MAINCOR

Technical Manual

MAINFLOOR

Underfloor heating systems

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Underfloor heating systems

Renovation system
Stapler system
Rail system

Pipe positioning panel system
Wall heating system

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1. General

Over the past few years, underfloor heating has become highly popular for heating homes and industrial buildings. What was once considered to be relatively expensive can now be fitted or retrofitted in almost any building at low cost.

The advantages are not only the cosy warmth provided and architectural freedom in interior design, but also the low flow temperature and energy saving aspects.

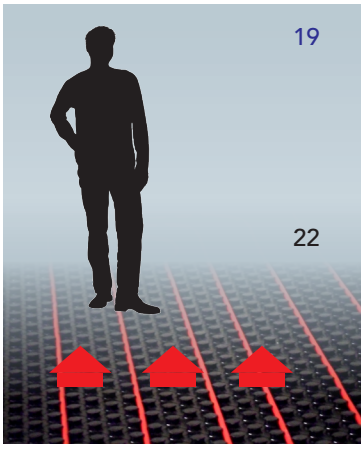
Lower energy consumption means lower heating costs and a lower CO_2 impact on the environment. This enables optimal use of renewable energies and condensing heating technology. Heat pump systems are extremely energy-efficient and require minimum energy input throughout the year.

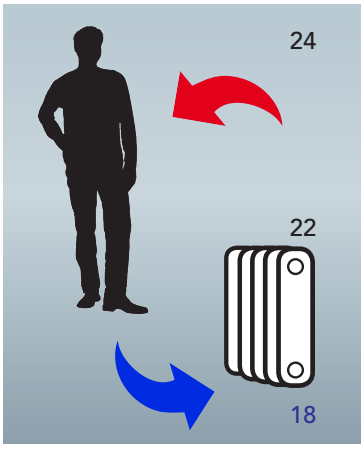
The energy saving provided by underfloor heating results from the heat radiated from surrounding components. In order to provide the same level of comfort as conventional radiator heating, it is possible to reduce the room temperature by 1-2°C.

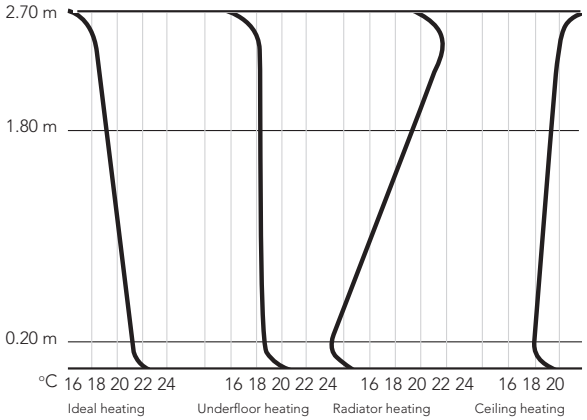
Reducing the room temperature by just 2°C results in an annual cost saving of 12%.

A further reason for using underfloor heating is the cosy warmth it provides. The exchange of heat between the human body and surrounding surfaces, the temperature of which is evenly distributed and slightly lower than the body, is perceived as particularly pleasant.

Lower temperatures mean higher relative humidity. Underfloor heating is the only type of system to radiate heat upwards draught-free with an almost ideal temperature profile. The low heat radiation also suppresses dust turbulence.







1.2 Laying methods

Bifilar pattern

Features:
- mainly used for tight laying distances or awkwardly shaped rooms;
- uncomplicated pipe layout due to mostly 90° installation;
- uniform heat distribution.
- Bending radii must be taken into account

Application:
all types of buildings

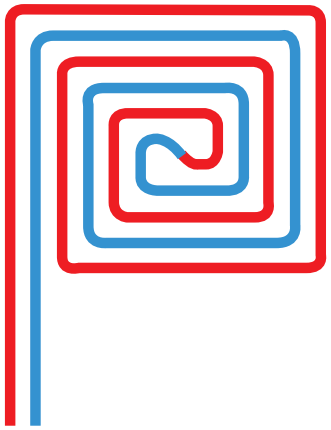


Fig. 1: Bifilar pattern

Meander pattern

Features:
- fast and easy installation in particular when using the rail system;
- heating circuit starting at window or external wall;
- slight temperature drops between flow and return;
- for laying in large window areas with preceding marginal zone.

Application:
for all types of buildings, in particular industrial underfloor heating, wall heating, concrete core activation, surface embedded heating.

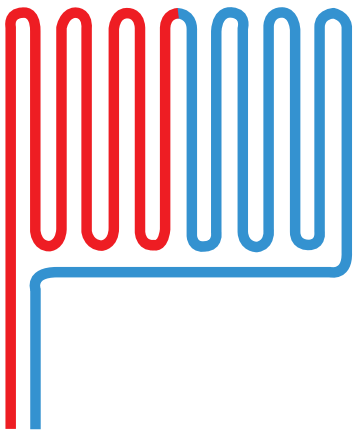


Fig. 2: Meander pattern

1.3 Thermal insulation and impact sound requirements

What are the insulation requirements in Germany and Europe?

EN 1264 specifies a U-value for insulation in buildings. Heat insulation requirements for Germany are defined in the Energy Saving Ordinance (EnEV) and can exceed the values specified in EN 1264 in some cases. The specific heat loss of a building can be calculated by an architect or energy adviser taking into account the total thermal envelope. The assessment of the energy efficiency is documented in an energy performance certificate. The U-values of the respective components are documented in the energy pass and are compulsory for contractors.

EnEV 2014 and EN 1264

Standard	Description
EN 1264	Underfloor heating, system components
EnEv	Energy Saving Ordinance
DIN 4108	Thermal insulation in buildings
DIN 4109	Sound insulation in buildings
EN 12831	Calculation of the design heat load
DIN V 18599	Calculation of the net, final and primary energy demand
EN ISO 6946:2008-04 DIN 1996-11	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
EN ISO 7345 as DIN 1996-01	Thermal insulation - Physical quantities and definitions
EN ISO 9346 as DIN 1996-08	Thermal insulation, mass transfer - Physical quantities and definitions
EN 12524	Building materials and products - Hygrothermal properties

Excerpt from standards to be observed.

On 16 October 2013, the Federal Government adopted amendments to the Energy Saving Ordinance (EnEV). The amendments came into force on 1 May 2014 for the most part. The Federal Government is endeavouring to fulfil the commitments agreed in the 1997 Kyoto Protocol with the aim of ensuring that virtually all existing building stock is climate-neutral by 2050. The EU Directive (2010/31/EU), which specifies the total energy efficiency of buildings, is the basis for EnEV 2014.

The most important requirement of the Energy Saving Ordinance (EnEV) for new buildings is the annual primary energy demand compared to a standardised reference building with the same dimensions and geometry and specified technical features. Focusing on the total energy demand has the advantage that less efficient insulation can be compensated by a highly efficient heating system and vice versa.

According to the reference made in the Energy Saving Ordinance (EnEV) to pertinent DIN, DIN EN and ISO specifications and applicable technical directives, special reference is made here to possible updates and amendments that were not yet in force at the time of printing this technical manual.

As the main bulk of the heat generated by an underfloor heating system must be radiated upwards, the thermal resistance of the layers below are subject to specific requirements.

DIN EN 1264, part 4 distinguishes between three types of floor and ceiling constructions with the minimum thermal resistances shown in the table opposite.

	Thermal insulation	$R_{Dä,m/n}$
A	Rooms for similar use	0.75 m² K/W
B	Rooms not for similar use*, unheated rooms (e.g. basements) and ground	1.25 m² K/W
C	Outside air (-15°C) (e.g. underground car parks, thoroughfares)	2.00 m² K/W

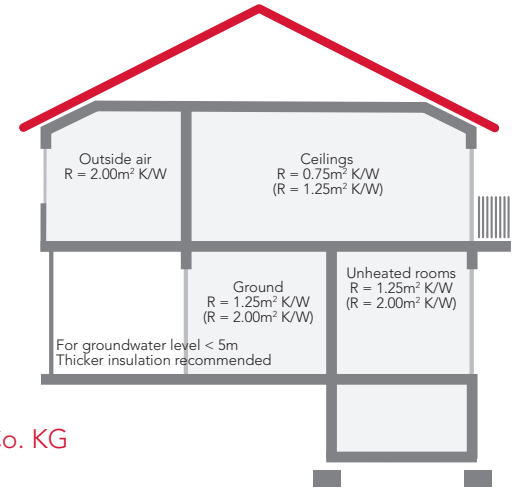
Thermal insulation specifications for underfloor heating systems according to DIN EN 1264, part 4 and DIN 4701, part 2 (minimum requirements)

Important!

Insulation requirements according to the Energy Saving Ordinance (EnEV) must be taken into account!

Example:

Reference object according to German Energy Saving Ordinance (EnEV): ceiling against outside air: U=0.28 W (m²xK) Insulation roll 30-2 WLG 040 + 110 mm EPS WLG 040.
Floor slab against ground and ceiling to unheated rooms U=0.35 W (m²K) Insulation roll/pipe positioning plate 30-2 WLG 040 + 80 mm EPS 040.



Floor		$R_{DÄ}$ [m² K/W]	Insulation layer thickness in mm for WLG 045	040	035	030	025
A heated room below		0.75	35	30	30	25	20
B unheated room or at distances to heated room below or directly at ground level (groundwater > 5m)*		1.25	60	50	45	40	35
C outside air**	Design temperature ≥ 0°C	1.25	60	50	45	40	35
	Design temperature < 0°C ≥ -5°C	1.5	70	60	55	45	40
	Design temperature < -5°C ≥ -15°C	2	90	80	70	60	50

*) at a groundwater level of ≤ 5m, a higher R-value should be used

**) these values are considerably reduced compared to insulation layers previously used in normal practice

Impact sound requirements

DIN 4109 defines requirements for the sound insulation of rooms requiring protection against noise. Distinction is made between two types of sound transmission: impact and airborne sound. The minimum requirement for $L'_{n,w}$ is 53db. The impact sound level is made up of the normalised impact sound level of a solid floor without floor covering and the impact sound level reduction of a floor covering. Calculation takes place according to DIN 4109 as shown in the table above. Increased sound insulation as specified in supplement 2 of DIN 4109 is achieved by an additional reduction of about 5db. The impact sound level reduction is related to the equivalent dynamic stiffness s' according to DIN 29052-1. The table opposite shows the dependence between the reduction ΔL_w and dynamic stiffness s':

$L'_{n,w} = L_{n,w,eq} - \Delta L_w + 2$ dB	
$L'_{n,w}$	weighted normalised impact sound level of the entire floor construction
$L_{n,w,eq}$	equivalent weighted normalised impact sound level of solid floor without floor covering
ΔL_w	Impact sound level reduction of floor covering
2 dB	Safety margin

Dynamic stiffness s' (MN/m³)	Reduction level L_w (db)
≤ 30	26
≤ 20	28
≤ 15	29
≤ 10	30

The dynamic stiffness according to EN 13163 must also be specified. EN 13163 specifies „Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products". Specified are material properties with reference to related test methods and conformity assessment, marking and labelling requirements. Application-specific requirements are nationally regulated. In Germany, this takes place via the application standard DIN 4108-10 „Thermal insulation and energy economy in buildings". This specifies minimum requirements for all european harmonised insulation materials for different areas of application.

Product data	Symbol	Description
Compression resistance	dm	moderate compression resistance
	ds	very high compression resistance
Acoustic properties	sg	low compressibility
	sm	moderately compressible
Insulation	DEO	Interior insulation of ceilings and floor slabs under screed without noise protection requirements
	DES	Interior insulation under screed on ceilings or floors with noise protection requirements

Requirements for substructures

Installation of the MAINFLOOR dry construction system is subject to the following conditions: Substructures must be dry, firm, rigid and free from cracks, dirt and parting compounds must be removed. The dry construction elements must have full contact and rest flat against the substructure as the load distribution layers in dry construction systems are unable to compensate for any unevenness. Any unevenness must be compensated by appropriate measures. This can take place with dry fill material or naturally moist insulation; depending on the particular requirements, other compensating methods that have been approved and tested in compliance with the relevant technical directives can also be used. To prevent damage from rising moisture, the following moisture barriers/foils must be installed, e.g. bituminous or plastic sheeting with appropriate certification. The requirements of DIN 18650-5 must be observed.

Supplementary thermal insulation

For increasing the thermal insulation below the MAINFLOOR dry floor system in rooms at ground level or adjacent to rooms without heating or limited heating subject to compliance with the requirements of the Energy Saving Ordinance (EnEV) and DIN EN 1264.

Products:

Expanded polystyrene EPS 035 DEO 200 kPa 1,000 x 500 x 20 mm or 30 mm
Thermal conductivity: 0.035W/m²K

Extruded polystyrene XPS 035 DEO 300 kPa 1,250 x 600 x 30 mm
Thermal conductivity: 0.035W/m²K
Compressive stress: 0.30N/mm² with 10% compression
Building material class: B1 (flame retardant) according to DIN 4102

Extruded polystyrene XPS 035 DEO 500 kPa 1,250 x 600 x 40, 50 or 60 mm
Thermal conductivity: 0.035W/m²K
Compressive stress: 0.50N/mm² with 10% compression
Building material class: B1 (flame retardant) according to DIN 4102

Weight of construction

The dry construction system is light in construction. This is an essential requirement for the refurbishment of old buildings. Structural data must be taken into account.

Layer construction DIN 18560 Design B

No contact with the screed occurs due to the separation of the system components of the construction. Expansion joints therefore do not need to be taken into account as for wet systems.

