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UNIFLOOR UNDERFLOOR HEATING

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GENERAL INFORMATION

Architectonic demand, reduction of heating-related costs, and an effort to reach the ideal thermal comfort are the conditions that are currently making underfloor heating more and more preferable.
In the past, the large-area underfloor heating was only used as additional heating together with other type of heating. Relatively high heat loss of buildings and low thermal outputs of the floor heating, as a result of low input temperature of the heating medium, were the obstructions. New building materials and higher thermal protection of buildings contributed to high growth of underfloor heating applications.
Underfloor heating roots go back to more distant past. One of the first attempts for underfloor heating was warming the floor with burnt gases flowing under residential premises. Most frequently, a fireplace was located out of these premises and the burnt gases were led through the ducts inbuilt in peripheral walls. The air, however, was the heat carrier. The first reference to warm water heating dates back to 18th century in France. In the 20th century the warm water heating became a widely used method of heating and in combination with low-temperature sources it represents current trends in the heating technology.

Possible uses

Use of warm water underfloor heating is not limited. The only one condition is covering the heat loss of a heated object without exceeding the maximum allowable wear layer temperature.
Possible uses of underfloor heating:

- family houses
- public buildings
- sanitary facilities
- swimming pools
- heating of historical buildings
- heating of churches
- pavements and access roads unfreezing
- support for biological growth of plants
- playgrounds, sport halls, and tennis courts

Warm water underfloor heating design must meet the following requirements:

a) creation of thermal comfort only in the users residential zone
b) guarantee of static bearing capacity of the floor heating surface
c) accurate dilation of heating surfaces and individual circuits
d) considering users' operating regime or technology
e) elimination of impact of orientation towards the cardinal points
f) fulfilment of hygiene aspects and the maximum temperature of wear layer

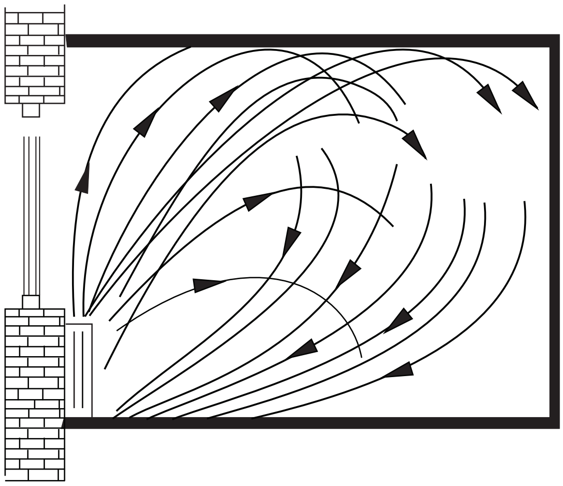
Underfloor heating advantages

- possibility to adjust the system to a more advantageous energy source (thermal pump, solar collectors, ...)
- creating pleasant and healthy environment
- low energy demand
- operating costs reduction
- optical extension of the premises and expression of pure interior lines
- natural air moisture content
- bare dust raising
- enabling free choice of floor covering
- economical warming especially of high premises

UNDERFLOOR HEATING PRINCIPLE

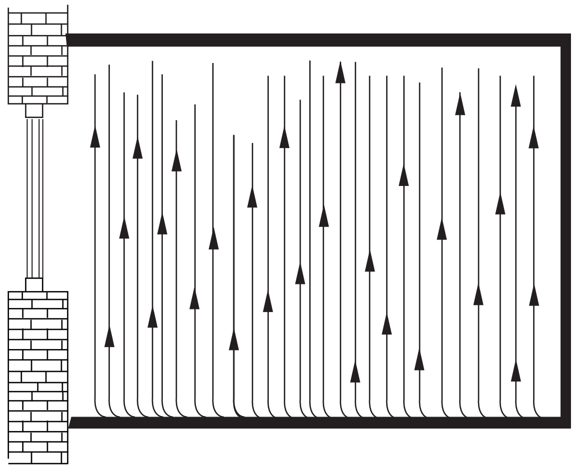
Underfloor heating belongs to radiant heating methods. Proportion of the radiant component to the convective component in the total heat transfer from the heating surface is 55 % : 45 %.
Underfloor heating differs from the conventional convective heating (radiator heating, convector heating) in the method of heat transfer and thermal conditions in the room.

Convective heating



In the convective heating, a heating body delivers the heat to the surrounding air which then delivers the heat to the walls.
A typical demonstration of this methods is the fact that temperature in the room is higher than temperature of walls. Characteristic air flow is formed in the room (increased dust formation) and there is a big difference in air temperatures under the ceiling and near the floor.

Underfloor heating



Underfloor heating, unlike the convective heating, is characterised by even temperature distribution and significantly lower air flow (lower dust formation). Due to the radiant component's effect, the walls around the heated room get warmer. The walls then heat the surrounding air. Relative air humidity is optimally maintained which has a favourable effect on airways.

SURFACE TEMPERATURE OF THE FLOOR

Specific output of the underfloor heating depends, among other effects, on the floor temperature. Floor surface temperature must be relatively low, 25 ℃ to 35 ℃, so that the value specified by sanitary standards is not exceeded. The maximum temperature of the heating medium is 50 ℃, therefore, underfloor heating is classified as the low temperature heating method suitable for use of energy obtained from low potential sources.

Sanitary standard specifies maximum allowable temperatures:

24 °C to 26 °C	for rooms where people are mostly standing
26 °C to 29 °C	for residential rooms and offices
30 °C to 35 °C	for bathrooms, spas, halls, swimming pools

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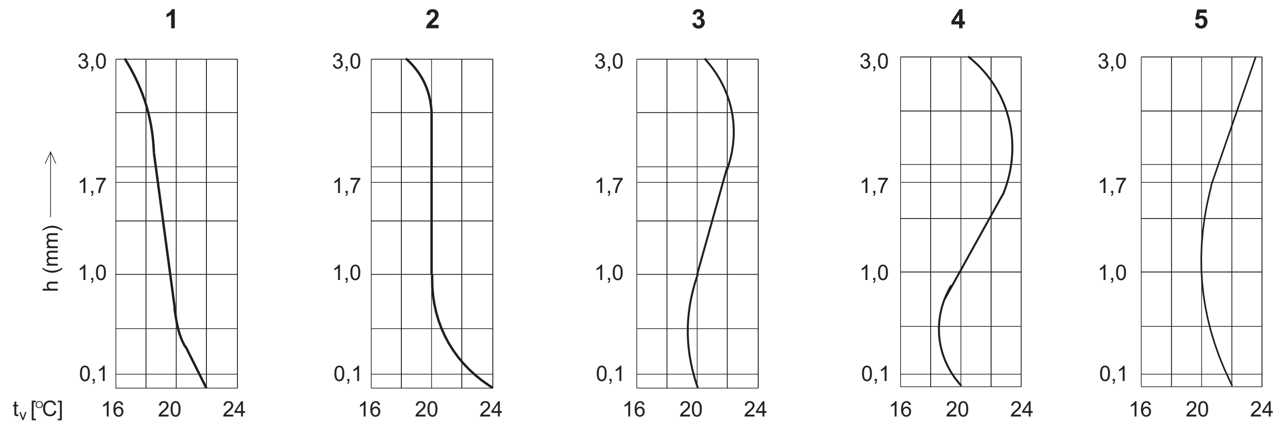
THERMAL PROFILES

An ideal heating method is heating with such temperature distribution throughout the room in which the temperature of air around a person's head is approximately 2 ℃ to 3 ℃ lower than around a person's feet.
This requirement is best met particularly by warm water underfloor heating.
Moreover, temperature reduction in 2 ℃ to 3 ℃ means 12 % to 18 % saving of energy required for the heating.

Vertical thermal profile

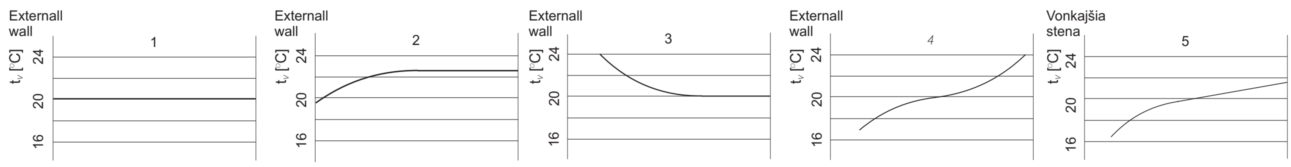
Vertical temperature distribution is the result of uneven warming and cooling of individual walls in the interior. This unevenness increases proportionally to the increase of the heating body surface temperature.
As with the large-area underfloor heating the temperature of the heating floor is the lowest one among all methods of radiant heating, vertical temperature distribution is almost ideal.



Ideal heating | *Underfloor heating* | *Heating body next to external wall* | *Heating body next to internal wall* | *Ceiling heating*

Horizontal thermal profile

Horizontal temperature distribution depends on the heating surface position in the direction from an external wall towards an internal wall. With the underfloor heating, the heating surface is usually represented by the entire floor, therefore, the horizontal profile can be regarded as ideal as well.



Ideal heating | *Underfloor heating* | *Heating body next to external wall* | *Heating body next to internal wall* | *Ceiling heating*

UNDERFLOOR HEATING DESIGN PRINCIPLES

A basic condition for calculating and designing the warm water underfloor heating is correct understanding of the purpose, architectonic expression, constructional and structural execution, and method of operation running in a particular building. Completely different approaches are applied when we want to use this heating method for example in an industrial building, or in a church, or a family house.

When calculating the energetic balance of individual buildings, it is necessary to consider the requirements for calculation of heat loss in special cases, i.e. when building structures adjoin to the ground, or if the building's height, or the height of heated premises, exceeds the required value. Last but not least, in case of a building with massive building structures, or with moist sources and excessive glazed surfaces. Similarly, when determining energy consumption, it is necessary to know the operation type, because in most cases the heating is interrupted.
Special emphasize is put on the right choice of floor structure, as especially in case of extreme load it must be reinforced with construction steel, depending on the static calculation. Subsequently, a proper installation method is chosen considering the heating surface shape, and, above all, with an emphasis put on formation of separate expansion units, while applying the most suitable installation technology, including execution of necessary heating and operation tests. Regulation issues represent a separate topic. Therefore, there must be a proper interaction between the constructional concept of the building and the heating system design, including the heat source, design of the heating system as such, and also the choice of adequate measuring, regulating, and automation technology. Otherwise, the operation of such building, despite all advantages of warm water underfloor heating, does not necessarily has to show declared energetic and comfort parameters.

When considering an option to install the underfloor heating, it is necessary to consider important factors, such as:

Thermal and technological properties of a building

UNIVENTA underfloor heating can be used in all types of buildings provided that the the heat loss of the object is lower than 20 W/m^3, or the annual heat consumption is lower than 70 to 80 kWh/m^3.

Recommended thermal resistance values:

Peripheral wall	R = min. 3 m K/W^2
Ceiling	R = min. 5 m K/W^2
Floor	R = min. 2 m K/W^2

Overall height of the floor

Underfloor heating height is 8 cm to 15 cm. The floor structures are different above the heated premises, above the unheated premises, on the mineral terrain, and directly adjacent to the external environment. Depending on the location of the floor structure, required thickness of thermal insulation is identified.

Insulation thickness depends on the temperature of the environment under the underfloor heating:

Position of underfloor heating	Recommended thermal resistance R [m^{2}K/W]	Insulation thickness	Total floor height *
Above the heated room	0,75	min. 30 mm	110 mm
Above the terrain or unheated room	2,00	min. 60 mm	140 mm
Above the free space	2,50	min. 100 mm	180 mm

** total height of the structure includes thermal insulation, 70 mm thick heating concrete, and 10 mm thick floor covering*

Heat source

The best source for the low temperature underfloor heating in terms of regulation and operation is the low temperature source of warm water (condensing boiler, thermal pump). In case of combination with a solid fuel boiler, the heating system must include a storage tank. In case of different high temperature source, e.g. a gas boiler, it is necessary to install the mixing armature. Regardless of the used heat source, we recommend to place a safety thermostat on the supply piping (warmer branch), as it stops the heat source or the pump in case of unacceptable heating water temperature increase.

