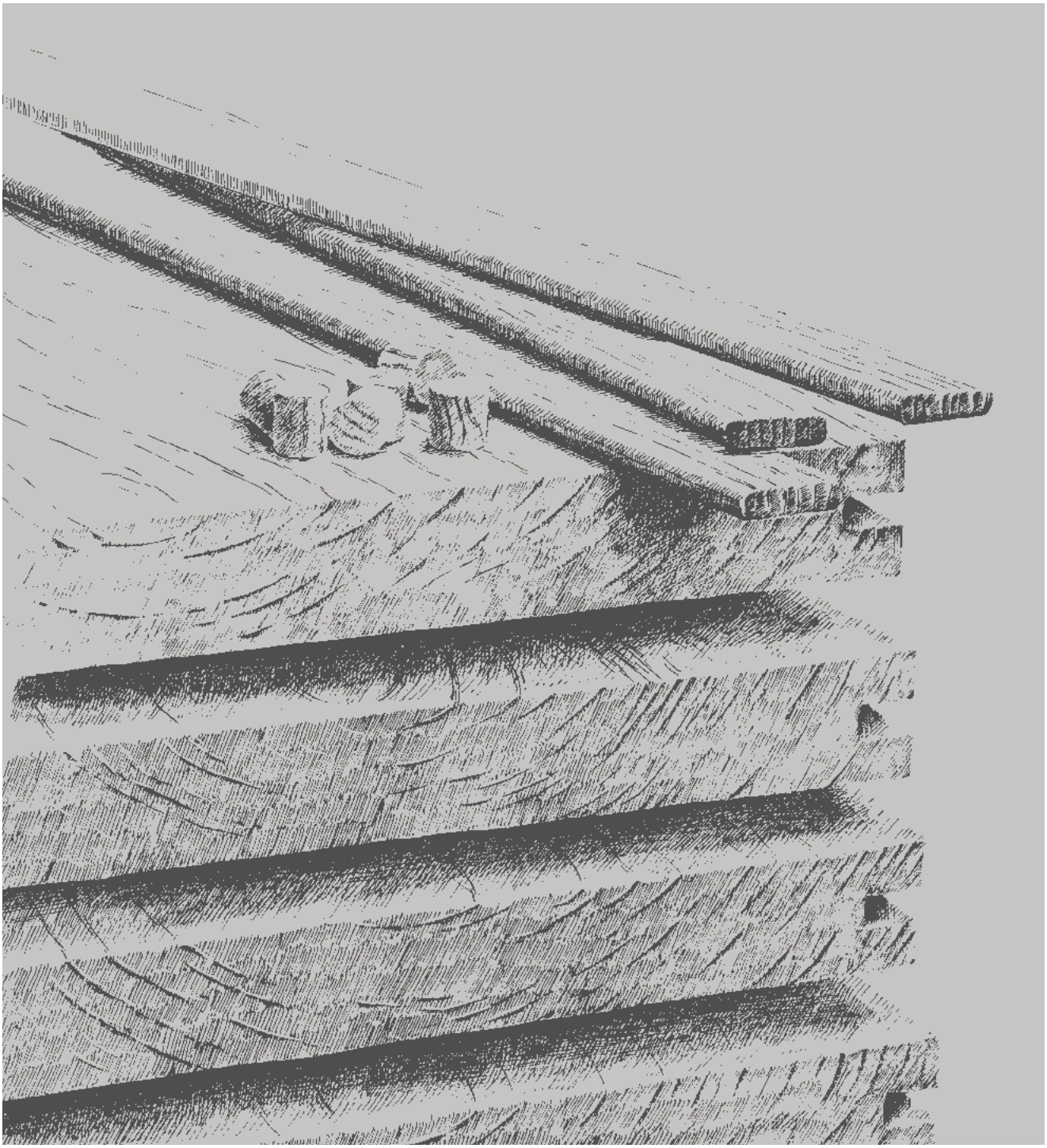

Before installation

Instructions

April 2024

Dinesen

A Dinesen floor is a unique piece of nature. It is a living material which must be treated with care. Our instructions explain in detail how you get the best result so the floor can last for centuries.

If you need any additional advice about Dinesen floors, you are very welcome to contact us.

To order and purchase products in the maintenance series, please go to our webshop at dinesen.com

Contents

1 A solid plank floor

A solid plank floor from Dinesen provides a firm foundation. To ensure the high level of quality and careful processing, every plank passes through 10 pairs of hands on its way through the production process. Generally, we always recommend the thicker planks. They are more stable, have a deeper sound and last a generation or two longer.