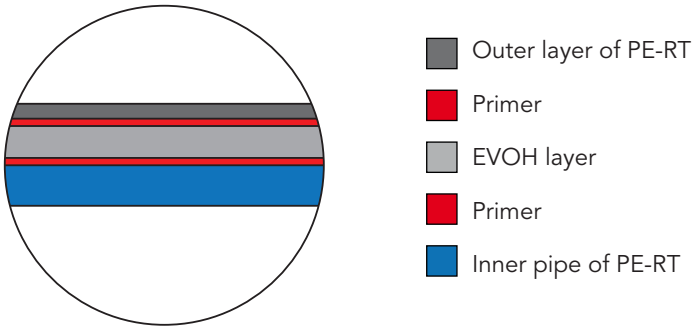
2. Types of pipes

2.1 PE-RT

Different types of MAINCOR PE-RT pipes are available. All MAINCOR underfloor heating pipes are oxygen tight according to DIN 4726.
PE-RT pipe has five layers with an embedded EVOH layer.

Areas of application

Heating, e.g. underfloor heating
Radiator connection
Concrete core activation
Open space heating
Special applications



Product data

Product designation	PE-RT plastic pipe	PE-RT plastic pipe	PE-RT plastic pipe
Dimensions	10 x 1.3	14 x 2.0	16 x 1.5
Colour	Natural	Natural	Natural
Max. temperature load	90°C	90°C	90°C
Max. continuous temperature load	70°C	70°C	70°C
Max. operating pressure in bar (ISO 10508) at 70°C	6 bar	6 bar	6 bar
Application class (ISO 10508)	4	4	4
Water capacity l/m	0.043	0.079	0.133
Bending radius	5 x d	5 x d	87.5 mm

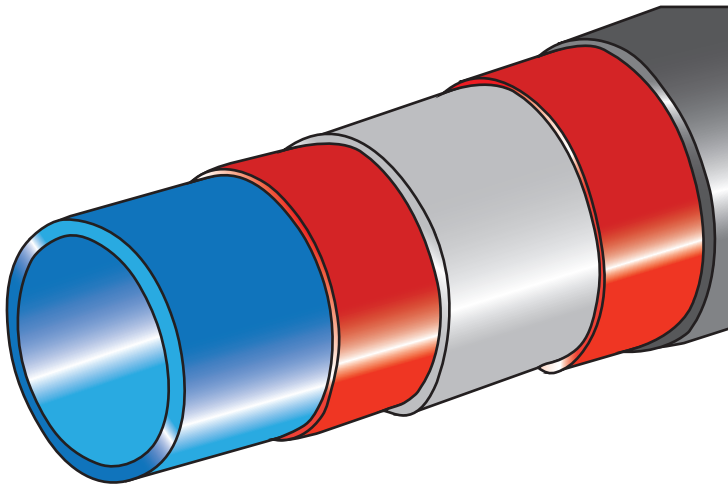
Product designation	PE-RT plastic pipe	PE-RT plastic pipe	PE-RT plastic pipe
Dimensions	16 x 2.0	17 x 2.0	20 x 2.0
Colour	Natural	Natural	Natural
Max. temperature load	90°C	90°C	90°C
Max. continuous temperature load	70°C	70°C	70°C
Max. operating pressure in bar (ISO 10508) at 70°C	6 bar	6 bar	6 bar
Application class (ISO 10508)	4	4	4
Water capacity l/m	0.113	0.133	0.201
Bending radius	5 x d	5 x d	5 x d

2.2 Composite pipe PE-RT/AL/PE-RT

MAINCOR PE-RT/Alu/PE-RT multilayer composite pipe with embedded aluminium layer is oxygen tight according to DIN 4726.
Despite being highly flexible, this multilayer composite pipe is characterised by high tenacity and fatigue strength.

Areas of application

Heating, e.g. underfloor heating
Radiator connection
Concrete core activation
Open space heating
Special applications



Product data

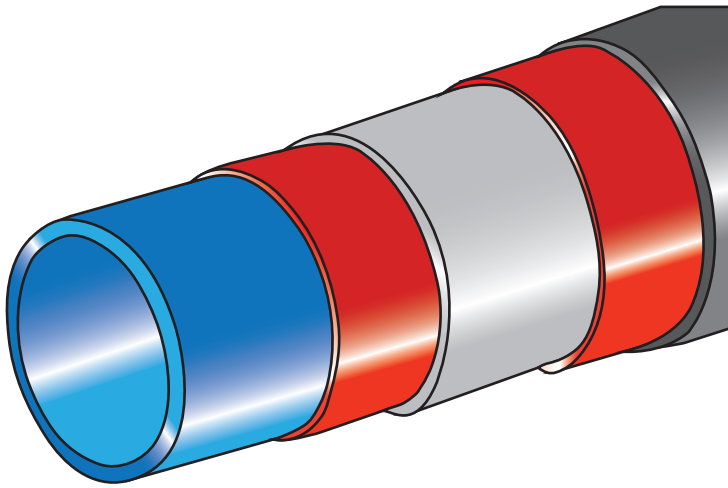
Product designation	PE-RT/Alu/PE-RT composite pipe
Dimensions	16 x 2.0
Colour	Red
Max. temperature load	90°C
Max. continuous temperature load	70°C (80°C for heating)
Max. operating pressure in bar (ISO 10508) at 70°C	6 bar
Application class (ISO 10508)	4
Water capacity l/m	0.113
Bending radius	5 x d

2.3 PE-Xa

Different types of MAINCOR PE-Xa pipe are available. All MAINCOR underfloor heating pipes are oxygen tight according to DIN 4726.
The PE-Xa pipe has five layers with an embedded EVOH layer.

Areas of application

Radiator connection
Underfloor heating
Wall heating
Floor cooling
Ceiling cooling



Product data

Product designation	Plastic pipe PE-Xa	Plastic pipe PE-Xa	Plastic pipe PE-Xa
Dimensions	16 x 2.0	17 x 2.0	20 x 2.0
Colour	Natural	Natural	Natural
Max. temperature load	90°C	90°C	90°C
Max. continuous temperature load	70°C	70°C	70°C
Max. operating pressure in bar (ISO 10508) at 70°C	6 bar	6 bar	6 bar
Application class (ISO 10508)	4	4	4
Water capacity l/m	0.113	0.133	0.201
Bending radius	5 x d	5 x d	5 x d

2.4 Classification

- according to ISO 10508

Pipe performance requirements are specified for five different application classes. The applicable classes are shown in the table below:

Application class	T_D		T_{max}		T_{mal}		Typical area of application
	°C	Time Years	°C	Time Years	°C	Time Hours	
1	60	49	80	1	95	100	Hot water supply (60°C)
2	70	49	80	1	95	100	Hot water supply (70°C)
4	20	2.5	70	2.5	100	100	Underfloor heating and low temperature radiator connections
	40	20					
	60	25					
5	20	14	90	1	100	100	High temperature radiator connections
	60	25					
	80	10					

T = Temperature, T_D = Design temperature, T_{max} = Maximum design temperature, T_{mal} = Fault temperature

Each application class relates to a typical area of application and takes into account a service life of 50 years. Classification corresponds to the requirements in ISO 10508-4. All specified typical fields of application are recommendations and for guidance only.
Each application class has a corresponding permissible operating pressure of 4 bar, 6 bar, 8 bar or 10 bar, depending on the particular application.

The concept of the application class defines the purpose of ISO 10508-4 - the theoretical description of dynamic conditions within the application classes accurately reflects the reality compared to structural data. Manufacturers, planners and installers are provided with a basis for the selection of suitable pipes for specific areas of application. The application classes four and five are valid specifically for heating applications, while classes one and two are valid for hot water supply. The product standards DIN EN ISO 15875, DIN EN ISO 22391 and DIN EN ISO 21003 define the application classes for geometrical conditions.

Areas of application

Different types of MAINCOR pipes are available for diverse areas of application.
The following table shows the possible applications of individual pipes for MAINCOR underfloor heating systems.

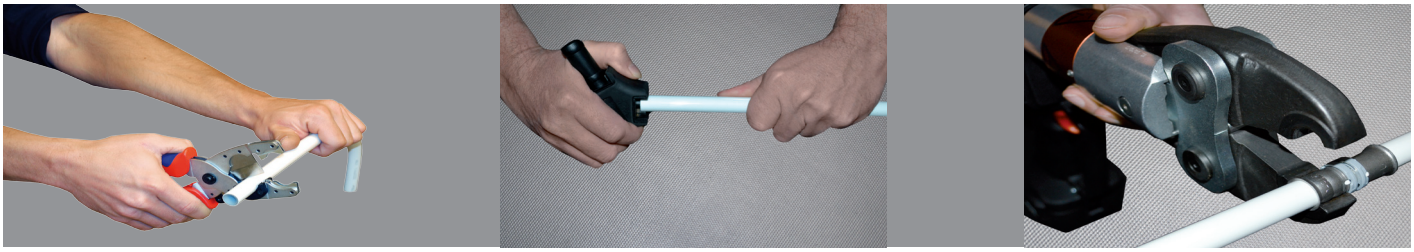
Pipe type	Dimensions	System					
		Dry construction system	Dry construction system Eco	Renovation system Mini	Staple system	Rail system	Pipe positioning plates
PE-RT/Alu/PE-RT	16mm x 2.0mm	x	x		x	x	x
PE-Xc	10mm x 1.3mm			x			
PE-RT	10mm x 1.3mm			x			
PE-RT	14mm x 2.0mm				x	x	x
PE-RT	16mm x 2.0mm				x	x	x
PE-RT	17mm x 2.0mm				x	x	x
PE-RT	20mm x 2.0mm				x	x	
PE-RT	25mm x 2.3mm				x		
PE-Xa	16mm x 2.0mm				x	x	x
PE-Xa	17mm x 2.0mm				x	x	x
PE-Xa	20mm x 2.0mm				x	x	

2.5 Connection system

The connection system is selected depending on the type of pipe used and machines available.

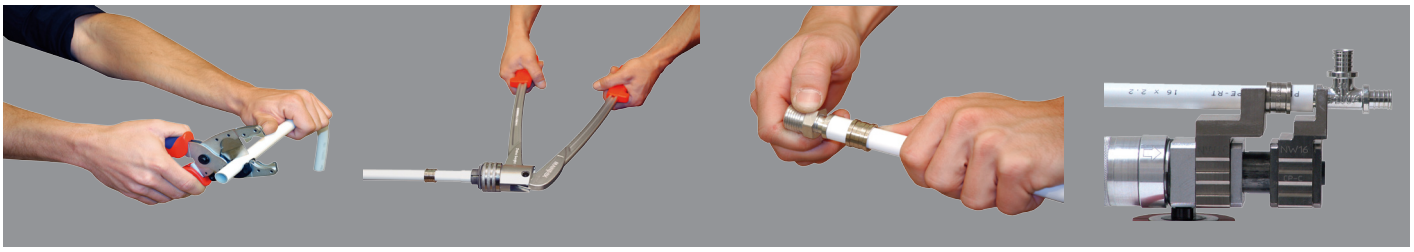
Pressing system

The pipe is cut off at right-angles, calibrated and deburred. The respective fitting is then pressed on to the pipe. Pressing takes place using a pressing jaw mounted on a suitable press. A tight connection is produced within 10 seconds.



Sliding sleeve system

The pipe is cut off at right angles, the sliding sleeve is fitted to the pipe. The pipe is then widened so that the fitting can be mounted. The sliding sleeve is moved with suitable sliding forks mounted on the respective sliding tool.



Clamp ring screwing

The clamp ring screwing enables pipe and manifold connections to be established quickly and reliably. The connection between the pipe and fitting is established by a combination of clamp ring screwing and union nut. This is a detachable connection.

3. Underfloor heating systems

3.1 Renovation system

The MAINFLOOR renovation system can be laid directly on existing surfaces such as screed, tiles or wooden flooring.

Areas of application

Residential and office buildings
Medical practices
Detached houses

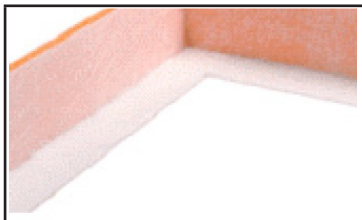
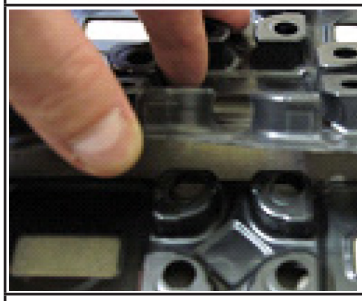
Product designation	Plastic pipe PE-Xc	PE-RT plastic pipe
System components		
Article number	12010220	50100031200
Dimensions	10 x 1.3	10 x 1.3
Colour	Red	Natural
Max. temperature load	90°C	90°C
Max. continuous temperature load	70°C	70°C
Max. operating pressure in bar (ISO 10508) at 70°C	8 bar	6 bar
Application class (ISO 10508)	4	4
Water capacity l/running metre	0.043	0.043
Packaging unit	200m	200m

Useful load up to 3 kN/m^2, concentrated load up to 2kN

Product designation	Pipe positioning plate
Article number	51903160
Plate dimensions	1.025m x 1.025m
Plate dimensions	1.0m x 1.0m
Colour	Black
Material	PS
Pipe positioning element height	13 mm
Pipe diameter	10 mm
Packaging unit	15 pcs

Installation instructions

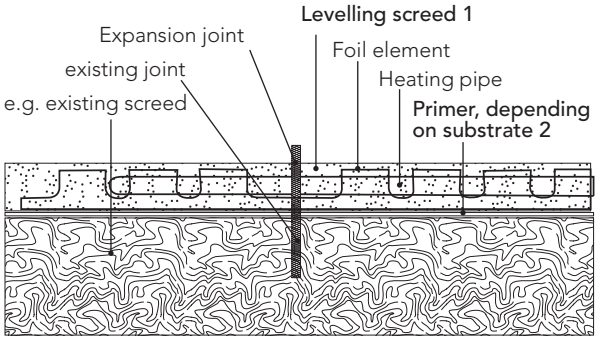
Prior to installation of the renovation system, the subfloor must be checked for sufficient load-bearing capacity by the contractor! The subfloor must be firm, clean (free from grease and cleaning agents) and free from cracks. Cracks must be filled with resin if necessary and any unevenness (isolated ridges, pipes, cables) removed. The type of priming depends on the material of the old substrate. Wood surfaces require special attention, joints must be sealed, primed with special primer, levelled with a 2 mm thick floor-levelling compound and primed twice with screed primer. The manufacturer's instructions must be observed in any event!

