

Floor Heating under Fixed Dry Floorings

Application Sheet

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Indoor Heating, Renovation

Floor Heating under Fixed Dry Floorings
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Application Briefing

When floors in flats, houses, basements or patios are renovated, comfort floor heating can be added without using screed or without breaking up the old floor. The comfort is provided by Devicell Dry™ heating system which is designed to be in contact with wooden sub or top floorings.

Devicell Dry™
 - consists of a 12 mm polystyrene plate and a 1 mm aluminium plate with cable grooves.
 - is installed on the old / sub floor, right under the new top flooring e.g. timber or parquet.
 - ensures fast responding floor heating and evenly distributed floor heat.

In the case of comfort floor heating, supplementary heating is required. But up to 100 W/m², it can provide the total heating of sufficiently insulated rooms.

Opportunities

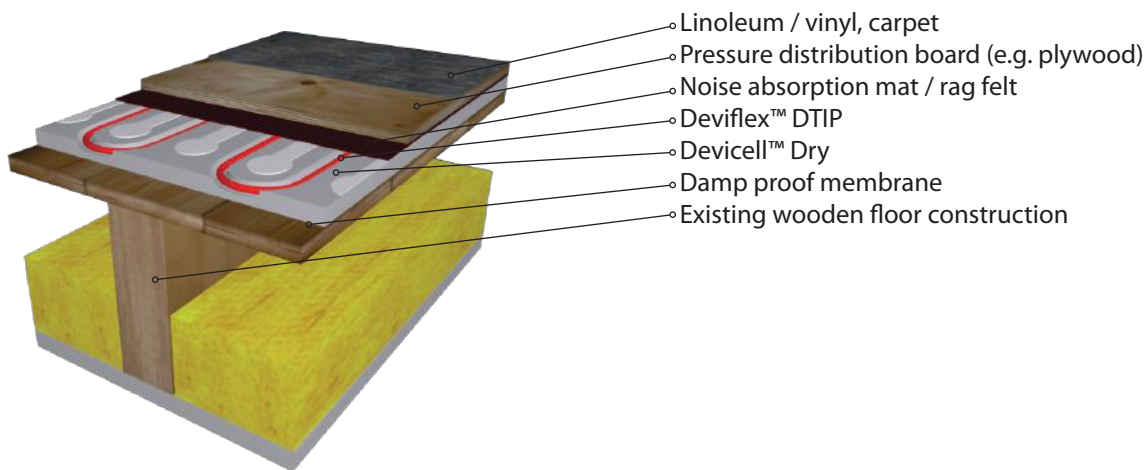
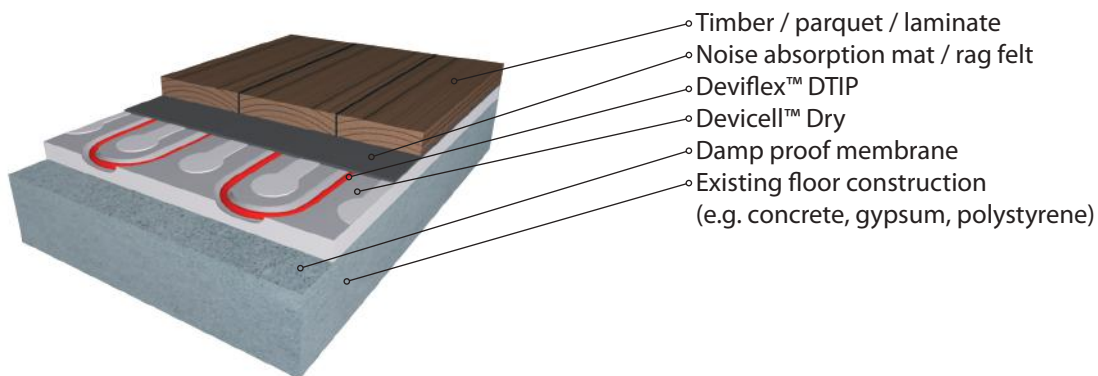
- Up to 20 mm soft wood (pine)
- Up to 30 mm hard wood (oak)
- Linoleum, Vinyl
- Thin carpets
- Up to 100% floor coverage

Installation

- No mason work with screed
- Cable grooves every 100 mm
- Fits Deviflex™ DTIP
- Building height 13 mm
- Fits odd corners

Performance

- Reduced downward heat loss
- Even temperature distribution
- Quick response time with timer
- Noise reduction 3 dB



The opposite combination with top flooring and existing floor construction is also optional.

Product Selection

Product	Options	Description
Devicell™ Dry	2 or 5 m ² package 50 m ² pallet	
Deviflex™ DIN IEC 60800	DTIP-6, DTIP-10	Twin conductor cable
Thermostat	Devilink™ CC and FT/RS Devireg™ 550 with adaptive timer Devireg™ 535 with simple timer	Wireless indoor heating system Advanced timer thermostat Simple timer thermostat
Sensor	NTC floor sensor cable for FT/ Devireg™ Room sensor for RS / Devireg™	Included in thermostat Built in the thermostat
Accessories	Mounting set for sensor Aluminium tape 38 mm x 50 m	To ensure cable contact in cavities
Other	13 mm plaster board Vapour barrier or damp proof membrane Noise absorption mat or rag felt Top flooring	For non-heated areas To prevent moisture from below

Basically, there are three possible heat densities that can be installed:

The sensor required depends on what type of heating is present:

Distance between cable lines CC [cm]	Heat density [W/m ²]	
	DTIP 6 W/m	DTIP 10 W/m
10	60	100
20	-	50

Sensor type	Comfort heating	Total heating
Room sensor	Not required	Required
Floor sensor	Required	Required under wooden floors

Example

A basement of 28 m² with a required heat density q_{heat} of 125 W/m² requires a comfort heating supplement to radiator heating.

An installed heat density q_{inst} of 100 W/m² is chosen by means of DTIP 10 W/m at 10 cm CC.

The power required by cables is therefore $28 \times 100 = 2800 \text{ W}$.

To avoid excessive cable, 2 cables of 1000 W and 1400 W are chosen.

4 x 2 m² and 4 x 5 m² packages of Devicell™ Dry are chosen.

Devireg™ 550 with a floor sensor only is to be selected, when a radiator thermostat controls the room temperature.

See next page for more guidance.

Calculation

The Devicell Dry™ heating system is mainly used for comfort floor heating, which means additional room heating is required to maintain a stable room temperature all year round.

$$q_{inst} = \frac{q_{cable} \cdot 100 \cdot \frac{cm}{m}}{CC}$$

$$p_{cable} = 0,85...0,9 \cdot q_{inst} \cdot A_{heat}$$

However, the system can provide the total heating of a room if the room is sufficiently insulated but this requires a calculation of the actual room heat loss.

The room heat loss q_{room} depends on the degree and the age of the insulation. In new houses, the building contractor can provide these details

$$q_{room} = 1.0 \cdot 1.5 \cdot \frac{E_{house}}{2 \cdot A_{house}}$$

If the room has obstacles such as fixed cupboards, baths etc, this must be taken into consideration when calculating the actual required heat density q_{heat} .

$$q_{heat} = 1.4 \cdot q_{room} \frac{A_{room}}{A_{heat}}$$

The floor heating system may be undersized up to 10% but this means that the floor heating will respond slower.

q_{inst}	W/m ²	Installed heat density ≤ 100 W/m ²
CC	cm	Centre distance = 10 or 20 cm
q_{cable}	W/m	Cable output = 6 or max. 10 W/m

P_{cable}	W	Power required by cable (See Product Sheets) Undersized to avoid excessive cable
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but in old houses, it is often difficult to find details about how the building is constructed and thus this can be difficult to calculate. In such situations, the present energy consumption can give a rough estimation. This must be multiplied by up to 1.5 depending on where in the house the room is located and the general condition of the room.

q_{room}	W/m ²	Room heat loss provided by the contractor or calculated
E_{house}	kWh	Total energy consumption for the house
A_{house}	m ²	Total living area in the house

q_{heat}	W/m ²	Required heat density incl. 40% safety
A_{room}	m ²	Gross room area
A_{heat}	m ²	Net free laying area without obstacles.

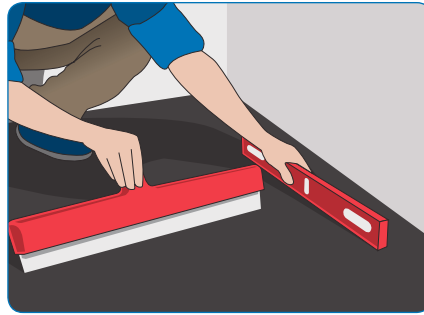
At 10% shortage, additional heat emitters must be considered to remedy the room's heat loss q_{room} , otherwise the room temperature will decrease 1 degree for every 10 W/m² shortage.

At 25% shortage or more, the heat density provides comfort floor heating only and supplementary heating is required for sufficient room heating.

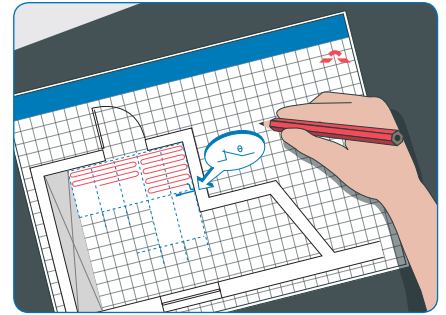
Installation Summary

Required tools:

- Knife
- Compass saw
- File
- Glue gun
- Aluminium tape
- Milling cutter
- Installation manuals



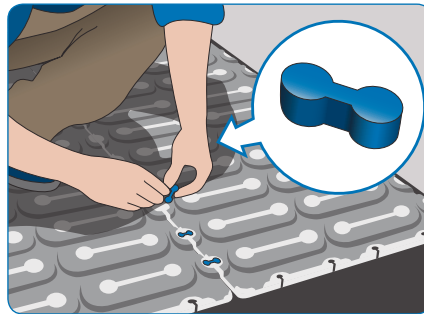
1) Make sure that the sub floor is reasonably level, firm and stable. New concrete needs to dry out for 30 days before installation.



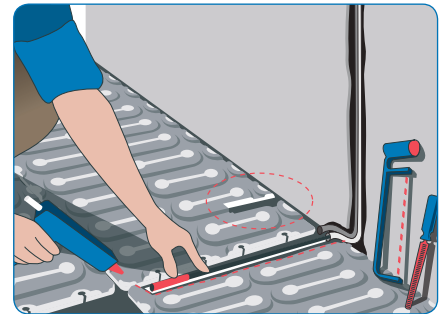
2) Draw a plan positioning cable, cold tail, floor sensor, thermostat and connection box, if any. Avoid all present and future objects fixed to the floor such as cupboards.



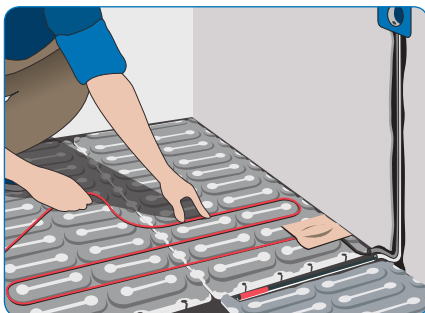
3) Cut out a wall groove and fix cable ducts and connection box. Clean the sub floor and lay out a vapour barrier or damp proof membrane.



4) Install the Devicell™ Dry plates on the heated areas and optionally 13 mm plasterboards on the non-heated areas.



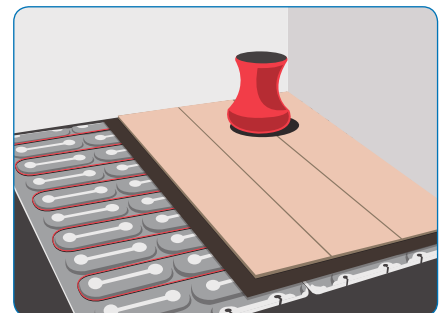
5) Cut out a hole for the warm/cold cable connection and the floor sensor conduit and file any sharp edges. Fix the conduit to the sub floor with glue or screws.



6) Install the Deviflex™ heating cable. Make sure that the cable, end termination and warm/cold cable connection are in contact with the aluminium plate or aluminium tape at all times.



7) Check the insulation resistance and Ohm rating of the heating cables. Compare the Ohm rating with the nominal, written on the cable label. Plaster the wall groove and connect the cold tail, sensor and thermostat.



8) Install the floor finish at a room temperature of approximately 15°C. Install a noise absorption mat and wooden floor, if desired.

Commissioning

9) Recheck and compare the insulation resistance and Ohm rating for the heating cables and check earth resistance.

10) The Devireg™ thermostat must be commissioned as prescribed in the thermostat manual.

According to ISO 13732-2, the comfortable floor surface temperature depends on the flooring material.

However, observe the maximum floor surface temperature according to the flooring manufacturer. For most wooden floor products, the temperature is usually around 27°C.

All temperature settings must be set some degrees higher to compensate for the heat resistance in the top flooring.

11) Train the end-user or daily supervisor in the operation of the heating system.

12) The floor temperature must be increased slowly during the first week to allow the new floor settle. This is also recommended in the beginning of a heating season.

Soft wood (pine)	22.5 - 28°C
Hard wood (oak)	24.5 - 28°C
Hard linoleum / vinyl	24 - 28°C
Textiles (rugs, carpets)	21 - 28°C

Thermal resistance [m ² K/W]	Examples of flooring	Details	Approximate setting for 25°C floor temperature
0.05	8 mm HDF based laminate	> 800 kg/m ³	28°C
0.10	14 mm beech parquet	650 - 800 kg/m ³	31°C
0.13	22 mm solid oak plank	> 800 kg/m ³	32°C
0.18	22 mm solid fir planks	450 - 650 kg/m ³	35°C

Important

Avoid Beech and Maple in multilayered constructions unless press dried. Do not install more than 100 W/m² and heating cables higher than 10 W/m.

Wood shrinks and swells naturally, depending on the relative humidity RH in the room. The optimal range is 30-60% RH. In order to keep the relative humidity uniform and within the optimal range:

- Install a vapour barrier for subfloors <95% RH and damp proof membrane >95%.
- Ensure 100% contact between cables and the floor materials above (no air gaps).
- Install the heating system in the whole floor area at 15°C surface temperature.
- Always install a floor sensor to limit the floor surface temperature.

The total insulation value R above cables is max. 0.25 m² K/W (2.5 Tog). For carpets, the insulation value R above the pressure distribution board is 0.10 m² K/W (1 Tog)

Do not use any alkali compound such as screed or tile glue together with Devicell Dry™.

Do not cut or cross Deviflex™ constant wattage cables.

Check the insulation resistance and Ohm rating of the heating cables before and after installation.

All electrical connections must be done by authorised persons according to local regulations.

Performance

Insulation

Devicell™ Dry has an insulation value R of 0.26 m²K/W and reduces the downward heat loss.

Floor constructions	R-value [m_K/W] Without / with Devicell™ Dry	Reduction of downward heat loss
Ground floor – no insulation	0.17 / 0.43	60%
Ground floor - 100 mm insulation	2.39 / 2.65	10%
Upper floor – no insulation	0.33 / 0.59	44%
Upper floor – 50 mm insulation	1.44 / 1.70	15%

Temperature Distribution

Since the Devicell insulation breaks the thermal bridge downwards and the aluminium distributes the heat sideways, the temperature distribution and response time is improved.



Response Time and Energy Consumption

The result is a quick responding floor surface temperature, which makes this application ideal for timer thermostats.

For short time comfort floor heating ($\tau_{\text{heat}} \leq 2$ hrs/day), the approx. annual energy consumption is:

$$e_{\text{heat}} = 0.3 \cdot q_{\text{inst}} \cdot \tau_{\text{heat}}$$

For 100 W/m² and 2-hours daily comfort heating, the approx. annual energy consumption is:

$$e_{\text{heat}} = 0.3 \cdot 100 \cdot 2 = 60 \cdot \frac{\text{kWh}}{\text{m}^2}$$

Approx. response time at 20°C Room temperature Devicell Dry with 14 mm parquet Installed on upper / ground floors with poor insulation

