

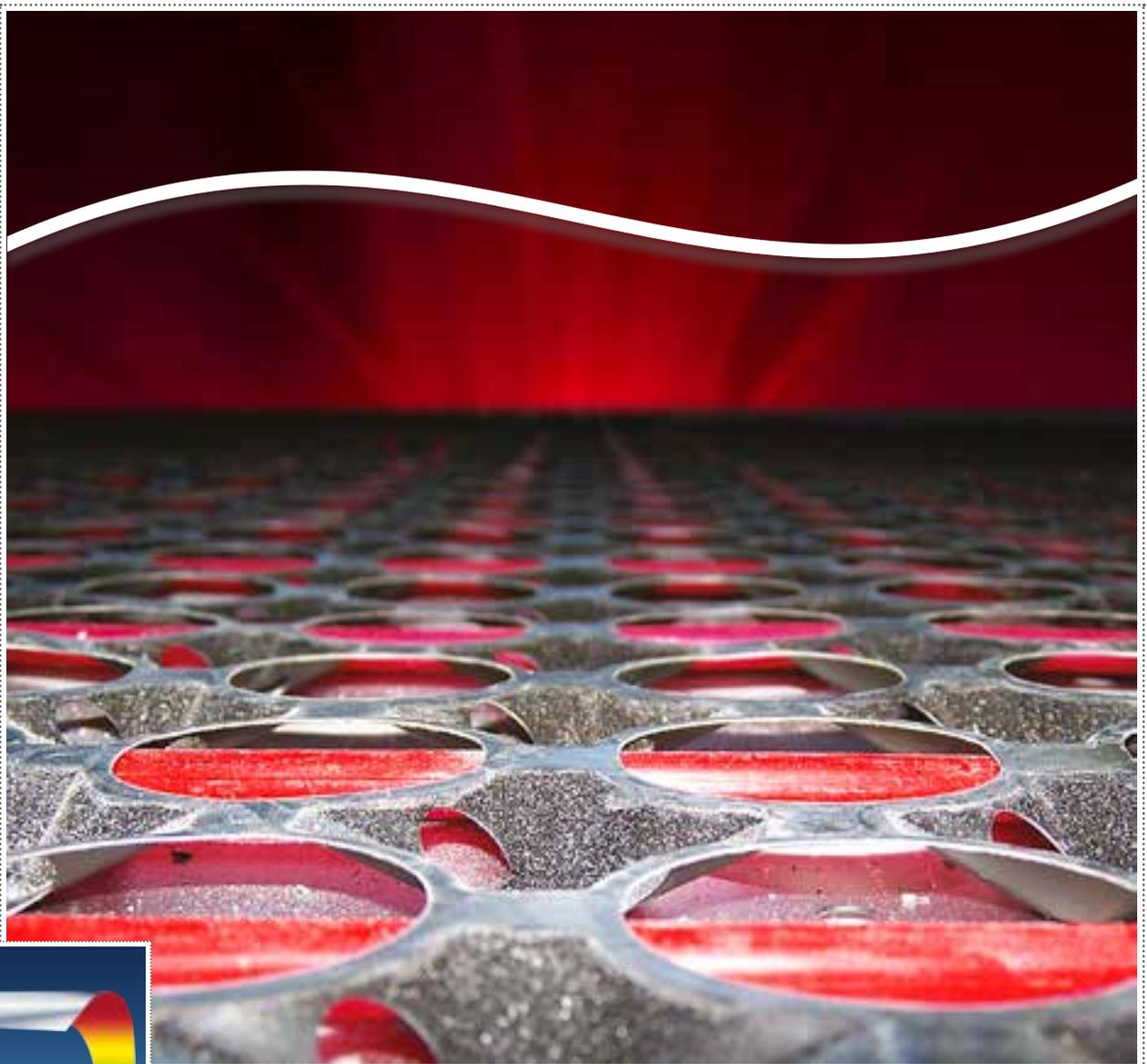


effidur Klima WP 1000
Registriernummer 7F257



TECHNICAL MANUAL

FLOOR RENOVATION SYSTEM WP (COMB PANEL)



TESTS & CERTIFICATES

PUSH CONNECTION SYSTEM

IMA Dresden - Tests according to DIN EN 1254-3 and W 534 DVGW

PIPE MATERIAL

SKZ Würzburg, MPA Nordrhein-Westfalen - Test of oxygen permeability according to DIN 4726

SYSTEM SCREED

MPA Stuttgart - Test of bending tensile strength and pressure resistance following DIN 13813

Sächsische Bauprnf Edelman GmbH - Test of adhesive tensile strength analogue to DIN 1048

LOAD-BEARING BEHAVIOUR

MPA Stuttgart - Test according to European Guideline for Pre-Cast Screed Parts, evaluation according to DIN 1055-3

IMPACT SOUND BEHAVIOUR

ift Schallschutzzentrum Rosenheim - Test according to DIN EN 140-8

HEAT FLOW DENSITY & HEATING-UP BEHAVIOUR

WTP Berlin - Tests according to DIN EN 1264-2/3/4

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THE FLOOR RENOVATION SYSTEM WP INTRODUCTION



COMFORT OF AN UNDERFLOOR HEATING



In general there are three kinds of heat transfer - conduction, convection and radiation.

With an underfloor heating the heat is transmitted through radiation. This has the advantage that all room confining areas show a homogenous temperature allocation.

The use of an underfloor heating also avoids the raise of dust as known from radiator heatings and this way improves the room hygiene. Since dust often causes allergies, a panel heating can create a healthier surrounding. In general the room shows less hot and dry air due to the even heat distribution. The respiratory system of the residents is less irritated and the risk of inflammations and the growth of bacteria and viruses is minimised.

Furthermore, there are no humid zones on the heated area and therewith no mould is formed. As comfortable side effect there is no cleaning of radiators necessary. Additionally, more floor space is available since there is no space required for radiators.

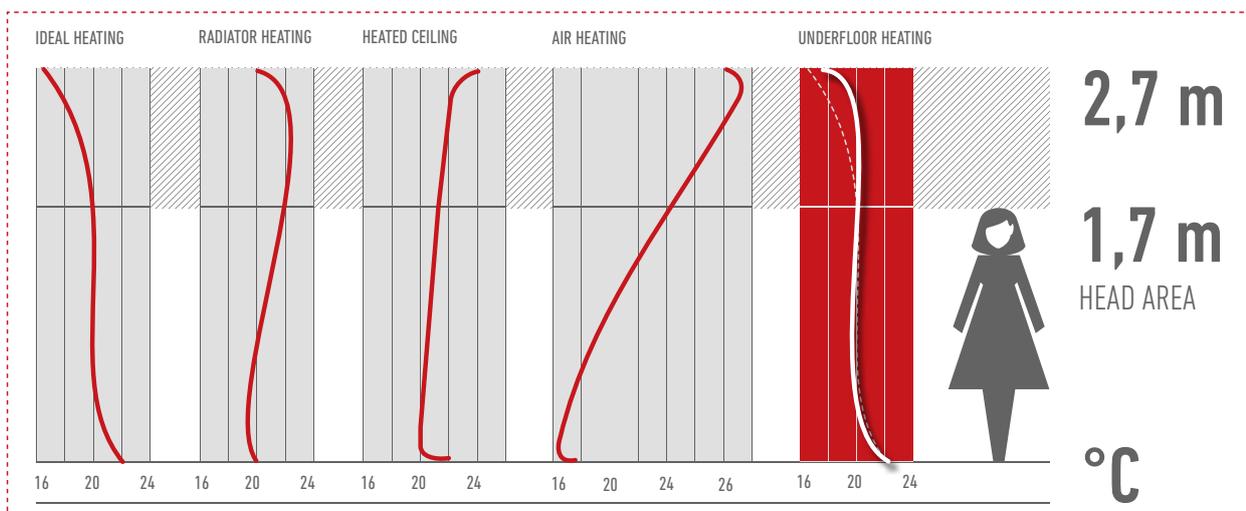
Thermal comfort means the comfort of people in a set room climate. An „acceptable thermal room climate“ is defined under DIN EN ISO 7730 as a surrounding that 80 % of its residents sense as comfortable. In general a room is comfortable if the temperature differences between

- » wall surfaces and the ambient air is less than 4 Kelvin
- » foot to head level is less than 3 Kelvin
- » various wall surfaces (radiation asymmetry) is less than 5 Kelvin

and if the air speeds and their turbulences within closed rooms are small to avoid air draught. Hereby different uses of a room influence the individual temperature requirements.

From experience the following temperatures are comfortable»

Living room» 20 °C to 22 °C / bed room» 16 °C to 18 °C / bath room» 24 °C to 26 °C



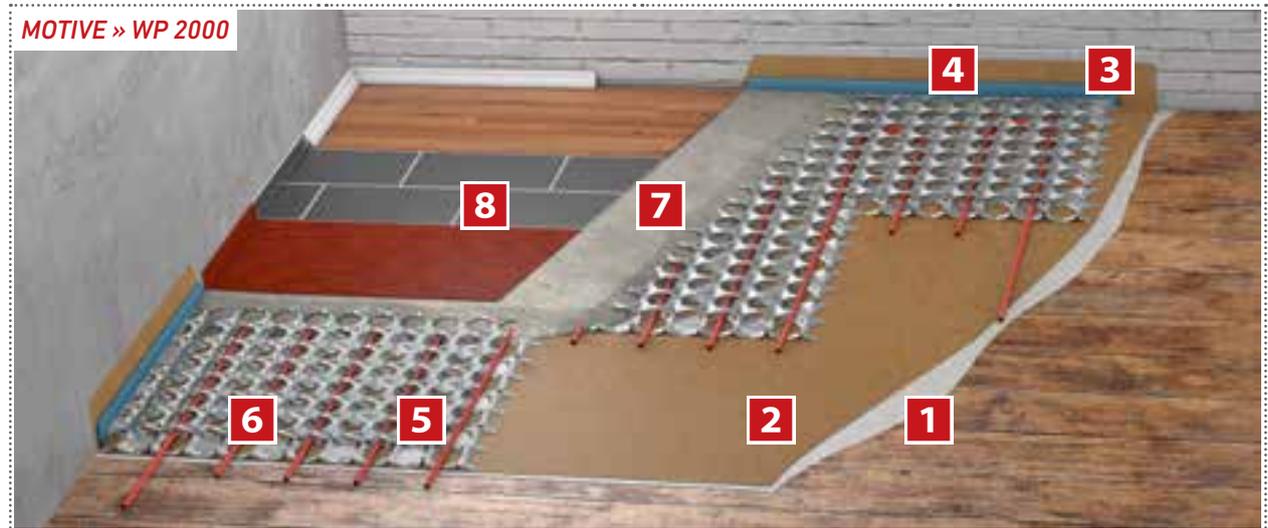
An underfloor heating is closest to an ideal heating regarding the vertical heat differences. Panel heatings are energy efficient and ideally suited for the use of renewable energies due to their very low flow temperature level. They create a maximum of comfort.

BASIC PRINCIPLE OF COMB PANELS

EFFIDUR floor systems WP consist of two preformed steel sheets that are firmly connected to each other to form a honeycomb shaped panel. These comb panels (WP) are fit as floating floor area without connection to the sub-floor, if necessary equipped with pipes and backfilled with screed with a minimum overlap in height of only 5 mm. This way an innovative, highly stable floor system is created, that can be used as floor reinforcement or equipped with pipe for heating or cooling just as required.

THE COMB PANEL SYSTEM CONSISTS OF THREE TYPES

WP 900 [14 mm total]	WP 1000 [15 mm total]	WP 2000 [25 mm total]
BASIS WITHOUT HEATING	CLIMATE HEATING / COOLING	CLIMATE HEATING / COOLING
<p>14 mm SYSTEM HEIGHT 9 mm + 5 mm SYSTEM SCREED</p>	<p>15 mm SYSTEM HEIGHT 10 mm + 5 mm SYSTEM SCREED</p>	<p>25 mm SYSTEM HEIGHT 20 mm + 5 mm SYSTEM SCREED</p>
<p>system height 9 mm [+ 5 mm SFM] Applicable for reinforcement of the old sub-floor without heating of the new floor.</p>	<p>system height 10 mm [+ 5 mm SFM] Especially suited for the retrofit of old buildings, where an underfloor heating is only feasible with a low building height.</p>	<p>system height 20 mm [+ 5 mm SFM] Advantage here» Heating pipes ø 8 mm can be crossed and other media might be integrated.</p>



- | | | | |
|----------------------------------|---------------------------|---------------------------------|-------------------------|
| 1 Impact Sound Insulation | 2 Separation Layer | 3 Border Insulation Tape | 4 Bracket |
| 5 Comb Panel | 6 Heating Pipe | 7 System Screed | 8 Floor Covering |

Each comb panel type is delivered to the building site in handy measurements of 1192 x 556 mm (length x width) or in a specific case with a variable length including all components through qualified wholesalers / craftsmen. The packages containing 10 comb panels can easily be carried to the building site (1200 x 560 x 1 resp. 200 mm) weighing about 30 kg.

ADVANTAGES AT A GLANCE

- » Low building height from 9 mm* flush floor finish possible for barrier-free access.
- » widely independent from sub-floor - unevenness of up to 20 mm can be balanced out without further works.
- » Reinforcement of sub-floor - highly load-bearing traffic areas feasible.
- » Excellent controllability - comparable to radiators through fast heat spreading of the steel panel and heating pipe close to the surface this way very short heating-up periods, ideal for temporarily used rooms, fast reaction to external heat input (solar irradiation).
- » Homogeneous head spreading - low temperature ripple at the floor surface already from a system size of only 15 mm, confirmed through testing according to DIN CERTCO Nr. 7F257.
- » Highly energy-efficient through low flow temperatures - up to 5 K lower than conventional underfloor heating, i.e. savings on heating costs of up to 10 %
- » Low material input - this way low static impact on the building through weight of the floor system.
- » Quickly ready for floor covering already after 5 days, when using system WP1000 heated, system screed SFM with a thickness of 10 mm* and under ideal ambient conditions.
- » Ideal for modern low temperature heating facilities, condensing boiler technology and heat pumps.

[*without screed overlap flushed for flooring with tiles and flags in middle-bed method, see detailed information at installation instructions under chapter "Backfilling with system screed SFM".]

PARAMETER	WP 900	WP 1000	WP 2000	NOTES
system height	9 mm	10 mm	20 mm	without screed (SFM) overlap and sub- or super-structure
building height	14 mm	15 mm	25 mm	comb panel with 5 mm screed (SFM) overlap
dimensions in mm	1080 x 480 ≈ 0,52 m ²	1080 x 480 ≈ 0,52 m ²	1080 x 480 ≈ 0,52 m ²	usable area per comb panel
weight without screed	approx. 5 kg/m ²	approx. 5 kg/m ²	approx. 5 kg/m ²	one packing unit = 5 m ² (10 comb panels)
weight with screed	approx. 29 kg/m ²	approx. 30 kg/m ²	approx. 45 kg/m ²	comb panel with 5 mm screed (SFM) overlap, at even subfloor
heat flow density	---	60 - 90 W/m ²	60 - 90 W/m ²	at a pipe distance of 120 mm and a pipe ø 8 - 10 mm for $\vartheta_i = 20\text{ }^\circ\text{C}$
cooling flow density	---	20 - 40 W/m ²	20 - 40 W/m ²	at a pipe distance of 120 mm and a pipe ø 8 - 10 mm for $\vartheta_i = 26\text{ }^\circ\text{C}$ einem Rohr ø 8 - 10 mm für $\vartheta_i = 26\text{ }^\circ\text{C}$
maximum field size without joints	up to 200 m ² for heated areas up to 300 m ² for unheated areas			using system screed SFM

LOAD-BEARING BEHAVIOUR OF THE FLOOR SYSTEMS (EXCERPT FROM SURVEY REPORT OF MPA STUTTGART)

effidur comb panel in combination with effidur system screed upon separation layer / various insulation	licit traffic loads in kN/m ² ***		licit point loads in kN***	
	15 mm made of 10 mm WP 1000 with 5 mm system screed SFM overlap, directly borne on reinforced concrete floor	up to 5,0		up to 4,0
15 mm made of 10 mm WP 1000 with 5 mm system screed SFM overlap, upon acoustic fleece 4 mm (CP 2)	up to 2,0		up to 2,0	
25 mm made of 20 mm WP 2000 with 5 mm system screed SFM overlap, upon acoustic panel 25 mm (CP 5)	up to 2,0		up to 1,0	
25 mm made of 20 mm WP 2000 with 5 mm system screed SFM overlap, upon acoustic fleece 4 mm (CP 2)	up to 3,0		up to 3,0	
35 mm made of 20 mm WP 2000 with 15 mm system screed SFM overlap, upon acoustic fleeces 4 mm (CP 2)	up to 5,0		up to 4,0	
When avoiding point loads in corner and border areas and subject to the applied insulation material load-bearing capacity of up to 8 kN/m ² feasible				

** ϑ_i = Indoor temperature / *** application fields acc. to DIN 1055 part 3, edition 2002

COMB PANEL SYSTEM WP TECHNICAL DESCRIPTION



APPLICATION FIELD

RETROFIT OF OLD BUILDINGS

- » underfloor heating with extremely low building height.
- » system can be fit upon old, but load-bearing floor boards and other floorings.
- » system can be fit upon worn-out and contaminated sub-floors.
- » imperfections of up to 0,2 m² per m² can be covered with the effidur floor system (for larger imperfections please contact us).
- » unevenness of up to 20 mm can be balanced out by backfilling with system screed without further works.
- » considerable improvement of sound insulation of the floor feasible.

INDUSTRIAL BUILDINGS

- » highly load-bearing traffic areas with low heights.
- » heated and chilled industrial floors / ceilings.

NEW BUILDINGS / PRE-FABRICATED BUILDINGS

- » floors with comfortable sound insulation feasible in spite of lightweight construction.
- » ceramic and natural stone floorings in combination with the comb panel system feasible upon nearly all kinds of sub-floors.

PUBLIC BUILDINGS / CHURCHES

- » fast heat-up of temporarily used rooms (e.g. meeting rooms) easily possible.
- » barrier-free building feasible (e.g. hospitals, homes for the elderly).

APPLICATION FILEDS ACC. TO LICIT AREA AND POINT LOADS

APPLICATION FIELD (EXAMPLE)			work load kN/m ²	point load kN
A1	attic	non-suited for residential purposes, but accessible attic with clear height of up to 1.80 m	1,0	1,0
A2	lounge areas	rooms with sufficient lateral distribution of loads, rooms and hallways in residential buildings bed rooms in hospitals, hotel rooms incl. kitchen and bath rooms	1,5	-
A3		as A2, but without sufficient lateral distribution of loads	2,0	1,0
B1	offices, working areas, hallways	hallways in office buildings, offices, medical practice, waiting rooms, lounges incl. hallways, barns for small domestic animals	2,0	2,0
B2		hallways in hospitals, hotels, home for the elderly, boarding schools etc. kitchens, medical treatment rooms incl. operating rooms without heavy devices	3,0	3,0
B3		as B2, but with heavy devices	5,0	4,0
C1	rooms, meeting rooms and areas suited for meetings (except for categories A, B, D and E)	areas with tables e.g. class rooms, cafés, restaurants, dining halls, reading halls, entrance halls	3,0	4,0
C2		areas with firm seating, e.g. areas in churches, theatres or cinemas, convention halls, auditorium, waiting rooms	4,0	4,0
C3		freely accessible areas, e.g. museum areas, exhibition areas etc. entrance areas of public buildings and hotels, impassable yard cellar ceilings	5,0	4,0
C4		sports and play areas, e.g. dancing halls, sports halls, gymnastics and power sports areas, stages	5,0	7,0
C5		areas for large gatherings, e.g. in buildings as concert halls, terraces, entrance halls as well as tribunes with firm seating	5,0	4,0
D1	sales rooms	sales rooms up to 50 m ² net area within residential or office buildings or similar	2,0	2,0
D2		areas in retail and department stores	5,0	4,0
D3		as D2, but with increased point loads due to high storage racks	5,0	7,0

excerpt from survey report of MPA Stuttgart, on the basis of DIN 1055 part 3, edition 2002

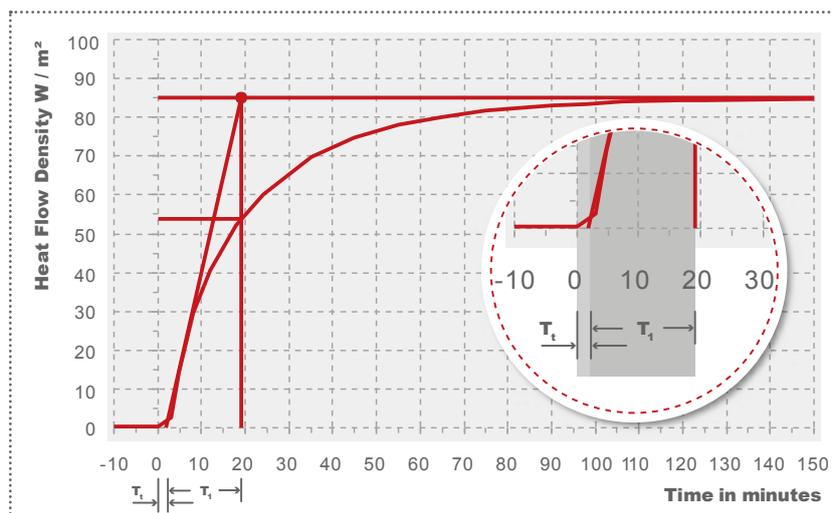
The matching especially with the according current edition of DIN EN 1991-1-1 and DIN EN 1991-1-1/NA is necessary!

HEATING / COOLING

STANDARD PLANNING VALUES FOR FLOOR COVERINGS

FLOOR COVERING	THICKNESS (d) in mm	THERMAL RESISTIVITY (R _{λ,B}) in m ² K/W
soft stone, e.g. marble	12	0,006
ceramic tile	13	0,012
hard stone, e.g. granite	30	0,014
carpet	4 - 10	0,05 - 0,17
PVC	2	0,010
linoleum	2,5	0,015
mosaic parquet (oak)	8	0,038
laminated	9	0,044
strip parquet (oak)	16	0,086
strip parquet (oak)	22	0,105
cork prefinished parquet	11	0,13

HEATING-UP BEHAVIOUR



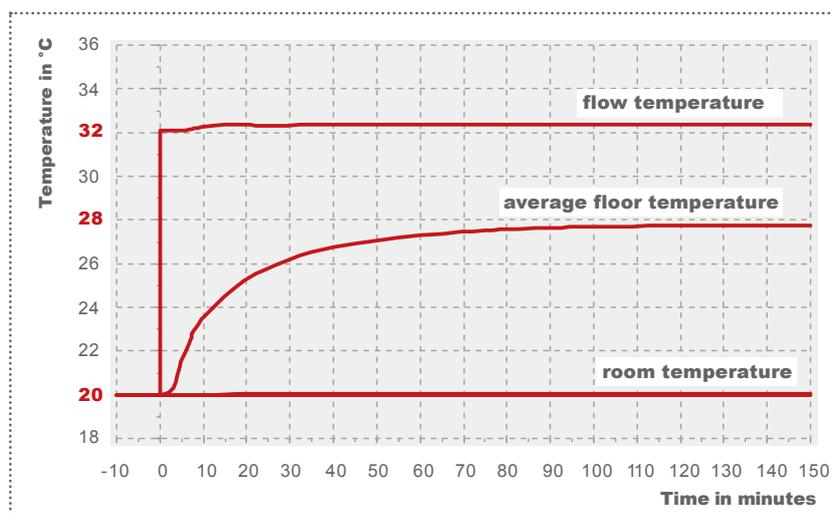
In order to evaluate the time response of the effidur floor system WP 1000 a heating-up chart has been recorded showing the time dependent behaviour of the surface temperatures and the heat flow density of the underfloor heating area.

Based on a non-operating state of the effidur floor system with 20 °C, the heat water flow has been activated and the flow temperature has been increased to 32 °C in order to reach an average surface temperature of approximately 28 °C.

The results are shown in the charts.

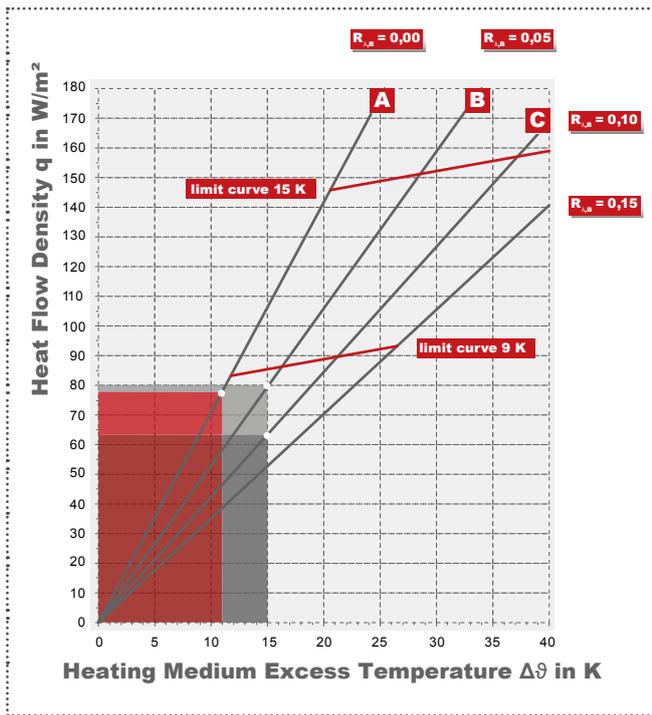
It became apparent that already 19 minutes after activating the heat water flow 63.2 % of the total licit output had been reached as requested for comparing.

Hereby the effidur floor system requires a two-minute initiation period (T_i) and 17 minutes pure heating-up time (T₁).



test set-up» Klima WP 1000 including 5 mm system screed (SFM) overlap, heating pipe 8 x 1,1 mm, pipe distance 120 mm

HEAT OUTPUT



thermal resistivity of flooring				
$R_{\lambda, B}$ in $m^2 K/W$	0,00	0,05	0,1	0,15
characteristic curves of floor system $q = K_H \times \Delta\theta$				
K_H in W/m^2K	7,089	5,294	4,224	3,514
limit of specific thermal output for residential areas $\vartheta_{F, max} - \vartheta_i = 9 K$				
q_{G1} in W/m^2	83,1	86,2	89,6	93,2
$\Delta\vartheta_{G1}$ in K	11,72	16,29	21,21	26,53
limit of specific thermal output for border areas $\vartheta_{F, max} - \vartheta_i = 15 K$				
q_{G2} in W/m^2	145,7	151,2	157,1	163,5
$\Delta\vartheta_{G2}$ in K	20,56	28,57	37,2	46,53
heat transfer coefficient				
underfloor heating» $\alpha_F = 10,80 W/m^2 K$				

← Klima WP 1000 including 5 mm system screed (SFM) overlap, heating pipe 8 x 1,1 mm, pipe distance 120 mm

EXAMPLE CALCULATIONS» AT 20 °C ROOM TEMPERATURE

e.g.	Floor Covering	Thermal Resistivity	Average Temp. of Heating Medium	Achieved Heat Flow Density
A	tile	0,00 $m^2 K/W$	31 °C	78,0 W/m^2
B	Laminated	0,05 $m^2 K/W$	35 °C	79,4 W/m^2
C	strip parquet 22 mm	0,10 $m^2 K/W$	35 °C	63,4 W/m^2

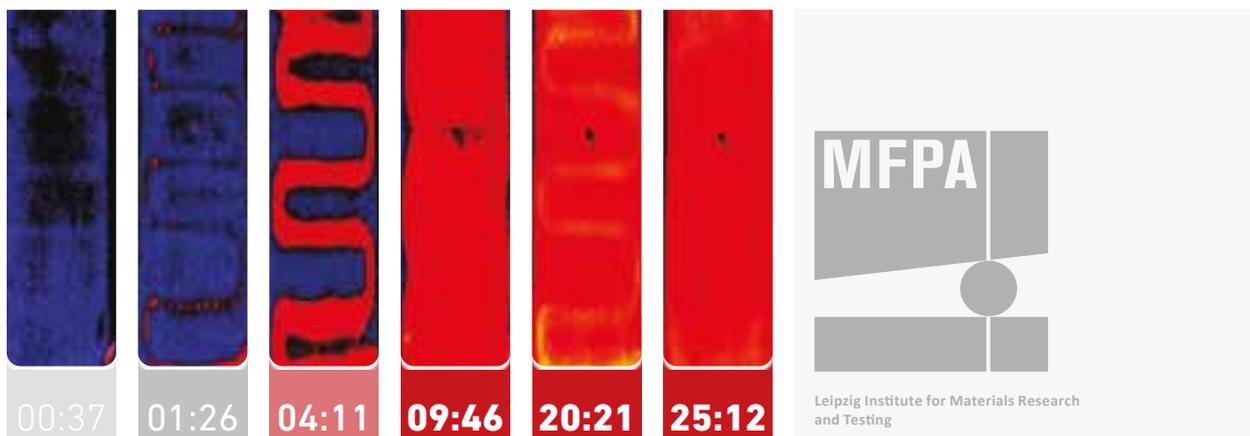
MAXIMUM FLOOR SURFACE TEMPERATURES ACC. TO DIN EN 1264

lounge areas» to 29 °C
 bathrooms» to 33 °C
 border areas» to 35 °C

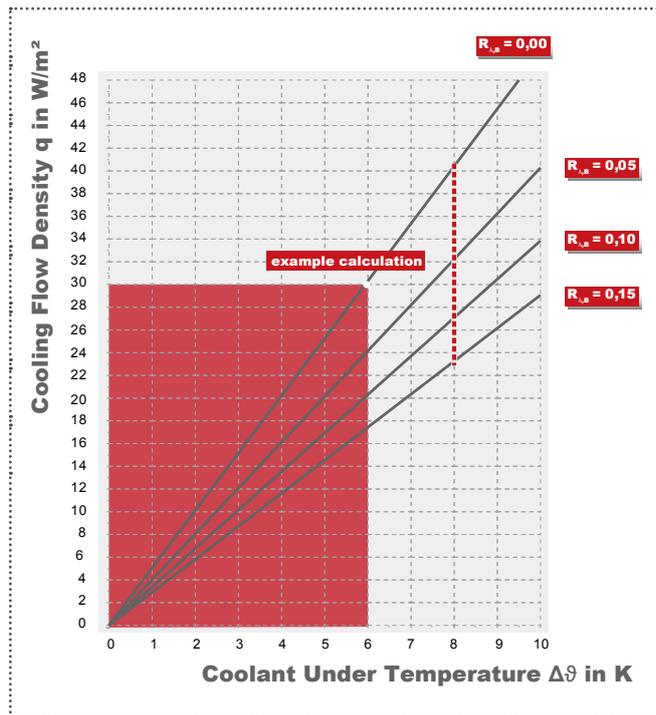
In order to avoid excessive surface temperatures, the flow temperature of floor systems with integrated heating needs to be set accordingly.

