HARD FACTS

- about screed and lifetime of heating cables

Nexans

BRINGS ENERGY TO LIFE

Lifetime of heating cables

How long does a heating cable last?

A frequentlty asked question with a difficult answer, as it is challenging to make predictions, especially about the future. As the inventor of the heating cable, and the company with the longest experience on the market with underfloor heating, Nexans has seen examples of its own heating cables which have been working for about 60 years, but there are also examples of heating cables that fail after only 1-2 years of operation. In floors, as it turns out, it is often screed with inadequate thermal conductivity that is the cause of an early failure. Life expectancy of heating cables that are installed and used correctly, is 40 years or more.

What are the determining factors?

There are two aspects that are crucial for the lifetime of a heating cable: It must be properly laid, and it must lie well.

"Properly laid" means that the installation instructions are followed for all parts of the installation, both the electrotechnical part, and the part that pertains to the embedding.

To "lie well" means that the cable is at rest and protected against external, mechanical stress, such as movement in a floor. Shifts in flooring and landscape/wheeltracks may cause the conductors to break.

"Properly laid"

A heating cable is "properly laid" when the installation is correctly dimensioned in relation to the application, and when the restrictions and recommendations given by the supplier have been followed. This encompasses e.g. correct/maximum square meter power, distance to thermal barriers (drains, pipes, walls and others) and type of flooring. Regarding embedding, it is important to observe and follow both the heating cable supplier's installation instructions (minimum screed thickness above the cable, requirements for thermal conductivity and a maximum total screed thickness) and the supplier of the screed instructions with respect to correct water usage, mixing (using a power tool), and the maximum time before use and compacting so as to avoid a porous screed.

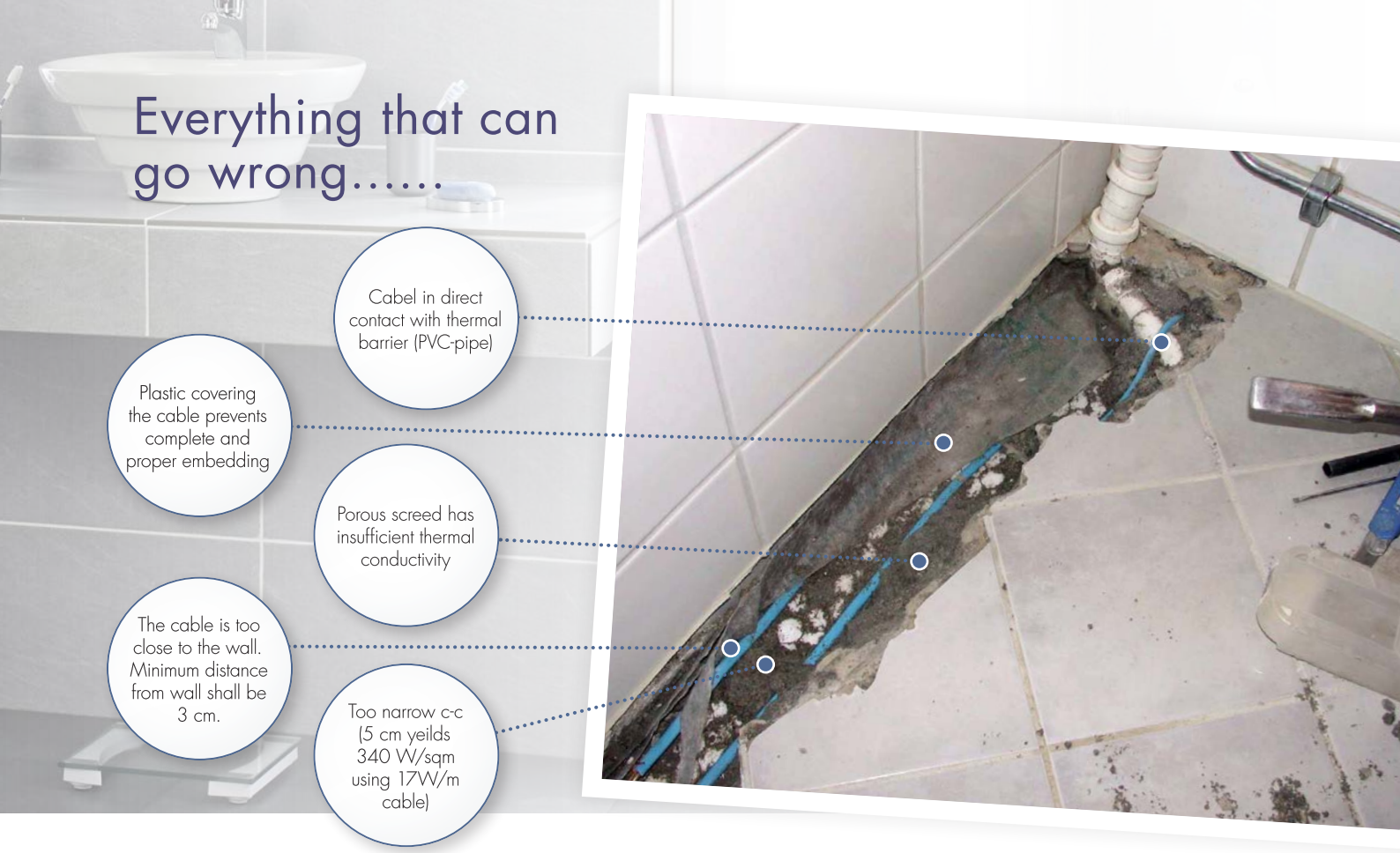
"Lying well"

