

Installation Guide

Outdoor Heating Applications Mats and cables



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1 Introduction

In this installation manual, the word “element” refers to both heating cables and heating mats.

- If the words “heating cable” or “heating mat” are used, the instruction in question applies only to this type of element.

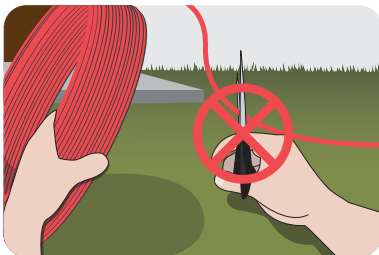
The intended uses of the heating elements covered by this installation manual are shown in the following.

For other applications please contact your local sales office.

1.1 Safety Instructions

Never cut or shorten the heating element

- Cutting the heating element will void the warranty.



- Cold leads can be shortened to suit requirements.



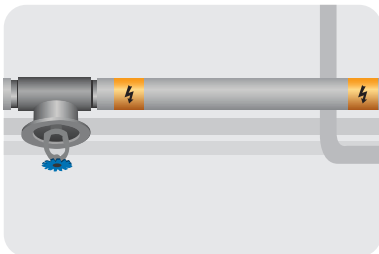
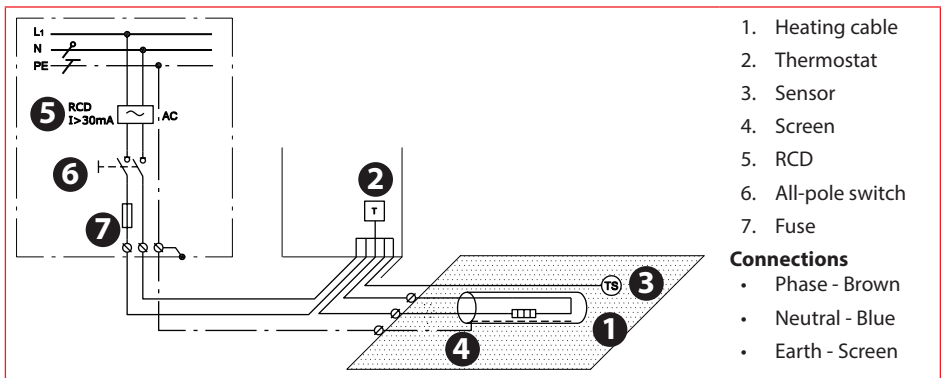
Elements must always be installed according to local building regulations and wiring rules as well as the guidelines in this installation manual.

- Any other installation may hamper element functionality or constitute a safety risk, and will void the warranty.

Elements must always be connected by an authorised electrician using a fixed connection.

- De-energize all power circuits before installation and service.

- Each heating element screen must be earthed in accordance with local electricity regulations and connected to a residual current device (RCD).
- RCD trip rating is max. 30 mA.
- Heating elements must be connected via a switch providing all pole disconnection.
- The element must be equipped with a correctly sized fuse or circuit breaker according to local regulations.



The presence of a heating element must

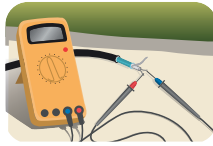
- be made evident by affixing caution signs or markings at the power connection fittings and/or frequently along the circuit line where clearly visible
- be stated in any electrical documentation following the installation.

Never exceed the maximum heat density (W/m^2 or W/m) for the actual application.

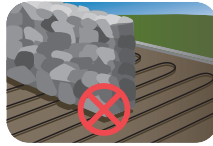
1.2 Installation guidelines



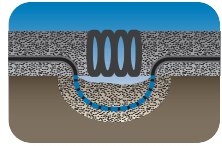
Prepare the installation site properly by removing sharp objects, dirt, etc.



Regularly measure ohmic resistance and insulation resistance before, during and after installation.



Do not lay heating elements under walls and fixed obstacles. Min. 6 cm space is required.



Keep elements clear of insulation material, other heating sources and expansion joints.



Elements may not touch or cross themselves or other elements and must be evenly distributed on areas.



The elements and especially the connection must be protected from stress and strain.



The element should be temperature controlled and not operate at ambient temperature higher than 10°C in outdoor applications.

