

**ELEKTRA**  
***Heating  
Cables***



• BET



## Application

ELEKTRA BET heating cables are designed to protect concrete mixtures poured and curing in temperatures below 0°C.

- They protect concrete mixtures from heat loss and do not let the surface of concrete freeze.
- They speed up the process of concrete curing.

The heating cables provide heat to concrete mixtures and keep their temperature above 0°C, until the concrete has reached the required mechanical strength.

Utilising a controller, measuring the temperature of concrete mixtures will stop concrete from overdrying or freezing. The heating cables are attached to reinforcement. After concrete has cured, the power supply must be switched off and the power supply conductors – cut off.

### Note:

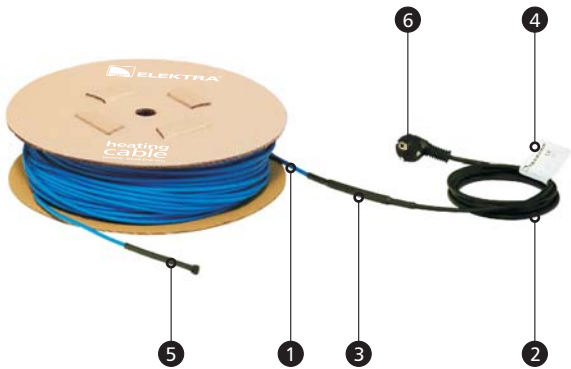


Concrete mixtures must not be poured in temperatures below -15°C.

## Characteristics

ELEKTRA BET heating cables

- are terminated with a 2.0 m long power supply conductor with a 16A hermetic plug
- specific power output: 32W/m  
and 40W/m
- power supply: 230V 50/60Hz
- external diameter: Ø 5mm
- min. radius of cable's bending: 5D
- the cables are screened, and their connection to the construction switchboard equipped with a residual current device constitutes effective anti-shock protection



- ① ELEKTRA BET heating cable
- ② "cold tail" power supply conductor
- ③ connecting joint between the power supply conductor and the heating cable
- ④ label
- ⑤ end joint
- ⑥ hermetic plug

## Note:



Do not attempt to apply ELEKTRA BET heating cables for any other purposes other than warming up concrete mixtures.

Never cut or shorten the heating cable.

Heating cables **must not** touch or cross.

Never stretch or strain the cable excessively, nor hit it with sharp tools.

## General information

Pouring concrete mixtures in temperatures below 0°C is only possible for warm concrete mixtures.

When heating concrete mixtures poured and then curing in temperatures below 0°C, assess the required heating power per m<sup>2</sup> and the area of a concrete requiring heat. The heating output depends on:

- application of covers, such as tarpaulin, foil or non-woven fabrics to shelter formwork or directly concrete mixtures, protecting concrete surface against wind
- application of thermal protection with insulation material preventing heat loss from concrete surface
- the material formwork is made of (plywood, steel)

**Suggested heating output of the heating cables per m<sup>2</sup> of the heated surface of a concrete element**

Type of formwork	Method of protection of the concrete mixture surface against heat loss	Specific heating output [W/m <sup>2</sup> ]	Spacing between cables [cm]
plywood	insulating material 50mm thick, covered with tarpaulin, foil or non-woven fabric	75	50
steel	insulating material 50mm thick, covered with tarpaulin or non-woven fabric	100	40
plywood	no protection	150	25
steel	no protection	200	20

The place especially vulnerable to freezing in case of concrete mixture is the contact surface touching the previously poured concrete element. In such places, decrease the cable spacing recommended in the table by half. Negative influence of frozen concrete elements where concrete mixtures will be poured can be limited by:

- application of concrete mixtures of min. temperature +15°C
- spot unfreezing of the frozen concrete element with hot air

## Calculating the area of a concrete element

The area of a pole, beam or pillar to be heated should be calculated as their perimeter multiplied by their height (length).

In concrete walls, heating cables should be laid on both sides of the wall.

In ceilings with bottom reinforcement only, heating cables should be laid on bottom reinforcement, and the upper surface of the ceiling must be protected, at least with a cover.

