

Application Guide

Designing hydronic floor heating

Get the optimum results

7

applications

to help you design
and install Danfoss
floor heating systems.





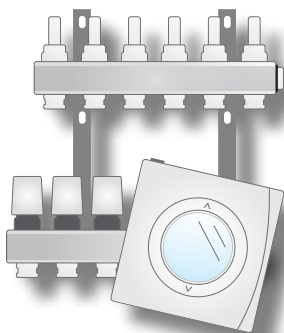
THE RIGHT PRODUCTS FOR YOUR APPLICATION

Choosing the right products not only depends on the application. Once you have identified the product groups relevant for your application, simply go to the Product Guide brochure to narrow down the choice to specific product codes.

This application guide:

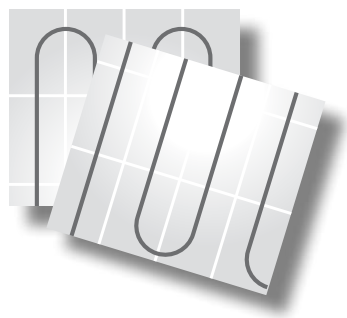
- Recommends specific product groups for different applications
- Recommends which pipe layout pattern to use in different situations
- Shows the benefits and impact of using cement and liquid screed

Application guides for **manifolds and controls**



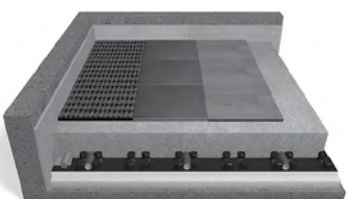
- 05 | FLOOR HEATING SYSTEM WITH INDIVIDUAL ROOM CONTROL, LOW TEMPERATURE
- 06 | FLOOR HEATING SYSTEM WITH INDIVIDUAL ROOM CONTROL, HIGH TEMPERATURE
- 07 | MIXED SYSTEM WITH INDIVIDUAL ROOM CONTROL, HIGH TEMPERATURE
- 08 | FLOOR HEATING SYSTEM WITH REFERENCE ROOM CONTROL, LOW TEMPERATURE
- 09 | MIXED SYSTEM WITH SELF-ACTING ROOM CONTROL
- 10 | FLOOR HEATING SYSTEM WITH INDIVIDUAL ROOM CONTROL, LOW TEMPERATURE AND COOLING IN 2-PIPE SYSTEM
- 11 | FLOOR HEATING SYSTEM WITH INDIVIDUAL ROOM CONTROL, LOW TEMPERATURE AND COOLING IN 3/4-PIPE SYSTEM

How to design **effective pipe layout**



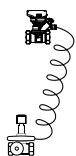
- 14 | MEANDER PATTERN VS. SNAIL PATTERN
- 15 | SMALL WINDOWS VS. LARGE WINDOWS
- 16 | BATHROOM AND KITCHEN LAYING PATTERNS AND DISTANCE
- 17 | LARGE ROOMS LAYING PATTERNS AND DISTANCE

Choosing the right **floor screed**

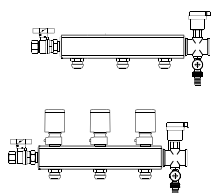


- 19 | LIQUID SCREED VS. CEMENT SCREED

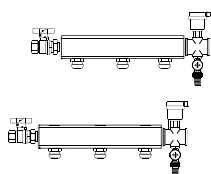
APPLICATION SYMBOLS



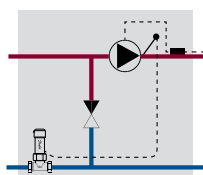
Balancing valves



Manifold with control valves
for actuators



Manifold without control valves
for actuators



Mixing shunt



Room thermostat generic



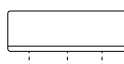
Room thermostat wired



RA-HC with actuator TWA



FHV self-acting thermostatic valve



Connection box



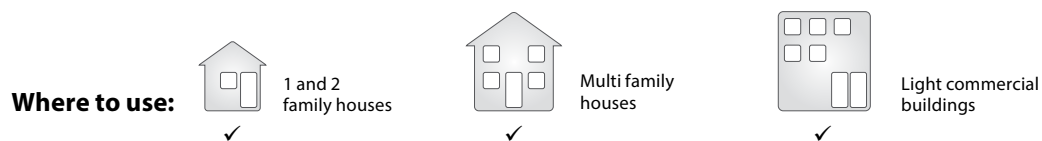
ECL weather compensator



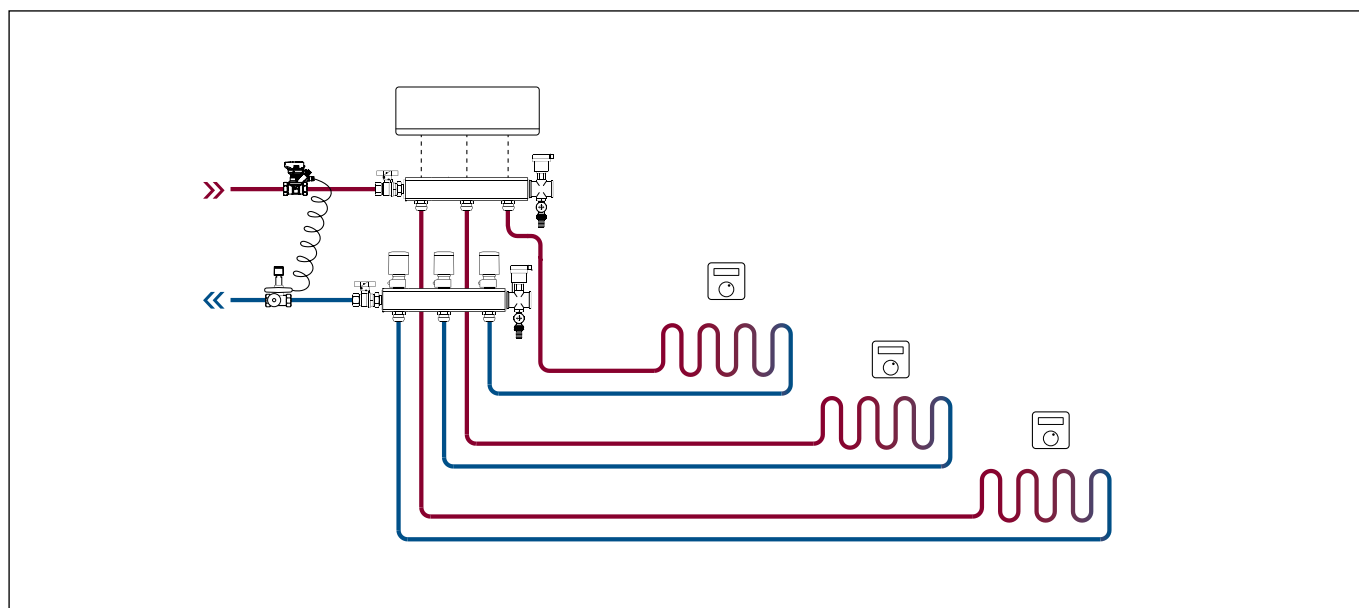
ESM-11 pipe sensor for supply pipe
for automatic change over between
cooling and heating in 2-pipe system or
dew point sensor in 3/4 pipe systems