- Store in a dry, warm place at temperatures between +5 °C to +30 °C.

1.3 System overview

Standards	ECsafe	ECsnow (EFTCC)	ECasphalt (DTIK)	ECsport (DSM3)
60800:2009 (cable)	M2	M2	M2	M2

M2

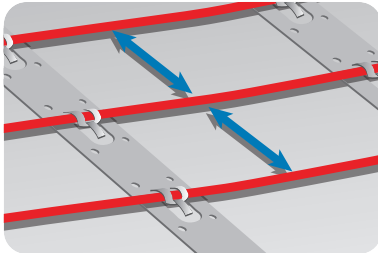
For use in applications with **high risk of mechanical damage**.

Product selection:	ECsafe	ECsnow (EFTCC)	ECasphalt (DTIK)	ECsport (DSM3)
Frost protection of roof and gutter systems	+	+	-	-
Snow and ice melting on ground areas	(+)	+	+	+
Field / seed bed heating	-	+	-	+

1.4 Calculating C-C distance for heating cables

The C-C distance is the distance in centimetres from the centre of one cable to the centre of the next.

For heating of gutters, please refer to the number of cables per metre, see section 3.1.



$$C-C [cm] = \frac{\text{Area [m}^2\text{]}}{\text{Cable length [m]}} \times 100 \text{ cm}$$

or

$$C-C [cm] = \frac{\text{Cable output [W/m]}}{\text{Heat density [W/m}^2\text{]}} \times 100 \text{ cm}$$

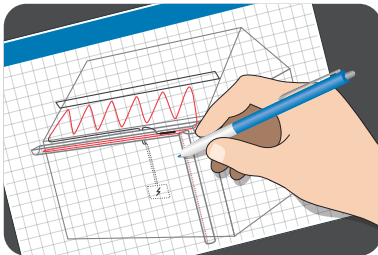
Max. C-C distance

Roof and gutter systems	10 cm
Ground areas	20 cm
Field / seed bed heating	25 cm

- Heating cable bending diameter must be at least 6 times cable diameter.
- The actual cable length may vary +/- 2 %.

230V/400V			
C-C [cm]	W/m ² @ 20 W/m	W/m ² @ 25 W/m	W/m ² @ 30 W/m
5	400	500	-
7,5	267	333	400
10	200	250	300
12,5	160	200	240
15	133	167	200
20	100	125	150
25	80	100	120

1.5 Planning the installation



Draw a sketch of the installation showing

- element layout
- cold leads and connections
- junction box/cable well (if applicable)
- sensor
- connection box
- thermostat

Save the sketch

- Knowing the exact location of these components makes subsequent troubleshooting and repair of faulty elements easier.

Please observe the following:

- Observe all guidelines - see section 1.2.
- Observe correct C-C distance (heating cables only) - see section 1.4.
- Observe required installation depth and possible mechanical protection of cold leads according to local regulations.
- When installing more than one element, never wire elements in series but route all cold leads in parallel to the connection box.
- For single conductor cables, both cold leads must be connected to the connection box.

1.6 Preparing the installation area



- Remove all traces of old installations, if applicable.
- Ensure that the installation surface is even, stable, smooth, dry and clean.
 - If necessary, fill out gaps around pipes, drains and walls.
- There must be no sharp edges, dirt or foreign objects.

2 Installing elements

It is not recommended to install elements at temperatures below -5°C .

At low temperatures, heating cables can become rigid. After rolling out the element, briefly connect it to the mains supply to soften the cable before fastening.

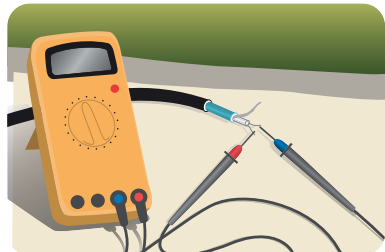
Measuring resistance

Measure, verify and record element resistance during installation.

- After unpacking
- After fastening the elements
- After the installation is finalized

If ohmic resistance and insulation resistance are not as labelled, the element must be replaced.

- The ohmic resistance must be within -5 to $+10\%$ of the value labelled.
- The insulation resistance should read $>20\text{ M}\Omega$ after one minute at min. 500V DC .