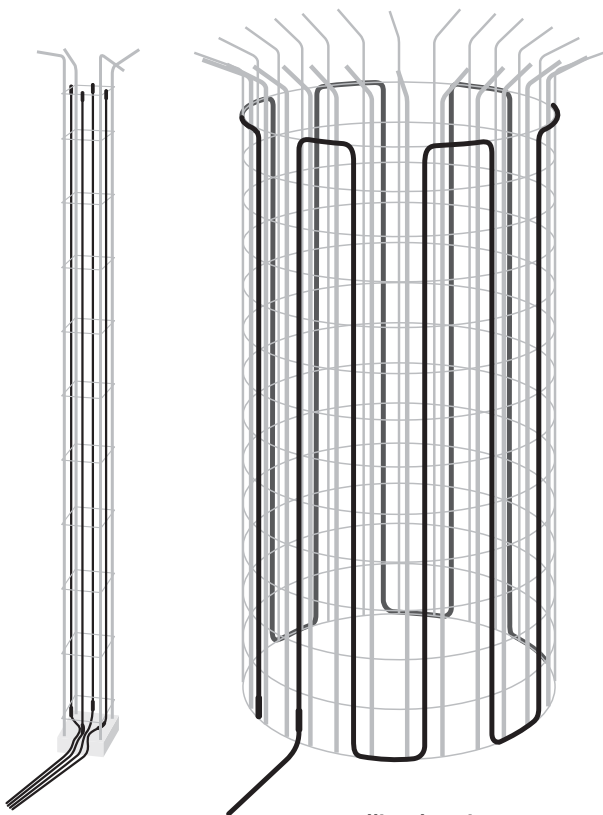
Rims of ceiling, located on poles or concrete walls executed earlier – therefore significantly cooled down, are especially vulnerable to freezing.

In such places it is recommended to lay heating cables with decreased spacing. In ceilings thicker than 25cm, also the upper part of the ceiling must be heated – if possible (upper ceiling reinforcement present), otherwise, it is necessary (except for the cover) to provide thermal insulation laid on the surface of the ceiling.

**Heating cables on the surface of a concrete should be placed symmetrically (if possible).**

**It influences positively the even temperature distribution, and – therefore – does not cause appearance of stresses.**





**Installing heating cables on a concrete pillar**

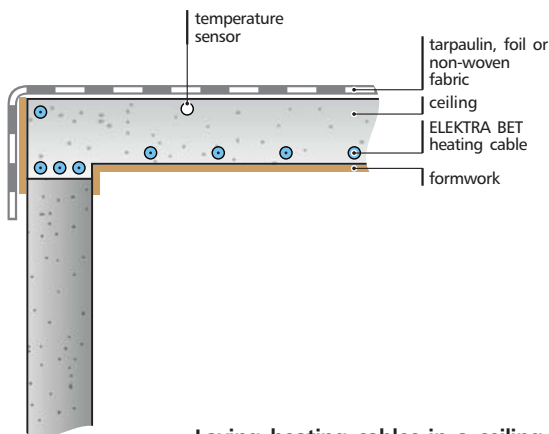
**On a pole or beam the number of cables must not be lower than 4.**

**Laying heating cables on a concrete pillar – cables must be laid to maintain axial symmetry.**



# ELEKTRA Heating Cables

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Laying heating cables in a ceiling with bottom reinforcement, based on an earlier executed concrete wall

## Installation

### Note:

Before their installation, heating cables should be stored in temperatures above 0°C, to maintain flexibility during the actual installation.



Attach ELEKTRA BET heating cables to stirrups, distribution bars or construction reinforcement. Maintain previously determined spacing between cables.

The cables should be fixed so that the distance from the formwork surface is not lower than 25mm.

### Note:



Heating cables can cross with construction reinforcement, but must not be laid along reinforcement bars in the distance lower than the required thickness of the envelope of reinforcement bars.

Use plastic cable ties, min. 2.5mm wide. Spacing between fixings should not exceed 30cm.

## Check

To ensure that the heating cable has not been damaged during installation, perform the following tests:

- resistance of the heating core
- insulation resistance



Measurement of the heating core's resistance

# ELEKTRA Heating Cables

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## Measurement of insulation resistance

The measurement results of the heating core's resistance should not vary from the label value by more than -5%, +10%.

The heating cable insulation's resistance, as measured with a meter with a rated voltage of 1000V (megaohmmeter), should not be lower than 50 M $\Omega$ . After the concrete mixture has been poured, repeat the measurements to check whether the heating cable has not been damaged during installation works.