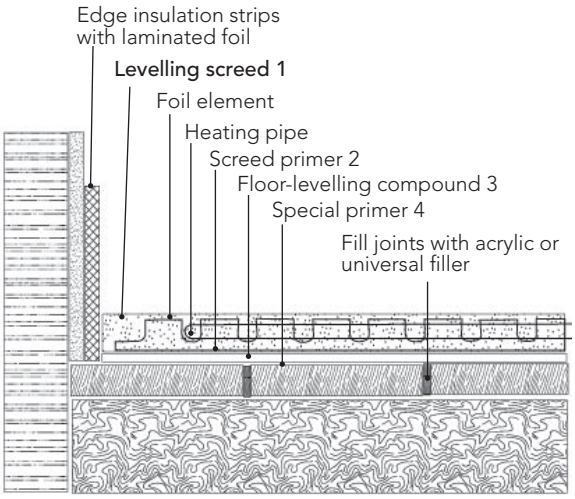
	Fixing insulation strip to walls.
	Remove about 10 cm of the protective foil, fix the pipe support foil element including protective foil to the semicircular profiles in the left corner of the room. Slowly remove the protective foil and fix to the floor. Place the next pipe support foil elements with the semicircular profiles over the outer row of the closed side, connect the plates and remove the protective foil as for the first plate. If adhesion to the floor is insufficient, fixing can take place mechanically if required.
	Fast one-man laying of PE-RT heating pipes. Self-aligning pipe guidance in profiles with 50 mm pitch and laying at a 45° angle with 70 mm pitch. Fill heating circuits and test under pressure.
	Pouring filling compound.
	The new floor is walkable after about 5 hours and loadable after 2 days. Ready for foot traffic after preparatory subfloor heat-up phase and a residual moisture of ≤ 0.3 CM - % (test with CM instrument).

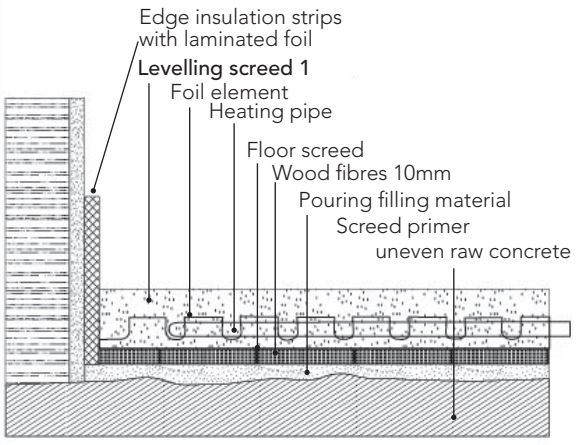
Renovation system installation examples

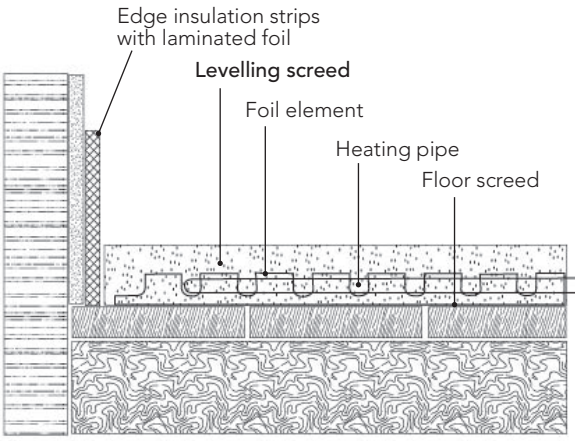
The MAINFLOOR renovation system can be installed on different substrates and in different designs. The manufacturer's instructions and pertinent standards must be observed for installation of the system!

The subfloor must be sound and dimensionally stable, crack and vibration-free, firm, dry and clean. The underfloor heating must not be switched on while laying the screed and the subfloor must be at normal room temperature.





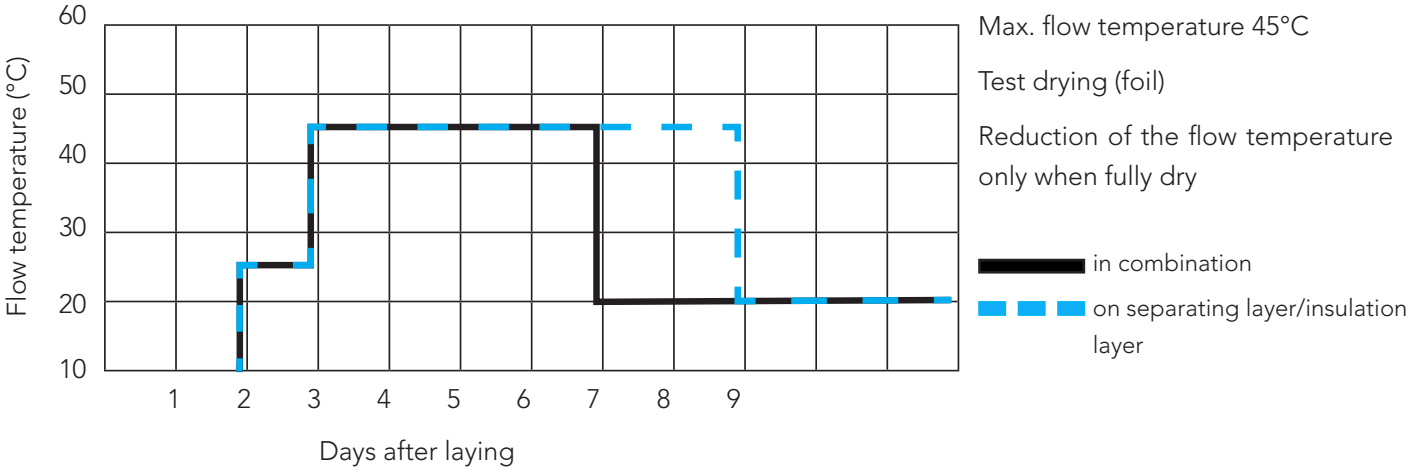




Processing example with Knauf levelling screed 425

The renovation system must be installed as previously described. This processing example is based on the technical directive F422.de of Knauf. Observe the manufacturer's instructions for processing.

The graph below shows a preparatory heat-up phase for a layer thickness of 20 mm. The floor is ready for foot traffic after seven days. If a separating layer is to be installed, this is extended by two days. Readiness for foot traffic is given from a CM residual moisture of 0.3%.



Top coverings	Composite construction	Screed on insulation layer or separating layer
Textile	Without restriction	Without restriction
Elastic	Without restriction	Without restriction
Tiles	Without restriction	Ceramic tiles up to 60 cm x 60 cm Natural stone up to 40 cm x 40 cm
Parquet	Without restriction	Mosaic, multilayer hardwood flooring others available on request
Floating flooring	Without restriction	Without restriction

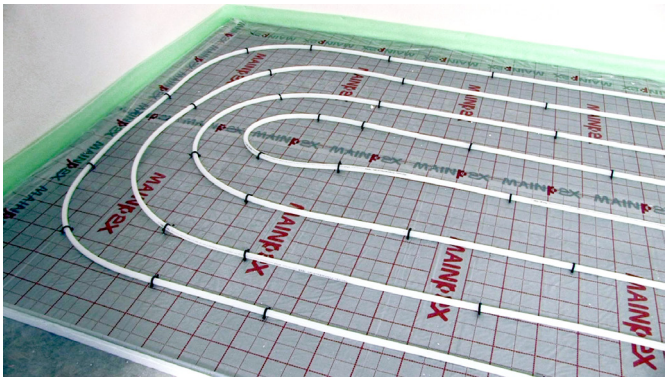
Special screed layer thicknesses			
Name	Bag size	Consumption	Thickness
Weber.Plan 813-10	25 Kg	1.5Kg/m² per 1mm layer thickness	Up to 10mm
Weber.Plan 813-25	25 Kg	1.5Kg/m² per 1mm layer thickness	Up to 25mm
Weber.Plan 813-40	25 Kg	1.5Kg/m² per 1mm layer thickness	Up to 40mm
PCI-Periplan	25 Kg	1.6Kg/m² per 1mm layer thickness	2mm - 30mm
Knauf 425	40 Kg	1.8Kg/m² per 1mm layer thickness	see F422.de

3.2 Stapler system

The staple system is the most popular method for laying underfloor heating systems. Free installation and uncomplicated handling make this method of installation a classic among underfloor heating systems. In conjunction with the MAINCOR insulation roll and foil, the U-clips are held securely.

Areas of application

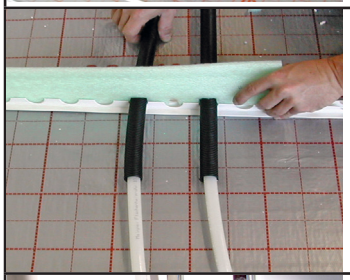
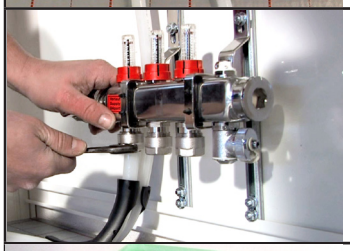
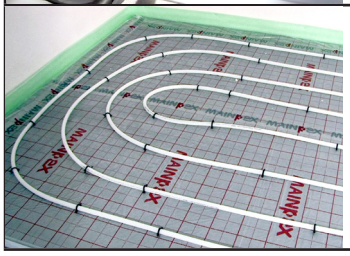
Old and new buildings
Industrial buildings
Passive house systems
Radiant heating and cooling
Cement and floating screed



System components

Product designation	**Insulation roll 20-2**	**Insulation roll 25-2**	**Insulation roll 30-2**	**Insulation roll 30-3**	**Fanfold board 30**	**U-clip**
Article number	50903034	50903252	50903020	50903303	509030235	50903021
Nominal thickness dl	30 mm	25 mm	30 mm	30 mm	30 mm	-
Compressibility	2 mm	2 mm	2 mm	2 mm	-	-
Thermal conductivity category	WLG 045	WLG 045	WLG 040	WLG 040	WLG 035	-
Thermal conductivity according to DIN 4108	0.045 W/mK	0.045 W/mK	0.040 W/mK	0.040 W/mK	0.035 W/mK	-
Thermal resistance	0.44 m^2K/W	0.55 m^2K/W	0.75 m^2K/W	0.75 m^2K/W	0.857 m^2K/W	-
Stiffness	20 MN/m^3	20 MN/m^3	20 MN/m^3	20 MN/m^3	-	-
Impact sound level reduction	28 db	28 db	28 db	29 db	-	-
Traffic load	4 kPa	4 kPa	5 kPa	4 kPa	100 kPa	-
Material	EPS	EPS	EPS	EPS	EPS	-
Applicable standards	EN 13163 DIN 4108	EN 13163 DIN 4108	EN 13163 DIN 4108	EN 13163 DIN 4109	EN 13163 DIN 4108	-
Designation according to standard	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP3	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)100-BS50	-
Area of application	DES sg	DES sg	DES sg	DES sg	DEO	-
Quality control	CE/FIW	CE/FIW	CE/FIW	CE/FIW	CE/FIW	-
Fire behaviour according to EN 13501	Class E	Class E	Class E	Class E	Class E	-
Building material class according to DIN 4102	B2	B2	B2	B3	B2	-
Foil material	PP fabric	PP fabric	PP fabric	PP fabric	PP fabric	-
Protection against moisture according to DIN 18560	Yes	Yes	Yes	Yes	Yes	-
Foil overlap	30 mm	30 mm	30 mm	30 mm	30 mm	-
Packaging unit	10 m^2	10 m^2	10 m^2	10 m^2	10 m^2	900 pcs
Dimensions	10 m x 1.0 m	10 m x 1.0 m	10 m x 1.0 m	10 m x 1.0 m	2.0 m x 1.0 m	40 mm

Installation instructions

	The edge insulation strip must be fixed to the walls.
	The insulation roll is rolled out on to the insulation underlay and bonded to it. The edge insulation strip is bonded to the insulation roll if necessary. EN 4108 and the Energy Saving Ordinance (EnEV) must be observed in any event.
	The pipe is uncoiled using the MAINCOR pipe decoiler and fixed in place with the tacker. For floating screeds, the pipes must be fixed closer together to prevent flotation. Specified minimum bending radii must be observed.
	Expansion joints must comply with EN 1264.
	The pipes are finally connected to the manifold.
	Installation completed with the staple system.