Floor covering type

With the UNIVENTA underfloor heating, all common types of floor covering can be used and its thermal resistance should not exceed $R = 0.15\ m^2K/W$.
The most ideal floor covering is the ceramic tile flooring. If the textile floor covering is used, it is also necessary to count with partial reduction of thermal output. Textile carpets with the pile height more than 10 mm and a rubber base are not recommended (textile carpets with the max. pile height of 5 mm are suitable), neither is PVC floor with a felt pad, or the parquetry made of soft wood.
We recommend using wooden parquets with the maximum thickness of 15 mm made of well dried hard wood. When cork is used, the maximum recommended thickness is 3 mm. If the mosaic parquets are used, the maximum thickness of 9 mm must be respected.
To reach better heat passage, the flooring must not be laid freely on the floor surface, but it is recommended to fix it by bonding or laying into the cement screed layer.
When bonding the wooden flooring, it is recommended to use the glue for parquets. If other types of wooden flooring are used, we recommend consulting the instruction manual with the supplier.
Wooden tiles and parquets must be full-surface glued; a glue layer is applied to both bonded surfaces. In case of surfaces larger than 25 m^2, it is necessary to use reinforcement made of construction steel with the minimum eye of 100 mm, due to expansion reasons.

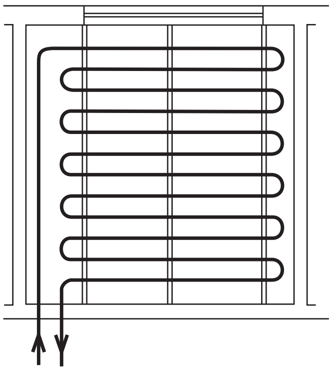
Heat capacity

Heat capacity of underfloor heating is 4 to 8 hours. This drawback can be solved by choosing a suitable regulation of the underfloor heating system, proper height of the floor piping pour layer and a suitable wear layer.
If anhydride (gypsum) screed is used instead of a typical concrete pour, the heat capacity can be reduced to 3 to 5 hours.

PIPE LAYING METHOD

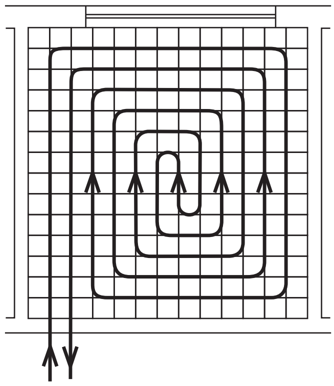
Pipes for underfloor heating can be laid in the floor using the parallel method or the meander method.
Pipe fixation can be carried out using: - clip rails (see page 18)
- insulation panels (see page 18)

Parallel method

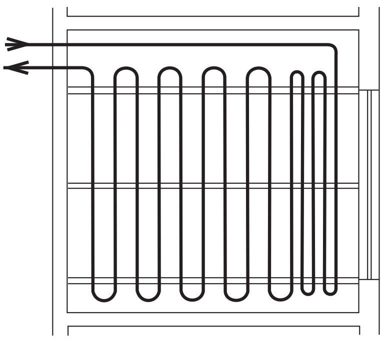


Parallel pipe laying is the easiest method and, at the same time, a trouble free method, if the flexible pipes made by the UNIVENTA Company are used. Asymmetric arrangement of the premises can be very easily solved, which can be rather complicated with other laying methods.
Heating circuit is first led along the most cooled wall, so the heating water temperature falls from the external wall towards the internal wall. Temperature distribution in heated rooms is thus more even. The bends are shaped in the 180 ˚angle, which requires the use of pipes with smaller diameters (Ø 16, Ø 17).

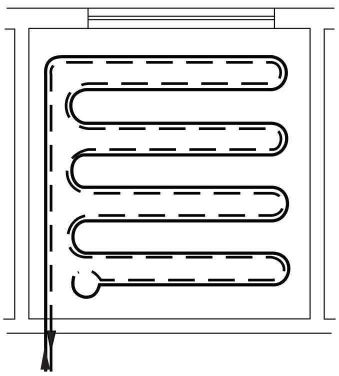
Meander method



Meander pipe laying is more complicated than parallel one, especially when underfloor heating is laid in premises with atypical layout.
Surface temperature of the floor, however, is more even; disadvantage is the decrease in internal temperature in horizontal direction from the internal structure towards the external one. Pipes are laid in the 90 ˚angle, which enables the use of pipes also with larger diameters (Ø 20).



Both these methods enable formation of the so-called marginal zone which eliminates negative impacts of cold walls. The marginal zone increases density of the heated surface, especially under the windows, glazed surfaces, or doors.



Bifilar laying is a special method of floor pipe laying. Pipes are laid next to each other. This method enables achieving the same average temperature of the heating water in all circuit points, and thus also more even surface temperature of the floor.

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UNIVENTA UNIFLOOR WARM WATER UNDERFLOOR HEATING DESIGN

Heat loss calculation

The first step in designing the warm water underfloor heating is correct and accurate calculation of the heat loss according to the STN EN 12831 : 2002 standard – Calculation Method of the Designed Heat Input. To ensure that the energy consumption in case of central heating is not too excessive, a building must comply with thermal and technical requirements.

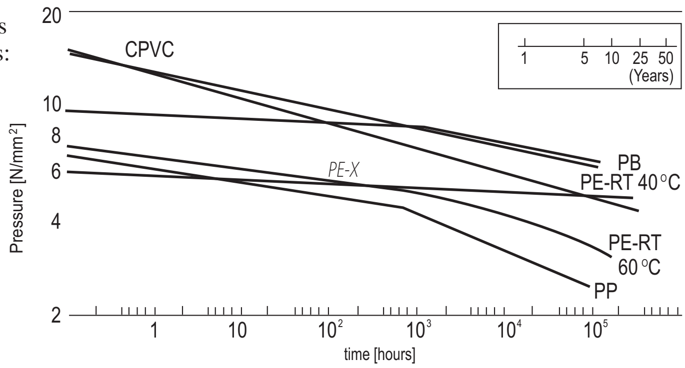
Documents for project elaboration

- constructional part of the project documentation (floor layouts, cross-sections and side sections, illustrations, position of a building in the terrain)
- detailed composition of walls, floor and ceiling structures (used materials, window and door types...)
- building's position (standing separately, attached, protected or unprotected position, very unfavourable conditions, cardinal points...)
- underfloor heating design is also based on the data regarding the ceiling and the floor composition, floor wear layer, and furniture arrangement.

Underfloor heating designing

a) Underfloor heating can only be designed on the basis of high-quality pipe distribution. Three types of materials came forward out of the wide-range offer of plastic pipes:

- polybutylene PB
- thermally resistant polyethylene Dowlex PE-RT
- cross-linked polyethylene PE-X polypropylene PP



The diagram shows the impact of pressure and temperature on the damage to a pipe depending on the time

b) Underfloor heating is suitable especially for the use in combination with low energy heat sources (accumulation boilers, solar collectors, thermal pumps, etc.), because self-regulation effect is very favourable here.

c) Underfloor heating is suitable for common residential buildings thanks to its favourable properties in terms of comfort in the room. In case of buildings with strong solar heat gain, the following measures must be taken:

- shading or active sun shields
- use of solar radiation detector and its inclusion in the regulation circuit
- low temperature of the heating medium at the input (low thermal resistance of the floor)

d) For buildings with very variable use (variable internal load or fast changes of the specified temperature in the room) it is not recommended to use underfloor heating alone. Here the underfloor heating can be used as the primary heating in combination with conventional heating bodies with faster response.

When designing warm water underfloor heating, it is necessary to consider also thermal persistence:

- ideal temperature difference between the supply pipe and the reverse pipe is 10 K at most, ideally 5 K to 6 K

Heating method	Radiator	Convective	Undefloor - hydronic	Underfloor - electric
Period [hour]	0,4 to 0,8	0,3 to 0,1	8,0 to 4,0	3,0 to 6,0

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DESIGN RECOMMENDATIONS

- in terms of ideal temperature distribution we recommend the maximum heating circuit length of 100 lm, in extreme cases up to 120 lm
- determination of input data in other rooms must be based on the same heating water mean temperature, so that it is not necessary to adjust each manifold circuit separately to a different value
- in terms of better regulation and better temperature distribution we recommend for each larger room to have its own circuit. If the surface in the area is larger, it is necessary to include proportionally larger amount of heating circuits in the design. Small rooms (e.g. bathrooms, restrooms...) can be included in a single circuit.
- heating circuits lengths should be approximately the same. One heating circuit can contain several smaller rooms. Different floor temperatures are reached by changing the heat pipes spacing.
- the size of a heated area of one circuit should not be larger than 25 m. One dimension of the area is 6 m at most. Larger heating surfaces must be divided by an expansion gap into expansion units.
- a pipe leading through an expansion gap must be placed in a protective pipe (polyethylene grooved coil) with the minimum length of 50 cm, whereas the half-length equals the expansion place
- heating coil spacing is 100 to 300 mm. Edge pipe is laid about 150 mm to 250 mm from the wall
- along the peripheral walls it is advisable to reduce pipe spacing – to form the so-called marginal zone and to increase thus the surface temperature of the floor. This will increase the heating output and reduce unfavourable cold radiation from the wall.
- thickness and quality of thermal insulation layer under the heating surface affects the size of the downward heat flow. If there is some unheated space under the heated premises, the loss should not exceed 10 % of the thermal output.
- heating pipe is placed so that the supply pipe is first led to the most cooled wall
- a manifold should be situated so that the distance of heat pipes in heating surfaces is approximately the same

MATERIAL CONSUMPTION

FOR THE CLIP RAIL SYSTEM:

Installation module [data in cm]	**40/40**	**30/30**	**25/25**	**25/15**	**25/5**	**5/25/5**
Max. size of individual circuit surface [m^2]	42	33	27	21	18	11
Heat pipe * [lm/m^2]	2,8	3,6	4,4	5,5	6,6	10
Clip rails [lm/m^2]	1	1	1	1	1	1
Clip nails [pc/m^2]	5	5	5	5	5	5
PE foil [m^2/m^2]	1,1	1,1	1,1	1,1	1,1	1,1
Peripheral expansion strips ** [lm/m^2]	1,1	1,1	1,1	1,1	1,1	1,1
Thermal insulation with thickness of 30 mm [m^2/m^2]	1	1	1	1	1	1
Plastificator *** [kg/m^2]	0,3	0,3	0,3	0,3	0,3	0,3

* *transit connection lengths must be added to pipe lengths*

** *for exact calculation we recommend accurate summation of peripheral walls*

*** *for the concrete layer height of 72 mm*

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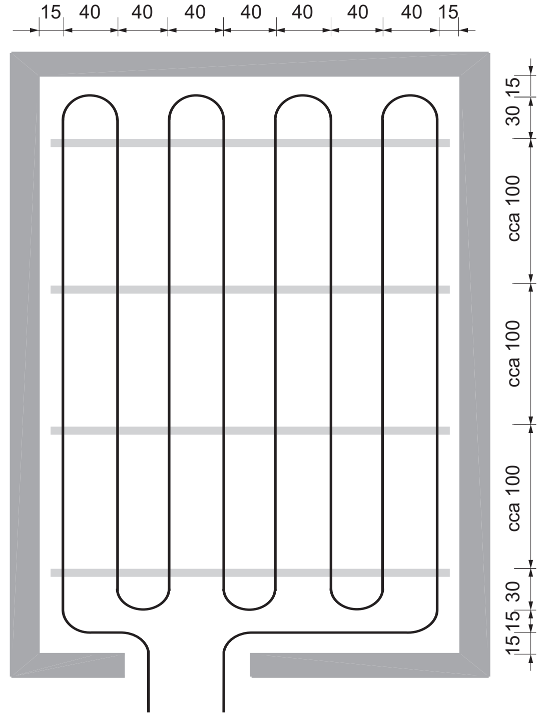
INSTALLATION MODULES WITH USE OF CLIP RAIL

