



Installation Guide

Danfoss Self-limiting Heating Cables

SLPG-10/26/33, SLPG-18, SLHW-55/70, SLPH-10



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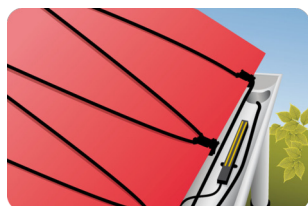
1 Introduction

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

For other applications please contact your local sales office.

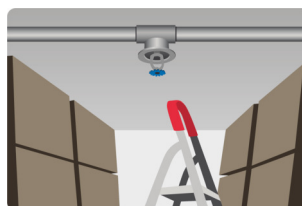
Frost protection of roof and gutter systems

- see section 4.4



Frost protection of pipe systems

- see section 4.1, 4.2, 4.3



1.1 Self-limiting Heating Cables

Introduction

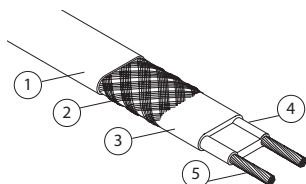
The heating cables are used mainly for ice and snow melting on roofs and in gutters, down pipes, for frost protection of pipes and for temperature maintenance of the hot-water supply.

There are 4 types of Danfoss self-limiting heating cables with various effects depending on the application.

Cable Construction

Self-limiting heating cables are designed with a temperature dependant resistant element between two parallel bus wires.

When the bus wires are connected to the mains, a current goes through the temperature dependant resistant element which will then heat. As the element is heated the resistance value rises causing the current to decline and heating is reduce. This explains the self-limiting effect.



The regulation of the output takes place independently on the entire length of the cable according to the actual ambient temperature.

If the ambient temperature rises the heating effect of the cable is reduced. Due to this self-limiting capability, overheating of the cable can be avoided, also if two heating cables are touching or crossing.

As self-limiting heating cables always gives off a certain amount of effect, it is recommended to connect the heating cable to a thermostat to be able to disconnect the current when heating is not required.

Due to the parallel power supply the heating cable can be shortened anywhere. This simplifies the planning and installation.

1. Outer sheath
2. Screen
3. Insulation
4. Self-limiting heating element
5. Bus wires

1.2 Safety Instructions



- Cutting the heating element will void the warranty.
- Cold leads and mat mesh can be cut or shortened to suit requirements, only.

Never cut or shorten the heating element



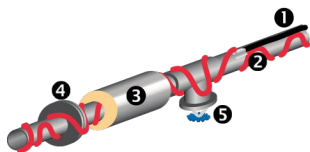
Elements must always be installed according to local building regulations and wiring rules as well as the guidelines in this installation manual

- Any other installation may hamper element functionality or constitute a safety risk, and will void the warranty.
- Make sure that elements, cold leads, connection boxes, and other electrical components do not come into contact with chemicals or flammable materials during or after installation.

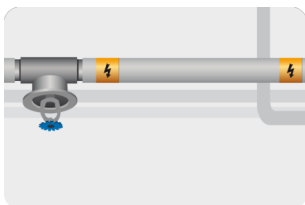
Elements must always be connected by an authorised electrician using a fixed connection.

- De-energize all power circuits before installation and service.
- The connection to the power source must not be directly accessible to the end user.
- Each heating cable screen must be earthed in accordance with local electricity regulations and connected to a residual current device (RCD).
- Recommended RCD trip rating is 30 mA, but may be up to 300 mA where capacitive leakage may lead to nuisance tripping.
- 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, e.g. 10/13 A for a 1.5 mm² cold lead and 16/20 A for a 2.5 mm² cold lead.

Pipe Tracing



- Sensor
- Heating Cable
- Insulation
- Fitting
- Valve



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 installation.

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

1.3 Handling

- If the heating cable is delivered on a cable drum you should use a reliable holder for the drum when unrolling the cable.
- Pull the heating cable straight of the drum.
- Avoid pulling violently, breaking or squeezing the heating cable.
- Do not place the heating cable over sharp objects or edges.

- The heating cable must be protected against excess strain and tension. Stepping on the cables or crossing the cables with vehicles should be avoided, as this may damage the cables.
- The surface onto which the cable is to be installed must be clean and free of sharp objects.
- Never secure the cable with metal or metal strips.
- Do not connect power to heating cable while it is on the drum or shipping carton.

1.4 System Overview

Cable	Color	Application	Effect	Dimension	Cap	Mechanical Class
SLPG-10	Blue	On pipes	10W/m @ 10 °C	5,5 x 11,5 mm	Polyolefin UV	IEC 60800:M2
SLPG-26	Red	On pipes	25W/m @ 10 °C	5,5 x 11,5 mm	Polyolefin UV	IEC 60800:M2
SLPG-33	Grey	On pipes	33W/m @ 10 °C	5,5 x 11,5 mm	Polyolefin UV	IEC 60800:M2
SLPG-18	Black	Roof & gutter	18W/m @ 10 °C	5,8 x 11,3 mm	Polyolefin UV	IEC 60800:M2
SLPG-18	Black	Roof & gutter	18W/m @ 10 °C	5,8 x 11,3 mm	Polyolefin UV	IEC 60335-2-96
SLHW-55	Green	On pipes	8W/m @ 55 °C	5,8 x 11,8 mm	Polyolefin UV	IEC 60800:M2
SLHW-70	Red	On pipes	12W/m @ 70 °C	5,8 x 11,8 mm	Polyolefin UV	IEC 60800:M2
SLPH-10	Blue	On / in pipes	10W/m @ 10 °C	5,3 x 7,7 mm	Thermoplastic	IEC 60800:M2
SLPH-10	Blue	On / in pipes	10W/m @ 10 °C	5,3 x 7,7 mm	Thermoplastic	IEC 60335-2-96

Voltage 220V - 240V AC

Minimum installation temperature -5° C.

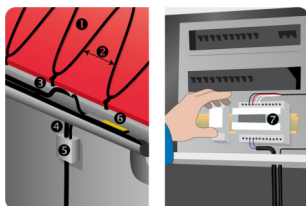
Max. temperature ON = 65° C.

Max. temperature OFF = 85° C.

Note:

- The stated effect is measured on the cable installed on pipe under insulation.
- The Self-limiting cables have to be in good thermal contact with the item to be heated.
- When self-limiting cables are surrounded by thermal conducting materials (water / concrete, etc.) the effect may be double in relation to the nominal value.

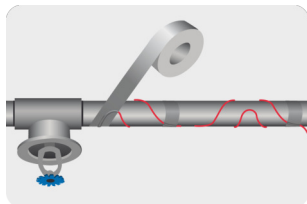
1.5 Functional Overview



1. Element
2. C-C distance
3. Cold lead connection
4. Cold lead
5. Connection box (if any)
6. Sensor
7. Thermostat

2 Installation in General

2.1 Fastening Methods



Danfoss Aluminium Tape

For ensuring efficient heat transfer.



Spaceclip

For attaching cables and relieving from sharp edges.

2.2 Calculating C-C Distance

For areas on roofs the C-C distance is the distance in centimetres from the centre of one cable to the centre of the next.

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

or

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

The max. C-C distance for roof and gutter systems is 10 cm.

W/m ² @ 220V/380V			
C-C [cm]	20 W/m	25 W/m	30 W/m
5	366	457	-
7,5	244	305	366
10	183	229	274

W/m ² @ 230V/400V			
C-C [cm]	20 W/m	25 W/m	30 W/m
5	400	500	-
7,5	267	333	400
10	200	250	300

W/m ² @ 240V/415V			
C-C [cm]	20 W/m	25 W/m	30 W/m
5	436	544	-
7,5	290	363	436
10	218	272	327

SLPG-18			
C-C [cm]	220V/380V	230V/400V	240V/415V
5	329 W/m ²	360 W/m ²	392 W/m ²
7,5	219 W/m ²	240 W/m ²	262 W/m ²
10	165 W/m ²	180 W/m ²	196 W/m ²

2.3 Calculating Cable Length

Please consider all of the below when calculating the length of the heating cable:

- Heated pipe length
- Number of connections x 0,3 m heating cable.
- Number of specials x 0,5 m heating cable.
- Number of T-derivations x 1 m heating cable.
- Heating cable length for flanges, fittings and measured pipe extensions.

2.4 Max. Cable Length

	SLPG-10			SLPG-26			SLPG-33		
	Max. heating cable length at 230 V								
	FUSE			FUSE			FUSE		
Temperature	10A	16A	20A	10A	16A	20A	10A	16A	20A
-30° C	50 m	120 m	150 m	30 m	45 m	64 m	22 m	43 m	52 m
-15° C	70 m	139 m	186 m	40 m	58 m	75 m	25 m	49 m	64 m
0° C	85 m	165 m	190 m	50 m	75 m	85 m	32 m	60 m	70 m
10° C	120 m	205 m	205 m	65 m	88 m	117 m	40 m	70 m	90 m

	SLPG-18			SLHW-55			SLHW-70		
	Max. heating cable length at 230 V								
	FUSE			FUSE			FUSE		
Temperature	10A	16A	20A	10A	16A	20A	10A	16A	20A
-30° C	40 m	77 m	106 m	-	-	-	-	-	-
-15° C	60 m	93 m	125 m	-	-	-	-	-	-
0° C	80 m	110 m	135 m	-	-	-	-	-	-
10° C	105 m	145 m	162 m	70 m	88 m	117 m	60 m	80 m	90 m

	SLPH-10 (on pipe)		SLPH-10 (in pipe)	
	Max. heating cable length at 230 V			
	FUSE		FUSE	
Temperature	10A	16A	10A	16A
-30° C	50 m	54 m	-	-
-15° C	79 m	85 m	-	-
0° C	96 m	103 m	-	-
10° C	100 m	107 m	60 m	60 m

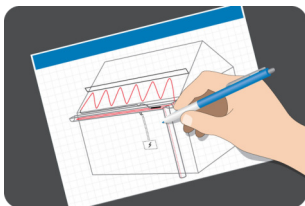
Installation Guide

Danfoss Self-limiting Heating Cables

2.5 Planning the Installation

Draw a sketch of the installation which shows

- 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.

Bear in mind the following:

- Observe correct C-C distance (heating cables only) - see section 2.2.
- Observe required installation depth and possible mechanical protection of cold leads.
- When installing more than one element, never wire elements in series but route all cold leads in parallel to the connection box.

2.6 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, or walls or apply foil covering
- There must be no sharp edges, leaves, dirt or foreign objects.

3 Installing Heating 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

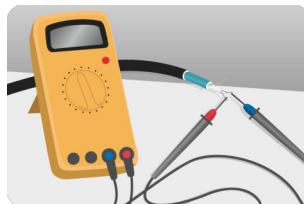
Measure, verify and record element resistance during installation.

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

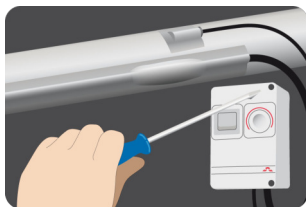
Also measure if there is connection between the two conductors or from the conductor to the metal sheath.

If the insulation resistance is not as labelled, the element must be replaced.

- Check for short circuits by measuring between the two bus wires and the screen.



3.1 Installing Elements



The heating cables bending diameter must not be less than 25 mm (32 mm for SLPG-18). The cable must only be bended on the flat side.

For reduction of electricity consumption, we strongly recommend that it is possible to switch off the heating cable, i.e. by using a ECtemp thermostat.

After installation the cable insulation resistance must be measured and recorded.

At low temperatures the heating cable can become stiff and difficult to work with. This problem can be solved by connecting the unreeled cable to the mains for a brief period of time.

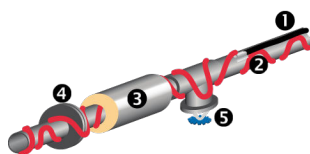
4 Application

4.1 Installation on Pipes

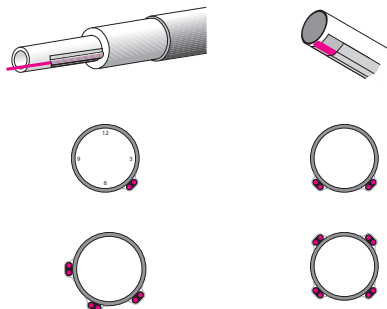
Frost protection of pipe systems [W/m]

Δt [K]	Insulation [mm]	Pipe diameter DN [mm]											
		15	20	25	32	40	50	65	80	100	125	150	200
20	10	8	9	11	14	16	19	24	29	36	44	-	-
	20	5	6	7	8	9	11	14	16	19	24	28	36
	30	4	5	5	6	7	8	10	12	14	17	19	25
	40	4	4	5	5	6	7	8	9	11	13	15	19
	50	3	4	4	5	5	6	7	8	9	11	13	16
30	10	12	14	17	20	24	29	37	44	-	-	-	-
	20	8	9	10	12	14	17	20	24	29	35	42	-
	30	6	7	8	9	11	12	15	18	21	25	29	37
	40	5	6	7	8	9	10	12	14	17	20	23	29
	50	5	6	6	7	8	9	11	12	14	17	19	24
40	10	15	19	22	27	32	39	49	-	-	-	-	-
	20	10	12	14	16	19	22	27	32	39	47	-	-
	30	8	9	11	12	14	17	20	23	28	33	39	50
	40	7	8	9	10	12	14	16	19	22	26	31	39
	50	6	7	8	9	10	12	14	16	19	22	26	32

Pipe tracing



1. Sensor.
2. Heating cable.
3. Insulation.
4. Fitting.
5. Valve.



The self-limiting heating cable may only be used for installations with pipes of metal or plastic.

When installing heating cables on plastic pipes:

- Place a strip of aluminium tape on the pipe.
- Place the heating cable on the aluminium tape.
- Secure the heating cables with aluminum tape.

It is recommended that the entire cable is covered with aluminum tape, to ensure efficient heat transfer to the plastic pipe.

The cable must be placed optimal on the 5 or 7 o'clock position of the pipe, thus mechanical strain of the heating cable is prevented when e.g. the insulators are working along the pipe.

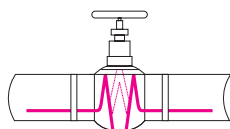
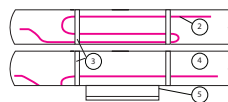
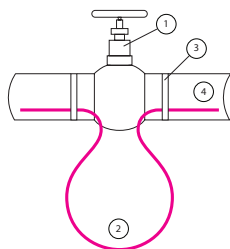
There must always be as much insulation as possible on the pipe to reduce the heat loss.

WARNING!
230V AC HEATING CABLE

- When the heating cable is installed on pipes, the insulation should be clearly marked with a warning.

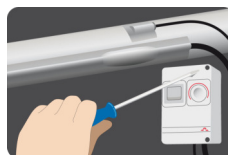
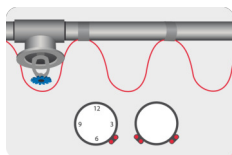
Installation on Special Flanges and Pumps

- Always observe the minimum tolerable bending diameter of 25 mm (32 mm for SLPG-18)!
- Heating cables on specials, valves etc. should always be positioned so that they are easily assessable and replaceable in connection with inspection and repair and so that it will not be necessary to cut them! You can avoid this problem when there is sufficient cable wrapped in a spiral around the specials.



1. Valve
2. Heating cable
3. Aluminium tape
4. Pipe
5. Pipe fitting

Installation Summary

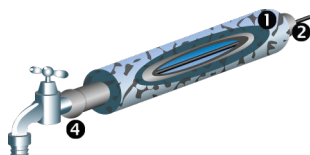


Straight cables must be fitted as shown at 5 or 7 o'clock. In-pipe cables are fitted directly in the pipe with compression gland. Cables wrapped around pipes are attached as shown for every 20-30 cm of pipe with aluminium tape (for large pipe diameters only).

Extend cold leads/terminate cables, and place connections in a dry place. Mount connection box on or close to pipe, and install thermostat next to pipe.

4.2 Installation in pipes

In-pipe Frost Protection



1. Insulation.
2. Heating cable.
3. Sensor (optional - not shown).
4. Fitting.

- Installation of SLPH in pipes is energy-saving, because the heating cable is in direct contact with the fluid that is to be heated.
- Do not use the heating cable in pipes with inlet water pressure above 1 MPa (10 bar). Please note that in this case the heating cable must be connected via a fault current relay (RCD), and it must be possible to disconnect the heating cable.
- **Never** install the heating cable in taps and valves.

- **Never** switch on power, before the pipe is filled.
- If the heating cable is damaged during installation, it **must** be replaced.
- When the heating cable is installed in pipes, the pipe or insulation should be clearly marked with a warning.

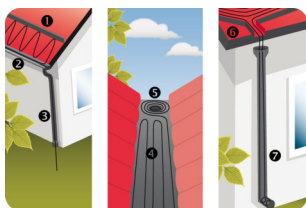
WARNING!
230V AC HEATING CABLE

4.3 Installation Inside the Pipe

1. Fit a T-shaped pipe of a generous size over the pipe.
2. Fit the wadding (the item with male thread) inside the T-shaped pipe.
3. Push the heating cable through the wadding, using lubricant to facilitate the installation. The connection between heating cable and connecting cable must be outside the wadding.
4. Mount the Wadding in the following sequence:
 - Mount the nut with the flat side facing the connection.
 - Mount the washer on the heating cable.
 - Squeeze the rubber seal on the heating cable.
5. Mount the male threaded part with the female threaded part facing the end of the cable.
6. The heating cable must extended straight through the T-shaped pipe.
7. Turn the wadding until it fits tightly
8. Insulate the pipe with at least 30 mm insulation or more if required.



4.4 Installing on 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, the heat density and the number of cable lines, depends on the design temperature and the gutter diameter.

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Danfoss Self-limiting Heating Cables

Design temperature	Heat density	Cable lines	C-C
°C	[W/m ²]	[No.]	[cm]
0 to -5	200 - 250	1	8-9
-6 to -15	250 - 300	2	7
-16 to -25	300 - 350	2	6
-26 to -35	350 - 400	3	4-5

We recommend that you always use a controller for controlling the self-limiting heating cables to avoid waste of energy.



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

5 Finalizing the Installation

Connecting cables

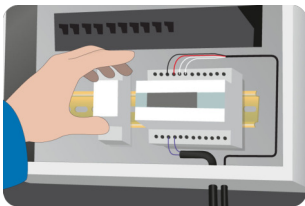
- Connect all cold leads and the sensor to the connection box.
- See the installation manual for the thermostat.

Final check and documentation

- Make sure that the heat distributor (e.g. roof, pipe) can withstand the heat from the element. This is particularly important if the element is connected to a thermostat that does not allow configuration of maximum temperature - see section 4.4.

- Document the following using text, drawings, or photos:
 - cable type, spacing, depth, layout, circuit ID, sensors.
 - location of connections between cold lead and heating element.
 - location of end caps (twin conductors only).
 - location of expansion joints, if any.
- Re-check and compare the insulation resistance.

Hand-over to the end user





- Instruct the end-user or the daily supervisor in the operation and maintenance of the heating system.
- Before every period of continuous use, check for faults in the distribution board, thermostat, and sensors.

5.1 Connecting a Thermostat

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 to e.g. the floor or the pipe.

- Note, however, that the limit must not exceed the maximum temperature limit specified per application (see section 4).

Thermostat	Max. load	 Frost protection of roof and gutter systems	 Frost protection of pipe systems
ECtemp 316	16 A	-7 °C < On < +3 °C	-
ECtemp 330/610	16/10 A	On < +3 °C	On < +5 °C
ECtemp 850	2 x 15A	Melting < +3°C	-

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