3.3 Rail system

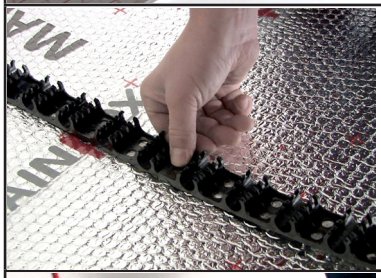
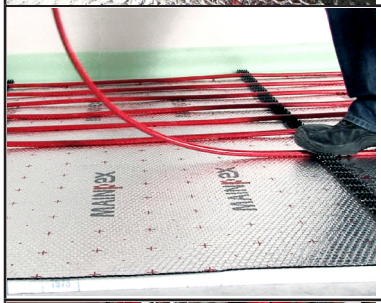
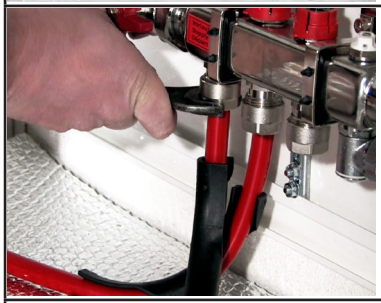
The MAINCOR rail system can be combined with different types of insulation materials and insulation thicknesses. The pipes are simply clicked into the rails for quick and easy installation and can also be corrected after installation. The MAINCOR rail system is suitable for 14 to 20 mm pipes.

Areas of application

Old and new buildings
Wall and ceiling heating systems
Radiant heating and cooling
Cement and floating screed

System components

Product designation	**Insulation roll 20-2**	**Insulation roll 25-2**	**Insulation roll 30-2**	**Insulation roll 30-3**	**Fanfold board 30**	**Clip rail**
Article number	50903034	50903252	50903020	50903303	509030235	50903036
Nominal thickness dl	30 mm	25 mm	30 mm	30 mm	30 mm	-
Compressibility	2 mm	2 mm	2 mm	2 mm	-	-
Thermal conductivity category	WLG 045	WLG 045	WLG 040	WLG 040	WLG 035	-
Thermal conductivity according to DIN 4108	0.045 W/mK	0.045 W/mK	0.040 W/mK	0.040 W/mK	0.035 W/mK	-
Thermal resistance	0.44 m^2K/W	0.55 m^2K/W	0.75 m^2K/W	0.75 m^2K/W	0.857 m^2K/W	-
Stiffness	20 MN/m^3	20 MN/m^3	20 MN/m^3	20 MN/m^3	-	-
Impact sound level reduction	28 db	28 db	28 db	29 db	-	-
Traffic load	4 kPa	4 kPa	5 kPa	4 kPa	100 kPa	-
Material	EPS	EPS	EPS	EPS	EPS	PP
Applicable standards	EN 13163 DIN 4108	EN 13163 DIN 4108	EN 13163 DIN 4108	EN 13163 DIN 4109	EN 13163 DIN 4108	-
Designation according to standard	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP2	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)5-BS50-SD20-CP3	EPS-EN13163-L(3)-W(3)-T(1)-S(5)-P(5)-DS(N)100-BS50	-
Area of application	DES sg	DES sg	DES sg	DES sg	DEO	-
Quality control	CE/FIW	CE/FIW	CE/FIW	CE/FIW	CE/FIW	-
Fire behaviour according to EN 13501	Class E	Class E	Class E	Class E	Class E	-
Building material class according to DIN 4102	B2	B2	B2	B3	B2	-
Foil material	PP fabric	PP fabric	PP fabric	PP fabric	PP fabric	-
Protection against moisture according to DIN 18560	Yes	Yes	Yes	Yes	Yes	-
Foil overlap	30 mm	30 mm	30 mm	30 mm	30 mm	-
Packaging unit	10 m^2	10 m^2	10 m^2	10 m^2	10 m^2	100 m
Dimensions	10 m x 1.0 m	10 m x 1.0 m	10 m x 1.0 m	10 m x 1.0 m	2 m x 1 m	1m x 3.8cm

	The edge insulation strip must be fixed to the walls.
	The insulation roll is rolled out on to the insulation underlay and bonded to it. The edge insulation strip is bonded to the insulation roll if necessary. For insulation material selection, EN 4108 and the Energy Saving Ordinance (EnEV) must be observed in any event.
	The MAINCOR rail system is simply bonded to the already laid insulation. The material requirement is 1m per m^2. The substrate must be dust-free for bonding.
	The pipe is uncoiled using the MAINCOR pipe decoiler and simply clicked into the rails. Expansion joints must comply with EN 1264.
	The laid pipes are connected to the manifold.
	Example of an installation completed with the rail system with pipes laid in a meander pattern.

3.4 Pipe positioning panel system

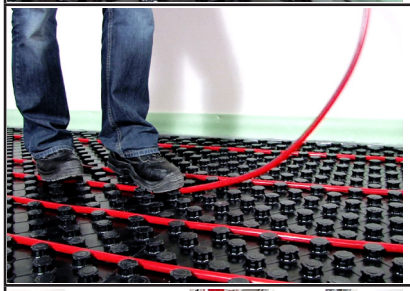
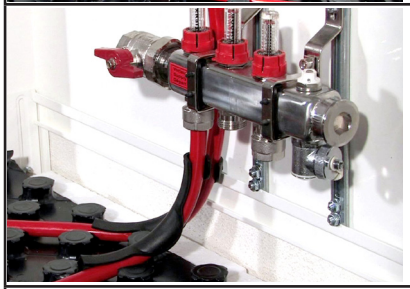
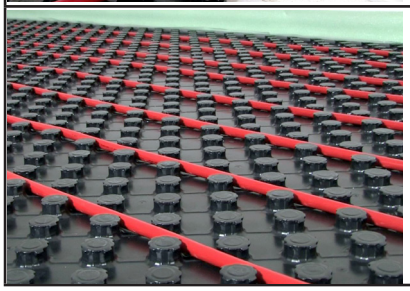
The MAINCOR pipe positioning panel system is floating screed tight. The pipe positioning elements hold the heating pipes securely. The panels are tread resistant and designed for flexible pipe laying due to numerous additional elements.

Areas of application

Industrial buildings
Passive house systems
Cement and floating screed

System components

Product designation	Pipe positioning panel without Insulation	Premium pipe positioning panel	
		NP 11	NP 30-2
Article number	51903060	51903061	51903062
Total thickness	-	31 mm	51 mm
Nominal insulation thickness	-	11 mm	30 mm
Compressibility	-	-	2 mm
Thermal conductivity category	-	WLG 035	WLG 040
Thermal conductivity according to DIN 4108	-	0.035 W/m²K	0.040 W/m²K
Thermal resistance	-	0.31 m²K/W	0.75 m²K/W
Stiffness	-	-	SD 20
Impact sound level reduction	-	-	28 db
Traffic load	N.A.	75 kPa	5 kPa
Material	PS	PS/EPS	PS/EPS
Applicable standards	EN 1264	EN 1264 EN 13163	EN 1264 EN 13163
Designation according to DIN EN 13163	-	EPS-EN13163-T1-L1-W1-S1-P3-DS(N)5-DLT(1)5-BS250-CS(10)150	EPS-EN13163-T1-L1-W1-S1-P3-DS(N)5-BS100-SD20-CP2
Area of application	-	DEO	DESsg
Fire behaviour according to EN 13501	Class E	Class E	Class E
Building material class according to DIN 4102	B2	B2	B2
Protection against moisture according to DIN 18560	Yes	Yes	Yes
Packaging unit	12 pcs	13 pcs	6 pcs
Plate dimensions	1.4m x 0.8m	1.4m x 0.8m	1.4m x 0.8m
Plate dimensions	1.45m x 0.85m	1.45m x 0.85m	1.45m x 0.85m

	The edge insulation strip must be fixed to the walls.
	The panels must be laid out and joined simply by pressing the elements into each other. The insulation requirements of EN 4108 and the Energy Saving Ordinance (EnEV) must be observed in any event.
	The pipe positioning panels must be sealed with PE sealing tape at the edges.
	The heating pipe is simply pressed into the pipe positioning plates.
	The pipes are finally connected to the manifold.
	Installation completed with the pipe positioning plate system with pipes laid in a bifilar pattern.

3.5 Wall heating system

The MAINCOR wall heating system for wet and dry construction is used when underfloor heating cannot be installed or an additional heat source is required. The MAINCOR wall heating system offers considerable advantages compared to conventional heating systems with respect to low flow temperatures. Walls must be structurally capable of supporting the wall heating. Angular and flatness tolerances according to DIN 18202 must be observed.

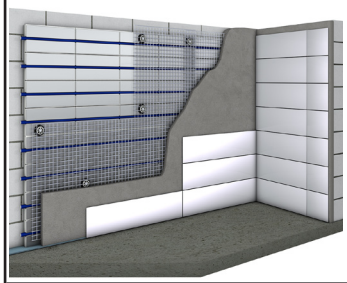
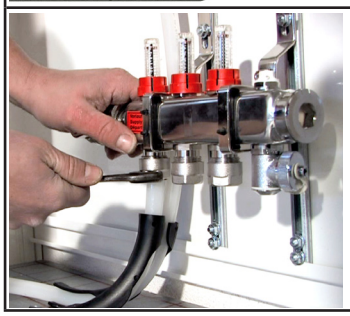
Areas of application

For heating or cooling old and new buildings, bathrooms, saunas, low flow temperatures, wet and dry construction

System components

Product designation	Clip rail	Dry construction aluminium VA 12.5
Article number	50903036	51903030
Pipe dimensions	16 x 2.0	16 x 2.0
Colour	Black	white/aluminium
Material	PP	EPS/Al
Width	45 mm	1 m
Length	1 m	0.5 m
Packaging unit	100 m	10 pcs/box

Product designation	PE-RT/Alu/PE-RT composite pipe
Article number	10016203
Dimensions	16 x 2.0
Colour	Red
Max. temperature load	90°C
Max. continuous temperature load	70°C
Max. operating pressure in bar (ISO 10508) at 70°C	10 bar
Application class (ISO 10508)	4
Water capacity l/running metre	0.133
Packaging unit	300 m

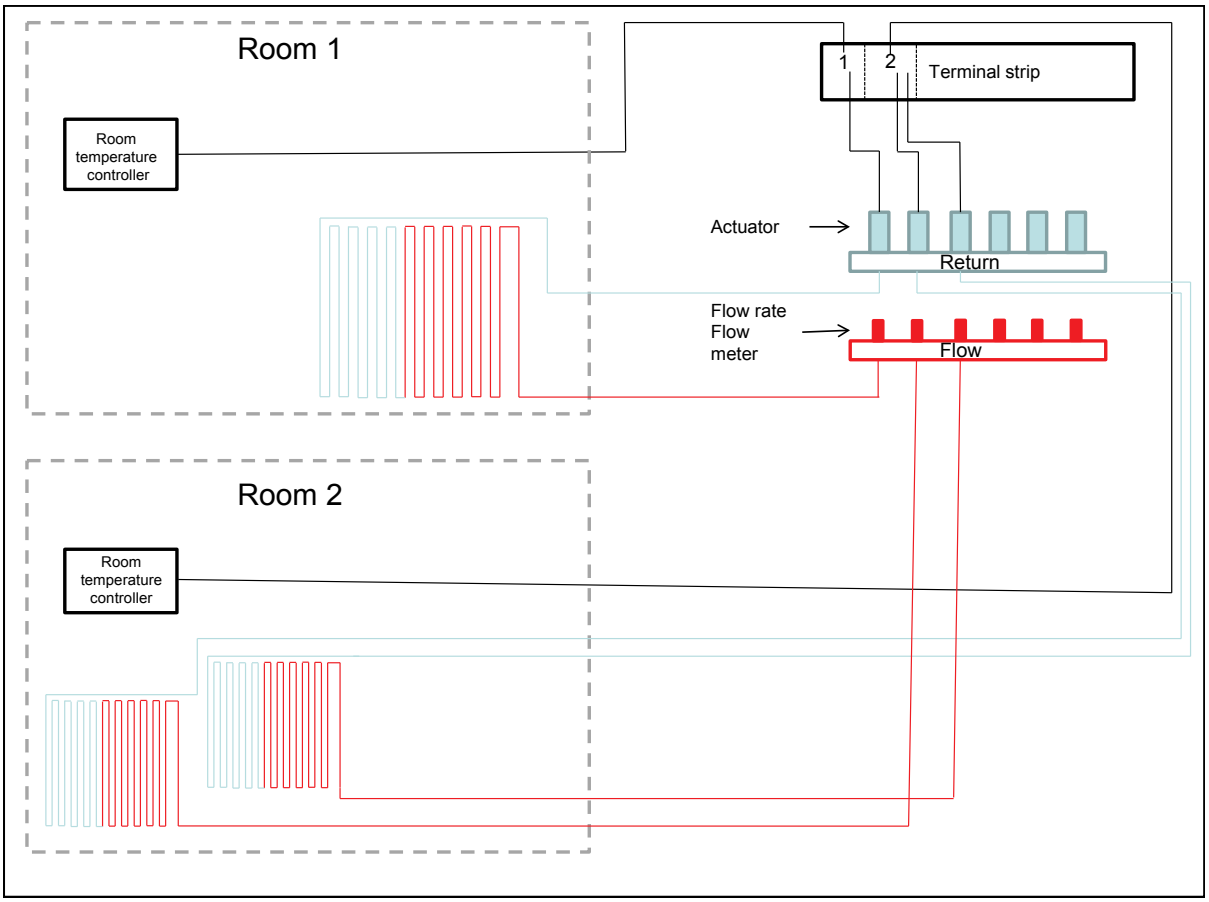
	If required: fixing insulation. The heat demand must be determined beforehand depending on the heating load according to DIN EN 12831. As no standards exist for wall heating systems with regard to testing, design, layout and construction, thermal design/planning takes place according to DIN EN 1264.
	The dry construction element Alu VA 12.5 is fixed to the wall using Mapei Ultrabond adhesive.
	After installation of the clip rails, the pipes are laid ascending in a meander pattern and pressed into the groove. The flow pipe must be mounted so that the water flows from the bottom up along the wall.
	Semi-finished laid wall heating prior to plastering.
	Mesh must be placed over the installed wall heating to support the plaster. Important to note is that pure gypsum plaster cannot be used at temperatures above 50°C.
	The laid pipes are connected to the manifold.