Dinesen planks are always delivered unfinished, and after installation, the floor must be sanded and finished. This gives you the opportunity to choose the finish that matches your expectations of the floor. It is important to consider the advantages and disadvantages of the various finishes carefully. You can read more about this in Dinesen's "After installation" instructions.

1.1 The properties of wood

Wood is a hygroscopic material that absorbs and emits humidity from the environment. It will always adapt to an equilibrium level of humidity, determined by the temperature and relative humidity of the air. When delivered, Dinesen planks are dried to a moisture content of 8% +/- 1%. This corresponds to a relative air humidity (RH) of approx. 40-45%.

If the air humidity drops, the wood will emit moisture and shrink in width, which results in contraction cracks. Cracks will always appear in between the planks during winter, at which time the floor has its most beautiful appearance. Generally, however, the air humidity should not be allowed to drop below 35% RH.

Below is an overview of the reaction of the floor planks to varying degrees of air humidity at a normal temperature of 18-25 °C. The recommended intervals and tolerances in air humidity are highlighted in grey.

The overview applies to a correctly installed floor, cf. the guidelines in this and the other instructions from Dinesen, and the information is only intended as a general guide.

ifferent installation method will affect the actual movement of the planks differently.

Climate condition	Reaction
60-70% RF	Slight transverse warping should be expected
50-60% RF	No contraction gaps, slight warping should be expected
40-50% RF	The floor planks are stable and level
30-40% RF	Moderate contraction gaps (approximately 1% of plank width) and slight warping should be expected
20-30% RF	Contraction gaps of 1% of the width or more and moderate transverse warping should be expected. There will also be minor drying cracks
< 20% RF	More pronounced transverse warping and drying cracks will appear. The floor will be depleted, and the lifetime of the planks will be reduced

Table 1

2 How to succeed

- Consider the humidity factor throughout, from the design stage to construction. Let the humidity factor play a decisive role from the beginning, and never allow yourself to be pressured into installing floors under conditions where the humidity presents a problem.
- Always make sure to measure the moisture content of the concrete prior to installation, regardless whether the cast layer is new or old. Also check that wood-based constructions are in compliance with relevant set limits..
- All work that might add moisture to the construction, such as masonry work and basic paint work, must be finished prior to the installation of the floor.
- For the vapour barrier, use at least 0.20 mm PE foil or similar.
- The building must be dry and without construction humidity. Never have the floor planks delivered until the building is sealed off, dry and warm, and the humidity levels are under control.
- Place a good hygrometer in the building and keep an eye on the humidity level. The building must be at an equilibrium with the season's mean humidity. A digital hygrometer can be purchased from Dinesen.
- Check, document and conform to the values in table 2.

2.1 General requirements for humidity and climate

Measuring point	Level
Room temperature	18-25 °C
Room humidity	35-65% RH
Concrete moisture content	Max. 85% RH when a vapour barrier is used. If you leave out the vapour barrier, the residual moisture content must be less than 65% RH. **NB:** 85% RH corresponds to approximately 2.0 CM depending on the type of concrete etc. Be aware of any restrictions in the national standard requirements
Humidity in joists/beams	Max. 10-12%
Humidity in plywood/chipboard	Max. 8-10%
Vapour barrier	Min. 0.20 mm PE foil

Table 2

3 Humidity

Humidity should be one of the main focal points in connection with the design, planning and installation of a solid Dinesen plank floor.

3.1 Humidity and plank floors

Much construction work requires proper drying, and materials such as plaster and wood suffer considerable damage if they are exposed to high levels of humidity. Because wood is hygroscopic, it will always adapt to achieve equilibrium with its environment. In this process, air humidity plays a major role. Unfortunately, those responsible for construction projects often compromise on the drying phase, which results in severe damage. Construction humidity is the cause of major delays as well as over-expenditure, but fortunately, this is avoidable if humidity is included in the planning process from the design stage.

Make realistic timetables, plan the dehumidification process, and use the right type of concrete.

3.2 Humidity and temperature

If the air is fully saturated with steam, the relative air humidity (RH) is 100%. A relative air humidity of 50% means that the air contains 50% of the maximal amount humidity it can contain. When it rains, the relative air humidity exceeds 100%. Air humidity depends in part on the building's location, structure, heating and ventilation.

The higher the temperature, the more water the air can hold. Because wood is hygroscopic, it will always adapt to achieve equilibrium with its environment. In this process, air humidity plays a major role. When cold outside air enters the building and warms up, the air dries. Dry air absorbs humidity from the plank. This causes the plank to contract and in turn leads to contraction gaps between the planks. The gaps appear when the air is driest, and the lower the air humidity, the larger the gaps. See also Table 1.