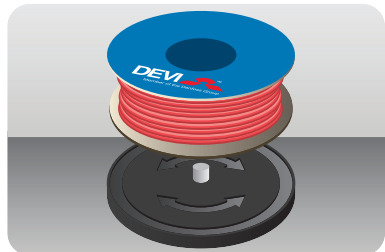


2.1 Installing heating elements

Observe all instructions and guidelines, see section 1.1 and see section 1.2.

Heating elements

- Position the heating element so that it is at least half the C-C distance from obstacles.
- Elements must always be in good contact with the heat distributor (e.g. concrete), see section 3 for details.



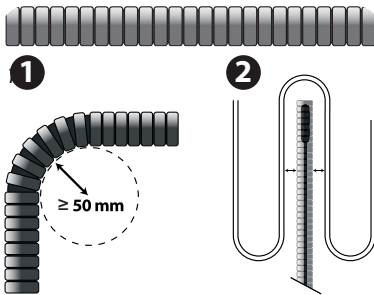
Heating mats

- Roll out heating mats with the heating cables facing up. If this is an asphalt application roll out the heating mats with plastic mesh over the heating cables.
- When the heating mat reaches the area boundary, cut the liner/net and turn the mat before rolling it back.

Extending cold leads

- Avoid extending cold leads if possible. Wire cold leads to e.g. junction boxes or cable wells.
- Be aware of power loss in the cable according to local regulations.

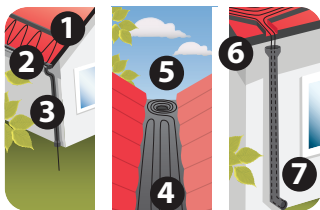
2.2 Sensor installation



- The sensor should be mounted in an insulating conduit, sealed at the end, for easy replacement of the sensor if required.
- The sensor must be considered a LIVE cable; therefore any extension made to the sensor wiring should be treated in the same way as normal mains voltage cabling.
- The sensor can be extended up to a total of 50 m using 1.5 mm² installation cable.
- The minimum bending radius for the pipe is 50 mm (1).
- The sensor cable must be placed between two loops of the heating cable (2).
- Route the conduit to the connection box.

3 Applications

3.1 Frost protection of roof and gutters



1. Roof Edge /Eave
2. Gutter
3. Downpipe to Frost-free Well
4. Gutter Valley
5. Flat Roof with Drain
6. Roof with Baffles
7. Downpipe with Open End

To provide sufficient heat in gutters and down pipes, the heat density and the number of cable lines [n] depends on:

- design temperature
- the gutter/pipe diameter

Gutter/pipe diameter	No. of cable lines [n]
75 - 120 mm	1
120 - 150 mm	2*
150 - 200 mm	3

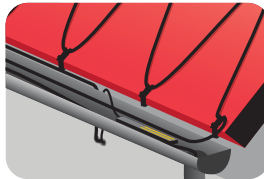
* Two lines of 30 W/m (60 W/m) require minimum Ø120 mm downpipe and a moisture sensitive controller, e.g. ECTemp 850.

Design temperature	Heat density	ECsnow 20T (EFTCC)		ECsnow 30T (EFTCC)		ECsafe 20T (EFTPC)	
		[n]	[C-C in cm]	[n]	[C-C in cm]	[n]	[C-C in cm]
0 to -5 [°C]	200 - 250 W/m ²	1	9	-	-	1	9
6 to -15	250 - 300	2	7 - 8	1	12	2	7 - 8
16 to -25	300 - 350	2	6	2*	10	2	6
26 to -35	350 - 400	3	5	2*	8	3	5

Installation summary



Install ECTemp 850 sensor, if any, in gutter according to sensor manual.



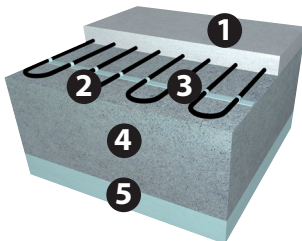
Extend sensor cables and cold leads, and place connections in a dry place. Seal all penetrations through e.g. roofs and walls.



Inform the end user to check for and remove sharp edges, leaves, and dirt from the heated roof and gutter systems every autumn.