## Controls

For the control of heating cables warming concrete mixtures, **ETI 1544 controller** should be utilised. The controller will perform the temperature measurement of concrete mixtures with a temperature sensor and only switch the heating system on when the temperature of already poured concrete drops e.g. below 10°C, and switch it off when the temperature exceeds the given level.

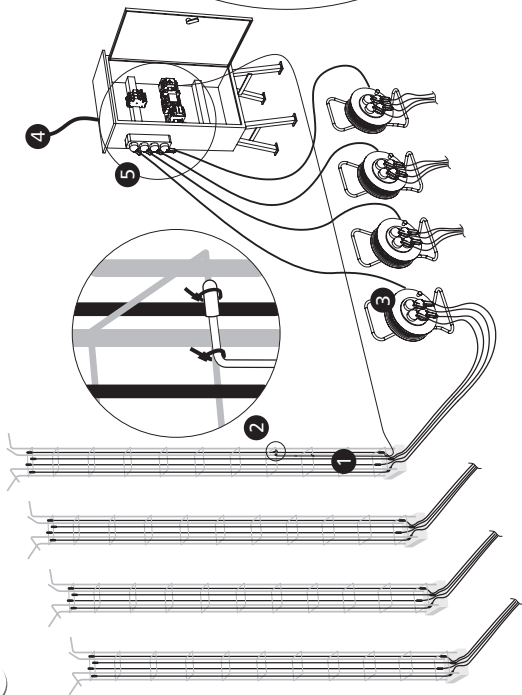
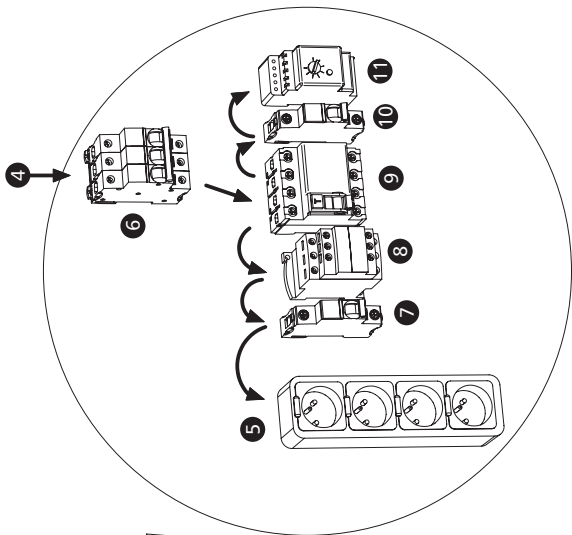
The number of heating cables that can be connected to the controller with a **contactor**, depends on the size of the power supply available. The controller should only control heating cables installed in similar conditions, to ensure heating cables are **powered at the correct times**.



**ETI 1544 controller  
and temperature sensor  
ETF-144/99**

- ① ELEKTRA BET heating cables
- ② temperature sensor for installation in concrete
- ③ reel extension cord
- ④ power supply for the construction switchboard
- ⑤ hermetic mains sockets
- ⑥ main circuit breaker
- ⑦ circuit breaker for the heating circuits
- ⑧ contactor
- ⑨ residual current device
- ⑩ circuit breaker for the temperature controller
- ⑪ ETI 1544 temperature controller

# ELEKTRA Heating Cables



## Installation of a temperature sensor

The temperature sensor's wire should be attached to reinforcement with cable ties. The temperature sensor should be positioned close to the surface of the concrete, between heating cables. In ceilings with bottom reinforcement only, the temperature sensor should be positioned directly under the ceiling's surface. The temperature cable's wire can be extended up to 50m with a standard cable (2 core 1.5mm<sup>2</sup>).

## Anti-shock protection

The electric circuit of the heating cable should be equipped with a residual current device of the sensitivity level  $\Delta \leq 30$  mA.

## Operation

Warming concrete commences with setting the required temperature on the controller. Warming concrete mixtures should be already performed during the pouring process. Do not allow concrete mixtures to cool down.

**Note:**

After concrete mixtures have cured, switch off the power supply and cut off the power supply conductors. The heating cables remain in concrete. The controllers can be reused.

**Note:**

Demounting of formwork should only be executed after the heating is completed and concrete elements gradually cooled down. Sudden cool down of an element might result in the increase of stresses in concrete.