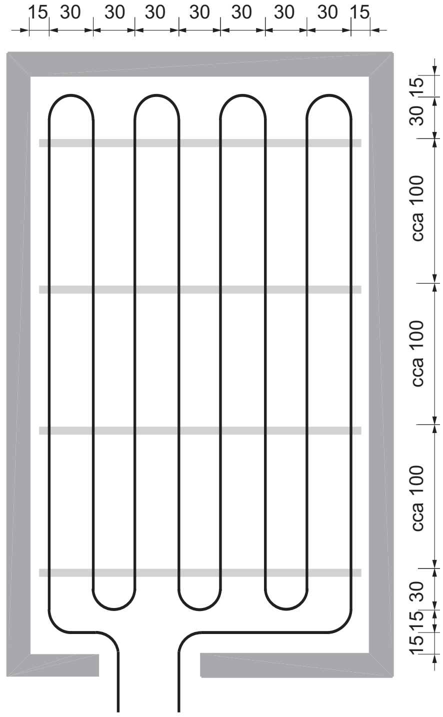
NOTE: SPACING DATA IN CM

40 / 40



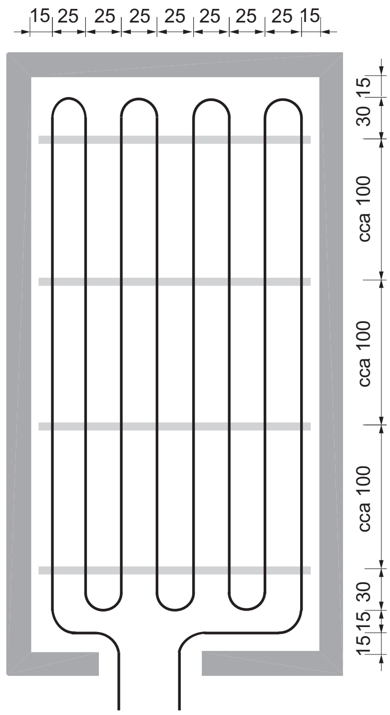
Pipe consumption: 2,8 lm / m²
(without the supply length)

30 / 30



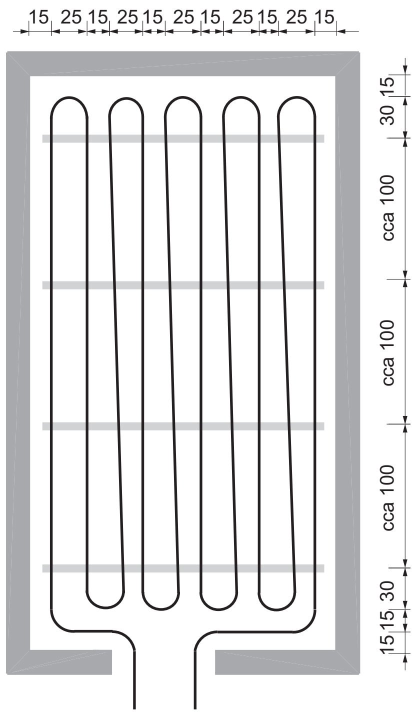
Pipe consumption: 3,6 lm / m²
(without the supply length)

25 / 25



Pipe consumption: 4,4 lm / m²
(without the supply length)

25 / 15



Pipe consumption: 5,5 lm / m²
(without the supply length)

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NOTE: SPACING DATA IN CM

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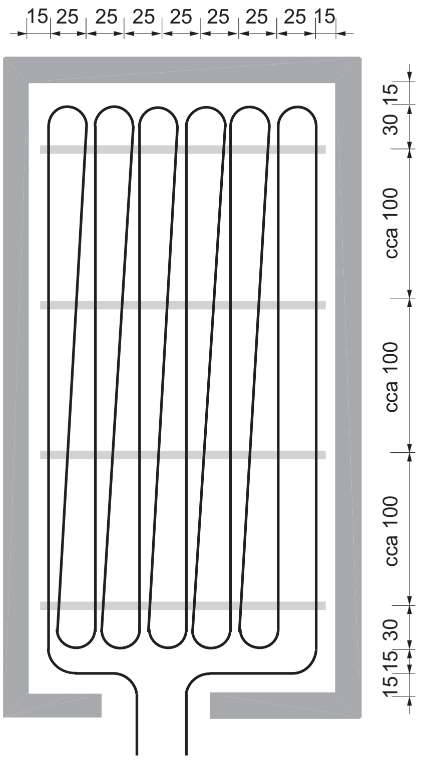
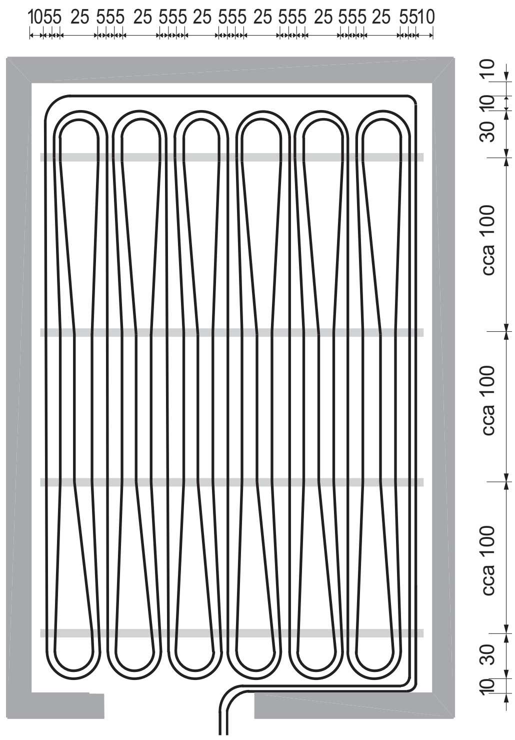


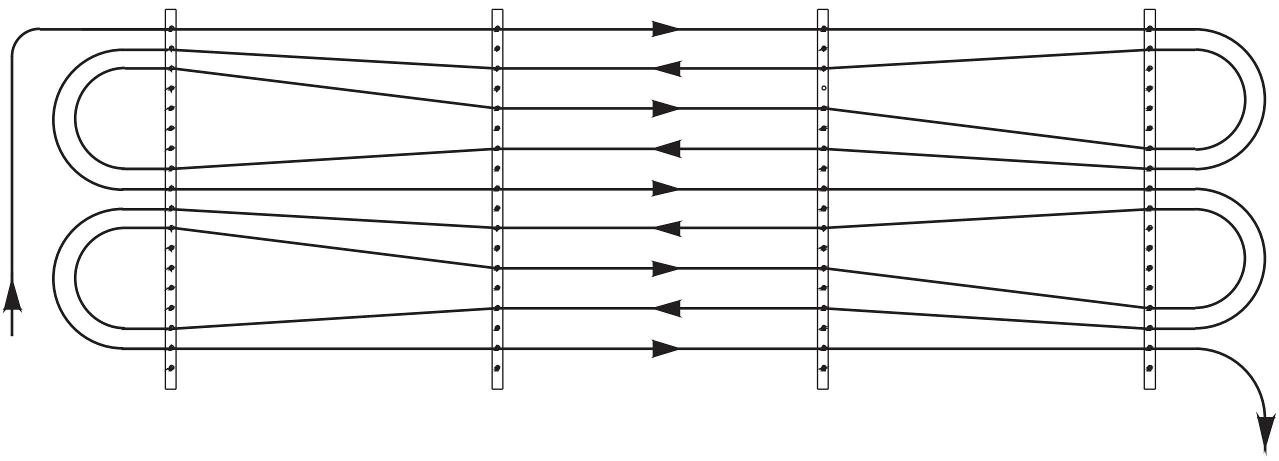
Pipe consumption: 6,6 lm / m²
(without the supply length)

5 / 25 / 5



Pipe consumption: 10 lm / m²
(without the supply length)

5/ 25 / 5 installation module detail



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MATERIAL CONSUMPTION

WITH INSULATION PANELS:

Pipe spacing [data in cm]	**30**	**20**	**15**	**10**	**5**
Max. size of individual circuit surface [m^2]	16,5	11,0	7,5	5,5	4
Heat pipe * [lm/m^2]	3,3	5,0	6,6	10,0	20,0
Insulation panel UNIFLOOR [m^2/m^2]	1	1	1	1	1
Peripheral expansion strips ** [lm/m^2]	1,1	1,1	1,1	1,1	1,1
Plastificator *** [kg/m^2]	0,3	0,3	0,3	0,3	0,3

* *transit connection lengths must be added to pipe lengths*

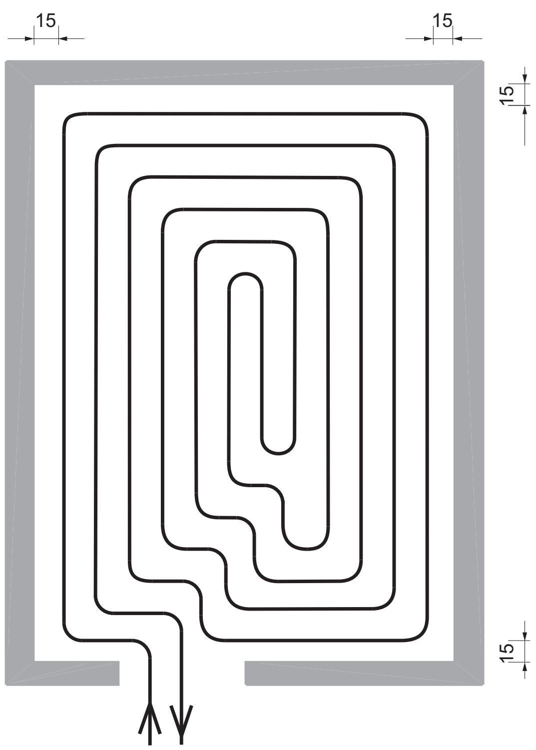
** *for exact calculation we recommend accurate summation of peripheral walls*

*** *for the concrete layer height of 72 mm*

INSTALLATION WITH USE OF INSULATION PANELS

A pipe can be laid in a two-way spiral (meander method) with 50 mm spacing. Just like pipe attachment into rails, here the pipe is attached in the distance of 150 mm from the wall. Similarly, it is possible to create the so-called marginal zone by reducing the pipe spacing.

NOTE: SPACING DATA IN CM



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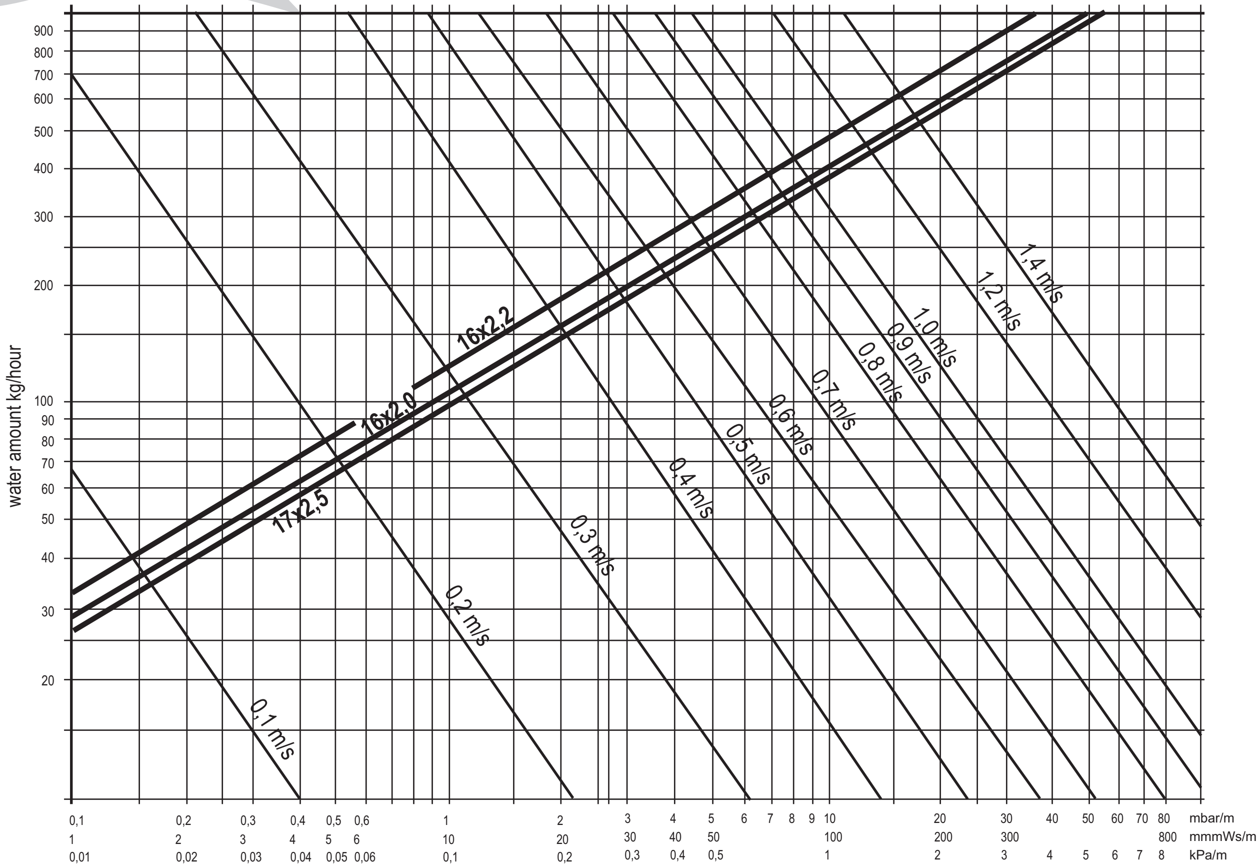
HEAT LOSS [mbar/1 lm of pipe]