4. Control system

4.1 Basic principles

A modern heating system is made up of numerous individual components. A sophisticated control system is an important building block. MAINCOR control systems are perfectly matched for quick and easy installation and are of the highest quality.

Principle layout



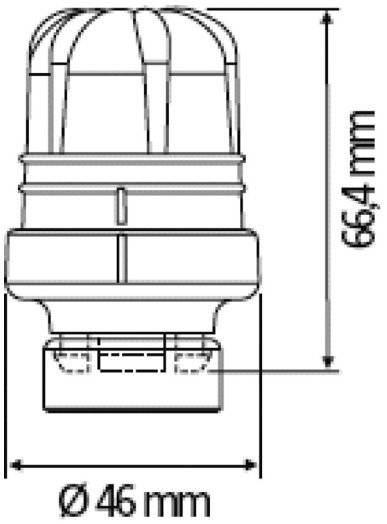
The current room temperature is measured by the room temperature controller, which heats the room based on the preset temperature. The room temperature controller is connected to the actuator via a terminal strip. When the room temperature controller sends a „heat" signal, the actuator is opened and heats the heating circuit(s). Each terminal strip channel can control several actuators (heating circuits).

The connection between the room temperature controller and terminal strip can be wired or radio controlled. The principle shown above applies to both systems.

Connection of the room temperature controller must take place by a trained and qualified person.

4.2 Actuator

The MAINCOR actuator is suitable for all MAINCOR manifolds. The operating status is indicated via a window at the top of the actuator. The actuator is closed when in an unpowered state and has a working stroke of 4.5 mm.



The MAINCOR actuator is robust and noiseless. Manual adjustment enables easy installation and simple emergency operation. The „First open" function is realised via an interlock system. The valve stroke indicator constantly shows the operating status and stroke position. The MAINCOR actuator is available in 230V and 24V versions, each normally closed. Overhead installation is possible.

Product designation	**Actuator**	**Actuator**
Article number	50903011	50903111
Power supply	230 VAC 50Hz	25 VAC
Starting current	<1 A	<0.5 A
Power consumption	2.5 W	2.5 W
Thermal actuator	open/closed	open/closed
Valve type	normally closed	normally closed
Connecting cable	2 x 0.5mm², 1 metre long	2 x 0.5mm², 1 metre long
Degree of protection	IP54	IP54
Safety class	II	II
Stroke	4.5mm	4.5mm
Connecting dimension	M 30 x 1.5 mm	M 30 x 1.5 mm
Weight	about 120g	about 120g
Dimensions	d= 46mm, 80.4mm high open	d= 46mm, 80.4mm high open
Storage temperature	-25°C to 70°C	-25°C to 70°C
Operating temperature	0°C - 50°C	0°C - 50°C

4.3 Regulation-box RTL

The control box consists of a wall mounting box with premounted RTL valve block and external RTL head, blanking plate, vent valve and wall cover. The valve block has a 3/4" external thread (eurocone) for pipe-sided connection via clamp connection. The regulation-box RTL arranged in the return flow of the heating system controls the maximum permissible return temperature in the system via an integrated RTL thermostatic valve.

Areas of application

Radiant heating
Wall heating
Individual room control
Particularly for small rooms

Product data

Technical data	
Width	156 mm
Height	211 mm
Depth	64 mm
Depth of box with head	138 mm
Depth compensation	23 mm
Pipe connection	3/4" external thread, eurocone
Thermostat head connection	M 30 x 1.5

The adjustment range of the installed RTL thermostat head is 1-5 as shown in the temperature table below.

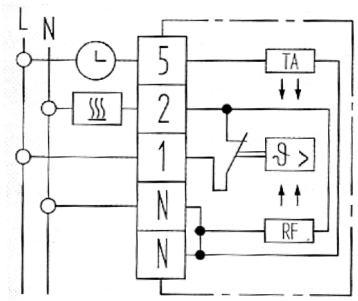
Regulation-box RTL adjustment range					
Setting mark	1	2	3	4	5
approximate return temperature	10°C	20°C	30°C	40°C	50°C

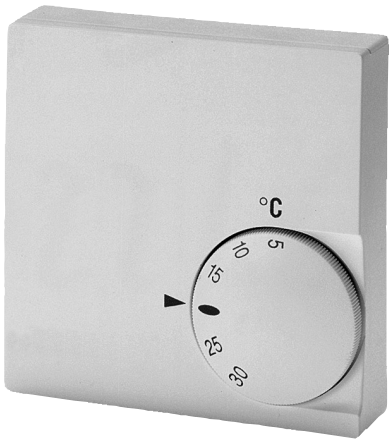
4.4 Room temperature controller

On-wall heating

MAINCOR room temperature controllers are popular with customers - intuitive operation, timeless design and fast installation are the main attributes. The thermostat is electromechanical with a very low hysteresis.
MAINCOR room temperature controllers are available in various designs for individual applications. External heat sources such as sunlight in rooms can be taken into account.

Product data

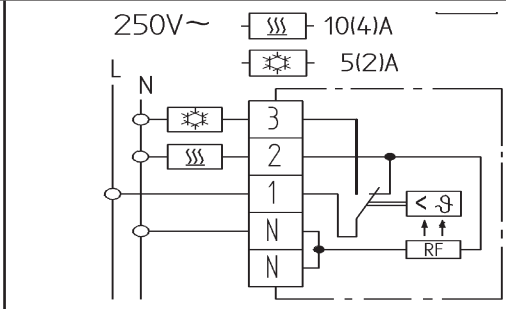
Product designation	**Room temperature controller for on-wall heating**
Article number	50903012
Contact	1 NC contact
Switching current	10 A (AC), 100W DC
Operating voltage	AC 230V 50/60Hz
Power consumption	-
Output signal	On/Off
Control range	5°C - 30°C
Operating time	-
Hysteresis	0.5 K
Degree of protection	IP 30 (DIN EN 60529)
Dimensions	75mm x 75mm x 25.5mm
Circuit diagram	

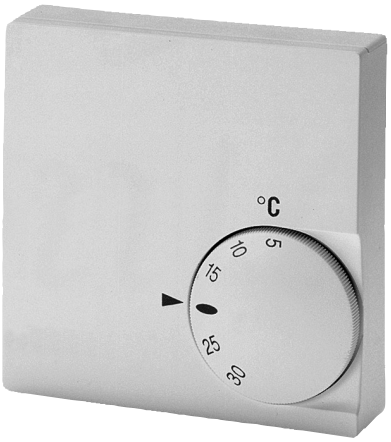


On-wall heating/cooling

MAINCOR heating/cooling room temperature controllers are popular with customers. Intuitive operation, timeless design and fast installation are the main attributes. The room temperature controllers are electromechanical with one changeover contact for heating and cooling.
MAINCOR room temperature controllers are available in various designs for individual applications. External heat sources such as sunlight in rooms can be taken into account. A cooling system can also be controlled via the radiant heating with the aid of an additional contact.

Product data

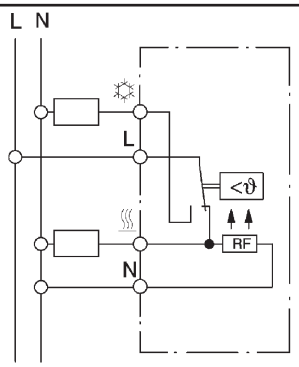
Product designation	**Room temperature controller for on-wall heating/cooling**
Article number	50903016
Contact	1 changeover contact
Switching current	Heating 10 A (AC), 30W DC Cooling 5 A (AC)
Operating voltage	AC 230V 50/60Hz
Power consumption	-
Output signal	Heating/Cooling
Control range	5°C - 30°C
Operating time	-
Hysteresis	0.5 K
Degree of protection	IP 30 (DIN EN 60529)
Dimensions	75mm x 75mm x 25.5mm
Circuit diagram	



In-wall

MAINCOR in-wall room temperature controllers have the same features as the heating/cooling room temperature controllers only that they are suitable for in-wall mounting.
MAINCOR room temperature controllers are available in various designs for individual applications. External heat sources such as sunlight in rooms can be taken into account. A cooling system can also be controlled via the radiant heating with the aid of an additional contact.

Product data

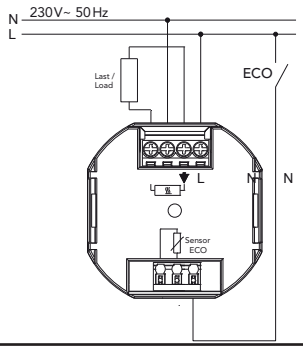
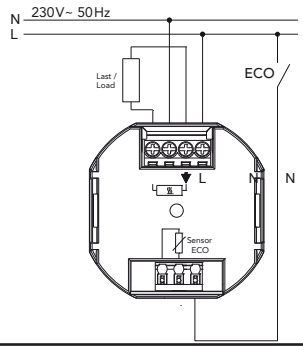
Product designation	In-wall room temperature controllers
Article number	50903013
Contact	1 changeover contact
Switching current	Heating 10 A (AC) Cooling 5 A (AC)
Operating voltage	AC 230V 50/60Hz
Power consumption	-
Output signal	Heating/Cooling
Control range	5°C - 30°C
Operating time	-
Hysteresis	0.5 K
Degree of protection	IP 30 (DIN EN 60529)
Dimensions	75mm x 75mm
Circuit diagram	

Energy-saving room temperature controllers

MAINCOR energy-saving room temperature controllers with large temperature display feature an individual weekly programming option. These controllers include special programmes such as party mode and holiday mode and are available with an optional external sensor.

Room temperatures quickly increase when exposed to heat sources such as sunlight or tiled stoves and conventional temperature controllers switch off the heating when a specific temperature is reached. Since warm water underfloor heating systems in particular take longer to heat up, relatively low floor temperatures and possibly cold feet can result. The minimum limitation of the 3L prevents excessive floor cooling so that a certain amount of heat is retained in the floor. This minimum temperature can be individually adjusted.

Product data

Product designation	Energy-saving room temperature controller 3R	Energy-saving room temperature controller 3L with limiter function
Article number	50903113	50903114
Contact	1 NO contact	1 NO contact
Switching current	10 A (AC)	10 A (AC)
Operating voltage	AC 230V 50	AC 230V 50
Power consumption	1.2W	1.2W
Output signal	On/Off - PWM	On/Off - PWM
Control range	5°C - 30°C	5°C - 30°C
Operating time	max. 10 min	max. 10 min
Hysteresis	0.5K	0.5K
Degree of protection	IP 30	IP 30
Dimensions	80.5mm x 80.5mm	80.5mm x 80.5mm
Circuit diagram		

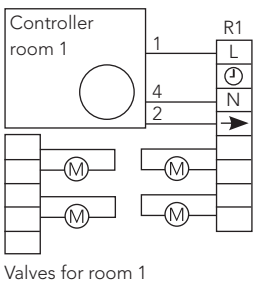
4.5 Terminal strip

MAINCOR terminal strips are used for wiring electrothermal actuators to room temperature controllers for individual room control. One room thermostat per channel can be connected to several actuators.
Room temperature controllers are connected to the respective actuators via the terminal strip. The terminal strip can be coupled with the pump logic and control the fixed setpoint control set.

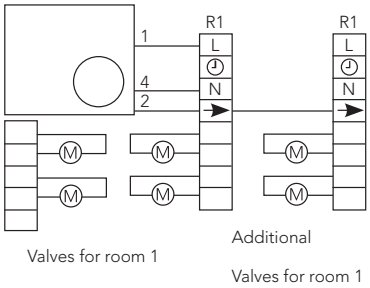
Product data

Product designation	230V terminal strip	24V terminal strip	Heating+Cooling terminal strip	Pump logic cover	Cover for pump logic with 6-channel time switch
Article number	50903014	51903014	50903015	50903017	50903018
Channels	6	6	6	-	-
Actuators per channel	maximum 5	maximum 5	maximum 5	-	-
Actuators per strip	maximum 14	maximum 14	maximum 14	-	-
Operating voltage	230V 50Hz	230V 50Hz	230V 50Hz	Provided by terminal strip	Provided by terminal strip
Power consumption	10 W	50 W	10 W	-	-
Output signal	On/Off	On/Off	On/Off	-	-
Ambient temperature	0°C - 50°C	0°C - 50°C	0°C - 50°C	0°C - 50°C	0°C - 50°C
Weight	~700g	~2,000g	~700g	~ 150g	~ 150g
Degree of protection	IP 40	IP 40	IP 40	IP 40	IP 40
Dimensions	310mm x 90mm x 65mm	310mm x 90mm x 65mm	310mm x 90mm x 65mm	305mm x 90mm	305mm x 90mm

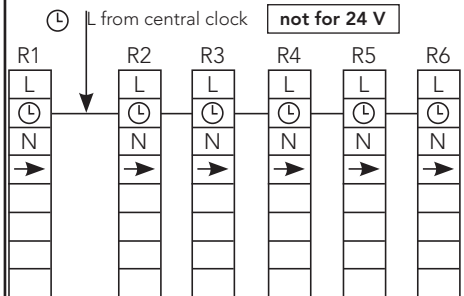
Terminal diagram



The room temperature controller is connected to the terminal strip via the respective channel (R1 - R6). At least one three-core cable without protective conductor must be laid between the room controller and terminal strip.

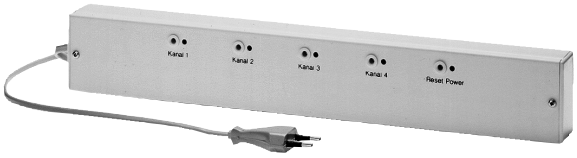


Several channels can be assigned to one room controller via parallel connection.