Floor heating system with individual room control

low temperature



- Advantages:**
- Individual room comfort and energy savings achieved by room thermostats
 - Energy savings on heat production and pump energy with connection box relays
 - Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting



Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	✓	✓	✓	(✓)**	(✓)**	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	✓	✓	✓	✓	–	
Balancing valve	ASV-PV	ASV-BD				
	✓	✓				

Complementary products suitable for application:

- Mixing shunts are not needed in low supply temperature applications
- ** BasicPlus and BasicPlus² can be combined with connection box to achieve energy savings on heat production and pump energy with relays

Floor heating system with individual room control

high temperature

Where to use:



1 and 2 family houses
✓

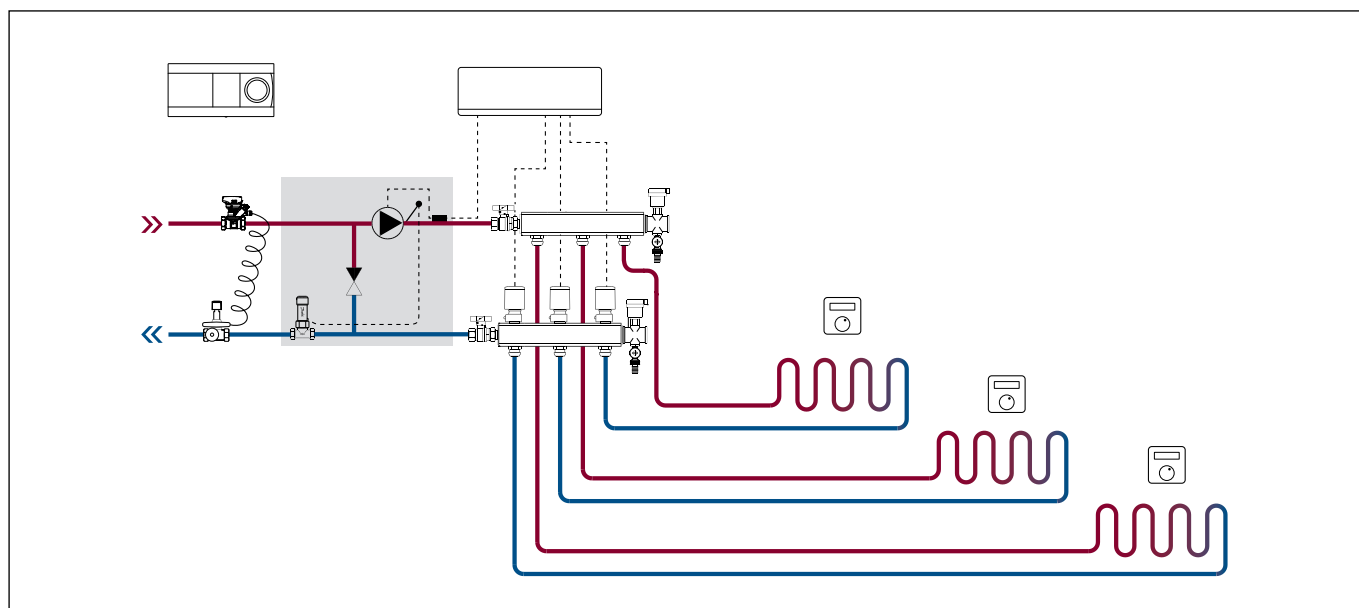


Multi family houses
(✓)



Light commercial buildings
(✓)

- Advantages:**
- Individual room comfort and energy savings achieved by room thermostats
 - Energy savings on heat production and pump energy with connection box relays
 - Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting



Components suitable for application:

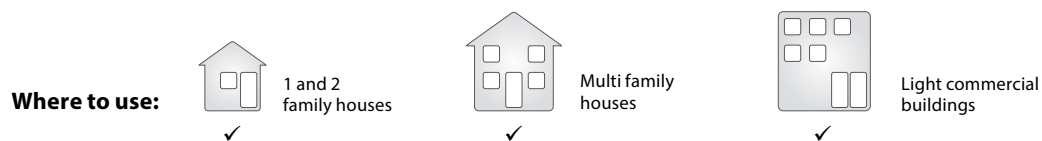
Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	✓	✓	✓	(✓)**	(✓)**	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	✓	✓	✓	✓	–	
Balancing valve	ASV-PV	ASV-BD				
	✓	✓				

Complementary products suitable for application:

