mounting or suitable corrosion protection is recommended.

Protection against external corrosion must meet the following requirements:

- Waterproof
- Non-porous
- Resistant to heat and ageing
- Undamaged

The use of closed-cell insulation materials or hoses has proved to be effective as corrosion protection.

The minimum protection against external corrosion is coating, priming or painting.

Hoses or felt wrapping is not permissible, as felt retains absorbed moisture for prolonged periods and therefore promotes corrosion.



Planners and fitters are responsible for planning and implementing corrosion protection.

Protection against bimetallic corrosion

If non-rusting Cr-Ni-Mo steels (material no. 1.4401) are directly combined with galvanized steel pipes, bimetallic corrosion occurs on the galvanized steel pipes. Bimetallic corrosion can be prevented by the installation of spacers (length $L > 50$ mm surface in contact with water).

Gas installation

Mapress Stainless Steel Gas does not need any protection against corrosion due to the material properties of the non-rusting Cr-Ni-Mo steel (material no. 1.4401) This also applies to concealed routing and underfloor routing, providing the following situations can be reliably excluded:

- Indirect or direct contact with materials or substances containing chloride or other corrosion promoters
- Indirect or direct contact with electrical current

Technically proficient corrosion protection is required if these situations cannot be reliably excluded.

Influence of operational conditions and processing

Pitting corrosion after water pressure test

The probability of pitting corrosion is increased if residual water remains in the pipe after the water pressure test.

Electrical trace heaters

Electrical trace heaters can be used if it is ensured that the temperature of the inside wall of the pipe does not exceed 60 °C over prolonged periods.

Short periods of up to one hour per day are permissible at 70 °C for thermal disinfection.

Bending Mapress Stainless Steel system pipes

Heating (sensitisation) of the stainless steel pipes changes the material structure of non-rusting Cr-Ni-Mo steel (material no. 1.4401) and can cause damage resulting from intercrystalline corrosion.

Mapress Stainless Steel system pipes should therefore never be bent using artificial heat.



Mapress Stainless Steel system pipes can be bent cold on building sites with standard pulling bending tools up to a diameter of d 54 mm.

Sealing materials

Sealing tape and materials of Teflon which contain water-soluble chloride ions are not suitable for sealing stainless steel threaded connections, as they can cause crevice corrosion in drinking water pipes.

Suitable sealing materials are:

- Hemp sealing
- Plastic sealing tape and threads

Installation in concrete

In special areas of application, e. g. sprinkler systems, pipes of non-rusting Cr-Ni-Mo steel (material no. 1.4401) can be installed in concrete without any special thermal or acoustic insulation requirements.

During installation it must be ensured that the pipe is fully embedded in the concrete without formation of cavities.

Influence of insulating materials

Incorrectly used insulation can cause corrosion in pipes.

Insulation materials for thermal insulation of pipes made of non-rusting steel may contain up to 0.05 % water-soluble chloride ions.



Insulation materials and hoses of AS quality according to AGI-Q 135 are considerably below this level of maximum 0.05 % of water soluble chloride ions and are therefore particularly suitable for stainless steel.

Closed-cell insulating materials ensure effective corrosion protection, as they prevent the concentration of chlorides.

Solder / welding of stainless steel pipelines

We do not recommend solder joints with stainless steel pipelines for aqueous media due to the type of danger caused by knife-cut corrosion.

We do not recommend that stainless steel pipelines in drinking water installations are welded on the construction site using inert gas shielded arc welding. Even professional WIG / inert gas shielded arc welding cannot prevent annealing colours (oxide layers) resulting in the area of the weld seam.

Drinking water supply lines made of stainless steel should only be realised on construction sites using pressed joints due to possible damage caused by corrosion resulting from soldering or welding.

1.6.2 Corrosion Mapress Carbon Steel

Corrosion of heating and cooling installations

Resistance to corrosion

Resistant to inner corrosion

Amongst other things, the type of corrosion effects are influenced by the quality of the water and the operating conditions.

Mapress Carbon Steel is corrosion resistant in closed loop heating systems; in other words, there is no significant admission of oxygen.

The probability of corrosion of the non-alloy steel increases when oxygen enters into the heating system.

There is no risk of corrosive damage from oxygen that enters when filling and supplementing with water.

Corrosion-causing oxygen enters the system by flowing through open expansion vessels or when negative pressure occurs in the heating system.

Concentrations of oxygen greater than 0.1 g/m³ in the heating water indicate an increased probability of corrosion.



Mapress Carbon Steel is not corrosion resistant in respect to the condensate discharge of oil fuel value boilers. The condensation in these systems has a pH value of 2.5 - 3.5 and may also contain sulphuric acid.

Resistance against external corrosion

Normally the outer surfaces of an installation in buildings do not come into contact with watery corrosive medias.

Therefore, with Mapress Carbon Steel, outer corrosion can only occur after being exposed to unintended corrosive medias over longer periods (e.g. penetration of rainfall, moisture in the walls, condensed water, leaking water, spray or cleaning water).

– Mapress Carbon Steel fittings

Mapress Carbon Steel fittings are galvanically zinc-plated. The 8 µm thick zinc coating provides good corrosion protection against the short term effect of moisture.

– Mapress Carbon Steel system pipe, plastic coated

The plastic coating that is fitted onto the Carbon Steel system pipes ex-factory provides a good corrosion protection.

– Mapress Carbon Steel system pipe, externally galvanized

The 8 µm thick zinc coating of the Mapress Carbon Steel system pipes with outside galvanizing provides good corrosion protection against the short term effect of moisture.

Resistance against bimetal corrosion

Mapress Carbon Steel can be combined with all product materials in any sequence with closed water loops.

In this cases, Mapress Carbon Steel can be combined with Mapress Stainless Steel or Mapress Copper.

Corrosion protection

Protection against inside corrosion

The following measures delay the generation of corrosion:

- Adding oxygen binding media to the circulating water
- Setting the pH value of 8.5 - 9.5 necessary for Carbon Steel

The following must be observed when selecting water additives for corrosion prevention:

- Only use water additives that have been tested and approved by Geberit
- Observe the manufacturers' instructions for use



There is no danger of corrosion from oxygen that enters when filling and supplementing with water, as the oxygen is bound into iron oxide compounds as a result of the reaction with the inner steel surface of the system. In addition, the oxygen that is generated from the heated heating circuit water escapes when the heating system is de-aerated.

Protection against outside corrosion

Mapress Carbon Steel should not be permanently exposed to moisture.

In the case of installations in rooms with excessive exposure to moisture, the pipes should be installed outside of this area.

When installing in-wall or under screed, the Mapress Carbon Steel pressfittings and stripped sections of the pipe should be coated using an additional suitable corrosion protection.

If the pipes are installed under concrete ceilings, a contact foil should be used between the concrete ceiling and steel pipe (according to DIN 1988, Part 7, Paragraph 5.3) in addition to the pipe cladding.

Protection against outside corrosion is provided by:

- Coatings
- Plastic binders
- Corrosion protection binders

Protection against external corrosion must meet the following requirements:

- Waterproof
- Non-porous
- Resistant to heat and aging
- Undamaged

Thermal insulation material or hoses have been proven successful as a minimum protection against outside corrosion.

Thermal insulation materials are not an adequate corrosion protection with cold water installations.

Felt or similar materials should not be used for corrosion protection, as felt retains absorbed moisture for prolonged periods and therefore promotes corrosion.



Planners and fitters are responsible for planning and implementing corrosion protection.

Corrosion of compressed air installation

Mapress Carbon Steel is only resistant against corrosion in dehumidified compressed air systems with dry compressed air. Any humidity and air contained in the installation system may lead to corrosion.

1.6.3 Corrosion MapressCuNiFe

Resistance to corrosion

Mapress system pipes made of CuNi10Fe1.6Mn have an excellent corrosion-resistance, especially against sea water. The reason for the good corrosion-resistance is a natural thin protective layer that develops quickly under the influence of clean water.

This complicated protective layer mainly comprises copper(I) oxide and is improved using additional nickel and iron. The final layer develops quickly, within the first few days, but requires up to three months before it is completely developed. The decisive factor for the long-term behaviour of copper / nickel is the initial effect (exposition), which means that the pipes must be continually rinsed through using clean sea water. When a good surface layer has developed, the speed of the corrosion reduces over the years. If clear sea water is not available ferrous sulphate or NaDDTC (Natriumdiethyldithiocarbonat) should be added to the fresh water to enable the creation of the surface layer.

Copper-nickel alloys are some of the best corrosion-resistant copper materials.

In principle, copper-nickel alloys with 10 % nickel (Ni) have a good resistance against sea water. The presence of oxygen in the water is necessary to maintain the surface layer.

When the flow speed for a given geometry has reached a size that is too large, the protective layer may become damaged due to the effect of shearing stress from the sea water, and this may lead to impact erosion. According to DIN EN 85004-2, the flow speed should be between 1 m/s and max. 3.0 m/s, depending on the diameter.