A heating cable is lying well when it is not exposed to external mechanical influences. Shift in flooring is typically such an influence, and may be caused by a too thin layer of screed around the heating cable. Most providers of screed for "thin floors" recommend a minimum thickness of at least 2 cm, if the cable is installed on a wooden floor or on other surfaces where shifts could occur. This is to ensure sufficient strength and stability of the floor. Another possible consequence of floors with shifts are tiles that break or become loose.

Operating temperature and thermal conductivity

Nexans heating cables are designed for a maximum continuous operating temperature of 65 °C on the outer jacket. This is, however, an abnormally high operating temperature, as a cable in a floor (with tiles) that holds 27 °C on the surface, will have a temperature of the outer sheath of 35-40 °C. Most heating cables are controlled by a thermostat, and in a bathroom, it is usually a thermostat with floor sensor. If the screed in the floor does not have sufficient thermal conductivity, the difference in temperature between the cable outer sheath and the sensor becomes large. The reason for this is that the screed isolates, and it is difficult for

Everything that can go wrong.....



the heat to reach the sensor located at a distance from heating cable. This will, however, eventually happen, once the temperature difference is large enough (heat transfer occurs by difference in temperature between two locations).

Overheating

Heating cables, in the same way as other cables, have conductor insulation and sheath protection in various plastic materials. To these plastic materials, "stabilizers" are added. The purpose of the stabilizers is to keep the plastics soft and flexible, and with that help to ensure longevity of the cables. The stabilizers degrade overtime, though, and the higher the operating temperature, the faster the degradation. Finally (and hopefully long after the expected lifetime of the cable), the outer sheath will rupture at the slightest bending of the cable. The remaining content of stabilizer in the sheath can be used to determine approximately which operating temperature the cable has been working under.

Wet rooms and floor membranes

Most cases of malfunction of heating cables occur in bathrooms and other wet rooms. This is reasonable, given the long tradition of installing heating cables in such rooms, and because of the relatively high power installed, often 130W/sqm - 150W/sqm.

If the screed here has poor thermal conductivity, the temperature of the cable may become higher than it is intended for. If the outer sheath of a heating cable ruptures as a result of overheating, the risk is high that water will penetrate the sheath and enter into the cable, at least in wet rooms with "bottom membrane" (i.e. a membrane installed under the screed embedding the heating cable). Nexans accepts both "bottom" and "top" membranes used with our heating cables, but national regulations may dictate whether "bottom membrane" is permitted in a country or not.

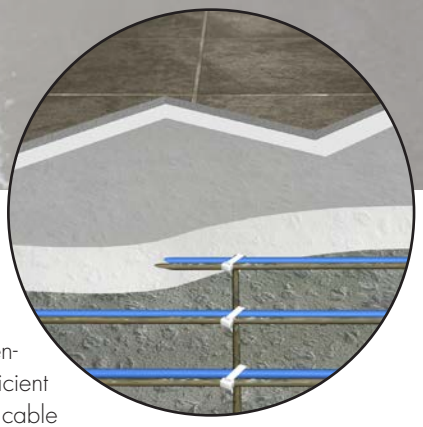
Nexans recommendation, however, is the top membrane. Please also note that some screeds require the use of the top membrane. When a bottom membrane is used, the floor will ultimately, when showered directly upon, get saturated by water, and in combination with soap residues, etc. it creates a very corrosive (alkaline) environment in the floor. The heating cable can withstand alkaline environment under normal operating conditions, but should it become damaged or get a ruptured outer sheath, the corrosive and electrically conductive water will come in contact with the screen/protective conductor and cable core, and the materials within the outer sheath will degrade/corrode over time. Water will also "wander" inside the cable, and the cable is, in effect, ruined and impossible to repair. In such cases, a new cable (and floor) needs to be installed in order to once again get a heated floor.