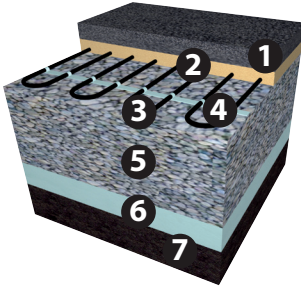
3.2 Snow melting on ground areas

Free constructions, e.g. platforms, steps, bridges, and terraces



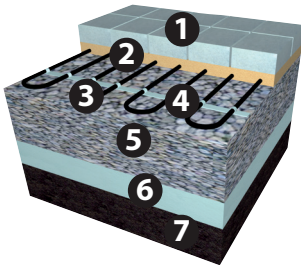
1. Top layer of concrete slab or mastic asphalt.
2. Heating cable.
3. Danfoss CLIP fastening accessory or mesh reinforcement.
4. Underlying free construction.
5. Insulation (optional)

Ground areas, e.g. ramps and car parks



1. Top layer of concrete slab or asphalt concrete.
2. Sand bed or concrete or asphalt concrete.
3. Heating cable.
4. Danfoss CLIP fastening accessory or mesh reinforcement.
5. Supporting layer of crushed stones/concrete /old asphalt.
6. Insulation (optional, ensure supporting layer is suitable).
7. Soil.

Ground areas, e.g. driveways, walkways, and pavements



1. Top layer of pavement blocks or concrete slab
2. Sand bed
3. Heating cable
4. Danfoss CLIP fastening accessory or mesh reinforcement
5. Supporting layer of crushed stones
6. Insulation (optional, ensure supporting layer is suitable)
7. Soil

Ground thermostat is mandatory

- In sand bed: mat output from 250 W/m² and cable output from 25 W/m.
- In mastic asphalt or concrete bed: cable output from 30 W/m with a heat density > 500 W/m² (C-C < 6 cm) (ECasphalt (DTIK)).

Limited power supply

- Reduce the area to be heated, e.g. by heating tire tracks instead of the whole driveway.
- Divide and prioritise the area into 2 zones by means of ECTemp 850 .
- Install less W/m² than recommended. Snow melting performance will be reduced. Do not install less W/m² than recommended in areas of drainage, e.g. in front of heated steps.

Do not install cables in sand only

- The heating cables must be protected by a hard top layer.

Embedding in concrete, mortar or screed

- The bedding must not contain sharp stones.
- Must be sufficiently wet, homogeneous, free of air voids:
 - Pour at a moderate delivery speed to avoid displacement of the element.
 - Avoid excessive use of rakes, shovels, vibrators, and rollers.
- Allow a drying time of approximately 30 days for concrete and 7 days for moulding compounds.

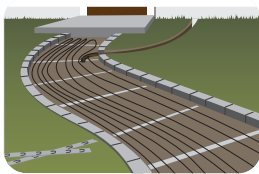
Embedding in mastic or asphalt concrete (road asphalt)

- Use ECasphalt (DTIK) only, fully embedded.
- Use mastic asphalt cooled down to max. 240°C or
- 3 cm hand rolled asphalt concrete (max. 8 mm. stone size), cooled down to

- max. 80°C before applying a second layer with a max. 500 kg drum size (no vibrator).
- Apply ground sensor dummy $\varnothing 100 \times H 100$ mm, made from heat resistant material, e.g. cellular glass insulation.

- Apply Sensor conduit 5/8"-3/4" made from heat resistant material, e.g. metal.

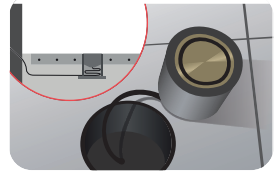
Installation summary



Prepare installation surface with Danfoss CLIP fastening accessories and/or mesh reinforcement. Fix conduit for sensor cable and sensor tube/dummy for ECtemp 850 sensor, if any.



Extend cold leads with connection sets and place connections in a dry place. Seal all penetrations through walls or similar structures. Apply caution tape above cold leads.



After laying blocks or pouring concrete/asphalt, install external sensor(s), and extend sensor cable(s) according to sensor manual.

3.3 Field/seed bed heating

A heated field is considered a workplace e.g.