Water amount M [kg/h]	Heat loss R [mbar]	Flow rate W [m/s]
45	0,20	0,10
57	0,30	0,16
67	0,40	0,19
76	0,50	0,21
85	0,60	0,22
93	0,70	0,24
100	0,80	0,25
106	0,90	0,27
112	1,00	0,29
118	1,10	0,30
125	1,20	0,31
130	1,30	0,32
136	1,40	0,33
142	1,50	0,34
147	1,60	0,35
152	1,70	0,37
158	1,80	0,38
163	1,90	0,40
168	2,00	0,41
173	2,10	0,43
178	2,20	0,44
183	2,30	0,45
187	2,40	0,46
191	2,50	0,47
196	2,60	0,48
200	2,70	0,49
205	2,80	0,50
209	2,90	0,51
213	3,00	0,52
223	3,25	0,55
233	3,00	0,57
243	3,75	0,60
252	4,00	0,62
261	4,25	0,64
270	4,50	0,66
278	4,75	0,68
287	5,00	0,71
296	5,25	0,73
305	5,50	0,75
313	5,75	0,77
320	6,00	0,79
335	6,50	0,82
350	7,00	0,86

Heat loss depending on the water flow volume for a pipe 17 x 2.5 mm (with minimum differences it applies also to pipes 16 x 2.2 mm and 16 x 2.0 mm).
When specified radiuses are respected, resistances of the bends are negligible.

HEAT LOSS AND OUTPUTS



Heat loss diagram

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UNDERFLOOR HEATING OUTPUTS ACCORDING TO STANDARD DIN 4725

for covering with thermal resistance R_λ = 0.02 m^2 K/W (ceramic tile flooring)

supply temperature [°C]	standard room temperature ti [°C]	Heat output [Watt] for floor covering for installation modules				
		30/30	25/25	25/15	25/5	5/25/5
30	15	36	42	48	54	64
	18	27	31	36	41	48
	20	21	24	28	32	38
	22	15	17	20	22	27
	24	8	9	11	12	15
35	15	51	59	67	77	91
	18	42	48	55	63	75
	20	36	42	48	54	64
	22	30	35	40	45	54
	24	24	28	32	36	43
40	15	66	75	86	99	117
	18	57	65	75	86	101
	20	51	59	67	77	91
	22	45	52	59	68	80
	24	39	45	51	59	70
45	15	80	92	106	121	143
	18	71	82	94	108	127
	20	66	75	86	99	117
	22	60	69	79	90	106
	24	54	62	71	81	96
50	15	95	109	125	143	169
	18	86	99	114	130	154
	20	80	92	106	121	143
	22	74	86	98	112	133
	24	69	79	90	103	122

for covering with thermal resistance R_λ = 0.05 m^2 K/W (linoleum, PVC covering)

supply temperature [°C]	standard room temperature [°C]	Heat output [Watt] for floor covering for installation modules				
		30/30	25/25	25/15	25/5	5/25/5
30	15	33	37	42	47	55
	18	24	28	32	36	41
	20	19	22	25	28	32
	22	13	15	17	20	23
	24	7	8	9	11	12
35	15	46	52	59	67	77
	18	38	43	49	55	64
	20	33	37	42	47	55
	22	27	31	35	40	46
	24	22	25	28	32	37
40	15	59	67	76	86	100
	18	51	58	66	75	86
	20	46	52	59	67	77
	22	41	46	52	59	68
	24	35	40	45	51	59
45	15	72	82	93	105	122
	18	64	73	83	94	109
	20	59	67	76	86	100
	22	54	61	69	78	91
	24	48	55	63	71	82
50	15	86	97	110	125	144
	18	78	88	100	113	131
	20	72	82	93	105	122
	22	67	76	86	98	113
	24	62	70	80	90	104

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for covering with thermal resistance R_λ = 0.08 m^2 K/W (carpet)

supply temperature [C]	standard room temperature ti [C]	Heat output [Watt] for floor covering for installation modules				
		30/30	25/25	25/15	25/5	5/25/5
30	15	30	33	38	42	48
	18	22	25	28	32	36
	20	17	19	22	25	28
	22	12	14	16	17	20
	24	7	8	8	9	11
35	15	42	47	53	59	67
	18	34	39	44	49	56
	20	30	33	38	42	48
	22	25	28	31	35	40
	24	20	22	25	28	32
40	15	54	60	68	76	87
	18	47	52	59	66	75
	20	42	47	53	59	67
	22	37	41	47	52	59
	24	32	36	41	45	52
45	15	66	74	83	93	106
	18	59	66	74	83	95
	20	54	60	68	76	87
	22	49	55	62	69	79
	24	44	50	56	63	71
50	15	78	87	99	110	126
	18	71	79	90	100	114
	20	66	74	83	93	106
	22	61	68	77	86	98
	24	56	63	71	80	91

for covering with thermal resistance R_λ = 0.10 m^2 K/W (parquets)

supply temperature [C]	standard room temperature ti [C]	Heat output [Watt] for floor covering for installation modules				
		30/30	25/25	25/15	25/5	5/25/5
30	15	28	31	35	39	44
	18	21	23	26	29	33
	20	16	18	21	23	26
	22	12	13	14	16	18
	24	6	7	8	9	10
35	15	39	44	49	55	62
	18	33	36	41	45	51
	20	28	31	35	39	44
	22	23	26	29	33	37
	24	19	21	23	26	29
40	15	51	57	64	71	80
	18	44	49	55	61	69
	20	39	44	49	55	62
	22	35	39	44	49	55
	24	30	34	38	42	48
45	15	62	69	78	87	98
	18	55	62	69	77	87
	20	51	57	64	71	80
	22	46	51	58	64	73
	24	42	46	52	58	66
50	15	73	82	92	103	116
	18	67	74	84	93	105
	20	62	69	78	87	98
	22	58	64	72	80	91
	24	53	59	67	74	83

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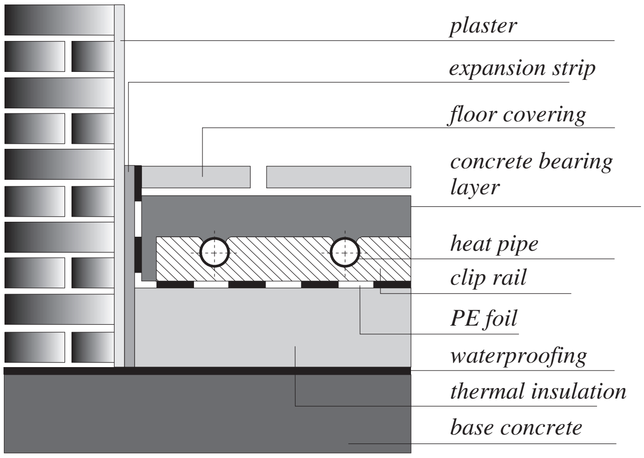
UNDERFLOOR HEATING COMPONENTS

The UNIVENTA Company offers a full range of underfloor heating having all important properties that the underfloor heating should have. Moreover, the quality of offered products is proved by the fact that during the company's long-lasting operation on the market no defect of floor pipe was reported.

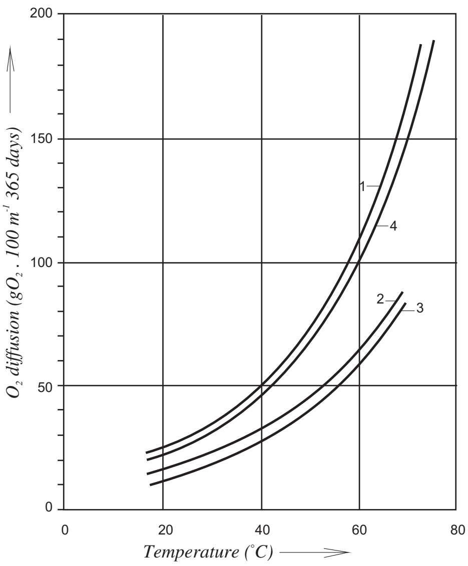
Heat pipe



The most important part of the underfloor heating is represented by heat pipes. Their selection must be made considering the fact that during its service life the pipe is located inside the floor and any failure would require cutting out the floor and subsequent repair. Therefore, it is very important to take especially the quality into consideration. From the thermal and technological point of view, the best material for underfloor heating is copper. Its disadvantage, however, is a high price, so it is often replaced with plastic pipes.
With components typically used in the heating systems, especially plastic ones, there is increased permeability of air oxygen which causes ferric oxide formation and thus also formation of sediments that cause pipe wall abrasion in high speed of water flow in the system.

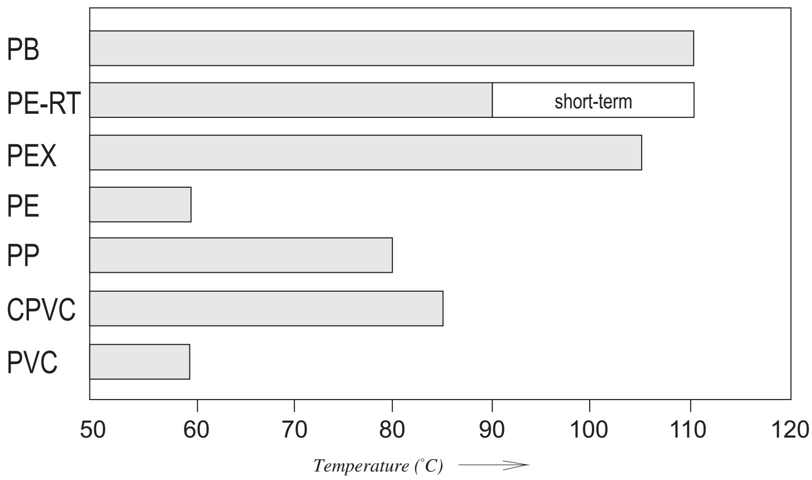
Eventually, the pipe wall can become so thin it even opens up and then the whole system is destroyed. That is why not all plastic pipes meet the high requirements. Basic qualities that heat pipes must meet include:

Resistance to oxygen diffusion



1 – polypropylene
2 – branched polyethylene
3 – polybutylene
4 – thermally resistant polyethylene

Thermal resistance



Plastic pipes disadvantage is their high linear thermal expansion:

PE-RT	5-fold higher
PB	10-fold highe
PE-X	14-fold higher

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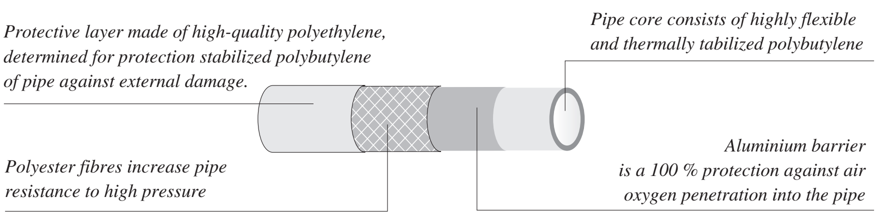
4-layer polybutylene pipe UNIVENTA NOXY® PB 17 x 2.5 mm

A high quality pipe for underfloor heating has a 100 % barrier against oxygen diffusion, minimum expansion, very good flexibility, high thermal and pressure resistance. A pipe core is made of polybutylene with high abrasion resistance and firmness stability with rising temperature. The wet abrasion test has proved three-fold higher resistance against abrasion compared to PE-X pipes (SKZ Würzburg ASTM no. D638). Pipes made of polyethylene are used where exceptional quality and long service life guarantee is required. Moreover, its reliability is provided by risk-free installation and almost excluded destruction of homogenous solidity of the pipe.
Maximum safe water temperature: 70 °C
Maximum operating pressure: 9 bar
Attachment options: bolted connection, polyfusion welding
Colour: blue.

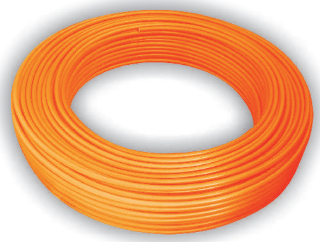
Pipe with exceptional thickness of wall structure 2.5 mm represents also high safety coefficient and offers the highest reliability to customers.