Be cautious

Although heating cables are mechanically strong, it is still important to proceed in such a way that they are not damaged during installation. All disciplines involved in the construction process must take care to avoid, insofar as possible, stepping on the cable, ensure that sharp objects are not dropped and hit the cable, or do other things that may inflict cable damage. Has it been damaged, an otherwise perfect installation and embedding is of little help.

What does Nexans say?

(Frequently asked questions).



Q: What are the requirements for thermal conductivity?

A: For traditional cement based mortars the minimum requirement is 1.0 W/mK, while for screeds and other special mortars, the minimum requirement is 0.6 W/mK with a maximum of 3 cm molding thickness. For thicker floors, the requirement is the same as for traditional cement based mortars.

In screeds with thermal conductivity greater than 1.0 W/mK, heating cables with a linear power of 17 W/m and installed area power up to 150 W/m^2 may be used.

In screeds with thermal conductivity below 1.0 W/mK, it is recommended to use heating cables with a linear power of 10 W/m and installed area power less than 100 W/m^2.

Q: How thin can the layer of screed be?

A: The heating cables shall be covered by minimum 5 mm of screed if the top flooring is tiles (or smilar). In all other types of floors, the minimum covering is 10 mm. If the there is a risk of shift in the floor, many suppliers of screed recommend a minimum of 20mm total thickness, regardless of top flooring.

Q: How thick can the screed/mortar be?

A: Due to thermal inertia, and because it can be challenging to compact the mortar properly, recommended maximum molding thickness is 6 cm.

Q: Will the warranty still be valid if the floor is 7 cm thick?

A: Yes, if the screed/mortar is compacted so that the required minimum thermal conductivity is achieved, the warranty is still valid although the floor is thicker than 6 cm.

Q: Can MILLIMAT be installed directly in tile adhesive?

A: Yes, but it is recommended to use screed as the initial layer, and then install the tiles afterwards. This is to ensure that there are no air pockets in the embedding mass (the tile adhesive, if used this way), something which would reduce its thermal conductivity, and eventually damage the cable.

Q: What is the minimum distance between the heating cable and the wall?

A: Normally, the distance from the wall to the first cable strand will be ½ c-c, and for indoor installations the desired installed power (W/sqm) will dictate the c-c for the cable strands.

The heating cable must invariably be at least 3 cm from the finished wall to ensure that there is sufficient screed between the cable and the thermal barrier (wall).

Q: What is the minimum distance between the heating cable and drain?

A: The minimum distance between the heating cable and drain is 5 cm. In a thin floor (less than 3 cm thick), the distance may well be increased towards 10 cm.

Q: Can I install heating cables together with pipes for hydronic heating?

A: Yes, but the heating cables must be installed in accordance with the following: Crossing/peripendicular pipes/cables - minimum 5 mm separation; parallel pipes/cables - at least 3 cm separation. The same applies to drain pipes.

Q: Is it permissible to use screeds containing additives?

A: Screeds that contain fiberglass which work as reinforcement is permitted, as long as the screed fulfills the requirements with respect to thermal conductivity. Screeds containing polystyrene beads, or the like, are not permitted, as these will not fulfill the requirements for heat conductivity. Metal fiber reinforced screeds are also not approved, as metal fibers can damage the outer sheath of the heating cable.

Q: Does Nexans approve the use of rapid drying screeds?

A: Yes, but this is a challenging type of screed to work with, and Nexans does not recommend it. However, it is approved as long as it is being compacted well, so that the finished molding compound, when it is dried and cured, meets requirements with respect to thermal conductivity.

Q: Can I switch on the heating cables so as to get the screed to dry faster?

A: **No!** The screed/mortar shall dry and cure naturally, and accelerating this process will leave you with a screed of inferior quality, both with respect to strength and thermal conductivity property.

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