The switched phase is applied via the respective terminals by a central clock.

4.6 Radio control



The MAINCOR radio control is used when a cable installation is not possible or desired. The MAINCOR radio room controller is coupled with the radio control according to the enclosed description and can be assigned one or more channels. Active transmitter monitoring – in the event of transmitter failure, heating takes place with 30% of the output. A pump logic is already integrated in the MAINCOR radio control.

Product data

Radio terminal strips		
Product designation	**4-channel radio control**	**6-channel radio control**
Article number	50903031	50903032
Channels	4	6
Actuators per channel	10	10
Actuators per strip	40	60
Operating voltage	230V 50Hz	230V 50Hz
Power consumption	3 W	3 W
Output signal	On/Off	On/Off
Ambient temperature	0°C - 50°C	0°C - 50°C
Weight	~530g	~530g
Degree of protection	IP 40	IP 40
Dimensions	372mm x 42mm x 65mm	450mm x 42mm x 65mm

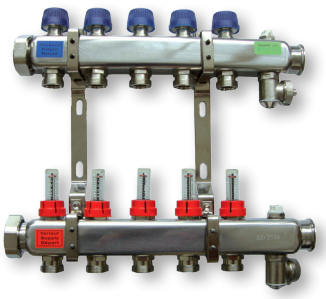
Radio room controller		
Product designation	Radio controller/transmitter AP	Digital clock thermostat
Article number	50903030	50903033
Operating voltage	2 x 1.5V battery	2 x 1.5V battery
Temperature reduction/increase	~2K or 4K (internal jumper)	-
Transmission frequency	868Mhz	868Mhz
Radio range	typically 100m in free air or 1 ceiling or 3 walls	typically 100m in free air or 1 ceiling or 3 walls
Control range	5°C - 30°C	5°C - 32°C
minimum operating time	-	1 minute
Hysteresis	0.5 K	Adjustable
Degree of protection	IP 30	IP 30
Dimensions	75mm x 75mm x 25.5mm	137mm x 96.5mm x 31.3mm

5. Accessories

5.1 Heating manifolds

The MAINCOR stainless steel heating manifold has been designed specifically for the precise control of underfloor and wall heating systems. The return manifold is located at the top with the control valves with a M 30 x 1.5 external thread on which the MAINCOR actuators are mounted. The flow manifold is located below with either flowmeter or flow limiter.

FBH manifold, stainless steel 1 1/4“ type DFA



Areas of application:

- Radiant heating
- Wall heating
- Underfloor heating

Flow manifold		
Entry left	R 1 1/4“	Internal thread
Exit right	R 1“	Internal thread
Flow limiter	Percentage value 0 - 100 %	
Flowmeter	1 - 5 l/minute	

Return manifold		
Entry left	R 1 1/4“	Internal thread
Exit right	R 1“	Internal thread
Control valve connection	M 30 x 1.5	External thread
Maximum valve stroke	3.5	mm
Valve opening force	about 39	N
K_{Vs}	3	m^3/h

Product data

Technical data		
Maximum static pressure	PN 6	Bar
Maximum heating medium temperature	60	°C
Filling and drainage valve	R 3/8“	External thread
Bleeder valve	R 3/8“	External thread
Heating circuit connection	R 3/8“	eurocone external thread

Heating circuits	**Manifold, long Overall length in mm including ball valve**	**Manifold, short Overall length in mm including ball valve**
2	255	250
3	305	300
4	355	350
5	405	400
6	455	450
7	505	500
8	555	550
9	605	600
10	655	650
11	705	700
12	755	750
13	805	800
14	855	850

5.2 Flow meter

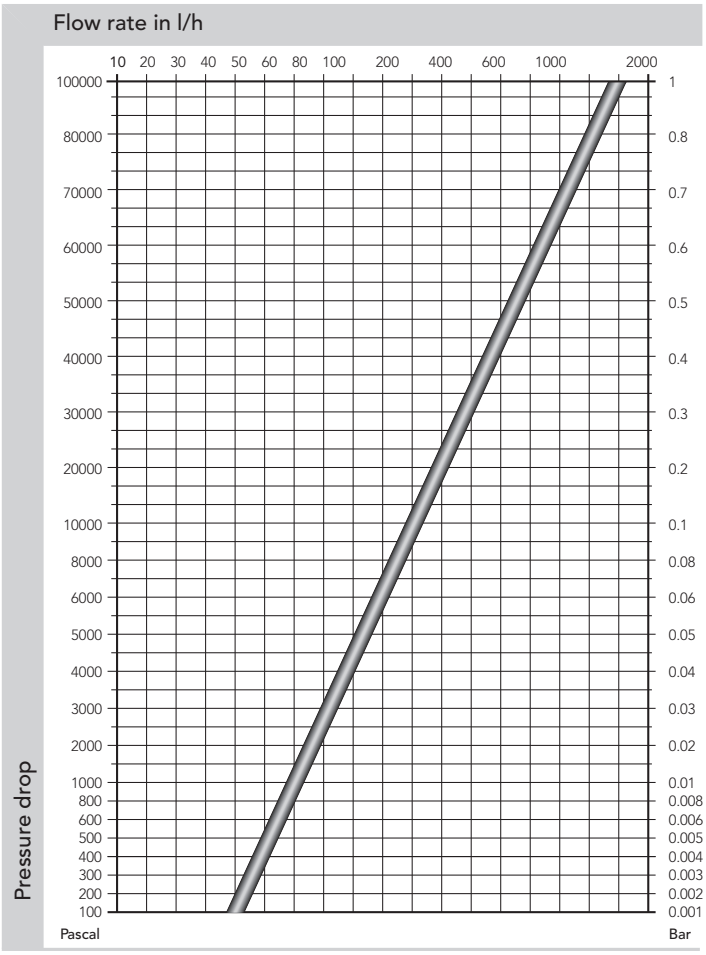
The flow meter is used for precise and convenient adjustment of the required water volumes in the heating circuits. Hydronic, correctly balanced systems ensure optimal energy distribution and economical operation in accordance with the Energy Saving Ordinance. With the flow meter, any qualified person can adjust the correct water volume directly on-site without investment in training and expensive measuring instruments.

Use

The valve flow area can be varied by turning the black spindle, which simultaneously changes the flow rate. The flow cannot be shut off completely with the flow meter. If the flow needs to be shut off, this can take place with the control valve with blue cap on the return manifold. The required flow rate can be adjusted by turning the valve. For hydronic balancing, the interaction of the flow meters must be taken into account and fine adjustment made.

Product data

The flow rate is always indicated on the sight-glass of the flow meter. A Kvs value of 1.1 m3/h is reached with the flow meter fully open. The measuring accuracy is about +/- 10% of the indicated value.



5.3 Flow limiter

To ensure that heating circuits with different heat outputs or register length are only supplied with the appropriate heating water volume, hydronic balancing (inductance) of the individual heating circuits is necessary. This can take place simply and precisely with the DFB flow limiter. For this purpose, the DFB has a scale from 1 to 10, which corresponds to 10 to 100%. This enables more precise adjustment of Kv values from 0.025 to 0.986 m3/h.

Use

The MAINCOR flow limiter enables hydronic balancing to be carried out quickly and easily. Balancing takes place on a percentage basis in relation to the longest heating circuit, which corresponds to the setting „10“ (100%).

(10/K) x heating circuit length = flow limiter adjustment

K = longest heating circuit

Example 1		
Heating circuit	**Length**	**Flow limiter adjustment**
1	100	*10*
2	60	*6*
3	50	*5*
4	30	*3*

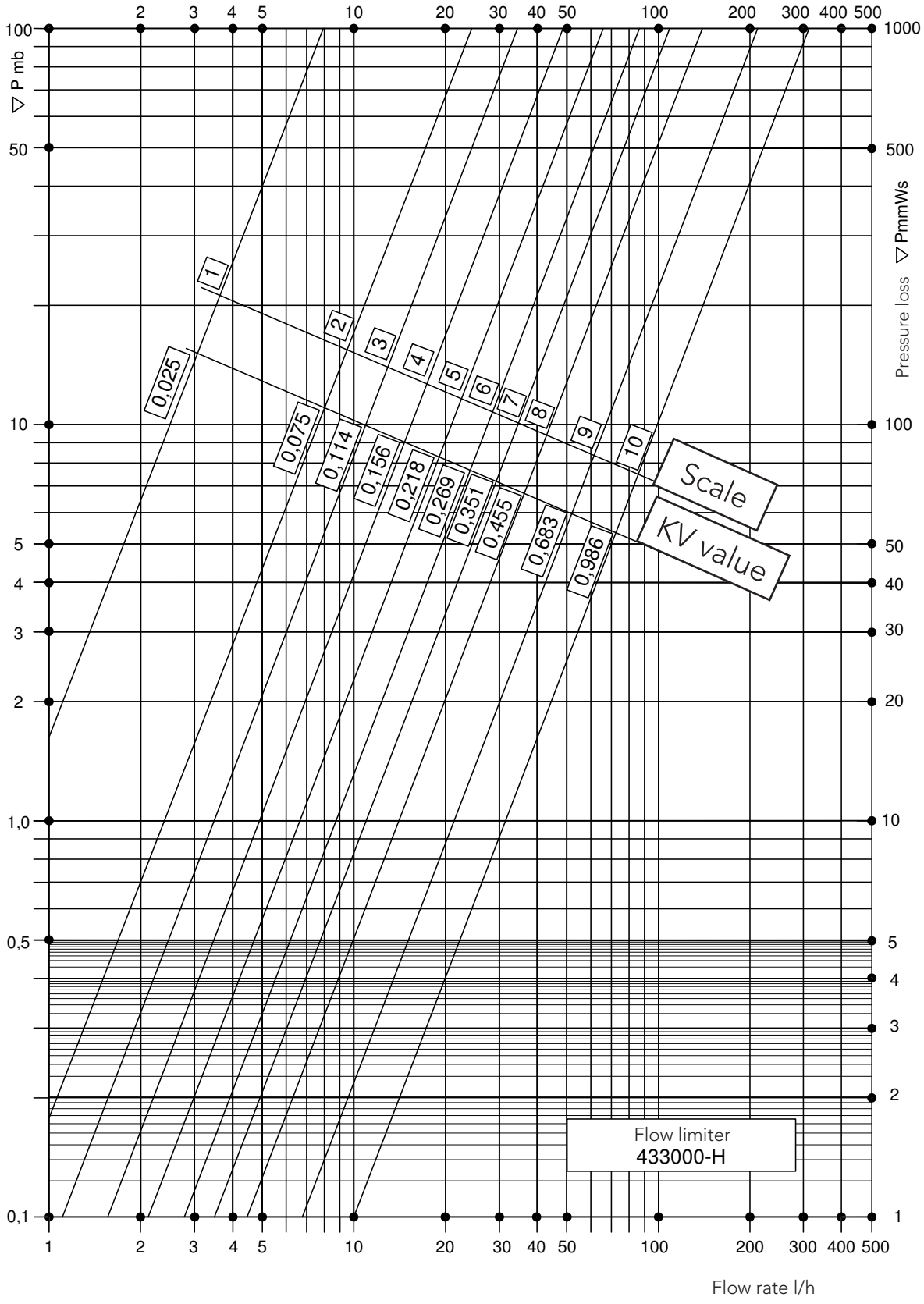
Example 2		
Heating circuit	**Length**	**Flow limiter adjustment**
1	60	*10.00*
2	20	*3.33*
3	45	*7.50*

Product data

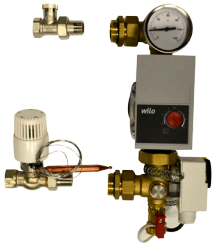
The scale values correspond to one tenth of the respective flow percentage values. Adjustments must take place according to the table below. The diagram on the following page shows the flow rates of individual settings.

	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Adjustment value	1	2	3	4	5	6	7	8	9	10

Flow rate diagram



5.4 Fixed setpoint control set



The MAINCOR fixed setpoint control set is a compact control station for controlling the flow temperature in radiant heating systems. This compact unit is designed for installation in standard distribution cabinets, however it must be ensured that the distribution cabinet is ordered one stage larger than required.

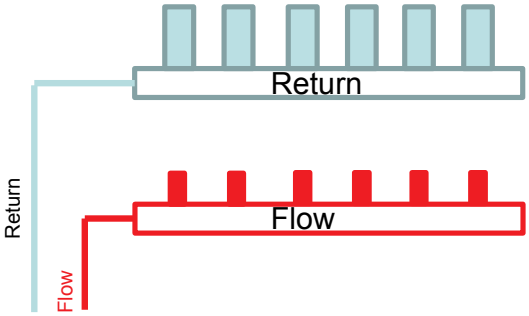
Use:

Through the controlled supply of hot water (e.g. 70°C) from the primary circuit and the addition of colder return water from the underfloor heating system, the flow temperature is reduced to a level appropriate for an underfloor heating system (e.g. 40°C). This is an injection circuit. The flow temperature for the underfloor heating can be adjusted at the thermostat head of the thermostatic valve. Depending on the size of the manifold, the flow temperature of the boiler should be minimum 10 - 15°C higher than the required underfloor heating system temperature to ensure an adequate heat supply. A safety temperature monitor switches off the pump in the event of excessive temperature (e.g. fault on the thermostatic valve) to prevent damage to the underfloor heating system.
Electrical connections must be established by a skilled person. To ensure that the fixed setpoint control set operates efficiently, it must be operated together with a pump logic.