Order no. 110110
Packing: 360 lm



4-layer polybutylene pipe UNIVENTA RADIA-NOXY® PB 16 x 2.2

A pipe with structure similar to the previous one
, with a coat made of thermally resistant polyethylene to be used not only for underfloor heating, but also for connecting the radiators and the floor convectors. The pipe has a 100 % barrier against oxygen diffusion, minimum expansion, very high flexibility, high thermal and pressure resistance. A pipe core is made of polybutylene with high abrasion resistance and firmness stability with rising temperature.
Maximum safe water temperature: 80 °C
Maximum operating pressure: 8 bar
Attachment options: bolted connection, polyfusion welding
Colour: orange, white

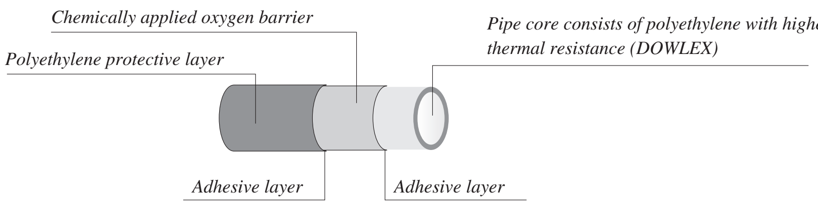


Order no. 110120 - orange
Order no. 110125 - white
Packing: 360 lm

5-layer pipe UNIVENTA FLEXI PE-RT 17 x 2.0 mm

Pipe for underfloor heating. A pipe core made of thermally resistant polyethylene is protected against oxygen diffusion by special chemical treatment EVOH.
Pipe surface is protected by polyethylene coat.
Maximum safe water temperature: 70 °C
Maximum operating pressure: 6 bar
Attachment options: bolted connection
Colour: red, violet

Order no. 110130
Packing: 360 lm



Pipe breaking during installation is excluded if the specified radiuses are respected.

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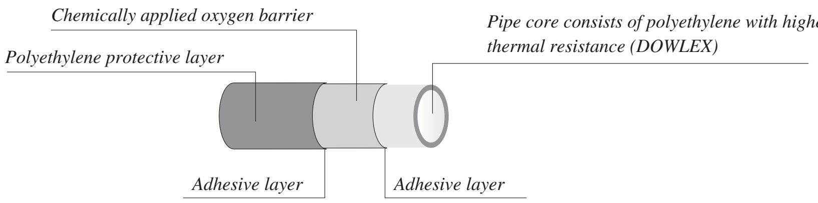
3-layer pipe UNIVENTA FLEXI PE-RT 16 x 2.0 mm

Pipe for underfloor heating. A pipe core made of thermally resistant polyethylene is protected against oxygen diffusion by special chemical treatment EVOH.
Pipe surface is protected by polyethylene coat.
Maximum safe water temperature: 70 °C
Maximum operating pressure: 6 bar
Attachment options: bolted connection
Colour: blue, green

Order no. 110140
Packing: 360 lm

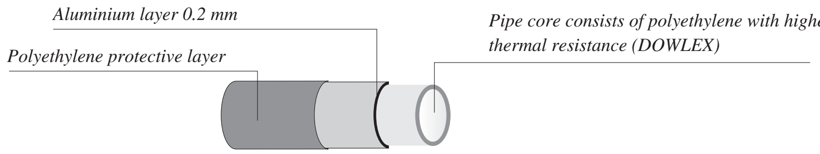


Pipe breaking during installation is excluded if the specified radiuses are respected.

3-layer pipe UNIVENTA PEX-AL-PEX 16 x 2.0 mm

Pipe for underfloor heating and connection of heating bodies. A pipe core made of thermally resistant polyethylene is protected against oxygen diffusion by a 100 % oxygen barrier. Pipe surface is protected by a polyethylene coat.
Maximum operating water temperature: 95 °C
Maximum operating pressure: 6 bar
Attachment options: bolted connection, press fittings TH-PRESS
Colour: white

Order no. 140100
Packing: 200 lm



Pipe breaking during installation is excluded if the specified radiuses are respected.

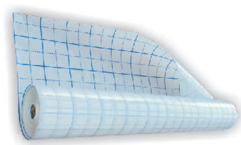
Polyethylene foil for underfloor heating

Polyethylene foil with 0.12 mm thickness prevents from penetration of batch moisture into thermal insulation. Suitable also for separation of waterproofing from thermal insulation.

Order no. 111310 *folded width - 1 m*
Packing: 100 m² *unfolded widthe - 2 m*

Special polyethylene foil - reinforced

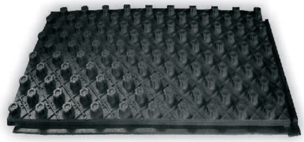
Special polyethylene foil reinforced with polyester fibres with printing (raster 10 x 10 cm), for more demanding applications. It protects against batch moisture penetration into thermal insulation.
Unfolded width: 103 cm



Order no. 111320
Packing: 103 m²

Insulation panel UNIFLOOR

An insulation panel with a resistant black foil. It consists of the EPS 150 board and black moulded hardened foil with protrusions.
Panel dimensions: 1,200 x 600 x 50 mm (0.72 m^2), polystyrene thickness 30 mm
For pipe diameter: Ø 16 mm – Ø 18 mm
Pipe spacing: 50 mm
Thermal resistance: 0.857 m^{2}K/W
Colour: black

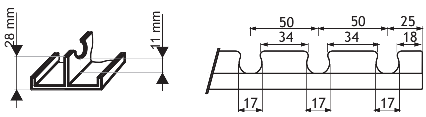


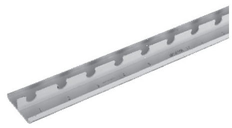
Order no. 112010
Packing: 10 pcs

Clip rail 16/17

Plastic clip rail for symmetrical placement of floor pipes. The rail ensures ideal pipe placement above the thermal insulation level in the concrete layer and perfect flooding around the whole pipe. Such execution contributes to higher underfloor heating output in comparison with attachment to the insulation panel.
Rails are placed with spacing of ca 1 m and attached using the clip nails.
Nominal length: 3 m (±3% tolerance)

For pipe diameter: Ø 16 mm – Ø 17 mm
Pipe spacing: 50 mm



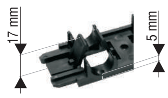


Order no. 112110
Packing: 36 m/108 m

Clip rail PENTA Ø 14/15/16/17/18

Plastic clip rail with low profile height, suitable especially for anhydrite screeds and wall heating/cooling. The rail ensures ideal pipe placement above the thermal insulation level in the concrete layer and perfect flooding around the whole pipe. The rail has the connection system for unlimited possible extension.

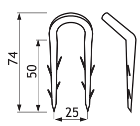
Nominal length: 1 m (divided into 20 cm sections)
For pipe diameter: Ø 14 mm to Ø 18 mm



Order no. 112125
Packing: 100 m

Large clip nail

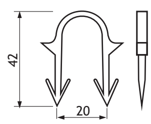
A clip nail for fixation of a clip rail and floor pipes into thermal insulation. Firm plastic and special shaping ensure perfect fixation.
For pipe diameter: up to Ø 25 mm



Order no. 112130
Packing: 50/1000 pcs

Small clip nail

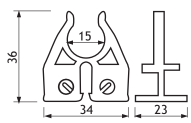
A clip nail for fixation of a clip rail and floor pipes into thinner thermal insulation.



Order no. 112140
Packing: 100/1500 pcs

Clip nail for reinforcement made of construction steel

Clip nail for simple fixation of floor pipes to reinforcement made of construction steel.
For pipe diameter:Ø 15 mm to Ø 17 mm



Order no. 112150
Packing: 1 pc

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Peripheral expansion strip

Expansion strip 8 mm thick and 150 mm high has a very good ability to compensate changes of the concrete bearing layer due to thermal expansion. It also protects against sound bridges and thermal bridges. Expansion strips are laid along the periphery of the entire heated room, between individual rooms, and also if the heated area is larger than 40 m2, or if the ratio of sides is more than 1 : 2 (max length of one side is 6 cm). More information can be found in the chapter on expansions.
Expansion strip is equipped with a translucent PE foil along the whole length.
Version: without an adhesive tape/with an adhesive tape for practical adhesion to the wall

Order no. 113110
Packing: 50 lm

Order no. 113111 (s lepiacou páskou)
Packing: 25 lm

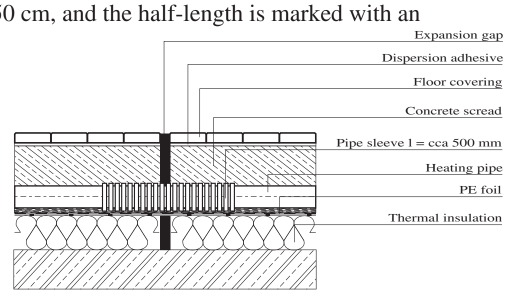
Expansion profile

A practical rail for attaching the expansion strip or the 1 cm thick polystyrene. It is used together with an expansion strip to separate large areas. Adhesive tape on the bottom side of the rail ensures stabile placement.
Dimensions (h. x w.): 21 x 36 mm, length 2 m.

Order no. 113120

Protective pipe (pipe sleeve)

A flexible, impact-resistant and fire-resistant pipe is determined for protection of floor pipes at places of connection to a manifold, pipe passage between individual rooms, and at passage through all expansion sections.
Protective pipe size should be at least 50 cm, and the half-length is marked with an expansion place.
Internal diameter: Ø 18 mm
For pipe diameter: up to Ø 17 mm



Order no. 144120
Packing: 100 lm

Super-plastificator

Plasticising additive to concrete and plaster mixtures, based on modified melamine-formaldehyde resin with high flow effect. It is used to improve liquidity, flexibility, and thermal conductivity of the grouting around the floor pipes.
Volume density: 1,150 kg/m^3
Consumption: 0.3 l/m^3 for concrete layer thickness of 72 mm. Mixing proportion must be respected as specified in the instruction manual. Overdosing does not increase the concrete flexibility; it slows down its setting.

Order no. 114210
Packing: 10 L / 25 L

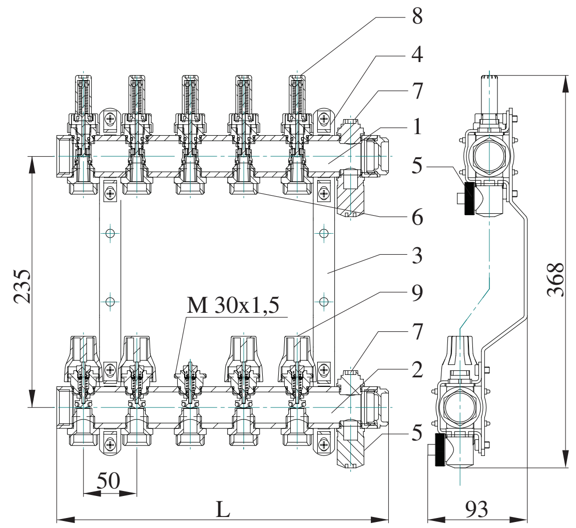
Pipe reel

Pipe reel-off is the most practical aid for the floor pipes installation. A fixed reel adjustable to various coil diameters. Unique dismountable solution requires the minimum space when transported (size when dismounted is 67x50x24 cm).

Order no. 991110

Underfloor heating manifolds – VERSION I – UNIVENTA ULTIMATE

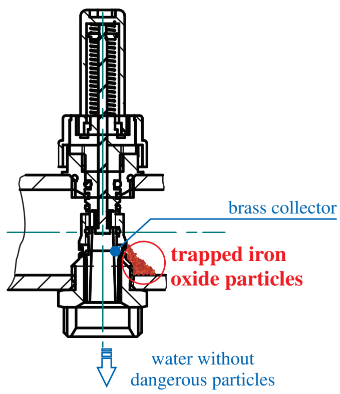
Manifolds for underfloor heating consist of two parts – a manifold body (supply pipe) and a collector body (return pipe), which are interconnected by a holder.
Supply pipe is equipped with visual flow meters used to make accurate adjustments of the required flow volume for individual branches in l/min. Max flow volume of typically supplied manifolds for one circuit is 2.4 l/min. Higher flow volume (4.8 l/min) can be reached by replacing the flow meter.
Manifolds include a structural component systematically separating the impurities and protecting against their inlet into pipes.
Impurities can be removed using a fill/drain valve of the manifold. The manifold also contains the air vent (for better deaeration we recommend aslant installation).
Connecting to the main circuit can be carried out from the left or the right side. Supplied labels enable demarcation of rooms and corresponding circuits.
Max. operating pressure: 6 bar
Manifold connection: ¾ " internal thread
Circuits connection: ¾ " external thread.



1- manifold body
2 – collector body
3 - holder
4 – adjusting sleeve
5 – fill/drain valve
6 – iron oxides collectors with connection for individual circuit branches (VO thread 3/4")
7 – air vent
8 – visual flow meters
9 – thermostatic vents with manual heads

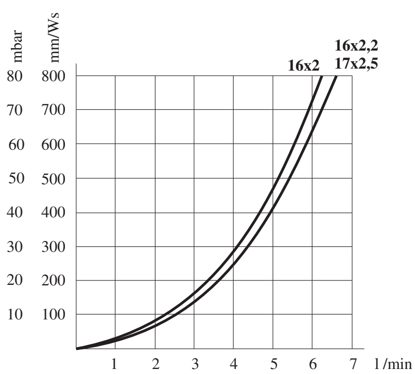
Technical parameters:

Number of circuits	2	3	4	5	6	7	8	9	10	11	12	13	14
Length L [mm]	160	210	260	310	360	410	460	510	560	610	660	710	760
Number od holders	2												
Order no.	**115102**	**115103**	**115104**	**115105**	**115106**	**115107**	**115108**	**115109**	**115110**	**115111**	**115112**	**115113**	**115114**

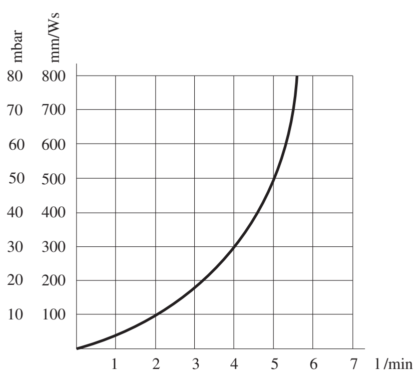


Heat loss

Total heat loss is assessed on the basis of individual losses at the supply valve and the return valve.



Heat loss of connecting screwings (supply and return pipe of the same circuit)



Heat loss of manifolds (manifold + collector)

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Bolted connection

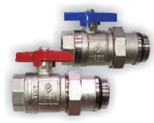
Brass bolted connection with a special o-ring made of EPDM Shore 80 for connecting the pipe to the manifold or other threaded piece.
Connection size: ¾" internal thread, Euro-Cone.
For pipe dimensions:

Ø16x2.0 mm	**Order no. 114320**
Ø16x2.2 mm	**Order no. 114330**
Ø17x2 mm	**Order no. 114340**
Ø17x2.5 mm	**Order no. 114350**

Packing: 10 pcs

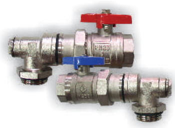
Spherical valves for manifold connecting

Determined for connecting the manifolds to the heating water main piping. The set includes 2 spherical valves, including the sealings made of EPDM.
Manifold connection dimension: 1 " external thread
Version:
- direct
- corner



Spherical valve for brass manifold direct – set

Order no. 117110



Spherical valve for brass manifold corner – set

Order no. 117210

End set for addition of one circuit

Extension end set enables additional creation of one manifold circuit.
The set includes fill/drain valve and the air vent.

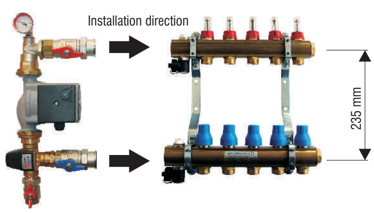
Manifold connection dimension: 1 " external thread

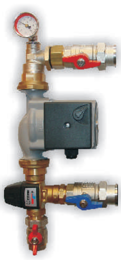
***Order no.* 117310**

Mixing set ULTIMATE PLUS

A set for combining the underfloor heating and high-temperature heating (radiators, floor convectors). The mixing set ensures preparation of the required water temperature for underfloor heating. It is connected to the brass manifold ULTIMATE.
Connection extent: 1 " external thread

Output temperature setting extent: 35 – 60 ℃
Max operating temperature: 110 ℃
Pump type: U 55-25S, connection G 6/4",
230 V, 50Hz, 130 mm





Order no. 117510

Safety thermostat

Master safety thermostat with adjustable required temperature from 10 to 90 ℃.
Master thermostat can be attached to a pipe using a spring, so it is suitable for controlling the temperature of heating water for underfloor heating, controlling the temperature of return water for condensation boilers, etc.
Potential-free terminals: 16 (2.5) A

Order no. 117710

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UNI-BOX set

In case of connecting a single circuit of underfloor heating, it is practical to use the UNI-BOX containing an outlet for connecting one circuit, an RTL head, and an air vent. The set provides regulation of the input temperature into the floor (wall) heating in the range from 20 ℃ to 50 ℃.
The set is placed into the wall and can be in a version with a head placed inside the box (version A) or with a head directed towards the interior (version B).
RTL head connection thread: M30x1.5

A

B


Order no. 117910 version A
117920 version B

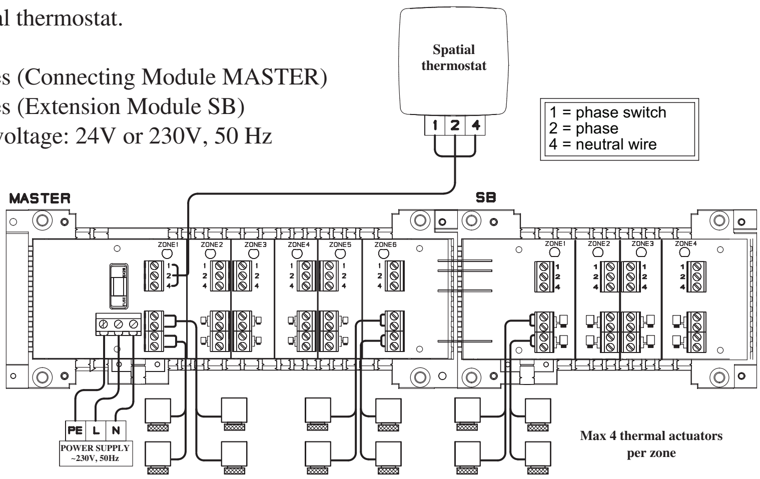
Double spatial thermostat

To regulate individual rooms separately, it is possible to use the set consisting of a spatial thermostat and a thermal actuator. The spatial thermostat communicates with the thermal actuator depending on detected temperature. The thermal actuator is installed on the manifold at the respective circuit of a given room. If necessary, the circuit is closed or opened.
Connection of the double spatial thermostat requires a 3-wire cable.
Adjustable temperature range: 5 to 30 ℃
High regulation sensitivity: ±0.5 K (NTC semi-conductor)
Switching voltage: TRIAC 24V/230V, max 75W
Operating voltage: 24V or 230V, 50Hz

Order no. 119210

Connecting Module MASTER and Extension Module SB

They serve for interconnection of several thermal actuators and a spatial thermostat.
Version:
- for 6 zones (Connecting Module MASTER)
- for 4 zones (Extension Module SB)
Operating voltage: 24V or 230V, 50 Hz



Order no. 119310 Basic module MASTER

Order no. 119320 Extension module SB

UNIVENTA Thermal Actuator

Two available types of thermal actuators:
- NC without current, closed, IP 65
- NO without current, open, IP 40
Height: 70 mm, diameter ca 45 mm, electric cable length 1m
Supply voltage: 230 V
Input: 2 W (NC), 3 W (NO).
Connection: cap nut M30x1.5

Thermal actuator NC-230 V Order no. 119110

WATER INLET RESISTANT

Thermal actuator NO-230 V Order no. 119120

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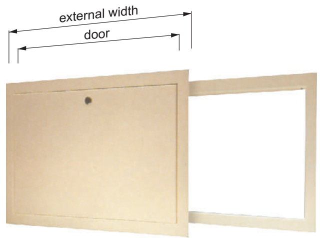
Manifold cabinets

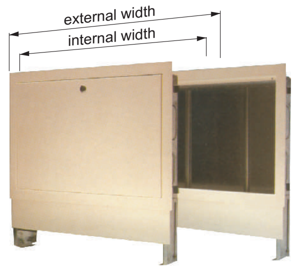
UNIVENTA FRAME – DOOR
They are determined to be installed in plasterboard structures. The surface is coated with white colour RAL 9016. The door is closed with a coin lock. The height is regulated a masking part.

TYPE	Length [mm]	Height [mm]	Number of manifold circuits	*Order no.*
1	350		up to 2	*118101*
2	450	570	up to 4	*118102*
3	580	to	up to 7	*118103*
4	780	625	up to 10	*118104*
5	930		up to 14	*118105*



UNIVENTA CABINET - IN WALL
To be installed in a wall. A box body is made of galvanized steel metal. The frame and the door have the surface coated with white colour RAL 9016. In the box body there is a rail for attaching the manifold. On the sides of the box there are break-out plugs for supply and return piping. Removable door can be closed with a coin lock.

TYPE	Length [mm]	Height [mm]	Depth [mm]	Number of manifold circuits	*Order no.*
1	350			up to 2	*118201*
2	450	560	110	up to 4	*118202*
3	580	to	to	up to 7	*118203*
4	780	660	165	up to 10	*118204*
5	930			up to 14	*118205*

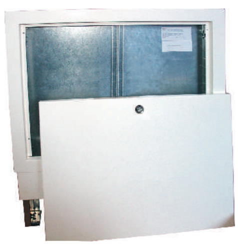


UNIVENTA CABINET - ON WALL
To be installed on a wall. A box body is made of galvanized steel metal; the surface is coated with white colour RAL 9010. The door can be closed with a coin lock. Manifold is only connected from the floor.

TYPE	Length [mm]	Height [mm]	Depth [mm]	Number of circuits ULTIMATE	*Order no.*
1	350			up to 2	*118301*
2	450			up to 4	*118302*
3	550	585	110	up to 7	*118303*
4	650			up to 10	*118304*
5	800			up to 14	*118305*

UNIVENTA CABINET - IN WALL - THIN
To be installed in thinner partition walls. A box body is made of galvanized sheet metal, the surface is coated with the white colour RAL 9010. The door can be locked with a coin lock.

TYPE	Length [mm]	Height [mm]	Depth [mm]	Number of circuits ULTIMATE	*Order no.*
2	450	700		up to 4	*118402*
3	600	to	75	up to 7	*118403*
4	900	820		up to 10	*118404*
5	1200			up to 12	*118405*



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UNDERFLOOR HEATING INSTALLATION

Installation can only be carried out by a professionally competent company.
During the installation, cooperation among the works carried out by companies responsible for heating, concrete production, and concrete floor slabs laying is very important. The company installing the underfloor heating must respect all applicable standards regarding thermal and technical principles, insulation regulations, allowable dimensions and limit tolerances in the building industry, principles for processing of concrete and plaster screeds.
Underfloor heating can be carried out using two methods:

- wet method
- dry method

Wet method

In the wet method of underfloor heating installation, the pipes are flooded by the concrete mixture. The heating medium temperature at the supply pipe ranges from 35 ˚C to 55 ˚C. Temperatures below 60 ˚C have no negative impact on the concrete durability.

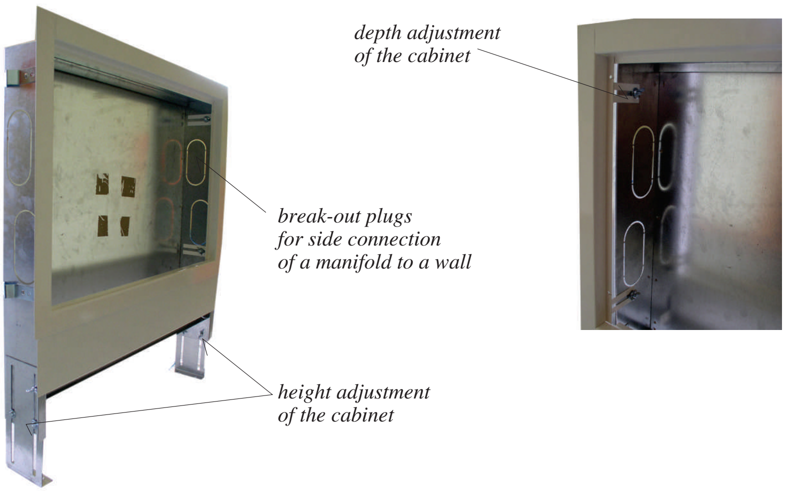
Preparation for underfloor heating installation

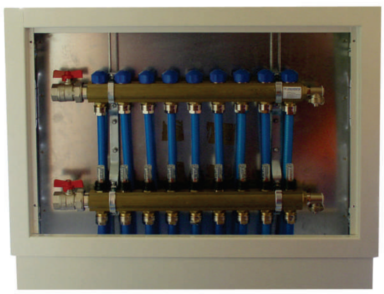
The architect specifies the wall into which a manifold cabinet shall be embedded into a cut-out (or the cabinet is attached directly to the wall). Cabinets supplied by the UNIVENTA Company can be adjusted in height and depth.