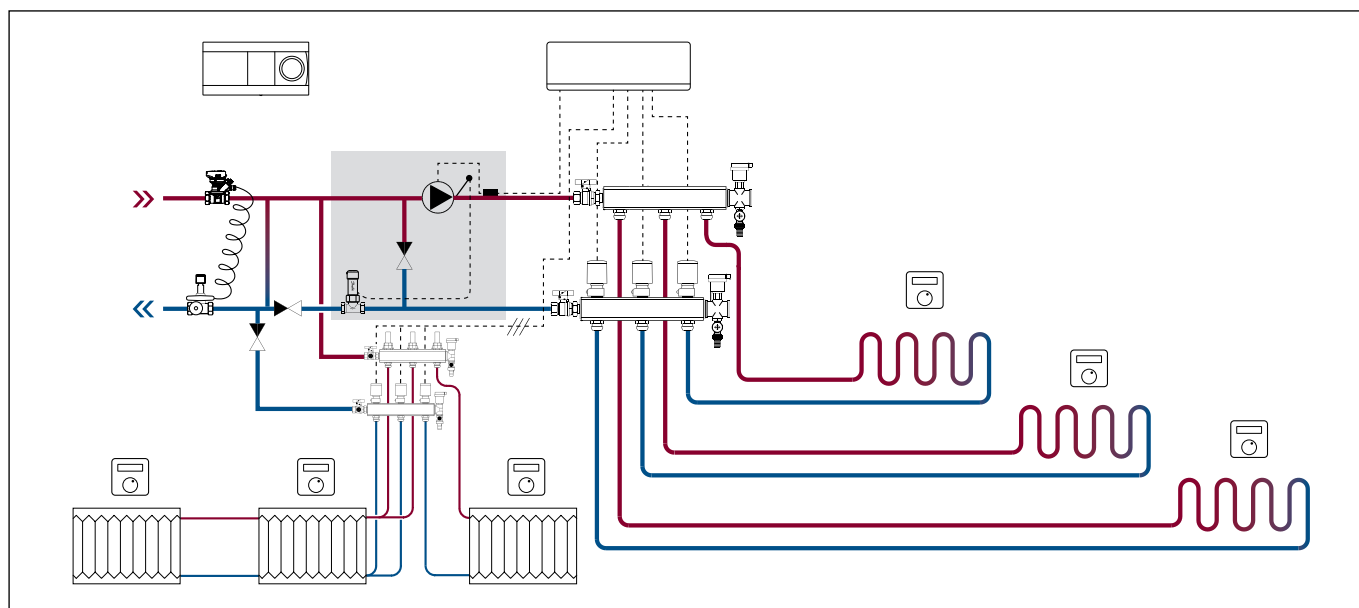
- Mixing shunts to be used in applications with high supply temperatures
- An upgrade ECL kit can be applied to the FHM-Cx mixing shunt to allow for weather compensated supply temperatures
- ** BasicPlus and BasicPlus² can be combined with connection box to achieve energy savings on heat production and pump energy with relays

Mixed system with individual room control

high temperature



- Advantages:**
- Individual room comfort and energy savings achieved by room thermostats
 - Energy savings on heat production and pump energy with connection box relays
 - Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting



Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	✓	✓	✓	(✓)**	(✓)**	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	✓	✓	✓	✓	–	
Balancing valve	ASV-PV	ASV-BD				
	✓	✓				

Complementary products suitable for application:

- Mixing shunts to be used in mixed systems where there is a need to differentiate the supply temperature in part of the system e.g. radiator system with high supply temperature and floor heating with low temperature
- An upgrade ECL kit can be applied to the FHM-Cx mixing shunt to allow for weather compensated supply temperatures
- **BasicPlus and BasicPlus² can be combined with connection box to achieve energy savings on heat production and pump energy with relays

Floor heating system with reference room control

low temperature

Where to use:



1 and 2 family houses



Multi family houses

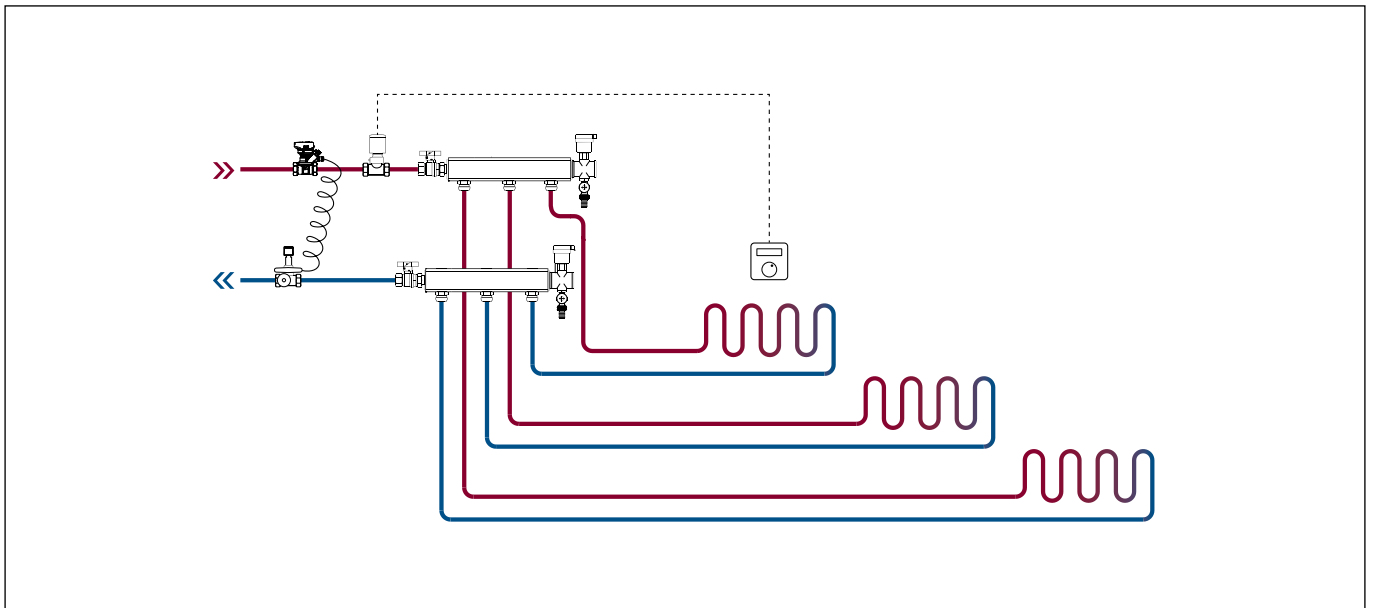


Light commercial buildings



Advantages:

- Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting



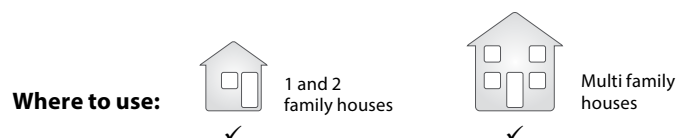
Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	–	–	–	✓	✓	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	(✓)*	(✓)*	(✓)*	(✓)**	✓	
Balancing valve	ASV-PV	ASV-BD	RA-HC			
	✓	✓	✓			

Complementary products suitable for application:

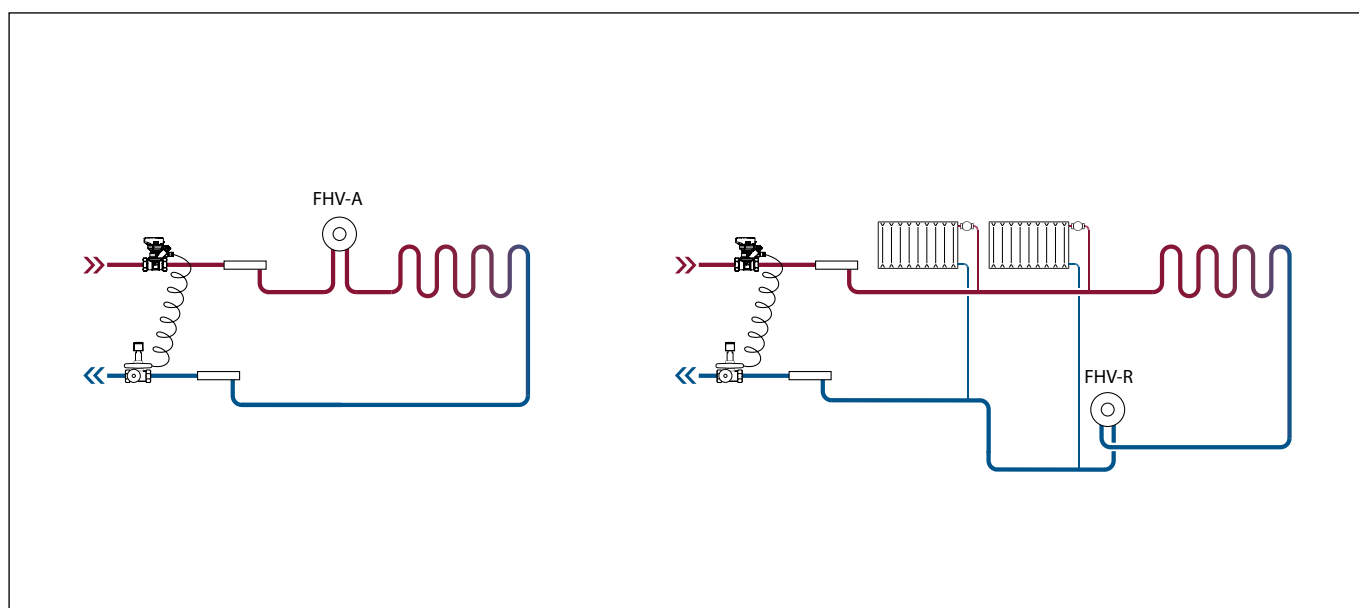
- * Use manifolds FHF, FHF-F and SSM-F for easier flow setting
- ** Rough pre-setting with Allen key

Mixed system with self-acting room control



Advantages:

- Individual room comfort and energy savings achieved by room thermostats



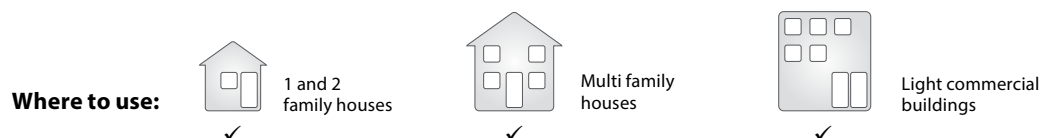
Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	–	–	–	–	–	✓
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	–	–	–	–	✓	
Balancing valve	ASV-PV	ASV-BD				
	✓	✓				

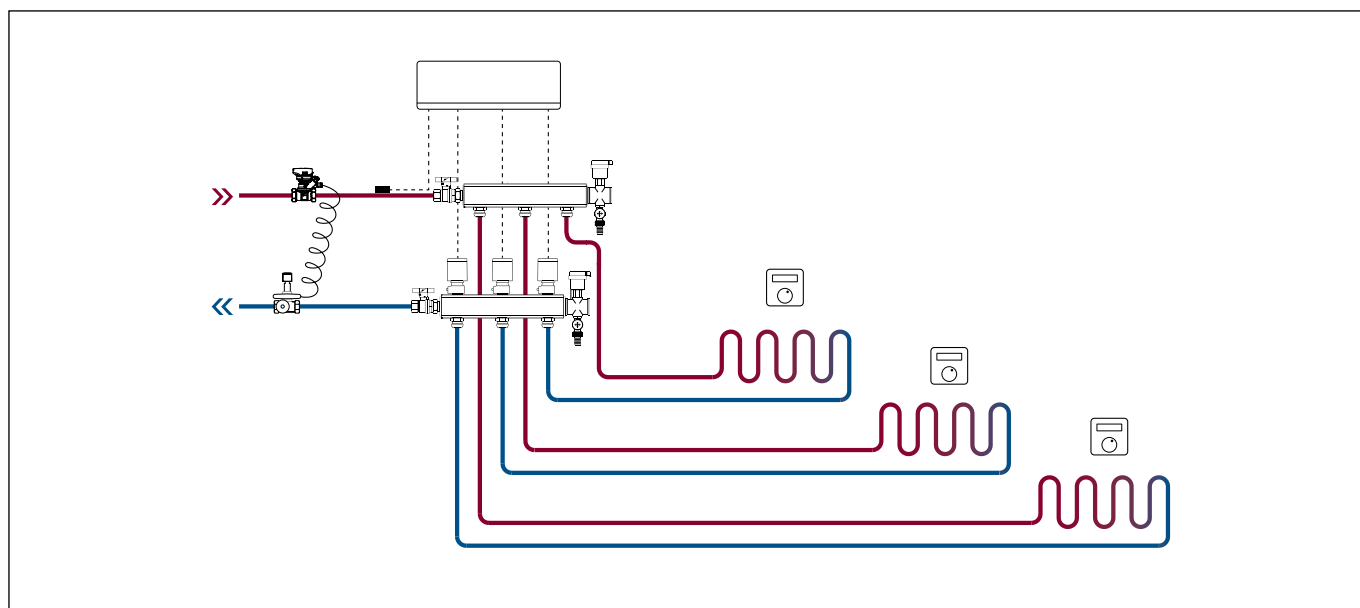
Complementary products suitable for application:

- In case of multi family houses, balancing valve AB-QM should be used

Floor heating system with individual room control low temperature and cooling in 2-pipe system



- Advantages:**
- Individual room comfort and energy savings achieved by room thermostats
 - Energy savings on heat production and pump energy with connection box relays
 - Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting
 - Use floor heating system for passive cooling



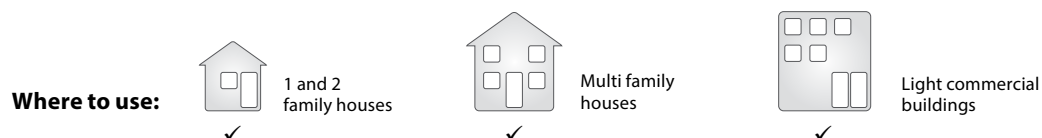
Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	–	✓	–	–	–	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	✓	✓	✓	✓	–	
Balancing valve	ASV-PV	ASV-BD				
	✓	✓				

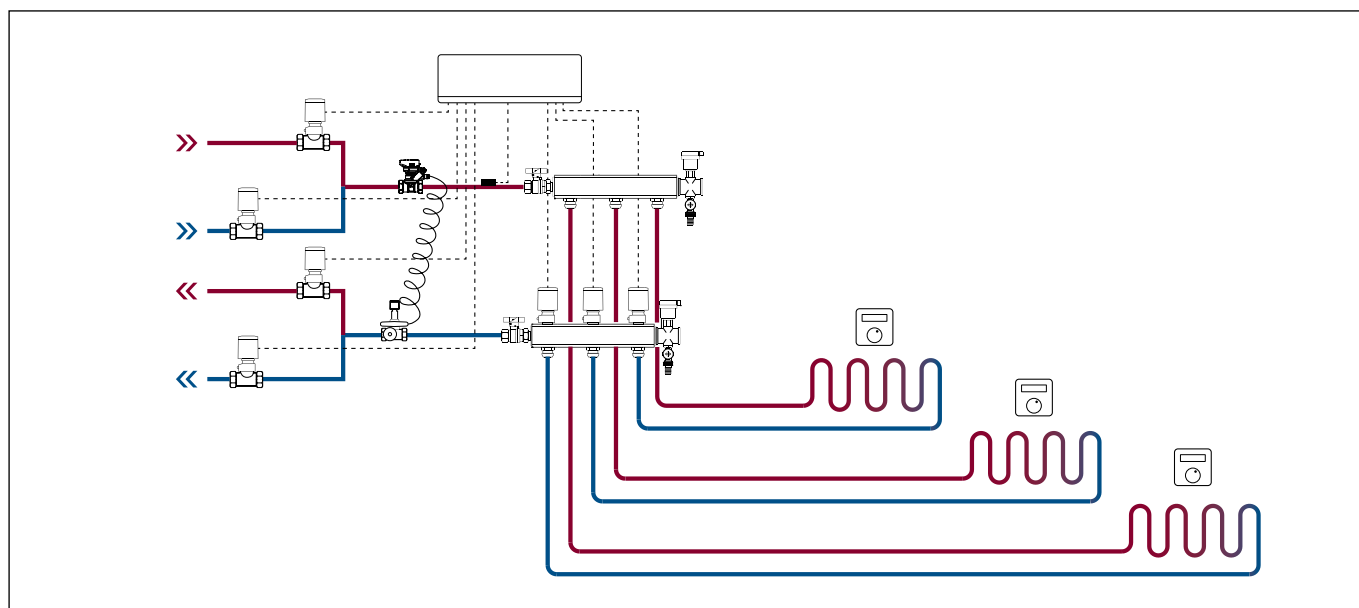
Required products for application:

- ESM-11 pipe sensor for supply pipe for automatic change over between cooling and heating
- Remote controller CF-RC for configuration of system

Floor heating system with individual room control low temperature and cooling in 3/4-pipe system



- Advantages:**
- Individual room comfort and energy savings achieved by room thermostats
 - Energy savings on heat production and pump energy with connection box relays
 - Ensure correct flow to heating system on apartment level with balancing valves and manifold flow setting
 - Use floor heating system for passive cooling



Components suitable for application:

Controls *	Danfoss Link	CF2 ⁺	FH-Wx	BacisPlus	BacisPlus ²	FHV
	–	✓	–	–	–	–
Manifolds *	FHF-F	FHF	SSM-F	FH-ME	FHF-B	
	✓	✓	✓	✓	–	
Balancing valve	ASV-PV	ASV-BD	RA-HC **			
	✓	✓	✓			

Required products for application:

- Remote controller CF-RC for configuration of system
- Dew point sensor CF-DS
- ** Only if differential pressure in the system is <1 bar. If differential pressure is higher please contact Danfoss

Easier application specification **Online**

Our online QuickPlanner dimensioning program enables you to calculate the correct pre-setting values in just minutes. Go online and have the following information ready:

- Room sizes
- Heat requirement (W/m²)
- Supply temperature
- Desired room temperature
- Floor type



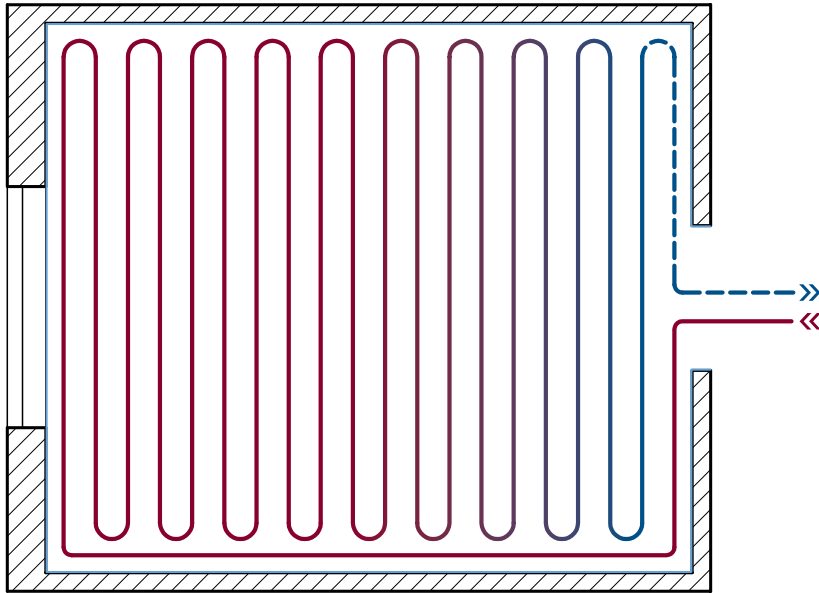
HOW TO DESIGN **EFFECTIVE PIPE LAYOUT**

Application guidelines for heating circuit layout.

The application guidelines provide you with basic application ideas and recommendations on how to design effective layout patterns for different rooms.

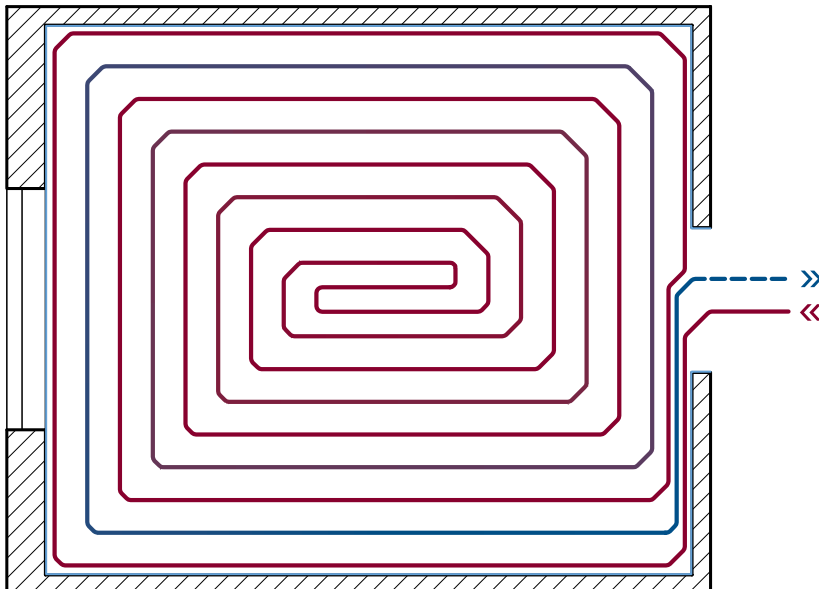
Meander pattern vs. snail pattern

Benefits



Meander pattern

- The meander pattern is easy to lay
- BasicRail™, BasicClip™ and BasicGrip™ systems can be used
- The meander pattern will distribute heating less uniformly across the room. In effect, some parts of the floor will be warmer than others



Snail pattern

- Heating is equally distributed as supply and return water runs adjacent. This provides comfort compared to the meander pattern.
- Requires more planning to lay
- Difficult to use BasicRail™

Pipe distance independent of pattern

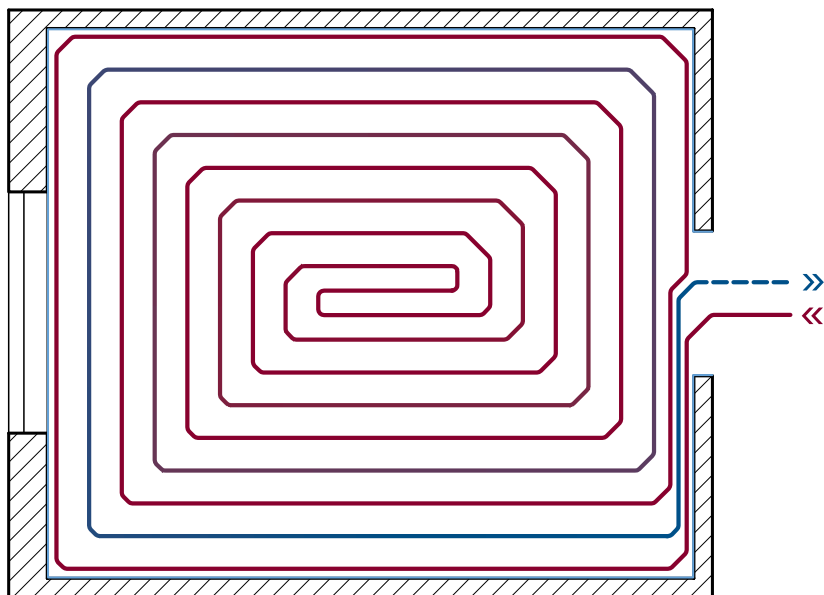
type example:

Floor type:	Wooden floor
Heat requirement:	40 W/m ²
Mean water temp.:	35 °C
Room temperature:	20 °C
= Pipe distance	200 mm CC

For information about your specific building, please consult Danfoss.

Small windows vs. large windows

Pipe distance



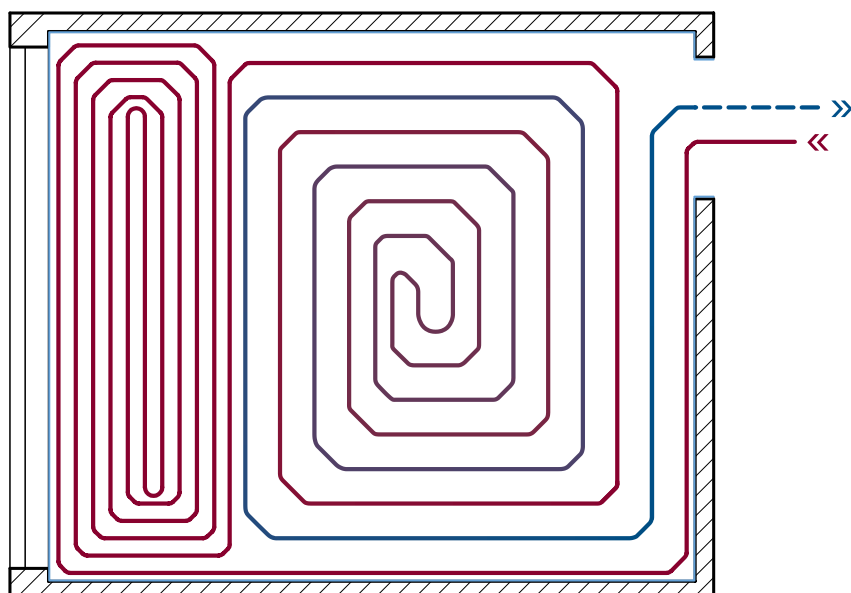
Small or no windows

Smaller windows do not need to be taken into account as the downdraft is limited.

Example:

Floor type:	Tile floor
Heat requirement:	40 W/m ²
Mean water temp.:	35 °C
Room temperature:	20 °C
= Pipe distance	200 mm CC

For information about your specific building, please consult Danfoss.



Large floor-to-ceiling window

At larger windows the pipe distance must be reduced in order to account for downdraft from the windows.

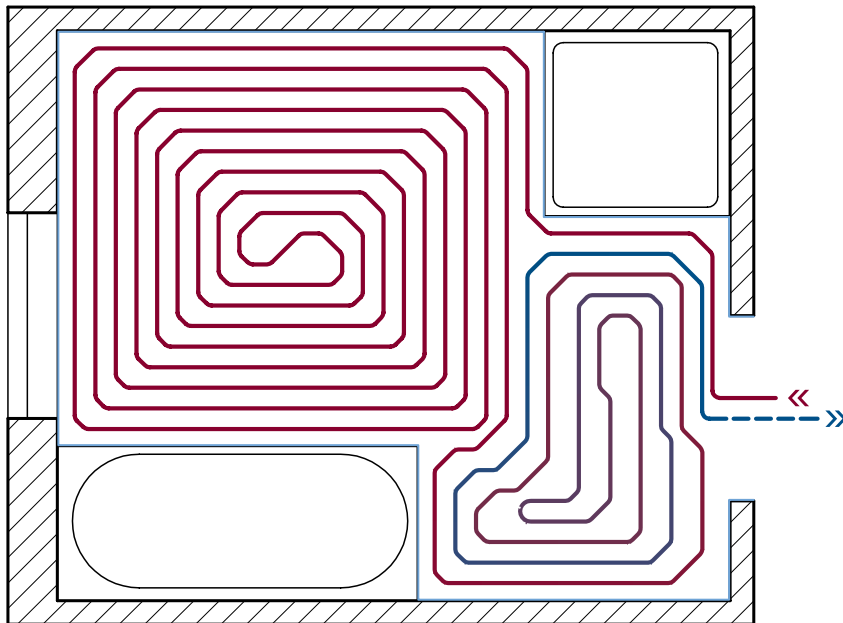
Example:

Floor type:	Tile floor
Heat requirement:	92 W/m ² (at the window)
Mean water temp.:	35 °C
Room temperature:	20 °C
= Pipe distance, window	120 mm CC
= Pipe distance, rest	200 mm CC

For information about your specific building, please consult Danfoss.

Bathroom and kitchen

Laying patterns and distance



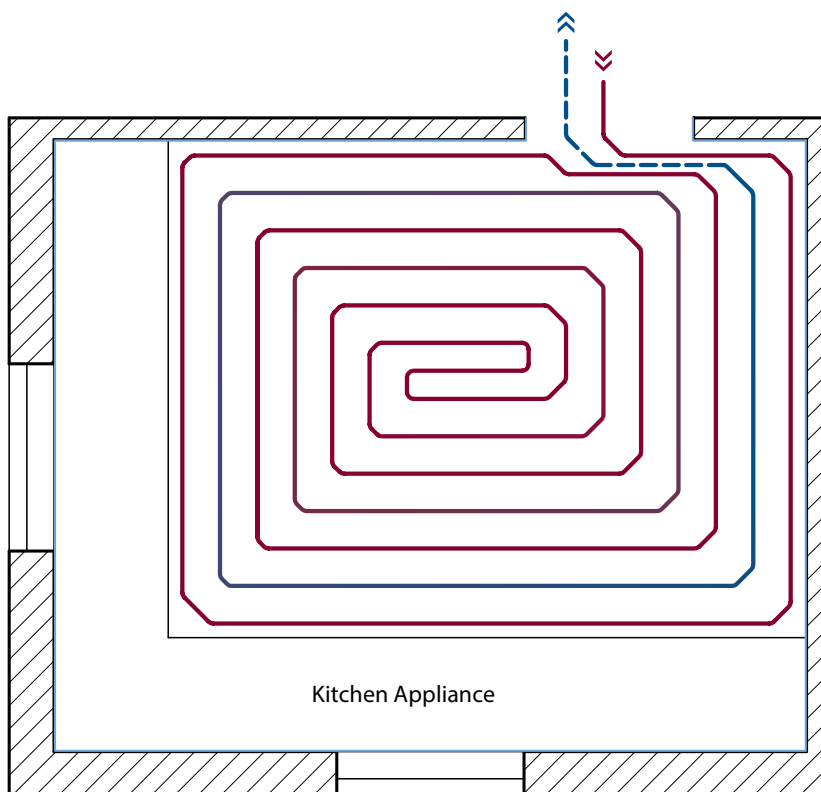
Bathroom

Suggested snail pattern for a typical bathroom. Due to the requirement for higher temperatures in the bathroom, the pipe distance should be reduced.

Example:

Floor type:	Tile floor
Heat requirement:	67 W/m ²
(at the window)	
Mean water temp.:	35 °C
Room temperature:	24 °C
= Pipe distance, window 120 mm CC	

For information about your specific building, please consult Danfoss.



Kitchen

Avoid placing pipes under the kitchen cabinets. If pipes are placed under the kitchen cabinets, the temperature in the cabinets will increase which is not optimal if they contain food.

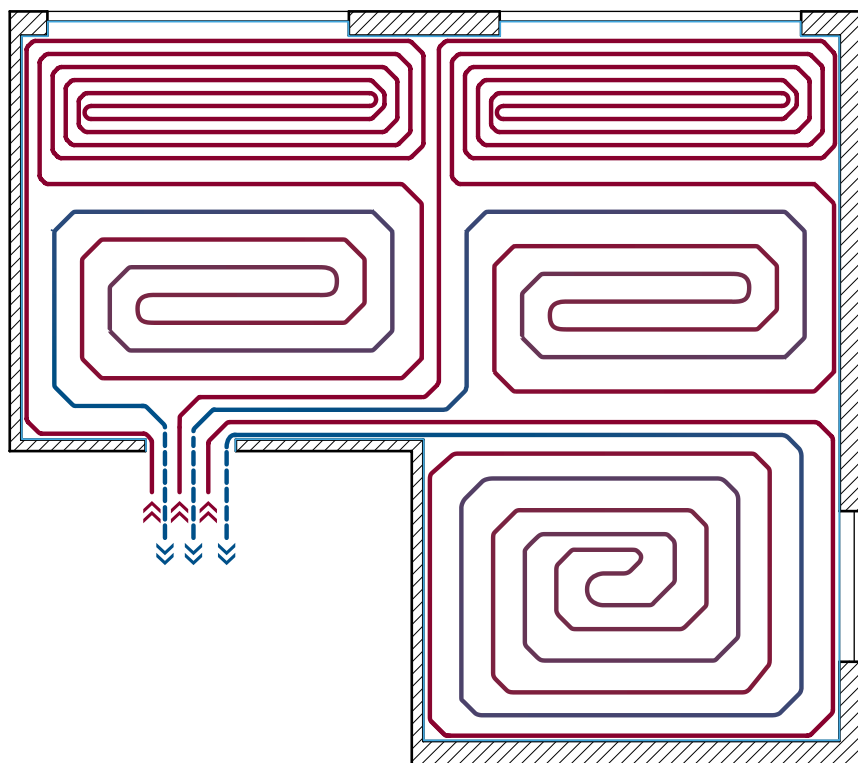
Example:

Floor type:	Wooden floor
Heat requirement:	40 W/m ²
Mean water temp.:	35 °C
Room temperature:	20 °C
= Pipe distance 200 mm CC	

For information about your specific building, please consult Danfoss.

Large rooms

Laying patterns and distance



Large rooms

Suggested snail pattern for a typical large room.

Due to the size of the room the number of circuits must be increased (in this example to three circuits).

Example:

Floor type:	Wooden floor
Heat requirement:	40 W/m ²
Mean water temp.:	35 °C
Room temperature:	20 °C

Number of circuits **3**

= Pipe distance, window	120 mm CC
= Pipe distance, rest	200 mm CC

For information about your specific building, please consult Danfoss.

CHOOSING THE RIGHT FLOOR SCREED

Application guidelines for floor build-up.

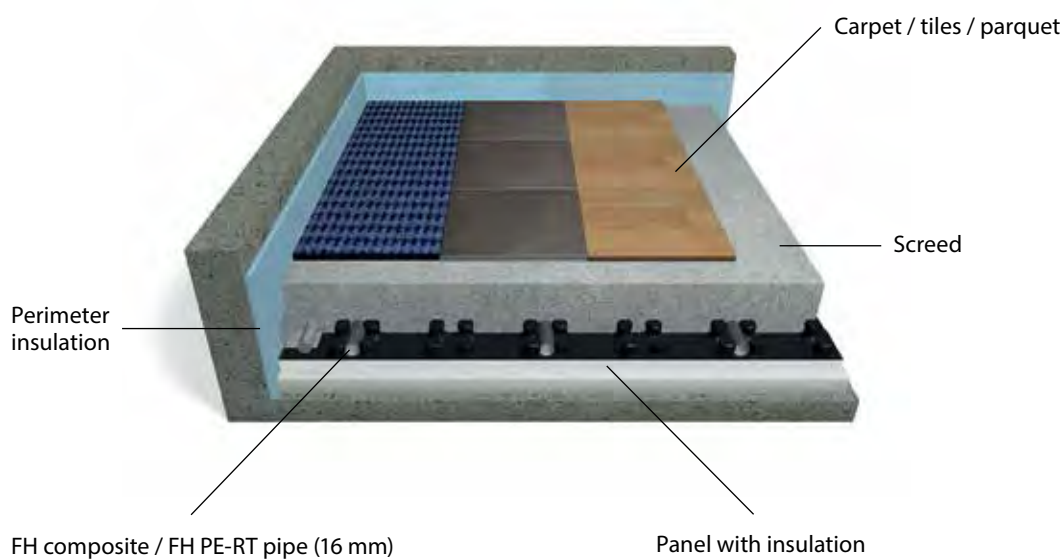
Liquid and cement screed both ensure a smooth and even surface. However, the two types of screed each have different benefits and impact on floor thickness and weight.

Liquid screed vs. cement screed

Benefits and impact

Liquid screed

- + Floor **thickness** reduced compared to cement screed
- Floor **weight** reduced compared to cement screed
- Reducing thickness and weight can be important in e.g. renovations
- Liquid screed is often more expensive

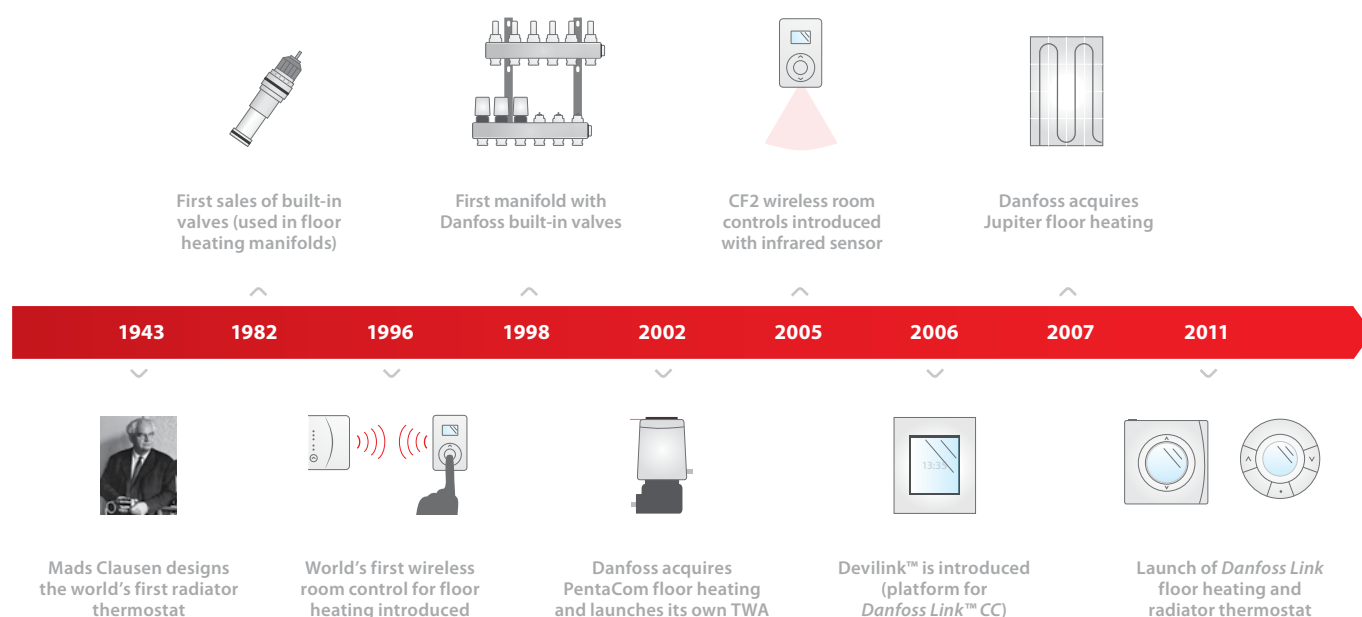


		Liquid *	Cement	
Screed thickness	[mm]	65	85	
Insulation thickness	[mm]	35	35	
Construction height	[mm]	100	120	Height excluding floor finish
Weight	[Kg/m²]	140	176	Weight excluding floor finish
Thermal resistance (R)	[m²K/W]	0.87	0.87	Thermal resistance value for floor heating panel
Thermal transmission coefficient (U)	[W/m²K]	0.96	0.96	Check building regulation for thermal insulation requirement
Distribution load	[kN/mm²]	<2.0	<2.0	
Point load (>20 cm²)	[kN]	<2.0	<2.0	
Impact subsonic noise reduction	[dB]	28	28	Calculated value according to DIN 4109. Applies to concrete slabs thicker than 12 cm (DIN 4109; m² > 276 kg/m²)

* Example based on cement screed with CAF F5 additive. Using other CAF additives will impact thickness and weight.

Pioneering heating controls for decades

Danfoss has been designing and developing heating control systems for more than 80 years. Throughout that time, it has been our goal to continuously innovate, perfect and refine cutting-edge heating and cooling solutions.



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