3.3 Construction moisture and moisture from other building components

Subfloors are typically either cast or light timber constructions.

Joists, tiers of beams and subfloors consisting of existing solid boards, plywood or chipboard must be dry before the new floor is laid. In renovation or restoration, existing solid subfloors or beams may have absorbed moisture. Always check the moisture content of the sub-construction before installing the floor.

Concrete is a porous material that continues to absorb and emit moisture throughout its lifetime, depending on the temperature and humidity of the environment. For traditional concrete, drying is a very slow process that easily takes 4-6 months. Even that timespan can only be achieved if builders quickly seal the building, introduce heating and initiate dehumidification. Quicker drying times can be achieved by choosing quick-drying concrete. This is an issue that needs to be considered during the early project stages.

Concrete moisture is difficult to measure accurately, and surface moisture meters are far from accurate enough. Always have a specialist carry out this measurement. Moisture measurement is a very cheap preventive step to prevent major costs later for the builder and the client.

The responsibility for ensuring that the concrete is dry enough is often a grey area, with the risk that no one takes charge. The client and the contractor need to agree who is responsible and agree that the floor is not installed until Dinesen's requirements are met.

4 Underfloor heating under Dinesen floors

Dinesen recommends installing underfloor heating under Dinesen floors as a comfortable and durable solution. About 80% of our projects are established with underfloor heating. Dinesen has years of experience with underfloor heating under solid floors, and it is an unproblematic solution, provided you adhere to the conditions described below.

In principle, (water-based) underfloor heating is simply a plastic coil that is embedded in the floor construction. Sending hot water through the coil heats up the construction and thus the room. Depending on the building's insulation, it may be necessary to use supplementary heat sources in the form of radiators, a heat recovery system or a wood-burning stove.

If the underfloor heating is to be the only heat source, the total heat loss from the room must be less than the heat emitted by the floor surface. That requires a formal energy or heat loss assessment, especially in older buildings or in connection with renovation projects. Even if the building lives up to the insulation requirements in the building code – for example in a new building – the conditions listed below should still be considered in the decision-making process.

4.1 Conditions

4.1.1 Humidity and underfloor heating

Regardless of whether the floor has underfloor heating, concrete moisture will always be very harmful to a wooden floor. It is crucial to ensure that the humidity content of the concrete does not exceed 85% RH. If heating coils have been embedded in the concrete, the underfloor heating should be switched on after 30 days when the concrete has hardened. Even in the hottest summer and with high outdoor temperatures, the underfloor heating should be switched on at normal operating temperature for at least one month before the floor is installed, and the concrete moisture must always be measured before the floor is installed. Dinesen recommends a destructive measurement of concrete moisture. An indicative surface measurement – such as a GANN measurement – is not accurate enough. If the underfloor heating is not switched on, the concrete will not lose its residual humidity until after the floor is installed, and the heat is switched on; that may cause severe damage to the floor. A vapour barrier should always be installed on top of the dry concrete floor.

4.1.2 The properties of the floor with underfloor heating

As mentioned earlier, wood is a hygroscopic material that absorbs and emits humidity from the environment. It will always adapt to an equilibrium level of humidity, determined by the temperature and relative humidity of the air. When delivered, Dinesen solid planks are dried to a moisture content of 8 +/– 1%. This corresponds to a relative air humidity (RH) of approx. 40-45%.

If the air humidity drops, the wood will emit moisture and shrink in width, which results in contraction cracks. The higher the surface temperature, the lower is the air humifity just above the floor, and the more the wood will contact. Cracks will always appear in between the planks during winter, at which time the floor has its most beautiful appearance. Generally, however, the air humidity should not be allowed to drop below 35% RH, cf. Table 1.

The capacity of a material to conduct heat is called its thermal conductivity = λ (w/m°k). For plank floors, the thermal conductivity depends on the density of the wood (kg/m3). Therefore, Oak and Ash has a slightly better thermal conductivity than Douglas and Pine.