- football pitches
- golf greens
- greenhouses

Safety instruction, see section 1.1.

The installation depth must always be considered carefully

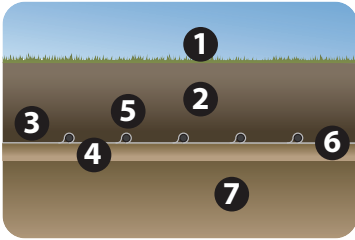
- Agree with local electrical and safety authorities before installing the cables.
- Observe local requirements for installation depth, possible mechanical protection for cold leads and markings.

- Observe insertion depth of objects like lawn aerators, vertidrain, spades, javelins, pegs, anchor bolts etc.
- For efficient heating the installation depth should be max. 25-30 cm.
- Any work in the soil after installation must be done by instructed personnel only.

Field/seed bed heating should be established with multiple zones, depending on field size, sun and shadow. Each zone must be provided with

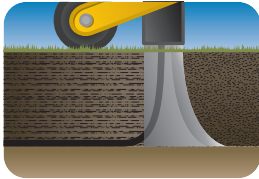
- 2 x sensors or 1 sensor probe for measuring average top soil temperature.
- Sealed junction box or cable well for connecting cold leads to power supply.
- Max distance to junction box or cable well 20 m from each zone.

Free constructions, e.g. platforms, steps, bridges, and terraces

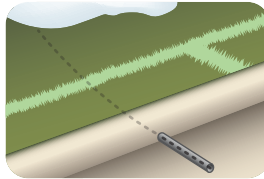


1. Grass.
2. Topsoil.
3. Sensor in steel conduit.
4. Sand/soil.
5. Heating cable.
6. Fitting band (for installation on new constructions).
7. Ground with drainage system.

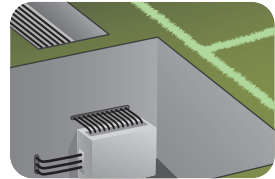
Installation summary



Roll out and fix elements on base construction. For retrofit installation cables can be plowed into the soil.



Fix conduit as high as possible for sensor cables or sensor probe in each zone.

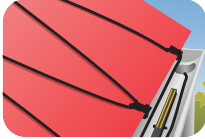




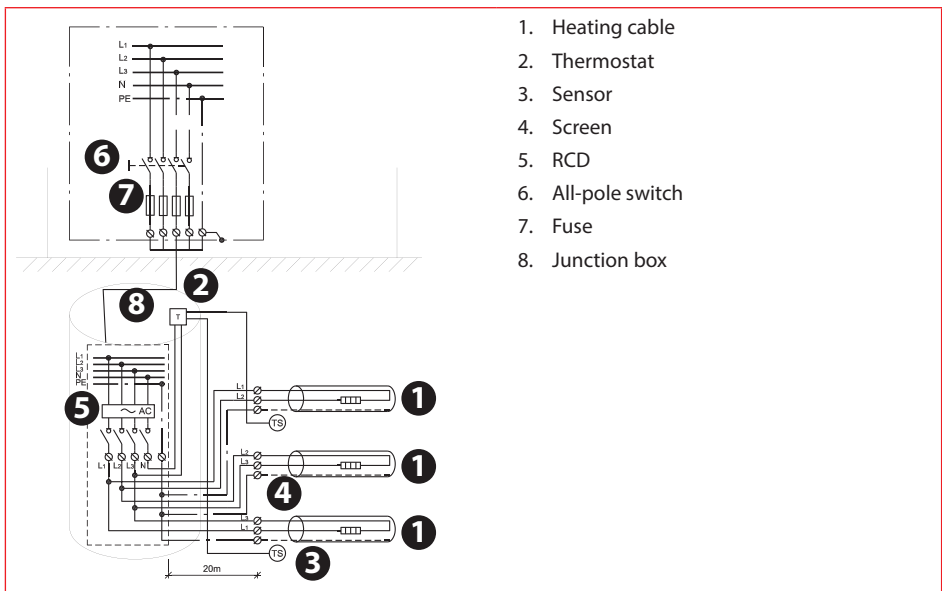
Wire cold leads in cable trench in 1 layer only (no bundling, no pipes). Apply caution tape above cold leads and cover with sand. Connect cold leads and sensors to sealed junction boxes or cable wells max. 20 m from each zone.