HEAT SPREADING BEHAVIOUR

Time-dependent heat spreading (data in minutes) – tested and confirmed by MFPA [Leipzig Institute for Materials Research and Testing].



COOLING OUTPUT



thermal resistivity of flooring

$R_{\lambda, B}$ in $m^2 K/W$	0,00	0,05	0,10	0,15
-------------------------------	------	------	------	------

characteristic curves of floor system
 $q = K_K \times \Delta\theta$

K_K in $W/m^2 K$	4,98	4,04	3,39	2,91
--------------------	------	------	------	------

cooling flow density bei $\Delta\theta = 8 K$

q_G in W/m^2	39,9	32,3	27,1	23,3
------------------	------	------	------	------

heat transfer coefficient

Floor cooling » $\alpha_{F,K} = 6,50 W/m^2 K$

← Klima WP 1000 including 5 mm system screed (SFM) overlap, heating pipe 8 x 1,1 mm, pipe distance 120 mm

EXAMPLE CALCULATION» thermal resistivity $R_{\lambda, B} = 0 m^2 K/W$; room temperature 26 °C

Floor Covering	Flow Temperature	Return Flow Temperature	Return Flow Temperature
tile	18 °C	22 °C	≈ 30 W/m ²

The cooling flow density has been determined based on the basic characteristic curve according to draft DIN EN 1264-5.

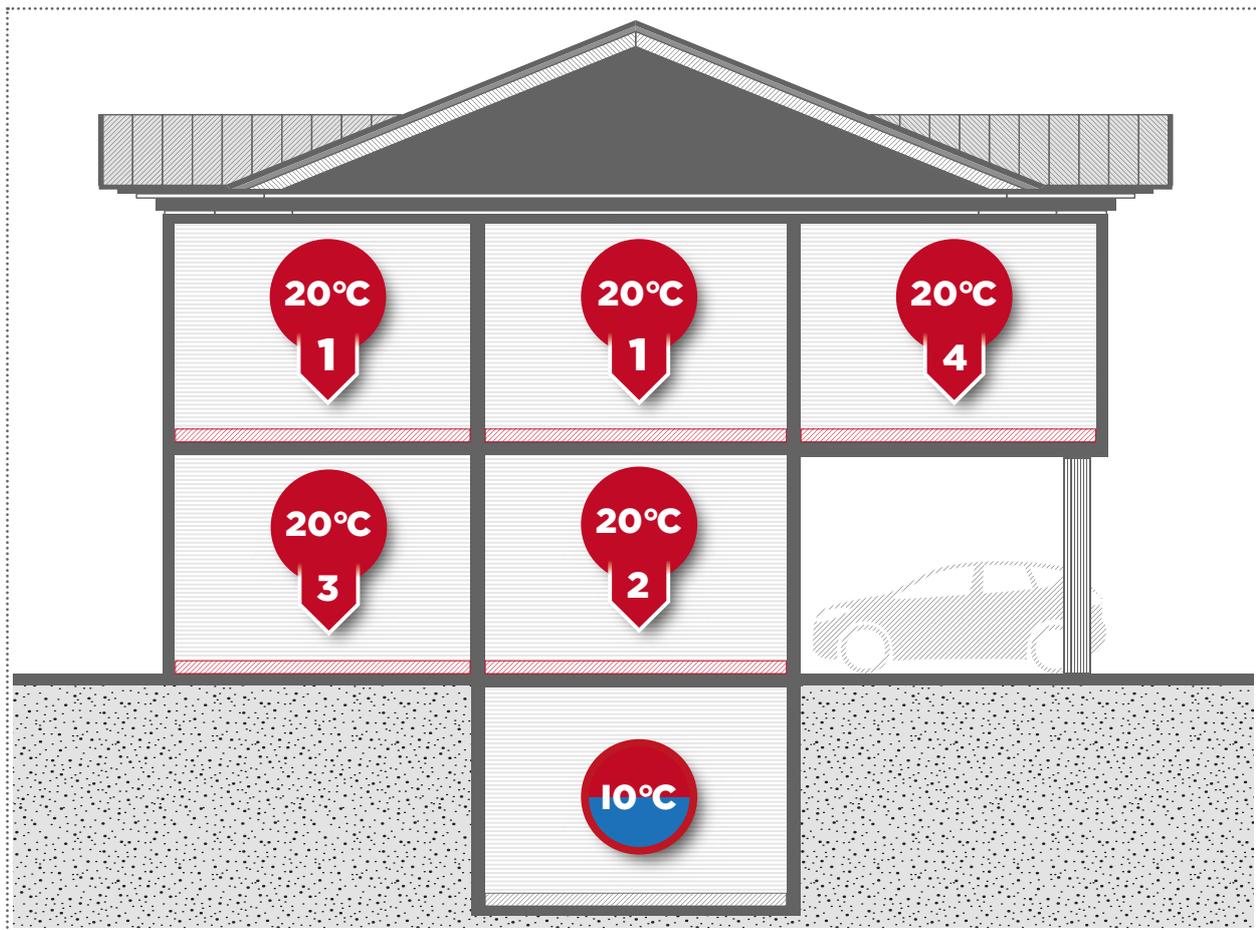
HEAT INSULATION

ADVICE

In order to limit the energy consumption within a building both for new buildings as well as for the retrofit of old buildings, amongst others the thickness of the heat insulation needs to be considered. For dimensioning the current Energy Saving Regulations are decisive. In Germany the Energy Saving Regulations EnEV 2009 respectively EnEV 2014 apply according to the date of the submitted building application until resp. after April 30th, 2014. In case the installation of the heat insulation is limited for technical reasons at the retrofit of old buildings, the requirements of the German Energy Saving Regulations are deemed to be complied with if the highest possible insulation thickness is fit according to the acknowledged rules of technology. Detailed requirements for the heat conductivity of the insulation(s) can be found at the according applicable Energy Saving Regulations. The Requirements of DIN EN 1264-4 apply for the insulation underneath an underfloor heating.

[please see other side for grafic of room situation]		REQUIRED MINIMUM THICKNESS IN mm			
What is underneath?	thermal resistivity $R_{\lambda, FB}$ in $m^2 K/W$ lt. DIN EN 1264-4	wood fibre $\lambda_D = 0,040$ W/mK	foamed polystyrene (EPS) $\lambda_D = 0,035 W/mK$	polyurethane (PUR) double aluminium foil $\lambda_D = 0,025 W/mK$	VIP vacuum insulation $\lambda_D = 0,008 W/mK$
case 1 » heated room	0,75	30	26	19	6
case 2 and 3 » unheated / temporarily heated room / ground spoil	1,25	50	44	31	10
case 4 » design temperature $T \geq 0 °C$	1,25	50	44	31	10
case 4 » design temperature $0 °C > T \geq -5 °C$	1,50	60	53	38	12
case 4 » design temperature $-5 °C > T \geq -15 °C$	2,00	80	70	50	16

HEAT INSULATION» CHART OF ROOM SITUATION



HEATING PIPE

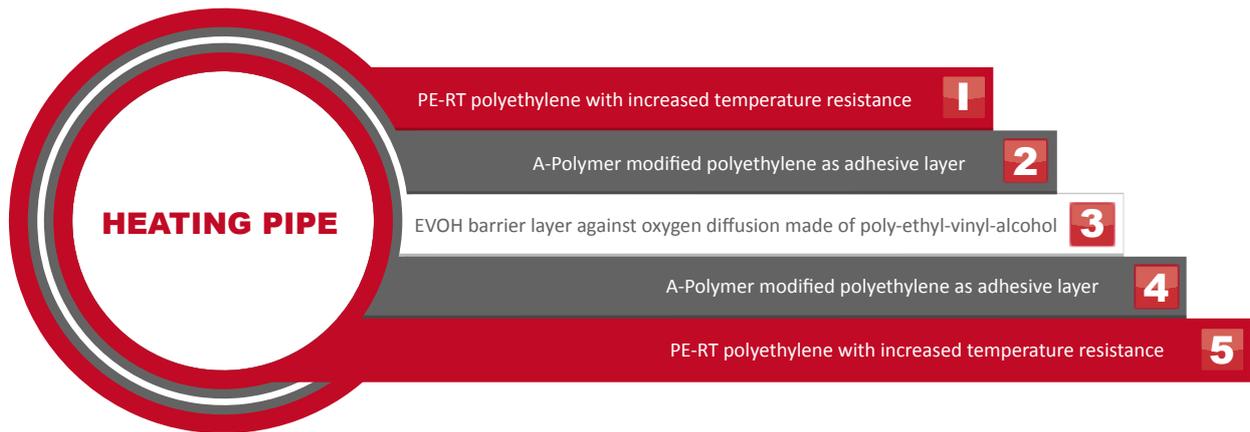
SET-UP & COMPONENTS

- » Basic material and protection layer are made of PE-RT DOWLEX 2344.
- » innovative synthetic, that does not require cross-linking; excellent features at high pressures and temperatures; extremely aging resistant.
- » highly flexible and easy to handle.

FUNCTION OF THE PE-RT LAYERS

- » protection of the oxygen barrier from mechanical damage, humidity and other environmental influences.
- » protection of the oxygen barrier from aging. Increase of the resistance to internal pressure - with the effidur heating pipe the oxygen barrier improves the pipe stability (EVOH has excellent mechanical strength properties).
- » Shrinkage is avoided; effidur pipes hardly show shrinkage (< 1,5 %; shrinkage known from PE-X does not occur).
- » ideal for press fittings: protection of the oxygen barrier from ripping.

Flexible fully synthetic 5-layer compound pipe made of PE-RT 80 (Dowlex 2344) according to DIN 16833 and application standard DIN 4726. Oxygen impermeable according to DIN 4726 oxygen barrier protected between two PE-layers. The pipe is approved as PEOC-SYSTEM with the corresponding fittings through DIN CERTCO, approval mark 3V217 PE-RT. The effidur heating pipe meets the requirements of ISO 10508: category 4 (underfloor heating, 6 bar).



OXYGEN BARRIER EVOH

- » high-barrier material poly-ethyl-vinyl-alcohol (EVOH).
- » firmly affiliated to one unit with the pipe material PE-RT.
- » avoiding oxygen diffusion until + 80 °C (requirement of DIN 4726 only until + 40 °C)
- » oxygen permeability of approximately 0,1 mg / m²d (many times better than required by DIN 4726).

SILTING OF THE HEATING PIPE - NO WORRIES!

The service life of a heating facility is essentially determined by the service life of the used metallic and non-metallic materials. The service life of metals is significantly distinguished by generating and preserving a thin protection layer of metal oxides. This surface layer inhibits corrosion so that a service life according to VDI 2067 is achieved. Nevertheless, chemical and physical processes can damage the protection layer.

For a long time the diffusion of oxygen through the pipes used in an underfloor heating was deemed negligible in comparison to other input possibilities. Experience shows that this factor shouldn't be underestimated. The diffusing oxygen enhances the corrosion of the used metal parts that could lead to unintentional deposits within the heating system. This way the efficiency and functionality of the facility is lowered.

Therefore, the use of oxygen impermeable pipe, in the case of synthetic pipe with a reliably protected oxygen barrier, is indispensable in closed, technically gas proof heating systems. This also requires the regulation VDI 2035 sheet 2.

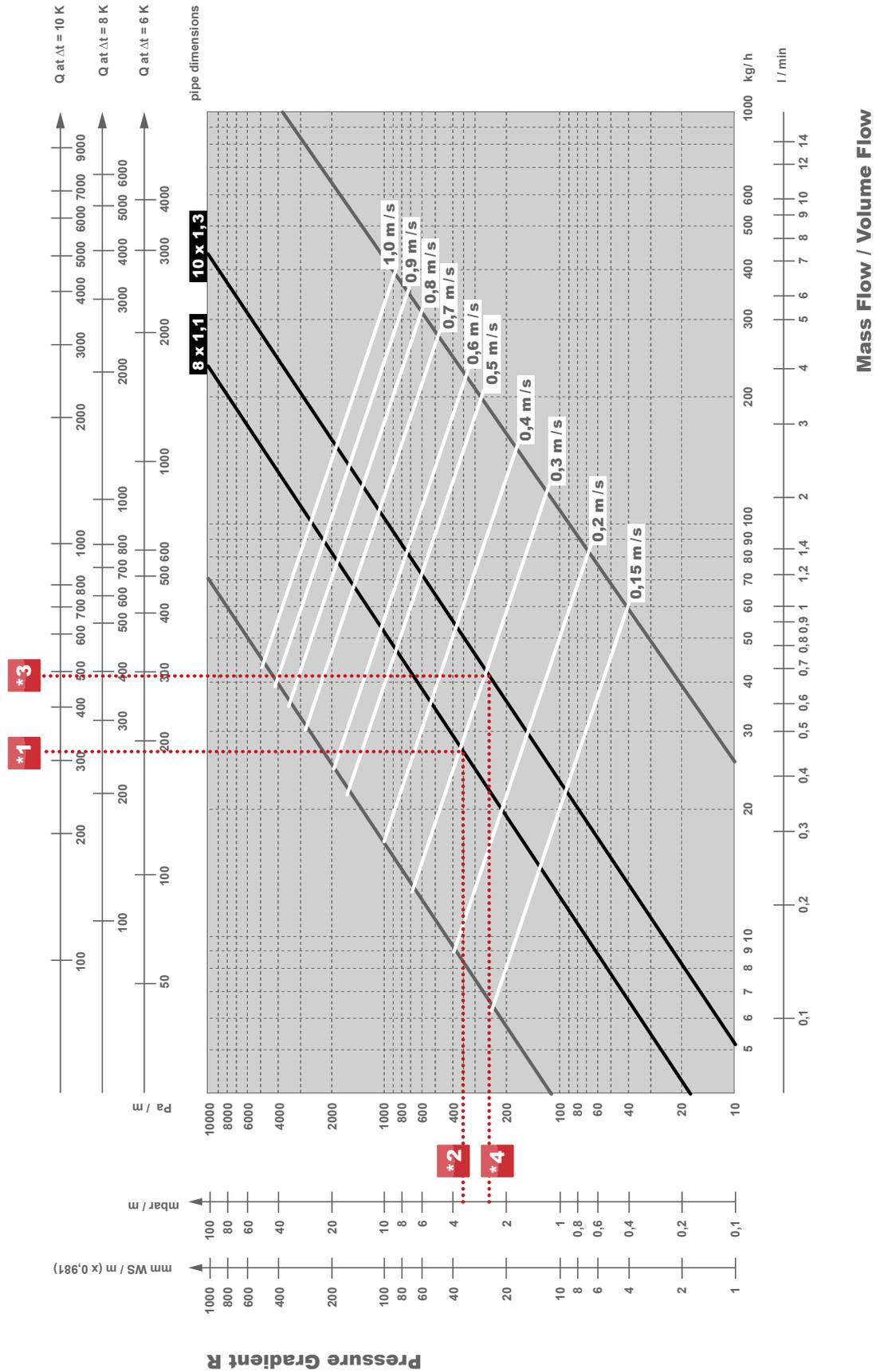
Effidur heating pipes have an organic oxygen barrier (EVOH) that limits the oxygen diffusion to approximately 0,1 mg / (m²d) and so undercuts the requirements of DIN 4726 (0,32 mg / (m²d)) many times.

The oxygen barrier is reliably protected from damage and humidity by the internal structure of the 5-layer compound pipe. Therefore externally sealing fittings can be used without problems.

When integrating an effidur floor heating or cooling system into an existing heating facility we recommend a hydraulic decoupling or the use of suited conditioning systems for the heating water (protection from lime and corrosion according to VDI 2035). The use of a flow filter additionally protects the heating system.

PRESSURE LOSS CHART FOR COMPOUND PIPE (PE)

Pressure Loss Diagram for 5-Layer Compound Pipe, Oxygen Impermeable acc. to DIN 4726



PRESSURE LOSS CALCULATION - EXAMPLE »

Pressure loss determination for an underfloor heating in order to calculate the required pump performance when connecting to an existing heating system. Since all heating loops are installed parallel and have the same length, the pressure loss for one loop per sub-manifold needs to be determined.

		heating pipe \varnothing 8 x 1,1 mm	heating pipe \varnothing 10 x 1,3 mm
LOCAL CONDITIONS	room size	16 m ²	16 m ²
	pipe length per heating loop	34 m	68 m
	area per heating loop	4 m ²	8 m ²
	number of heating loops	4	2
	manifolds for flow and return flow	2x UV 4-8	2x UV 2-10
	further components	thermostatic valve (flow), return temperature limiter (return flow)	thermostatic valve (flow), return temperature limiter (return flow)
	required heat flow density	80 W/m ²	60 W/m ²
	total heat output per heating loop (*1 resp. *3 at chart)	80 W/m ² x 4 m ² = 320 W	60 W/m ² x 8 m ² = 480 W
	temperature difference (flow - return flow)	10 K	10 K
PRESSURE LOSS PIPE	single value (*2 resp. *4 at chart)	3,5 mbar / m	2,5 mbar / m
	total value per heating loop (single value x length of heating loop)	119 mbar	170 mbar
PRESSURE LOSS SUB-MANIFOLD	value see chart "pressure loss of sub-manifold"	2 x 5 mbar = 10 mbar	2 x 5 mbar = 10 mbar
PRESSURE LOSS COMPONENTS	1 x thermostatic valve standard angled form at a mass flow rate of 110 resp. 82,5 kg/h	100 mbar	75 mbar
	1 x return temperature limiter standard angled form at a mass flow rate of 110 resp. 82,5 kg/h	22 mbar	17 mbar
PRESSURE LOSS TOTAL	sum of pressure losses pipe + manifolds + components	251 mbar \approx 0,25 bar	272 mbar \approx 0,27 bar

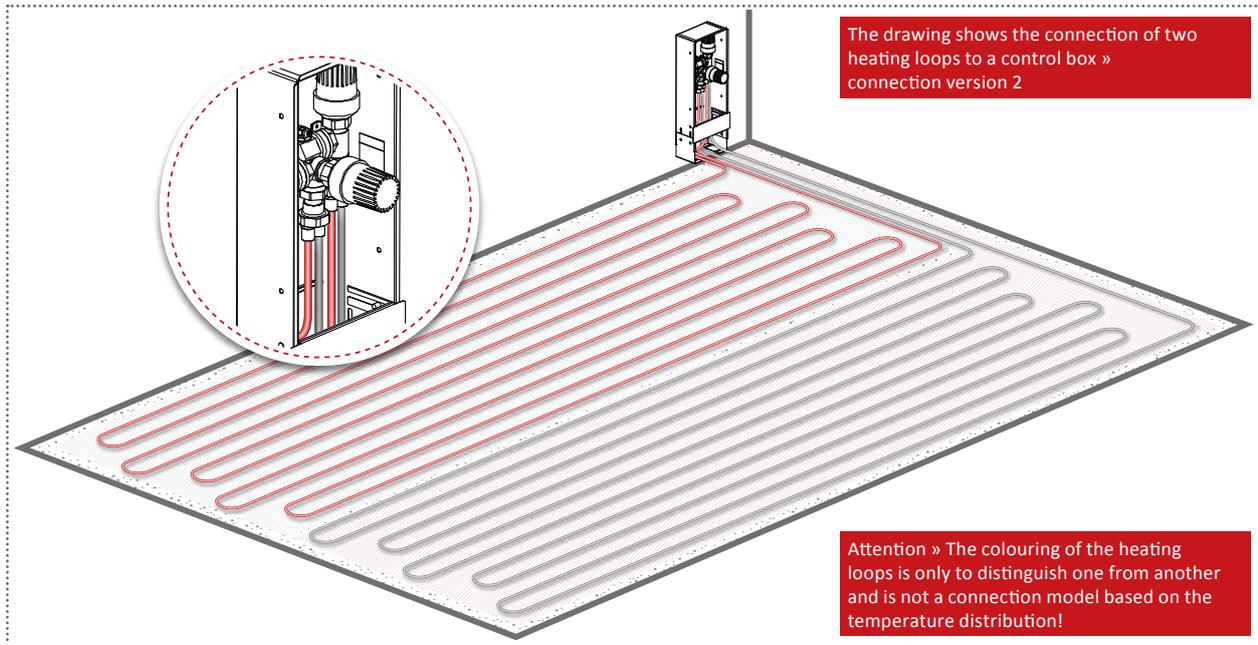
PRESSURE LOSS OF SUB-MANIFOLDS

	MODEL	PRESSURE LOSS
SINGLE PLUG CONNECTOR	STA AG-8 / STA IG-8 / STA IG-10	approx. 5 mbar
SUB-MANIFOLD 2-PORT / 4-PORT	UV2-8 / UV 2-10	approx. 5 mbar
	UV 4-8 / UV 4-10	approx. 5 mbar
MANIFOLD UNIT (\triangleq manifold bars)	VBG 4	approx. 10 mbar
	VBG 6	approx. 10 mbar

CONNECTION OF THE HEATING PIPES

The heating pipes can be connected through effidur single plug connectors, 2-port or 4-port sub-manifolds or with effidur multi-port manifold units. These manifolds can individually be equipped with control elements. You find a wide range of manifolds and pre-assembled control units at the chapter COMPONENTS/SUB-DISTRIBUTION resp. COMPONENTS/CONTROL UNIT.

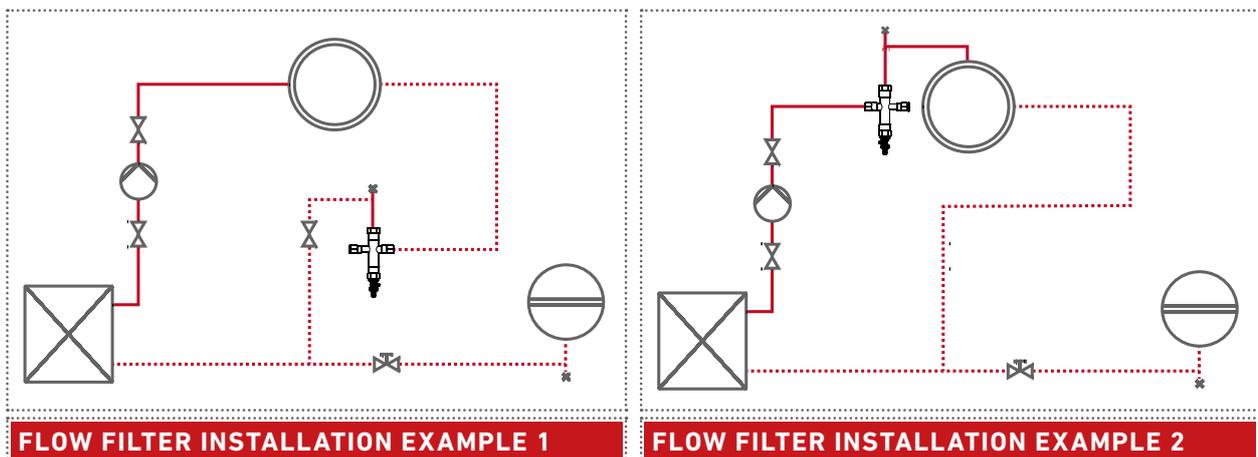
All manifolds of the effidur floor system have push connections with the John Guest principle. The manifolds might be installed in a wall recess or behind a dry wall in a distribution box. Pay attention to keep a minimum height of 200 mm between the distribution box and the floor.



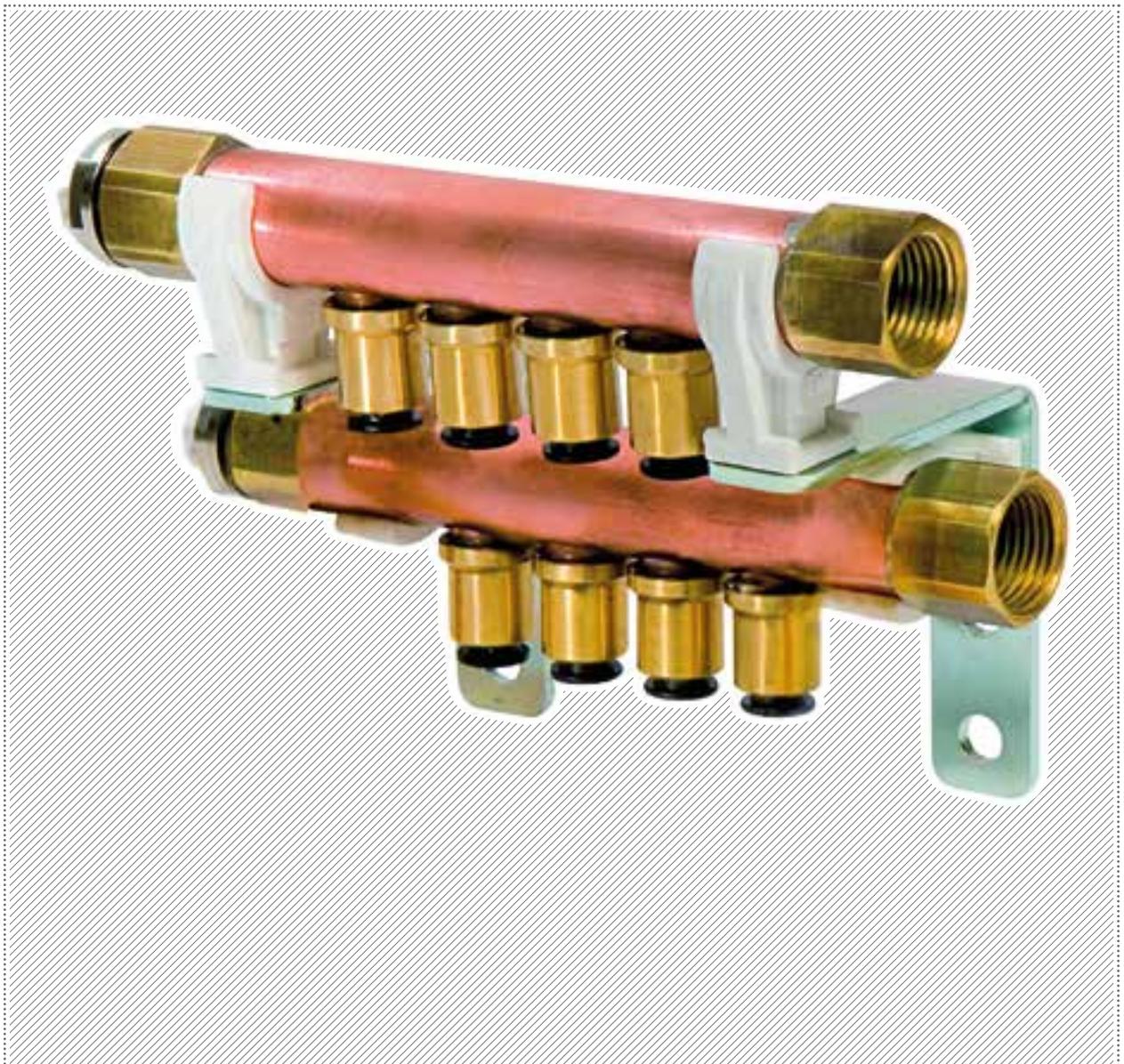
SYSTEM SEPARATION

When connecting the underfloor heating to an existing heating system we recommend the use of a flow filter or sludge collector for the entire heating system or for the underfloor heating only. Depending on the project it might be more favorable to install the filter or sludge collector directly at the flow (example 2) instead of shown in our example 1. This way contaminations of the existing facility from the installation, dirt or similar can't get into the loops of the underfloor heating. Pay attention to the manufacturer's instructions.

For existing heating facilities it might be useful for hydraulic reasons to separate the underfloor heating from the existing radiator heating. The underfloor heating needs then to be hydraulically separated from the rest of the facility through a heat exchanger. This way the underfloor heating can ideally be run with a separate pump. Pay attention to the manufacturer's instructions.



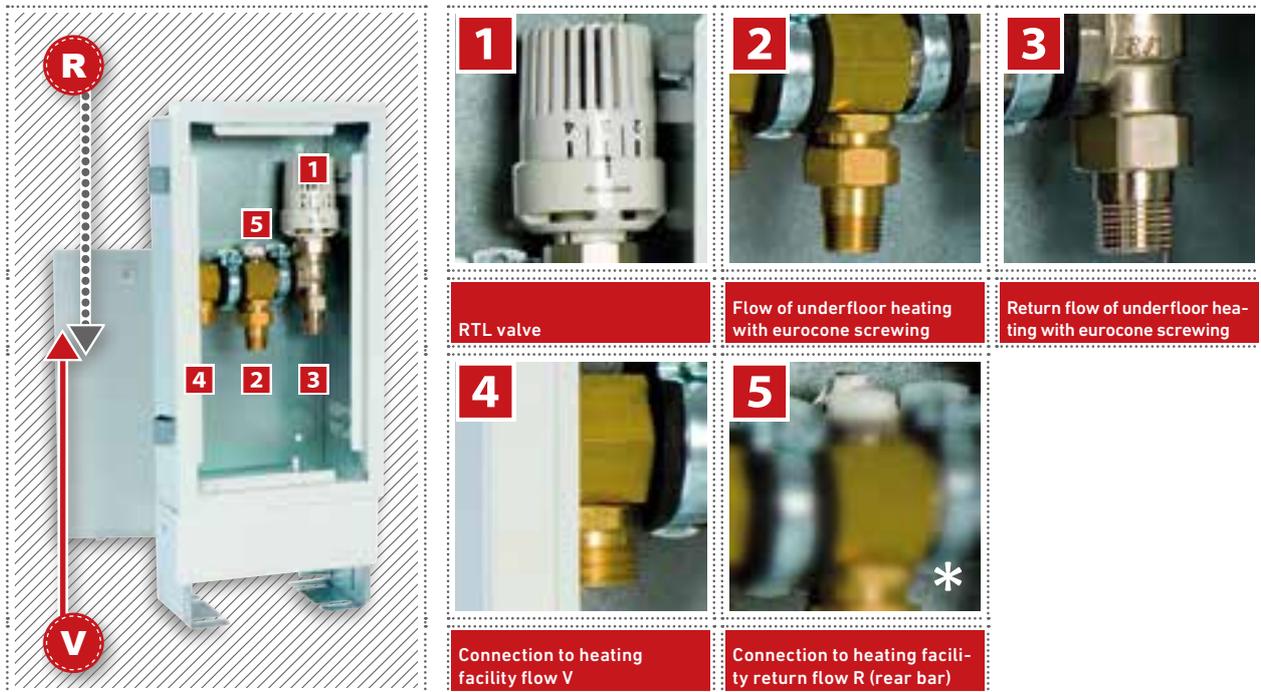
CONNECTION OPTIONS FOR MANIFOLDS & CONTROL UNITS



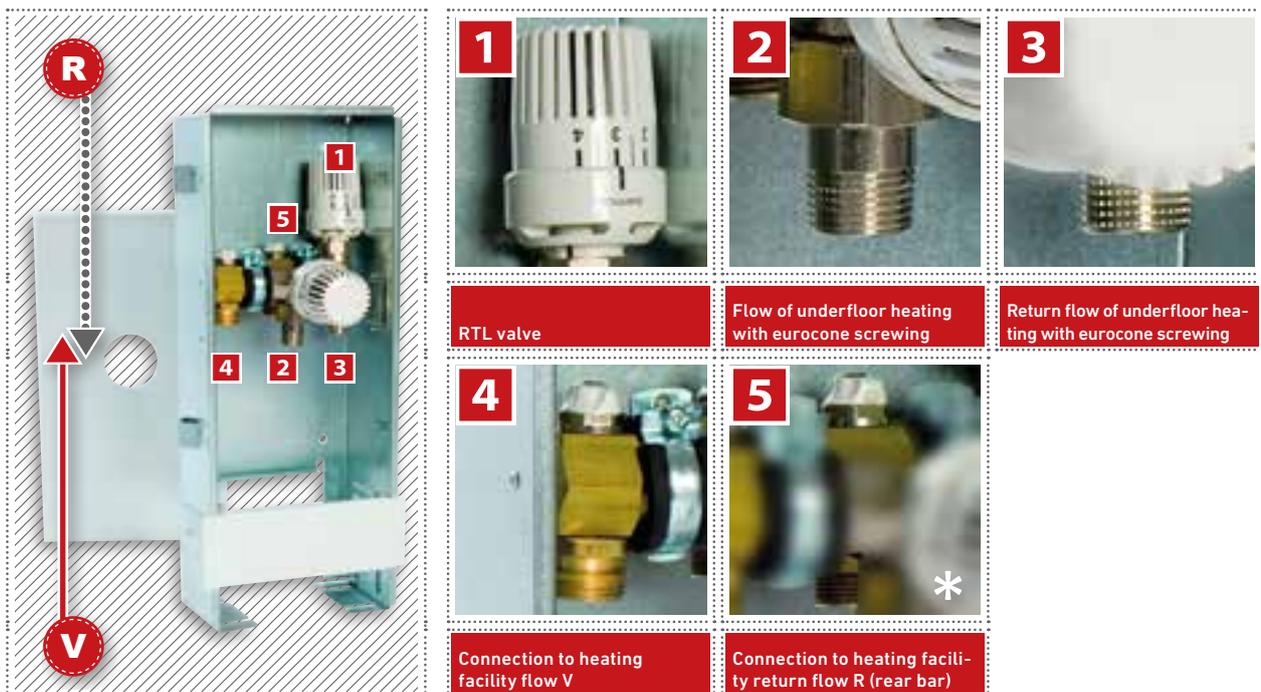
INSTALLATION INSTRUCTIONS FOR CONTROL BOXES

Pay attention to the total pressure loss when connecting UV4-10 to the control boxes for heating areas > 16 m²!