The thermal conductivity is used to calculate the thermal resistance:

Guideline values for thermal resistance

Wood type	Thermal resistance
Oak	0.17
Ash	0.17
Douglas	0.13
Pine	0.13

Table 3

Thermal resistance is calculated based on the thickness of a material divided by its thermal conductivity. Thus, thermal resistance reflects the insulation ability and is normally labelled R.

$$R = \frac{\text{thickness}}{\text{thermal conductivity}}$$

Thickness and variant	Formula and result (R)
Layers Ask	0,019 / 0,17 = 0,11
Laysers Douglas	0,019 / 0,13 = 0,15
Layers Eg	0,019 / 0,17 = 0,11

Table 4

As shown in the examples above, the thickness of the floor affects its insulation ability. The thicker the floor, the better the insulation. Therefore you may have to set a higher flow temperature to achieve a suitable surface temperature. The impact on energy consumption is minimal. The difference in energy consumption between a tile floor and a solid floor with 28 mm thick planks is max. 5-10%. And the difference in energy consumption between floors with 28 versus 35 mm Douglas planks is at most a few percent. See also section 4.1.3.

4.1.3 Heating requirement and heat loss

The surface temperature of a wooden floor must never exceed 27 °C, which means the surface can put out 75 W/m2 max. The surface temperature in a well-insulated house typically needs to be 2 °C above the desired room temperature. Hence, the poorer the general insulation, the higher the surface temperature has to be. If the building insulation is inadequate, there may be days when the desired room temperature cannot be achieved by underfloor heating alone. Dinesen cannot provide any further advice about the right flow temperature, as this depends on the construction and the specific heat loss. The key restriction is the max. surface temperature.

4.2 Types of underfloor heating

Underfloor heating is typically water-based. The two main categories are heavy underfloor heating with coils embedded in concrete and light underfloor heating with coils in heat emission plates. In rare cases, electric underfloor heating is used.

4.2.1 Heavy underfloor heating

Heavy underfloor heating is based on heating coils embedded in concrete, where the concrete distributes the heat to the entire floor surface. Concrete has good thermal conductivity properties but is slow to respond because it accumulates a great deal of heat.

4.2.2 Light underfloor heating

Light underfloor heating is based on heat emission plates in aluminium, where the heating coils are placed in curved grooves. The heat emission plates are placed just underneath the plank floor, and because aluminium is a good thermal conductor, the heat is quickly distributed throughout the floor surface. Aluminium responds quickly to changes in the demand for heating, so the room temperature will feel more stable than with heavy underfloor heating. The construction is slightly more complicated but provides a more pleasant floor to walk on, as the substructure is usually a joist construction. Light underfloor heating is installed by a carpenter and a plumber.

4.2.3 Electrical underfloor heating

Electrical underfloor heating is typically constructed with heat cables distributed in a joist construction. As with the other types of underfloor heating, the surface temperature must not exceed 27 °C. The cost of electricity should be included in considerations to install electrical underfloor heating. In the winter months, the electrical underfloor heating must be switched on all the time to provide basic heating for the house. It may be an advantage to combine electrical underfloor heating with radiators. Electrical underfloor heating is installed by a carpenter and an electrician.

4.3 Test, start-up and use

ⓘ Start up the underfloor heating slowly and gradually.

It is important to test the underfloor heating system for leaks. Furthermore, the user should receive a user's manual and thorough instructions in the operation of the system. During the first week, the flow temperature must not exceed 25 °C. After the first week, it may be increased by max. 5 °C every other day, until the required surface temperature has been reached. If the flow temperature is raised too quickly, the planks will warp. Often, the underfloor heating system is left on all year around, since it is controlled by in-room thermostats and therefore only uses energy when the thermostat reaches its pre-set point.

5 Pitfalls

- Always consider humidity when planning the project, and before the planks are delivered. Any damage that may occur is typically due to unintended high levels of humidity because humidity has not been a focal point.
- Make sure to determine and agree who is responsible for the dehumidification etc. during the construction process in order to prevent later complications.
- Upon delivery, always check that planks and accessories conform to order specifications in terms of quality, quantity, moisture content and appearance. That makes it possible to rectify any shortcomings or misunderstandings right away.
- Always carry the floor planks inside immediately after delivery – never, under any circumstance, leave them outdoors.
- Always check the straightness and the condition of the subfloor before beginning the installation. It is absolutely crucial that the subfloor lives up to the requirements in this instruction manual, and verifying this is your responsibility. If any of the conditions are not met, this must be rectified before the planks are installed.

5.1 Dinesen recommends

- Light underfloor heating with heat emission plates provides the shortest response time and the easiest temperature control.
- Make sure the building conforms to the U-value requirements in the current building code at any given time.
- Install convectors in front of windows that go all the way to the floor.
- Always start up the underfloor heating system slowly and gradually.

6 FAQ

1. Will underfloor heating result in more cracks and similar damages?

   Answer: If the air humidity is kept between 30 and 60% RH, underfloor heating will not result in cracks etc. If the surface temperature of the floor exceeds 27 °C, it will bring the air humidity under 30%, which may deplete the wood and cause cracks. Low air humidity and inadequate care and maintenance can cause minor cracks.