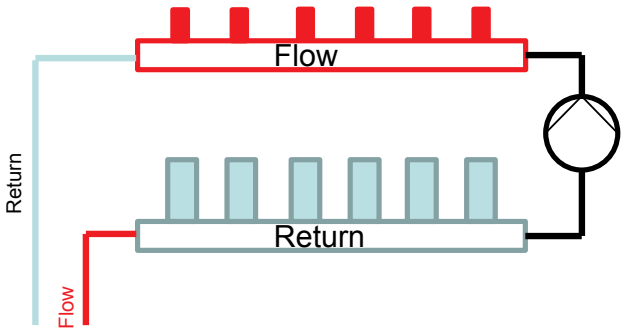
Technical data	
Max. operating temperature	50°C
Max. operating pressure	3 bar
Maximum test pressure	8 bar
Flow connection	1" IG
Return connection	1" IG
Fixed setpoint controller with capillary sensor	M 38 x 1.5
Contact thermostat	AT90
Drainage	1/2" AG
Pump connection	230V/50Hz

Installation:

Our heating manifolds are supplied pre-assembled for the most part. The flow manifold with flowmeters is located at the bottom and the return manifold with actuators is located at the top. In normal operation, i.e. without fixed setpoint control set, the heating manifold can easily be installed in the manifold cabinet.



If our fixed setpoint control set is used, the flow manifold must be located at the top and the return manifold at the bottom. The control valve is mounted on the return manifold. The radiator lockshield valve must be mounted on the flow manifold. When using a fixed setpoint control set, it is important that the return is connected to the flow manifold. For this purpose, appropriate reducers are supplied. On the opposite side, the fixed setpoint control set must be mounted so that the pump operates in the direction of flow.



5.5 Distribution cabinets

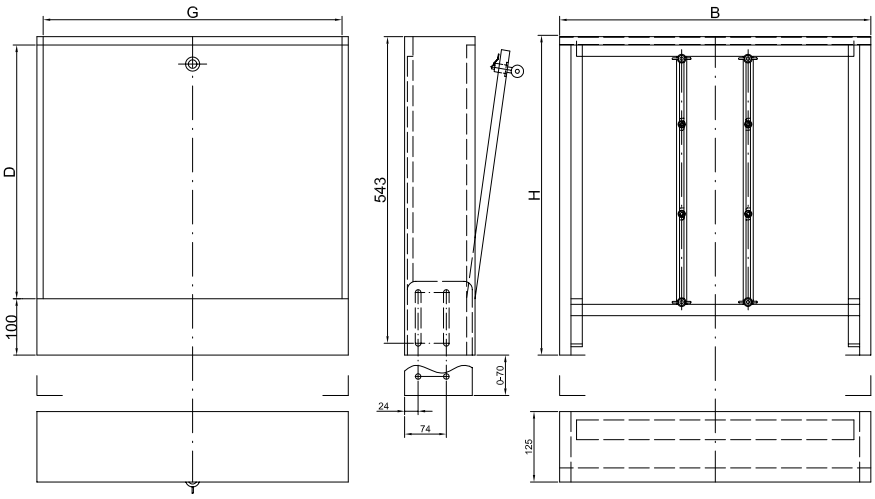
On-wall distribution cabinet

The MAINCOR on-wall distribution cabinet with removable door is made of electrogalvanised sheet steel. The mounting rails at the rear are used to support the heating manifold. The height adjustable cabinet feet provide stability for the manifold and also serve for levelling to the screed.

Use

The distribution cabinet is used in new and old buildings for safe and visually attractive accommodation of the heating manifold. The manifold is fixed to the floor and levelled with the feet. The upper third of the manifold should be fixed via the rear wall with screws.

Product data



	AP 5 3 - 5 circuits	AP 8 6 - 8 circuits	AP 11 9 - 11 circuits	AP 12 from 12 circuits
Article number	50922002	50922003	50922004	50922005
B (mm)	552	802	952	1,102
H (mm)	565-635	565-635	565-635	565-635
G (mm)	530	730	930	1,080
D (mm)	450	450	450	450

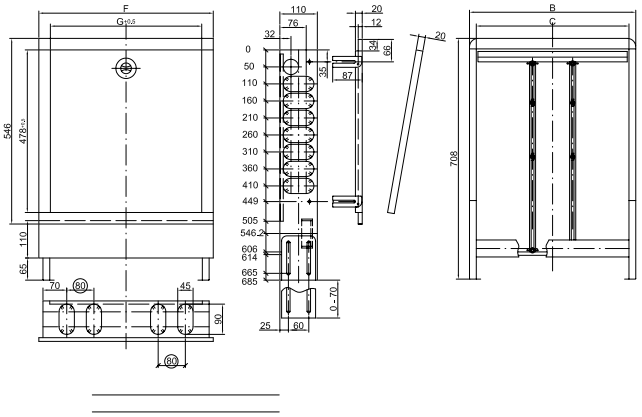
In-wall distribution cabinet

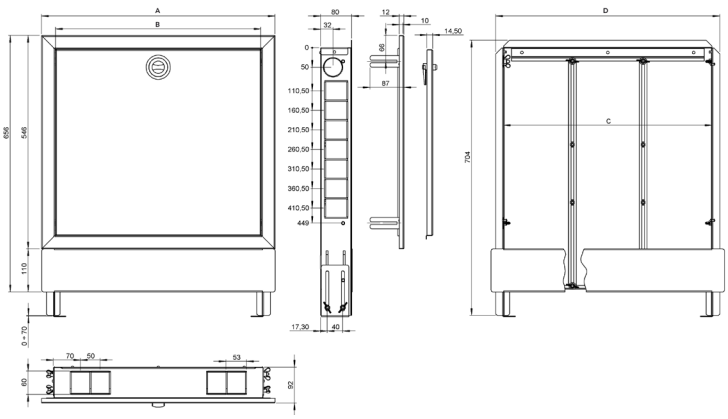
The MAINCOR in-wall manifold cabinet is made of electrogalvanised sheet steel with height adjustable installation frame. The mounting rails at the rear are used to support the heating manifold. The height adjustable cabinet feet provide stability for the manifold and also serve for levelling to the screed.

Use

The manifold cabinet is used in new and old buildings for safe and visually attractive accommodation of the heating manifold. The manifold is fixed to the floor and levelled with the feet (70mm height, 110-140mm or 80mm depth). The upper third of the manifold should be fixed via the rear wall with screws.

Product data





	UP 5 3 - 5 circuits	UP 8 6 - 8 circuits	UP 11 9 - 11 circuits	UP 12 from 12 circuits
Article number	50911002	50911003	50911004	50911005
B (mm)	489	724	874	1,024
C (mm)	449	684	834	984
F (mm)	513	748	898	1,048
G (mm)	445	680	830	980

	UP 5 2 - 5 circuits	UP 8 6 - 8 circuits	UP 11 9 - 11 circuits	UP 12 from 12 circuits
Article No.	50.933.002	50.933.003	50.933.004	50.933.005
A (mm)	513	748	898	1,048
B (mm)	441	676	826	976
C (mm)	449	684	834	984
D (mm)	489	724	874	1,024

5.6 Screed additive

To increase the screed density and improve the flexural and compressive strength, an additive must be used in order to establish a heating screed. Using this additive makes the screed easier to process, as the plastification is increased and less water is required.

Use

Standard screed mixers are used for mixing the screed mortar. Once the first sand has been placed in the machine, add MAINCOR screed additive followed by the binder and water; then add the remaining sand. Mixing time minimum 3 minutes! Ensure or adjust to an earth-moist to stiff-plastic consistency. Apply the screed mortar in the usual way, compact, level and smooth. Smoothing with a machine is recommended. The curing screed must be protected from direct sunlight and draught (for calcium sulphate screeds min. 48 hours). The usual DIN/EN specifications and applicable ZDB notices must be observed.

Designation	**Screed additive, normal**	**Screed additive, low**
Article	50903123	50903223
Basis	Powder	Powder
Density	0.54 kg/l	1.16 kg/l
Material consumption	about 0.05 - 0.2% of binder weight	about 0.4% of binder weight
Processing time	about 90 min. at +20°C	about 120 min. at +20°C
Packaging	15 kg bag	20 kg bag
Storage	12 months, dry	6 months, dry
Min. thickness	45 mm	35 mm
Yield	145 m^2 at 65 mm	400 m^2 at 45 mm
All specified values are approximate. These depend on both the binder and the site conditions.		

Important information:

The production of screed mortar must take place in compliance with the generally recognised building regulations and our processing guidelines as well as the requirements of DIN 18560 „Floor screeds in building construction“ and DIN EN 13813 „Screed material“. Nominal screed thicknesses must comply with the requirements of DIN 18560 „Floor screeds in building construction“ and DIN 18202 „Tolerances in building construction“. Higher nominal screed thicknesses can negatively influence the drying behaviour. The aggregate must be a sand of the particle size group 0/8 according to EN 13139. Fines ≤0.063 mm category 1 of maximum 3%. The grading curve should be constant between A8 and B8. This ensures the best results in terms of drying and strength. The use of an excessive amount of sand or sand that is too fine as well as too much water delays drying and reduces the screed strength. Any sedimentation layers and/or sinter layers must be removed with suitable abrasive material so that the drying phase is not hindered. For cement screeds, all test certificates are based on the use of CEM I cements. Other additives must not be used.

6. Performance tables

- according to DIN EN 1264

The following tables show the heat flow density depending on the laying distance and flow temperature using different types of floor coverings. The specified heat outputs are valid for the following systems:

- Stapler system
- Pipe positioning panel system
- Rail system

The heat output tables for our dry construction systems are also contained in the respective sections.

Flow 40°C/Return 30°C											
Room temperature θ_i [°C]	Heat output q [W/m²] Laying distance of heating pipes [mm]										Floor covering [m²K/W]
	300	250	225	200	175	150	125	100	75	50	
15	72	82	88	95	102	110	118	127	137	147	R_λ = 0.00 m²K/W without covering
18	61	69	74	80	86	92	99	107	115	124	
20	53	61	65	70	75	81	87	93	101	108	
22	45	52	56	60	64	69	74	80	86	93	
24	37	43	46	50	53	57	61	66	71	77	
15	58	65	69	73	78	82	88	93	99	105	R_λ = 0.05 m²K/W Tiles
18	49	55	58	61	65	69	74	78	83	89	
20	43	48	51	54	57	61	64	69	73	78	
22	36	41	43	46	49	52	55	59	62	66	
24	30	34	36	38	40	43	46	48	51	55	
15	49	54	57	60	63	66	70	73	78	82	R_λ = 0.10 m²K/W Carpet
18	41	46	48	51	53	56	59	62	65	69	
20	36	40	42	44	46	49	51	54	57	60	
22	31	34	36	38	40	42	44	46	49	51	
24	26	28	30	31	33	35	36	38	40	43	
15	43	47	49	51	53	56	58	61	64	67	R_λ = 0.15 m²K/W Parquet
18	36	39	41	43	45	47	49	51	54	56	
20	32	34	36	38	39	41	43	45	47	49	
22	27	29	31	32	34	35	37	38	40	42	
24	22	24	25	27	28	29	30	32	33	35	

Heat outputs that exceed the maximum surface temperature for occupied zones of 29°C are shown in red.

Flow 45°C/Return 35°C

Room temperature θ_i [°C]	Heat output q [W/m²]										Floor covering [m²K/W]
	Laying distance of heating pipes [mm]										
	300	250	225	200	175	150	125	100	75	50	
15	91	104	111	120	129	138	148	160	172	185	R_λ = 0.00 m²K/W without covering
18	79	91	97	105	113	121	130	140	151	163	
20	72	82	88	95	102	110	118	127	137	147	
22	64	74	79	85	91	98	105	113	123	132	
24	57	65	70	75	81	87	93	100	108	116	
15	73	82	87	92	98	104	110	117	125	133	R_λ = 0.05 m²K/W Tiles
18	64	72	76	80	86	91	97	103	109	116	
20	58	65	69	73	78	82	88	93	99	105	
22	52	58	62	65	69	74	78	83	89	94	
24	46	51	54	58	61	65	69	73	78	83	
15	62	68	72	76	79	84	88	92	98	103	R_λ = 0.10 m²K/W Carpet
18	54	60	63	66	70	73	77	81	86	90	
20	49	54	57	60	63	66	70	73	78	82	
22	44	49	51	54	56	59	62	66	69	73	
24	39	43	45	47	50	52	55	58	61	64	
15	54	59	61	64	67	70	73	77	80	84	R_λ = 0.15 m²K/W Parquet
18	47	52	54	56	59	62	64	67	70	73	
20	43	47	49	51	53	56	58	61	64	67	
22	38	42	44	46	48	50	52	55	57	60	
24	34	37	39	40	42	44	46	48	50	53	

Heat outputs that exceed the maximum surface temperature for occupied zones of 29°C are shown in red.

Flow 50°C/Return 40°C

Room temperature θ_i [°C]	Heat output q [W/m²] – Laying distance of heating pipes [mm]										Floor covering [m²K/W]
	300	250	225	200	175	150	125	100	75	50	
15	109	125	134	144	155	166	179	192	208	223	R_λ = 0.00 m²K/W without covering
18	98	112	120	130	139	149	160	173	187		
20	91	104	111	120	129	138	148	160			
22	83	95	102	110	118	127	136				
24	76	87	93	100	108	115					
15	88	98	105	111	118	125	133	141	150	160	R_λ = 0.05 m²K/W Tiles
18	79	88	94	99	106	112	119	127	135	144	
20	73	82	87	92	98	104	110	117	125	133	
22	67	75	80	84	90	95	101	108	114	122	
24	61	68	73	77	82	87	92	98	104	111	
15	75	82	86	91	96	101	106	111	118	124	R_λ = 0.10 m²K/W Carpet
18	67	74	78	82	86	90	95	100	106	111	
20	62	68	72	76	79	84	88	92	98	103	
22	57	63	66	69	73	77	81	85	90	94	
24	52	57	60	63	66	70	73	77	82	86	
15	65	71	74	78	81	85	89	92	97	101	R_λ = 0.15 m²K/W Parquet
18	58	64	66	70	73	76	80	83	87	91	
20	54	59	61	64	67	70	73	77	80	84	
22	50	54	56	59	62	65	67	70	74	77	
24	45	49	51	54	56	59	61	64	67	70	

Heat outputs that exceed the maximum surface temperature for occupied zones of 29°C are shown in red.