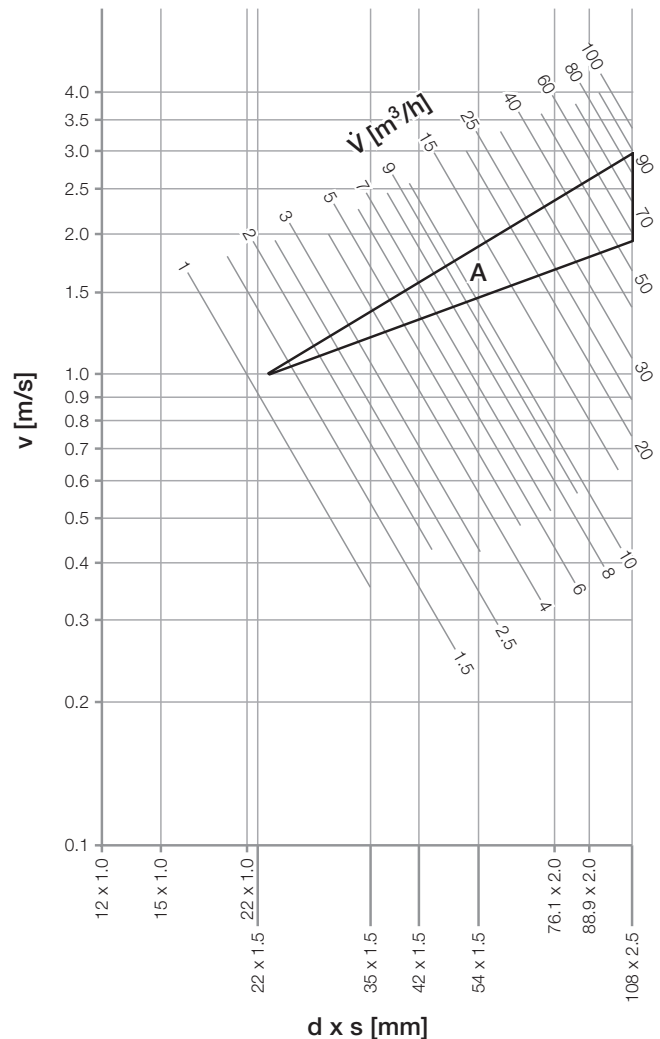


Figure 38: Flow speed Mapress CuNiFe according to DIN EN 85004-2

- v Flow speed
- \dot{V} Volume flow
- $d \times s$ Outside diameter \times Wall thickness
- A Recommended range for the flow speed

The proportion of iron in the copper-nickel alloy considerably improves the adhesive strength of the corrosion-protection layer and therefore the resistance against wearing corrosion, especially in sea water and other aggressive waters, such as briny water.

Resistant to inner corrosion

Copper-nickel alloy possesses a high resistance against chloride and crevice corrosion.

Intensive chlorination (dosage) can have a negative effect as the corrosion-resistance is reduced through wear.

1.7 Fire Prevention

1.7.1 Wall and ceiling feed-throughs

A distinction is made between combustible and non-combustible pipelines with fire protection for wall and ceiling feed-throughs.



The assignment to material classes is based on country-specific regulations.

1.7.2 Fire extinguishing and fire protection systems

Fire extinguishing and fire protection systems serve as preventative installations to:

- Protect and save persons
- Prevent spreading of the fire

The medium for preventative fire protection in pipe systems can be drinking water or non-drinking water.

Fire extinguishing and fire protection systems are:

- Hydrant systems (on real estate)
- Fire extinguishing water pipes
- Fixed water extinguishing systems

Fire extinguishing water pipes

Extinguishing water pipes are fixed installation pipes with fire extinguishing hose connection devices which can be closed off (wall hydrants as self-help facilities and use by the fire brigade).

Fire extinguishing pipes are subdivided into the following:

- "Wet" extinguishing water pipes: The riser pipe is wet and constantly filled with drinking water
- "Dry" extinguishing water pipes: The riser pipe is dry and is filled with water which is not suitable for drinking and used by the fire brigade
- "Wet/Dry" extinguishing water pipes: The riser pipe is dry and when required is filled with water from the drinking water network and taken into operation by remote actuation of taps

Extinguishing water pipes are part of the drinking water installation and do not require any additional approvals.

Fixed water extinguishing systems

Fixed water extinguishing systems are fixed fire extinguishing and fire prevention installations which independently detect and report a fire and automatically initiate the extinguishing procedures.

Fixed water extinguishing systems are subdivided into the following:

- Systems with open nozzles (e.g. spraying water extinguishing systems or tank irrigation systems)
- Systems with closed nozzles (such as sprinkler systems)

These systems are subject to the approval specifications of the VdS association.

1.8 Noise Insulation

Pipelines do not represent additional sources of noise.

However, they may transmit noises (solid-borne noise) that have other origins (appliances, taps) and must therefore be installed with sound insulation.

1.9 Additional work



The country-specific regulations and guidelines must be observed in the following description for additional work.

1.9.1 Pressure test

Completed pipes must be tested for tightness before they are covered or painted. They should be tested with a pressure test.

The test medium depends on the installation and planned commissioning.

If the pipe system remains unfilled after a pressure test, a pressure test with air should be performed.

The test medium and the results of the pressure test should be documented in a pressure test report.

Pressure test for drinking water installations

Tightness test with air

The tightness test for drinking water installations with compressed air or inert gases is also described in the information sheet "Tightness test for drinking water installations with compressed air, inert gas or water" of the ZVSHK / BHKS. For safety reasons, the test pressures are set to a maximum value of 3 bar which also applies for gas pipes.

The tightness test must be performed as follows:

- The test pressure is 110 mbar
- The test time is at least 30 min with a maximum pipe volume of 100 l; each additional 100 l increases the test time by 10 minutes

The tightness test is followed by a load test.

The load test must be performed as follows:

- The maximum test pressure is 3 bar up to DN 50; at DN 50 - DN 100 1 bar max
- The test time is 10 minutes after exposure to pressure

Pressure test with water

The tightness test with water is described in the ZVSH / BHKS information sheet "Tightness test of drinking water installations with compressed air, inert gas or water".

The tightness test with water should be performed directly before commissioning for reasons of hygiene and chemical corrosion. If this is not possible, the system must remain completely filled until commissioning. If necessary, disinfectant must be added to the water (for additional information please refer to the ZVSH / BHKS information sheet)



The medium for the pressure test with water must be of drinking water quality to prevent contamination of the pipe system.

If water remains in a pipe which contains air after a water pressure test, there is a higher risk of pitting corrosion, especially if the pipe system is not completely closed. This higher risk of corrosion results from evaporation of the remaining water which leads to an increase in the chloride ion content in the remaining liquid phase.

Pressure test for heating installations

The pressure test in installed pipes is generally performed with water (e. g. in accordance with DIN-VOB 18380)

The following must be observed during the pressure test on heating installations:

- The test pressure is 1.3 times the operating pressure at all points of the system, but at least 1 bar overpressure
- Immediately after the cold water pressure test, it should be checked that the system remains tight even at the highest temperature. For this purpose, the system must be heated to the calculated highest temperature.
- No pressure drop may occur during the test
- The pressure test must be adequately documented

Pressure test for natural gas installations

The pressure test for natural gas installations is performed, for example, according to DVGW G 600 / TRGI 86/96.

The type of pressure test depends on the operating pressure:

- Pipes with operating pressures of up to 0.1 bar must undergo a preliminary and main test.
- Pipes with operating pressures ranging from 0.1 to 1 bar must undergo a combined load and tightness test

Preliminary and main test

The preliminary test (tightness test) must be performed as follows:

- The test medium is either air or inert gas (e. g. nitrogen or carbon dioxide)
- The test pressure is 1 bar
- The test time is 10 mins., during the test the pressure should not drop
- The preliminary test must be adequately documented

The main test (tightness test) must be performed as follows:

- The test medium is either air or inert gas (e. g. nitrogen or carbon dioxide)
- The test pressure is 110 mbar
- The test time is 10 mins. after temperature compensation has been completed
- The main test must be adequately documented

Combined load test and tightness test

The combined load test and tightness test must be performed as follows:

- The test medium is either air or inert gas (e. g. nitrogen or carbon dioxide)
- The test pressure is 3 bar
- The test time is at least 2 hours after completed temperature compensation of 3 hours
- During the test time possible changes in temperature in the test medium must be observed
- A pressure recorder class 1 and a pressure gauge class 0.6 must be used.
- The pressure test must be adequately documented

Pressure test for liquid gas installations

The pressure test for liquid gas installations is performed, for example, in accordance with TRF 1996.

The requirements of the pressure test apply for low and medium pressure pipes.

The pressure test can be performed with air or nitrogen and also with water.

The pressure test with air or nitrogen must be performed as follows:

- The test pressure is 1.1 times the permissible operating overpressure, but at least 1 bar,
- The minimum test time is 10 mins. after temperature compensation has been completed
- The pressure test must be performed together with the corresponding equipment
- The pressure test must be adequately documented

The pressure test with water must be performed as follows:

- The pressure test with water must be performed at 1.3 times the permissible operating overpressure
- If a pressure test is planned for initial or periodical tests, corresponding discharge connections should be provided when the pipe is installed, or the layout should be designed for bottom discharge
- The pressure test must be correspondingly documented

1.9.2 Flushing pipes

The pipes are flushed before commissioning with drinking water or an intermittent mixture of compressed air and water.

More information on flushing drinking water pipes is given in DIN 1988 and the information sheets of the ZVSHK / BHKS.



The medium for flushing the pipes must be of drinking water quality to prevent contamination of the pipe system.

1.9.3 Insulation

General

The insulating of the pipelines serves to avoid

- heat loss
- heating of the media to be transported through the surroundings and
- propagation of sound

Drinking water installation

Drinking water pipelines (TW) must be protected against the formation of condensation and against heating. Drinking water pipelines that transport cold water should be installed at a sufficient distance from sources of heat so that the water quality is not affected by heating.

Pipelines for drinking water (TWW) and hot water lines (TWZ) must be insulated against unallowable loss of heat due to energy saving measures and for hygienic reasons.

Heating installations

The insulating of water heating systems is an energy saving measure. This measure for environmental protection serves to reduce the discharge of CO₂. In the private area, energy consumption for heating is the largest individual item with 53 %.

Cooling water system

The main task of the cold insulation is to prevent condensation formation and reduce the loss of energy over the complete period of using the cold water pipelines. The safe and permanent prevention of higher energy costs and the dew point temperature can only be achieved by using the correct dimensioning.



Insulation materials / insulating hoses can trigger corrosion attacks on the pipelines. As a result, special care must be made to the suitability of the materials to be used, when selecting them.

1.9.4 Disinfection

Pipe disinfection is necessary in the case of hygienic requirements or after contamination. Chemical disinfection according to W 551 or thermal disinfection at 70 °C according to W 291 can be performed.

The following DVGW data sheets must be observed during disinfection:

- W 291 (03/2000)
- W 551 (04/2004)

System technology

Additional work – Descaling

1.9.5 Descaling

Limescale deposits on Mapress Stainless Steel with the butyl rubber seal ring (CIIR) can be removed if necessary with limescale removers which have been approved by Geberit.

Geberit is unable to make any statements on the effectiveness of the limescale remover.

When using the limescale remover the following must be observed:

- Limescale removers must be checked to ensure that they are compatible with the seal ring CIIR black. Approval can be obtained from Geberit
- Always observe the manufacturer's instructions for use

Table 65: Mapress Stainless Steel limescale remover

Limescale remover	Chemical formula	Concentration	Temperature for use [°C]	Remarks
Sulfamic acid	H_2NSO_3H	5 - 10% aqueous solution	25	Manufacturer: Hoechst
Citric acid	$HO C CH_2 CO_2 H_2 CO_2$	25% diluted	20	For slight deposits For short-term use

1.9.6 Equipotential bonding

Metallic gasses and water supply lines must be integrated into the equipotential bonding of the building. Equipotential bonding must be provided for all electrically conductive pipelines. The person installing the electrical system is responsible for the equipotential bonding.

The following pipelines are electrically conductive and must be integrated into the equipotential bonding:

- Mapress Stainless Steel
- Mapress Stainless Steel Gas
- Mapress Carbon Steel, zinc-plated on the outside
- Mapress Carbon Steel, zinc-plated on the inside and outside

Piping systems with Mapress Carbon Steel system pipes, plastic coated, are not electrically conductive and do not have to be integrated into the main equipotential bonding. Therefore they are not suitable for the additional equipotential bonding.

1.9.7 Operation of the pipe installations

All applicable regulations must be observed for commissioning of pipe installations.

The system installer must brief the owner or manager on the installation. This must be documented by a handover and acceptance report.

The system owner or manager must also be given the maintenance and operating instructions for the installed taps and appliances.

The owner or manager of pipe installations is obliged to keep the system in correct working order.

Pipe installations must be run so that malfunctions and manipulation of the operational safety of the system is excluded.

The system owner is advised to conclude a maintenance contract with the installation company.

2 Application technology

2.1 Building applications



The country-specific regulations and guidelines must be observed in the following description for building applications.

2.1.1 Drinking water installation

Types and quality

The drinking water installation includes:

- Cold water pipes [TW]
- Hot water pipes [TWW] (85 °C conforming to DIN 1988)
- Circulation pipes [TWZ]
- Extinguishing water pipes [TW] conforming to DIN 1988-6 and DIN 14462 for the applications wet, dry / wet and dry

The quality of drinking water must meet the stipulations of the European Drinking Water Ordinance of 1998 on the quality of water for human consumption and the Drinking Water Ordinance (DWO).

In Germany, in addition, the DIN EN 12502 for material selection and the national standard DIN 50930-6 "Influencing water quality" also apply. The materials are selected on the basis of a new drinking water analysis in compliance with DIN EN 12502 and DIN 50930-6.

Pipe layout

General

The drinking water is distributed to the draw-off points on the various floors. The floor pipes branch from the riser pipes.

Distribution behind floor taps is possible with:

- Conventional T-piece installation
- Floor manifold ¹

Various versions of the pipe arrangement can be routed to the draw-off points. The constantly increasing demands regarding optimum hygiene and corrosion resistance as well as thermal and acoustic insulation require a technically sound pipe layout design by the planner and fitter. The pipes are either routed over the unfinished floor of the intermediate floors or inside pre-wall elements.

Conventional T-piece installation is replaced by joint-free, fully flexible pipes in one pipe dimension. The selection of a correct pipe arrangement ensures excellent drinking water distribution without stagnation in the intermediate floor manifold. In addition, the technical actions for minimising the growth of Legionella bacteria are provided.

Specifications for intermediate floor and individual supply pipes without circulation with a water volume of < 3 litre are generally fully met by one pipe dimension. Due to the low water content, the water is swiftly replaced after stagnation phases.

The following must be taken into account when planning pipe arrangements:

- Pipe arrangement
- Pipe laying
 - Type of prewall installation
 - Concealed installation in conventional masonry slits
- Location, type and number of the water draw-off points
- Type of use or frequency of water draw-off

When planning the pipe arrangement, all technical rules, standards and regulations must be taken into account. In addition, the following points must be complied with:

- Available pressure for the pipe should be used as far as possible
- The flow rates should be kept high
- Continuous flow through the entire pipe layout
- On draw-off points which are not used often, for reasons of hygiene (swift water replacement after stagnation phase) the pipe layout should be circular

For economical pipe layouts in intermediate floor installations individual pipes, series-connected pipes, circular pipes or a combination of these should be selected.

Pipe layouts such as T-piece installations or individual supply lines should only be selected for hygienic reasons if water is daily drawn off from the connected draw-off points.

The most economical and best hygiene conditions are series-connected and circular pipes. In comparison to all other pipe layouts the circular pipe systems have advantages due to high flow rates with the same pressure and heat distribution.

In addition, higher water draw-off is possible with the circular pipes and with small pipe diameters. The planner can select the most suitable version of the following illustrated and described pipe layouts.

1. The Mepla lined metal pipe in rolls is very suitable to this purpose due to its flexibility.

Conventional T-piece installation

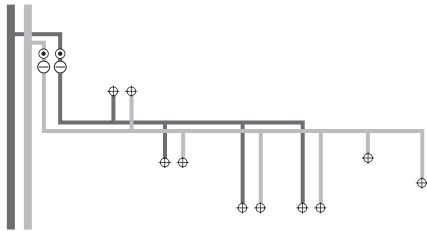


Figure 39: Conventional system

Advantages of conventional T-piece installation:

- Prefabrication of the complete unit or sections
- Efficient installation

Disadvantages of conventional T-piece installation:

- Possibly greater stagnation phases
- Draw-off points must be used regularly
- Greater pressure loss than in individual supply pipe systems

Individual supply pipe system

With the individual supply pipe system each draw-off point is connected to a separate supply pipe from the intermediate floor manifold.

This installation method is selected if there are only short pipe lengths between the manifold and the draw-off points, there is only a low pipe pressure and the draw-off points cannot be combined in groups with series connection or circular pipes.

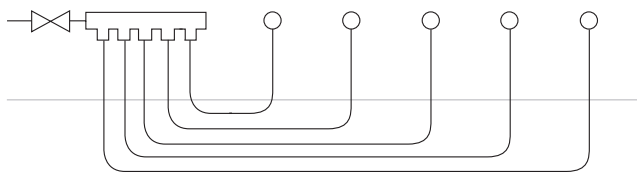


Figure 40: Individual supply pipe system

Advantages of the individual supply pipe system:

- Small pipe cross-sections
- Low water content
- Minimised pressure losses
- Individual connection for higher water requirements
- Less planning and calculation work
- Quick and easy pipe installation

Disadvantages of the individual supply pipe system:

- Greater stagnation phases
- Draw-off points must be used regularly
- Greater space requirements for pipes and intermediate floor manifold

Series-connected pipe system

The pipe layout is routed from one draw-off point directly to the next with double connections. Draw-off points are combined in groups and several draw-off points supplied by a joint pipe.

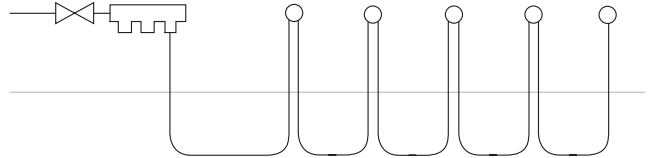


Figure 41: Series-connected pipe system

Advantages of the series-connected pipe system:

- Simple pipe layout
- Less pipe requirements
- Quick installation
- Low space requirements for intermediate floor manifold
- Low stagnation volume due to fast water replacement
- Optimum hygiene if a draw-off point which is frequently used is at the end of the row

Disadvantages of the series-connected pipe system:

- Higher pressure loss
- Larger draw-off point at beginning of row if possible

Circular pipe system

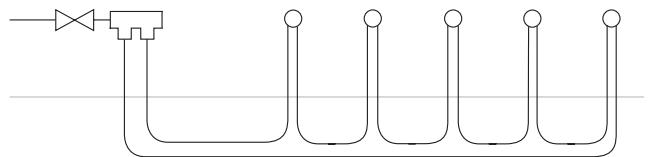


Figure 42: Circular pipe system

Advantages of the circular pipe system:

- Lower pressure loss enables higher water draw-off and considerably more draw-off points with the same size pipe cross-section
- More favourable pressure losses:
 - Approx. 30% in comparison to series-connected pipes
 - Approx. 50% in comparison to conventional T-piece installation
- Various draw-off points can be connected at greater distances from the intermediate floor manifolds or riser pipes
- Less space requirements for intermediate floor manifolds, as only two connections depending on the number of draw-off points
- Regular pressure and heat distribution
- Optimum water replacement
- Low stagnation times, replacement of the water content when one draw-off point is used
- The best pipe layout from a hygienic viewpoint, even with draw-off points which are not often used

Combined circular pipe system

The combined circular pipe system is suitable for pipe layouts with high water draw-off.

Individual draw-off fittings with a flow of $\dot{V}_R = 0.4$ l/s can each be connected with a circular pipe.

Advantages of the combined circular pipe system:

- At low supply pressures efficient hydraulic water supply
- Approx. 30% lower pressure losses in comparison with individual supply pipes

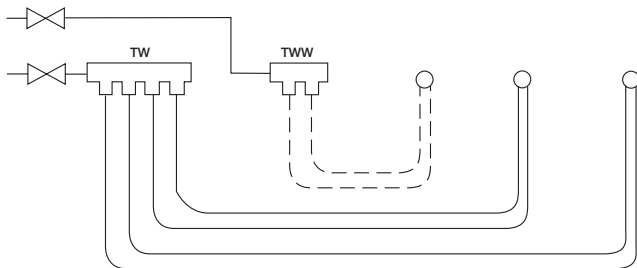


Figure 43: Combined circular pipe system

TW Cold drinking water

TWW Hot drinking water

Combined pipe system

The individual supply pipe system, series-connected supply pipe system and circular pipe system can be combined.

Installation example of a high-standard apartment:

- Individual WC supply line
- Series-connected double washbasin
- Kitchen: Circular pipe with dishwasher and washing machine
- Circular pipe for shower and bathtub with high water requirements

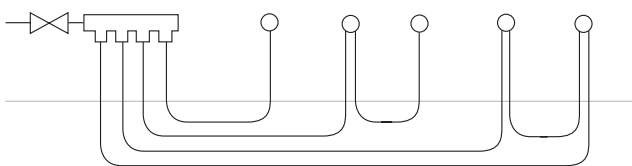


Figure 44: Combined pipe system

Advantages of the combined pipe system:

- Pipe layout can be adapted to the respective requirements
- High water requirements are met, even at draw-off points with high requirements, with small pipe diameter
- Low pressure losses with regular pressure and heat distribution
- Low degree of stagnation
- Optimum water replacement at draw-off points which are not often used

Combined pipe system

The pipe layout is a combination of individual supply pipe and circular pipe with a T-piece connection to the draw-off points.

The draw-off points can be connected in variable pipe layouts.

- Individual WC supply line
- Larger water draw-off points as circular pipe

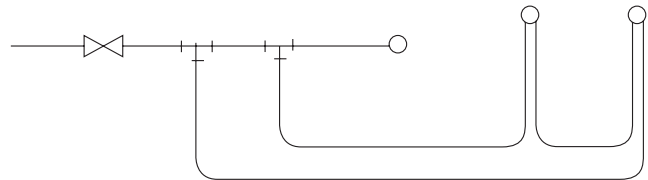


Figure 45: Combined pipe system

Block pipe system

Combinable sanitary connections (groups, blocks) such as shower and bathtub, WC, bidet or double sink branch as several series-connected connections from a joint intermediate floor manifold. The connections are either single or double connections.

Advantages of the block pipe system:

- Shorter pipe lengths
- Low space requirements for intermediate floor manifold

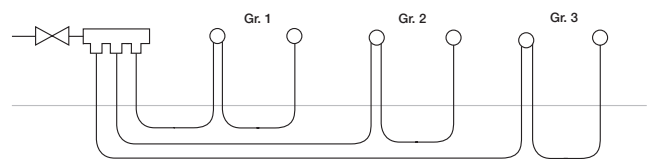


Figure 46: Block pipe system

Gr. Group

Group high-standard pipe system

In this pipe layout the cold water pipe is a circular pipe. The hot water is routed from the hot water intermediate floor manifold through to the last draw-off point of the individual group as a series-connected pipe and then back as a circulation pipe to the intermediate floor circulation collector.

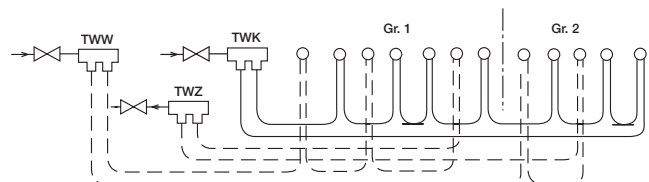


Figure 47: Group high-standard pipe system

TWK Cold drinking water

TWW Hot drinking water

TWZ Drinking water circulation

Gr. Group

Application technology

Building applications – Drinking water installation

Advantages of the high-standard group pipe system:

- No stagnation, optimum water replacement and optimum water distribution (cold water pipe as a circular pipe)
- All hot water draw-off points as series-connected pipe with circulation
- Operation prevents growth of Legionella bacteria
- Regular hot water temperature distribution with circulation collector

Disadvantages of the high-standard group pipe system:

- High space requirements for intermediate floor manifold or collector

Drinking water hygiene

Drinking water is our most valuable resource. It cannot be replaced.¹

The planner, installer and owner of a drinking water installation are responsible for ensuring drinking water hygiene in the system. Planning, installation and operation of a system must comply with specific standards and codes of practice in accordance with hygienic considerations.

Planning

When planning drinking water installations, the following points must be taken into account:

- Use of certified/approved installation materials (DVGW approval mark)
- Planning of large projects is based on the building description and use of the individual rooms, preventing over-dimensioning and stagnation (bypass pipes/dead pipes are not permitted)
- Insulation of hot and cold water
 - Cold water < 20 °C
 - Hot water > 55 °C
 - Mixture of cold/hot water only directly before the draw-off point
- System planning should take into account that during subsequent operation it should be possible to clean and disinfect appliance and system elements (accessible pipe inspection sections / sampling valves)
- Planning of fire extinguishing pipes in accordance with DIN 1988, Part 6 and the DVGW data sheet W405



Hot drinking water systems must be planned in accordance with DVGW W 551 and W 553. The size of the drinking water heater should be as small as possible.

Installation

When drinking water systems are installed, general and operative requirements must be taken into account:

General requirements:

- Processing of the installation systems in accordance with manufacturer's specifications
- Avoidance of combined installations with products of different manufacturers
- Hand-out of the pipe layout documentation to the owner

1. DIN 2001, section 2.1

Operative requirements:

- Storage of pipes/fittings in a dry and clean place
- Prevention of internal soiling on pipes and fittings
- Only remove films, caps etc. immediately before installation
- Do not lubricate or moisten sealing rings
- Protect installed system components against soiling (replace clean film or caps)

Commissioning

Commissioning must be performed in accordance with the following ZVSHK-information sheets:

- Tightness test on drinking water installations with compressed air, inert gas or water
- Flushing, disinfection and commissioning of drinking water installations

Operation

General instructions for operation:

- Always run drinking water installations in accordance with the applicable technical standards (cold water temperature < 20 °C and hot water temperature > 55 °C at each draw-off point)
- Prevent stagnation by suitable consumption
- Disconnect pipes which are no longer in use (DIN 1988-4)
- Do not use water from garden hoses as drinking water

Interruptions in operation:

- In the event of absence of, for example, a period of more than three days, the drinking water supply should be shut off before the water meter in buildings with one household and by the intermediate floor shut-off tap in blocks of flats (DIN 1988-8).
- When the system is taken into operation again once more after interruption, the taps should all be opened fully for a short period (for example 5 minutes) (DIN 1988-8).

Maintenance and repair:

- Coarse filters, hot water storage tank and heater should be regularly inspected and cleaned
- Keep shower heads, flow regulators and inserts on taps clean and remove deposits
- In large buildings a repair or hygiene plan should be compiled in accordance with VDI 6023 with the documentation of pipe system data



The plumber must instruct the owner on use of the system and remind the owner that he is obliged to have the system serviced regularly.

Disinfection of drinking water pipes (DVGW W 291 and W 551)

Disinfection of drinking water systems is described in the following DVGW codes of practice:

- W 291 (03/2000)
- W 551 (04/2004)

Data sheet W 291 applies to all installations and systems for transporting and distributing drinking water that come into either direct or indirect contact with the drinking water between the water source and the draw-off point of the consumer. Data sheet W 291 defines the disinfection chemicals that are used and the associated concentrations.

Data sheet W 551 applies to planning and installation, operation, maintenance, hygiene/microbiological monitoring and renovation of drinking water installations in public and private buildings. Reference is made to DVGW W 291 with regard to the chemicals and concentrations to use.



In order to achieve the optimum disinfection effect and to reliably prevent material damage, the specified concentrations and/or temperatures and times must be maintained for the period of action!

Directly following disinfection, the pipes must be thoroughly flushed with hygienically pure drinking water in order to remove the disinfectant agent and neutralised germs. All draw-off points must be flushed until the limit value of the Drinking Water Ordinance is reached.

In accordance with DVGW data sheet W 291, chemical disinfection of the system can be performed at room temperature using the chemicals listed in Table 1 and with the concentrations specified.

Table 66: Proposed disinfectants for pipelines according to DVGW W 291

Designation	Available as	Storage	Safety instructions ¹	Concentration for use ²
				Pipe Duration of use
Hydrogen peroxide H ₂ O ₂	Aqueous solution in various concentrations	Not exposed to light, cool, contamination must be avoided	Protective equipment required for solutions > 5%	150 mg/l H ₂ O ₂ min. 12 h / max. 24 h
Sodium hypochlorite NaOCl	Aqueous solution with max. 150 g/l chlorine	Not exposed to light, cool, enclosed in collection pan	Alkaline, corrosive, toxic, protective equipment required	50 mg/l chlorine min. 12h / max. 24 h
Calcium hypochlorite Ca(OCl) ₂	Granulate or tablets approx. 70% Ca(OCl)	Cool, dry, in sealed container	Alkaline, corrosive, toxic, protective equipment required	50 mg/l chlorine min. 12h / max. 24 h
Chlorine dioxide ClO ₂	Two components (sodium chloride, sodium peroxodisulphate)	Not exposed to light, cool, in sealed container	Oxidising agent, do not inhale chlorine dioxide gas, protective equipment required	6 mg/l ClO ₂ min. 12h / max. 24 h

¹ Comply with the corresponding instructions in the manufacturer's safety data sheets

² Recommended value



A cleaning and disinfection report according to DVGW W 291 must be filled in for each disinfection action.

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for drinking water installations:

- Mapress Stainless Steel 1.4401

Mapress Stainless Steel 1.4401 can be used for all types of drinking water without restriction.

The applications comprise:

- Cold water pipes [TW]
- Hot water pipes [TWW] (85 °C conforming to DIN 1988)
- Circulation pipes [TWZ]
- Extinguishing water pipes [TW] conforming to DIN 1988-6 and DIN 14462 for the applications wet, dry / wet and dry

Hygiene characteristics

The high level of drinking water quality is not affected by the Mapress Stainless Steel 1.4401.

Mapress Stainless Steel 1.4401 does not release any heavy metals to the drinking water and cannot cause nickel allergies. The permitted limit value for a nickel migration is significantly fallen below (in accordance with EU Directive 98: < 0.02 mg/l Nickel).

The approvals and hygiene tests for the pressed joints also include the gap between the pressfitting and the seal ring CIIR black made of butyl rubber.

The seal ring complies with the recommendations for plastics in drinking water systems (KTW recommendations) and has passed the test for hygiene according to the national DVGW data sheet W 270.

For extinguishing water pipes, Mapress Stainless Steel 1.4401 corresponds to the requirements of DIN 1988, Part 6.

Disinfection

Mapress Stainless Steel 1.4401 is also suitable for drinking water when chlorine is continually added for disinfection.

According to the Drinking Water Ordinance, a maximum of 1.2 mg/l chlorine (free chlorine in the disinfection solution) can be added. The limit value of free chlorine is allowed to be 0.3 mg/l in treated drinking water.

Exceptions are approved with a high or increased degree of microbial contamination up to 6 mg/l chlorine (free chlorine in the disinfection solution). The content of free chlorine in the drinking water is only allowed to rise to a maximum of 0.6 mg/l in this case.

Drinking water installation

Mapress Stainless Steel 1.4401 is suitable for all approved drinking water after treatment and does not require any additional measures for protection against corrosion.

Treated water

Mapress Stainless Steel 1.4401 with the black seal ring CIIR made of butyl rubber is suitable for all types of treated water such as partially desalinated (descaled, decarbonised) and fully desalinated (deionised, demineralised and distilled) up to highest-grade water with a conductivity less than 0.1 µS/cm and is absolutely corrosion-resistant.

All water treatment methods such as ion exchange or reverse osmosis etc. can be used.

Mapress Stainless Steel 1.4401 is not suitable for highest-grade water, pharmaceutical water or similar that has increased purity requirements exceeding the drinking water quality

Electrical trace heaters

Electrical trace heaters can be used if it is ensured that the temperature of the inside wall of the pipe does not exceed 60 °C over prolonged periods.

For thermal disinfection short periods of up to one hour per day are permissible at 70 °C.

2.1.2 Gas installation

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for gas installations:

- Mapress Stainless Steel Gas

Mapress Stainless Steel Gas has been checked and certified for gas installations according to the requirements of the following testing guidelines:

- DVGW VP 614
- ÖVGW G1 TR Gas (A)

Mapress Stainless Steel Gas is approved and certified for the following media:

- Natural gases
- Liquefied gases

Components

Mapress Stainless Steel Gas comprises the following components:

- Mapress Stainless Steel system pipe with DVGW test mark
- Mapress Stainless Steel Gas pressfitting

The pressfittings are factory pre-mounted with a yellow seal ring H-NBR made of hydrogenated acrylonitrile-butadiene rubber. The marking is displayed in table 43, “Marking of Mapress Stainless Steel gas pressfitting,” on page 18.

Information for the pressing tools to be used can be found in chapter “Mapress pressing tools” on page 21.

Laying

Mapress Stainless Steel Gas is HTB approved ($p_{HTB,max} = 5 \text{ bar}$) and can be laid on the wall as well as concealed in the wall.¹

Mapress Stainless Steel Gas is installed as an above ground pipeline within buildings (with HTB) and outside buildings (without HTB). There is no approval for installations underground.

An additional protection against corrosion with concealed installations is not necessary due to stainless steels outstanding resistance against corrosion.

Connections to commercially available gas fittings and components made from gunmetal, brass, aluminium die cast as well as ductile grey cast iron are made using pressfittings with thread or flange connections.

In case of repairs, the connection to the system pipe made of stainless steel or copper is established through material-specific adapter components of Mapress Stainless Steel Gas pressfittings or through commercially available adapters (such as GEBO adapter with union nut for gas) according to DIN EN or DVGW.

Such off-system adapters must be implemented with utmost care. Special care must be taken to ensure that the outer surface of the system pipe is correctly prepared and not damaged.

2.1.3 Heating installations

Process of the heating systems

Heaters are systems that have the main purpose of regulating temperatures by heating cold rooms so that the people staying in the room feel comfortable. Most heating systems are closed loop systems that are filled with water for transferring the heat. The medium is heated by the heat generator and is brought into circulation using a circulation pump and the heat is released again at defined positions in the room through irradiation and / or convection.

Therefore a heating system consists of the following fundamental processes:

- Heat generation
- Heat distribution
- Heat dissipation

In **heat generation**, the provided energy is converted into useful heat by the heat generator.

In **heat distribution**, the useful heat is transferred from the heat generator to the individual heat discharge locations.

In **heat dissipation**, the useful heat is transferred to the heat discharge locations such as radiators, panel heaters or air heating equipment in the rooms to be heated.

The following illustration explains the principle processes in a heating system:

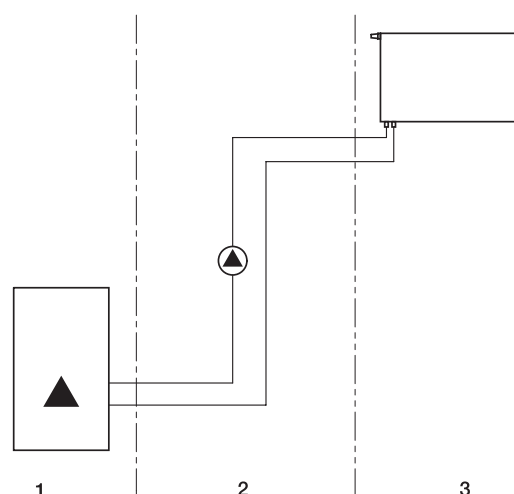


Figure 48: Fundamental processes of a heating system

- 1 Heat generation
- 2 Heat distribution
- 3 Heat dissipation

1. HTB: High Thermal Loads (proven tightness of the connection at 650 °C and PN 5 / PN 1 over a period of 30 min)

Application technology

Building applications – Heating installations

Classification of warm water heating systems

Warm water heating systems can be classified according to the following principles:

Principle	Types
Connection to the atmosphere	<ul style="list-style-type: none"> ■ Open heating systems ■ Closed heating systems
Acting turnover force	<ul style="list-style-type: none"> ■ Gravitation force heating systems ■ Pump heating systems
Channel of supply	<ul style="list-style-type: none"> ■ District heating supply ■ Local heating supply
Heat distribution	<ul style="list-style-type: none"> ■ One pipe heating systems ■ Two pipe heating systems
Pipe layout	<ul style="list-style-type: none"> ■ Upper distribution ■ Lower distribution

Open and closed heating systems

The following figures show the structure of an open and a closed heating system

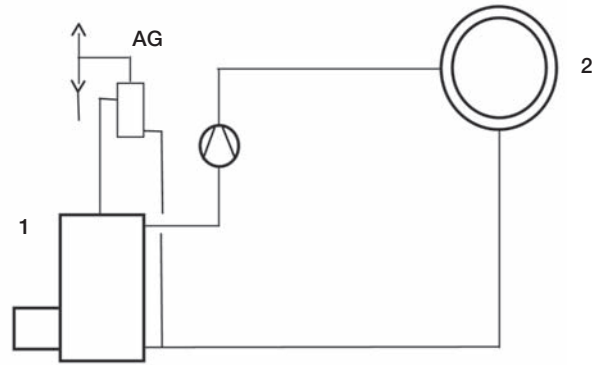


Figure 49: Open water heating system

- 1 Heating tank
- 2 Consumers
- AG Compensation vessel

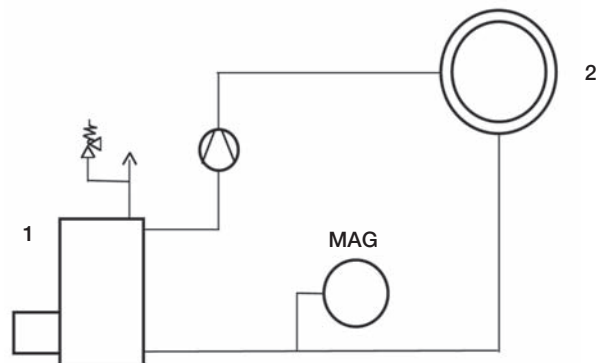


Figure 50: Closed water heating system

- 1 Heating tank
- 2 Consumers
- MAG Diaphragm compensation vessel

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for heating installations:

- Mapress Stainless Steel
- Mapress Carbon Steel

Mapress Stainless Steel

Mapress Stainless Steel can be used for all closed and open hot water heating systems that have a maximum operating temperature of 100 °C without restriction.

Additives in the heating water must be checked to ensure that they are compatible with the black seal ring CIIR. The following table provides an overview of the tested and approved corrosion-protection agents.

Table 67: Tested and approved corrosion-protection agent Mapress Stainless Steel

Additive	Seal ring material		Application / Concentration	Manufacturer ¹
	CIIR	EPDM		
DEWT-NC	x	x	0.4% solution	Drew Ameroid, Hamburg
Hydrazine / Levoxin	x	x	Oxygen bonding agent	Lanxess, Leverkusen
Levoxin	x	x	Oxygen bonding agent	Lanxess, Leverkusen
Sodium sulphite	x	x	Na ₂ SO ₃ -surplus	Various manufacturers
Thermodus JTH-L	x	x	1% solution	Judo, Waiblingen
Tri-sodium phosphate	x	x	(Na ₃ PO ₄) Alkalisiation	Various manufacturers

¹ The manufacturer's instructions for use must always be observed

Mapress Carbon Steel

Mapress Carbon Steel can be used for all closed hot water heating systems that have a maximum inlet flow temperature (sustained temperature) of 100 °C. Prevent atmospheric oxygen from entering the heating water.

Additives in the heating water must be checked to ensure that they are compatible with the black seal ring CIIR. The following table provides an overview of the tested and approved corrosion-protection agents.

Mapress Carbon Steel is not suitable for open water heaters due to the thin wall thickness and the oxygenation capacity that is a feature of the system.

Table 68: Tested and approved corrosion-protection agents for Mapress Carbon Steel

Additive	Seal ring material		Application / Concentration	Manufacturer ¹
	CIIR	EPDM ²		
DEWT-NC	x	x	0.4% solution	Drew Ameroid, Hamburg
Hydrazine / Levoxin	x	x	Oxygen bonding agent	Lanxess, Leverkusen
Levoxin	x	x	Oxygen bonding agent	Lanxess, Leverkusen
Sodium sulphite	x	x	Na ₂ SO ₃ -surplus	Various manufacturers
Thermodus JTH-L	x	x	1% solution	Judo, Waiblingen
Tri-sodium phosphate	x	x	(Na ₃ PO ₄) Alkalisiation	Various manufacturers

¹ The manufacturer's instructions for use must always be observed

² Flat gasket

Application technology

Building applications – Remote and local heat installation

2.1.4 Remote and local heat installation

Principles

A remote heating network is a pipe which distributes heat (heating water) over a long distance from a central heat source to consumers.

Local heating networks have short distribution distances between the heat source and the consumers.

Remote and local heating pipes are sub-divided as follows:

- **Primary circuit:** The primary circuit is the pipe layout from the heat source to the transition point (building inlet).
- **Secondary circuit:** The pipe layout inside the building of the consumer (house network) is referred to as the secondary circuit.

Connection of the secondary circuits to the primary circuits in remote and local heating networks can be either direct or indirect.

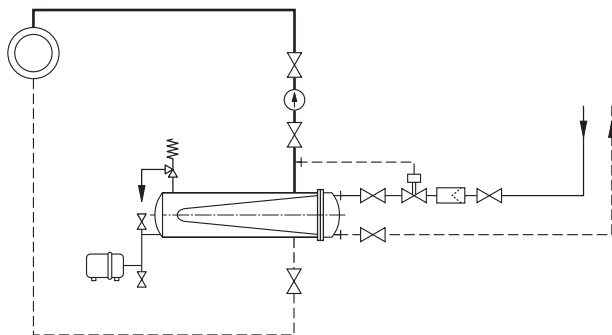


Figure 51: House station with indirect connection of the heating system to the remote heating network

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for the secondary circuit of remote and local heat installations:

- Mapress Stainless Steel
- Mapress Carbon Steel

The following operational conditions apply:

Table 69: Operational conditions Mapress Stainless Steel and Mapress Carbon Steel Remote and local heat installation

Mapress seal ring	Operating temperature _{max} [°C]	Remarks
CIIR black	120	Only in secondary circuit
FEPM	140	-

2.1.5 Heat pump installation

Principles

The most important fuels for hot water heating and hot water provision are heating oil and gas. At the beginning of the seventies more attention was paid to looking for alternative energy sources which are available in sufficient quantities. For this reason, attempts were made to make use of the temperature of the air, water and ground. The energy of these sources is inexhaustible and can be easily regenerated by the radiation of the sun (also diffusely.) The heat quantities of these sources are of relatively low temperatures, so that direct use for hot water heating or provision is not possible.

By means of the use of physical processes, these low temperatures are increased by so-called heat pumps and used for heating.

The heat pump uses the reverse of the principle of operation of a cooling system (e.g. refrigerator):

- As the result of vaporisation (expansion) of a refrigerant, the heat is removed from the energy source (air, water, ground).
- In the compressor the temperature level of the vaporised refrigerant is increased by compression.
- The generated heat is transferred to the heating circuit in the condenser.

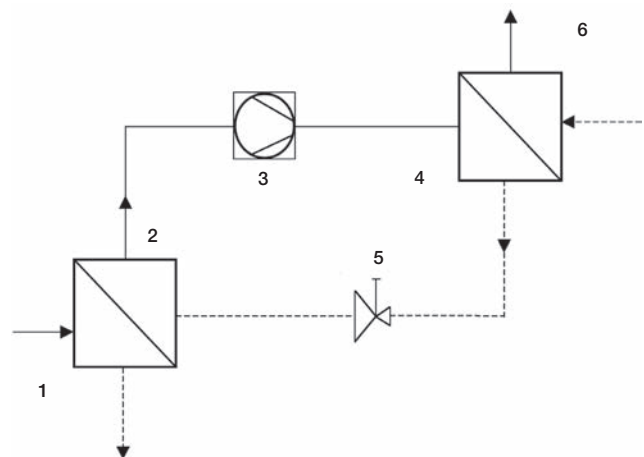


Figure 52: Principle of operation of a heat pump

- 1 Surroundings (air, water, ground)
- 2 Vaporiser
- 3 Compressor
- 4 Condenser
- 5 Expansion valve
- 6 Consumer circuit (heating, hot water)

In building technology there are the following main types of heat pumps:

- Air/water heat pump
- Water/water heat pump
- Brine/water heat pump

The heat quantities from the various sources is reflected in the performance number of the heat pump (quotient of heating performance and electrical power consumption).

The utilisable temperature levels require different modes of operation and control of the heat pump systems, e.g.:

- Monovalent operation
- Bivalent-parallel operation
- Bivalent-partially-parallel operation
- Bivalent-alternative operation

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for installing heat pumps:

- Mapress Stainless Steel 1.4401
- Mapress Carbon Steel

Mapress Stainless Steel 1.4401

Mapress Stainless Steel 1.4401 can be used for heat pump systems that have a maximum operating temperature of 120 °C.

Mapress Stainless Steel 1.4401 can be used to connect the ground connector or serve as a ground connector.

The installation of Mapress Stainless Steel 1.4401 system pipes as a heat exchanger coil with a cooling base for recovering the stored solar energy from the ground or air is also possible using heat collector fences or heat collector branches.

The following table provides an overview of the tested and approved corrosion-protection agents with corrosion protection.



Finished antifreeze agents based on glycol contain further additives. The compatibility of the seal rings with these water additives must be tested.

Table 70: Tested and approved anti-freeze agents with corrosion protection / inhibitors Mapress Stainless Steel

Additive	Seal ring material			Application	Manufacturer ¹
	CIIR	EPDM ²	FPM green ³		
Antifrogen N	x	x	x	Antifreeze agent	Hoechst / Clariant
Antifrogen L	x	–	x	Antifreeze agent	Hoechst / Clariant
Antifreeze	x	x	x	Antifreeze agent	Aral
Ethylene glycol (antifreeze basis)	x	x	x	Antifreeze basis (without inhibitors)	Various manufacturers
Frost-Ex 100	x	x	x	Antifreeze agent	TEGEE Chemie, Bremen
Glykosol	x	x	–	Antifreeze agent	Prokühlsole, Alsdorf
Solan (replaces Pekasol 2000)	x	x	x	Cooling brine	Prokühlsole, Alsdorf
Pekasol L	x	x	x	Cooling brine	Prokühlsole, Alsdorf
Propylene glycol (antifreeze basis)	x	x	x	Maximum 100 (without inhibitors)	Various manufacturers
Tyfocor	x	x	–	Antifreeze agent / Cooling brine	Tyforop-Chemie, Hamburg
Tyfoxit F20	x	x	x	Cooling brine / Cooling medium	Tyforop-Chemie, Hamburg

¹ The manufacturer's instructions for use must always be observed

² EPDM flat gasket

³ FPM seal ring and flat gasket

Application technology

Building applications – Heat pump installation

Mapress Carbon Steel

Mapress Carbon Steel can be used for closed heat pump systems that have a maximum operating temperature of 120 °C.

Prevent atmospheric oxygen from entering the heating water.

The following table provides an overview of the tested and approved corrosion-protection agents with corrosion protection.



Finished antifreeze agents based on glycol contain further additives. The compatibility of the seal rings with these water additives must be tested.

Table 71: Tested and approved antifreeze agents with corrosion protection / inhibitors Mapress Carbon Steel

Additive	Seal ring material			Application	Manufacturer ¹
	CIIR	EPDM ²	FPM green ³		
Antifrogen N	x	x	x	Antifreeze agent	Hoechst / Clariant
Antifrogen L	x	–	x	Antifreeze agent	Hoechst / Clariant
Antifreeze	x	x	x	Antifreeze agent	Aral
Ethylene glycol (antifreeze basis)	x	x	x	Anti-freeze basis (without inhibitors)	Various manufacturers
Frost-Ex 100	x	x	x	Antifreeze agent	TEGEE Chemie, Bremen
Glykosol	x	x	–	Antifreeze agent	Prokühlsol, Alsdorf
Pekasol L	x	x	x	Cooling brine	Prokühlsol, Alsdorf
Propylene glycol (antifreeze basis)	x	x	x	Anti-freeze basis (without inhibitors)	Various manufacturers
Tyfocor	x	x	–	Antifreeze agent / Cooling brine	Tyforop-Chemie, Hamburg

¹ The manufacturer's instructions for use must always be observed

² EPDM flat gasket

³ FPM seal ring and flat gasket

2.1.6 Cooling water installation

Principles

Cooling water installations serve on the one hand to create a pleasant climate in rooms for habitation and on the other hand to maintain the functional safety of machines and system components (motors, turbines).

For economical reasons, various types of water (ground water, surface water or brackish water) are used as a medium.

There are open-circuit and closed-circuit cooling water systems.

The difference in temperature between the inlet flow and the return flow should be as great as possible, so that a large quantity of heat is carried away with a small quantity of circulating water.

The cheapest temperature range of an air conditioning system for building technology purposes is 9 K.

The inlet temperature ranges from +4 °C to +6 °C, the return temperature from +12 °C to +15 °C. This range is always determined by the respective application.

Mapress pressfitting systems

The following Mapress pressfitting systems can be used in cooling water installations:

- Mapress Stainless Steel 1.4401
- Mapress Carbon Steel

Mapress Stainless Steel 1.4401

Mapress Stainless Steel 1.4401 can be used for all open and closed cooling water systems without restriction under the following operating conditions:

- Mapress Seal ring CIIR black
 - Water/ antifreeze mixture: -30 - +40 °C
 - Cooling water: 0 - 100 °C
- Mapress Seal ring FPM green
 - Water/ antifreeze mixture: -30 - +180 °C

The content of water-soluble chloride ions in cooling water should not exceed 250 mg/l.

Table 70 on page 69 provides an overview of the tested and approved antifreeze agents with corrosion protection.

Mapress Carbon Steel

Mapress Carbon Steel can be used for closed cooling water systems under the following operating conditions:

- Mapress Seal ring CIIR black
 - Water/ antifreeze mixture: -30 - +40 °C
 - Cooling water: 0 - 100 °C
- Mapress Seal ring FPM green
 - Water/ antifreeze mixture: -30 - +180 °C

The non-alloy steel is not suitable for open cooling water systems due to the thin wall thickness and the high oxygenation capacity.

Table 71 on page 70 provides an overview of the tested and approved antifreeze agents with corrosion protection.

2.1.7 Solar installations

Principles

Solar heating systems are a special method for obtaining thermal energy by using solar energy.

The collector and absorber surface absorbs the solar energy (also diffusely). The absorbed thermal energy is routed to the heat storage tank by a solar liquid, normally a water and antifreeze mixture.

The main application is hot water heating: After-heating is performed with a heating boiler.

The use of solar energy for heating purposes is only possible to a limited degree, as during the winter months the energy level of the sun is relatively low.

If the solar system is used in combination with hot water heating and a heating system (combined system), the hot water heater is supplied first. When the hot water tank is heated, the excess thermal energy is made available for heating the rooms. This method of using solar energy can also be used for heating swimming pool water.

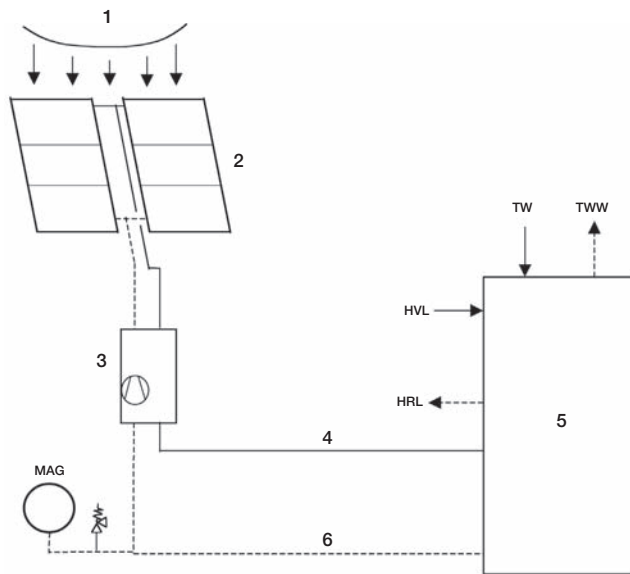


Figure 53: Solar systems

- 1 Solar radiation
- 2 Solar collectors
- 3 Pump group
- 4 Solar inlet flow
- 5 Solar storage tank
- 6 Solar return flow
- TW Cold drinking water
- TWW Hot drinking water
- HVL Heating inlet flow
- HRL Heating return flow

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for closed solar installations:

■ Mapress Stainless Steel

The factory pre-mounted black seal ring CIIR is not suitable for use in solar installations.

The approved seal ring FPM green made of fluorinated rubber at operating temperatures between - 30 - + 180 °C will be supplied separately for this application. This replaces the factory pre-mounted seal ring CIIR black. The replacement is carried out on-site by the plumber.

The seal ring FPM green only reaches the increased temperatures using a water / antifreeze mixture (solar liquid). This seal ring is not therefore suitable for use with other media or at increased temperatures, such as high pressure steam.

Table 70 on page 69 provides an overview of the tested and approved antifreeze agents with corrosion protection.

2.1.8 Fixed water extinguishing systems (sprinkler systems)

The following Mapress pressfitting systems can be used for fixed water extinguishing systems:

- Mapress Stainless Steel
- Mapress Carbon Steel

Our sprinkler brochure provides you with detailed information. We would be pleased to send it to you upon request.

2.1.9 Oil supply installation

Mineral oil

Today mineral oil is used as a fuel and a lubricant. Due to its versatility, mineral oil is very much in demand, for example as a fuel for industrial, commercial and domestic use, as a lubricant or base material in the chemical industry.

Mineral oil sources are limited, and alternative sources of energy are being sought. One alternative alongside renewable solid fuels (e.g. wood and grain) is vegetable oil. The main sources are rapeseed, sunflowers and flax.

Currently the main applications of mineral oil are in the automobile and chemical industries.

Heating oil EL

Heating oil EL (extra light) is often used in households as a fuel for heat generation. In addition to heating oil EL, there is also heating oil S for large-scale plants. Heating oil S must be heated for transport, as it is a more viscous fluid.

Installations for transport from heating oil tanks to the heating boilers can be either:

- Single line system
- Two-line system
- Circular pipe with multiple boiler systems



Figure 54: Heating oil EL supply in single line system

- 1 Oil boiler with oil burner
- 2 Oil filter with ventilation
- 3 Shut-off element
- 4 Quick-action valve
- 5 Filling valve
- 6 Ventilation

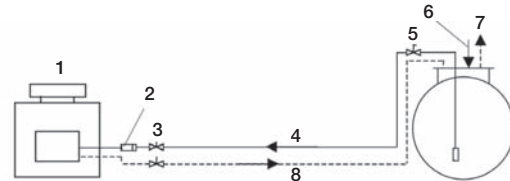


Figure 55: Heating oil EL supply in two-line system

- 1 Oil boiler with oil burner
- 2 Oil filter
- 3 Shut-off element
- 4 Oil supply
- 5 Quick-action valve
- 6 Filling valve
- 7 Ventilation
- 8 Oil return flow

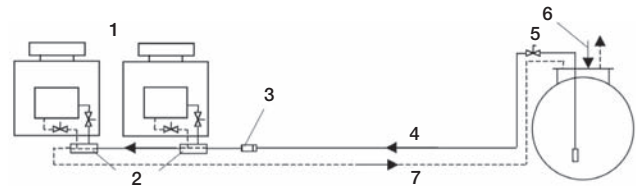


Figure 56: Heating oil EL supply in circular pipe system

- 1 Oil boiler with oil burner
- 2 Gas air separator
- 3 Oil filter
- 4 Oil supply
- 5 Quick-action valve
- 6 Filling valve
- 7 Oil return flow

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for oil supply installations without restriction:

- Mapress Stainless Steel
- Mapress Carbon Steel

Mapress Stainless Steel and Mapress Carbon Steel are suitable for transporting water-polluting substances in the sense of the Water Ecology Act.

The factory pre-mounted black seal ring CIIR is not suitable for use in oil supply systems.

The approved seal ring FPM red made of fluorinated rubber will be supplied separately for this application. This replaces the factory pre-mounted seal ring CIIR black. The replacement is carried out on-site by the plumber.

2.1.10 Special applications

Concrete core activation

Principles

The concrete core activation is used for the air conditioning of rooms. The retention capacity of the exposed surfaces of the building (walls, ceilings and floors) is used for this purpose. These components are fitted with pipe systems where water flows through. The piping system can be used for heating or cooling.