Cabinet adjustment depth is chosen depending on the manifold equipment:

- for a manifold itself ca 120 mm
- for a manifold equipped with thermal actuators ca 130 mm to 150 mm
- for a manifold with a mixing armature min 150 mm

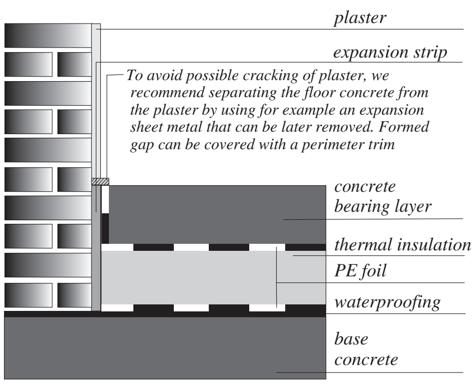
Then the manifold is attached and connected to the main distribution from the boiler.





Manifolds are placed in the height of cca 300 mm up to 650 mm. If necessary, a manifold can also be placed below the ceiling. For such installation it is necessary to consider the fact that an air vent must be placed in the highest position of the heating system.

We recommend the heat pipes to be laid and connected to a manifold after the plastering works are completed, when the door frames are in place. If the heat pipes are installed and then flooded with the concrete screed before applying the plaster to the building, we recommend separating the plaster from the floor concrete. The building must be in the closed stage, including embedding the windows and complete electrical installations. It is also conditioned by completion of the boiler circuit and manifolds connection. The floor into which the underfloor heating shall be installed must be plain and free from any impurities. If the heating surface is adjacent to any natural terrain, a water-proof layer must be inserted to prevent from penetration of ground moisture into the heating floor structure.



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INSTALLATION PROCEDURE

1. Marginal expansion strip is attached peripherally around the room where the surface finish works are completed and the floor structure is insulated, and then the thermal insulation plates are laid.
Note: If the surfaces are very accurate, expansions can be made by cutting the concrete into 1/3 of the layer thickness

2. Before the thermal insulation is laid, the water proofing of the base concrete must be completed, as well as all distribution piping inside the floor. Insulation thickness depends on the floor type. The insulation is laid so that a continuous layer is formed. An insulation layer thicker than 30 mm should be laid in two layers so that the bottom layer gaps are covered with the top layer. It is usually freely laid on top of the floor.
If a bitumen layer (IPA) is applied on the base concrete, we recommend inserting a separating polyethylene foil (PE foil) between this layer and the thermal insulation. It shall prevent from possible penetration of free gases into the thermal insulation and the volume sublimation of the insulation.

3. A covering PE foil protects against penetration of the mixture moisture into the insulation layer. It is laid continuously, or with 20 to 30 cm overlaps, and near the walls and expansions it is laid to the height of 10 cm (forming a pot). In case of damp premises (swimming pool, laundrette, spa, kitchen) it is recommended to spread a covering foil against vapour penetration also under the insulation layer. In case of floors on natural ground, regardless of the underfloor heating, side insulation is important as well. This applies also to damp premises. Depending on the used type of water proofing, the PE foil is laid under the thermal insulation as well (see the recommendation in section 2).

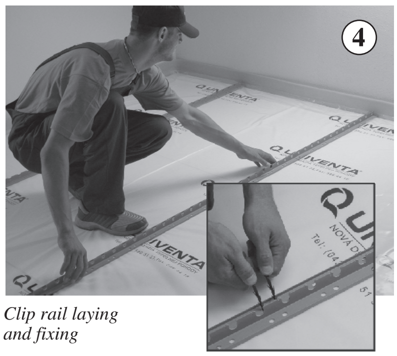
4. Plastic rails with grooves are laid, with the required spacing, on the surface with thermal insulation and the foil. Using the clip nails, they are attached to the insulation layer.

5. Before connecting the pipe to the manifold body, required amount of pipe sleeve is slipped over the pipe and the pipe is balanced using the calibration former. The pipe sleeve must always be used if the pipe passes through the expansion, at pipe connections to the manifold and collector. The pipe sleeve should be at least 50 cm long (25 cm from the place of expansion to both sides).

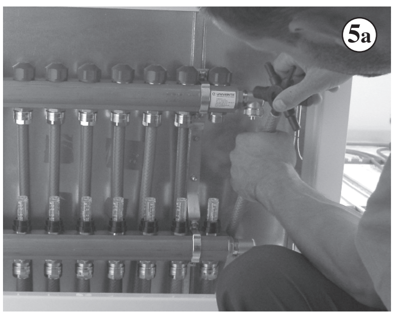
Expansion strip laying

Thermal insulation laying

PE foil laying

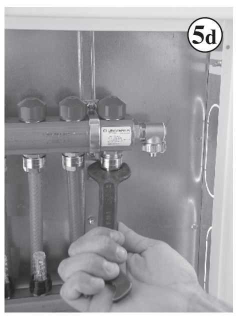


Clip rail laying and fixing



Pipe calibration

Screwing application



Pipe attachment to the manifold

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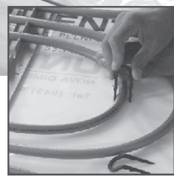
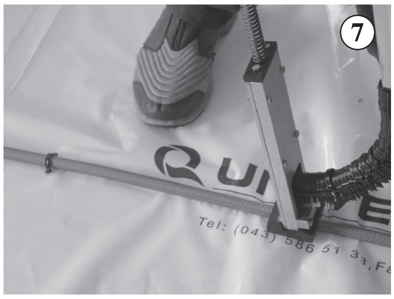
6. On the basis of calculated thermal loss, the architect shall specify the pipe laying module and the heating circuit length for each heated room. After connecting to the manifold, the heat pipes are laid into the rails over the entire room and the circuit is closed back on the manifold. Floor pipe laying is made so that the supply pipe is first led along the most cooled wall. Underfloor heating output distribution shall become similar to the distribution of thermal loss of the room. Pipe distance from the edge is 100 mm to 250 mm.
Pipe laying direction near expansions must be respected in parallel with the expansions.

Heat pipe laying



Bends fixing

7. The pipe can be laid directly on thermal insulation using a stapling gun and the nails.



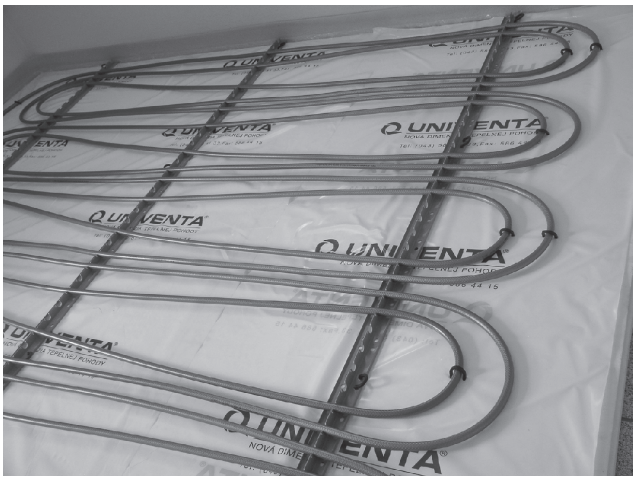
Clip nails fixing using a stapling gun

8. Underfloor heating can be laid also on the rigid insulation panel with PE foil on one side. The panel has also a thermal insulation function.
Clip nails fixing using a stapling gun9. A pipe reel is an integral part of the underfloor heating installation; it provides comfortable, trouble-free, and fast installation.

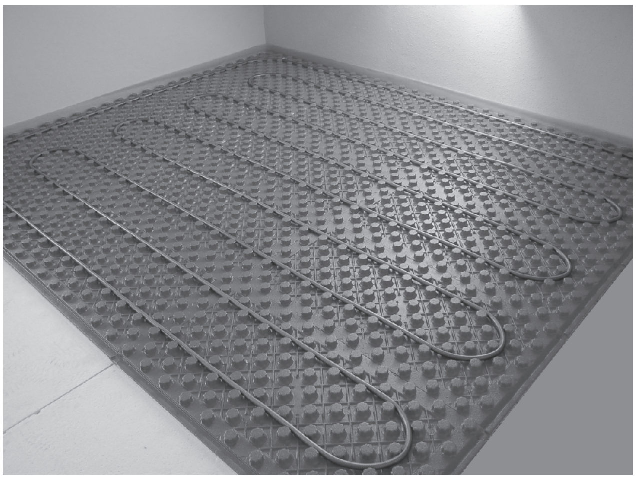
Insulation panel laying

Heat pipe laying

Pipe reel



Attaching the pipes to the clip rails



Pipe laying in the rigid insulation panel

PRESSURE TEST

When the floor pipes laying is completed, the pressure test must be carried out, as it serves for testing the whole system. During the test the spherical valve on the manifold must be well closed to prevent from pressure escape to the boiler circuit and subsequent possible damage of regulation components or pumps (the boiler circuit is pressurised separately). The system is pressurised in the range from 0.2 to 0.4 MPa and it must stay in this condition for at least 24 hours.
Allowed pressure decrease is 1/3 of the original value (e.g. due to temperature difference).
If the pressure test shows any leakage, the cause must be localised and repaired, and the system must be pressurised again.
Pressure test execution shall be recorded in the protocol.

CONCRETE SCREED

Heating circuit depressurising is followed by pouring the concrete with the prescribed concrete mixture composition. Concrete is poured in a pressurised state and the overpressure is maintained for the following seven days without additional system pressurising.
Before the concrete is poured we recommend taking photos of the pipes so that if any constructional intervention is required, it is clear how and where the pipes are led.
For underfloor heating a common concrete screed is used and we recommend adding a plastificator.
The minimum thickness of the concrete layer is 65 mm to 72 mm (if anhydride-plaster screeds are used, plastificator is not necessary and the minimum thickness of the grouting is 55 cm. For more detailed information contact the plaster screed suppliers).
If the concrete mixture is transported manually, a special care must be taken to avoid pipe damaging. Fresh floor layer must be protected against excessive drying for the following 10 days at least (concrete layer should be maintained in a damp state for 5 to 8 days – either by moisturising, or covering with a foil. In case of excessive drying, the concrete plate should be protected by a polyethylene foil).
During the concrete setting it is necessary to keep the concrete in normal thermal and moisture conditions. Air temperature should not fall below 5 ℃, the concrete layer should not be exposed to impacts or quakes.
Due to expansion reasons, reinforcement made of construction steel must be used for the warm water underfloor heating in premises with the area larger than 25 m and premises with hard floor covering (ceramic, natural or artificial stone). The size and the type of construction steel shall be specified by the design engineer.

Recommended composition of the concrete mixture

For 1 m^2 of concrete:
gravel 4 to 8 mm ....225 kg
cement PC 325 ....50 kg
mixing water ....14 l

Plastificator dosage:
0,6 l / 50 kg of cement
1,2 l / 100 kg of cement

Using the cement of higher quality, insufficient concrete mixture stirring, adding the plastificator directly to the concrete mixture, or fast drying of the concrete without showering can cause internal tension and thus also deformation and lifting of the concrete plate.
Do not use limestone dolomite for preparation of the concrete mixture; use the river gravel with the recommended fraction. Concrete screed must meet the required construction standards specified by the design engineer.

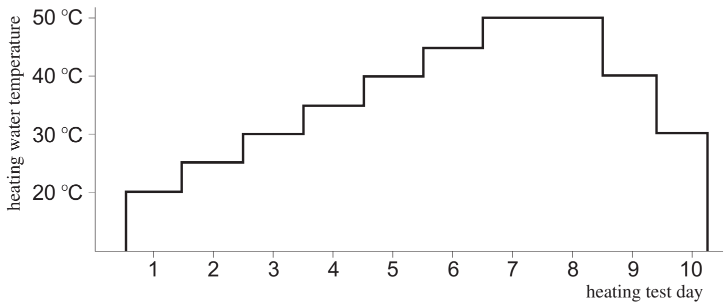
It is necessary to ensure that the concrete is thoroughly poured under the pipes so that the pipes are completely flooded in the concrete layer and the heat passage is ideal.

SYSTEM FILLING

Before the heating test is commenced, the system must be filled with the heating medium. As in other heating systems, the underfloor heating must not freeze. Use of anti-freeze mixtures is allowed.
Filling the branches must be carried out individually, each circuit separately. This shall ensure perfect deaeration of the system. (When the first circuit is being filled, others are closed).

HEATING TEST

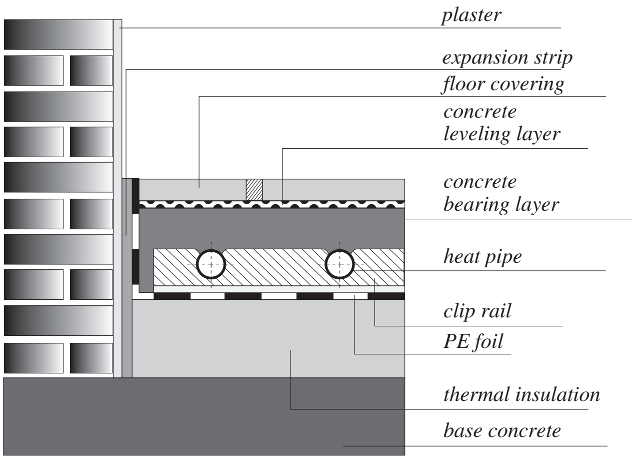
After 21 days (in case of reinforcement made of construction steel or a KARI grid) or after 28 days (in case of assembly rails) a heating test can be carried out. Before the heat source is put into operation, the spherical valves must be opened; during pressurising they must be closed. If there is a danger of the concrete setting to be disturbed by any sudden change of weather conditions (frost), operation of the underfloor heating can be commenced from the 10th to 28th day with the maximum input water temperature of 20°C.
The first heating up must not be carried out by fast increase in the heating water temperature; fluent increase must be maintained. We recommend the 5°C increase per one day, which corresponds to the floor temperature increase in ca 2°C per day. If the heat-up is too fast, the floor drying is uneven, and, as a result, the corners in the room can elevate.



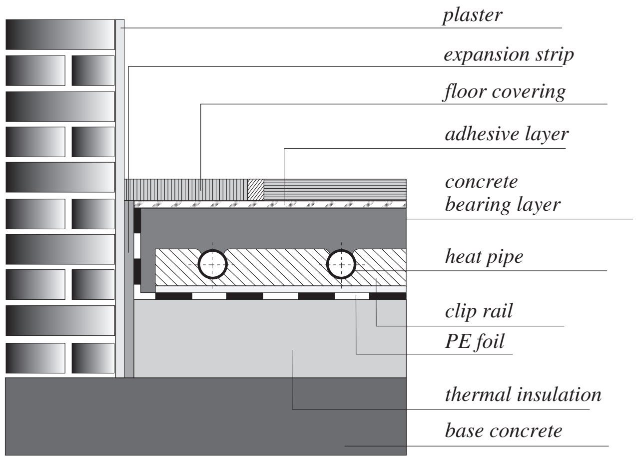
Dynamic heat-up diagram

FLOOR COVERING LAYING

After 14 days of testing operation the floor covering can be laid.



Floor covering laying into the cement screed



Floor covering laying into the glue layer

If the heating test was not carried out, the following rules apply to floor covering laying:

- ceramic floor can only be laid after the concrete is thoroughly settled. During the first heat-up, additional moisture release from the concrete screed can occur. To avoid damage to the covering, we recommend floor tiles to be joined after the first dynamic heat-up is carried out.
- laying of wooden, laminate, or other types of floor covering that form a single unit is excluded as the concrete moisture release is impossible. Laying of wooden wear layer must be carried out during the underfloor heating operation.

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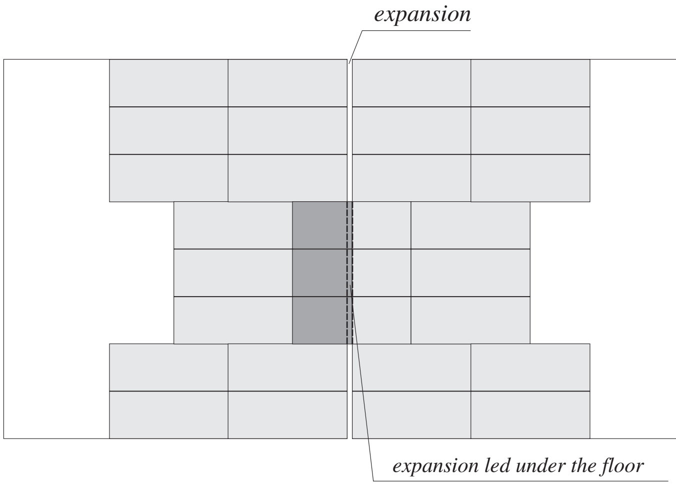
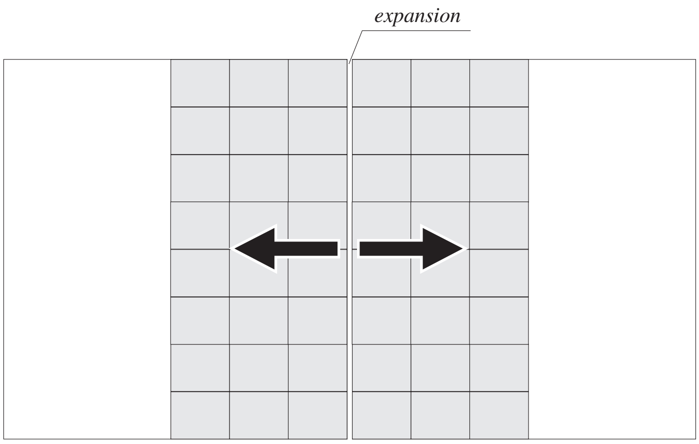
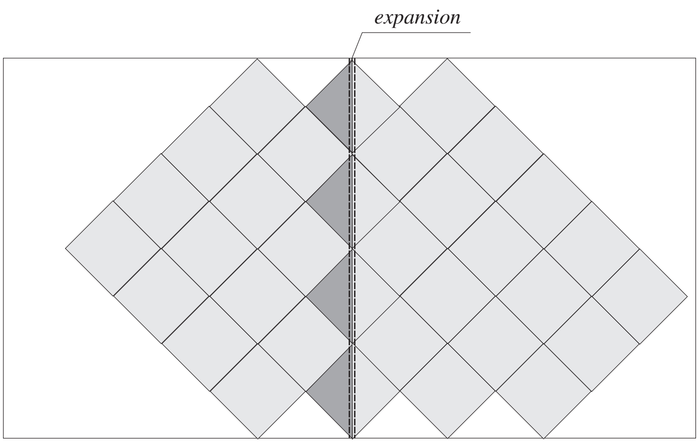
FLOOR COVERING LAYING METHODS AND EXPANSIONS FORMING



A part of the flooring marked with a dark colour, under which the expansion is led, should be bonded with silicone (hollow sound when knocking on it), the rest of the flooring should be bonded with a sealant „fixed“.



Symmetrical floor laying must proceed in the direction from the expansion.



With diagonal laying we recommend for a part of the flooring (marked with a dark colour), under which the expansion is led, to be bonded with silicone, the rest of the flooring to be bonded with a sealant.

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PROTOCOL ON PRESSURE TEST EXECUTION

Customer:.. Address: ....

☐ underfloor heating ☐ radiator connection ☐ wall heating
☐ sanitary system ☐ supply pipes to manifolds ☐ boiler room distribution

Committee members:

Heating supplier	Building contractor	Investor
Company:..	Company:...	Company:...
Address:...	Address:...	Address:...
Name:..	Name:..	Name:..
Tel no..:..	Tel no..:..	Tel no..:..

a) The system was pressurised with air – water *) under the pressure of .... MP and for the period of .... hours. The test result was satisfactory, as during the test no visible leakage or evident pressure decrease was observed.
b) Regulation centre .... has – has not*) been properly connected and tested to this day (detector, by-pass establishment, knowledge of the instruction manual, function testing).
c) Heating test of the heating system has – has not*) been carried out to this day.
d) Hydraulic additional regulation of the heating system has – has not*) been carried out to this day.
e) The system shall remain filled with water – pressurised with air*) for the subsequent building technologies.

With regard to the operating conditions of the construction, activities specified in sections b), c), d), e), *) have not been carried out. It was agreed that the installing company shall complete the required activities resulting from the tightness observed by the heating test, upon the investor's request, 14 days before the contractual deadline.

**) cross out irrelevant alternatives*

In .... on ....

....	....	....
seller (contractor)	party taking over (customer)	user (investor)

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PROTOCOL ON HEATING TEST EXECUTION

Customer: .... Address: ....

☐ underfloor heating ☐ wall heating

Committee members:

Heating supplier	Building contractor	Investor
Company:....................................	Company:....................................	Company:....................................
Address:......................................	Address:......................................	Address:......................................
Name:..	Name:..	Name:..
Tel no..:......................................	Tel no..:......................................	Tel no..:......................................

Date and time		Activity	Input temperature °C	Note
From	To			
		Concrete pouring		
		Gradual temperature increase	**10**	
			15	
			20	
			25	
			30	
			35	
			40	
			45	
			50	
		Cooling		

Observed defects

In .... on ....

....	....	....
seller (contractor)	party taking over (customer)	user (investor)

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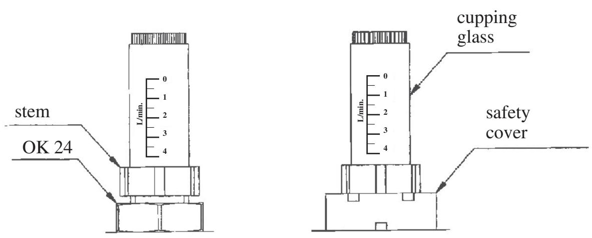
SYSTEM REGULATION

Hydraulic system regulation

Using the flow meters located on the manifold's return pipe, the required flow volume in l/min is set for individual circuits. During the regulation, supply valves of individual circuits must be open.

Certain heating water flow volume is assigned to each heating circuit, depending on the project. Setting the required flow volume is carried out until the required value is reached. As the flow volumes of individual heating circuits affect each other during the setting, they must be adjusted by slight additional regulation of each circuit. When the flow volume setting procedure is completed, the safety cover must be fixed.



Spatial temperature regulation

The best regulation of the interior temperature is equithermal regulation that regulates the temperature of the heating medium depending on detected external air temperature and enables to achieve the required interior temperature. Equithermal regulation can be supplemented with a spatial thermostat.

ENSURING THE REQUIRED TEMPERATURE OF HEATING WATER

As for underfloor heating, preparation of the heating water is one of the main factors affecting the output, service life, as well as thermal comfort. The most ideal choice is the choice of a low-temperature heat source directly ensuring the required heating water temperature. Such sources include thermal pumps or condensation boilers.
Heat sources function can also be provided by common solid-fuel boilers, gas boilers, or electric boilers. Connecting the underfloor heating system to a solid-fuel boiler is the least suitable method due to hard-to-regulate output. With such a solution, it is necessary to connect also an accumulation tank to the system, as it collects the excessive heat, out of supply to the heating system.
With application of typical gas boiler, or electric boiler, the required output temperature for the underfloor system heating is ensured by the mixing valve.
Regardless of the heat source, we recommend using an emergency thermostat that stops the source or a pump if the temperature exceeds the critical (preset) limit.

UNDERFLOOR HEATING OPERATION

Operation of the large-area warm water underfloor heating must meet the following requirements:

a) enable regulation of the supply water temperature to the heating circuits in the temperature range from 20 °C to 60 °C
b) prevent from spontaneous increase of the supply heating water temperature above 60 °C
c) exclude low-temperature corrosion of a heat source
d) ensure deaeration of heating circuits
e) ensure thermal comfort in heated interiors
f) enable regulation of the flow volume in l/min in individual circuits
g) avoid exceeding the temperature of the wear layer above the maximum value specified in the standard

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