CONNECTION OPTION 1 AT THE EXAMPLE OF CONTROL BOX» RB1 RTL W

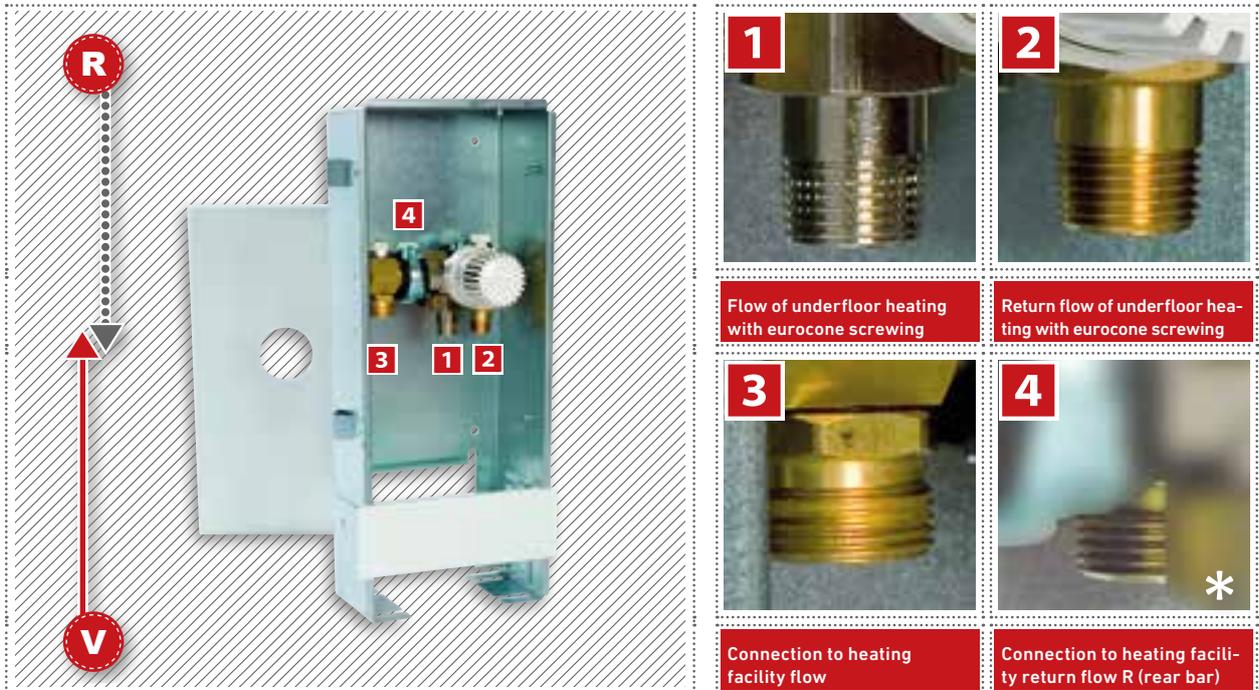


CONNECTION OPTION 2 AT THE EXAMPLE OF CONTROL BOX» RB2 TH RTL OW

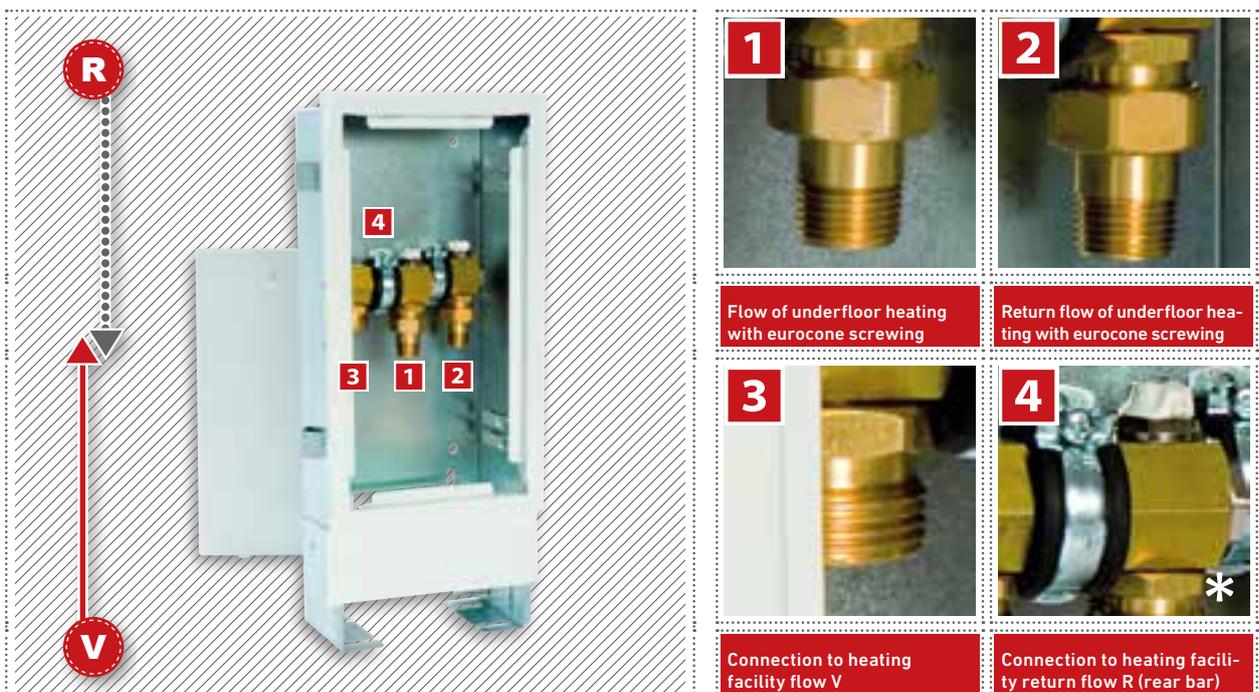


* THE LAST PICTURE OF EACH SEQUENCE SHOWS THE CONNECTION AT THE REAR BRASS BAR OF THE CONTROL BOX.

CONNECTION OPTION 3 AT THE EXAMPLE OF CONTROL BOX» RB3 TH OW

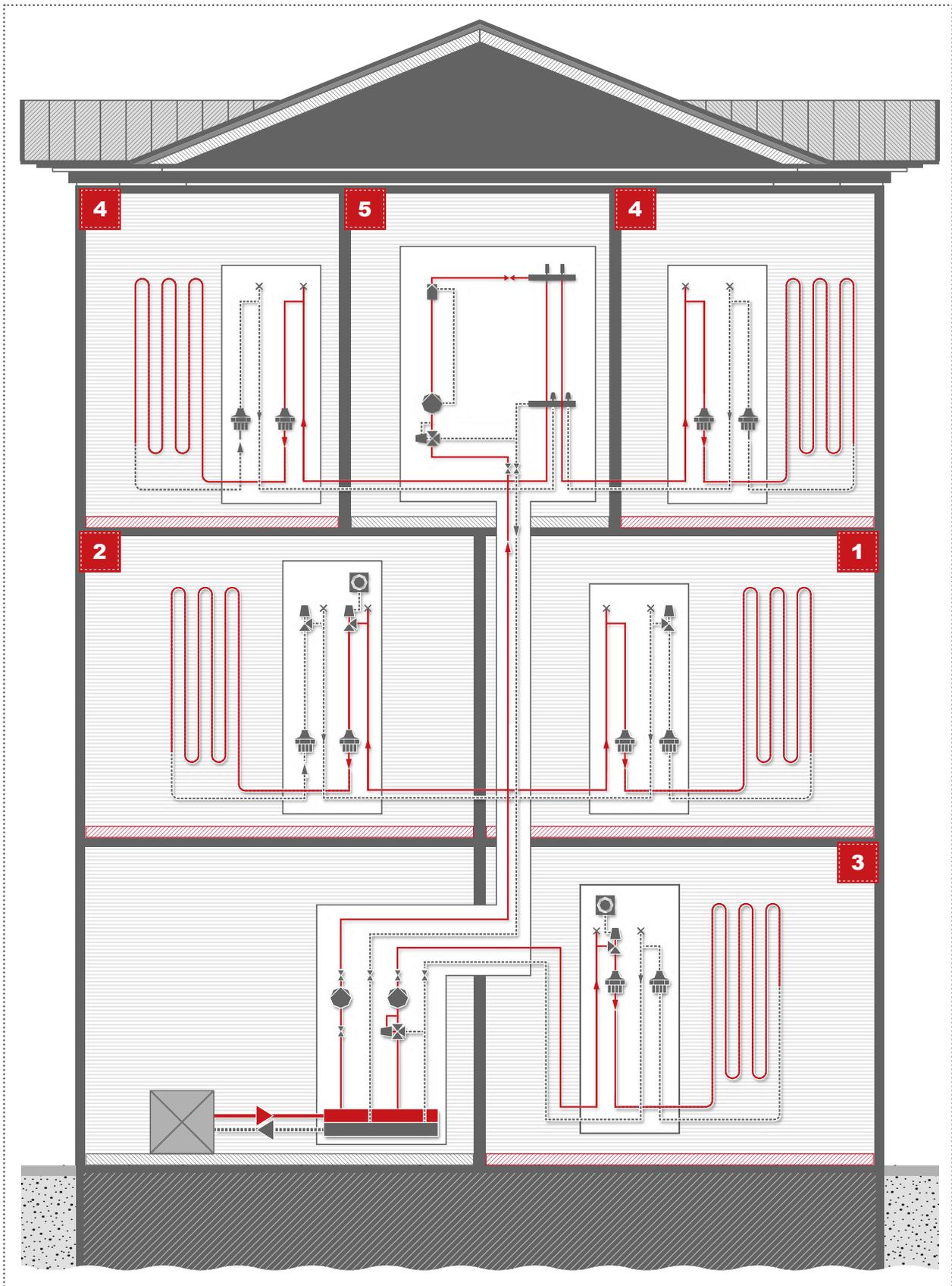


CONNECTION OPTION 4 AT THE EXAMPLE OF CONTROL BOX» RB4 W



* THE LAST PICTURE OF EACH SEQUENCE SHOWS THE CONNECTION AT THE REAR BRASS BAR OF THE CONTROL BOX.

CONNECTION OPTIONS FOR CONTROL BOXES





CONNECTION OPTION 1

For limiting of the return temperature via RTL (return temperature limiter) valve for areas of up to 16 m²*; set temperature range» return temperature 20 - 50 °C.

THIS OPTION CONTAINS»

- » built-in box (w 170 x h 450 - 515 x d 100 - 150 mm)
- » cover white resp. ready to decorate and tile,
- » RTL-valve "Uni RTLH" with thermostat
- » ventilation valve,
- » 2x connections G ¾" eurocone x ½" male thread for sub-manifolds



CONNECTION OPTION 2

For single room control via thermostatic valve and limiting of the return temperature via RTL (return temperature limiter) valve for areas of up to 16 m²*; set temperature range» room temperature 7 - 28 °C; return temperature 20 - 50 °C.

THIS OPTION CONTAINS»

- » built-in box (w 170 x h 450 - 515 x d 100 - 150 mm)
- » cover white resp. ready to decorate and tile,
- » RTL valve "Uni RTLH" with thermostat; thermostatic valve "Uni LH" with thermostat resp. selectively with remote control or prepared for actuator (M30 x 1,5)
- » ventilation valve, 2x connections G ¾" eurocone x ½" male thread for sub-manifolds



CONNECTION OPTION 3

For single room control via thermostat valve without limiting of the return temperature for use within premixed heating circuit for areas of up to 16 m²*; set temperature range» room temperature 7 - 28 °C.

THIS OPTION CONTAINS»

- » built-in box (w 170 x h 450 - 515 x d 100 - 150 mm)
- » cover white resp. ready to decorate and tile,
- » thermostatic valve "Uni LH" with thermostat resp. selectively with remote control or prepared for actuator (M30 x 1,5); 2x ventilation valves, 2x connections G ¾" eurocone x ½" male thread for sub-manifolds



CONNECTION OPTION 4

As sub-distribution without thermostatic valve without limiting of the return temperature for use within premixed heating circuit for areas of up to 16 m²*.

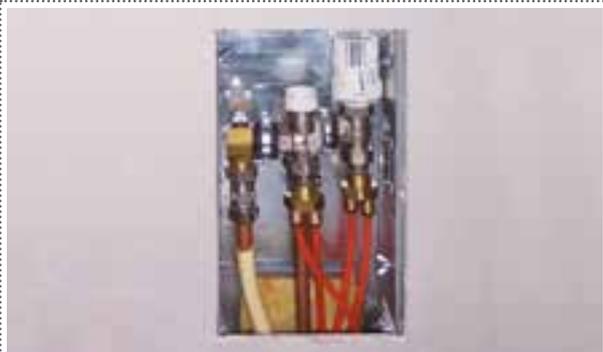
THIS OPTION CONTAINS»

- » built-in box (w 170 x h 450 - 515 x d 100 - 150 mm)
- » cover white resp. ready to decorate and tile,
- » 2x ventilation valves,
- » 2x connections G ¾" eurocone x ½" male thread for effidur sub-manifolds

* Pay attention to the total pressure loss when connecting UV4-10 to the control boxes for heating areas > 16 m²!

PRACTICE EXAMPLES FOR DISTRIBUTION

PROXIMATE DISTRIBUTION OF HEATING CIRCUITS PER ROOM



Control box option 2 with sub-manifold 2-port.



Manifold unit 6-port at control unit.



Zonal sub-distribution through the ceiling.

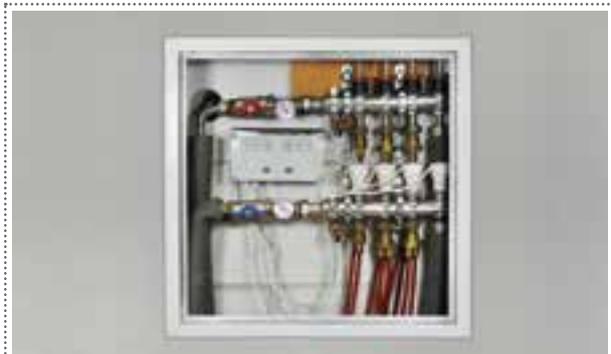


Manifold unit 6-port.

The hydraulic balancing of the single ports of a sub-manifold and manifold unit (UV /VBG) is not intended therefore these heating circuits need to be nearly equal in length.

MAIN DISTRIBUTION WITH FLOW VOLUME REGULATING VALVES

If required actuators and sub-manifolds for a zonal distribution of the heating circuits.

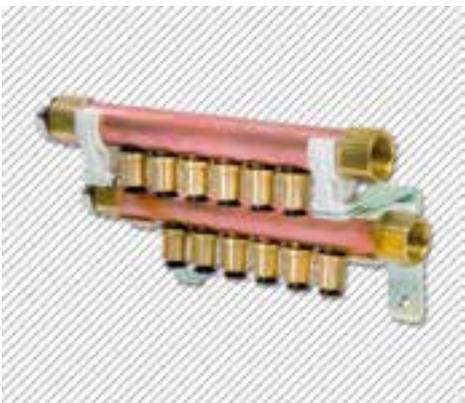


Floor-wise distribution with customary multi-port manifold (left picture) and effidur pre-distributor HKV-VA (right picture) equipped with sub-manifolds.

SUB-MANIFOLDS

	STANDARD \varnothing 8 mm	SPECIAL \varnothing 10 mm
	<p>PLUG CONNECTOR</p> <p>STA AG-8 \varnothing 8 mm - 1/2" male thread for a maximum of 4 m²</p>	
	<p>PLUG CONNECTOR</p> <p>STA IG-8 \varnothing 8 mm - 1/2" female thread for a maximum of 4 m²</p>	<p>PLUG CONNECTOR</p> <p>STA IG-10 \varnothing 10 mm - 1/2" female thread for a maximum of 8 m²</p>
	<p>SUB-MANIFOLD 2-PORT</p> <p>2x \varnothing 8 mm - 1/2" female thread for a maximum of 8 m²</p>	<p>SUB-MANIFOLD 2-PORT</p> <p>2x \varnothing 10 mm - 1/2" female thread for a maximum of 16 m²</p>
	<p>SUB-MANIFOLD 4-PORT</p> <p>UV 4-8 4x \varnothing 8 mm - 1/2" female thread for a maximum of 16 m²</p>	<p>SUB-MANIFOLD 4-PORT</p> <p>UV 4-10 4x \varnothing 10 mm - 1/2" female thread for a maximum of 24 m²</p> <p>Pay attention to the total pressure loss for heating areas > 16 m²!</p>

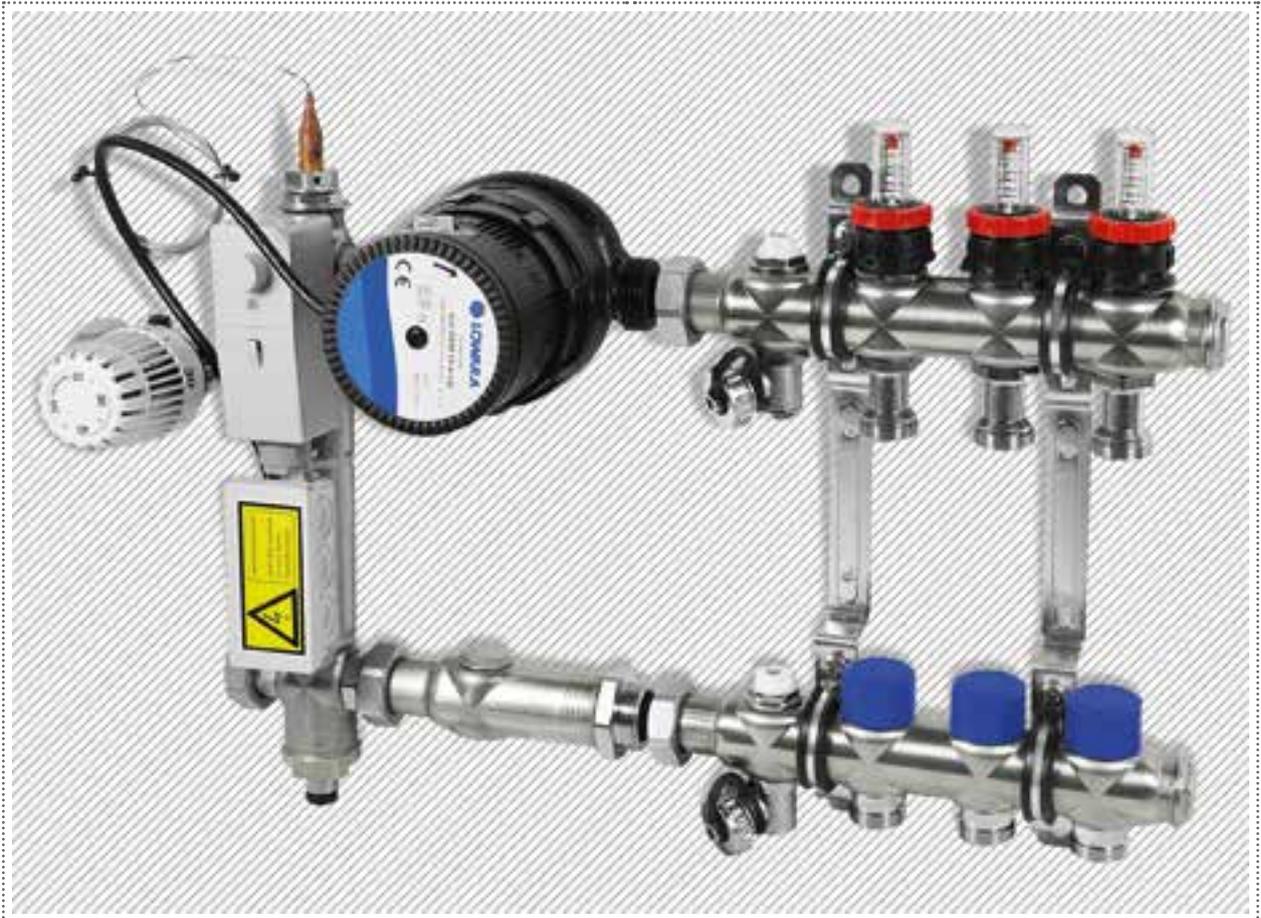
MANIFOLD UNITS & SCREW CONNECTIONS

		STANDARD Ø 8 mm	SPECIAL Ø 10 mm
	<p>MANIFOLD UNIT 4-PORT</p> <p>VBG 4 2 x manifold bar à 4 x Ø 8 mm - 1/2" female thread – 1 ventilation valve for max. 16 m²</p>		
	<p>MANIFOLD UNIT 6-PORT</p> <p>VBG 6 2x manifold bar à 6 x Ø 8 mm - 1/2" female thread - 1 ventilation valve for max. 24 m²</p>		

SCREW CONNECTION

	<p>SCREW CONNECTION AV</p> <p>For the connection of plug connectors and sub-manifolds to main manifold, valves and similar. Consisting of union nut G 3/4" euro cone with o-ring sealing and sleeve R 1/2"</p>
	<p>SCREW CONNECTION SELF-SEALING AVS</p> <p>Screw connection 3/4" for the connection of sub-manifolds resp. Plug connectors to conventional manifolds, valves with sleeve R 1/2" self-sealing through PTFE- threaded sealing ring. Consisting of G 3/4" euro cone with o-ring sealing and sleeve R 1/2"</p>

CONTROL UNIT & PRE-DISTRIBUTION



TECHNICAL SPECIFICATIONS RGHKV-VA

- Installation height»** 360 mm
- Installation length»** 290 mm
- Installation position»** horizontal
- Installation depth»** approx. 140 mm (Lowara)
approx. 160 mm (Grundfos)
- No. of heating loop ports»** 1 - 10
- Operation parameters»** max. 6 bar; primary max. 110 °C, max. differential pressure 700 mbar; secondary max. 50 °C
- Primary connection»** 1" union nut, flat sealing
- Secondary connection»** 1" male thread, flat sealing
- Pump (electronically controlled)»** Lowara Basic 15-4 / upon demand: Grundfos Alpha2 (L) 15-40

- » Fixed value controller with immersion feeler, flow settable from 20 °C - 50 °C, without auxiliary power;
- » STB (excessive temperature protection) preset to 60 °C as pipe sensor (not changeable from the outside);
- » Bypass with integrated regulating valve (simplifies the adjustment);
- » Temperature display 20 °C - 80 °C. Electrical pre-wiring of STB with pump.

TECHNICAL SPECIFICATIONS HKV-VA

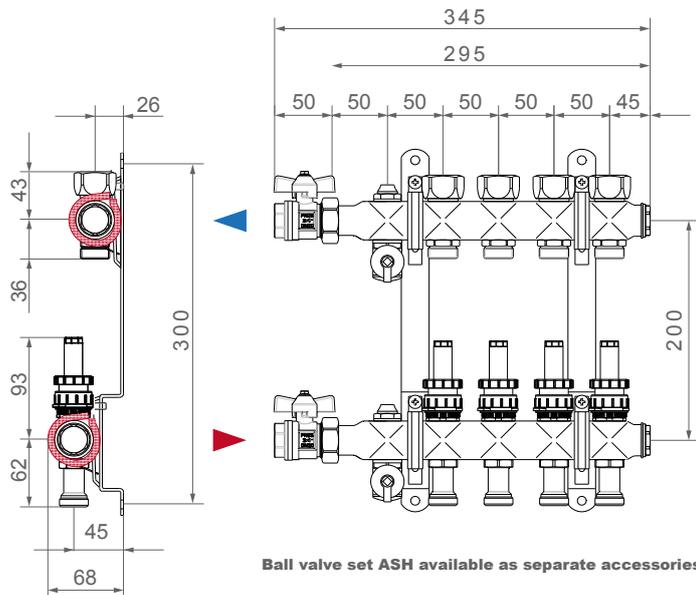
- Operating parameter»** max. + 80 °C / max. 6 bar.
- The manifold is to be run with heating water according to VDI 2035.**
- Flow»** integrated flow indicators 0 - 5 l/min
- Return flow»** integrated thermostatic valve inserts
- Port distance»** 50 mm
- Primary side»** 2 ball valves 3/4" female thread x 1" male thread, flat sealing.
- Secondary side»** 3/4" male thread with cone, suited for effidur AV / AVS. The screw connection AV / AVS is used for direct connection of the sub-manifolds (STA / UV 2 / UV 4).

Article No.	No. of ports	Overall length (without ball valve)
HKV2-VA	2	245 mm
HKV3-VA	3	295 mm
HKV4-VA	4	345 mm
HKV5-VA	5	395 mm
HKV6-VA	6	445 mm
HKV7-VA	7	495 mm
HKV8-VA	8	545 mm
HKV9-VA	9	595 mm
HKV10-VA	10	645 mm

PRE-DISTRIBUTOR HKV-VA

MATERIALS

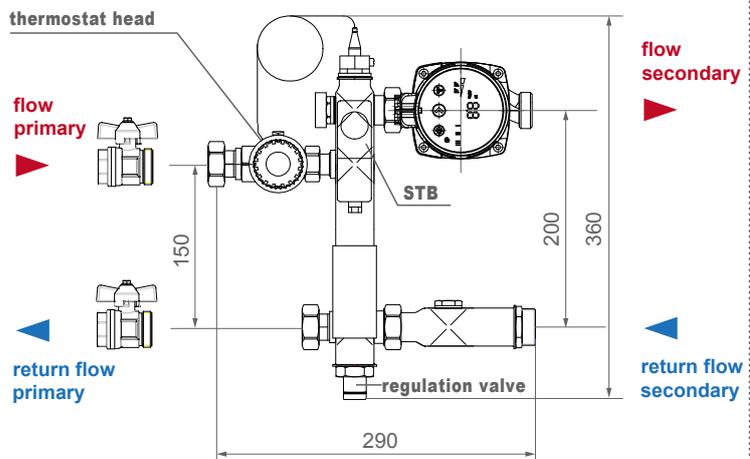
- Fittings»
Press-brass Ms 58, nickel-plated
- Manifold bars»
stainless steel 1.4301
- O-rings»
EPDM cross-linked by peroxide
- Flat seals»
WS 3825



CONTROL UNIT RGHKV-VA

Control unit for connection to pre-distributor. Sufficient for e.g. the heating of up to 120 m² of living space (even more when low heat demand). The flow temperature control enables a trouble-free connection of the underfloor heating to the heating facility.

The actuator at the primary flow controls the required flow temperature of the underfloor heating. Excessive flow temperatures are avoided through the built-in safety temperature limiter (STB). Electronically controlled pump adapts to the currently required heat demand.



Ball valve set ASH available as separate accessories!

ADJUSTMENT OF CONTROL UNIT AND PRE-DISTRIBUTOR

Close the primary valves (for the connection to the existing heating facility. The adjustment is to be implemented with operating circulation pump. Completely open all valves of the underfloor heating circuit (incl. regulating valves at the return flow of the pump unit), whereby prior to this the respective safety rings at the flow indicators need to be removed as well as the respective locking caps need to be turned upwards.

For adjustment the pump is to be set for constant strain. The level is to be chosen in a way that the heating circuit with the highest flow rate is sufficiently fed. The heating circuit with the highest calculated flow rate is to be set exactly by turning the regulating valve of the pump unit (eventually mark water volume per port at the distributor).

The meter-reading is carried out at the gauge-glass of the flow indicator. The scale shows values from 0 - 5 l/min (resp. 0 - 3 l/min). The adjusting procedure of the remaining heating circuits must now be executed at the respective regulating valves. Subsequently control all values and if necessary execute a vernier adjustment. After finishing the adjustment the locking caps need to be turned downwards and the according safety rings need to be fit (if required subsequently seal with leads).

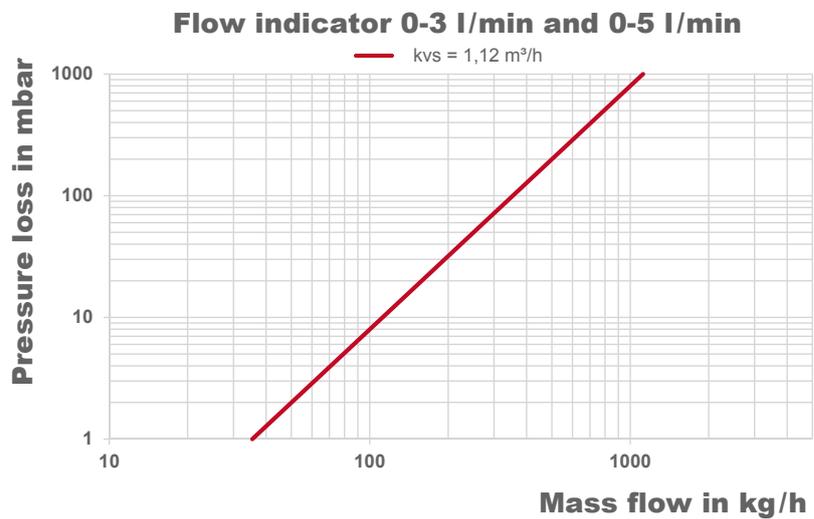
The flow indicators are completely lockable without changing the pre-settings. Now the operating mode of the circulating pump can be switched to variable strain, thereafter the actuators can be fit and the primary valves can be opened again. Afterwards the design temperature of underfloor heating is to be set at the thermostat head.

PRESSURE LOSS CALCULATION FOR THE PRE-DISTRIBUTOR

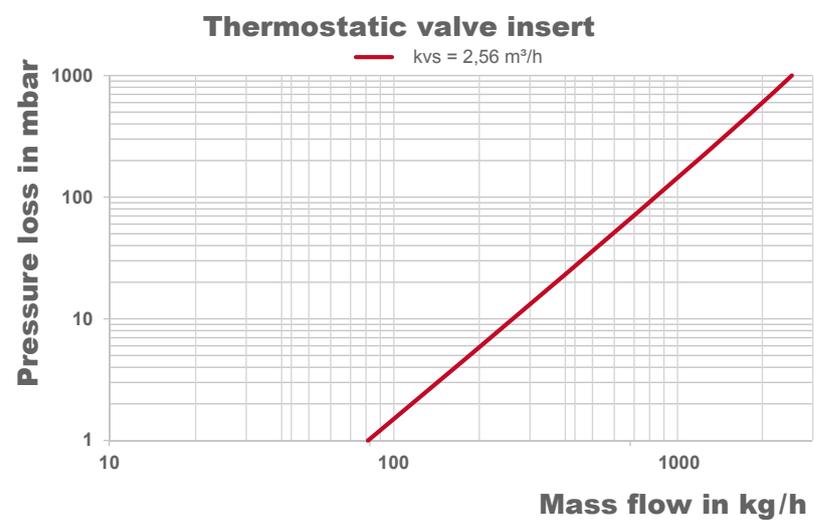
The pressure losses to be considered for the effidur pre-distributors HKV-VA are significantly determined by the regulating valves at the flow and the valve inserts at the return flow. The individual values per distributor port can be seen at the subsequent chart depending on the mass flow.

The calculating basis for the emerging pressure losses at the effidur sub-manifolds and effidur heating pipe can be found at the corresponding chapter of the technical manual.

PRESSURE LOSS OF REGULATING VALVE (FLOW)



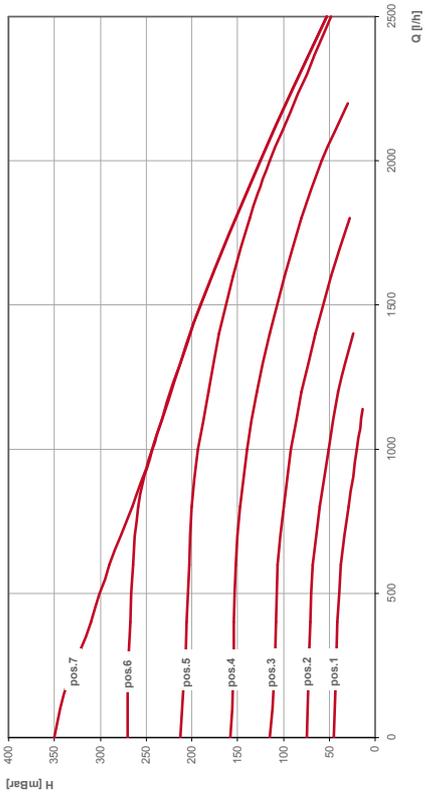
PRESSURE LOSS OF VALVE INSERT (RETURN FLOW)



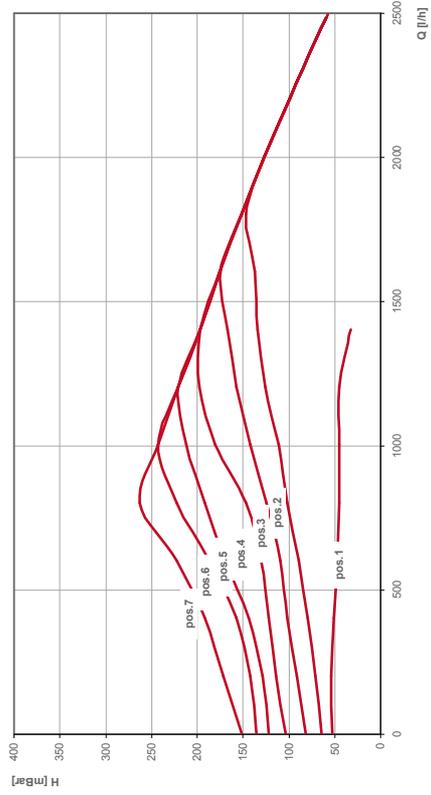
BASIC PUMP DATA / PRESSURE LOSS OF THERMOSTATIC VALVE

PUMP» LOWARA ECOCIRC BASIC 15-4

BASIC...- 4 / Constant rate

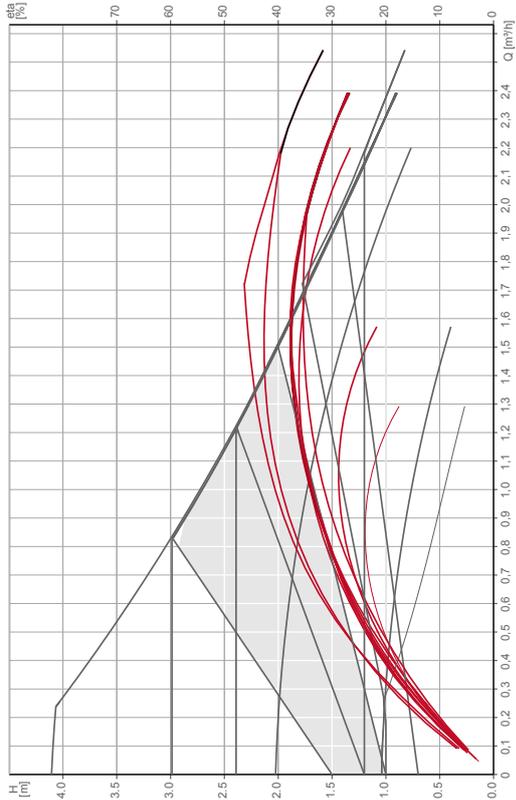


BASIC...- 4 / Proportional pressure



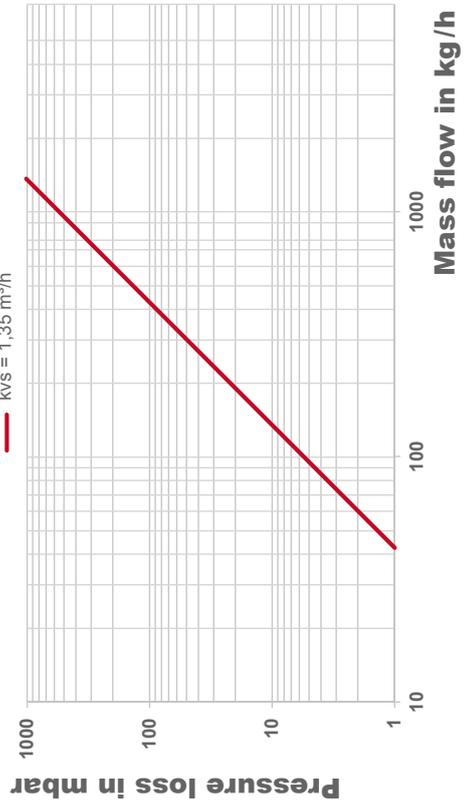
PUMP» GRUNDFOS ALPHA 2 (L) 15-40

THERMOSTATIC VALVE



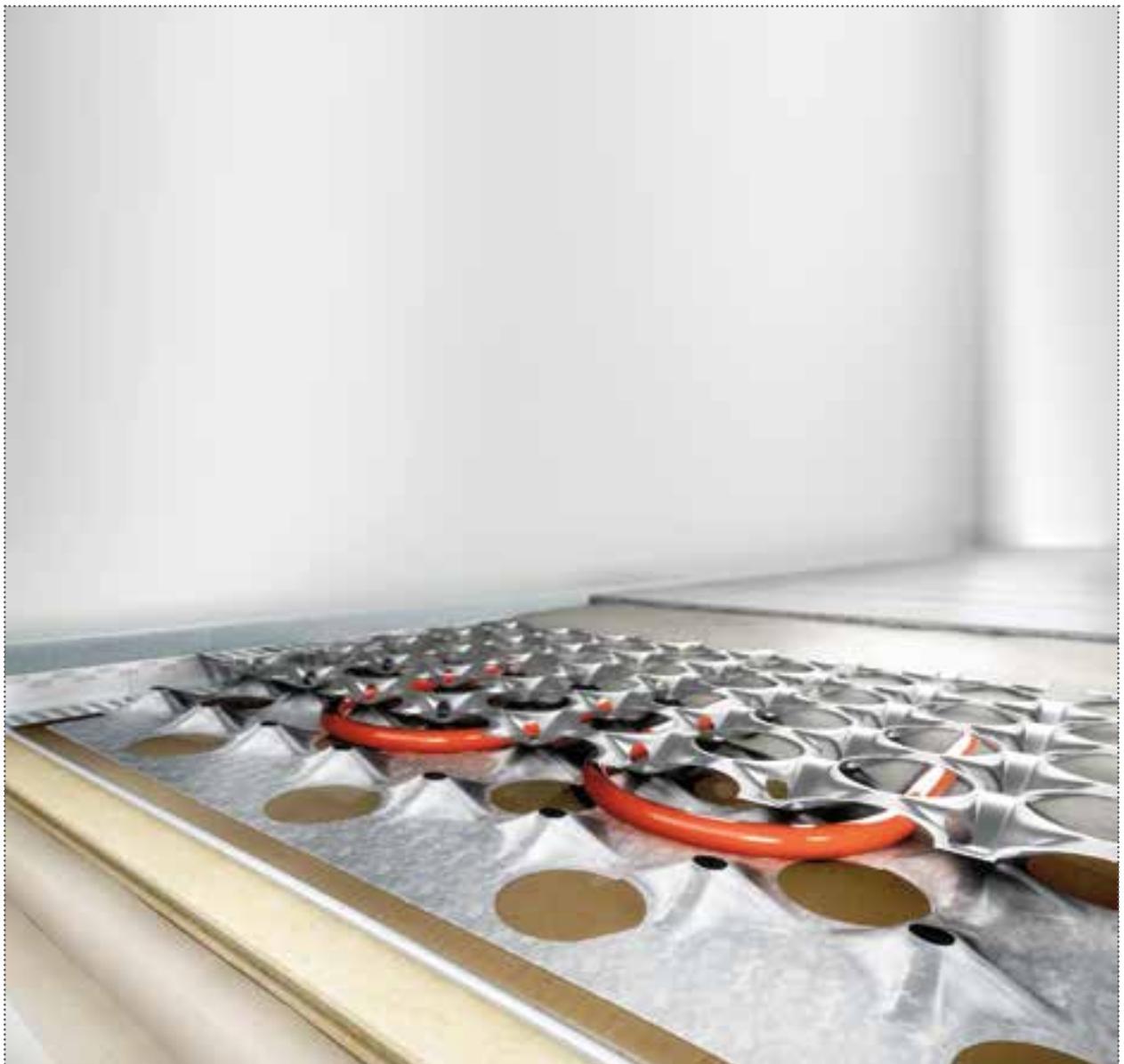
Thermostatic valve DN 15

— kvs = 1,35 m³/h



INSTALLATION INSTRUCTIONS FOR COMB PANEL SYSTEMS

COMB PANEL WP



IMPORTANT SAFETY ADVICE!

When fitting the effidur comb panels always wear labour protection gloves acc. to DIN EN 388 (minimum category 2) in order to avoid the risk of injury through sharp edges! You can use all common tools for sheet metal processing when cutting the comb panels considering the relevant safety advices. Take care of fire protection for the building and objects nearby because of flying sparks when cutting the steel panels. Additionally, it is necessary to wear protective eyewear!

AVERAGE FITTING TIME

We recommend that the effidur floor system is fit by a team of two workers. Hereby you need to consider the following times»

Fitting of the comb panels	10 min / m ²
Fitting of the heating pipe + connection to the heating system	10 min / m ²
Backfilling with system screed SFM	5 min / m ²
Team of two workers	≧ 4 m ² / h

The above mentioned fitting times refer to a rectangular medium-sized room (24 m²) and a team of two trained workers as well as the machine-supported backfilling with screed. The fitting times may vary (raise) with unsymmetrical and angled rooms and the manual backfilling with screed.

PREPARATIONS PRIOR TO PANEL FITTING

First the sub-floor needs to be evaluated regarding its load-bearing capacity and stability. Furthermore, it needs to be swept clean, passable and widely even. Unevenness of up to 20 mm can be balanced out without further measures. If these pre-conditions are not fulfilled, an underground needs to be created considering the required evenness. Consider sealing requirements according to DIN 18195 and implement according measures (also see documentation for SYSTEM SCREED).

Furthermore, the positioning and carrying out of the expansion joints need to be determined under consideration of the following points among others » joint plan of architect / data sheets of IGE & IWM / notices of this installation instruction.

Wooden floors might creak. These sounds might be improved, but not removed since they are part of this floor's nature. If required, wooden sub-floors need to be reworked.

Evenness can be created with the casting of concrete-bound light levelling compound upon the mostly found floor constructions or also when removed floor boarding upon load-bearing false floors. Hereby always pay attention to the static condition of the building and fire protection requirements. After backfilling of the comb panels with system screed (SFM) and its hardening the loads need to be borne and led-off by the bearing structure of the building.

Subsequently, the fitting of impact sound and heat insulation as well as the separation layer has to be implemented according to current standards. In order to avoid damage (as e.g. the deformation of comb panels or defects at the heating pipe), the fitter needs to take care, that no on-site traffic and no follow-up works are allowed before releasing the floor system for use. Please calculate 5 % offcuts.

FITTING OF BORDER INSULATION TAPES

Before fitting the border insulation tapes (RDS) lay out the effidur separation layer (SL) or depending on the building situation an alternative separation layer at all upcoming building parts (walls, columns etc.) with a minimum height of 10 cm and among each other with a minimum overlap of 10 cm (welded or glued).

Subsequently, fit the according border insulation tapes (RDS 10 / RDS 2000) without joints at all building parts bordering upright to the floor (walls, columns etc.). Hereby, form the complete overlaps that are designed at the borders of the PE-foam [fig. 1].



1 Simple forming of corners with border insulation tape. Overlapping of PE-foam.



2 Maximum distance between comb panel and border insulation tape » 2 cm.

The cutting-off of projecting border insulation tape may only be carried out after the fitting of floor coverings resp. when textile or elastic flooring after the hardening of the filling!

INSTRUCTIONS PRIOR TO THE FITTING OF COMB PANELS

The comb panels are fitted among each other in a linked manner, if required upon an insulation layer, but always upon a separation layer, as e.g. effidur SL. The fitting is carried out without joints per room, if permitted by the geometry and the areas size of the room (also see documentation for SFM). When fitting the comb panels a maximum gap of 2 cm towards the effidur border insulation tapes (RDS) resp. 1 cm to both sides of the effidur professional joint (PF) is licit [fig. 2, fig. 7].

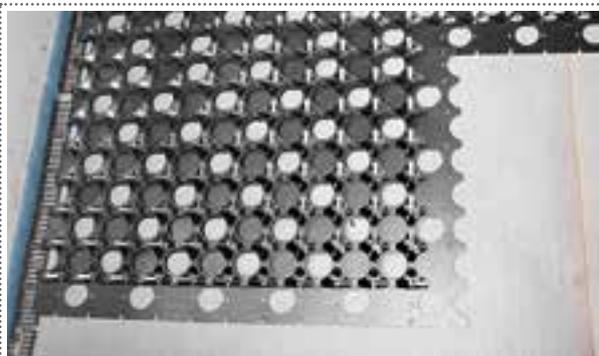
The cutting of the comb panels can be carried out with all common tools for sheet metal processing considering the relevant safety advices. Our sheet metal shears (HBS) are ideally suited for delicate metal sheet cuttings.

FITTING OF THE COMB PANELS

The comb panels consist of an upper and a lower panel that are connected to each other in a staggered manner. When fitting, the lower panel (asymmetric blanking) needs to be visible on the right side and on the front pointing in the installation direction. Thus, the bending clips point to the top [fig. 3].

Fitting shall always be carried out from left to right and if possible towards the door. Choose a straight and large wall as first installation line. When cutting the panels for the first row, trim back the overlapping top panel that is nearest to the wall, so that it is flush with the bottom panel. The remaining part of a line becomes the initial part of the next installation line. Avoid cross joints!

The installation should preferably be diagonally to the timber truss or to any other existing structure for load-bearing. In long narrow rooms the panels should be fitted lengthways along the longest wall.

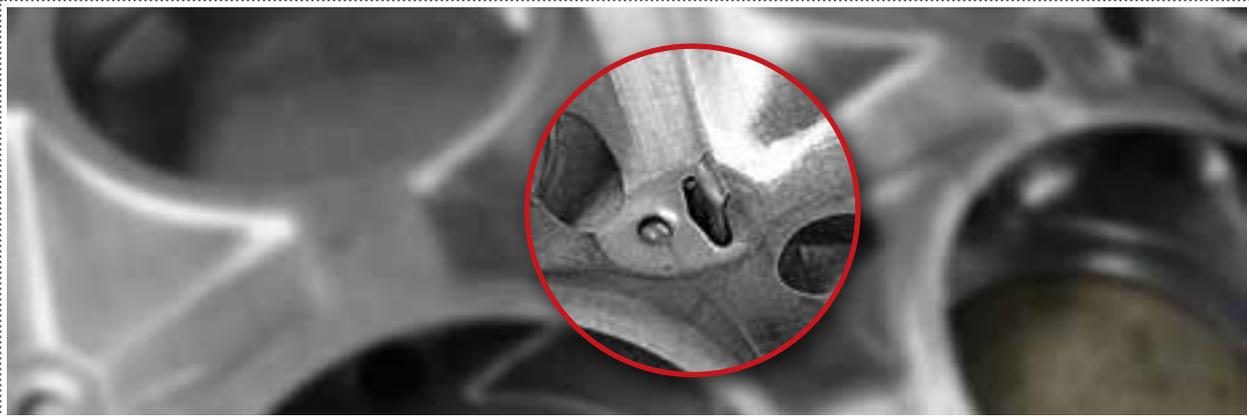


3 When fitting the lower panel needs to be visible on the right side and on the front.

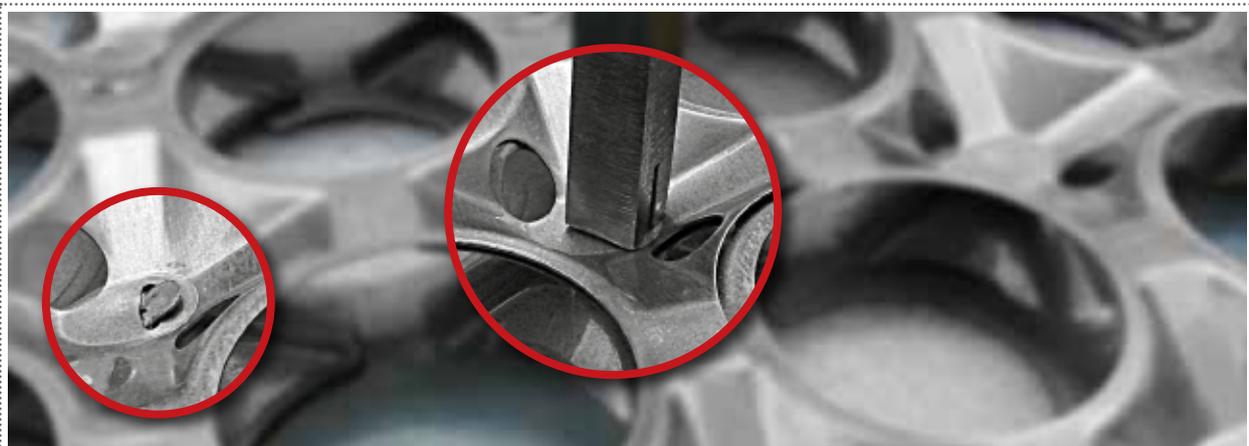


4 Insert brackets (HK) into border insulation tapes (minimum 3 pieces / m).

FITTING OF COMB PANELS [CONTINUATION]



5 Bending clips click into place through slotted holes.



6 Twist and bend bending clips for force-locked connection.

The single comb panels are put in place by reaching through the blanking of the upper panel. Carefully click the panel into place through the slotted holes [fig. 5]. Hereby, control the fitting of the bending clips and if necessary correct it through slight deforming.

Do not apply pressure when fitting! After fitting bend or twist the projecting clips with the bending tool (VS). Thus, a force-locked connection of the panels is created [fig. 6].

The connection of the single panels has to be carried out with the utmost care. Damages of the separation layer (e.g. effidur SL) need to be avoided, since the comb panels are subsequently backfilled with thin fluid screed.

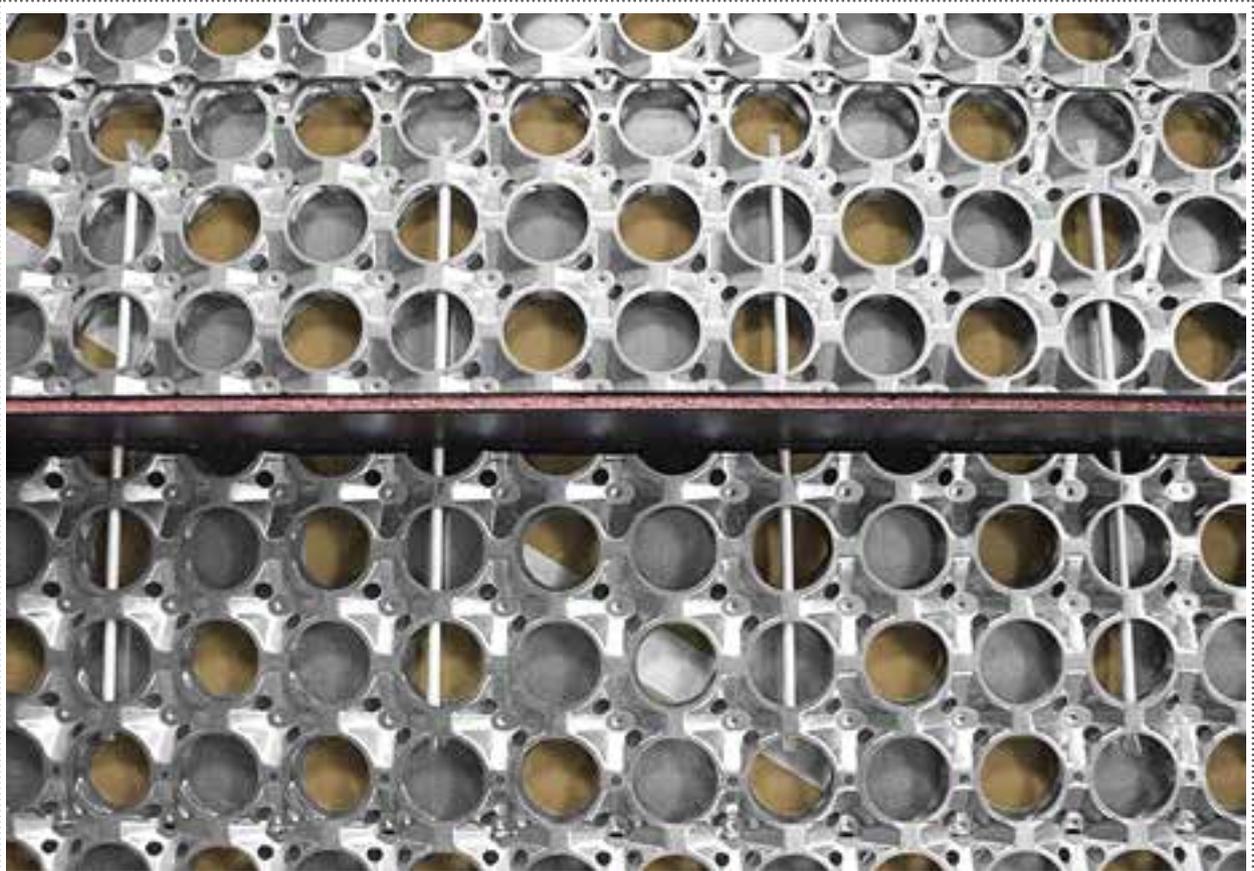
After fitting of the comb panels, the brackets are inserted into the border insulation tapes (minimum. 3 pieces / m) in order to fix these areas [fig. 4].

Before backfilling with system screed the comb panels need to be checked for defects and damages especially in bordering or joint areas as well as at upcoming building parts (walls).

ADVICE!

Do not apply pressure when fitting the panels!

FITTING WITHIN DOORWAY AREAS / DEFINITION OF FIELD SIZE



7

Fitting at doorway areas and other field definition through professional joint (PF) and joint dowel (here» FDS) Maximum gap between comb panel and professional joint» 1 cm.

Expansion joints need to be provided at upcoming building parts, at area projections, within large / geometrically unfavourable floor areas, within doorway areas and for the separation of heated and unheated areas.

Herefore consider the joint plan of the architect / planner according to DIN 18560 and the information sheets of IGE / IWM!

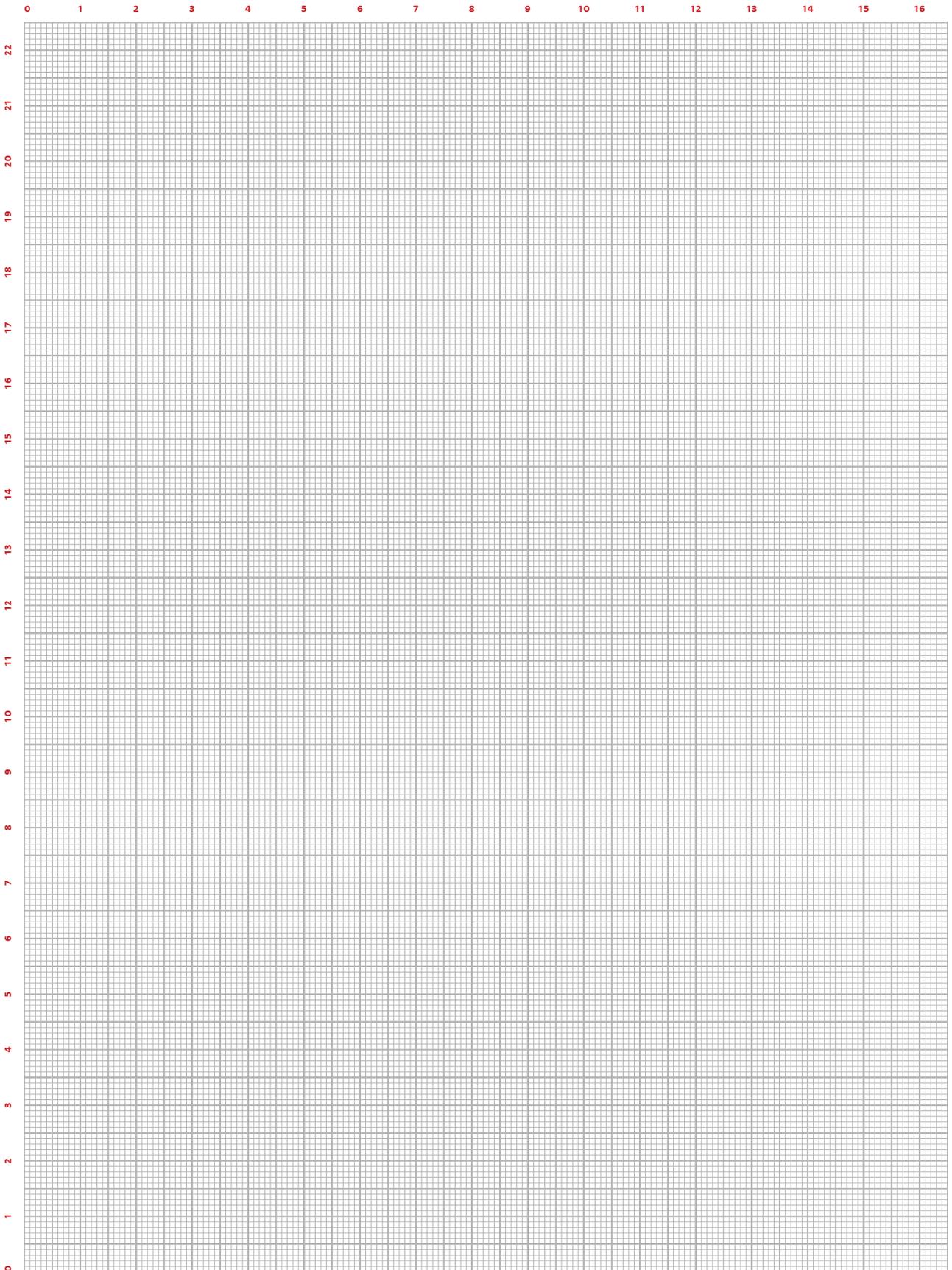
Heated room areas in a rectangular form and a size of up to 200 m² (side length ration maximum 2:1) can be fitted without joints when using the system screed SFM.

Larger areas or areas with an unfavourable geometry (projecting corners, long narrow corridors or L-forms) resp. also doorway areas and borderlines between heated and unheated areas are to be divided with e.g. self-adhesive professional joints (PF).

Off-sets in height caused by uneven strain of bordering system areas can be minimised by using 3 – 4 pieces of joint dowels (FD / FDS) per meter of professional joint [fig. 7]. Areas with different use (heated to unheated) shall only be coupled after approval and only with joint dowels with sound protection (FDS). Building separation joints are to be adopted in equal width through the entire floor without a reinforcement through joint dowels etc.!

Alternative joint profiles / joint dowels for heated and unheated areas need to be approved and matched with the specific application.

The cutting-off of projecting joint profiles (PF etc.) may only be carried out after the fitting of floor coverings resp. when textile or elastic flooring after the hardening of the filling.



INSTALLATION INSTRUCTIONS FOR COMB PANEL SYSTEMS

HEATING PIPE HR



DIMENSIONING

	requirement of DIN 4726	effidur heating pipe
Design Stress σ (licit stress)	3,34 Mpa	3,60 Mpa
Max. operating pressure for pipe 8 x 1,1 mm	9,5 bar	10,3 bar
Max. operating pressure for pipe 10 x 1,3 mm	9,5 bar	10 bar

The effidur heating pipe securely meets the requirements of DIN 4726!

INSTALLATION

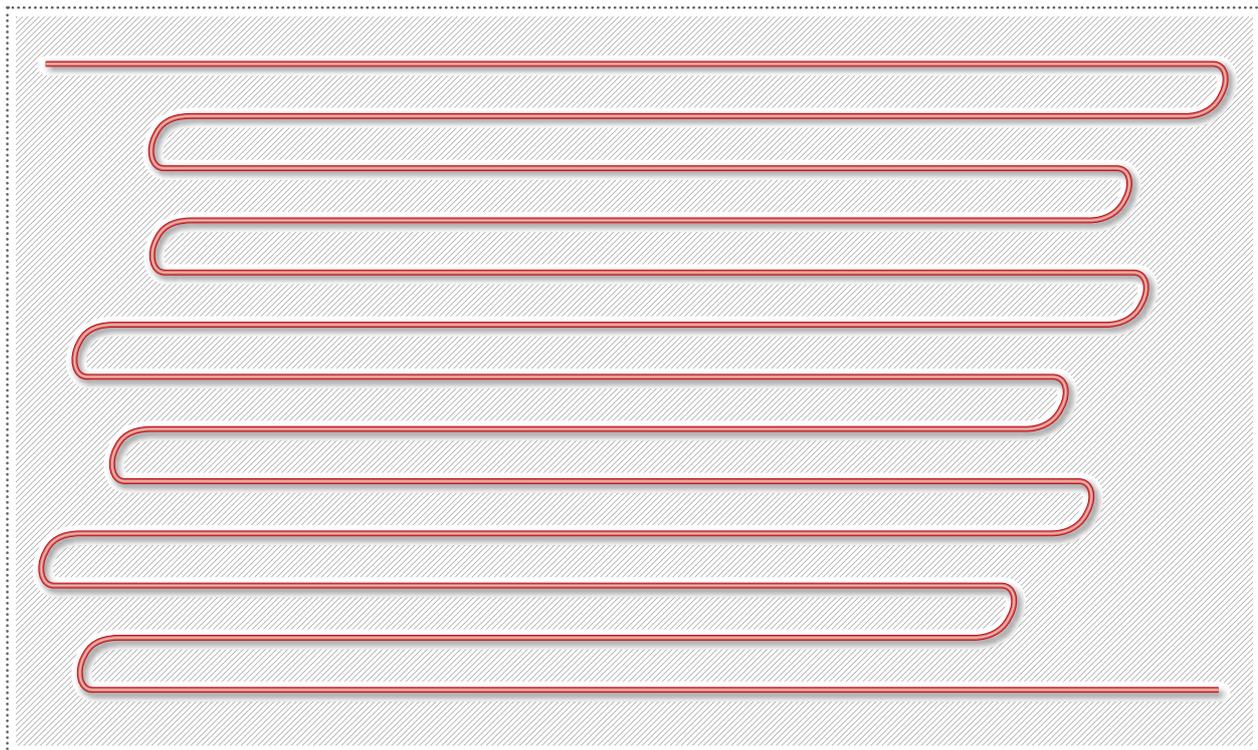
	heating pipe ϕ 8	heating pipe ϕ 10
Dimension of heating pipe	8 x 1,1 mm	10 x 1,3 mm
Application within effidur system	WP 1000 + WP 2000	WP 2000
Max. length of heating loop	35 m	70 m
Max. area per heating loop	4 m ²	8 m ²
Material consumption incl. cut-offs	approx. 8,5 m / m ²	approx. 8,5 m / m ²

FITTING IN MEANDER FORM

- » Fitting distance approx. 12 cm = each second row within the comb panels,
- » Fit pipe in a meander form,
- » Heating pipes can be inserted lengthwise, crossways and diagonally,
- » Larger pipe dimensions (max. outer diameter 16 mm) are in fact possible for system version WP 2000, but can only conditionally be recommended due to the increased stiffness and consequently an increased installation effort.

The crossing of heating pipes within the system WP 2000 is only possible when using heating pipe dimension ϕ 8 x 1,1 mm.

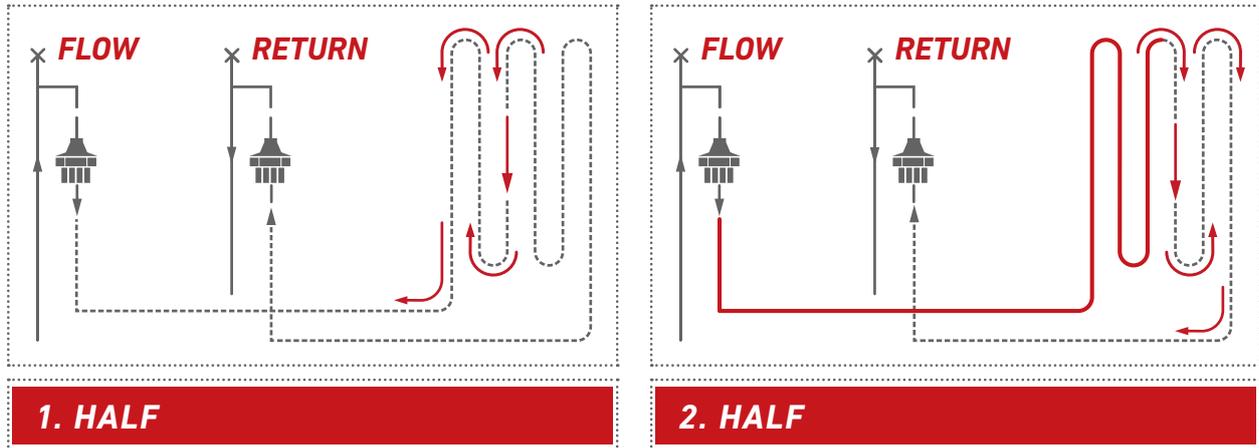
The heating pipe shall not be connected through couplings or other elements within the floor area!



AUXILIARY TOOLS

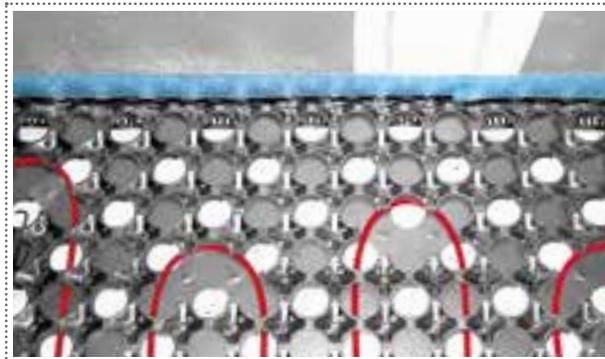
- » Pipe threader (steel spring) for threading into the heating pipe (RE 8 / RE 10)
- » Turning roll (UR)
- » Sheet metal shears (HBS)
- » Pipe cutter (ROS / RC)

We recommend to start fitting the pipe in the middle of the heating loop!



ADVICE» You will find further / detailed fitting schemes at the end of this document!

In general the heating pipe is fitted into the systems panels in a meander form (fig. 1 to 5), fitting in a helical form is not necessary due to the excellent heat distribution of the heating elements and is technically difficult to be executed.



1

Staggered cut-out for pipe bends; with feed for flow / return flow.

The ideal pipe distance of 120 mm can be met by fitting the pipe into every second punched row of the comb panels.

In order to keep the pressure loss of the pipe system low, do not exceed a maximum pipe length of 35 m for pipe (Ø 8 x 1,1 mm) resp. 70 m for pipe (Ø 10 x 1,3 mm) per heating loop, this corresponds to an area of approx. 4 m² (pipe Ø 8 mm) resp. 8 m² (pipe Ø 10 mm).

Any area size is feasible by parallel installation of several heating circuits.

Pay attention to pressure loss diagram (see COMB PANEL SYSTEM - TECHNICAL DESCRIPTION)!

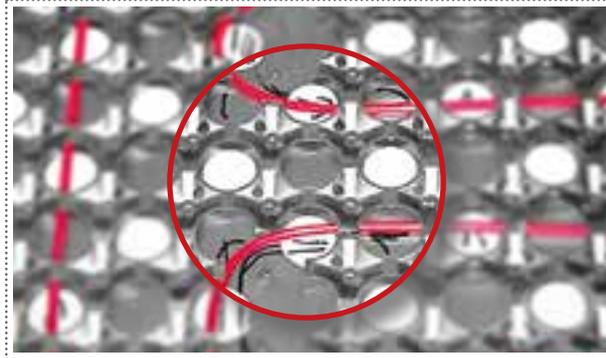
A hydraulic balancing of each part of the sub-manifolds (UV) resp. manifold units (VBG) is not intended, therefore the pipe lengths of the different heating loops shall approximately be equal. In order to simplify the installation the heating pipe contains consecutive meter marks.

Choose long and straight lines with few bends for fitting the pipe. Furthermore it is recommend for a better overview to mark the single heating loops on the comb panels before fitting, e.g. with a pen or by placing the turning rolls at the intended changes of direction (see fig. 3).

Check the pipe visually for defects when cutting to length and fitting into the panels. Take care not to damage and kink the pipe. Furthermore apply a pipe protection cap (SK 8 / SK 10) to each pipe end (after the removal of the pipe threader (RE 8 / RE 10) and until the connection to the manifold) in order to avoid the input of dirt that could lead to the clogging of the pipe.

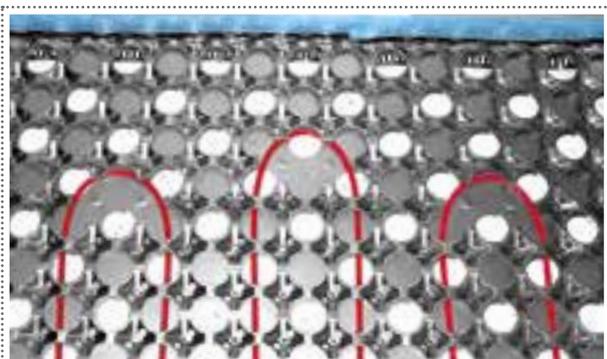


2 Fitting of the heating pipe into the panels.

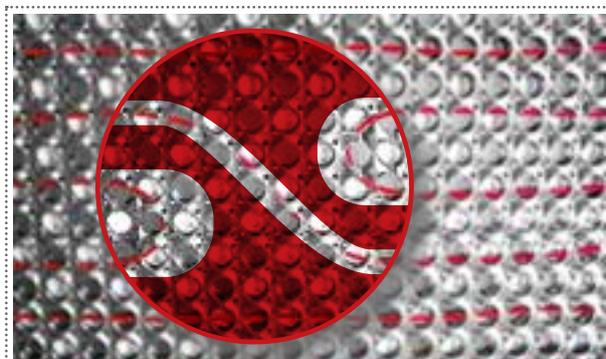


3 Fitting of the heating loop according to marked course of the pipe.

For fitting the pipe use the effidur tool sets WS 8 / WS 10 (consisting of pipe theader, twisting tool and turning rolls for pipe \varnothing 8 mm / \varnothing 10 mm). Besides the possibility of purchase, the tools may also be rented. The use of the tools is shown by figures **6** to **11**.



4 Staggered cut-out for pipe bends.



5 Heating loops fitted interleaving into each other.

For forming 180° bends you need to cut out two dies of the upper metal panel (fig. **6**) with a sheet metal shear or similar in order to insert the turning rolls in a staggered manner (fig. **1** and **4**).

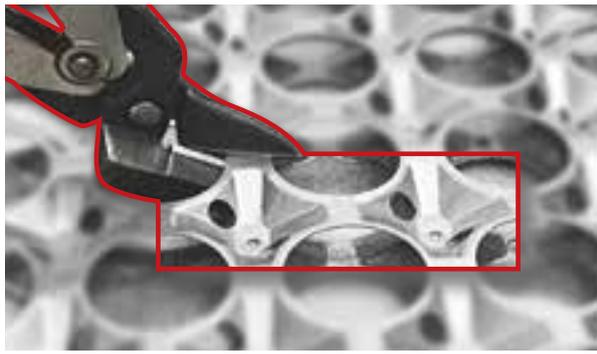
These cut-outs allow to lead the heating pipe out of the comb panels, to bend it outside and to lead the pipe back into the panels without damaging it. It is recommended to let the pipe stick out of the turning rolls (fig. **9**) until the final fixing in order to facilitate the terminal fine adjustment.

Finally the pipe is pushed through the turning roll (fig. **10**). The tool can now be removed and the pipe can be fit into its final position (fig. **11**). When forming 90° bends the cut-out of dies is not necessary, but recommended when several 90° bends shall be fit consecutively. When connecting the heating pipe to the sub-distributor pay attention to form a pipe loop for the compensation of alterations in length and tensile stress so that the heating pipe is not kinked or damaged.

The bends for pipe guiding RFB 8 (for pipe \varnothing 8 - 10 mm) resp. RFB 12 (for pipe \varnothing 10 - 14 mm) can be used as anti-kink device when forming 90° bends and when the pipe is outside of the comb panels.

In order to avoid damages, put a piece of flexible corrugated pipe over the heating pipe as protection (SR 8 / SR 10) at emersion points of the pipe within the floor area as well as at joint and other duct areas. Before connecting to the manifold, the pipe ends are to be cut to length free of burrs and right angles to the axis with e.g. pipe shears (ROS) / pipe clipper (RC) and equipped with the according supporting sleeves (SHK 8 / SHK 10). Subsequently the system is pressure tested using the pressure test protocol.

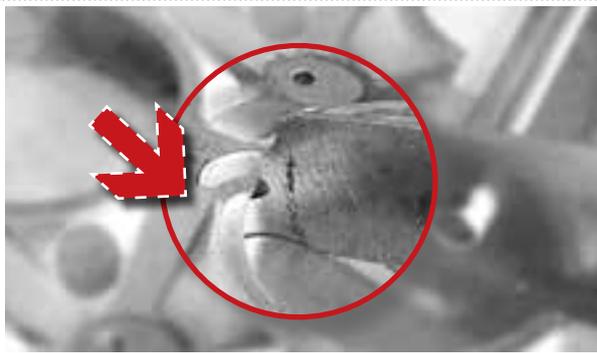
If the pressure test is successful the effidur heating loops can be connected to the heating system. Depending on the installation situation an individual connection is possible (see chapter CONNECTION OPTIONS).



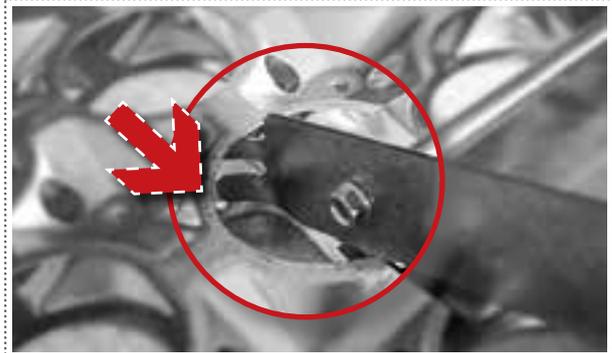
6 Cut-out of dies for the insert of turning rolls.



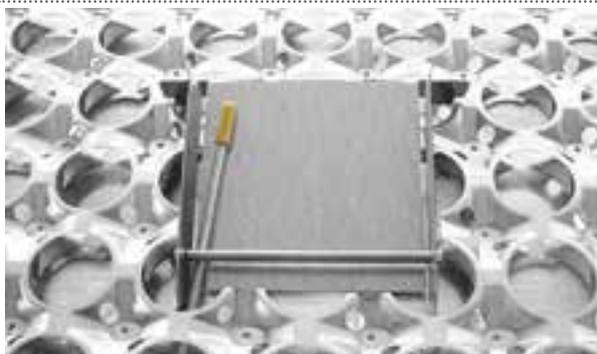
7 Rear anchorage of the turning roll for 180° bend fitting.



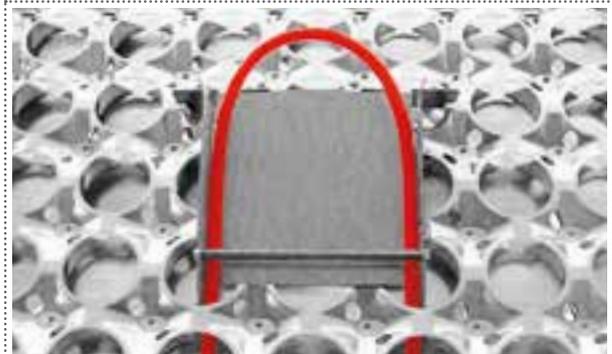
7 Front anchorage of turning roll for system WP 1000.



7 Front anchorage of turning roll for system WP 2000.



8 Principle of turning roll» lead pipe out of the system – bend it outside of the floor system – fit pipe back into comb panels.

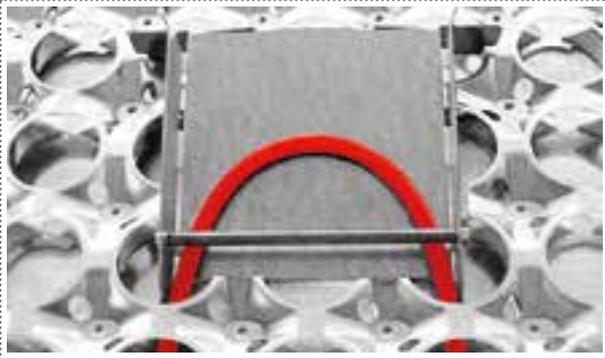


9 Let pipe stick out for final adjustment.

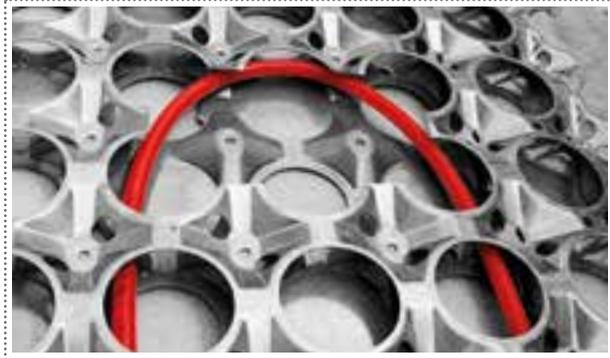
ADVICE!

Make sure that the floor heating system has successfully passed a pressure and functional test before the backfilling with system screed or other coverings!

(See chapter PROTOCOLS!)

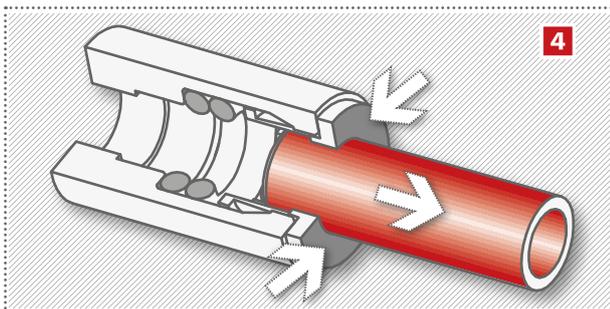
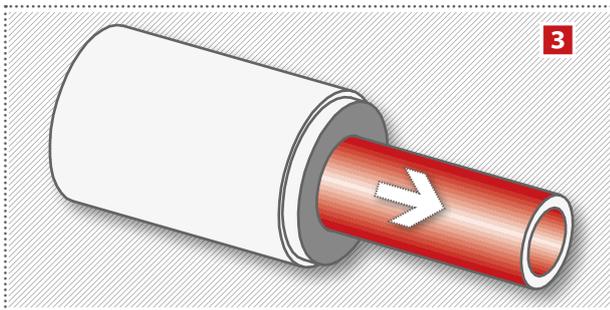
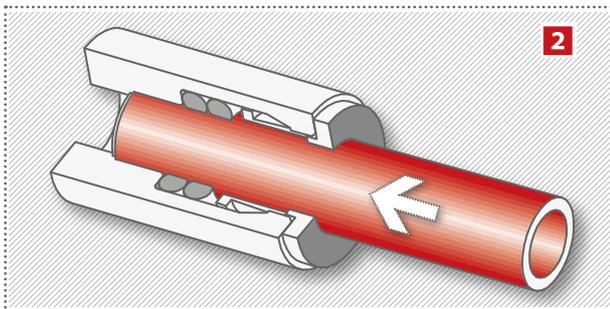
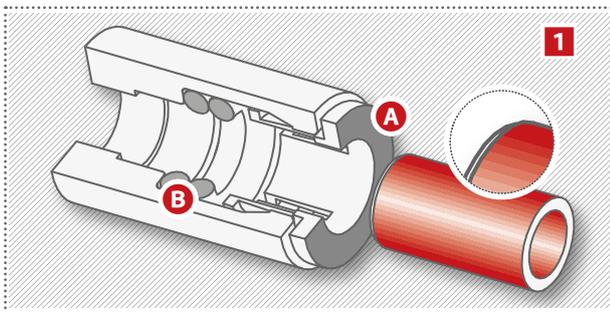


10 After final adjustment push pipe through turning roll.



11 Subsequently remove turning roll and push pipe back under the upper metal sheet.

CREATION OF A PLUG CONNECTION



1 Cut pipe to length free of burrs and right angles to the axis (ROS / RC) and equip pipe ends with the according supporting sleeves (SHK 8 / SHK 10).

- A** holding clamp with stainless steel teeth
- B** O-ring (2x)

2 Push pipe into the fitting up to the stop. Cartridge grips before o-ring seals! Make sure that the fitting is free to plug and not restrained by obstacles from the building site.

3 Pull at pipe to check, if connection is safe. The pipe is now in an assured position. The stainless steel teeth grip while the o-ring guarantees a permanently tight connection.

The system shall be checked this way before each use.

TEST OF PLUG CONNECTION SYSTEM

For commissioning check the plug connection, no matter if it is a new or an existing one, according to the following procedure (according to DIN 18380 and with cold water 10 – 23 °C)»

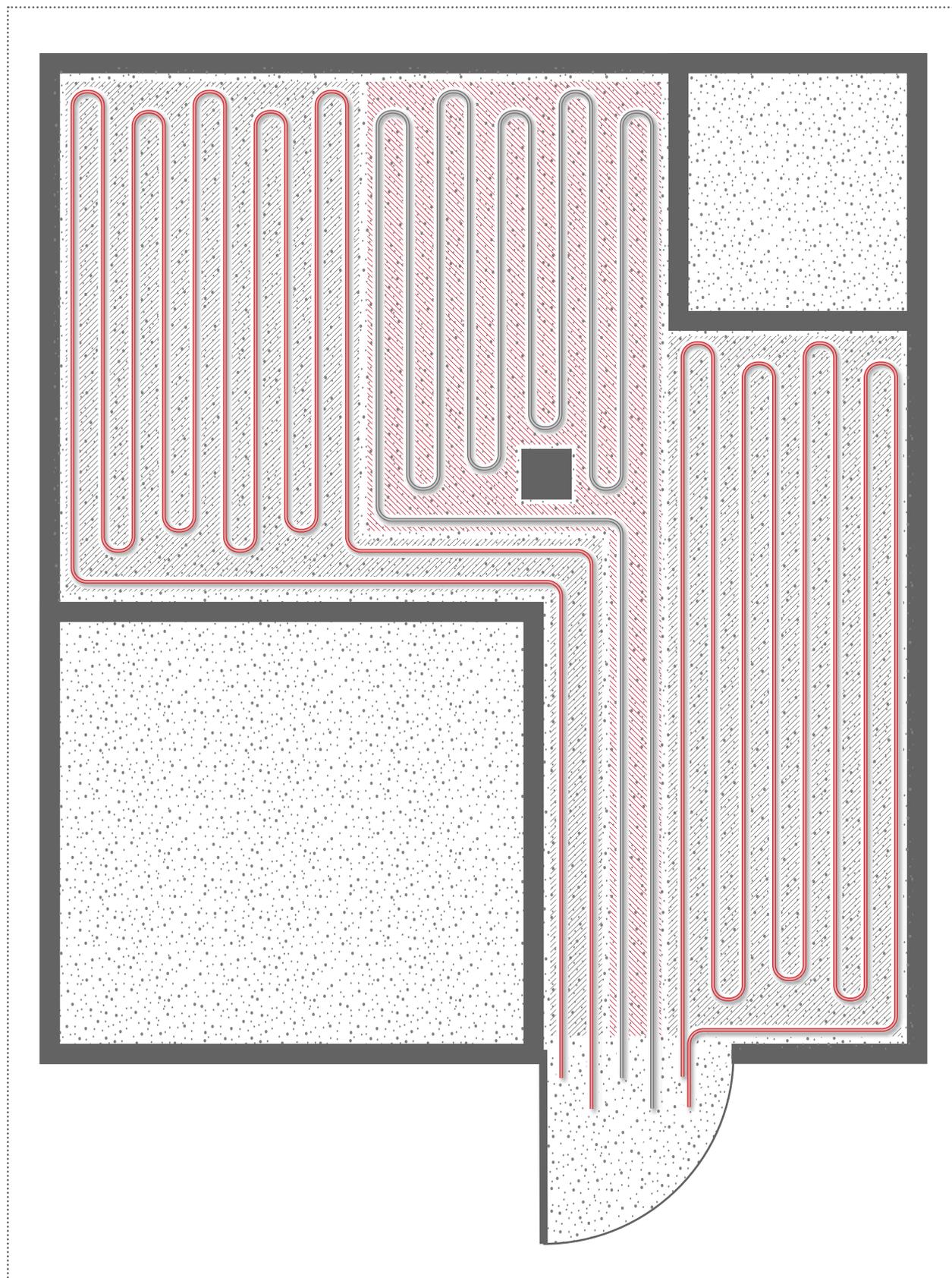
Charge	p = 2 bar / 10 min
Pressure Discharge	p = 0 bar
Charge	p = 10 bar / 10 min

The plug connectors are ready for operation if no leakage occurs at the connecting areas during the entire testing period. When operating with warm water, the leak tightness needs to be checked after the cold water test with the highest expectable temperature. (see pressure test protocol under PROTOCOLS). The commissioning of the plug connections does not replace additional testing instructions for other parts of the facility!

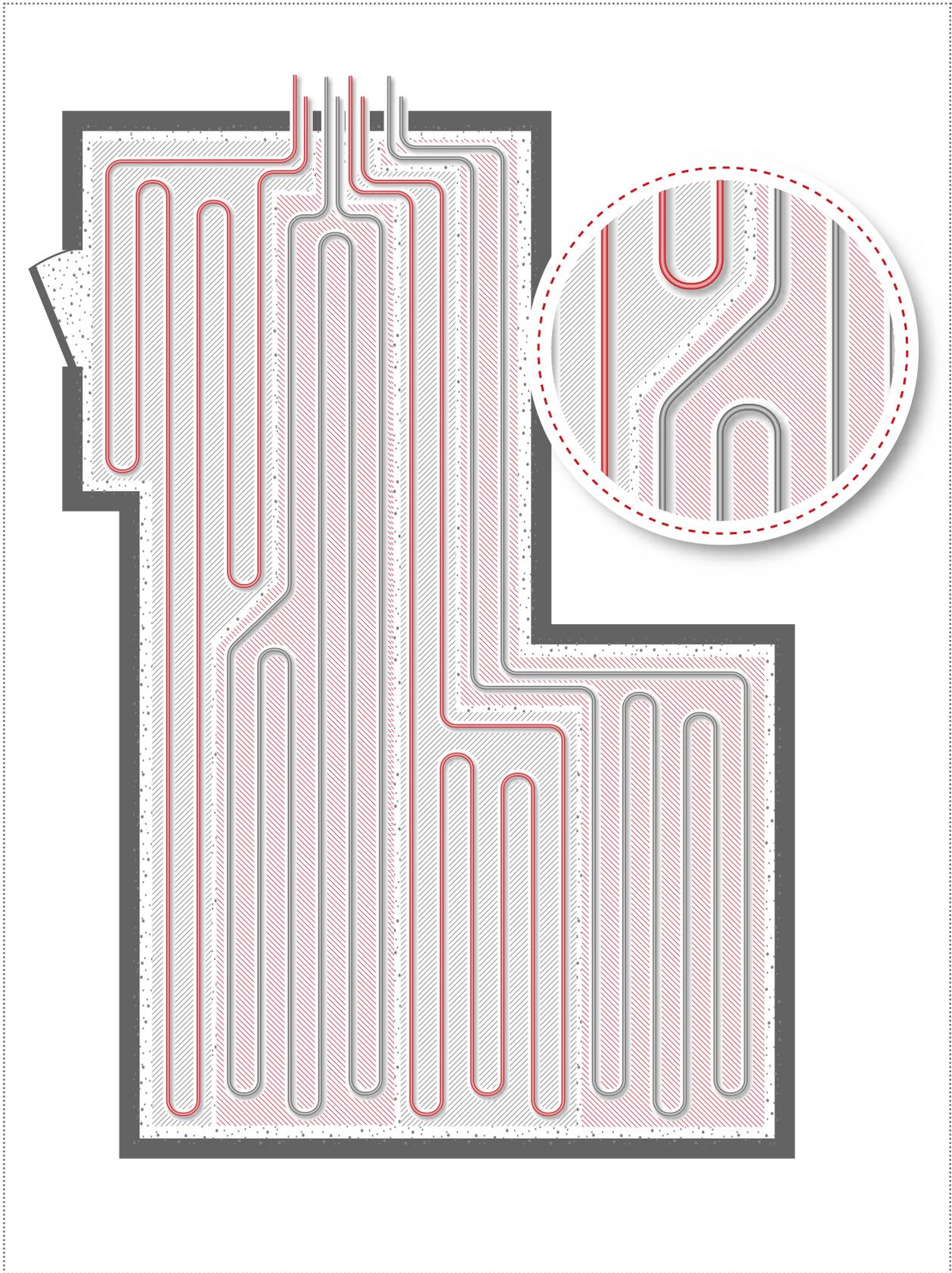
4 Simple disconnecting of the connection – Make sure that the system is depressurized. Push the cartridge square against the face of the fitting. The pipe can now easily be removed.

EXAMPLES OF INSTALLATION SCHEMES

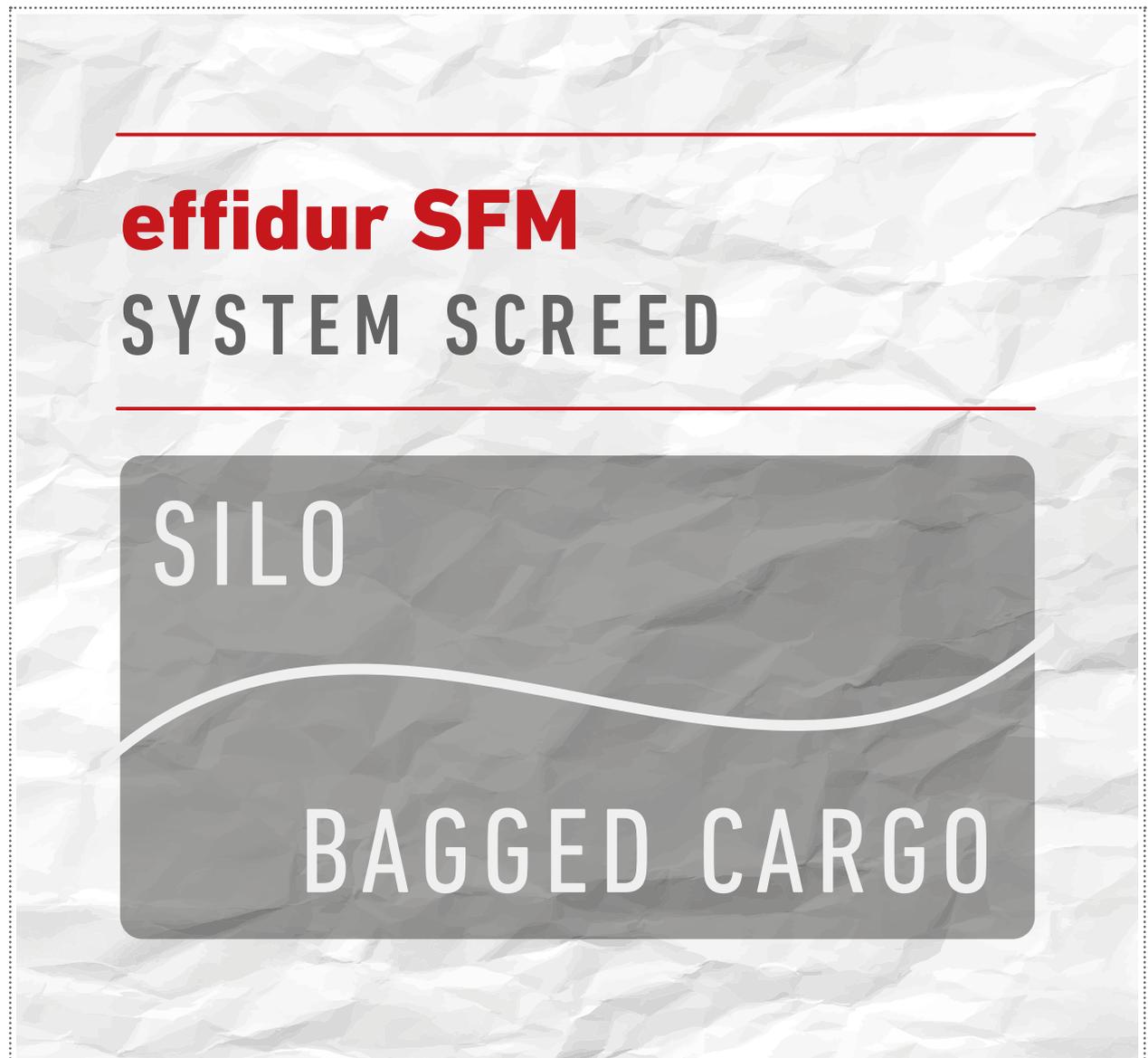
Example 1» room with column and 3 heating loops, installed parallelly.



Example 2» room with 4 heating loops , thereof 2 fitted interleaving into each other.

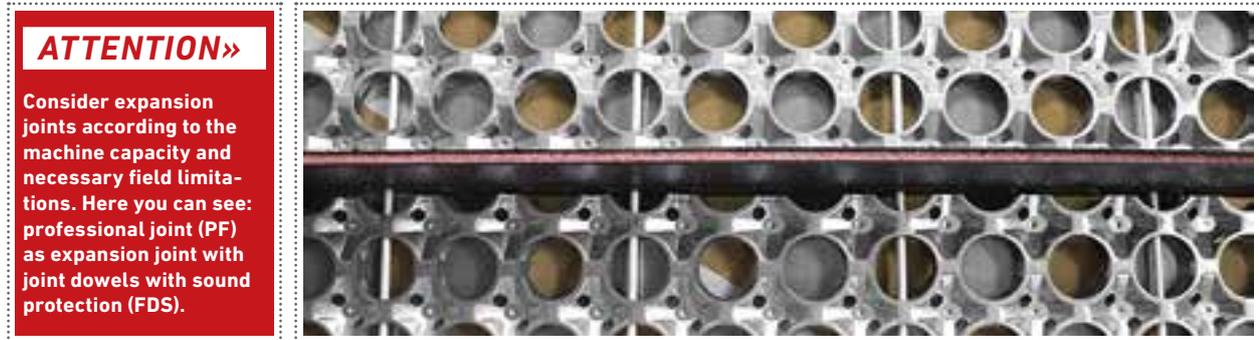


**INSTALLATION INSTRUCTIONS
FOR COMB PANEL SYSTEMS**
SYSTEM SCREED SFM



PRELIMINARY NOTES

A maximum field size of 300 m² (width-to-height ratio max. 2 : 1) at a rectangular room area must be adhered when pouring the effidur system screed upon separation / insulation layer. Heated areas are limited to a maximum field size of 200 m². All rising building parts must have movement joints in the form of border insulation tapes (RDS 1000 / RDS 2000). Larger areas or areas with an unfavorable geometry, such as e.g. corners, large narrow corridors or L-forms respectively doorway areas and between heated and unheated areas must be subdivided e.g. with the self-adhesive professional joint (PF). Additionally the field sizes of the system screed and the planned floor covering are to be adjusted to each other.



Effidur floor systems shall not be exposed to a permanent humidity strain without special measures according to DIN 18195. The use within residential kitchens and bathrooms is possible without problems, if the system is fit with a water blocking system and a border insulation. In areas with an expected humidity strain from the underground, a consistently effective sealing without gaps against rising humidity acc. to DIN 18195 needs to be implemented. This applies especially to „young“ concrete ceilings and soil-touching undergrounds.

Areas with a scheduled used floor drain (e.g. flush-type showers) as well as garages cannot be fit with effidur SFM! We are glad recommending you an alternative backfilling material for these applications.

POURING OF SYSTEM SCREED

We recommend the backfilling of the effidur comb panels with the system screed SFM, since it is especially adjusted and guarantees the conformity with the existing tests!

One bag of effidur screed SFM (25kg) is mixed with 4.0 l of clear water with the help of a fine fettling machine with agitator or for small areas of up to 10 m² manually with an electrical mixer. For larger areas the screed shall be poured from a screed silo with the help of a silo mixing pump. The screed can only be poured at temperatures between +5 °C to +30 °C! The screed consistency is adjusted with a 1-liter testing drum (ø 7 cm; filling height 26 cm) upon a horizontally aligned, dry plexiglass disc (or comparable underground, minimum 50 x 50 cm) with the specified flow spread (fig. 1).

The right mixing ratio enables an easy pouring, the complete backfilling of the comb panels (fig. 2) and the fast development of a surface ready for floor covering.



1 Test of the flow spread. FLOW SPREAD» SFM» 38 - 42 cm



2 Complete backfilling of the comb panels with system screed SFM.

Depending on the assumable load situation according to DIN EN 1991-1-1(/NA), the existing resp. planned insulation layer, the floor covering etc. the comb panels are to be backfilled with a minimum thickness of system screed SFM. For evaluation take the excerpt from survey report of MPA-Stuttgart into consideration (see chapter FLOOR RENOVATION SYSTEM WP – INTRODUCTION). An additional thickness might be necessary depending on the underground / planned floor set-up!



3

Venting of the system screed with a spiked roller.



4

Venting of the SFM with a buffing tool, alternatively also with a wiper.

When pouring, no water shall separate from the screed. The freshly poured screed SFM is wobbled with a buffing tool / wiper, a hard broom or a spiked roller at least once in longitudinal and once in a lateral sense. This way the material vents and levels itself out. (fig. **3** and **4**)

ADVICE!

The comb panels are to be backfilled with an overlap of system screed of minimum 5 mm to a maximum of 20 mm. Please also pay attention to the chapters INSTALLATION INSTRUCTIONS FOR COMB PANELS, PROTOCOLS and the data sheet for system screed!

When flooring with ceramic tiles or natural stone with plasticised grout in a middle bed method and without sealing requirements, the overlap of system screed upon the comb panels can be abandoned. Pre-condition is a flooring format of up to 0,1 m², a pressure resistant underground as well as a flatness tolerance of the sub-construction according to DIN 18202. We recommend the coordination with the executing craft.

When backfilling heated floor constructions with system screed during wintertime, it has proven successful to fit the screed with the floor heating operating with a maximum flow temperature of approx. 20 °C. This way you achieve the heating of the building structure and the surrounding air and the occurrence of excessive thermal strains during the heating-up process is minimized.

DRYING OF THE SYSTEM SCREED

The freshly poured system screed needs to dry out without hindrance. The temperature of the building site must be at least +10 °C. The use as storage area for building material etc. is not allowed during the drying process!

The freshly poured SFM is to be protected for 2 days from air draught, frost and direct solar irradiation. Subsequently, start ventilating. The drying out is facilitated through a so-called intermittent ventilation (2-3 times daily opening of all windows and doors for approx. 15 minutes and then closing again), additionally start heating if applicable from the second day, beginning with a flow temperature of 25 °C.

In order to achieve a faster readiness for floor covering the use of humidity removal devices after 7 days is licit, if their withdrawal performance is adjusted to room volume and air humidity. Depending on the building site temperature and the device type an additional heat source might be required.

For heated effidur floor systems the heating contractor shall compile a protocol „functional heating/ ready for floor covering“, whereby the flow temperature needs to be set between + 35 °C and + 45 °C depending on the dimensioning. (see chapter PROTOCOLS).

A warranty for the floor system with underfloor heating is only effected if a protocol for functional heating /ready for floor covering exists in due form and is handed over from the heating contractor to the builder resp. site manager immediately after completion of the heating ready for floor covering.

Reference value for the drying period of heated system screed with a thickness of 25 m: approx. 7 to 10 days. For unheated effidur floor systems an empirical formula for the drying period of the system screed is a time span of one week per centimeter of installation thickness.

Single occurring craquelling cracks (hair-line cracks) after the screed installation are only superficial and influence neither its load-bearing capacity nor its fitness for use. They are not a defect and can professionally be closed.

Resilient movements of the completed comb panel system, especially in room corners when fitted as floating floor, are constructively necessary and depending on the load as well as the thickness and material of the used insulation material.

COVERING OF THE SYSTEM SCREED

The cut-off of projecting border insulation tapes (RDS 1000 / RDS 2000) resp. joint profiles (PF) shall only be effected after fitting of the floor covering resp. after the hardening of fillers when using textile or elastic coverings.

The system screed is suited for all common indoor floor coverings (e.g. carpet, laminate, parquet, tiles, natural stone).

When flooring pay attention to all common standards and guidelines and especially to the according manufacturer's instructions.

The system screed SFM needs to be dry before flooring with diffusion resistant / vapour-permeable coverings. (ready for covering = 1,3 CM-% resp.. = 1,8 CM-% residual moisture). You may find detailed information for the system screed SFM at the building material data sheet.

Depending on the planned floor covering it might be necessary to grind, fill and undercoat the finished system screed. The effidur SFM always needs to be ground off, if its surface consists of soft, instable zones or of thin, hard shells that easily peel off. Generally the effidur system screed does not tend to such surfaces when being fit professionally (the correct flow spread is essential). Nevertheless, finishing works of consecutive crafts often lead to a contamination of the screed surface. The floor covering, the adhesive, auxiliary materials (undercoating / filling etc.) and the SFM ready for covering need to form an interlocking connection in order to assure the required adhesion of the floor covering.

THEREFORE, THE FOLLOWING PREPARATORY MEASURES MIGHT BE NECESSARY»

- » Grinding of the system screed (cleaning grinding)
- » Vacuum-cleaning of the dust with a high-performance industrial vacuum cleaner
- » Grounding of the SFM with adequate priming coat

These working steps serve as preparation for the floor covering and are to be effected by the executive specialized craft. All three working steps are special services, that are to be announced and reimbursed separately acc. to VOB, part A, § 9.

In case drilling or cutting within the effidur floor system is necessary for structural reasons, this is only possible after preliminary planning and in accordance with the heating contractor and the architect. The position of the heating pipes within the screed needs to be considered!

DISCLAIMER

The information give into this product brochure, in particular illustrations, descriptions, dimensions, weights and other parameters, is not binding. This is because technical progress means that our products are continually being developed and perfected. The general terms and conditions of business of effidur GmbH apply.



PROTOCOLS





PRESSURE TEST PROTOCOL

PROTOCOL FOR LEAK TEST OF EFFIDUR FLOOR SYSTEMS WITH INTEGRATED HEATING ACC. TO DIN EN 1264-4

- Building principle »**
- Building project »**
- Construction stage »**
- Building component »**

REQUIREMENTS / DOCUMENTATION

Before testing the heating facility for leak tightness it shall be rinsed and ventilated in order to guarantee a proper flow. In case of the risk of freezing appropriate measure (e.g. heating the room) shall be taken.

The **pressure** and **functional test** of the heating facility needs to be started with cold water (10 - 23 °C) immediately before pouring the screed SFM or any other backfilling material according to **DIN 18380**. Furthermore, pay attention to DIN EN 1264-4.

- 1. Charge with testing pressure »** p = 2 bar for a period of 10 minutes
- 2. Pressure discharge »** p = 0 bar
- 3. Charge with testing pressure »** p = 10 bar for a period of 10 minutes

Immediately after the cold water pressure test and before pouring the screed the permanent tightness of the heating facility needs to be tested through a test heating with 3 - 6 bar and the planned maximum heat water temperature, but not exceeding 55 °C.

When pouring the screed keep twice the operating pressure, but at least 6 bar and not exceeding 10 bar (with cold water!)

- Max. licit operating pressure »** **bar**
- Testing pressure »** **bar**
- Load duration »** **h**
- Maximum temperature »** **°C**
- Pressure at end of test »** **bar**

CONFIRMATION

The tightness has been determined, overstrain did not occur.

..... location, date location, date location, date
..... Principle Heating Installer Site Manager / Architect



PROTOCOL OF FUNCTIONAL HEATING /
HEATING READY FOR COVERING FOR SCREED SFM

Building principle »

Building project »

Floor layer »

Heating installer »

Heating system » **effidur floor system CLIMATE**  **WP 1000**  **WP 2000**

Pouring of screed SFM at »

Average thickness of SFM » **(in mm)**

PRELIMINARY NOTES

Border insulation tapes» In order to form border joints install the appropriate border insulation tapes (RDS 1000 / RDS 2000) with brackets (HK) (only cutting-off after installation of the floor covering).

Movement joints» Movement / expansion joints , e.g. effidur professional joint (PF) need to be available at all upcoming building parts, at area projections, within large or long and narrow floor areas resp. at L-forms, within doorway areas and for the separation of heated and unheated areas. Therefor pay attention to the joint plan, which is to be provided by the construction engineer according to DIN 18560 and to the information sheets of IGE / IGM. For the application of joint dowels (FD / FDS) within the professional joint (PF) see chapter INSTALLATION INSTRUCTIONS OF COMB PANELS.

Nominal thickness of system screed (SFM)» Depending on the anticipated loads according to DIN EN 1991-1-1(/ NA), the existing resp. planned insulation layer, the floor covering etc. the comb panels are to be backfilled with a minimum thickness of screed SFM. For evaluation take the excerpt from survey report of MPA-Stuttgart into consideration (see chapter FLOOR RENOVATION SYSTEM WP – INTRODUCTION). An additional thickness might be necessary depending on the underground / planned floor set- up!

Drying of SFM» The freshly poured SFM is to be protected for 2 days from air draught, frost and direct solar irradiation. Subsequently, start ventilating. The screed SFM is to be dried through heating. The drying period depends on the screed thickness, temperature, air humidity and the room air exchange rate. The drying period is essentially accelerated through the heat-up of the screed using the underfloor heating. Therefor assure sufficient ventilation. Several times per day open opposing doors and windows for approx. 15 minutes, in order exchange the heated, humid air with cooler, dryer air through a so-called intermittent ventilation. When backfilling heated floor constructions with system screed during wintertime, it has proven successful to fit the screed with the floor heating operating with a maximum flow temperature of approx. 20 °C. This way you achieve the heating of the building structure and the surrounding air and the occurrence of excessive thermal strains during the heating-up process is minimized.

HEAT-UP INSTRUCTIONS

A functional heating needs to be executed a heating screed before laying the floor covering according to DIN EN 1264. Additionally the screed SFM needs to be dried through heating (heating ready for covering). The present heat-up instructions combine the functional heating and the heating ready for covering.

START OF HEAT-UP» 24 HOURS AFTER FITTING OF THE SYSTEM SCREED SFM

1. Adjust flow temperature after 1 day to 25 °C and keep for 5 days
2. Subsequently raise flow temperature to 35°C*
3. The functional heating is completed if the flow temperature has been kept at 35°C* for 2 days without failure.

PROTOCOLS

4. Within the scope of the subsequent heating ready for floor covering the flow temperature is still kept at 35 °C* until the screed SFM is dry. (Approximate value for the drying period at a maximum flow temperature of 35 °C and a screed thickness of 25 m: approx. 7 - 10 days).

Test for remaining humidity with applied foil and subsequently execute CM-measurement (see» “Test / Control of drying”).

5. After drying the flow temperature is to be lowered gradually to 20 °C according to instruction “Cooling-down”.
6. Now the flow temperature is adjusted in a way to achieve a floor surface temperature of 15 - 18 °C (corresponds to approx. 20 - 25 °C at the flow).
7. Subsequently the screed SFM is ready for covering.

HEAT-UP		
DATE	FLOW TEMPERATURE IN °C	SIGNATURE
	25	
	35	
	(40)*	
	(45)*	

TEST OF DRYING (FOIL TEST)		
DATE	DRY » YES / NO	SIGNATURE

CONTROL OF DRYING (CM-MEASUREMENT)		
DATE	% (RESIDUAL MOISTURE)	SIGNATURE

COOLING-DOWN		
DATE	FLOW TEMPERATURE IN °C	SIGNATURE
	30	
	20	

HEATING READY FOR COVERING FINISHED		
DATE	OUTDOOR TEMPERATURE IN °C	SIGNATURE

LOWERING OF FLOW TEMPERATURE		
DATE	FLOW TEMPERATURE IN °C	SIGNATURE

HEATING READY FOR COVERING FINISHED (IF REQUIRED FOR FOLLOW-UP WORKS)		
DATE	OUTDOOR TEMPERATURE IN °C	SIGNATURE

Test of drying acc. to point 4 of the heat-up instructions»

Put PE-foil (measurements approx. 50 cm x 50 cm) on top of the heated SFM surface, seal borders with adhesive tape. When heating (flow temperature: 35 °C) no condensation water shall form underneath the foil within 24 hours, else continue heating and ventilating. **The testing of the drying process with the help of a foil test only serves as decision-making tool and does not replace the CM-measuring before flooring!**

Flooring of the SFM»

The screed SFM needs to be dry (ready for covering = 1,3 CM-% resp. = 1,8 CM-% residual moisture) before installing diffusion tight / diffusion permeable floor covering.

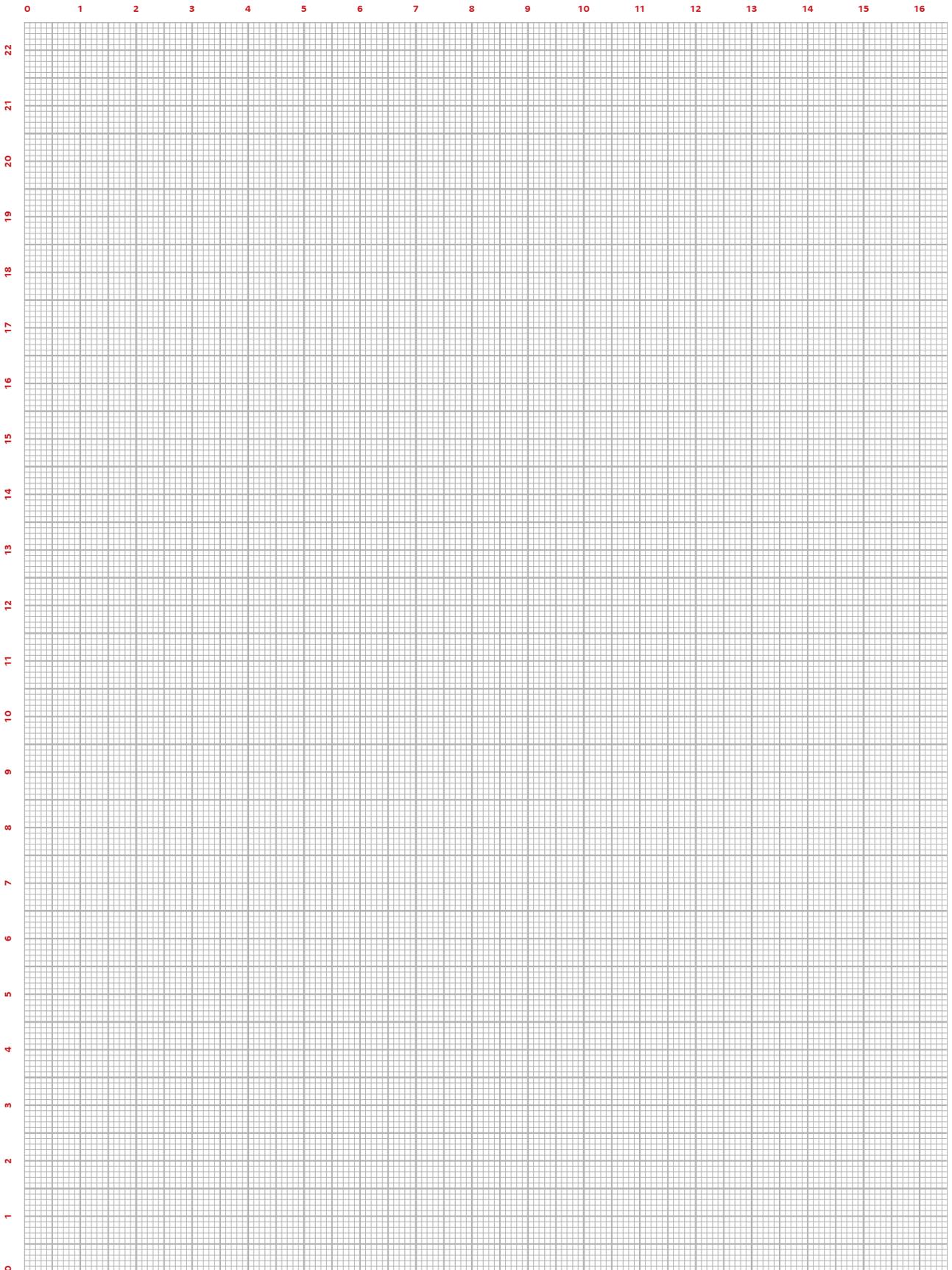
Hard and steam-tight coverings shall be fit approx. 1 – 3 days after cooling-down. If the floor covering is delayed for more than 3 days, the system screed needs to be re-tested for drying as described before with a foil and if required a CM-measurement needs to re-assure that the screed is ready for covering. If the time period between finished screed drying and floor covering is more than 1 week, the implementation of an evaporation protection becomes necessary! Before flooring clean the completely dried SFM mechanically, vacuum with an industrial vacuum cleaner and apply a suited primer. Use flooring adhesives that are suited for underfloor heating, for rigid covering (tiles, natural stone) use plasticised adhesive or joint grout.

For the heated floor systems WP 1000 / WP 2000 it is absolutely necessary to file a protocol for functional heating / heating ready for covering and to present it upon demand to the foorer according to VOB, part C flooring works DIN 18365, edition 2012, point. 3.1.1 and 3.1.2)!

***The mentioned maximum flow temperature (35 °C) is considered as minimum requirement. If the design temperature is higher than 35 °C, then an increase of 5 K per 24 hours needs to be implemented for heat-up after the execution of point 2 and until the required temperature level. Within the further progress of the functional heating / heating ready for covering apply the actual design temperature instead of the assumed 35 °C, however not exceeding 45 °C.**

CONFIRMATION

Principal	location, date	stamp, signature
Site Manager / Architect	location, date	stamp, signature



COMPONENTS LIST



BUILDING MATERIAL

SOUND INSULATION

ACOUSTIC MAT			
	tear-resistant heat and impact sound insulating mat with low build-up height of only 4 mm, impact sound improvement of up to 18 dB, $\lambda = \text{approx. } 0,038 \text{ W/ (m}\cdot\text{K)}$, (width = 1000 mm, thickness = 4 mm)	ORDER CODE TSM	QUANTITY UNIT m ²
		PACKAGING UNIT 10 m ² / coil 25 m ² / coil 50 m ² / coil	
ACOUSTIC MAT SUPER			
	heat and impact sound insulating mat with a thickness of 5 mm, permanently elastic and pressure-resistant, can be double fitted (pay attention to traffic loads!), impact sound improvement when single fitted of up to 20 dB, when double fitted of up to 22 dB, $\lambda = \text{approx. } 0,041 \text{ W/ (m}\cdot\text{K)}$, (width = 1500 mm, thickness = 5 mm)	ORDER CODE TSMs	QUANTITY UNIT m ²
		PACKAGING UNIT 15 m ² / coil 30 m ² / coil 60 m ² / coil	
ACOUSTIC FLEECE			
	sound reducing, thin insulation layer, especially suited for retrofit, when only low floor building heights are possible, impact sound improvement of up to 21 dB, $\lambda = \text{approx. } 0,040 \text{ W/ (m}\cdot\text{K)}$, (width = 1250 mm, thickness = 4 mm)	ORDER CODE TSV	QUANTITY UNIT m ²
		PACKAGING UNIT 35 m ² / coil	

SEPARATION LAYER

HUMIDITY PROTECTION			
	film-coated paper for covering of insulation material or as separation layer acc. to DIN 18560, suited for hot air welding, consumption approx. 1,15 m ² / m ² of floor (overlapping and border areas), width of coil 1,30 m	ORDER CODE SL	QUANTITY UNIT m ²
		PACKAGING UNIT 130 m ² / coil	

BUILDING MATERIAL

ADHESIVE TAPE

PAPER ADHESIVE TAPE			
	B = 90 mm, width = 90 mm, unfoldable to 180 mm	ORDER CODE	QUANTITY UNIT
		KB	coil
		PACKAGING UNIT	
		25 m / coil	
SYNTHETIC ADHESIVE TAPE			
	B = 50 mm, width = 50 mm, white printed with effidur logo	ORDER CODE	QUANTITY UNIT
		KBK	coil
		PACKAGING UNIT	
		65 m / coil	

EXPANSION JOINT

PROFESSIONAL JOINT			
	solid joint profile with self-adhesive base for forming expansion joints, especially between heated and unheated areas, (height = 80 mm, thickness = 10 mm, width = 50 mm, length = 1200 mm)	ORDER CODE	QUANTITY UNIT
		PF	piece
		PACKAGING UNIT	
		1 piece 5 pieces	

JOINT DOWEL			
	two-sided flexible joint dowel to avoid staggering in height and to minimise dishing effects in joint areas, consumption per m of professional joint: 3 - 4 pieces, (length = 300 mm, thickness = 4 mm)	ORDER CODE	QUANTITY UNIT
		FD	piece
		PACKAGING UNIT	
		5 pieces 25 pieces	

BUILDING MATERIAL

BEWEGUNGSFUGE

CONTINUATION

JOINT DOWEL WITH SOUND PROTECTION			
	two-sided flexible joint dowel to avoid staggering in height and to minimise dis-hing effects in joint areas, use when sound protection is required, consumption per m of professional joint: 3 - 4 pieces, (length = 300 mm, thickness = 6 mm)	ORDER CODE FDS	QUANTITY UNIT piece
		PACKAGING UNIT 5 pieces 25 pieces	

SYSTEM SCREED (SFM)

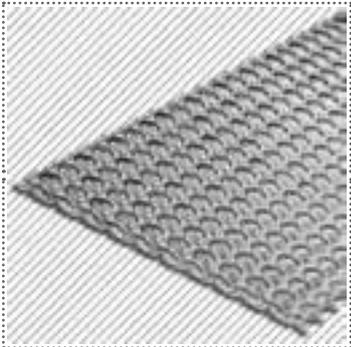
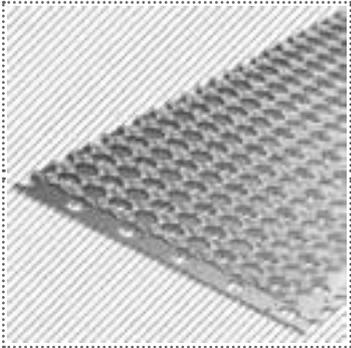
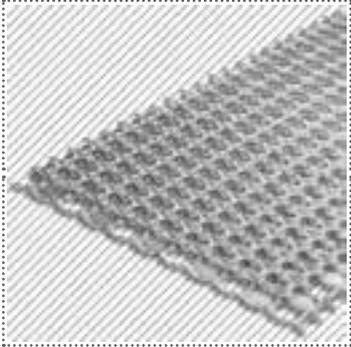
SYSTEM SCREED			
	high-quality concrete-sulphate screed, nearly self-levelling, quality class CT/CA-C30/F8 acc. to DIN EN 13813 for backfilling of comb panels, consumption approx. 13,2 l / bag, with WP 2000 / 25 mm system height approx. 0,52 m ² , with WP 1000 / 15 mm system height approx. 0,88 m ²	ORDER CODE SFM	QUANTITY UNIT bag
		PACKAGING UNIT 25 kg / bag 36 bags / pallet	

SYSTEM SCREED SILO			
	ORDER CODE SFM SILO	QUANTITY UNIT Tonne (t)	
	PACKAGING UNIT delivery of SFM SILO upon demand		

high-quality concrete-sulphate screed, nearly self-levelling, quality class CT/CA-C30/F8 acc. to DIN EN 13813 for backfilling of comb panels, consumption approx. 13,2 l / bag, with WP 2000 / 25 mm system height approx. 0,52 m², with WP 1000 / 15 mm system height approx. 0,88 m²

FLOOR SYSTEM

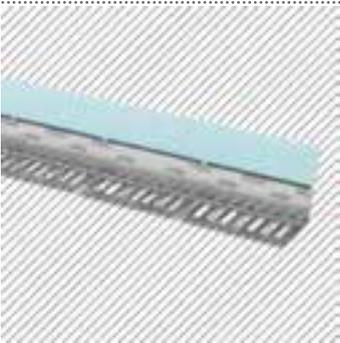
COMB PANEL

COMB PANEL 900 [WP 900]			
	comb panel made of zinc-plated steel sheet, system height 9 mm, open, 1192 x 556 mm, 0,5 m ² / panel	ORDER CODE	QUANTITY UNIT
		WP 900	m ²
		PACKAGING UNIT	
		5 m ² / package	
COMB PANEL 1000 [WP 1000]			
	comb panel made of zinc-plated steel sheet, system height 10 mm, open, 1192 x 556 mm, 0,5 m ² / panel	ORDER CODE	QUANTITY UNIT
		WP 1000	m ²
		PACKAGING UNIT	
		5 m ² / package	
COMB PANEL 2000 [WP 2000]			
	comb panel made of zinc-plated steel sheet, system height 20 mm, open, 1192 x 556 mm, 0,5 m ² / panel	ORDER CODE	QUANTITY UNIT
		WP 2000	m ²
		PACKAGING UNIT	
		5 m ² / package	
BORDER INSULATION TAPE 1000			
	for WP 900 and WP 1000, length = 1000 mm, height = 50 mm, with hold for brackets made of zinc-plated steel sheet, for stabilizing border areas and for compensation of horizontal expansions within the floor construction, consumption approx. 1,3 m / m ² of floor	ORDER CODE	QUANTITY UNIT
		RDS 1000	meter
		PACKAGING UNIT	
		1 m 10 m 50 m 100 m	

FLOOR SYSTEM

COMB PANEL

CONTINUATION

BORDER INSULATION TAPE 2000			
	for WP 2000, length = 1000 mm, height = 50 mm, with hold for brackets made of zinc-plated steel sheet, for stabilizing border areas and for compensation of horizontal expansions within the floor construction, consumption approx. 1,3 m / m ² of floor	ORDER CODE RDS 2000	QUANTITY UNIT meter
		PACKAGING UNIT 1 m 10 m 50 m 100 m	
BRACKET			
	zinc-plated steel sheet, length = 85 mm, for fixing of the comb panels to the border insulation tape, consumption approx. 3 pieces / m	ORDER CODE HK	QUANTITY UNIT piece
		PACKAGING UNIT 10 pieces 50 pieces 500 pieces	

HEATING PIPE

STANDARD \varnothing 8 mm			8
HEATING PIPE 8			
	ORDER CODE HR 040-8	QUANTITY UNIT meter	
	PACKAGING UNIT 40 m / coil 6 coils per packaging box (\triangleq 240 m)		
5-layer-compound pipe \varnothing 8 x 1,1 mm (coil length 40 m), oxygen impermeable acc. to DIN 4726 , max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m ² of floor, max. length of heating loop 35 m = approx. 4 m ²			

FLOOR SYSTEM

HEATING PIPE 8			
	5-layer-compound pipe \varnothing 8 x 1,1 mm (coil length 200 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m ² of floor, max. length of heating loop 35 m = approx. 4 m ²	ORDER CODE	QUANTITY UNIT
		HR 200-8	meter
		PACKAGING UNIT	
		200 m / coil	
HEATING PIPE 8			
	5-layer-compound pipe \varnothing 8 x 1,1 mm (coil length 600 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m ² of floor, max. length of heating loop 35 m = approx. 4 m ²	ORDER CODE	QUANTITY UNIT
		HR 600-8	meter
		PACKAGING UNIT	
		600 m / coil	
SPECIAL \varnothing 10 mm (for WP 2000 only)			10
HEATING PIPE 10			
	5-layer-compound pipe \varnothing 10 x 1,3 mm (coil length 75 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m ² of floor, max. length of heating loop 70 m = approx. 8 m ²	ORDER CODE	QUANTITY UNIT
		HR 075-10	meter
		PACKAGING UNIT	
		75 m / coil	
HEATING PIPE 10			
	5-layer-compound pipe \varnothing 10 x 1,3 mm (coil length 150 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m ² of floor, max. length of heating loop 70 m = approx. 8 m ²	ORDER CODE	QUANTITY UNIT
		HR 150-10	meter
		PACKAGING UNIT	
		150 m / coil	

FLOOR SYSTEM

HEATING PIPE

CONTINUATION

SPECIAL ø 10 mm (for WP 2000 only)

10

HEATING PIPE 10



5-layer-compound pipe ø 10 x 1,3 mm (coil length 300 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m² of floor, max. length of heating loop 70 m = approx. 8 m²

ORDER CODE

HR 300-10

QUANTITY UNIT

meter

PACKAGING UNIT

300 m / coil

HEATING PIPE 10



5-layer-compound pipe ø 10 x 1,3 mm (coil length 600 m), oxygen impermeable acc. to DIN 4726, max. temperature 95 °C, nominal pressure 6 bar, testing pressure 10 bar, consumption approx. 8,5 m per m² of floor, max. length of heating loop 70 m = approx. 8 m²

ORDER CODE

HR 600-10

QUANTITY UNIT

meter

PACKAGING UNIT

600 m / coil
delivery upon demand

PROTECTION COMPONENT

GENERAL

FLOW FILTER



ORDER CODE

SF

QUANTITY UNIT

piece

PACKAGING UNIT

1 piece

for heating facilities with a performance of up to 28 kW for separating contaminations in the heating water, connections 1" female thread x 3/4" female thread

FLOOR SYSTEM

GENERAL

CONTINUATION

BEND FOR PIPE GUIDING 8

	for protecting the heating pipe for pipe \varnothing 8 - 10 mm	ORDER CODE	QUANTITY UNIT
		RFB 8	piece
		PACKAGING UNIT	
		2 piece 10 piece 100 piece	

BEND FOR PIPE GUIDING 12

	for protecting the heating pipe for pipe \varnothing 10 - 14 mm	ORDER CODE	QUANTITY UNIT
		RFB 12	meter
		PACKAGING UNIT	
		2 piece 10 piece 100 piece	

STANDARD \varnothing 8 mm

8

PROTECTION PIPE 8

	for heating pipe \varnothing 8 mm corrugated pipe, length = 200 mm, for the mechanical protection of the heating pipe wherever the pipe comes out of the floor system and in areas of lead-through (e.g. professional joints)	ORDER CODE	QUANTITY UNIT
		SR 200-8	piece
		PACKAGING UNIT	
		2 piece 10 piece 100 piece	

PROTECTION PIPE 8 [COIL]

	for heating pipe \varnothing 8 mm corrugated pipe, customized coil length, for the mechanical protection of the heating pipe wherever the pipe comes out of the floor system and in areas of lead-through (e.g. professional joints)	ORDER CODE	QUANTITY UNIT
		SR 8	meter
		PACKAGING UNIT	
		ordering unit = meter (m)	

FLOOR SYSTEM

PIPE PROTECTION

CONTINUATION

PIPE PROTECTION CAP 8			
	for heating pipe \varnothing 8 mm for closing of pipe ends until finishing of the fitting and as protection against contaminations	ORDER CODE SK 8	QUANTITY UNIT piece
		PACKAGING UNIT 2 piece 10 piece 100 piece	
SPECIAL \varnothing 10 mm (for WP 2000 only)			10
PIPE PROTECTION 10			
	for heating pipe \varnothing 10 mm corrugated pipe, length = 300 mm, for the mechanical protection of the heating pipe wherever the pipe comes out of the floor system and in areas of lead- through (e.g. professional joints)	ORDER CODE SR 300-10	QUANTITY UNIT piece
		PACKAGING UNIT 2 piece 10 piece 100 piece	
PIPE PROTECTION 10 [COIL]			
	for heating pipe \varnothing 10 mm corrugated pipe, customized coil length, for the mechanical protection of the heating pipe wherever the pipe comes out of the floor system and in areas of lead-through (e.g. professional joints)	ORDER CODE SR 10	QUANTITY UNIT meter
		PACKAGING UNIT ordering unit = meter (m)	
PIPE PROTECTION CAP 10			
	for heating pipe \varnothing 10 mm for closing of pipe ends until finishing of the fitting and as protection against contaminations	ORDER CODE SK 10	QUANTITY UNIT piece
		PACKAGING UNIT 2 piece 10 piece 100 piece	

SUB-DISTRIBUTION

SINGLE PLUG CONNECTOR

STANDARD \varnothing 8 mm

8

PLUG CONNECTOR 8



single plug connector \varnothing 8 mm - 1/2" male thread (incl. 1x supporting sleeve) for areas of up to 4 m²

ORDER CODE

STA AG-8

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece
10 piece

PLUG CONNECTOR 8



single plug connector \varnothing 8 mm - 1/2" female thread (incl. 1x supporting sleeve) for areas of up to 4 m²

ORDER CODE

STA IG-8

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece
10 piece

SPECIAL \varnothing 10 mm (for WP 2000 only)

10

PLUG CONNECTOR 10



ORDER CODE

STA IG-10

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece
10 piece

single plug connector \varnothing 10 mm - 1/2" female thread (incl. 1x supporting sleeve) for areas of up to 8 m²

SUB-DISTRIBUTION

SUB-MANIFOLDS

STANDARD \varnothing 8 mm

8

SUB-MANIFOLD 2-PORT FOR HEATING PIPE \varnothing 8 mm



with 2x plug connector \varnothing 8 mm - 1/2" female thread (incl. 2x supporting sleeve) for areas of up to 8 m²

ORDER CODE

UV 2-8

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece

SUB-MANIFOLD 4-PORT FOR HEATING PIPE \varnothing 8 mm



with 4x plug connector \varnothing 8 mm - 1/2" female thread (incl. 4x supporting sleeve) for areas of up to 16 m²

ORDER CODE

UV 4-8

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece

SPECIAL \varnothing 10 mm (for WP 2000 only)

10

SUB-MANIFOLD 2-PORT FOR HEATING PIPE \varnothing 10 mm



with 2x plug connector \varnothing 10 mm - 1/2" female thread (incl. 2x supporting sleeve) for areas of up to 16 m²

ORDER CODE

UV 2-10

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece

SUB-MANIFOLD 4-PORT FOR HEATING PIPE \varnothing 10 mm



with 4x plug connector \varnothing 10 mm - 1/2" female thread (incl. 4x supporting sleeve) for areas of up to 24 m²

ORDER CODE

UV 4-10

QUANTITY UNIT

piece

PACKAGING UNIT

2 piece

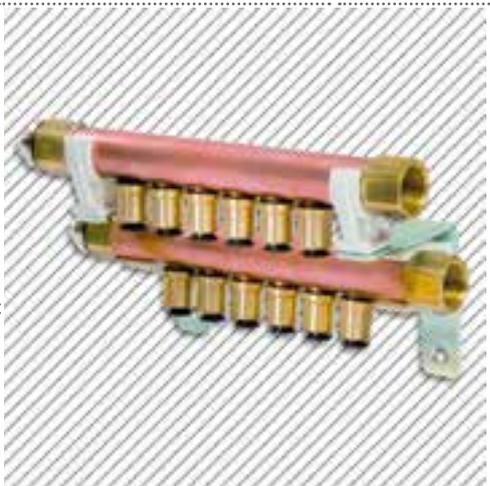
SUB-DISTRIBUTION

MANIFOLD UNIT STANDARD \varnothing 8 mmMANIFOLD UNIT 4-PORT FOR HEATING PIPE \varnothing 8 mm

	ORDER CODE VBG 4	QUANTITY UNIT piece
	PACKAGING UNIT 1 piece	

MANIFOLD UNIT 4-port for heating pipe \varnothing 8 mm with flow and return flow bar, each with 4x plug connector \varnothing 8 mm - 2x 1/2" female thread (incl. 2x ventilation valve, 8x supporting sleeve), length = 165 mm, for areas of up to 16 m²

MANIFOLD UNIT 6-PORT FÜR HEATING PIPE 8 mm

	ORDER CODE VBG 6	QUANTITY UNIT piece
	PACKAGING UNIT 1 piece	

MANIFOLD UNIT 6-port for heating pipe \varnothing 8 mm with flow and return flow bar, each with 6x plug connector \varnothing 8 mm - 2x 1/2" female thread (incl. 2x ventilation valve, 12x supporting sleeve), length = 215 mm, for areas of up to 24 m²

SUB-DISTRIBUTION

ACCESSORIES

GENERAL

SCREW CONNECTION

	<p>screw connection 3/4" for the connection of sub-manifolds resp. single plug connectors to conventional manifolds and valves, consisting of union nut G 3/4" euro cone with o-ring sealing and sleeve R 1/2"</p>	<p>ORDER CODE</p> <p>AV</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>2 piece 10 piece</p>	

SCREW CONNECTION SELF-SEALING

	<p>screw connection 3/4" for the connection of sub-manifolds resp. single plug connectors to conventional manifolds and valves with self-sealing sleeve R 1/2" through PTFE- threaded sealing ring. consisting of union nut G 3/4" euro cone with o-ring sealing and sleeve R 1/2"</p>	<p>ORDER CODE</p> <p>AVS</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>2 piece 10 piece</p>	

STANDARD \varnothing 8 mm

8

BLIND PLUG 8

	<p>sealing plug \varnothing 8 mm, for the sealing of non-used manifold ports</p>	<p>ORDER CODE</p> <p>BS 8</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>2 piece 10 piece</p>	

COLLET 8

	<p>8 mm collet, spare part for all plug connectors \varnothing 8 mm</p>	<p>ORDER CODE</p> <p>HZJG 8</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>2 piece 10 piece</p>	

SUB-DISTRIBUTION

ACCESSORIES

CONTINUATION

SUPPORTING SLEEVE 8			
	supporting sleeve for pipe \varnothing 8 x 1,1 mm, for calibrating and reinforcement of pipe ends, is included in original effidur manifold equipment, only order as spare part	ORDER CODE	QUANTITY UNIT
		SHK 8	piece
		PACKAGING UNIT	
		2 piece 10 piece 100 piece	
SPECIAL \varnothing 10 mm (for WP 2000 only)			10
BLIND PLUG 10			
	sealing plug \varnothing 10 mm, for sealing of non-used manifold ports	ORDER CODE	QUANTITY UNIT
		BS 10	piece
		PACKAGING UNIT	
		2 piece 10 piece	
COLLET 10			
	10 mm collet, spare part for all plug connectors \varnothing 10 mm	ORDER CODE	QUANTITY UNIT
		HZJG 10	piece
		PACKAGING UNIT	
		2 piece 10 piece	
SUPPORTING SLEEVE 10			
	supporting sleeve for pipe \varnothing 10 x 1,3 mm, for calibrating and reinforcement of pipe ends, is included in original effidur manifold equipment, only order as spare part	ORDER CODE	QUANTITY UNIT
		SHK 10	piece
		PACKAGING UNIT	
		2 piece 10 piece 100 piece	

CONTROL UNIT

CONTROL BOX

CONTROL BOX » VERSION 1.1			
	for limiting of the return temperature via RTL valve, built-in box with cover white, closed, incl. RTL valve with thermostat, for areas of up to 16 m ² *	ORDER CODE RB 1 RTL W	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 1.2			
	for limiting of the return temperature via RTL valve, built-in box with cover ready to decorate and tile, closed, incl. RTL valve with thermostat, for areas of up to 16 m ² *	ORDER CODE RB 1 RTL U	QUANTITY UNIT Piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 2.1			
	for single room control via thermostatic valve and limiting of the return temperature via RTL valve, built-in box with cover white, closed, incl. thermostatic valve with remote control and RTL valve with thermostat for areas of up to 16 m ² *	ORDER CODE RB 2 THF RTL W	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 2.2			
	for single room control via thermostatic valve and limiting of the return temperature via RTL valve, built-in box with cover ready to decorate and tile, closed, incl. thermostatic valve with remote control and RTL valve with thermostat for areas of up to 16 m ² *	ORDER CODE RB 2 THF RTL U	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	

CONTROL UNIT

CONTROL BOX

CONTINUATION

CONTROL BOX » VERSION 2.3



for single room control via thermostatic valve and limiting of the return temperature via RTL valve, built-in box with cover white, with opening for thermostat, incl. thermostatic valve pointing to the front and RTL valve with thermostat for areas of up to 16 m²*

ORDER CODE

RB 2
TH RTL OW

QUANTITY UNIT

piece

PACKAGING UNIT

1 piece pre-assembled,
packed in a box.

CONTROL BOX » VERSION 2.4



for single room control via thermostatic valve and limiting of the return temperature via RTL valve, built-in box with cover white, closed, incl. bottom part of thermostatic valve (prepared for actuator connection thread M30 x 1,5; not included) and RTL valve with thermostat, for areas of up to 16 m²*

ORDER CODE

RB 2
THV RTL W

QUANTITY UNIT

piece

PACKAGING UNIT

1 piece pre-assembled,
packed in a box.

CONTROL BOX » VERSION 2.5



ORDER CODE

RB 2
THV RTL U

QUANTITY UNIT

piece

PACKAGING UNIT

1 piece pre-assembled, packed
in a box.

for single room control via thermostatic valve and limiting of the return temperature via RTL valve, built-in box with cover ready to decorate and tile, closed, incl. bottom part of thermostatic valve (prepared for actuator connection thread M30 x 1,5; not included) and RTL valve with thermostat, for areas of up to 16 m²*

*** The mentioned heating area applies in general for a pipe distance of 12 cm and a flow rate within the heating pipe < 0,4 m/s and the according effidur plug connectors (UV4-8, UV2-10, UV4-10 bzw. STA IG-8). Pay attention to the total pressure loss for areas larger than 16 m², when connecting UV4-10 to the control units.**

CONTROL UNIT

CONTROL BOX

CONTINUATION

CONTROL BOX » VERSION 3.1			
	for single room control via thermostatic valve without limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover white, closed, incl. thermostatic valve with remote control, for areas of up to 16 m ² *	ORDER CODE RB 3 THF W	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 3.2			
	for single room control via thermostatic valve without limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover ready to decorate and tile, closed, incl. thermostatic valve with remote control, for areas of up to 16 m ² *	ORDER CODE RB 3 THF U	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 3.3			
	for single room control via thermostatic valve without limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover white, with opening for thermostatic valve pointing to the front, for areas of up to 16 m ² *	ORDER CODE RB 3 TH OW	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	
CONTROL BOX » VERSION 3.4			
	for single room control via thermostatic valve without limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover white, closed, incl. bottom part of thermostatic valve (prepared for actuator connection thread M30 x 1,5; not included), for areas of up to 16 m ² *	ORDER CODE RB 3 THV W	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	

CONTROL UNIT

CONTROL BOX

CONTINUATION

CONTROL BOX » VERSION 3.5

	<p>for single room control via thermostatic valve without limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover ready to decorate and tile, closed, incl. bottom part of thermostatic valve (prepared for actuator connection thread M30 x 1,5; not included), for areas of up to 16 m²*</p>	ORDER CODE RB 3 THV U	MENGENEINHEIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	

CONTROL BOX » VERSION 4.1

	<p>as sub-distribution without thermostatic valve and limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover white, closed, uncontrolled with ventilation valve, for areas of up to 16 m²*</p>	ORDER CODE RB 4 W	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece pre-assembled, packed in a box.	

CONTROL BOX » VERSION 4.2

	ORDER CODE RB 4 U	QUANTITY UNIT piece
	PACKAGING UNIT 1 piece pre-assembled, packed in a box.	

as sub-distribution without thermostatic valve and limiting of the return temperature for use within pre-mixed underfloor heating loop, built-in box with cover ready to decorate and tile, closed, uncontrolled with ventilation valve, for areas of up to 16 m²*

*** The mentioned heating area applies in general for a pipe distance of 12 cm and a flow rate within the heating pipe < 0,4 m/s and the according effidur plug connectors (UV4-8, UV2-10, UV4-10 bzw. STA IG-8). Pay attention to the total pressure loss for areas larger than 16 m², when connecting UV4-10 to the control units.**

CONTROL UNIT

CONTROL VIA WIRE

ROOM THERMOSTAT WALL-MOUNTED

	extremely flat, 230 V, 50 Hz, opener, scale 5...30 °C, pure white	ORDER CODE RT 230V	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

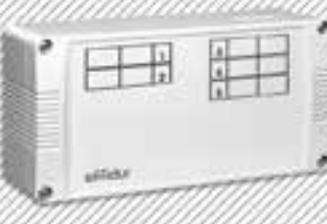
ROOM THERMOSTAT WALL-MOUNTED WITH CLOCK

	230 V, 50 Hz, relay / closer, scale 5...30 °C, time-dependent valve control, suitable as master for master-slave-operation, pure white	ORDER CODE RTU 230V	QUANTITY UNIT piece
		PACKAGING UNIT 1piece	

ROOM THERMOSTAT WALL-MOUNTED WITH CLOCK AND BACKGROUND LIGHTING

	230 V, 50 Hz, relay / closer, scale 5...30 °C, time-dependent valve control, suitable as master for master-slave-operation, background lighting, pure white	ORDER CODE RTUB 230V	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

TERMINAL BLOCK 5-CHANNEL IP20

	terminal block within box for wiring of up to 5 room thermostats and a maximum of 4 actuators per channel, type of protection IP 20, grey	ORDER CODE KL 5 IP20	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

CONTROL UNIT

CONTROL VIA WIRE

CONTINUATION

TERMINAL BLOCK 5-CHANNEL IP65			
	terminal block within box for wiring of up to 5 room thermostats and a maximum of 4 actuators per channel, type of protection IP 65, grey	ORDER CODE KL5 IP65	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	
TERMINAL BLOCK 8-CHANNEL IP20			
	terminal block within box for wiring of up to 8 room thermostats and a maximum of 4 actuators per channel, type of protection IP 20, grey	ORDER CODE KL8 IP20	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	
TERMINAL BLOCK 8-CHANNEL IP65			
		ORDER CODE KL8 IP65	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece (pre-assembled, packed in a box.)	
terminal block within box for wiring of up to 8 room thermostats and a maximum of 4 actuators per channel, type of protection IP 65, grey			

CONTROL UNIT

WIRELESS CONTROL

WIRELESS TEMPERATURE SENSOR

	wall-mounted temperature sensor, extremely flat, radio transfer to control unit, scale 5...30 °C, pure white	ORDER CODE FTF	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

WIRELESS TEMPERATURE SENSOR WITH CLOCK

	radio transfer to control unit, scale 5...30 °C, time-dependent valve control, suitable as master for master-slave-operation, pure white	ORDER CODE FTF U	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

WIRELESS TEMPERATURE SENSOR WITH CLOCK AND BACKGROUND LIGHTING

	radio transfer to control unit, scale 5...30 °C, time-dependent valve control, suitable as master for master-slave-operation, with clock and background lighting, pure white	ORDER CODE FTF UB	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

TEMPERATURE CONTROLLER 1-CHANNEL WIRELESS TEMPERATURE CONTROLLER IP30

	wall-mounted, closer 13,5 (3) A, 230 V, 50 Hz, surrounding 0...40 °C, IP 30, pure white	ORDER CODE FTR 1	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

CONTROL UNIT

WIRELESS CONTROL

CONTINUATION

TEMPERATURE CONTROLLER 4-CHANNEL WIRELESS TEMPERATURE CONTROLLER IP20			
	wall-mounted, closer 5 (1) A, 230 V, 50 Hz, surrounding -10...50 °C, IP 20, max. 4 actuators per channel, light grey	ORDER CODE	QUANTITY UNIT
		FTR 4 IP20	piece
		PACKAGING UNIT	
		1 piece	
TEMPERATURE CONTROLLER 4-CHANNEL WIRELESS TEMPERATURE CONTROLLER IP65			
	wall-mounted, closer 5 (1) A, 230 V, 50 Hz, surrounding -10...50 °C, max. 4 actuators per channel, IP 65, light grey	ORDER CODE	QUANTITY UNIT
		FTR 4 IP65	piece
		PACKAGING UNIT	
		1 piece	
TEMPERATURE CONTROLLER 8-CHANNEL WIRELESS TEMPERATURE CONTROLLER IP20			
	wall-mounted, closer 5 (1) A, 230 V, 50 Hz, surrounding -10...50 °C, IP 20, max. 4 actuators per channel, light grey	ORDER CODE	QUANTITY UNIT
		FTR 8 IP20	piece
		PACKAGING UNIT	
		1 piece	
TEMPERATURE CONTROLLER 8-CHANNEL WIRELESS TEMPERATURE CONTROLLER IP65			
	wall-mounted, closer 5 (1) A, 230 V, 50 Hz, surrounding -10...50 °C, max. 4 actuators per channel, IP 65, light grey	ORDER CODE	QUANTITY UNIT
		FTR 8 IP65	piece
		PACKAGING UNIT	
		1 piece	

CONTROL UNIT

PRE-DISTRIBUTION / CONTROL UNIT

PRE-DISTRIBUTOR			
	ORDER CODE 2 » HKV2-VA 3 » HKV3-VA 4 » HKV4-VA 5 » HKV5-VA 6 » HKV6-VA 7 » HKV7-VA 8 » HKV8-VA 9 » HKV9-VA 10 » HKV10-VA		
	QUANTITY UNIT piece		
stainless steel manifold 1", valve inserts M30 x 1,5 and flow control pre-assembled, unit lengths»			
HKV2-VA	245 mm	HKV7-VA	495 mm
HKV3-VA	295 mm	HKV8-VA	545 mm
HKV4-VA	345 mm	HKV9-VA	595 mm
HKV5-VA	395 mm	HKV10-VA	645 mm
HKV6-VA	445 mm		
lengths of further versions = +/- 50 mm per port			

CONTROL UNIT FOR STAINLESS STEEL MANIFOLD 1"			
	with electronically controlled pump, flow temperature adjustable, incl. safety temperature limiter, total length of unit = 290 mm.	ORDER CODE RG HKV-VA (LOWARA)	QUANTITY UNIT piece
	alternative pump GRUNDFOS Alpha 2L 15-40 - upon demand! RG 2 HKV-VA (GRUNDFOS)	PACKAGING UNIT 1 piece	

SHUT-OFF SET HORIZONTAL			
	2x ball valve 3/4" female thread x 1" male thread, flat sealing, connection horizontal, among others for the shut off of flow and return of the pre-distributor HKV-VA, installation length = 50 mm	ORDER CODE ASH	QUANTITY UNIT set
		PACKAGING UNIT 2 piece	

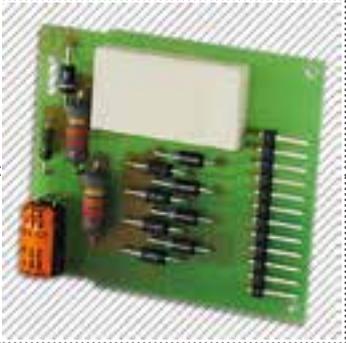
CONTROL UNIT

ACCESSORIES

ACCESSORIES			
	230 V, 50 Hz, closed when currentless, tightly arranged design, operating display, fixing M30 x 1,5, incl. 0,8 m connection wire, pure white	ORDER CODE STA 230V	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

ACCESSORIES (CONTROL UNIT)

PUMP MODULE FOR 5-CHANNEL-TERMINAL BLOCK (WIRE)			
	pluggable, activates pump, as soon as 1 channel receives a heating demand	ORDER CODE PM5	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

PUMP MODULE FOR 8-CHANNEL-TERMINAL BLOCK (WIRE)			
	pluggable, activates pump, as soon as 1 channel receives a heating demand	ORDER CODE PM8	QUANTITY UNIT piece
		PACKAGING UNIT 1 piece	

MAGNET FASTENING SET			
	for the simple fastening of terminal blocks / multi-channel-receivers within the distributor boxes, 4 pieces per set	ORDER CODE MBS	QUANTITY UNIT 4 piece / set
		PACKAGING UNIT 1 Set	

CONTROL UNIT

ACCESSORIES [CONTROL UNIT]

CONTINUATION

CONNECTION COMBINATION RADIATOR		
	ORDER CODE AK HK	QUANTITY UNIT piece
	PACKAGING UNIT 1 piece	
for the connection and separate control of an underfloor heating to a radiator heating, flow with thermostatic valve, connection of thermostat head M30 x 1,5, return flow with adjustable temperature limiter, radiator / pipe connection G3/4" euro cone		

ACCESSORIES

BUILT-IN BOX

BUILT-IN BOX BUILT-IN BOX, COVER WHITE		
	ORDER CODE UP BW	QUANTITY UNIT piece
	PACKAGING UNIT 1 piece	
with magnetic clamp, WxHxD 120 x 310 x 60 mm, (if required pipe lead-through to break-off, adjustable depth from 60 to 95 mm) minimum height for installation 200 mm		

ACCESSORIES

ACCESSORIES [CONTROL UNIT]

CONTINUATION

BUILT-IN BOX BUILT-IN BOX WITH COVER READY TO DECORATE AND TILE**ORDER CODE**

UP BU

QUANTITY UNIT

piece

PACKAGING UNIT

1 piece

WxHxD 450 x 200 x 90 mm (if required pipe lead-through to break off, adjustable depth from 90 to 140 mm), minimum height for installation 200 mm

BUILT-IN BOX BUILT-IN BOX WITH FRAME AND DOOR**ORDER CODE**

UP BR T

MENGENEINHEIT /ME

piece

PACKAGING UNIT

1 piece

(powder coated white) WxHxD 450 x 200 x 90 mm (if required pipe lead-through to break off, adjustable depth from 90 to 140 mm), minimum height for installation 200 mm

TOOL

PIPE THREADER STANDARD FOR HEATING PIPE Ø 8 mm			
	steel spring for screwing into the pipe end for better guidance of the pipe when threading into the comb panels; l = 245 mm	ORDER CODE	QUANTITY UNIT
		RE 8	piece
		PACKAGING UNIT	
		1 piece	
PIPE THREADER SPECIAL FOR HEATING PIPE Ø 10 mm			[for WP 2000 only]
	steel spring for screwing into the pipe ends for an ideal guidance of the pipe when threading into the comb panels; l = 245 mm	ORDER CODE	QUANTITY UNIT
		RE 10	piece
		PACKAGING UNIT	
		1 piece	
TWISTING TOOL			
	for the twisting of bending clips and thus forming an interlocking connection among the comb panels	ORDER CODE	QUANTITY UNIT
		VS	piece
		PACKAGING UNIT	
		1 piece	
TURNING ROLL			
	special tool for the fitting of 180 ° bends when inserting the heating pipe	ORDER CODE	QUANTITY UNIT
		UR	piece
		PACKAGING UNIT	
		1 piece	
TOOL SET			
	TOOL SET for heating pipe Ø 10 mm consisting of 5x turning roll, 1x pipe threader, 1x twisting tool	ORDER CODE	QUANTITY UNIT
		WS 8 WS 10	Set

TOOL

PIPE SHEARS			
	for synthetic pipe, for cutting-off without burrs and pipe deformation, for pipe diameter 4 to 22 mm	ORDER CODE	QUANTITY UNIT
		ROS	piece
		PACKAGING UNIT	
		1 piece	
SPARE CUTTERS FOR PIPE SHEARS			
	for synthetic pipe, for cutting-off without burrs and pipe deformation, for pipe diameter 4 to 22 mm	ORDER CODE	QUANTITY UNIT
		ROS EM	piece
		PACKAGING UNIT	
		1 Piece	
PIPE CLIPPER			
	for synthetic pipe, for cutting-off without burrs and pipe deformation, for pipe diameter 4 to 12 mm	ORDER CODE	QUANTITY UNIT
		RC	piece
		PACKAGING UNIT	
		1 piece	
SPARE BLADE FOR PIPE CLIPPER			
	for synthetic pipe, for cutting-off without burrs and pipe deformation, for pipe diameter 4 to 12 mm	ORDER CODE	QUANTITY UNIT
		RC EK	piece
		PACKAGING UNIT	
		1piece	
SHEET METAL SHEARS			
	for the accurate building situation-dependent cutting of the comb panels and the cut-out of panel parts when fitting of pipe bends	ORDER CODE	QUANTITY UNIT
		HBS	piece
		PACKAGING UNIT	
		1 piece	

REPAIR SET

STANDARD \varnothing 8 mm

8

REPAIR SET 8

	<p>2 x plug connector \varnothing 8 mm, for the repair of pipe damages after backfilling with screed (incl. 2x supporting sleeve)</p>	<p>ORDER CODE</p> <p>RS 8</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>1 piece</p>	

REPAIR SET PIPE SOCKET FOR HEATING PIPE \varnothing 8 mm

	<p>pipe socket \varnothing 8 mm upon compression fitting \varnothing 8 mm, flat sealing with rubber ring (incl. 1x supporting sleeve)</p>	<p>ORDER CODE</p> <p>RS QV 8</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>1 piece</p>	

SPECIAL \varnothing 10 mm

10

REPAIR SET 10

	<p>2 x plug connector \varnothing 10 mm, for the repair of pipe damages after the backfilling with screed (incl. 2x supporting sleeve)</p>	<p>ORDER CODE</p> <p>RS 10</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>1 piece</p>	

REPAIR SET PIPE SOCKET FOR HEATING PIPE \varnothing 10 mm

	<p>pipe socket \varnothing 10 mm upon compression fitting \varnothing 10 mm, flat sealing with rubber ring (incl. 1x supporting sleeve)</p>	<p>ORDER CODE</p> <p>RSQV10</p>	<p>QUANTITY UNIT</p> <p>piece</p>
		<p>PACKAGING UNIT</p> <p>1 piece Upon request!</p>	

With this form you can send us your non-binding material enquiry, upon which we pre-calculate your building project. Besides the mandatory fields (marked with a star), you will find several criteria at the project-describing part of the form, whose early information optimises the result as well as consider a number of influencing factors for the entire calculation.

GENERAL / POSTAL INFORMATION

Building project* »

Send enquiry to* »

Company »

Contact person* »

Address* »

Postal code / City* »

Phone* / Fax »

Email* »

Field of activity* »
[] Installer [] Planner [] Architect
[] Merchant [] Private [] else

INFORMATION FOR BUILDING PROJECT

additional resp. special info, remarks»

Large empty dotted box for additional information or remarks.

You will find this MATERIAL DEMAND as active form with details and explanations on our website at the service center!

Send to »

effidur logo and contact information: Kurze Straße 10, D-09117 Chemnitz, Phone 00 49 371 2399 - 200, Fax 00 49 371 2399 - 229, Mail info@effidur.de, Web effidur.de

FLOOR RENOVATION SYSTEM WP

FORM PAGE 2

Floor level	----										
Name of room	----										
Room space	m ²										
Heated space hereof	m ²										
Standard indoor temperature	°C										
Max. floor surface temperature	°C										
Condition of sub-floor (e.g. timberwork, wooden flooring, concrete)	----										
Defects at sub-floor	y/n										
Available installation height plus insulation - top edge of system screed up to 2.5 cm	y/n										
Planned floor covering» 1» Tiles, natural stone 2» Laminate, PVC, carpet 3» Parquet,cork, wooden flooring 4» else	----										
Impact sound insulation » Acoustic mat TSM 4 mm, » Acoustic mat super TSM5 5 mm, » Acoustic fleece TSV 4 mm, » else (on site) » none	----										
Supplied flow temperature controllable up to 45 °C (not known = 0)	y/n										
Proposal for control / connection 1» Control box 2» Pre-distributor (HKV) 3» HKV with control 230 V 4» HKV with wireless control 5» not required	----										

1. GENERAL

- 1.1 Lieferungen und Leistungen der Firma effidur GmbH (im folgenden Lieferer genannt) Products and services of effidur GmbH (hereinafter referred to as Supplier) shall only be delivered or provided in accordance with the Terms and Conditions specified below. They form an integral part of all contracts that the Supplier concludes with its Customers for offered services and products. The General Terms and Conditions of the Supplier shall also be valid for all future deliveries, services or offers towards the Customer even if they are not separately stipulated again.
- 1.2 Terms and Conditions of the Customer shall not be binding for the Supplier, even if they have not been explicitly rejected. Even so, if the Supplier refers to a document of the Customer which contains general terms and conditions of the Customer or of third parties or which refer to such terms and conditions, it is not deemed as the Supplier's agreement with the validity of these terms and conditions.
- 1.3 All business transactions and relations shall be performed by electronic data processing equipment. In the framework of the Federal Data Protection Law, the Customer is informed that the company-related and personal data required for this will be stored by the Supplier. This data will only be used within the Supplier's company and is not disclosed to any third parties.

2. QUOTATIONS AND QUOTATION-RELATED DOCUMENTS

- 2.1 Any quotations submitted by the Supplier shall be non-binding and subject to confirmation unless it is explicitly characterised as binding or does contain specific terms of acceptance.
- 2.2 Any documentation such as figures, drawings and weight specifications shall be of an approximate nature, unless explicitly characterised as binding. The same shall apply to any performance or consumption data. Therewith no acceptance of a warranty is associated. They are no guaranteed properties, but serve as descriptions or identifications of services and products. Customary variations or variations that are due to regulatory framework or which represent a technical improvement as well as the replacement of single components by equal parts are licit as long as the usability of the product for the contractually destined purpose is not affected.
- 2.3 The Supplier reserves all ownership and industrial property titles as well as copyrights to any cost estimates, drawings, pictures, brochures and catalogues, samples, tools and other documentation or resources. In case the objects mentioned before and possible copies thereof are not required for the proper course of business anymore or negotiations did not lead to a contractual agreement, the Customer shall immediately upon request return these objects completely to the Supplier. The Customer shall not gain access or disclose these objects themselves or their content to any third party, nor shall he use or copy them himself or by third parties without the explicit agreement of the Supplier.

3. ORDERS

- 3.1 An order shall be deemed accepted after written confirmation by the Supplier. Any agreements or subsidiary agreements made on phone, by fax, telex or in oral conversation shall require the Supplier's written confirmation to become effective.
- 3.2 The concluded contract between the Customer and the Supplier including these General Terms and Conditions is solely relevant for the legal relation between both parties. This contract completely comprises all agreements and subsidiary agreements between both contract parties relevant to the subject of the contract. Any oral engagements of the Supplier before the conclusion of the contract are legally non-binding and oral agreements of the contract parties are replaced by the written contract, unless the oral agreements explicitly state, that they continue to bindingly apply. Modifications and amendments of the concluded agreements, including these General Terms and Conditions, shall be made in writing to become effective. Except for the Managing Directors or authorised signatories the Supplier's staff members are not authorised to conclude differing oral agreements. The written form is ensured by a transmission via facsimile. Any other form of telecommunication, especially email, is not effectual. The Supplier may accept orders within 14 days after receipt.
- 3.3 Contracts can also be concluded via electronic data transmission (especially via email and EDIFACT-systems), (hereinafter referred to as electronic contracts). The criteria mentioned under clause 3.1 and 3.2 apply for electronic contracts under the condition that:
- » written confirmations are replaced by confirmations in a tele-communicative form (e.g. emails or EDIFACT messages),
 - » written contracts are replaced by electronic contracts,
 - » the written form is replaced by any form of telecommunication (especially emails or EDIFACT messages).

4. PRICES AND PAYMENTS

- 4.1 Prices shall be deemed ex Supplier's works and without VAT, for deliveries to foreign countries customs duties, fees and other public charges are additionally charged. Prices shall be valid for a period of 4 months after the signing of the contract. In case of altering metal prices for more than 5 % within the terms of binding offers or within the 4-months-term prices may be adapted according to the weight of the offered product and proportionally to the metal price change. In case of a hereby caused increase in price of more than 15 % the Customers shall be entitled to resign from the contract. (source: www.kme.com/de/service/metalpreise) The effectual VAT tax rate that is valid at the day of invoicing is applied. In case longer delivery periods have been agreed or the performance can only be realised after a period of 4 months due to reasons caused by the Customer, the prices valid at the time of delivery shall apply, even if the Customer has not been expressly notified of the adjustment of prices.
- 4.2 For any deliveries of up to a net invoice value of EUR 1.500,00 packaging and freight (postage) shall be additionally charged. An extra charge of EUR 15,00 shall be made on deliveries with small quantities of up to a net invoice value of EUR 50,00. Deliveries to foreign countries with a net invoice value of more than EUR 1.750,00 are free German border. Return deliveries shall not be made unless the Supplier's prior written agreement has been obtained. Any customised goods will not be taken back. Any disbursed freight, packaging, inspection and repair costs for return deliveries shall be borne by the Customer, if they do not comprise defective goods from the Supplier and/or the return delivery has been effected by the Customer without the agreement of the Supplier. In any case the Customer will be charged with a rate of

15 % of the value of the commodities, however, a minimum amount of EUR 20,00. The Customer is allowed to proof, that the Supplier's expenses were considerably lower

- 4.3 Any additional costs for special forms of dispatch (such as express delivery, night delivery, transport insurance, consignment with value declared) shall only be borne by the Supplier in the case that the return delivery is effected on demand and/or due to defective goods of the Supplier and if this is required to ensure Customer's right.
- 4.4 Invoices shall be payable within 21 days after the invoicing date without any deductions. Payments within 14 days after the invoicing date shall be subject to a 2 % discount. The Supplier's date of receipt is relevant as date of payment.
- 4.5 Any payments made to persons who are not in possession of a written authority to collect, shall be deemed ineffective.
- 4.6 Retention of payments or any set-off with possible counterclaims shall be excluded unless the Customer's counterclaims are undisputed, legally determined or decisive.
- 4.7 The Supplier shall be authorised to effect outstanding deliveries or services of the contract against payment in advance or against deposits in case the Supplier is informed after signing of the contract about circumstances, that are likely to considerably lower the credit standing of the Customer, in case the Customer is already in delay with payments and in case the Customer's payments of the Supplier's outstanding invoices emerging from the contractual relationship (including open invoices emerging from single orders that are legally bound to the same master agreement) are at risk.

5. DEFAULT

- 5.1 Should the Customer be in default with the acceptance of the goods or services, the Supplier may specify a reasonable additional period for acceptance of at least 2 weeks. After the expiration of this period, the Supplier shall have the right to terminate the contract and to claim compensation for damages amounting to 15 % of the order value, subject to the right of claiming a higher damage if this can be proved by respective evidence. The Customer has the right to verify that a damage did not or only to a significantly lower amount occur.

6. DELIVERY

- 6.1 The delivery is effected immediately resp. to an agreed delivery period. The period of delivery shall start with the confirmation of the order, but not before the Customer's submittal of any documents, permits from authorities and releases to be provided by him, and the receipt of any down payments agreed.
- 6.2 The delivery period shall be deemed to be complied with if the object to be delivered has left the works, or the Customer has been notified of the readiness for dispatch, within the period specified. In the case of services the delivery period shall be deemed complied with, if the performance of the services has been offered up to the expiration of the delivery period.
- 6.3 In case that the Customer does not comply with his contractual obligations, the Supplier shall have the right – irrespective of his rights from the default of the Customer – to ask the Customer for an extension of the delivery period or a postponement of the delivery date for a time period equal to the Customer's default.
- 6.4 Should the Supplier be unable to comply with the period of delivery for reasons he is not responsible for (this also includes strike and lockout), the delivery period shall be extended by a reasonable time after the removal of the reasons. Similar provisions shall apply in case such events occurred in one of the sub-suppliers' works. In case that the delivery is considerably impeded or impossible due to these circumstances and the obstacles are not temporary the Supplier shall have the right to resign from the contract.
- 6.5 In case of non-compliance with the delivery period for reasons other than the ones specified under Clause 6.4. the Customer may specify an additional period of at least 2 weeks and terminate the contract after the expiration of that period.
- 6.6 Should the period of delivery be extended on the request of the Customer or for reasons for which the Customer is responsible, any costs incurred as a result of this shall be invoiced to the Customer.
- 6.7 The Supplier shall have the right for partial deliveries, if
- » the partial delivery is useful for the Customer within the scope of the intended use;
 - » the delivery of the remaining goods is guaranteed and
 - » no significant additional expenses or costs for the Customer are caused (unless the Supplier explicitly accepts to bear these costs).

7. PASSAGE OF RISK / ACCEPTANCE / COSTS FOR STORAGE

- 7.1 The delivery is effected though the Supplier's dispatch or through collecting by the Customer. This also applies if a freight paid delivery is agreed.
- 7.2 Any goods supplied shall be accepted by the Customer, even if they exhibit insignificant defects. Where required the acceptance of the delivered goods shall be deemed to be effected if
- » the delivery and the installation, if also to be effected by the Supplier, is completed,
 - » the Supplier has informed the Customer under reference to clause 7.2 about the acceptance and has asked him to accept the delivery,
 - » 12 working days have passed since the delivery or installation or if the Customer has begun to use the goods and 6 working days have passed since the delivery or installation, and the Customer has failed to accept the delivery within this period due to other reasons than defects claimed by the Customer to the Supplier which significantly affect the use of the goods or make it impossible.
- 7.3 Should the dispatch or the collection of the goods be delayed for reasons caused by the Customer, the risk shall pass to the Customer on the day of readiness for dispatch/collection or the notification thereof to the Customer.
- 7.4 At the latest the risk shall pass to the Customer when handing over (relevant is the beginning of the loading process) the delivery goods to the forwarding agent, the freight carrier or any other third party being authorised for forwarding. This also applies for partial deliveries or when the Supplier has undertaken further services (e.g. dispatch and installation).
- 7.5 Storage costs occurring after the passage of risk shall be borne by the Customer. For storage by the Supplier costs amounting to 0,25 % of the invoice value of the stored goods are charged per week. The rights to claim and verify further costs or lower storage costs are reserved.

8. ERECTION AND AFTER-SALES SERVICES.....

- 8.1. Any erection work shall be paid for separately. Erection costs comprise in particular material and travelling costs as well as wages.
- 8.2. Any lump-sum prices agreed for erection work shall not include any extra costs for overtime, work at night or on Sundays or public holidays, if such work has been ordered by the Customer or became necessary for reasons for which the Customer can be blamed. Thus work shall be subject to additional payment.
- 8.3. Any erection or commissioning work shall be deemed completed with the successful trial commissioning by the Supplier and shall be accepted immediately afterwards. Should any delays in erection or commissioning occur for which the Supplier cannot be held responsible, risk shall pass to the Customer from that point of time.
- 8.4. The above shall apply mutatis mutandis for after-sales services.

9. WARRANTY

- 9.1. The warranty period is 1 year starting with the delivery resp. acceptance. This does not apply for the production or delivery of buildings, products that are commonly intended to be used for buildings as well as planning and supervising services for buildings.
- 9.2. The delivered goods shall be checked thoroughly immediately after being delivered to the Customer or to third parties determined by the Customer. The goods are deemed accepted if the Supplier is not informed about defects in the manner stated under clause 3.2 point 6 regarding evident defects or other defect that are noticeable at an immediate and careful control within 7 days after the detection of the defect or after the point of time when the defect became noticeable for the Customer during normal use without closer control. Upon request the defective goods are to be returned carriage paid to the Supplier. In case of an entitled notice of defect the Supplier reimburses the costs for the most favourable way of dispatch; this does not apply when the costs are increased since the goods are located elsewhere than the location of the intended use.
- 9.3. If a defect is caused by the Supplier the Customer has the right to claim for compensation under the preconditions mentioned under clause 10.
- 9.4. In case of defective parts from sub-suppliers that the Supplier cannot remove due to legal licensing or effective reasons, the Supplier shall choose whether to claim warranty himself against the sub-supplier in the Customer's favour or to cede his right of warranty to the Customer. Warranty claims against the Supplier for such parts are only accepted in case the legal enforcement of the before mentioned claims against the sub-supplier were ineffective, e.g. due to bankruptcy of the sub-supplier, or if they are unwinable and if all other preconditions required within these General Terms and Conditions are met.
- 9.5. The right of warranty is excluded if the Customer or third parties authorised by the Customer modify the delivered good without the prior agreement of the Supplier and if the removal of the defect therewith becomes impossible or is unreasonably impeded. In any case the Customer will be charged with additional costs occurring during the removal of the defect due to the modification.
- 9.6. Any right of warranty is excluded in the particular case of a delivery of used parts that is properly agreed with the Customer

10. LIABILITY FOR CAUSED DAMAGES

- 10.1. The Supplier's liability for damages, independent from legal grounds, especially for impossibility, delay, defective or wrong delivery, breach of contract, neglect of duties at negotiations and unauthorised acts is - if the damage is caused by the Supplier - limited under the conditions of this clause 10.
- 10.2. The Supplier is not responsible
 - a) in the case of slight negligence of his executives, legal representatives, employees or other vicarious agents;
 - b) in the case of gross negligence of his non-executive employees or other vicarious agents. If contractually significant duties are not neglected. Contractually significant are the duty to deliver and install on time and without defects as well as the duties for consulting, protection and care, that enable the Customer to use the delivered goods as agreed upon and to protect the Customer or any third party or the Customer's employees from danger of life, body and health and protect the Customer's properties from significant damage
- 10.3. In case the Supplier is liable for damages according to clause 10.2 the liability is limited to damages, that the Supplier did anticipate as possible consequence of a breach of contract when signing the contract or was obliged to anticipate them because of circumstances that he knew or that he was obliged to know when acting with due diligence. Collateral and subsequent damages that are caused by defects of the delivered goods are only accepted for compensation if such damages are typically predictable when using the delivered goods as intended.
- 10.4. In the case of liability for slight negligence the Supplier's obligation for compensation of property and personal damages is limited to an amount of EUR 2.5 millions per liability case also if contractually significant duties have been neglected.
- 10.5. The before mentioned exclusions and limitations of the Supplier's liability also apply to their full extent in the favour of his executives, legal representatives, employees and other vicarious agents.
- 10.6. If the Supplier provides technical information or does act as consultant and these services are not part of his contractually agreed duties, they are free of charge and any liability is excluded.
- 10.7. The limitations mentioned under this clause 10 do not apply for the Supplier's liability concerning deliberate acting, guaranteed product features, injury of body, life and health or concerning the Product Liability Act.

11. LIABILITY FOR DEFECTS

- 11.1. The Supplier's liability for defects is limited to his products or services and does not apply for entire facilities. The Supplier's liability is subject to the Customer's full compliance with his contractual commitments.
- 11.2. The Supplier's liability for defects does not apply for normal wear and tear and does not apply for damages that have been caused after the passage of risk by defective or negligent treatment, excessive strain and similar. The before mentioned also applies for alterations to the delivered goods that have been effected by the Customer or third

parties as well as in the case of incorrect installation by the Customer or third parties.

12. SUPPLIER'S RIGHT FOR TERMINATION OF THE CONTRACT

- 12.1. In the case of unforeseen events, which essentially change the economic significance and the content of the service, or have considerable effects on the Supplier's factory, or in case it turns out later that the service cannot be provided in parts or as a whole, the contract shall be adjusted accordingly. Should this not be possible or economically justifiable, the Supplier reserves the right to terminate the contract in part or as a whole. The Supplier shall notify the Customer of such conditions for termination without delay after their occurrence.

13. RETENTION OF TITLE

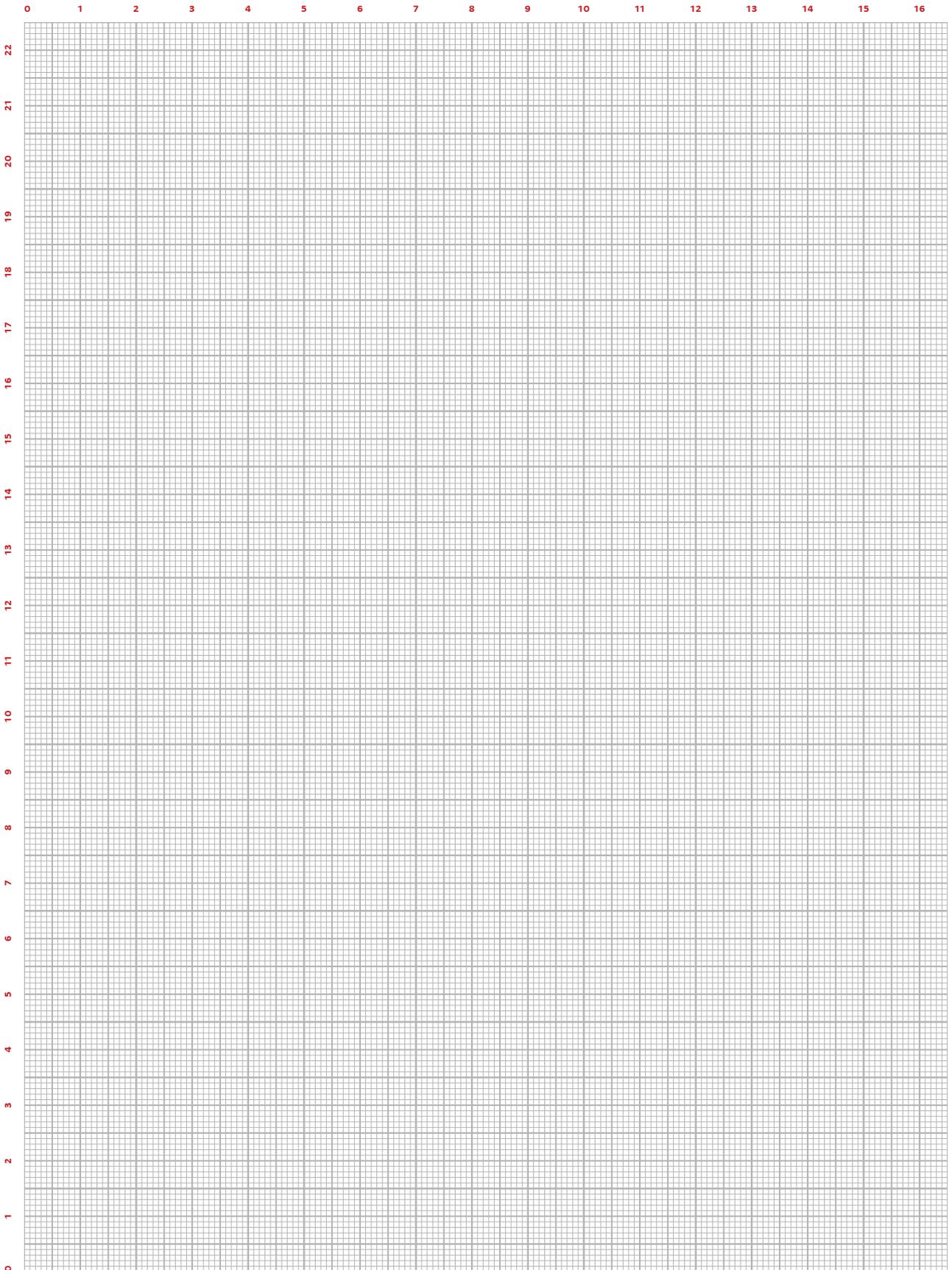
- 13.1. The subsequently agreed retention of title serves as security for all existing and future claims of the Supplier against the Customer. The Supplier retains title of the delivered goods until the purchase price has been paid in full (including possible costs). The goods as well as their substitutes according to this clause that are covered by the retention of title are hereinafter referred to as retained goods.
- 13.2. The Customer stores the retained goods free of charge for the Supplier.
- 13.3. The Customer is authorised to process and re-sell the retained goods in the context of his normal business operations until the event of a contract termination occurs. The Customer is not entitled to pledge or assign the retained goods as security.
- 13.4. In case the retained goods are processed by the Customer it is agreed that the processing is effected under the name and in the favour of the Supplier as manufacturer and the Supplier acquires direct property or if the processing is effected with materials of several owners or if the value of the processed goods is higher than the value of the retained goods the Supplier acquires the joint-property (fractional property) of the newly manufactured goods proportionally to the value of the retained goods. In the case that the Supplier does not acquire property the Customer already now assigns his future property or - in the above-mentioned proportion - his joint property of the newly manufactured goods as security to the Supplier. If the retained goods are joint with other goods to a unitary good or if they are inseparably mixed with other goods and if one of the other goods is deemed as main good the Customer - if the main good is his property - assigns the joint-property of the unitary good to the Supplier in the proportion mentioned under point 1.
- 13.5. In the case of re-selling of the retained goods the Customer already now assigns the herein emerging claim against the Buyer to the Supplier for security or in the case of the Supplier's joint property of the retained goods in the proportion to the joint property. The same applies for any other claims that replace the retained goods or in any other way emerge from the retained goods, as e.g. insurance claims or claims in tort for loss and destruction. The Supplier entitles the Customer until revoked to collect the claims that are assigned to the Supplier in his own name and in the Supplier's favour. The Supplier shall only revoke this authorisation to collect in case of a termination of the contract (13.8.).
- 13.6. In the case that third parties claim access to the retained goods, especially by garnishment, the Customer immediately informs them about the Supplier's property and also informs the Supplier in order to enable him to accomplish his property rights. If the third party is not able to reimburse the judicial and extra-judicial costs emerging in this context to the Supplier than the Customer shall be held liable for these costs from the Supplier.
- 13.7. The Supplier shall release the retained goods or the goods and claims, that emerge from them upon request at his own choice if their value exceeds the value of the secured claims by more than 50 %.
- 13.8. If the Supplier resigns from the contract (termination of the contract) due to non-contractual behaviour of the Customer - especially delay of payment - he is entitled to reclaim the retained goods.

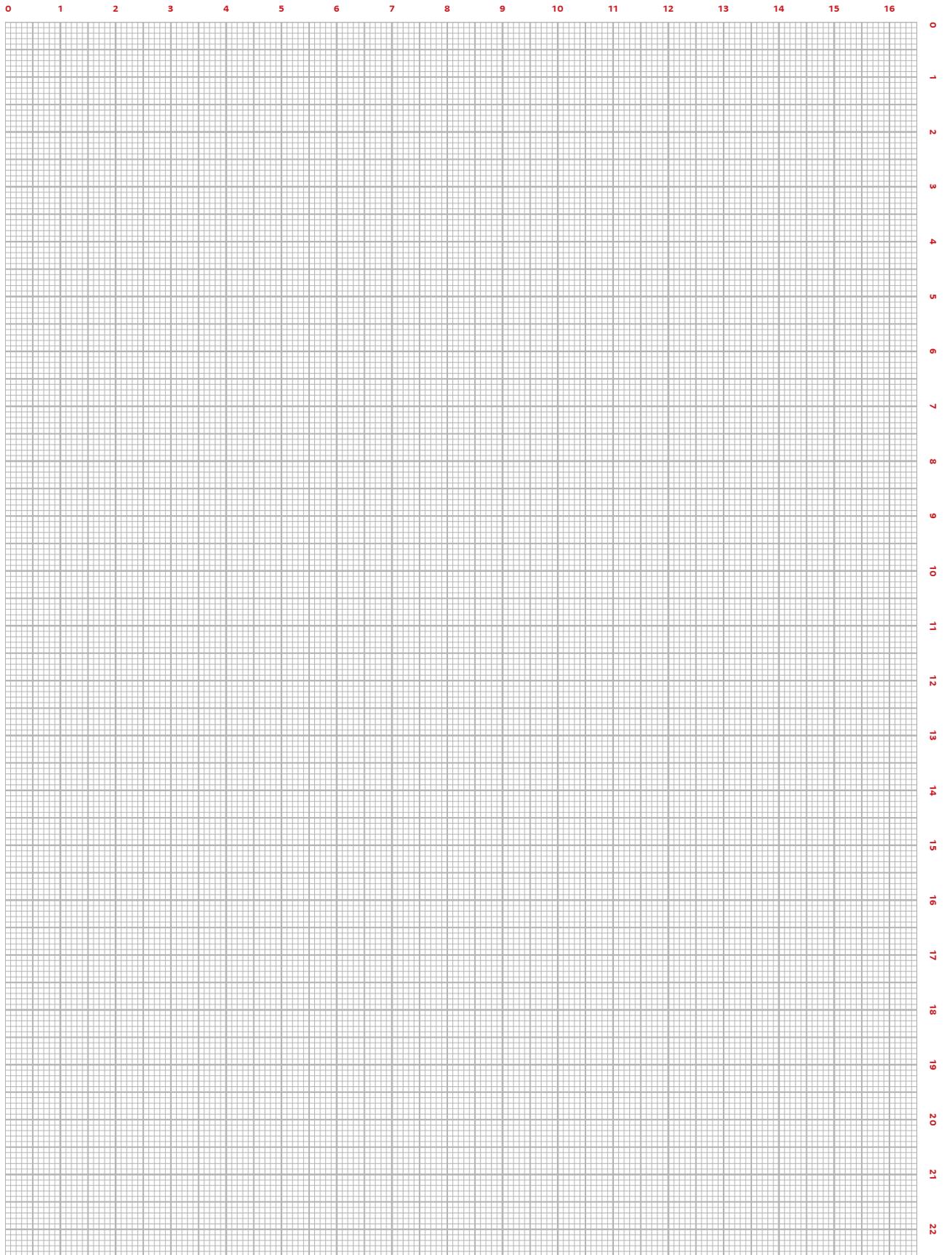
14. PLACE OF PERFORMANCE AND JURISDICTION

- 14.1. Place of performance and jurisdiction shall be the Supplier's headquarters. Compulsory legal provisions about exclusive places of jurisdiction are excluded from this clause.
- 14.2. The written notices mentioned within these General Terms and Conditions are to be addressed directly to the Supplier's headquarters. Notices addressed to representatives require a written confirmation of the Supplier's management.
- 14.3. The legal relation between the Supplier and the Customer is solely subject to the right of the Federal Republic of Germany. The UN Convention on Contracts for the International Sale of Goods (CISG) dated April 11th, 1980 is not applied.

15. SEVERABILITY

Should any provisions of this Contract become legally ineffective, the remaining provisions shall remain unaffected. Any ineffective provisions shall be replaced by effective ones in good faith and in the sense of the Contract.







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