The water circulating in the concrete ceiling prepares the concrete storage tank so that an automatic exchange of energy occurs, depending on the room temperature. Due to the components' scope of storage, the concrete core activation is relatively inert and so an individual, rapid and room-relevant temperature control is not possible. Due to the inertness of the system, we suggest charging the accumulator of the building overnight (with energy for heating or cooling the room depending on the type of application) so that enough energy is provided for heating or cooling the rooms during the main time of use. When designing the concrete core activation, care must be taken to avoid falling below the dew point so as to protect the building and piping system.

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for concrete core activation:

- Mapress Stainless Steel

The following operating conditions must be observed:

- Operating pressure: Max. 16 bar
- Operating temperature: -30 °C - +120 °C

Condensate drains for condensing boilers

Principles

In these appliances in addition to the thermal energy in the waste gas, the evaporation enthalpy of the steam contained in the waste gas is utilised.

In gas applications the condensing boiler is used for heating and hot water (dewpoint approximately 55 °C). The occurring condensate must be routed to the sewer through a condensate drain. The pH value of the condensate is between 3.5 and 5.2.

In addition to gas condensing boilers, there are also versions which run with heating oil EL (dewpoint approx. 50 °C). The pH value of the condensate in this case is between 2.5 and 3.5 and it can contain sulphurous acid.

The condensate of the condensing boilers only contains a low concentration of fluorocarbons. Fluorocarbons promote corrosion in the heating section of the device and in the waste gas pipes and condensate pipes. If there is an emission source of fluorocarbons directly nearby, the installation room or combustion air supply of the device must be selected so that these contaminants are not supplied to the condensate with the combustion air.

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for condensate discharge:

- Mapress Stainless Steel

Mapress Stainless Steel

Mapress Stainless Steel is resistant against the condensate of gas burners and can be used for this type of condensate drain.

Mapress Stainless Steel cannot be used for condensate drains from oil condensing boilers.

Disinfectant solutions

The following Mapress pressfitting systems can be used for disinfectant solutions:

■ Mapress Stainless Steel

Mapress Stainless Steel can be used in swimming baths or hospitals for surface disinfection and for preventing athletes foot using disinfectant solutions.

The following table provides an overview of the tested and approved disinfectants.

Table 72: Tested and approved disinfectants Mapress Stainless Steel

Additive ¹	Seal ring material	Application / Concentration	Manufacturer ²
CIIR			
BAKTONIUM	x	0.5 - 2% solution	Witty Chemie
NÜSCOSEPT	x	0.5 - 2% solution	Dr. Nüsken Chemie
HEXAQUART S	x	0.5 - 3% solution	B. Braun & Meslungen AG
MULTIDOR	x	0.25 - 1% solution	Henkel Hygiene
MYXAL S	x	0.1 - 2% solution	Physioderm GmbH
QUATAMON MED	x	1.0 - 2% solution	S. & M. Schülke & Mayr GmbH
TERRALIN	x	0.25 - 2% solution	S. & M. Schülke & Mayr GmbH
XEROCID	x	0.5 - 2% solution	MFH Marienfelde GmbH

¹ Used in swimming pools, hospitals etc. for surface disinfection

² The manufacturer's instructions for use must always be observed

2.2 Industrial applications

The preceding chapter, building applications, described the potential applications and technical conditions of Mapress Stainless Steel and Mapress Carbon Steel in detail.

In the area of industry, there are a large number of potential application where MapressCuNiFe and additional seal rings can be used.



The country-specific regulations and guidelines must be observed in the following description for industry applications.

2.2.1 Compressed air installation

Principles

Compressed air has a wide range of applications. This medium is used in almost all fields of the producing and processing industries.

The maximum operating pressure in compressed air systems is 10 bar; machines and tools often only require a connection pressure of up to 6 bar.

Due to the special safety requirements at high pressures and the high energy costs for the generation and maintenance of compressed air, sufficient but low operating pressures should be selected.

Depending on the application, various requirements must be met by compressed air installations:

- Residual oil content
- Moisture content
- Purity

Compressed air can also contain oil to lubricate downstream consumers. If purity requirements are high, a drier or oil separator is used.

These specifications must be clarified at the planning stage of compressed air supply for the selection of materials and systems.

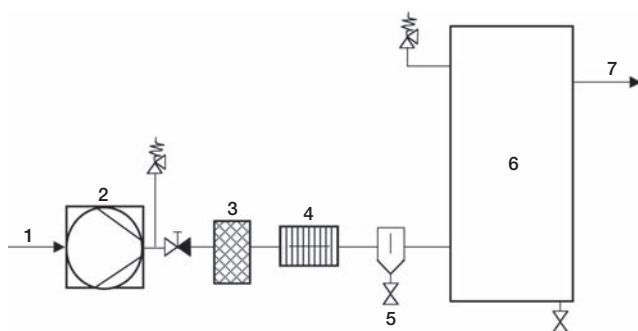


Figure 57: Diagram of a compressed air system

- 1 Air supply
- 2 Compressor
- 3 Oil separator
- 4 Aftercooler
- 5 Water separator
- 6 Compressed air vessel
- 7 Consumers

Mapress pressfitting systems

The following Mapress pressfitting systems can be used for compressed air installations:

- Mapress Stainless Steel
- Mapress Carbon Steel

Mapress Stainless Steel

The following operating conditions must be observed when using Mapress Stainless Steel:

- Operating pressure: Max. 16 bar¹
- Operating temperature: Room temperature

Care must be taken that a professional connection of the pressed joint is made and that the insertion distance is maintained.



Mapress Stainless Steel is also suitable for inert gases (non-explosive and non-toxic) such as nitrogen, argon and carbonic acid.

Mapress Carbon Steel

Mapress Carbon Steel can only be used in dry compressed air systems, otherwise any humidity and air contained in the installation system may lead to corrosion.

The following operating conditions must be observed when using Mapress Carbon Steel:

- Operating pressure: Max. 16 bar¹
- Operating temperature: Room temperature

Care must be taken that a professional connection of the pressed joint is made and that the insertion distance is maintained.

We recommend moistening the seal ring with soap solution or water before installing so as to improve the lubrication effect of the seal ring and ensure optimum sealing of the connection for compressed air.



Mapress Carbon Steel is also suitable for inert gases (non-explosive and non-toxic) such as nitrogen, argon and carbonic acid.

1. Higher pressures possible upon consultation with Geberit

Mapress seal rings

Residual oil exists in most compressed air systems. This is the reason why the compressed air is categorised into 4 classes. If there is a residual oil content of > 5 mg/m³, the FPM red seal ring should be used due to the higher oil resistance.

Table 73: Suitable Mapress seal rings for compressed air lines with residual oil content according to DIN ISO 8573-1 2001

Compressed air categories	Residual oil quantity _{max} [mg/m ³]	Mapress seal ring
0	As specified by the equipment user or supplier the specifications are more stringent than class 1.	
1	0.01	CIIR black / FPM red
2	0.10	CIIR black / FPM red
3	1.00	CIIR black / FPM red
4	5.00	CIIR black / FPM red

2.2.2 Vacuum lines

The following Mapress pressfitting system can be used for vacuum lines up to 200 mbar absolute (reduction of the ambient air pressure from 1013 mbar to 813 mbar):

- Mapress Stainless Steel

2.2.3 Saturated steam applications

The following Mapress pressfitting systems can be used for saturated steam applications with operating temperatures up to max. 180 °C and operating pressures up to max. 10 bar:

- Mapress Stainless Steel

The factory pre-mounted black seal ring CIIR is not suitable for use in saturated steam systems.

The approved seal ring FEPM light green made of tetrafluoroethylene propylene rubber will be supplied separately for this application. This replaces the factory pre-mounted seal ring CIIR black. The replacement is carried out on-site by the plumber.



The Pressure Equipment Directive must be observed when using Mapress Stainless Steel together with the seal ring FEPM light green.

2.2.4 Fuels and oils of hazard category A III

The following Mapress pressfitting systems can be used when transporting fuels, engine oils and transmission oils of hazard category A III:

- Mapress Stainless Steel
- Mapress Carbon Steel

Use red FPM seal rings made of fluorinated rubber for these applications.

2.2.5 Pipelines carrying sea water

The following Mapress pressfitting systems can be used for pipelines carrying sea water:

- MapressCuNiFe

The following operating conditions must be observed:

- Operating pressure: 10 - 13 bar
- Operating temperature: -20 °C - +120 °C

The operating pressure is dependant on the approval and dimension.

2.2.6 Applications MapressCuNiFe

MapressCuNiFe is suitable for the following uses:

Table 74: Applications MapressCuNiFe

Application	Mapress seal ring
Seawater sanitary systems	CIIR black
Air conditioning	CIIR black
Deck wash systems	CIIR black
Sanitary grey / black water drainage	CIIR black
Sprinkler	CIIR black / FPM red ¹
Fire main / water spray foam	CIIR black
Freshwater cooling	CIIR black
Seawater cooling	CIIR black
Compressed air	CIIR black / FPM red ²
Inert gas	CIIR black
Hydraulic oil	FPM red
Fuel oil	FPM red
Cargo oil	FPM red
Lubrication oil	FPM red
Bilge systems	CIIR black
Ballast systems	CIIR black

¹ Please ask Geberit for more information

² Please see table 73, "Suitable Mapress seal rings for compressed air lines with residual oil content according to DIN ISO 8573-1 2001," on page 77