2. Does underfloor heating mean larger contraction gaps?

   Answer: Wood will always strive for an equilibrium moisture level in relation to the air in the environment. Dinesen floors have been dried to 8-10%, and regardless of underfloor heating, they will contract in the winter, when the air humidity is low. With an interior air humidity between 40 and 45% RH, the wood will adapt to a moisture content of 8% wood humidity. If the air humidity drops to 30% RH, the wood will adapt to 6%, which means that it contracts. The underfloor heating does not in itself lead to larger contraction gaps. The higher the surface temperature, the larger the contraction gaps. You should expect the planks to contract by an average of approximately 1% in width, cf. Table 1.

3. Does underfloor heating cause more warping?

   Answer: With seasonal variations, floor planks will warp slightly. That is the nature of wood; it occurs regardless of underfloor heating and is of no concern. Significant warping only occurs if there are problems with humidity levels in the building, or if the construction humidity has not been fully eliminated before the floor planks were installed.

4. Does underfloor heating make the wood creak?

   Answer: If you follow Dinesen's recommendations for temperature and air humidity, underfloor heating will not make the floors creaky. Creaking often occurs because the joists are too wet, the joists are placed too far apart or the blocking up of the joists is not good enough. However, large variations in temperature or air humidity can temporarily cause individual planks to creak slightly.

5. Why must the surface temperature not exceed 27 °C?

   Answer: A temperature above 27 °C will not be pleasant. If the temperature exceeds 27 °C, the air humidity can drop below 30% RH, which depletes the wood and may cause cracks and scratches. If the building is properly insulated, a surface temperature above 27 °C will never be necessary.

6. Is it possible to achieve a sufficiently high room temperature through thick, solid wooden planks?

   Answer: A room temperature of approximately 20 °C is easily achievable. Of course, this requires that the building is correctly insulated, and that you follow the advice and recommendations in Dinesen's instructions. In older buildings with inadequate insulation, it will often be necessary to have a supplementary heat source.

7. Is the energy consumption higher with solid floors than with 15 mm engineered wood flooring?

   Answer: As wood has insulating properties, a certain heat loss should be expected through the construction. Therefore, when the heat has to pass through a thicker layer, there will be a higher heat loss. A thick floor therefore requires a higher flow temperature to achieve the same surface temperature as a thin engineered wood floor. However, this does not lead to a significantly higher energy consumption.

8. Does the energy consumption go up when the flow temperature is raised?

   Answer: The first time the water is heated to 45 °C instead of 35 °C, it uses slightly more energy, but in subsequent use, it makes no difference. This is because the energy consumption depends exclusively on the difference between the flow and return temperature.

9. Why is it important to start the underfloor heating up gradually?

   Answer: The wood needs to adapt to the temperature changes gradually. If the change is too rapid the wood may warp. That applies both to the first start-up after installation and to any subsequent start-ups for the winter season.

10. What are the benefits of using an oil finish in connection with underfloor heating?

    Answer: Oil seals the surface and preserves the natural moisture content of the wood, which helps prevent the plank floor from drying out.

11. Can I use lye and soap on Douglas and Pine in connection with underfloor heating?

    Answer: Yes. It is important, however, to pay attention to the state of the floor and to clean it in accordance with Dinesen's recommendations. The floor needs moisture, soap as well as correct maintenance to avoid tiny depletion cracks in the wood surface.

12. How does the room temperature affect energy consumption?

    Answer: If the room temperature is lowered from 22 °C to 21 °C you can save approximately 10% on your heating bill.

7 General guidance

7.1 Dinesen instructions

Before installation
Installation
After installation
Pattern

See also our detailed instruction videos concerning sanding, finishing, floor-washing and maintenance on dinesen.com. The instruction videos are only to be seen as a supplement to our instructions.

7.2 Literature

Træinformation: "Træ 79" (traeinfo.dk)

Dinesen's instructions are based on Danish building codes and regulations. Reservations are therefore made for national codes of practice. Please note that we can only offer advice about our own product, and thus, any additional advice lies outside the service we offer. Other building components and products require a degree of knowledge and insight that makes it necessary to seek advice from a specialist. Dinesen thus does not offer advice about the positioning of insulation and vapour barriers. As we have no control over the actual quality of workmanship, materials used and worksite conditions, these written instructions do not constitute an implied warranty of any kind. The illustrations in this document are strictly intended as a guide.

We do not accept any liability for printing errors.

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