4 Optional settings

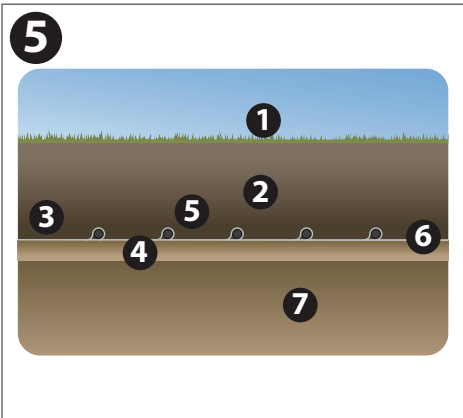
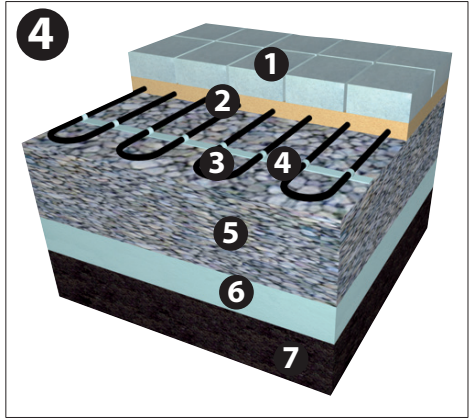
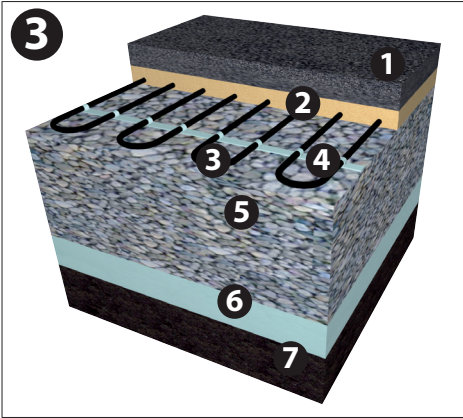
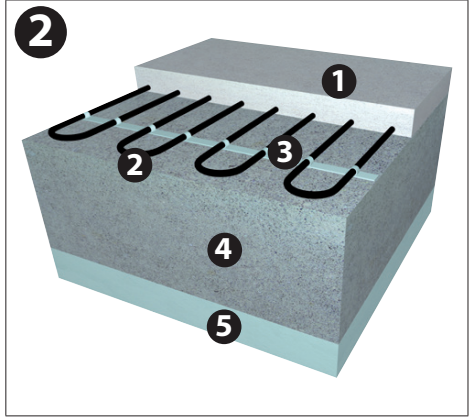
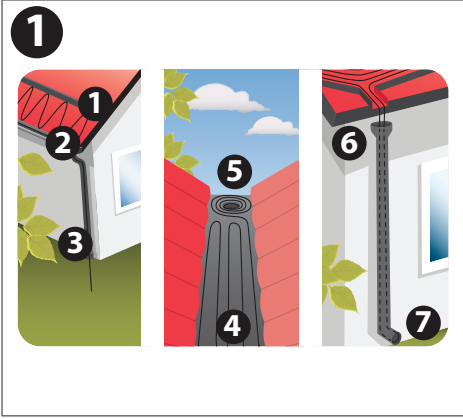
If the element is connected to a thermostat such as a ECTemp, configure basic settings according to the table below and as described in the thermostat installation manual.

If applicable, adjust the temperature limit in accordance with the manufacturer's recommendations in order to prevent damage.

				
Thermostat	Max. load	Frost protection of roof and gutter systems	Snow and ice melting on ground areas	Field/seed bed heating
ECTemp 316	16A	-7° C < On < +3° C	-	
ECTemp 330	16A	On < +3° C	On < +3° C	Defrosting +3° C Growing +7° C
ECTemp 610	10A	On < +3° C	On < +3° C	
ECTemp 850	2 x 15A	Melting < +3° C	Melting < +3° C Standby < -3° C	



1. Heating cable
2. Thermostat
3. Sensor
4. Screen
5. RCD
6. All-pole switch
7. Fuse
8. Junction box



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