In fields without values, the surface temperature within the marginal zones is above 35°C and therefore outside the permissible range according to DIN EN 1264.

7. Standards

Applicable standards and directives for underfloor heating installation are shown in the following table. Only the most important reference DIN standards, requirements, regulations and ordinances are listed.

Standards and directives	Meaning
a.R.d.T.	Recognised technical rules
EnEV	Energy Saving Ordinance 2014
ETB	Introduced Technical Building Regulations
Heating costs V	Ordinance on the calculation of heating costs
VOB/B and C	General conditions of contract relating to the execution of construction work, DIN 1961
DIN 1055	Design loads for buildings
DIN 18195	Water-proofing of buildings
DIN 18202	Tolerances in building construction
DIN 18336	German construction contract procedures (VOB); Part C (ATV); Waterproofing
DIN 18352	German construction contract procedures (VOB); Part C (ATV); Wall and floor tiling
DIN 18353	German construction contract procedures (VOB); Part C (ATV); Laying of floor screed
DIN 18356	Laying of parquet flooring
DIN 18560	Floor screeds in building construction
DIN 4102	Fire behaviour of building materials and building components
DIN 4108	Thermal insulation and energy economy in buildings
DIN 4109	Sound insulation in buildings
DIN 4701	Heat demand of buildings
DIN EN 12831	Method for calculation of the design heat load
DIN EN 832	Thermal performance of buildings - Calculation of energy use for heating
DIN EN 1264	Underfloor heating, systems and components
DIN EN 13162	Thermal insulation products for buildings - Factory made mineral wool (MW) products
DIN EN 13163	Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products
DIN EN 13164	Thermal insulation products for buildings - Factory made extruded polystyrene foam (XPS) products
DIN EN 13165	Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products
DIN EN 13166	Thermal insulation products for buildings - Factory made phenolic foam (PF) products
DIN EN 13167	Thermal insulation products for buildings - Factory made cellular glass (CG) products
DIN EN 13168	Thermal insulation products for buildings - Factory made wood wool (WW) products
DIN EN 13169	Thermal insulation products for buildings - Factory made expanded perlite board (EPB) products
DIN EN 13170	Thermal insulation products for buildings - Factory made products of expanded cork (ICB)
DIN EN 13171	Thermal insulation products for buildings - Factory made wood fibre (WF) products
DIN V 4108-10	Thermal insulation and energy economy in buildings - Application-related requirements for thermal insulation materials
DIN V 4108-6	Thermal insulation and energy economy in buildings - Calculation of annual heat and energy use
DIN V 4701-10	Energy efficiency of heating and ventilation systems in buildings - Heating, domestic hot water supply, ventilation
DIN 16833	Polyethylene pipes of raised temperature resistance (PE-RT) - PE-RT type I and PE-RT type II
ISO 21003	Multilayer piping systems for hot and cold water installations inside buildings
DIN EN 22391	Plastic piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT)
ISO 10508	Plastic piping systems for hot and cold water installations - Guidance for classification and design
DIN 16839	Pipes of crosslinked high density polyethylene (PE-X)
DIN 4726	Warm water surface heating systems and radiator connecting systems - Plastic piping systems and multilayer piping systems
DIN EN ISO 15875	Plastic piping systems for hot and cold water installation - Crosslinked polyethylene (PE-X)

8. Certificates

ZERTIFIKAT

SKZ

Verleihungs-Urkunde

Die **SKZ** - TeConA GmbH verleiht der Firma

MAINCOR Rohrsysteme GmbH & Co. KG
Silbersteinstraße 14
97424 Schweinfurt
Deutschland

Herstellwerk: MAINCOR Rohrsysteme GmbH & Co. KG, 97478 Knetzgau

das Recht zum Führen des **SKZ** - Prüf- und Überwachungszeichens

GEPRÜFT SKZ ÜBERWACHT

A 462

für nachstehende Kunststofferzeugnisse

Heizungsrohre
Rohre aus PE-RT/Al/PE-RT, Typ 2

Handelsname: Mainpipe

nach den **SKZ** - Prüf- und Überwachungsbestimmungen **HR 3.12**

Mit der Führung des **SKZ** - Zeichens ist die Verpflichtung verbunden, bei der Herstellung und Prüfung der Erzeugnisse die vorgeschriebenen Bestimmungen einzuhalten.

Erstverleihung am: ---

Gültig bis: 13. März 2019

SKZ - TeConA GmbH SKZ international akkreditiert

i. V.

Würzburg, 14. März 2014

Zertifizierungsstelle

ZERTIFIKAT

SKZ

Verleihungs-Urkunde

Die **SKZ** - TeConA GmbH verleiht der Firma

MAINCOR Rohrsysteme GmbH & Co. KG
Silbersteinstraße 14
97424 Schweinfurt
Deutschland

Herstellwerk: MAINCOR Rohrsysteme GmbH & Co. KG, 97478 Knetzgau

das Recht zum Führen des **SKZ** - Prüf- und Überwachungszeichens

GEPRÜFT SKZ ÜBERWACHT

A 522

für nachstehende Kunststofferzeugnisse

Heizungsrohre
Rohre aus Polyethylen PE-RT
1-, 3- und 5-Schicht

Handelsname: MAINFLOOR

nach den **SKZ** - Prüf- und Überwachungsbestimmungen **HR 3.16**

Mit der Führung des **SKZ** - Zeichens ist die Verpflichtung verbunden, bei der Herstellung und Prüfung der Erzeugnisse die vorgeschriebenen Bestimmungen einzuhalten.

Erstverleihung am: ---

Gültig bis: 13. März 2019

SKZ - TeConA GmbH SKZ international akkreditiert

Würzburg, 24. April 2014

i. V.

Zertifizierungsstelle

9. Reports

Heat-up report for underfloor heating systems

according to DIN EN 1264, part 4 (function heating)

Construction project.....

Component/Stock/Room:.....
Customer:.....
Heating contractor: .....
Type of screed:.....
Manufacturer:.....
Screed layer: .....
Screeding completed on: .....
Start of heat-up with constant 25°C flow temperature on: .....
Start of heat-up at max. flow temperature

of .....°C (max. 60°C permissible) on:..... (earliest 3 days after commencement at 25°C)

Heat-up completed on:.....

(earliest 4 days after commencement at max. flow temperature)

Was heating interrupted?

of .....to.....

Was the heated floor area free? yes/no

Were the rooms ventilated without draught? yes/no

The system was approved at an outside temperature

of .....°C for further building measures on:

.....

The system was not in operation at the time yes/no

The floor was heated at a temperature of.....°C:

.....

Building contractor/Customer	Resident engineer	Installer
Stamp/Signature	Stamp/Signature	Stamp/Signature

Template for pressure test

Pressure test report according to DIN 18380 for heating pipes

Construction project:

.....

.....

.....

.....

Construction phase:

.....

.....

.....

Tester/Company:

.....

.....

.....

System height .....m

Flow temperature design parameters ..... °C Return temperature.....°C

Start:.....(date, time) Test pressure:..... bar (min. 5 bar, max. 6 bar)

End: .....(date, time) Pressure drop: ..... bar (max. 0.2 bar)

max. permissible operating pressure (based on lowest point of the system) ..... bar

Nominal diameters used.....

The aforementioned system was heated on ..... to the design temperature and no leaks were detected. After cooling, no leaks were detected.

A visual inspection of the joints was carried out: yes/no

Antifreeze was added to the water: yes/no

Sequence as stated above: yes/no

Certification:

.....(Place, Date).....(Stamp, Signature, Contractor)

.....(Place, Date).....(Stamp, Signature, Customer)

Radiant heating construction requirements

CUSTOMER ADDRESS:

Company: _____

Name: _____

Street: _____

Postcode, Town: _____

Tel: _____

ADM Maincor: _____

Date: _____

BUILDING-SPECIFIC INFORMATION:

Type: O New building O Old building O Industrial building O Other

The following information must also be provided:
1. Construction plan as a drawing printout or file (dxf, dwg, tiff, pdf, ...)
2. Calculation of thermal insulation EnEV, heating load (if available)
3. Information on influencing factors such as ventilation systems, additional heating systems
4. Rooms with FBH must be marked in the construction drawing

SYSTEM-SPECIFIC INFORMATION:

O Wet system

O Staple O Rails O Pipe positioning panel
Screed: O Cement/Anhydrite O Floating screed
Top layer: O Tiles O PVC O Parquet O Carpet

O Dry system

O EPS O Eco
Top layer: O Fermacell O Parquet O Screed brick O Load distribution plate
O Strongboard

O Wall heating

O Dry system O Rail system

Type of insulation: _____

Flow temperature: _____ °C

Type of pipe: _____

Control method: _____

Manifold: O In-wall O On-wall

CALCULATION METHOD:

O Detailed calculation method (U values/heat demand of customer/according to DIN)

O Simplified calculation method with assumed heat demand

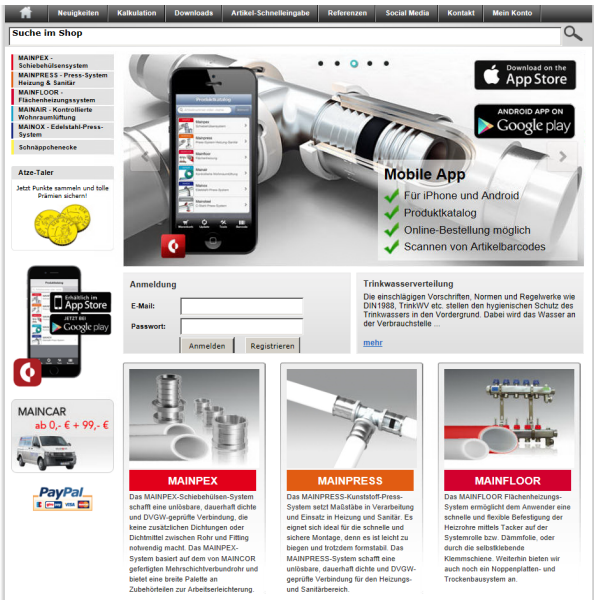
Where there is no calculation information, standard values according to DIN are assumed.
Design takes place according to DIN EN 1264.

Tick if applicable and complete and send with documents to the following address:
Maincor Rohrsysteme GmbH & Co. KG, Silbersteinstraße 14, 97424 Schweinfurt, Fax: +49 9721 65977 678

Planning and design

Quick calculation for computation of quantities FBH

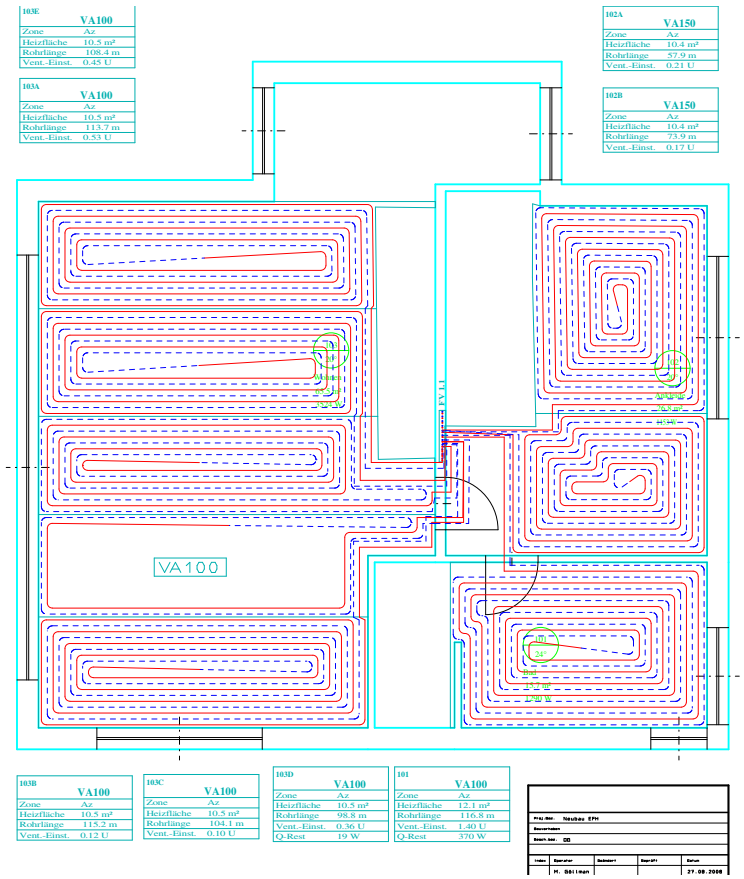
Our website offers an online calculation facility for the computation of quantities.
This is activated via a password and is free for our customers.



Planning and design via the calculation service

The attached technical performance tables and diagrams contain important basic principles for thermal calculation.

Our calculation service is also available for in-house use. We plan and design systems tailored to specific buildings. FBH design takes place according to DIN EN 1264 with dimensions, laying distances, quotation and a graph as CAD plan.
The heating load calculation for buildings according to DIN EN 12831 serves as a basis.



www.maincor.de

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MFL-THB-12/2014-01
Art. No: