ROTEx System 70: The Heat Distribution System for a Combination of Floor Heating and Radiators.
System 70

System 70 is a heat distribution system which enables you to connect floor heating panels and radiators to a single heating circuit distributor. This makes the combination of very different heating surfaces possible without the need for an additional regulating circuit or a separate system. This makes the following heating combinations possible:
- floor heating only
- a combination of floor heating and radiators
- radiators only
System 70 is the logical answer to the long-standing demands of clients, planning bureaus, heating system installers, architects, and scientists. The distinguishing features of this system are described in the following.

High Versatility

The heating surfaces of a room may be selected freely and combined without restrictions. This allows for greater freedom in room arrangement and interior design.

A New Level of Comfort

The clever combination of different room heating surfaces allows you to achieve new levels of comfort. The floor heating provides warm and cozy floors without drafts near cold exterior surfaces while the radiator heating assures flexible room temperature regulation (e.g. baths).

Efficient

The direct combination of radiators with floor heating enables an especially precise regulation of room temperature, using existing heat as much as possible. Under certain circumstances, this can lead to a reduction of fuel consumption.

Optimised to Work as a System

System 70 was developed and optimised in close cooperation with leading institutions from the heating and structural engineering branches. The system concept was always the top priority in this development. System 70 is more than a simple combination of existing components: The tuning and harmonisation of the products and their connection by way of the DUO heating pipe, developed exclusively for System 70, are the integral elements in this system.

Floor Coverings

Choose freely between parquet, ceramic tiles, carpeting, or synthetic floor covering – System 70 is compatible with practically any type of modern floor covering.

Proven

System 70 has proven itself to be a reliable heat distribution system in the 12 years since its introduction on the market. The high level of customer satisfaction this product has enjoyed is largely a result of trouble-free operation, individualised comfort possibilities, and the attractive design of the radiator connection.

 Tested

The complete system as well as all of its basic components are DIN/EN tested. A comprehensive quality control system and monitoring by independent testing institutions guarantee the highest possible level of quality and safety.

Safety

System 70 is designed in such a way as to minimise the number of connection points and completely avoid connections in the wall or the screed. The favourable ratio between the diameter of the inner water pipe and wall thickness makes the pipe extremely strong.

Affordable

Since it is purchased and operated as a system, System 70 is much more affordable than conventional heating surface combinations.

Range of Application

System 70 can be installed in virtually any building with a hot water heating system. The following list shows examples of the wide range of application of System 70:
- apartment buildings (single and multiple family dwellings)
- office and administration buildings
- indoor swimming pools and baths
- hospitals
- department stores
- day-care centres
- nursing homes
- renovation of buildings (e.g. baths)
- new additions and extensions to buildings (e.g. conservatories)
- hotels

For large surfaces, such as industrial buildings, warehouses, foyers, or gymnasiums, System 70 Industry with a DUO-25 heating pipe (25/18 x 2) is used. Both types of pipe may be combined in one unit.

Valuation by EnEV

The energy saving regulation called EnEV furthers heating systems with possible low primary energy expenditure. As pump voltage means according to DIN 4701 T10 a big primary energy expenditure, two circuit systems, which also are working with two pumps are higher valued concerning the primary energy expenditure than the ROTEX System 70. That means the primary energy expenditure of ROTEX System 70 is approx. 26 % - points lower than a conventional two pumps-system with underfloor heating and radiators. Additionally the higher spread of System 70 between flow and return flow also lowers the pump energy requirement. The primary energetic advantage of ROTEX System 70 which has come into being is considerable.
Floor heating meets and exceeds the regulations introduced in the past decades requiring buildings to drastically lower heat consumption by improving heat insulation. Heat consumption rates of 50 W/m² in the most extreme conditions the unit is designed to work under (the coldest day of the year) are no longer a rarity, and the planned energy-saving ordinance (EnEV) will lower these rates even more. To meet these recent and future developments, the maximum surface temperature of modern floor heating units remains well under the maximum allowed value of 29 °C year round.

Floor heating has thus become the logical choice for heating modern buildings. There are practically no limitations as to the usage of the building or choice of floor coverings. Whether for single-family homes, offices or administrative buildings, indoor swimming pools or gymnasiums, hotels or hospitals, industrial buildings or warehouses – floor heating is an optimal heating surface offering numerous advantages.

System 70 is also exceptionally flexible as to sources of heat. It can be operated with conventional oil and gas burners, the most recently developed oil and gas burners, and even with long-distance energy. With such flexibility, System 70 is sure to become more popular as a heating system for new buildings in the years to come. With almost 20 years of experience manufacturing millions of meters of floor heating pipes, ROTEX is at the forefront of this floor heating revolution. Our products and production process have been under constant development and improvement during this period to keep in line with new developments and market demands. ROTEX has long played a pioneering role in many of these developments. Thus, you can rest assured that the planning, installation, and operation of ROTEX System 70 represents innovative, high-tech heating technology.
The following institutions were commissioned to determine the technical data of System 70:

**Output**

University of Stuttgart, IKE, Dept. of Heating, Ventilation, and Air Conditioning, Prof. Dr. Ing. H. Bach
- determined heating capacity according to DIN/EN 1264

**Impact Sound Insulation**

Fraunhofer Institute of Building Physics, Stuttgart
Prof. Dr. Ing. K. Gertis
- improved impact sound insulation of the system plates with integrated impact sound insulation according to DIN 52210

**Heat Insulation**

Fraunhofer Institute of Building Physics, Stuttgart
Prof. Dr. Ing. K. Gertis
- thermal conductivity and thermal resistance of the system plates according to DIN 52 612

**Fireproofing**

Research and Construction Material Testing Institute (FMPA), Stuttgart
Continuous Quality Control
Research Institute for Thermal Insulation (FIW), Munich
- certified quality control system according to DIN ISO 9001

**Heating Pipe**

South German Center for Synthetic Material (SKZ), Wuerzburg
- tested according to DIN 4726/4729 North-Rhein Westphalia State Material Testing Institute (MPA NRW), Dortmund
- tested for oxygen impermeability

**System Composition**

- continuous control according to RAL GZ963/1 Heat Technological Testing Institute (WTP), Berlin
- accredited testing laboratory for space heaters, space heating surfaces, and heating cost distributors

The following DIN norms and ordinances must be adhered to during the planning and manufacture of floor heaters:

<table>
<thead>
<tr>
<th>DIN</th>
<th>Norm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1055</td>
<td>Design Load for Structures</td>
<td></td>
</tr>
<tr>
<td>4102</td>
<td>Fireproofing for Building</td>
<td>Construction</td>
</tr>
<tr>
<td>4108</td>
<td>Heat Insulation for Building</td>
<td>Construction</td>
</tr>
<tr>
<td>4109</td>
<td>Sound Insulation for Building</td>
<td>Construction</td>
</tr>
<tr>
<td>1264</td>
<td>Floor Heating</td>
<td></td>
</tr>
<tr>
<td>18164</td>
<td>Foam Synthetic Material</td>
<td>as Insulating Material for the Building Trade</td>
</tr>
<tr>
<td>18165</td>
<td>Fibrous Insulating Material</td>
<td>for the Building Trade</td>
</tr>
<tr>
<td>18195</td>
<td>Sealing of Buildings</td>
<td></td>
</tr>
<tr>
<td>18202</td>
<td>Tolerance in Building</td>
<td>Construction</td>
</tr>
<tr>
<td>18336</td>
<td>Sealing Work</td>
<td></td>
</tr>
<tr>
<td>18353</td>
<td>VOB, part C: General Technical</td>
<td>Ordinances for Building Works, Screed Works</td>
</tr>
<tr>
<td>18560</td>
<td>Screeds in the Building</td>
<td>Trade</td>
</tr>
<tr>
<td>4701</td>
<td>Guidelines for the Calculation</td>
<td>of Heat Consumption for Buildings</td>
</tr>
<tr>
<td>EnEV</td>
<td>EnergieEinsparVerordnung</td>
<td>vom 01.02.2002</td>
</tr>
</tbody>
</table>
System 70 is a heat distribution system which enables the simultaneous use of floor heating panels and radiators. It uses only one heat flow line and one distributor, making a direct combination of these two types of heating surfaces possible for the first time ever. At the heart of this system is the DUO heating pipe, designed and optimised especially for this purpose. The pipe is made of irradiation cross-linked, oxygen-impermeable PE-X pipe (12 x 2 mm) and is covered with a ribbed polyethylene coating pipe. The air holes in the coating pipe provide optimal heat insulation characteristics. The DUO pipe is used for floor heating as well as for connecting radiators. The ROTEX DUO 17 AL is a revolutionary new development for the installation of radiators. The pipe is flexible but sturdy and can be easily moulded into the desired position by hand without the use of tools.

Floor Heating

Besides the DUO heating pipe, the system plates for floor heating constitute another key system component. The DUO pipe is placed in the system plates according to the grid spacing determined by the heating system calculation. The double coating of the DUO pipe is designed to lower the temperature of the heating water, which achieves much higher temperatures than with conventional floor heating systems.

The surface temperature of the pipe and the temperature distribution in the floor itself is thus identical to the temperature found in comparable floor heating systems.

Measurements of the average floor surface temperature performed during thermal testing of System 70 demonstrate that the maximum surface temperature is not even exceeded with higher flow temperatures. On floors heated exclusively with floor heating and on those combining floor heating and radiators, the DUO pipe is installed directly in the system plates. These plates offer the significant advantage of containing all the components necessary for the substructure:

- impact sound insulation
- required thermal insulation
- pipe fixing
- grid dimensions.

In contrast to conventional systems, the floor heating of System 70 offers the following advantages:

- With System 70, heat flow density and the floor surface temperature are highly dependant on the installation grid. By installing the heating pipes more closely together, one can achieve a significantly higher surface temperature in peripheral areas than in interior areas, whereby the water temperature remains constant throughout. This makes it possible to heat peripheral areas more without the necessity of separate flow temperatures.

- Due to the higher water temperatures used by System 70, the alteration of heating output caused by additional floor coverings (e.g. carpet) is much lower than with conventional systems.

- The permissible difference between flow and return flow temperature of System 70 is over 20 K. A difference of 15 K is typically chosen, leading to a significantly reduced water flow and a lower required pump output.

- The water content of the floor heating component of System 70 is only approximately 70 % of that of a conventional floor heating system.

The strong influence the grid dimensions exert on surface temperature with System 70 makes it necessary to strictly observe the settings in the heat technological specifications (see “Planning and Calculating”!).
### System Plates

#### Technical data of the system plates

(All measures in mm)

<table>
<thead>
<tr>
<th>Term</th>
<th>Basis-Integral 33-3</th>
<th>Compact 45</th>
<th>Mono 15</th>
<th>Protect-Integral 33-3</th>
<th>Protect 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of insulation layer</td>
<td>33-3</td>
<td>45</td>
<td>15</td>
<td>33-3</td>
<td>10</td>
</tr>
<tr>
<td>Total height with normal screed</td>
<td>94</td>
<td>108</td>
<td>79</td>
<td>94</td>
<td>74</td>
</tr>
<tr>
<td>Total height with Estrotherms</td>
<td>79</td>
<td>93</td>
<td>64</td>
<td>79</td>
<td>79</td>
</tr>
<tr>
<td>Laying grid rectangular</td>
<td>75/150/225/300</td>
<td>75/150/225/300</td>
<td>75/150/225/300</td>
<td>75/150/225/300</td>
<td>75/150/225/300</td>
</tr>
<tr>
<td>Laying grid diagonal</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>55/110/165/220/275</td>
<td>55/110/165/220/275</td>
</tr>
<tr>
<td>Laying measure</td>
<td>1200 x 600</td>
<td>1200 x 600</td>
<td>1200 x 600</td>
<td>1220 x 1200</td>
<td>1220 x 1200</td>
</tr>
<tr>
<td>Application type according to DIN 4108. T.10</td>
<td>DES sm</td>
<td>DEO</td>
<td>DEO</td>
<td>DES sm</td>
<td>DEO</td>
</tr>
</tbody>
</table>

### Foam Weights

<table>
<thead>
<tr>
<th>Feature</th>
<th>PST impact sound insulation layer</th>
<th>PS insulation layer</th>
<th>Covering foil</th>
<th>Weight of plate</th>
<th>Weight per m²</th>
<th>Thermal resistance</th>
<th>Dynamic stiffness</th>
<th>Impact sound insulation improvement level</th>
<th>Load at 2 % compression</th>
<th>Fire proofing class accord. to DIN 4102</th>
<th>Paching unit</th>
<th>Order-no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST impact sound insulation layer</td>
<td>approx. 12 kg/m³</td>
<td>-</td>
<td>-</td>
<td>0,7 kg</td>
<td>0,98 kg</td>
<td>0,75 m² K/W</td>
<td>&lt; 30 MN/m²</td>
<td>29 dB</td>
<td>7 kN/m²</td>
<td>B1</td>
<td>14 plates = 10,08 m²</td>
<td>17 10 01</td>
</tr>
<tr>
<td>PS insulation layer</td>
<td>approx. 30 kg/m³</td>
<td>approx. 32 kg/m³</td>
<td>-</td>
<td>1,5 kg</td>
<td>2,1 kg</td>
<td>1,28 m² K/W</td>
<td>-</td>
<td>19 dB</td>
<td>99 kN/m²</td>
<td>B1</td>
<td>8 plates = 5,76 m²</td>
<td>17 10 17</td>
</tr>
<tr>
<td>Covering foil</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,55 kg</td>
<td>0,8 kg</td>
<td>0,43 m² K/W</td>
<td>&lt; 30 MN/m²</td>
<td>18 dB</td>
<td>7 kN/m²</td>
<td>B1</td>
<td>20 plates = 14,40 m²</td>
<td>17 10 10</td>
</tr>
<tr>
<td>Weight of plate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2,8 kg</td>
<td>1,9 kg</td>
<td>0,75 m² K/W</td>
<td>-</td>
<td>29 dB</td>
<td>7 kN/m²</td>
<td>B2</td>
<td>7 plates = 10,25 m²</td>
<td>17 10 30</td>
</tr>
<tr>
<td>Weight per m²</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2,5 kg</td>
<td>1,7 kg</td>
<td>0,29 m² K/W</td>
<td>&lt; 30 MN/m²</td>
<td>18 dB</td>
<td>7 kN/m²</td>
<td>B2</td>
<td>11 plates = 16,10 m²</td>
<td>17 10 31</td>
</tr>
</tbody>
</table>

Total installations according to EN-1264 T4, see pages 9 - 12.
Using the standard- and protect system plates it can be installed ROTEX heating tubes DUO 17, DUO 17AL, M onopex 14, M onopex 14AL and the tube Varioflex 17.

**Standard system plates**

Standard system plates are only made of Polystyrene.

**Basis-Integral 33-3**

A patented fabrication process makes it possible to manufacture two foam layers of varying density in a single operation. The impact sound insulation level required by DIN 4109 is reached with the lower soft foam layer. The upper hard foam layer includes specially formed naps and provides the strength and firmness necessary to mount the pipes and hold them in place. Due to this special fabrication process there is no need for an additional plastic foil as the surface of the system plates is an effective moisture barrier for the screed. The naps are spaced at a distance of 75 mm from each other. Corresponding to this, the spacing of the pipes may be 75, 150, 225 mm, etc. The naps are designed to secure the pipe to the system plate. The heating pipes are raised from the system plate by way of integrated stays. This guarantees that the pipe is always completely surrounded by the screed, thus optimising the distribution of heat in the screed. When the plates are laid, they are form-fitted to each other. Special dovetail joints ensure that the plates are securely fixed, and a step fold fastened to it and surrounding it effectively prevents the development of impact sound bridges. The basic plate is used for floor heating installations situated above heated rooms. Its heat insulation exceeds the value of 0.75 m² K/W, prescribed by EN 1264. The total height of the installation including screed is approx. 94 mm.

**Compact 45**

According to DIN/EN 1264 part 4, a minimum heat conduction resistance of the insulation layer of 1.25 m² K/W has to be planned for, above unheated rooms or rooms in contact with the ground. For such rooms the system plate Compact 45 can be used. The total height of the screed is of 108 mm. For rooms above extremely low outside ambient air, ie. Below - 7 °C a minimum heat conduction resistance of 2.0 m² K/W is required.

If the Compact 45 is used, it has to be installed with an additional insulation of 30 mm insulation layer (W LG040). The total installation height including the screed is of 138 mm.

**Mono 15**

The Mono 15 plate is a polystyrene nap plate with reduced installation height due to the absence of a impact sound insulation layer. The Mono 15 plate is used whenever there is little room under the floor, as in refurbishing older buildings. The installation height is approx. 79 mm with normal screed. With the special screed additive Estrotherm S, the total installation height can be reduced by approx. 15 mm.

**Protect-System plates**

The Protect-System plates are made of two shells. The heat and impact sound insulation consists of polystyrene as well as the naps. The upper covering lay is made of moulded grey polystyrol. The polystyrol covering lay sticks out at one length and one width side, so that the next system plates are overlapping. It therefore makes a single homogenous polystyrene layer suitable for even the thinnest flowing screeds. Due to the nap structure of the Protect-System plates the tubes can be installed rectangular in the tube dimensions 75, 150, 225 and 300 mm. In diagonal installation the tube distances are of 55, 110, 165, 220 and 275 mm. No additional fixing elements are necessary.

**Protect-Integral 33-3**

A patented fabrication process makes it possible to manufacture two foam layers of varying density in a single operation. The impact sound insulation level required by DIN 4109 is reached with the lower soft foam layer. The Protect-Integral 33-3 is used for underfloor heating installations against heated rooms, the heat insulation corresponds to EN 1264 prescribed value of 0.75 m² K/W. The total installation height including the screed is of approx. 94 mm.

**Protect 10**

Polystyrene nap plate with reduced installation height without sound impact insulation. The Protect 10 is used preferable there where very low installation height are required, for example in renovations. With normal screed the total installation height is of approx. 74 mm. With the special screed addition Estrotherm S the total installation height can be reduced for approximately 15 mm.

Please note resistances quoted are to comply with local building standards and regulations.
**Wall Insulation Strip**

The screed of floor heating should be laid in a floating manner, as fixed connections with the solidium should be avoided. For this reason, all structural parts protruding upwards are fully surrounded with wall insulation strip. This gives the screed the freedom of movement it needs and aids in insulating it from the solidium. The wall insulation strip of type RDS has a PE-foil welded to it. This foil prevents acoustic bridges by covering the joints at the edges of the strip. The wall insulation strips should always be fastened under the PE-foil with the included nails or with clamps. Wall insulation strip, made of an 8 mm thick layer of PE-foam, should only be laid in areas where the system plate is also laid. Additional insulation plates are laid directly onto the surrounding walls without an underlying wall insulation strip, and then the wall insulation strip is laid on top of them.

**Technical Data**

<table>
<thead>
<tr>
<th></th>
<th>RDS-FP</th>
<th>RDS</th>
<th>RDS-F</th>
<th>DFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>material</td>
<td>PE-foam</td>
<td>PE-foam</td>
<td>PE-foam</td>
<td>cardboard</td>
</tr>
<tr>
<td>thickness</td>
<td>10 mm</td>
<td>8 mm</td>
<td>10 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>height</td>
<td>150 mm</td>
<td>150 mm</td>
<td>150 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>joint covering</td>
<td>Seal cord/ PE-foil</td>
<td>PE-foil</td>
<td>adhesive film/ PE-foil</td>
<td>-</td>
</tr>
<tr>
<td>compressibility</td>
<td>to 2 mm</td>
<td>to 2 mm</td>
<td>to 2 mm</td>
<td>to 2 mm</td>
</tr>
<tr>
<td>packing unit</td>
<td>25 lf㎡</td>
<td>25 lf㎡</td>
<td>25 lf㎡</td>
<td>25 pieces x 1 m</td>
</tr>
<tr>
<td>order no.</td>
<td>17 11 26</td>
<td>17 11 01</td>
<td>17 11 07</td>
<td>17 11 08</td>
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</tbody>
</table>

**Wall Insulation Strip for Free-flowing Screed**

Type RDS wall insulation strip is used with slightly moist screeds (cement or anhydride). For free-flowing screeds, type RDS-F wall insulation strip with adhesive film and extra foil is used. A special extending joint profile of type DFP is used for areas with extending joints, near doorways, etc. The joint profile is made of waxed cardboard and can be stuck directly onto the naps with its adhesive film.

Using a flow screed you should pay attention to the joint at the border range. Generally with the protect plate it is used a wall insulation strip Type RDS-FP. Due to the attached seal cord the PE foil can be fixed additionally, for avoiding an introducing of screed into the border range.

With free-flowing screed, special sealing measures must be taken, e.g. mounting foam, to prevent the screed from flowing through the profile.
Basis-Integral 33-3:
Installation on ceilings against heated rooms
Requirements according to EN 1264-4: $R_a, \text{ins} = 0.75 \, \text{m}^2 \, \text{k/W}$, Reg. No. 7 F 029

Protect-Integral 33-3:
Installation on ceilings against heated rooms
(Rooms with similar utilization)
Requirements according to EN 1264-4: $R_a, \text{ins} = 0.75 \, \text{m}^2 \, \text{k/W}$, Reg. No. 7 F 029

Mono 15 with additional insulation made by the construction side PST 17/15, WLG 045:
Installation on ceilings against heated rooms
(Rooms with similar utilization)
Requirements according to EN 1264-4: $R_a, \text{ins} = 0.75 \, \text{m}^2 \, \text{k/W}$, Reg. No. 7 F 029

Compact 45:
Installation on ceilings against unheated rooms and ground
Requirements according to EN 1264-4: $R_a, \text{ins} = 1.25 \, \text{m}^2 \, \text{k/W}$, Reg. No. 7 F 029

Basis-Integral 33-3 with additional insulation PS 20 SE, WLG 040, made by the construction side:
Installation on ceilings against heated rooms
Requirements according to EN 1264-4: $R_a, \text{ins} = 0.75 \, \text{m}^2 \, \text{k/W}$, Reg. No. 7 F 029

These constructions are a recommendation of EN 1264 T4 and can be used for buildings, which meet with the requirements of the maximum year-primary energy requirements according to EnEV. Buildings which are not built according to the EnEV, there is demanded a separate prove according to DIN 4108-6.

Note: Local building standards and regulations must be taken into account when selecting insulation thicknesses.
Protect-Integral 33-3 with additional insulation PS 20 SE, WLG 040, made by the construction side:
Installation on ceilings against unheated rooms and grounds
Requirements according to EN 1264-4: $R_{eq, \text{ins}} = 1.25 \text{ m}^2 \text{ K/W}$, Reg. No. 7 F 029

Mono 15 with additional insulation PS 20 SE, WLG 035, made by construction side:
Installation on ceilings against unheated rooms and grounds
Requirements according to EN 1264-4: $R_{eq, \text{ins}} = 1.25 \text{ m}^2 \text{ K/W}$, Reg. No. 7 F 029

Protect 10 with additional ceiling PS 20 SE, WLG 040, made by construction side:
Installation on ceilings against unheated rooms and grounds
Requirements according to EN 1264-4: $R_{eq, \text{ins}} = 1.25 \text{ m}^2 \text{ K/W}$, Reg. No. 7 F 029

Basis-Integral 33-3 with additional insulation PS 20 SE, WLG 040, made by construction side:
Installation on ceilings against rooms with not similar utilization
Requirements according to DIN EN 1264-4: $R_{eq, \text{ins}} = 1.25 \text{ m}^2 \text{ K/W}$, Reg. No. 7 F 029

Mono 15:
Very low floor installation (for example for rehabilitation)
According to DIN EN 1264-4 additional insulation necessary
Cement screed special type with Estrotherm S ZE 30*: 30 mm above tube
DIN EN 7 F 030

Protect 10:
Very low floor installation (for example for rehabilitation)
According to EN 1264-4 additional insulation necessary

* Traffic loads till 1.5 KN/m² (for example living-rooms)
  For traffic loads till 5 KN/m² bigger screed covering are needed:
  - Standard type (ZE 20/5 KN/m²): 65 mm above tube
  - Special type with Estrotherm S (ZE 30/5 KN/m²): 50 mm above tube

These constructions are a recommendation of EN 1264 T4 and can be used for buildings, which meet with the requirements of the maximum year-primary energy requirements according to EnEV. Buildings which are not built according to the EnEV, there is demanded a separate prove according to DIN 4108-6.

Note: Local building standards and regulations must be taken into account when selecting insulation thicknesses.
Contractors and building renovators are often confronted with the choice between a conventional "wet" floor heating system with cement, anhydrite, or free-flowing screed or a dry floor heating installation.

In comparison to the wet system, ROTEX System 70 secco offers a wide range of advantages:

- secco is ideal for adding a floor heating system to an existing building
- secco is installed without the use of water
- because of this, the otherwise necessary drying period is avoided (up to 40 days)
- water need not be carried into the building
- for this reason, secco is ideal for all dry constructed buildings, such as houses made of wood or prefabricated houses
- floor coverings may be laid immediately after the Fermacell dry elements have been applied
- secco has a drastically reduced surface weight (approx. 30 kg/m²); this helps relieve the burden on the ceiling construction (the wet system weighs approx. 130 kg/m²)
- the heat capacity of secco is much lower, leading to a significantly lower level of inertia
- secco uses the same system plates as the ROTEX wet screed system and is consequently more compatible with other systems
- radiator connection lines may be laid directly in the system plates

Functioning Principle

In installing ROTEX System 70 secco, the first step is to apply wall insulation strip to all rising structures, such as walls. Then, the system plates are laid in compliance with heat insulation requirements. ROTEX conducting elements made of galvanised sheet steel are pressed into the polystyrene plates directly after the first row of system plates has been laid. This procedure has the advantage of ensuring that the naps on the system plates are not damaged by accident, thus guaranteeing an optimal surface for the application of the conducting elements. For the same reason, areas with heavy foot traffic, such as corridors, should be worked on last, just before the heating pipes are laid. The elements are shipped in two lengths, 1200 mm and 400 mm. The smaller pieces shipped together with the longer ones make it possible to cover the entire area. There must, however, be a recess of at least 22 cm near the two terminal loops. All connection lines for the heating circuits as well as those for the heating circuit distributors should be placed in their respective casing in the elements or at least in the system plate. Parts of surfaces without conducting elements are covered up with smooth steel plates after the pipes have been laid.

The conducting elements should be spaced at a distance of 75 mm from each other. The established spacing of 150, 225, and 300 mm can thus be realised. It is best to lay the pipes in a meandering fashion. For the load distribution and sub layer, we use exclusively dry screed element of type 2 E 22, made by Fels Werke (Fermacell). The screed elements consist of two 12.5 mm thick plaster plates stuck to each other. They are pasted to the side walls and screwed in using the tongue and groove procedure. The floor covering may be laid on top of these plates immediately after they have been laid. Virtually any floor covering acceptable for floor heating may be used, however, any restrictions on floor coverings and installation guidelines recommended by Fels Werke should be kept in mind and adhered to unconditionally.

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Conducting Element WLE 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>width</td>
<td>372 mm</td>
</tr>
<tr>
<td>length</td>
<td>1200 mm</td>
</tr>
<tr>
<td>thickness</td>
<td>0,5 mm</td>
</tr>
<tr>
<td>material</td>
<td>galvanised sheet steel</td>
</tr>
<tr>
<td>packing unit</td>
<td>5,35 m²</td>
</tr>
<tr>
<td>package contents</td>
<td>8 1200 mm long WLE pieces</td>
</tr>
<tr>
<td>heating pipe</td>
<td>DUO 17/12 x 2 mm (17 x 2 mm not acceptable)</td>
</tr>
<tr>
<td>order no.</td>
<td>171113</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROTEX System plate</th>
<th>Permitted lumped load</th>
<th>Field of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono 15</td>
<td>1.5 kN</td>
<td>1 + 2</td>
</tr>
<tr>
<td>Compact 45</td>
<td>1.5 kN</td>
<td>1 + 2</td>
</tr>
<tr>
<td>Basis-Integral 33-3</td>
<td>1.0 kN</td>
<td>1</td>
</tr>
</tbody>
</table>

The permitted lumped load (≥ 10 cm²) are allowed to be installed in a distance of at least 50 cm. Distance to the corner ≥ 25 cm or loading area ≥ 100 cm². The sum of the lumped load is not permitted to exceed the max. admitted ceiling loading capacity.

The field of application 1 consists of living rooms, halls and attics in residential premises, the utilization range 2 offices, halls and attics in office buildings, sale-rooms up to 50 cm² basic area in residential premises.
**Mono 15:**
Installation on ceilings against heated rooms
(Rooms with similar application)
Requirements according to DIN EN 1264-4: $\omega = 0.75 \text{ m}^2 \text{ k/W}$, Reg. No. 7 F 036

**Basis-Integral 33-3:**
Installation on ceilings against rooms with similar application
Requirements according to DIN EN 1264-4: $\omega = 0.75 \text{ m}^2 \text{ k/W}$, Reg. No. 7 F 036

**Compact 45:**
Installation on ceilings against unheated rooms and ground.
Requirements according to DIN EN 1264-4: $\omega = 1.25 \text{ m}^2 \text{ k/W}$, Reg. No. 7 F 036

---

**Important Remarks:**
- the underlying ground must be completely level
- the floor may not be laid with electric lines and pipes

**Fermacell recommends:**
- to correct for uneven surfaces, only use Fermacell leveling product or a bound product
- a moisture seal against residual moisture is usually necessary
- PUR insulation material and PS 20 polystyrene must not be used

**Maximum insulation thickness, including ROTEX system plates, are:**
- with PS 30 polystyrene: max. 90 mm
- with extruded hard foam, e.g. styrodur: max. 120 mm

**Load**

<table>
<thead>
<tr>
<th>ROTEX System plate</th>
<th>Admitted lumped load</th>
<th>Field of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono 15</td>
<td>1.5 kN</td>
<td>1 + 2</td>
</tr>
<tr>
<td>Compact 45</td>
<td>1.5 kN</td>
<td>1 + 2</td>
</tr>
<tr>
<td>Basis-Integral 33-3</td>
<td>1.0 kN</td>
<td>1</td>
</tr>
</tbody>
</table>

Die admitted lumped load ($\geq 10 \text{ cm}^2$) are allowed to be installed in a distance of at least 50 cm. Distance to the corner $\geq 25 \text{ cm}$ or loading area $\geq 100 \text{ cm}^2$. The sum of the lumped load is not permitted to exceed the max. admitted ceiling loading capacity.

The field of application 1 consists of living rooms, halls and attics in residential premises, the field of application 2 offices, halls and attics in office buildings, sale-rooms till 50 cm² basic area in residential premises.

1. Load-bearing floor
2. Wall
3. Plaster
4. Wall insulation strip
5. Fermacell screed element 2 E 22 (2 x 12.5 mm)
6. Conduction element
7. DUO 17 AL/12 x 2 DD heating pipe
8. Mono 15
9. Basis-Integral 33-3
10. Compact 45
11. Additional insulation plate: 20 mm of extruded hard foam
12. Adhesive
13. Floor covering
14. Elastic joint
15. Skirting-board
16. Sealing layer in compliance with DIN 18195
16a Moisture seal against residual moisture in the installation, e.g. 0.2 mm PE-foil

**Note:** Local building standards and regulations must be taken into account when selecting insulation thicknesses.

These constructions are a recommendation of EN 1264 T4 and can be used for buildings, which meet with the requirements of the maximum year-primary energy requirements according to EnEV. Buildings which are not built according to the EnEV, there is demanded a separate prove according to DIN 4108-6.
The most important component of a floor heating system is the heating pipe. ROTEX is one of the leading manufacturers of PE-Xc pipes and has the experience of many millions of metres of pipe for floor heating systems. Surface heating pipes must be built to withstand a 50 year service life and designed with the following considerations in mind:

1. very good marks on long-term internal pressure tests, i.e. outstanding prospects for longevity
2. high operational loading capacity (able to be loaded to 10 bar at temperatures of 95 °C for short periods of time)
3. good thermal ageing stability
4. resistance against crack formation due to stress
5. chemical resistance, i.e. resistance against any additives potentially in the heating water, such as surface tension lowering agents and inhibitors
6. cold-installable without filling up with water, even with relatively tight bending radii
7. corrosion resistance
8. low pressure loss, no incrustations
9. high resistance to crack formation and abrasion, especially important for potentially rough handling at building sites
10. high impact resistance, especially cold impact resistance
11. quality assessment of pipe quality by way of self and independent monitoring

The requirements for PE-X heating pipes in DIN 16 892 and DIN 4726/4729 are fulfilled and even exceeded on many points.

The basic material is Lupolen, a high-performance polyethylene made by BASF which incorporates special additives to improve heat stabilisation.

The irradiation crosslinking procedure employed for the ROTEX DUO heating pipe has proved its merits in many years of experience. The PE pipe is first manufactured in the extrusion procedure and then exposed to the high energy of fast electrons in an electron accelerator during the crosslinking procedure. Linear molecule chains of the polyethylene are connected to a special network in this process. In this way, the thermal, chemical, and mechanical characteristics of the base material are improved significantly. Crosslinking by irradiation is a continuous crosslinking procedure. This guarantees a uniform crosslinking on the entire pipe.

All DUO pipes are tested in compliance with DIN 4726/29 reg. no. 3V216PE-Xc. The requirements concerning air-tightness according to DIN 4726 are exceeded by a large margin. The DUO pipe has an oxygen penetrability of only 1/10th of the maximum penetrability allowed of synthetic pipes in DIN 4726.

The amount of oxygen which seeps through the walls of the pipe is negligible and may thus be practically ignored. There is no possibility of corrosion on the iron components of the unit as a result of this factor.
Technical Data

<table>
<thead>
<tr>
<th></th>
<th>DUO 17 AL</th>
<th>HKflex 14 AL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>field of application</strong></td>
<td>floor heating and radiator connection</td>
<td>radiator connection</td>
</tr>
<tr>
<td><strong>outer pipe in mm</strong></td>
<td>17,5</td>
<td>21</td>
</tr>
<tr>
<td><strong>inner pipe in mm</strong></td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td><strong>pipe wall thickness of PE-Xc inner pipe in mm</strong></td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>thickness of entire pipe wall in mm</strong></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>material of PE-Xc basic pipe</strong></td>
<td>PE-Xc basic pipe aluminium/PE</td>
<td>PE-Xc basic pipe aluminium/PE</td>
</tr>
<tr>
<td><strong>anti-oxygen barrier</strong></td>
<td>Laser-welded aluminium coating</td>
<td>Laser-welded aluminium coating</td>
</tr>
<tr>
<td><strong>max. allowed temperature strain</strong></td>
<td>90 °C</td>
<td>90 °C</td>
</tr>
<tr>
<td><strong>short-term temperature strain</strong></td>
<td>110 °C</td>
<td>110 °C</td>
</tr>
<tr>
<td><strong>max. operating pressure</strong></td>
<td>7 bar</td>
<td>7 bar</td>
</tr>
<tr>
<td><strong>water content</strong></td>
<td>0.05 l/m</td>
<td>0.08 l/m</td>
</tr>
<tr>
<td><strong>min. bending radius</strong></td>
<td>60 mm or 30 mm with a bending tool</td>
<td>70 mm or 30 mm with a bending tool</td>
</tr>
<tr>
<td><strong>longitudinal expansion coefficient</strong></td>
<td>max 0.03 mm/mK</td>
<td>max 0.03 mm/mK</td>
</tr>
<tr>
<td><strong>packing unit</strong></td>
<td>120/240 m</td>
<td>75 m</td>
</tr>
<tr>
<td><strong>order no.</strong></td>
<td>17 06 01/17 06 02</td>
<td>17 06 07</td>
</tr>
</tbody>
</table>

Bending Characteristics

One of the most important advantages of this generation of pipes is flexibility. DUO 17 AL and HKflex 14 AL heating pipe can be bent by hand without a tool and remains indefinitely in this form. This facilitates the pipe laying process during the connection of the radiator. An important criterion for radiator connection is a unified shaping and appearance of the pipes connected to the radiator. With the help of a bending tool, this wish can be easily fulfilled.

The minimum bending radii are:
- 60 mm or 70 mm without bending tool
- 30 mm with bending tool

The DUO 17 AL and HKflex 14 AL thus allow you to dispense with many expensive fittings, elbows, and fixtures.

Stability against Outdoor Influences

High-energy short-wave UV rays cause many synthetic materials to age quickly. The aluminium coating protects the AL basic pipe against UV rays for the long-term. The PE protective coating also protects the heating pipe. This protective coating is UV efficiently stabilised with special additives in order to prevent premature ageing. Additionally, the aluminium coating protects it against external influences in exposed areas. The outer pipe (helically wound pipe or corrugated pipe) provides the pipe optimal protection from all hazards in the screed or in the wall.

Expansion Characteristics

One major advantage of an aluminium coating over synthetic material is lower heat expansion.

The AL heating pipe has a maximum thermal expansion coefficient of 0.03 mm/mK. Changes of length due to differing operating temperatures are thus not possible when this pipe is used for floor heating, as the heating pipe is completely enclosed by screed.

The same goes for the connection of radiators, as when, for example, the heating pipe is cast directly in the screed.

Even if the heating pipe is laid in a corrugated pipe or insulating hose there is no danger of negative effects due to the extremely low expansion coefficient. Moreover, you may eliminate all risks by simply laying the radiator connection lines at right angles in at least three places.
**Description**

The complete heating circuit distributor consists of the flow header, the return header, and 2 mounting components. The flow and return legs of the distributor are built as modules. Clients may thus choose between distributor sizes from 2 to 14 heating circuits. The synthetic materials used to fabricate the distributor cause no corrosion problems.

The flow modules are generally equipped with a stop valve. A protecting cap, installed at the factory, effectively prevents mechanical damage to the external thread. By screwing in the protecting cap completely, the heating circuit can be shut off without changing the water level of the return valve.

By removing the protecting cap and screwing in the SAT 5 actuator, each heating circuit may be set to electronic individual room control (prescribed by the heating unit regulations of 06/94).

Fine tuning valves are built into the return module to enable a precise adjustment of the heating water level. Locking ring sets are available for the connection of all common heating circuit pipes.

**The QuickFix System**

The QuickFix system was developed to facilitate the installation of the heating circuit distributor in the wall installation case WIC or the wall surface case WSC.

**The major advantages of QuickFix are:**

- quick and easy installation of the HCD in a wall installation case or a wall surface case
- adjustable beams
- lateral movement of the HCD for installation of the main connections is possible
- guiding and fastening of the heating pipes

**Installation Procedure:**

1. **installation of the cross joint and the ball valve**
2. place the HCD on the lower rail of the WIC / WSC
3. press the distributor onto the back wall of the case
4. to bolt the HCD, apply pressure to the snap-in pin and pull the clamp holder upwards

---

**Technical Data**

<table>
<thead>
<tr>
<th>HCD QuickFix</th>
<th><strong>number of heating circuits</strong></th>
<th>2 – 14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>spacing of pipe connections</strong></td>
<td>63 mm</td>
<td></td>
</tr>
<tr>
<td><strong>forward / return main connection</strong></td>
<td>R 1” inside</td>
<td></td>
</tr>
<tr>
<td><strong>max. water flow</strong></td>
<td>1600 l/h</td>
<td></td>
</tr>
<tr>
<td><strong>max. operating pressure</strong></td>
<td>6 bar</td>
<td></td>
</tr>
<tr>
<td><strong>max. allowed water temperature</strong></td>
<td>90 °C</td>
<td></td>
</tr>
<tr>
<td><strong>return tuning valve</strong></td>
<td>16 throttle levels</td>
<td></td>
</tr>
<tr>
<td><strong>possible pipe connections</strong></td>
<td>12, 14, 17 und 18 mm</td>
<td></td>
</tr>
<tr>
<td><strong>heating circuit module material</strong></td>
<td>hot-water resistant polyamide</td>
<td></td>
</tr>
<tr>
<td><strong>insulation measures</strong></td>
<td>rubber mounting</td>
<td></td>
</tr>
<tr>
<td><strong>order no.</strong></td>
<td>17 25 02 to 17 25 14</td>
<td></td>
</tr>
</tbody>
</table>

**Heating Circuit Distributor Measurements, (in mm)**

<table>
<thead>
<tr>
<th><strong>number of heating circuits</strong></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>measurement of distributor</strong></td>
<td>315</td>
<td>380</td>
<td>445</td>
<td>510</td>
<td>570</td>
<td>635</td>
<td>700</td>
<td>760</td>
<td>820</td>
<td>890</td>
<td>950</td>
<td>1020</td>
<td>1080</td>
</tr>
<tr>
<td><strong>measurement of distributor</strong></td>
<td>175</td>
<td>240</td>
<td>305</td>
<td>370</td>
<td>430</td>
<td>495</td>
<td>560</td>
<td>620</td>
<td>680</td>
<td>750</td>
<td>810</td>
<td>880</td>
<td>940</td>
</tr>
</tbody>
</table>
To install the heating circuit distributor HCD in rooms of different dimensions, wall installation case type WIC is available in 4 different lengths. The WIC consists of 1 mm of galvanised sheet steel. The door and the outer frame are powder coated in RAL 9010 white fine structure. It is placed directly on the bare floor and plastered into the distributor niche. The case is adjustable from a height of 670 to 740 mm and can be pulled out. The WIC requires an installation depth of at least 120 mm so that there is room for the electronic individual room control system.

### Wall Installation Case Dimensions

<table>
<thead>
<tr>
<th>Typ</th>
<th>WIC 05</th>
<th>WIC 10</th>
<th>WIC 15</th>
<th>WIC 20</th>
<th>WIC 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>measurements in mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>width W</td>
<td>495</td>
<td>700</td>
<td>850</td>
<td>1150</td>
<td>1450</td>
</tr>
<tr>
<td>depth D</td>
<td>110 - 170</td>
<td>110 - 170</td>
<td>110 - 170</td>
<td>110 - 170</td>
<td>110 - 170</td>
</tr>
<tr>
<td>frame width Fw</td>
<td>525</td>
<td>750</td>
<td>900</td>
<td>1200</td>
<td>1500</td>
</tr>
<tr>
<td>frame height Fh</td>
<td>495</td>
<td>495</td>
<td>495</td>
<td>495</td>
<td>495</td>
</tr>
<tr>
<td>frame depth Fd</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>door height Dh</td>
<td>435</td>
<td>435</td>
<td>435</td>
<td>435</td>
<td>435</td>
</tr>
<tr>
<td>door width Dw</td>
<td>465</td>
<td>692</td>
<td>842</td>
<td>1142</td>
<td>1442</td>
</tr>
<tr>
<td>height of niche</td>
<td>700 - 770</td>
<td>700 - 770</td>
<td>700 - 770</td>
<td>700 - 770</td>
<td>700 - 770</td>
</tr>
<tr>
<td>width of niche</td>
<td>505</td>
<td>710</td>
<td>860</td>
<td>1160</td>
<td>1460</td>
</tr>
<tr>
<td>max. no. of heating circuits-</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>with cross joint and ball valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. no. of heating circuits</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>with cross joint and ball valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and WMZ level and vertical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>order no.</td>
<td>17 72 05</td>
<td>17 72 10</td>
<td>17 72 15</td>
<td>17 72 20</td>
<td>17 72 25</td>
</tr>
</tbody>
</table>

**QuickFix:** Fasten the heating circuit distributor in the blink of an eye

**Binding the Heating Pipes in the Case**

When laying the pipes, make sure the pipes are not placed too tightly in the case. By way of generous bending it is possible to bind both heating pipes to the lower clamp row with the included plastic bands after connecting the flow and return.
If your heating circuit is installed directly on the surface of the wall, the wall surface case WSC is the ideal casing solution. First, a rear plate with distributor and pipe fixtures is installed on the wall. Then, the distributor is assembled and connected to the plate. Primary flow and return connections can be brought in by drilling the casing at either side or top, or by feeding from below. (Carried out on site by appointed mechanical contractor). Finally, the floor heating is installed and the screed is applied. Not until the end of the installation process is the white fine structure powder coated frame in RAL 9010 screwed onto the rear plate to prevent scratches or other damage to the distributor.

Wall Surface Case Dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>WSC 110</th>
<th>WSC 115</th>
<th>WSC 120</th>
<th>WSC 125</th>
</tr>
</thead>
<tbody>
<tr>
<td>measurements in mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>height H (mm)</td>
<td>665</td>
<td>665</td>
<td>665</td>
<td>665</td>
</tr>
<tr>
<td>width W (mm)</td>
<td>750</td>
<td>900</td>
<td>1200</td>
<td>1500</td>
</tr>
<tr>
<td>depth D (mm)</td>
<td>128</td>
<td>128</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>door height Dh (mm)</td>
<td>468</td>
<td>468</td>
<td>468</td>
<td>468</td>
</tr>
<tr>
<td>door width Dw (mm)</td>
<td>725</td>
<td>875</td>
<td>1175</td>
<td>1475</td>
</tr>
<tr>
<td>door depth Dd (mm)</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>max. no. of heating circuits with cross joint and ball valve</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>–</td>
</tr>
<tr>
<td>max. no. of heating circuits with cross joint and ball valve and heat meter W/MZ level and vertical order no.</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>order no.</td>
<td>17 41 10</td>
<td>17 41 15</td>
<td>17 41 20</td>
<td>17 41 25</td>
</tr>
</tbody>
</table>

It is generally best to avoid large bundles of heating pipes in front of the distributor. Some of the pipes may be placed in back under the wall. To avoid local overheating, the heating pipes should be covered with protective pipe (corrugated pipe) in the vicinity of the connection area.
Electronic Individual Room Control System

With the help of an electronic individual room control system, users can regulate the temperature individually in each room. In addition to the warmth output of the actual heating surfaces, the room temperature control system also takes all other heat sources into account, such as sunshine, warmth from lights or people, and other sources of warmth, such as a fireplace or a tiled stove. On the basis of a continuous comparison of the target and current temperatures, the room temperature control system opens and closes the individual heating circuits by way of electrical actuators.

For floor heating, this open/close control system is markedly superior to a continuous control system because it is the prerequisite for a even distribution of warmth in the room to be heated.

Room temperature control systems are not only a requirement for floor heating systems according to current heating system regulations, they are also a practical necessity. A noticeable increase in comfort and energy savings are strong arguments for a room temperature control system. The sluggishness typically associated with floor heating by the layman is often the result of negative experiences with floor heating systems without room temperature control.

The most important components of the control system are:
- heating circuit distributor
- actuators
- room temperature control system
- cable strip terminal

We offer two installation variants:
- cable-bound individual room control system 230 V
- radio-controlled individual room control system (wireless)

SAT 5 actuators are used in both variants, necessitating a 230 V electrical connection on the heating circuit distributor. In this way, not only can rooms with only floor heating be regulated, rooms with a combination of floor heating and radiators can also be regulated with a single shared temperature control system.

SAT Actuator
The installation of the actuator on the flow valve of the HCD is performed in the following four steps:
1. open forward flow valve fully (screw off red protecting cap)
2. screw on actuator adapter
3. plug in actuator
4. power connection on cable strip terminal

Attention: the HCD and the actuator must be installed in a vertical position (flow beam facing down). In addition, the room temperature control system and the actuator must be installed in the same space (there is no designated space for all heating circuits).

Room Temperature Control System (with Cables)
With the cabled variant, the calculation of room temperature occurs over the room temperature detectors RTR 4 and RTZ 1.

The room temperature detector RTR 4 is used for normal individual room regulation. The night setback is controlled by the weather dependent flow temperature control system (by others).

The RTR 4 is equipped with a thermal feedback which serves to make sure that there is no danger of the room temperature rising too high or falling too low. A permanent deviation from the settings is also avoided. This means that the RTR 4 is capable of reproducing the set room temperature level and holding it there for an extended period of time.

The correct installation of the control system is integral to ensure that it functions correctly.

When installing the control system, you must make sure that factors such as sunshine, other sources of warmth, or drafts cannot influence the system. Corners without circulation are not suitable either.

Ideal installation height: approx. 1-1.5 m above floor level

The functioning of the room temperature control system with the RTZ 1 time switch clock is the same as with the RTR 4.

Due to an integrated time switch clock with daily programs, a lowering at specified times in one or several rooms is possible.

Technical Data

<table>
<thead>
<tr>
<th>Description</th>
<th>SAT 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>operating voltage</td>
<td>230 V AC</td>
</tr>
<tr>
<td>regulating distance</td>
<td>approx. 3 mm</td>
</tr>
<tr>
<td>regulating time</td>
<td>approx. 3 min.</td>
</tr>
<tr>
<td>regulating power</td>
<td>90 N</td>
</tr>
<tr>
<td>operating output</td>
<td>2 W</td>
</tr>
<tr>
<td>connection line</td>
<td>1 m</td>
</tr>
<tr>
<td>excess-voltage protection</td>
<td>by varistor</td>
</tr>
<tr>
<td>relay direction</td>
<td>closed without current</td>
</tr>
<tr>
<td>installation height</td>
<td>47 mm</td>
</tr>
<tr>
<td>diameter</td>
<td>43 mm</td>
</tr>
<tr>
<td>order no.</td>
<td>175110</td>
</tr>
</tbody>
</table>
With the help of the cable strip terminal CST, which can be installed over the HCD, a perfect electrical wiring of the cabled variant of the individual room control system can be realised.

### Technical Data RTR 4 RTZ 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RTR 4</th>
<th>RTZ 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>230 V AC 50/60 Hz</td>
<td>230 V AC 50/60 Hz</td>
</tr>
<tr>
<td>Connection Line</td>
<td>4x1.5</td>
<td>5x1.5</td>
</tr>
<tr>
<td>Switching Current</td>
<td>10 A</td>
<td>4 A</td>
</tr>
<tr>
<td>Max. No. of Actuators</td>
<td>10 pcs/RTR</td>
<td>10 pcs/RTZ 1</td>
</tr>
<tr>
<td>Range of Temp. Control</td>
<td>5 °C - 30 °C</td>
<td>5 °C - 30 °C</td>
</tr>
<tr>
<td>Switching Temp. Difference</td>
<td>approx. 0.5 K</td>
<td>constant</td>
</tr>
<tr>
<td>Lowering Voltage</td>
<td>approx. 5 K (by external time switch clock)</td>
<td>2–7 K</td>
</tr>
<tr>
<td>Control Accuracy</td>
<td>thermal feedback</td>
<td>constant</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>75 x 75 x 27</td>
<td>160 x 80 x 36</td>
</tr>
<tr>
<td>Colour</td>
<td>white</td>
<td>white</td>
</tr>
<tr>
<td>Order No.</td>
<td>175111</td>
<td>175112</td>
</tr>
</tbody>
</table>

### Technical Data KKL-1 KKL-2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>KKL-1</th>
<th>KKL-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>230 V AC</td>
<td>230 V AC</td>
</tr>
<tr>
<td>Fuse</td>
<td>T 4 AH</td>
<td>T 4 AH</td>
</tr>
<tr>
<td>Connection</td>
<td>3 x 1.5</td>
<td>3 x 1.5</td>
</tr>
<tr>
<td>Overload Protection</td>
<td>50 W</td>
<td>50 W</td>
</tr>
<tr>
<td>together with basic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. No. of Actuators</td>
<td>14 pcs</td>
<td>8 pcs</td>
</tr>
<tr>
<td>Max. No. of RTR, RTZ 1</td>
<td>6 pcs</td>
<td>2 pcs</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>238 x 75 x 70</td>
<td>88 x 75 x 70</td>
</tr>
<tr>
<td>Order No.</td>
<td>175131</td>
<td>175132</td>
</tr>
</tbody>
</table>

Also using the expansions of the basic clamping ledge KKL-1 through the expanded clamping ledge KKL-2, it is not allowed to overstep the max. number of 14 actuators.
Radio-Controlled Individual Room Control System

The major advantage of the radio-controlled individual room control system is that there is no need for connection cables from the room temperature control system to the actuator. The unproblematic repositioning of the control system when changes are made to a room is also an advantage. Every radio-controlled room control system needs its own radio channel. Depending on your needs, the system can either use a single channel variant or one with 1 to 4 channels. For both variants, however, the same radio-control system (FRT) is used.

Radio-Control System FRT

FRT runs on batteries and is a 1 channel transmitter with a low operation mode. A distinguishing feature of the system is its ease of use.

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>FRT</th>
<th>FEM 1 Receiver</th>
<th>FEM 4 Receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>operating voltage</td>
<td>2 x 1.5 V battery</td>
<td>230 V AC</td>
<td>230 V AC</td>
</tr>
<tr>
<td>operation lifetime</td>
<td>approx. 3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>control process</td>
<td>constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>measurement interval</td>
<td>approx. 10 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>switch</td>
<td>day / night / off / heat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>low operation</td>
<td>with switch 2 or 4 K (over bridge)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>carrier frequency</td>
<td>433.92 M HZ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>modulation type</td>
<td>FM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>antenna</td>
<td>internal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>transmission interval</td>
<td>&lt;10 min. (data are sent multiple times)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>range</td>
<td>100 m unobstructed or 2 floors or 3 walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dimensions (L x W x H)</td>
<td>75 x 75 x 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>colour</td>
<td>white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>order no.</td>
<td>17 51 20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ideally, the receiver (FEM 1 or FEM 4) is installed in the distributor case above the HCD. The only requirement is a 230 V-AC power connection.

If more than one actuators are connected parallel to one another, they can be wired with binding posts to the FEM 1. The FEM 4 has its own integrated strip terminal.

Wireless Control System
Radiator Connection

With System 70 the radiators are connected to a central distributor on each floor. As for the heating pipes, the DUO 17 AL is used for a radiator output of up to 2.5 kW and the HKflex 14 AL is used for a higher output. The modern star-shaped arrangement we use for the connection leads to a largely hydraulic decoupling of the various heating surfaces, thus raising the operational safety and the control performance of the thermostat valves.

On floors where only radiators are installed the system plates need not be used, and the DUO pipe used to connect the radiators may be installed directly on the bare floor as long as the corresponding insulation regulations are adhered to.

System 70 may be used with practically any type of radiator connection commonly used today. Connections in the floor as well as connections in the wall may be carried out without problems.

Connection from the wall can be done equilaterally, reciprocally, or with valve radiators.

With an eye to today's high standards in interior design, we developed a high quality radiator connection for System 70 which also satisfies from the perspective of design.

The water-carrying heating pipe is thus sealed directly to the valve. From the outside, only a nickel-plated metal protective pipe is visible. With this radiator connection, the radiator may also be installed directly on the wall without requiring special connections in the wall or in the screed.

---

equilateral connection in the wall

connection in the wall with a valve radiator

connection in the floor with a valve radiator
Valves

**Thermostatic Valve**

ROTEX thermostatic valves, proven in millions of installations, are used for regulating room temperature when radiators are used. ROTEX has been manufacturing thermostatic valves for over 20 years. For use with System 70, we have chosen the R 1/2" angled and the R 1/2" horizontal valve from our range.

**Valve Block**

Valve radiators can also be connected with a special valve block.

**Return Valve**

An adjustable angled return valve is used to connect the radiator return pipe. This valve requires the same wall distances as the thermostatic valve. Here as well, the heating pipe is sealed directly within the valve housing. The housing is made of chromium-plated brass. The valve adjusting screw is accessible by removing the sealed cap. It can be turned with a standard screwdriver. The total adjustment range comprises 4 full turns (for adjustment values, see page 30).

**Metal Protective Pipe**

The water-carrying heating pipe is protected from light and mechanical damage at the exposed portion near the radiator connection by a high-grade nickel-plated metal protective pipe. The metal protective pipe (with a diameter of 15 x 1 mm for DUO 17 AL pipes and 17 x 1 mm for HKflex 14 AL pipes) is shipped in lengths of 50 and 80 mm or as a 1 meter piece. The 1 meter piece may be shortened according to individual needs at the installation site.

**Rosettes**

Two types of rosette are available to cover up the wall or floor connection: a flat rosette, type FR, and a universal rosette, type UR. The universal rosette may be ordered in different diameters (for the DUO pipe or the HKflex pipe) as well as in different heights (15, 30, and 40 mm).
A pipe manifold made of nickel-plated cast brass is used as a distributor for radiator connection. This pipe manifold is shipped with either two or three connections. To install more than three radiators, the self-sealing modules may be screwed together directly.

The housing of the distributor has an R 1” outer thread and an R 1” inner thread. Each end connection has an R 3/4” outer thread with Eurokonus to seal the clamping ring screw connection MV 12 and M V 14.

A special wall installation case with a fastening bow (WIC 50/55/60) is available for the radiator distributor.

Technical Data  | HAV
--- | ---
material | cast brass
test pressure | 10 bar
main connection | R 1” outer and R 1” inner
fork seal | R 3/4” outer
fork separation | Eurokonus 50 mm
available sizes | 2 and 3 end connections
sealing | self-sealing
clamping ring sets needed | MV 12 for DUO 12 AL and M V 14 for HKflex 14 AL pipe

WIC Dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>WIC 50</th>
<th>WIC 55</th>
<th>WIC 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>install. length</td>
<td>310</td>
<td>465</td>
<td>615</td>
</tr>
<tr>
<td>install. height</td>
<td>360</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td>niche height</td>
<td>495</td>
<td>495</td>
<td>495</td>
</tr>
<tr>
<td>install. depth</td>
<td>90/140</td>
<td>90/140</td>
<td>90/140</td>
</tr>
<tr>
<td>max. no. of radiators with ball valve</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>without ball valve</td>
<td>4</td>
<td>7</td>
<td>10</td>
</tr>
</tbody>
</table>

Clamping Rings for Radiator Connection

<table>
<thead>
<tr>
<th>Technische Daten</th>
<th>for DUO 17 and DUO 17 AL pipes</th>
<th>for HKflex 14 AL pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>connection to radiator distributor HAV</td>
<td>M V 12</td>
<td>M V 14</td>
</tr>
<tr>
<td>thermostat valve</td>
<td>KS 1</td>
<td>KS 2</td>
</tr>
<tr>
<td>R ½” return valve</td>
<td>KS 1</td>
<td>KS 2</td>
</tr>
<tr>
<td>R ½” x ¾” return valve</td>
<td>KS 1</td>
<td>KS 2</td>
</tr>
<tr>
<td>valve block for valve radiators</td>
<td>VK 12</td>
<td>VK 14</td>
</tr>
</tbody>
</table>

Wall Installation Case for HAV

A special wall installation case is used to install the heating circuit distributor in the wall. The case boasts a shallow installation depth and a low installation height. With wall installation case types WIC 50-60, the HAV can even be installed in thin partition walls and plaster walls. The case is made of galvanised sheet steel and the doors and the front frame are lacquered white. The case is installed by simply placing it on the bare floor and into the distributor niches. The case is already equipped with a mounting device for the brass distributor. In addition, 2 bushings with ventilation are included.

Clamping Ring Connectors

Special clamping ring connectors were developed to connect the DUO pipe and the HK pipe to the radiator and the proper distributor. System 70 is designed in such a way that there are no connections in the screed or the wall. The heating pipes are sealed to the distributor and directly to the connection valves on the radiator.
Floor Heating Layout

This section explains the basics of the heating technological design and layout of System 70. For purposes of estimation, power levels may be taken from the attached tables. Exact values may be determined by using the capacity characteristics. The values given are based on the results of the heating technological analysis required by EN 1264 for:

- System 70 7 F 029
- System 70 secco 7 F 036
- and System 70 Industry 7 F 041

The analysis was carried out at the University of Stuttgart, IKE, Department of Heating, Ventilation, and Air Conditioning Technology, under the direction of Prof. Dr. Ing. H Bach. The main prerequisite for the installation of heating surfaces is the calculation of heating requirements as prescribed in DIN 4701.

The calculation of the heat flux density for installation was carried out in compliance with EN 1264, floor heating systems and components, part 3, heating capacity and installation.

In order to make these calculations, the average heating load QW of each room is reduced by the heat flow in the room below it Q0. This results in the corrected heat consumption of the room:

QN, f = QN – Q0

To calculate the heat flux density of an installation (qdes), this heat consumption value is divided by floor heating surface A:

qdes = QN, f / AF

Selecting the Installation Grid Dimensions

The floor covering you intend to use should be known before making these calculations. If this is not the case, a heat conduction resistance of Rth = 0.1 m² K/W may be assumed (this corresponds to a carpet of medium thickness). The capacity characteristic curves are used to select the installation grid dimensions. Starting with the largest dimensions possible, check whether the intersection of the heat flow density requirement with the characteristic curve for the floor covering chosen lies below the limiting value in dependence to the heating middle excess temperature. If this is the case, these dimensions may be used; if this is not the case, run the same test again with smaller grid dimensions, and so on. If the heat flow density requirement cannot be met with any grid dimension, an additional border zone needs to be added adjacent to any outer walls. If this does not work either, additional heating surfaces such as radiators or screed convectors must be installed in the room. If floor heating surfaces are to be covered completely by furniture, the heat flow density for this area will be reduced. As furniture arrangements are always subject to change and as the reduction in heat flow density due to furniture is usually relatively low, furniture is usually not considered in the calculations. In extreme conditions (i.e. when the furniture covers more than 50 % of the floor surface) the covered surfaces should be counted as having 50 % less capacity in the calculation.

If floor heating as well as radiators are desired, System 70 is the logical choice for a simple combination of these forms of heating.

Calculating Water Flow

For the set point obtained from the heat capacity diagram, the excess temperature ΔθH in K (Kelvin) can be read on the lower axis. Add the room temperature θ to this value to get the required median heating water temperature θm. The total thermal output QK, the water needs to produce in this heating circuit can be calculated by combining the upward thermal output Qf with that lost to the room below (Q0). Qf generally lies between 10 and 15 %. To simplify matters, 15 % is used in the calculations below.

The required water flow in this heating circuit is as follows:

Vw = \( \frac{1,15 \cdot Q_f \cdot 3600}{4180 \cdot (\theta_V - \theta_H)} \)

thus:

Vw = \( \frac{Q_f}{(\theta_V - \theta_H)} \)

Qf in W

θV – θH in K

Vw in l/h

In order to limit the total pressure loss, it is advisable to limit the length of the heating circuit piping of System 70 to 80 m. With this limit the following maximum heating circuit surfaces are obtained. The lengths of the connecting lines have been uniformly assumed to be 2 x 5 m.

<table>
<thead>
<tr>
<th>Max. Surface of Heating Circuit</th>
<th>installation grid</th>
<th>with System 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 mm</td>
<td>10,5 m²</td>
<td></td>
</tr>
<tr>
<td>225 mm</td>
<td>16,0 m²</td>
<td></td>
</tr>
<tr>
<td>300 mm</td>
<td>21,0 m²</td>
<td></td>
</tr>
<tr>
<td>375 mm</td>
<td>26,0 m²</td>
<td></td>
</tr>
</tbody>
</table>

If the floor area to be heated is larger than the limits given above, the floor area should be divided into two or more heating circuits.

Hydraulic Adjustment

The pipe length of a heating circuit is obtained by multiplying the heating circuit area by the installation grid dimensions:

LKr = AKr · TKr

Tk in m²

LKr in m²

Then, the length of the line connecting the distributor to the heated room (LAN) needs to be added twice:

LKr, ges = LKr + 2 · LAN

The pressure loss per meter of heating pipe for the required water flow (Vw) can be found on the pressure loss diagram. Multiplying this figure by the total pipe length of the heating circuit (LKr, ges) yields the total pressure loss:

ΔpR, ges = ΔpR, ges – ΔpR, ges

This total pressure loss must be lower than the pressure boost provided by the pump selected. If it is not, several heating circuits should be used. The regulating valve in the return flow collector of the HCD must be adjusted in such a way that the sum of the calculated pressure in the heating circuit and the pressure loss in the regulating valve is equal to the total pressure loss at the distributor (Δpv, vert).

ΔpV, vert = Δpv, vert – ΔpR, ges

The characteristic curve closest to this operating point should be selected from the pressure loss diagram for the return flow valve.

Conservator Tank

In order to prevent oxygen from seeping in as a result of an incorrectly dimensioned or prestressed conservator tank, observe the guidelines in DIN 4807 part 1!

The heating pipe is coated with an airtight coating (in compliance with DIN 4729) which allows only a negligible amount of oxygen to diffuse into the heating water; there is thus practically no possibility of the iron components of the unit corroding.
All types of radiators may be used without restrictions with System 70. This means that a large product palette with numerous choices regarding colour and shape is available. The heat requirement of each room must be met or exceeded by the radiators installed in it. If capacity tables for the radiator you are considering are available for a temperature combination of 70/55, the radiator may be chosen directly according to those tables. For cases where only the standard heat capacity table is available, the 70/55 temperature combination must first be calculated as follows:

$$Q_{HK,n} = Q_{N,t} \cdot 1.57$$

(Q:N: standard heat capacity at 90/70)

This calculation is based on a target flow temperature of 70 °C, a temperature difference of 15 K, and an exponent of the capacity characteristic curve of the radiator equalling n = 1.3. Up to an output of 2.5 kW (this corresponds to a standard heat capacity of 3.9 kW), the radiator is connected with the DUO pipe. For larger radiators with outputs of up to 3.9 kW (standard heat capacity of 5.2 kW), the HKflex 14 AL pipe (21/14 x 2 in corrugated pipe) is used.

When radiators are connected astride, an reduction of 5 % in overall heating capacity can be expected.

$$Q_{HK,n,\text{astride}} = Q_{N,t} \cdot 1.65$$

### Hydraulic Balancing of the Radiator Circuits

With a target temperature difference of 15 K, the water flow required can be calculated directly by using the radiator output (Q.HK):

$$V_{HK} = \frac{Q_{HK} \cdot 3600}{4180 \cdot 15} = Q_{HK} \cdot 0.057 \text{ with } Q_{HK} \text{ in W and } V_{HK} \text{ in l/h}$$

Pressure loss caused by the length of the pipe (RL) can be taken from the pressure loss diagram for the heating pipe using the value $V_{HK}$. The pressure loss in the pipes may then be calculated by multiplying this figure by the total length of supply and return pipe:

$$\Delta p_{\text{pipe}} = R_L \cdot (L_{\text{forward}} + L_{\text{return}})$$

The differential pressure on the armature of the radiator may be calculated by subtracting the decrease of pressure in the connection lines from the differential pressure at the distributor:

$$\Delta p_{HK} = \Delta p_{\text{dist.}} - \Delta p_{\text{pipe}}.$$
Performance Tables for System 70 and System 70 secco

Performance Table for System 70 Wet System (DIN/EN reg. no. 7 FO 29) \( S_u = 45 \text{ mm} \)

<table>
<thead>
<tr>
<th>room temp. in °C</th>
<th>20 °C</th>
<th>22 °C</th>
<th>24 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>floor covering ( R_\lambda ) in m² K/W</td>
<td>0.00</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>flow temp. °C</td>
<td>heat flow density ( q_{des} ) in W/m² at a range from ((\theta_V - \theta_R) = 15 \text{ K})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>50</td>
<td>75</td>
<td>700</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>68</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>225</td>
<td>50</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>55</td>
<td>75</td>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>84</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>225</td>
<td>63</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>49</td>
<td>44</td>
</tr>
<tr>
<td>60</td>
<td>75</td>
<td>149</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>101</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>225</td>
<td>75</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>58</td>
<td>52</td>
</tr>
<tr>
<td>70</td>
<td>75</td>
<td>196</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>132</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>225</td>
<td>90</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>77</td>
<td>69</td>
</tr>
</tbody>
</table>

Performance Table for Dry Installation System 70 secco (DIN/EN reg. no. 7 FO 36) \( S_u = 25 \text{ mm} \)

<table>
<thead>
<tr>
<th>room temp. in °C</th>
<th>20 °C</th>
<th>22 °C</th>
<th>24 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>floor covering ( R_\lambda ) in m² K/W</td>
<td>0.00</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>flow temp. °C</td>
<td>heat flow density ( q_{des} ) in W/m² at a range from ((\theta_V - \theta_R) = 15 \text{ K})</td>
<td></td>
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<tr>
<td>50</td>
<td>150</td>
<td>57</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>225</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>31</td>
<td>28</td>
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<tr>
<td>55</td>
<td>150</td>
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<td>60</td>
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<td>225</td>
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<td>70</td>
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<td>73</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>61</td>
<td>56</td>
</tr>
</tbody>
</table>

The performance data are taken from the characteristic curves on pages 27 and 28.

The max. surface temperatures of 29 °C / 35 °C are not taken into account.

Reference Value: The median surface temperature of 29°C is reached at about 100 W/m².

Floor Coverings \( R_\lambda \) in m² K/W

- 0.00 = tile
- 0.05 = PCV, linoleum
- 0.1 = 6 mm carpeting
- 0.15 = 11 mm carpeting

Grid Dimensions and Amount of Pipe

- VA 75 = 13.0 m²/m²
- VA 150 = 6.7 m²/m²
- VA 225 = 4.4 m²/m²
- VA 300 = 3.3 m²/m²

Maximum Surface of Heating Circuit

- Maximum length of heating circuit 80 m

A System 70 Model

- room temperature 20 °C
- carpeting as floor covering 0.1m² K/W
- forward flow temperature 70 °C
- calculated heat flow density 60 W /m²

readings:

- grid dimensions 300 mm
- heat flow density 63 W /m²
System 70 Wet System Performance Characteristic Curves

**grid dimensions 75 mm**
- Boundary line for peripheral zones $(\theta_{F,\text{max}} - \theta_i) = 15\text{K}$

**grid dimensions 150 mm**
- Boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

**grid dimensions 225 mm**
- Boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

**grid dimensions 300 mm**
- Boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

heat flow density in W/m²
mean fluid temp - room $\Delta\theta_H$ in K

grid dimensions 75 mm
boundary line for peripheral zones $(\theta_{F,\text{max}} - \theta_i) = 15\text{K}$

grid dimensions 150 mm
boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

grid dimensions 225 mm
boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

grid dimensions 300 mm
boundary line for living areas and baths $(\theta_{F,\text{max}} - \theta_i) = 9\text{K}$

mean fluid temp - room $\Delta\theta_H$ in K
System 70 secco Dry System Performance Characteristic Curves

- Grid dimensions 150 mm
- Grid dimensions 225 mm
- Grid dimensions 300 mm

Heat flow density in W/m²

Mean fluid temp - room $\Delta \theta_{\text{m}}$ in K

$R_{\lambda,B}$

Boundary line for living areas and baths ($\theta_{\text{F,max}} - \theta_i$) = 9K
pressure decrease diagram for various reference values on the return valve of the QuickFix heating circuit distributor

decrease of pressure due to length for the 12, 14, and 18 mm heating pipes

decrease of pressure due to length in Pa/m

flow in l/h

set value

average floor surface temperature dependence on thermal output (according to the basis characteristic curve in DIN 4725 T2)

average floor surface temperature

dependence on thermal output

(at 20°C room temperature)

average heat flow density $q_{des}$ in W/m²
Characteristic Curves for Thermostats and Return Connections

Diagram depicting flow of thermostat valves

Pressure decrease diagram for the combination thermostatic valve / return valve with a 2 K difference in proportion of the thermostatic valve for various set values

Valve block adjustment diagram

Pre-set values

<table>
<thead>
<tr>
<th>Pre-set</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8*</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-band 2 K</td>
<td>0.03</td>
<td>0.06</td>
<td>0.12</td>
<td>0.18</td>
<td>0.23</td>
<td>0.28</td>
<td>0.33</td>
<td>0.38</td>
<td>0.41</td>
</tr>
<tr>
<td>kvs-value</td>
<td>0.03</td>
<td>0.06</td>
<td>0.12</td>
<td>0.18</td>
<td>0.25</td>
<td>0.32</td>
<td>0.38</td>
<td>0.44</td>
<td>0.51</td>
</tr>
</tbody>
</table>

* Factory pre-set values

Pressure drop in mbar

Flow in kg/h

Pressure drop in Pascal

Flow in l/h

Rotations

Percentage of radiator heating in %

Rotations to the left from the “closed” position

10 Pascal ~ 1 mm WS ~ 0.1 mbar
Computer Calculations

Special computer programs have been developed for the heat technical design of System 70. These programs may be used to plan a System 70 heating system for an entire building. The client-specific information indicated in the following checklist is all that is required to complete the necessary calculations:

- type of building (residence, office building, etc.)
- site plan
- building plan (layout and elevation cross sections)
- wall structures (materials, wall thickness)
- desired set temperature for each room
- planned floor coverings (possibly with thermal conductivity resistance values)
- type of heating surface planned for each room (floor heating, radiators, or a combination of floor heating and radiators)
- location of the distributor wall installation case

Using this information, the complete system can be designed in compliance with current norms and technical guidelines. This includes the calculation of heat consumption according to DIN 4701 as well as the layout of all heating surfaces. At the same time, the entire pipe network and the set values necessary for the hydraulic adjustment of the synthetic distributor and for the reversing valves of the radiators are calculated. Documents for the tender and bidding process can also be created with this program.

Calculation Tables Created with HT 2000

Installation

Construction Prerequisites

The building planner should see to it that the load-bearing floor base is sealed against ground moisture and ground water. These measures must be carried out in accordance with DIN 18195, “structural sealing”. All interior finishing should be done beforehand.

The plastering of the walls should reach down to the load-bearing floor base (concrete or wooden beams).

The load-bearing floor base must be able to support the floor heating unit and the estimated traffic load of the room. The height and the evenness of the surface of the load-bearing floor base must meet the requirements pertaining to angle and evenness tolerance in DIN 18202, table 2 and table 3, line 2. To test the horizontal position of the floor base, the thickness of the existing floor structure, and the grade of the connections, a meter mark must be installed in each room.

In performing these tests, the point of reference provided by the building planner or supervisor as to construction height should always be used. Obstacles laid on the floor base, such as pipe lines and electric lines, should be secured within the base so that there is an even surface for the insulation layer - or at least for the impact sound insulation. Make sure to take note of the construction height necessary for this during the planning stage. Unbound levelling products should not be used for to level out the floor base under any circumstances. If the heated floor construction is to be installed at a gradient (>1.5 %) in areas such as a shower, this gradient should be established in the load-bearing floor base in order to maintain the required even thickness of the screed.

Existing structural joints in the load-bearing floor base must have an even width, and they must be full squared, straight, and evenly aligned. In addition to the structural joints, joints should also be arranged in the insulation layer and in the screed. The load-bearing floor base must appear to be dry to the naked eye and free of dirt and loose objects.
Remark: If you apply PVC and sealant containing solvents under polystyrene insulation, there must be a separating layer between these two installation layers (e.g. PE-foil) in order to prevent plasticiser sorption, which could lead to the destruction of the polystyrene insulation.

**Insulation Layers**

If you wish to apply extra insulation under the system plates, make sure that it is interconnected and compact. The system plates must then be staggered next to one another. No additional impact sound insulation layer should be laid under the basic plate. According to DIN 18560 part 2, the compressibility of all insulation layers may not exceed 5 mm.

**Applying the System Plates**

The installation of system plates should be begun in the right-hand corner of the room. As an orientation aid, there is an “A” on the naps marking where to begin laying the plate.

 ROTEX Wall Insulation Strip must be applied evenly and completely to all surrounding walls and any other built-in structures, such as door frames or pillars. In order to avoid impact sound acoustic bridges, fixing nails should be applied in such a way that they are not connected with the screed.

ROTEX Wall Insulation Strip is designed to be thick enough to insure a compressibility of at least 5 mm after the hardening of the screed. The wall insulation strip is applied universally. It should start at the level of the bare floor and reach over the level of the finished floor. If you are using more than one layer of insulation, the wall insulation strip should be applied before the uppermost layer of insulation. The wall insulation strip should be secured so that it does not change position during application of the screed. Any portions of the insulation strip sticking out over floor level and the exposed covering should not be cut off until the floor covering has been completely applied; with textile or elastic coverings, they should not be removed until after the filler has hardened.

**Insulation covering**

In part 2 of DIN 18 560 it is mentioned the covering of the isolation which avoids that the moisture of the screed gets into the isolation lay. This covering is not necessary using a ROTEX underfloor heating construction, as due to material and the kind of construction, screed moisture permeation into the system plates is not possible.
Sound Insulation

The sound insulation of a building greatly influences quality of life. It is thus necessary to take special precautions for the planning and installation of airborne and impact sound insulation. Whether there is floor heating or not, floating screed improves the impact sound insulation of the floor construction because it dampens impact sound. In addition, it also improves airborne acoustic insulation. Furthermore, the guidelines in DIN 4109 should be adhered to.

For improved sound insulation, it is necessary that the installation be free of acoustic bridges. For this reason, it is especially important for the installation to be carried out conscientiously. The impact acoustic insulation must be installed on every surface. Materials in the impact acoustic insulation (e.g. PST) are also used as thermal insulation. However, not all thermal insulation material has impact sound insulating characteristics.

The requirements for sound insulation are described in DIN 4109. Table 3 describes the airborne and impact sound qualities construction materials in various types of buildings must have in order to protect rooms against sound from adjacent living and working spaces. These requirements must be fulfilled for the installation of a floor heating system as well.

Laying the Heating Pipes

The pipes should be handled with care. Most importantly, the pipe should be protected against direct sunlight, oils, fats, and paints. The packing material of the pipes should thus not be removed until immediately before the pipes are laid. The DUO heating pipe must be laid with a bending radius of at least $5 \times dR = 60$.

The beginning of the pipe is installed on the flow of the distributor. From this point out, the pipe is threaded through the installation grid between the naps. Throughout this threading process, it is necessary to make sure that the upper edge of the each of the naps is not damaged in order to insure that the pipe is held securely in place by the naps. For this reason, protective shoes without heels should be worn while laying the pipe.
Damage to the Pipes

As a rule, defective pipes should be replaced. PE-X-pipe may not be repaired by gluing or welding. If the pipe is damaged while the screed is being applied and there is no possibility of replacing it, both ends of the pipe can be resealed after removal of the damaged portion using a pipe coupling designed especially for floor heating pipes. Once installed, the union piece should be accessible for safety reasons. We thus do not recommend installing it directly in the screed, but rather in a commercially available protective casing with a cap.

Warning: Never install pipe connections in a pipe bend.

Connecting the Distributor

Near the distributor the heating pipes must usually be laid closer together than prescribed by calculations made for the heating circuit. To avoid overheating this area, the pipes should be insulated with a layer of corrugated pipe. By laying out the heating pipes in a sensible manner, e.g. laying them out toward the rear as well, you can avoid large bundles of pipes in the immediate area of the distributor. If you use the protect plate we recommend to use also the protect-HKV-plate. Plastic bindings can be used to arrange the pipes in the ROTEX wall cases, thus insuring an organised layout near the case.

Hydraulic Pressure Test

After the successful laying of the pipes, the unit should be filled and aerated. The fully installed and filled unit needs to be subjected to a hydraulic pressure test. The test pressure should be kept at approx. 6 bar for a period of 24 hours.

Before applying the screed, retighten all adjustable fittings.

Measuring the Degree of Moisture

Suitable points on the heating surface need to be designated to measure the degree of moisture. According to EN 1264 part 4, there must be at least 3 measuring points per 200 m² or per apartment. We recommend designating more than the minimum required measuring points, with at least one point in each room. An area of 10 cm (a diameter of 20 cm) around each measuring point should be free of heating pipe.

Screed and Warmth Distribution Layer

Not only is the screed the load-bearing structural element for floor coverings and room traffic in a room heated with floor heating, it also constitutes the “warmth distribution layer”. This structural element is usually constructed of cement. More and more, however, free-flowing screed with a calcium sulphate basis is being used.

The entire construction may be referred to as “floating screed”. The specific requirements for heated screed applied in a floating manner are described in DIN 18 560 part 2. Floating on the insulation means that the screed plates should not be connected in any way with vertical or other neighbouring structural elements. This is prevented by applying a wall insulation strip on all vertical and neighbouring structural elements (walls, pillars, pipe lines, stairwells, etc.). Once installed, the wall insulation strip must allow for a freedom of motion of at least 5 mm.

The wall insulation strip must remain until after the floor covering has been applied. Then it may be cut off. The wall insulation strip is necessary because it helps prevent acoustic bridges. As a result of the use of wall insulation strips, border joints are formed which also serve as settlement joints. The screed plate expands when heated in such a way that the thermal length difference can be taken up from the border joints in all directions without causing damage to any of the structural elements. The design width of the screed plate is calculated to take the static load and the screed material used into account.

Heated Screeds

Screed on heated floor heating installations, so-called heated screeds, do not differ from non-heated screeds for residential use in their mortar-technological composition. Heated screed with a cement or calcium sulphate basis (e.g. anhydrite) and a quality class of at least 20 can be produced at the construction site. Free-flowing screeds with cement or calcium sulphate as binding agents are appropriate for ROTEX wet systems. Not appropriate are screeds with a bitumen basis, such as melted asphalt.

Cement Screeds

Cement screed should be brought to a malleable consistency. The plasticity of cement screed can be improved significantly by using the screed additive Estrolith H. The screed coating on the heating pipe must be at least 45 mm thick. An exception to this rule is allowed when special screeds, such as cement screed ZE 30 with the screed additive Estrotherm S, are used. When this additive is used, the thickness of the pipe coating may be reduced to 30 mm. When ZE 20 or AE 20 are used with a 45 mm coating, the permissible traffic load is 1.5 kW/m². This high load capacity is also valid for ZE 30 cement screed with Estrotherm S. If higher load capacities are required, the necessary thickness of the screed must be determined by a structural engineer.
Calcium Sulphate Screeds

An important aspect about calcium sulphate screeds is that most producers of calcium sulphate prescribe that the screed temperature be limited to a temperature under the maximum temperature of 60 °C allowed near heating elements by DIN 18 560. With System 70, this is achieved with the help of the helically wound pipe (defined air layer). As with cement screeds, settlement joints are necessary.

During application, the temperature of the calcium sulphate screed should not descend below 5 °C. It should be held at a temperature above 5 °C for at least 2 days. The screed should also be protected from harmful influences such as heat, hard rain, and drafts for at least 2 days. With smaller sized structures, this can be guaranteed without taking any special measures, as long as the building is closed.

Calcium sulphate screed must be left alone to dry out and should not be exposed to high levels of moisture for an extended periods of time. Calcium sulphate screed should not be walked on for a period of 2 days and should not be exposed to heavy loads for a period of 5 days after application.

Free-flowing Calcium Sulphate Screeds

Calcium sulphate screeds can be suitable heated screeds as long as any guidelines prescribed by the producer of the binding agent you wish to use are adhered to. When using free-flowing screed it is important to take proper measures to effectively prevent the screed from coming into contact with the structural elements of the building. Special attention should be paid to the joints between each of the system plates and the border area. The wall insulation strip generally used with free-flowing screeds is type RDS-F, a special wall insulation strip featuring an adhesive base and PE-foil to prevent the screed from seeping through in border areas. When applying the screed, make sure the heating unit is filled with water and pressurised (approx. 6 bar).

Screed Additives

A prerequisite for the optimal thermal conductivity of cement screed is the complete coating of the heating pipes with screed. To make the screed flow as needed for this job it is advisable to mix in our screed additive Estrolith H. The drying time is shortened from approx. 21 to 10 days with the additive Temporex. The correct proportions to use may be taken from the included instruction booklet.

The screed additives Estrolith H, Temporex, and Estrotherm S are not used with screeds.

Reinforcement

Screeds applied on layers of insulation generally do not need to be reinforced. However, reinforcement can be useful in applying stone or ceramic coverings, especially with cement screeds, as it helps prevent the widening of possible cracks and high packing of the edges of cracks.

The formation of cracks can not be prevented by screed reinforcement.

Screed reinforcements should be protected against corrosion, especially when used in calcium sulphate screeds. The reinforcement should not be applied near settlement joints. With heated screeds, it should be placed in the middle third of the screed thickness.

Expansion Joints

A joint plan should be drawn up to facilitate differentiation between the different types and placement of the joints. The joint plan should be drawn up by the building planner and presented to firm carrying out the building work the as a part of the list of duties.

When deciding on the grid dimensions of the joints and the size of screed blocks, the type of binding agent as well as the intended floor covering and use of the room should be taken into account. For heated cement screeds which are to be used to apply stone or ceramic coverings, screed blocks separated by settlement joints should be applied in areas larger than 40 m². For areas smaller than 40 m² settlement joints should be used if the length of one side is over 8 m. The size relationship between sides of the screed plates should normally not exceed a ratio of 2 : 1. Neither the damper register nor the resistance mats should be separated by settlement joints.

Surfaces of different sizes usually meet each other at doorways. Dummy joints or settlement joints should be used at these junctures.

Heating circuits should not cross settlement joints.

Heating pipes should only cross settlement joints as connecting lines. In these cases the pipe should always be protected (e.g. with corrugated pipe). If vertical packing at settlement joints needs to be avoided, the screed plates should be connected to one another with special pegs in this area so that horizontal expansion is not hindered.

Implementing the Expansion Joints

The joints must be formed in such a way that there is at least 5 mm of space between the screed flanks.

 Settlement joints reach from the upper edge of the heat insulation to the upper edge of the floor covering and should not be bridged over by reinforcements or carrier mats. They should be filled with elastic material or closed with joint profiles after completion.

Dummy Joints (Spoon Cuts)

Dummy joints, also known as spoon cuts or cut joints, are predetermined breaking points used to break down tension arising during the setting of cement screed. To prevent the screed plate from cracking uncontrollably, the screed layer cuts into the fresh screed – taking into consideration the danger of damaging the heating pipes and lines – with a spoon, leaving a minimum of 1/3 of the original thickness of the screed at the points cut. A crack forms on this spoon cut due to shrinkage. When the floor is ready for the covering, the spoon cuts can be closed by adherence, for example with synthetic resin.
Floor Heating Installations for Older Buildings

Conventional floor heating installations often cannot be installed in old buildings because the necessary construction height is not available or because the wooden floors are unable to carry the extra load. Approximately 65 mm of screed is necessary for a conventional installation. This means an additional load of approx. 130 kg/m² due to the screed. The dry installation System 70 secco was developed especially as a solution to this problem; it results in only approx. 30 kg/m² of additional load.

Heating the Screed

There are two perspectives to this point: the installer of the heating system and the person who lays the screed and floor covering. In order to meet their differing demands, the expression “heating the screed” has been made more precise. We now differentiate between:

- a) functional heating
- b) preparation heating

a) functional heating

Functional heating serves to assure the installer of the heating system that the installation has been performed correctly.

Functional heating (identical to “heating” in EN 1264, section 5.2) is thus not heating to prepare the screed for the floor covering. For such heating a separate heating procedure and/or mechanical drying is usually necessary.

Cement screeds should be heated after 21 days at the earliest and anhydrite screeds after 7 days according to information provided by the manufacturer. The first heating begins with a flow supply temperature of 25 °C. This temperature should be held for 3 days. Afterwards, the unit is set to the maximum flow supply temperature and held there for another 4 days. Due to the insulating properties of the DUO heating pipe, the temperature of the initial 3 day heating should be 38 °C with System 70, and then the unit should be held at a set temperature of around 70 °C for 4 days. After this procedure has been carried out, it is not yet certain that the screed has reached the degree of moisture necessary for laying the floor covering.

The degree of moisture in the screed must be measured before the floor covering is laid.

b) preparation heating

The duration of the drying process for the screed cannot be determined beforehand. If there are high levels of moisture in the air it may stop altogether. This process can be speeded up by operating the floor heating (preparation heating) or by mechanically aided drying. Every preparation heating process should be taken care of by the client as a particular duty in compliance with VOB.

In order to insure fault-free work, the screed must be prepared in this manner before installation of the floor covering begins.

Required Moisture Content of the Screed

The maximum moisture content required to prepare the screed for floor coverings is indicated in the following table according to current technological standards.

<table>
<thead>
<tr>
<th>Upper floor</th>
<th>Concrete Screed</th>
<th>Calcium Sulfate Screed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic coverings</td>
<td>1,8</td>
<td>0,3</td>
</tr>
<tr>
<td>textile coverings</td>
<td>steam tight</td>
<td>1,8</td>
</tr>
<tr>
<td></td>
<td>steam permeable</td>
<td>3,0</td>
</tr>
<tr>
<td>Parquet</td>
<td>1,8</td>
<td>0,3</td>
</tr>
<tr>
<td>Laminate floor</td>
<td>1,8</td>
<td>0,3</td>
</tr>
<tr>
<td>Ceramic tiles</td>
<td>thick</td>
<td>3,0</td>
</tr>
<tr>
<td>natural/concrete stones</td>
<td>thin</td>
<td>2,0</td>
</tr>
</tbody>
</table>

The necessary fillers, stoppers, and glue must be able to withstand a temperature of 50 °C for an extended period of time (DIN 4725T4).
Installing the secco Dry System

Prerequisites

The floor must be completely level and solid. There should not be any lines, pipes, or cables on the floor surface. If such objects cannot be avoided, they should be covered up by a levelling layer.
A PE-foil must be applied to the ceiling of floors separating apartments to guard against residual moisture.
A structural sealing must be applied to floors adjacent to soil, as prescribed by DIN 18 195. (see important remarks on page 12 for further information).

Laying the Thermal Conducting Elements

ROTEx thermal conducting elements made of galvanised sheet steel are pressed into the styropor plates directly after the first row of system plates has been laid. This procedure has the advantage of reducing the danger of damage to the naps on the system plates due to their exposure, thus insuring an optimal surface for laying the thermal conducting elements. For the same reason, areas with heavy foot traffic, such as corridors, should be saved for last, just before the laying of the heating pipes. The elements are shipped in lengths of 1200 mm and 400 mm. The entirety of the surface can be easily covered by using the filler pieces shipped with the elements. However, an area of at least 22 cm should be left untouched near the two terminal loops. As with connection lines in front of heating circuit distributors, connection lines leading to the heating circuit distributor. When laying the pipes, keep in mind that a heating circuit with 17/12 x 2 mm DUO 17 AL pipes may have a maximum length of 80 m.

Applying the Screed Elements

Before the screed elements can be applied, the wall insulation strip must be applied evenly on the entire surface, the thermal conducting elements must lie smooth (without edges or similar irregularities) on the system plates, and the heating pipes must be tested for air-tightness at a pressure of approx. 6 bar.

The pressure must be maintained while the screed elements are being laid.

The application of the screed elements is performed according to the instructions of Fels Werke GmbH (Fermacell). For the dry system secco, the screed element 2 E 22 is used exclusively. The element consists of two plates stuck together in a staggered fashion with a thickness of 12.5 mm. Before beginning the laying process, read the Fels Werke instructions and proceed accordingly. The Fels Werke hotline at (05381)76400 is prepared to answer any questions concerning the application of screed elements.

Hydraulic Adjustment

When all heating surfaces are installed and connected, the unit may be filled with water and set to a pressure of 6 bar. The unit should be kept at this pressure for an entire day.

Hydraulic adjustment of the heating circuits according to the calculations may be performed during this pressure test. In order to make these adjustments for the floor heating circuits, the control valve of the distributor is adjusted according to the reference value from the computer calculations or from the pressure decrease diagram. Each radiator is adjusted with the help of the return valve. First, close the valves completely. Then, open them again by turning them the amount of times indicated by the calculations for your installation (the values may be taken from the computer calculations or from your own calculations). Once this procedure has been performed on all heating circuits, the unit is hydraulically adjusted.
The first step in connecting the radiators is to install the supply and connecting pipes and the distributors. Then, all radiators may be assembled. If the connection pipes are to be installed in the walls, mark the wall where you need to make wall slots, remove the radiator, and drill out the wall slots.

The installation always begins with the radiator. Described here is the installation of a radiator from the wall with a 1/2” elbow connection. Other types of installation may be performed in an analogous manner.

The steps depicted in the following must be carried out in the sequence shown:

1. Remove the helical reinforcing web from the pipe with special stripping pliers.
2. Bend the PEX-AL 12 pipe by hand.
3. Shorten the PEX-AL pipe with pipe cutting pliers, leaving approx. 20 mm at the end of the pipe free of protective coating.
4. Install the clamping ring set.
5. Connect the pipe to the thermostat valve.
6. Tighten the union nut.
7. Completed installation of a valve radiator connection from the wall.
1. Cut down the DUO AL pipe.

2. Remove approx. 10 cm of helical reinforcing web from the end of the pipe.

3. Attach the pipe connection nozzle (included in clamping ring set E 1).

4. Attach the plastic nut and the clamping ring set.

5. Screw the pipe into the distributor connection.

6. Tighten the nut with the included assembly wrench.

7. Put protective pipe on the connection lines and place them at regular intervals from one another.

8. Heating pipes fastened with plastic bindings.
**Wall Insulation Strip (WIC)**

made of PE-foam with 25 cm wide welded PE-foil – The foil strip is placed on the system plates to prevent the intrusion of screed material in the vicinity of the wall. This measure prevents the breaching of the sound insulation barrier.

height: 150 mm  
thickness: 8 mm  
compressible to 2 mm

packing unit: 25 m  
order no.: 171107

**Wall Insulation Strip for Free-flowing Screed (WIC-F)**

made of PE-foam with welded PE-foil and an 18 cm wide adhesive base – The PE-foil is placed above the system plate and the adhesive base is placed under it. This prevents the screed from seeping through in the wall area.

height: 150 mm  
thickness: 10 mm  
compressible to 2 mm

packing unit: 25 m  
order no.: 171126

**Expansion Joint Profile (EJ P)**

used to form settlement joints and joints at doorways – made of waxed cardboard with an adhesive base

length: 100 cm  
total height: 10 cm  
installation height: 7 cm  
thickness: 6 mm

packing unit: 25 pieces  
order no.: 171108

**Protective Pipe**

made of 19 x 25 mm plastic corrugated pipe – It is used for protecting the pipes near distributor connections and expansion joints.

packing unit: 25 cm  
order no.: 170053

**Pipe Cutting and Stripping Pliers with Calibration Knob**

tool for cutting off synthetic pipe cleanly and stripping helical reinforcing web

order no.: 171110

**Estrolith H Screed Additive for Cement Screeds**

Estrolith must be added in dosages of 1 % of the cement weight. Assuming 350 kg of PZ 35 F cement per cubic meter of screed, 0.150 kg of Estrolith H per square meter is required to cover the pipes with 45 mm of screed. For each additional cm of screed thickness, an additional 0.335 kg/m² is needed.

packing unit: 5 kg  
order no.: 171102

**Estrotherm S Screed Additive**

used to reduce the thickness of cement-based screeds – Estrotherm S must be added in dosages of 10 % of the cement weight. Thus, 1.5 kg/m² of Estrotherm S is required to cover the pipes with 30 mm of screed. ZE 30 screed should be used.

packing unit: 10 kg  
order no.: 171106

**Temporax Screed Additive**

used to shorten the drying period for cement-based screeds from 21 days to approx. 10-14 days – The dosage for cement screed and a 45 mm thick covering is approx. 0.250 kg/m².

packing unit: 10 kg  
order no.: 171111

**Pipe Fixing Clips (RHC 17/25)**

Made of PE-foam with welded foil and additional seal cord

height: 150 mm  
thickness: 10 mm

packing unit: 25 m  
order no.: 171126

**Combination Coupling (SK 12/14/18)**

couplings in compliance with DIN 8076 – may be used with 12, 14, and 18 x 2 mm PE-X heating pipes

packing unit: 2 couplings  
order no.: 177212 (12 x 2)  
order no.: 177214 (14 x 2)  
order no.: 177218 (18 x 2)

**Connection Screw Fitting (AR 12/14/18)**

for 12, 14, and 18 x 2 mm heating pipes with 1/2" external threads

packing unit: 2 screw fittings  
order no.: 177312 (12 x 2)  
order no.: 177314 (14 x 2)  
order no.: 177318 (18 x 2)

**Pipe Unwinder (RA 240)**

simplifies the laying of DUO 17/DUO 17 AL and Monopex 14 pipes – suitable for rolls of 240 and 120 m – can be rotated 360°

packing unit: 1 unwinder  
order no.: 171006

**Pipe Unwinder (RA4 600)**

simplifies the laying of DUO 17 heating pipes in 600 mm rolls and DUO 25 heating pipes in 200 and 440 m rolls.

packing unit: 1 unwinder  
order no.: 171007

**Pipe Cutting and Stripping Pliers with Calibration Knob**

tool for cutting off synthetic pipe cleanly and stripping helical reinforcing web

order no.: 171110

**Estrolith H Screed Additive for Cement Screeds**

Estrolith must be added in dosages of 1 % of the cement weight. Assuming 350 kg of PZ 35 F cement per cubic meter of screed, 0.150 kg of Estrolith H per square meter is required to cover the pipes with 45 mm of screed. For each additional cm of screed thickness, an additional 0.335 kg/m² is needed.

packing unit: 5 kg  
order no.: 171102

**Estrotherm S Screed Additive**

used to reduce the thickness of cement-based screeds – Estrotherm S must be added in dosages of 10 % of the cement weight. Thus, 1.5 kg/m² of Estrotherm S is required to cover the pipes with 30 mm of screed. ZE 30 screed should be used.

packing unit: 10 kg  
order no.: 171106

**Temporax Screed Additive**

used to shorten the drying period for cement-based screeds from 21 days to approx. 10-14 days – The dosage for cement screed and a 45 mm thick covering is approx. 0.250 kg/m².

packing unit: 10 kg  
order no.: 171111

**Wall Insulation Strip (WIC)**

made of PE-foam with 25 cm wide welded PE-foil – The foil strip is placed on the system plates to prevent the intrusion of screed material in the vicinity of the wall. This measure prevents the breaching of the sound insulation barrier.

height: 150 mm  
thickness: 8 mm  
compressible to 2 mm

packing unit: 25 m  
order no.: 171101

**Pipe Cutting and Stripping Pliers with Calibration Knob**

tool for cutting off synthetic pipe cleanly and stripping helical reinforcing web

order no.: 171110

**Estrolith H Screed Additive for Cement Screeds**

Estrolith must be added in dosages of 1 % of the cement weight. Assuming 350 kg of PZ 35 F cement per cubic meter of screed, 0.150 kg of Estrolith H per square meter is required to cover the pipes with 45 mm of screed. For each additional cm of screed thickness, an additional 0.335 kg/m² is needed.

packing unit: 5 kg  
order no.: 171102

**Estrotherm S Screed Additive**

used to reduce the thickness of cement-based screeds – Estrotherm S must be added in dosages of 10 % of the cement weight. Thus, 1.5 kg/m² of Estrotherm S is required to cover the pipes with 30 mm of screed. ZE 30 screed should be used.

packing unit: 10 kg  
order no.: 171106

**Temporax Screed Additive**

used to shorten the drying period for cement-based screeds from 21 days to approx. 10-14 days – The dosage for cement screed and a 45 mm thick covering is approx. 0.250 kg/m².

packing unit: 10 kg  
order no.: 171111

**Pipe Fixing Clips (RHC 17/25)**

for securing heating pipes – e.g. at terminal loops or in place of damaged naps

packing unit: 50 clips  
order no.: 171117 (DUO 17)  
order no.: 171125 (DUO 25)

**Pipe Unwinder (RA 240)**

simplifies the laying of DUO 17/DUO 17 AL and Monopex 14 pipes – suitable for rolls of 240 and 120 m – can be rotated 360°

packing unit: 1 unwinder  
order no.: 171006

**Pipe Unwinder (RA4 600)**

simplifies the laying of DUO 17 heating pipes in 600 mm rolls and DUO 25 heating pipes in 200 and 440 m rolls.

packing unit: 1 unwinder  
order no.: 171007
Before the floor covering can be applied, the floor heating unit must be heated up according to a prescribed procedure regardless of season. The so-called functional heating is documented with this protocol. The functional heating does not guarantee that the necessary degree of moisture for laying the floor covering has been reached.

Building

Heating Specialist:

Screed Layer: (name, address)

System Information

Unit: System 70  Monopex  varioperfect

Screed: cement screed (CS)  anhydrite (AE)  calcium sulphate

Screed Additive

Estrolith H  Estrotherm S  Temporex

Screed work completed on:

<table>
<thead>
<tr>
<th></th>
<th>Monopex</th>
<th>System 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>earliest</td>
<td>date of</td>
<td>flow temper-</td>
</tr>
<tr>
<td>start after</td>
<td>start</td>
<td>ature required</td>
</tr>
<tr>
<td>21 days with CS</td>
<td>date</td>
<td>25 °C</td>
</tr>
<tr>
<td>7 days with AE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thereafter</td>
<td>max. set-</td>
<td>max. set-</td>
</tr>
<tr>
<td>temperature</td>
<td>temperature</td>
<td>temperature</td>
</tr>
<tr>
<td>thereafter</td>
<td>cool-down</td>
<td>cool-down</td>
</tr>
</tbody>
</table>

* A flow temperature of 38 °C with System 70 corresponds to a flow temperature of 25 °C with conventional floor heating units.

Pressure Test: yes no

Handing Over to Client: outdoor temperature °C  flow temperature °C

floor heating yes no pressure of unit bar

Comments:

Confirmation
(place/stamp/signature) building owner/client planner/architect heating specialist
ROTEx System 70 Industry:
For Industrial Floor Heating and Radiators
Industrial Heating Surfaces

Heating industrial halls is especially demanding for a heating system. High ceilings, sporadic aeration due to the frequent opening and closing of large gates and doors, widely varying inner and outer warmth burdens, the high activity level of workers in such buildings, and the danger of drafts are the hurdles which must be overcome when designing an up-to-date industrial heating system. For rooms with high ceilings, an optimal and economical setting of the desired room temperature is especially important.

Heat padding underneath the roof of an industrial hall should be avoided. It is more practical to install a large-scale heating unit with an excellent vertical temperature profile under the floor of the hall.

Floor heating makes it possible to organise the room freely and flexibly, as no radiators are necessary. These qualities make floor heating an economical and energy-efficient thermal conduction solution for industrial halls.

At the same time, near exposed areas it is often wise to install alternative heating surfaces, such as hot-air-curtains over doors, radiators, or air heaters.

System 70 Industry offers the possibility of combining these heating surfaces by making it possible to connect a hot water floor heating unit and other heating surfaces to the same distributor. This is made possible by the special construction of the DUO 25 heating pipes System 70 Industry uses.

Combinations with Heating Surfaces in Different Parts of the Building

Besides industrial spaces, industrial buildings usually also include offices and social and sanitary areas. To heat these rooms, it is best to install floor heating as well as radiators.

With System 70 Industry, a ROTEX System 70 installation with 17/12 x 2 DUO-17 pipes can be installed for such areas. As both of these systems run on the same flow temperature, the entire building can be heated with a single water distributor regulated by a shared supply temperature control system.

Thus, System 70 Industry makes it possible to connect large-scale industrial heating surfaces and heating surfaces for office areas, such as floor heating and radiators, to a single distributor. This greatly simplifies the installation and operation of the heating unit.

A High Level of Comfort at a Low Cost

This free choice of heating surface in industrial halls and offices makes for a user-oriented heating system and a high level of comfort. Installation costs are low since the actual installation of the system is inexpensive. More importantly, energy consumption is also kept to a minimum since the level and type of heating is adapted to meet the requirements of each individual area.

The set supply temperature for System 70 Industry floor heating can be set to a maximum of 82 °C. Besides making the combination of heating surfaces possible, raising the water temperature for floor heating to such a level has several other advantages.

Advantages

- The double coating of the DUO pipe protects the inner water pipe from damages due to the rough conditions in industrial areas (even the use of concrete vibrators poses no problem).
- The water content of the entire unit is reduced due to the small diameter of the water pipes. This also makes a reduction in the size of the conservator tanks and a low level of inertia possible.
- A wide range of temperature at the standard setting of 20 K allows for reduced water flow and smaller circulation pumps.
- No additional protective pipe needs to be applied near expansion joints.
- The pipes are simple to install due to the use of system plates or by fastening them to the steel reinforcement.
- Deep drilling depths for fastening machinery to the floor are possible, thus allowing unlimited use of the floor area.

System 70 Industry

industrial hall with floor heating and hot-air-curtains over the doors

System 70:

bordering office area with floor heating and radiators.

The two systems are combined directly, i.e. they are connected to the same distributor.
System 70 can be used in any situation where large floor heating surfaces need to be installed. It is appropriate for single surfaces larger than 200 m². For smaller surfaces, ROTEX System 70 with the DUO-17 heating pipe should be installed. Typical fields of application for System 70 Industry are:
- assembly and production buildings
- machinery halls
- warehouses and high shelving warehouse
- showrooms and merchandise halls
- maintenance halls for busses, trains, aircraft, etc.
- large entrance halls and foyers
- sport and convention facilities
- indoor pools and baths

A structural engineer should calculate the dimensions of the concrete slab. The basis for these measurements is the weight of the equipment you intend to use on the surface, e.g. lumped loads such as shelves, machinery, and vehicles. Traffic loads in industrial buildings are much higher than in residential buildings. Whereas the traffic load in a residential building is generally around 1.5 kN/m², an industrial building must withstand loads of 7.0 to 30 kN/m², depending on use.

Industrial surface heating can be installed in practically any type of concrete slab construction. Types of construction are:

1. Reinforced concrete is the typical industrial floor type. Slabs of reinforced concrete often contain an upper and lower layer of welded wire mesh reinforcement. In this case, the heating pipes are installed in the lower layer.

2. Pre-stressed concrete contains steel reinforcement combined with mesh reinforcement. The steel reinforcement is pre-stressed. The concrete slab is thus exposed to a compressive strain which helps prevent cracks from forming.

3. Steel fibre concrete consists of concrete with steel fibres mixed in. The steel fibres perform the same task as mesh reinforcement, thus replacing them. This means that both the concrete and the reinforcement are installed at the same time, making it necessary to plan in a special element to secure the heating pipes.

4. Vacuum concrete gets its name from the vacuum treatment it receives. Depending on the type of reinforcement, it may be composed of reinforced, pre-stressed, or steel fibre concrete. The vacuum treatment serves to remove a large part of the mixing water from the concrete, causing the concrete floor to become firm more quickly.
For these fields of application, floor heating offers a wide range of advantages in comparison with other heating surfaces. Most of the warmth is carried by way of thermal radiation, producing the comfortable temperature desired near the floor. Towards the ceiling, on the other hand, the room temperature is – in contrast to convective heating – lower. In this way, the loss of warmth is reduced and energy use is kept to a minimum.

• Increases in air speed caused by the heating are kept to a minimum, thus preventing drafts and the transportation of dust.
• By way of this low air speed, the negative effects of production procedures liable to release harmful materials into the air are kept to a minimum as well.
• Room temperature can be regulated individually for each area.
• Despite comparably low air temperatures, the room climate is pleasant and stable throughout the heated area.

Industrial floor heating with PE-X pipes effects a vertical temperature profile which insures a constant temperature spread from the floor to the ceiling, even when ceiling heights vary considerably within the installation area.

**Heat Insulation**

Generally, the heat insulation underneath the floor heating should be installed in compliance with the prevailing heat insulation ordinances. However, according to the W SchV heat insulation is not necessary in the following situations:

- industrial structures with an average indoor temperature of \( \leq 12 \, ^\circ\text{C} \)
- industrial structures with an average indoor temperature of more than 12 \(^\circ\text{C}\) and less than 19 \(^\circ\text{C}\) which need to be heated for less than 4 months a year
- workshops, industrial halls, and warehouses, if they must be kept open for long periods of time due to their usage and if they have an average indoor temperature of less than 19 \(^\circ\text{C}\)
- industrial structures for which heat insulation would constitute an unnecessary extravagance according to § 14 Härtefälle

**Remark**

Insulation layers between the concrete slab and soil, i.e. outside of the structural sealing, must qualify as “perimeter insulation” as defined in (E) DIN 4108-2. Only then may the heat transition values in the heat insulation list be used.

**Important:**

If the room temperature is \( > 19 \, ^\circ\text{C}\) and qualifies for an exemption according to the conditions in § 14 Härtefälle, a \( K \)-value of \( \leq 0.93 \, \text{W/m}^2\text{K} \) must nevertheless be adhered to according to DIN 4108.

These exceptions are valid for most industrial usage. However, we recommend using the ISODUR system plate if you are using steel fibre concrete to secure the heating pipes. This provides a basic layer of insulation, limiting the downward flow of heat considerably. To keep a \(K\)-value of \( k_{\text{max}} = 0.35 \, \text{W/m}^2\text{K} \) in compliance with WSVO, approximately 75 mm of PS 30 SE must be laid underneath the ISODUR plate and 100 mm underneath the steel reinforcement layer. For surfaces with heavy loads, it is important to consider the compression resistance of the insulation material. For instance, Styrodur 5000 S could be used instead of PS 30.
The ISODUR Plate

The ISODUR system plate is pipe holder and insulation in one. It is a polystyrene nap plate with naps designed to secure the pipes and provide a trouble-free curved guide. The naps are 100 mm apart, making grid dimensions of 100, 200, 300, 400, and 500 mm possible. There are integrated 5 mm high ridges between the naps which help lift the pipe from the insulation, thus insuring that the pipes are completely surrounded with concrete or screed.

ISODUR plates have a surrounding step fold and are connected with one another with dovetail joints. ISODUR plates are not sensitive to moisture and resistant to heavy loads.

<table>
<thead>
<tr>
<th>ISODUR Plate Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>height of insulation layer</td>
</tr>
<tr>
<td>total height, including naps</td>
</tr>
<tr>
<td>width of step fold</td>
</tr>
<tr>
<td>grid dimensions for pipes</td>
</tr>
<tr>
<td>no. of dovetail joints</td>
</tr>
<tr>
<td>Application type according to DIN 4108 T. 10/DEO</td>
</tr>
<tr>
<td>thermal resistance R/A</td>
</tr>
<tr>
<td>weight of plate</td>
</tr>
<tr>
<td>weight per m²</td>
</tr>
<tr>
<td>fireproofing class</td>
</tr>
<tr>
<td>installation dimensions</td>
</tr>
<tr>
<td>packing unit</td>
</tr>
<tr>
<td>order no.</td>
</tr>
</tbody>
</table>

The DUO Pipe

The DUO pipe consists of a water-carrying inner pipe surrounded by a helical reinforcing web. The air gap between the water pipe and the reinforcing web leads to a pre-calculated heat insulation by virtue of which the water temperature necessary for floor heating may be raised. In this way, the temperature of the heating water can be set much higher than with conventional heating pipes.

<table>
<thead>
<tr>
<th>DUO 25 Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>diameter of helical reinforcing web</td>
</tr>
<tr>
<td>diameter of inner pipe</td>
</tr>
<tr>
<td>strength of inner pipe wall</td>
</tr>
<tr>
<td>material of helical reinforcing web</td>
</tr>
<tr>
<td>material of inner pipe</td>
</tr>
<tr>
<td>diffusion obstruction layer</td>
</tr>
<tr>
<td>max. temp. allowed</td>
</tr>
<tr>
<td>weight</td>
</tr>
<tr>
<td>water content</td>
</tr>
<tr>
<td>min. bending radius</td>
</tr>
<tr>
<td>max. length of heating circuit</td>
</tr>
<tr>
<td>max. output per heating circuit</td>
</tr>
<tr>
<td>packing units</td>
</tr>
</tbody>
</table>
Installation Variants

ROTEX System 70 Industry floor heating is available in two basic installation variants:
• with ISODUR system plate
• heating pipes secured to steel reinforcement

Preparation

The following steps must be carried out before installation regardless of whether the system is to be installed with ISODUR system plates or steel reinforcement:
• leveling and sealing of the sub-base
• application of a cleanliness layer
• application of PE-foil to seal against moisture from below
• application of the special wall insulation strip on all vertical surfaces
• installation of the heating circuit distributor

Installation with the ISODUR System Plate

The ISODUR system plate is insulation and pipe holder in one. It may be installed directly on the sealing layer of PE-foil laid during the preparation stage. The pipe-laying should always begin in a corner of the area to be covered. The “A” stamped in one of the naps should be placed in the corner you start with. You may walk on the naps without damaging them after installing the system plates. Then, starting at the distributor lay the pipes in the system plates according to the grid plan. When large surfaces are to be covered it is simpler to lay the pipes in a meandering fashion. If you prefer, you may also use a ring-shaped grid plan.

The naps on the system plates are designed to hold the pipe securely without additional holders. If you wish or need better insulation than that offered by the ISODUR plates, you may install a layer of heat insulation before laying the system plates.

If you are using the ISODUR plates, the concrete slab may be reinforced with either steel mats or steel pins. While the concrete is being applied the heating pipes must be under pressure. Concrete vibrators may be used at any time during the process of applying the concrete.

Installation with Steel Reinforcement

For an installation without ISODUR system plates, the DUO heating pipe is secured directly to the lower steel reinforcement mats. This can be done with binding wire covered with plastic. In this way, the pipe may simply be secured with a drill. The pipes may be laid beginning at the distributor after the lower steel mat layer has been applied. The dimensions sketched out in the grid plan can be achieved by counting the spaces between the grates of the steel reinforcement.

Pouring the Cement

Once you have laid all heating pipes and connected them to the distributor, the heating pipes are filled with water and pressurised to at least 2.5 bar. After this, the extra reinforcement layers are applied. The cement may then be poured. The heating pipes must remain pressurised during this process.

Heating

The question as to how soon the unit may be heated up should be left to the pourer of the cement or a structural engineer, as it depends upon the density and quality of the cement (21 days after pouring the cement at the earliest). The floor heating is then operated with a flow temperature which is 5 K higher than that of the cement for a period of at least 1 week. Then, the flow temperature is raised by 5 K each day until the set temperature is reached. The unit is held at this temperature for at least 4 days, and then the temperature is lowered by 10 K each day until the operating temperature is reached. A running protocol of the heating process should be kept. We have included a sample protocol on page 50.

The density of the concrete slab is determined by a structural engineer using purely statistical data. The fact that the floor is to be heated plays no role in these calculations as the concrete warms up only insignificantly due to floor heating. After a setting time of two to three days, the concrete slab is sawed into accordance to the structural engineer’s data in order to create predetermined breaking points for the contraction of the cement. The joints must then be filled with an elastic substance.
The QuickFix heating circuit distributor (HCD) is used to connect the heating pipes and the distribution. This distributor, which provides connections for 2 to 14 heating circuits, is described on page 15. The electronic individual room control system is described on pages 18 and 20.

The heating circuit distributor must be installed in one of the special cases described in the following.

There are two sizes of distributor case for the heating circuit distributors. There is a case covering without a rear wall, which is installed directly on the wall during the installation of the distributor, and a fixing console with a rear wall which may be attached to the wall or installed away from the wall. The cases can be installed on a wall or without the support of a wall (if, for example, the walls are to be built later). When pouring the concrete, the area near the distributor must be free of concrete (polystyrene can be laid in this area or it can be chiselled free). In this way, additional heating surfaces may be connected later.

---

<table>
<thead>
<tr>
<th>Dimensions of the Heating Circuit Distributors and Case Coverings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(suitable for assembly on or away from wall)</td>
</tr>
<tr>
<td>STK/WIC 40</td>
</tr>
<tr>
<td>no. of heating circuits</td>
</tr>
<tr>
<td>distributor dimensions with cross joint and ball valve</td>
</tr>
<tr>
<td>distributor dimensions</td>
</tr>
<tr>
<td>spacing of holes on mounting</td>
</tr>
<tr>
<td>height of case</td>
</tr>
<tr>
<td>width of case</td>
</tr>
<tr>
<td>depth of case</td>
</tr>
<tr>
<td>STK/WIC 45</td>
</tr>
<tr>
<td>no. of heating circuits</td>
</tr>
<tr>
<td>distributor dimensions with cross joint and ball valve</td>
</tr>
<tr>
<td>distributor dimensions</td>
</tr>
<tr>
<td>spacing of holes on mounting</td>
</tr>
<tr>
<td>height of case</td>
</tr>
<tr>
<td>width of case</td>
</tr>
<tr>
<td>depth of case</td>
</tr>
</tbody>
</table>

Measurements in mm

Important: The installation height from the OK distributor case to the OK finished flooring must be between 680 and 730 mm.
The fundamentals of heating system installation are:

• calculating heat consumption of the space to be heated.
• determining desired room temperature.
• deciding which floor covering is to be used.
• determining density of the concrete plate.
• allocating proportions of heating output between floor heating and other heating surfaces.

System 70 Industry floor heating is installed with the help of a computer program developed especially for this purpose. For more information or for aid or advice in planning your industrial heating system, the experienced ROTEX planning department is at your disposal. Included in the results of the installation calculations are the allocation of pipes to each area, the setting of the distributor for each heating circuit, the length of each heating circuit, and the water flow necessary for each heating circuit. The results are compiled in a table with all measurements necessary for installation.

The working sequence which must be followed when installing a ROTEX System 70 Industry heating unit differs from the sequence followed for an unheated industrial surface only in the addition of two extra steps: the laying of the ISODUR plates and of the pipe. The following table summarises the individual steps:

<table>
<thead>
<tr>
<th>Task</th>
<th>Performed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>groundwork, base work</td>
<td>building firm</td>
</tr>
<tr>
<td>application of structural sealing</td>
<td>building firm</td>
</tr>
<tr>
<td>application of special wall insulation strip on all vertical surfaces</td>
<td>heating specialist</td>
</tr>
<tr>
<td>installation of distributor</td>
<td>heating specialist</td>
</tr>
<tr>
<td>laying of ISODUR plates</td>
<td>heating specialist</td>
</tr>
<tr>
<td>or laying of steel mats</td>
<td>building firm</td>
</tr>
<tr>
<td>laying of 25/18 x 2 DUO pipe and connection to distributor</td>
<td>heating specialist</td>
</tr>
<tr>
<td>pressure test, pressurisation until concrete is applied</td>
<td>heating specialist</td>
</tr>
<tr>
<td>pouring and levelling of concrete</td>
<td>building firm</td>
</tr>
<tr>
<td>sawing of concrete</td>
<td>building firm</td>
</tr>
<tr>
<td>filling of gaps with elastic material</td>
<td>building firm</td>
</tr>
<tr>
<td>heating start, at least 21 days after installation</td>
<td>heating specialist</td>
</tr>
</tbody>
</table>

DUO pipe is shipped in 200, 440, and 1400 m rolls. Our pipe unwinders (type PU) were developed to make the task of laying the pipe simpler and trouble-free. For larger surfaces, a pipe drum with an unwind stand and 1400 m of DUO pipe is available. A fork lift or other lifting machine is absolutely necessary to transport this pipe drum. The pipe for System 70 Industry floor heating is laid in a meandering or a ring-shaped fashion. If the pipes are separated by less than 300 mm, they are laid in an omega shape in curves, i.e. the diameter of the curves becomes greater than the spacing of the pipes.
Heating Protocol for 
ROTEx System 70 Industry Floor Heating

Before the floor covering can be applied, the floor heating unit must be heated up according to a prescribed procedure regardless of season. This protocol documents this heating procedure.

building:

heating specialist:

building firm:

(name, address)

building information: total thickness of concrete mm thickness above pipe mm

heating start: 21 days after pouring of cement

heating procedure: Flow temperature is raised 5 K per day until max. set temperature is reached. This temp. is held for 4 days, then cooling begins.

cooling procedure: flow temperature sunk by 10 K per day

flow temperature: For System 70 and System 70 Industry (DUO heating pipes), the heating process begins at 38 °C (corresponding to 25 °C with conventional floor heating systems).

<table>
<thead>
<tr>
<th>flow temperature</th>
<th>flow temp. measured</th>
<th>date</th>
<th>necessary time period</th>
</tr>
</thead>
<tbody>
<tr>
<td>heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>43 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>48 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>53 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>58 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>63 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>set temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 °C</td>
<td></td>
<td></td>
<td>4 days</td>
</tr>
<tr>
<td>cooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>50 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>40 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>30 °C</td>
<td></td>
<td></td>
<td>1 day</td>
</tr>
</tbody>
</table>

shut-off or control depending on weather

pressure test: yes no

handing over to client:

outdoor temp. °C flow temp. °C

floor heating in operation yes no pressure of unit bar

remarks:

confirmation:

(place/stamp/signature) building owner/client planner/architect heating specialist
The specific warranty claims described in the following are open to all installation firms who have installed our floor heating and thermal distribution systems without using foreign parts. Furthermore, at the time of installation the firm must be a member in good standing of the guild with jurisdiction over the municipality in which the firm is located or members of the trade association for heating, ventilation, and air-conditioning technology or another officially recognised trade association for the heating, sanitary, or air-conditioning industries. A further prerequisite for warranty claims is the observance of our planning, installation, and usage instructions.

On the basis of these warranty claims, we commit ourselves for a period of 10 years starting with the installation of the unit, at the longest 10 1/2 years from the date of delivery of the parts, to replacing defective system plates manufactured and delivered by ROTEX free of charge. Within the same period of time we commit ourselves to replacing defective PE-Xc and AL heating pipes manufactured and delivered by ROTEX free of charge. In addition, we also commit ourselves to reimbursing installation expenses to the installation firm contracted by the client, inasmuch as these costs are found to be due to manufacturing faults caused by us. Such claims are valid particularly in the case of damage to the property of the client for which we are found to be at fault and/or consequential damages resulting from this damage. Additionally, expenditures arising as a result of the removal, disassembly, or clearing of defective materials and the assembly, installation, or laying of fault-free materials are also included. Our liability to compensate for damages is limited to an amount of 5 million EUR per building. The specific warranty claim to which we commit ourselves with this warranty statement is not valid for damages or expenditures found to be due to faulty pipe connection parts. The installer has the right to no further warranty claims.
Feel free to ask for information about these ROTEX products as well.

- ROTEX HeatLine® - The coming heating
- ROTEX A1 - The condensing specialist
- ROTEX System 70 - Underfloor heating with radiator connection
- ROTEX Sanicube - The hygienic warm water accumulator
- ROTEX Solaris - The direct, unpressurised solar energy unit
- ROTEX VA®-System - Installation system for heating and sanitary
- ROTEX variocistern - For the use of rain water

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