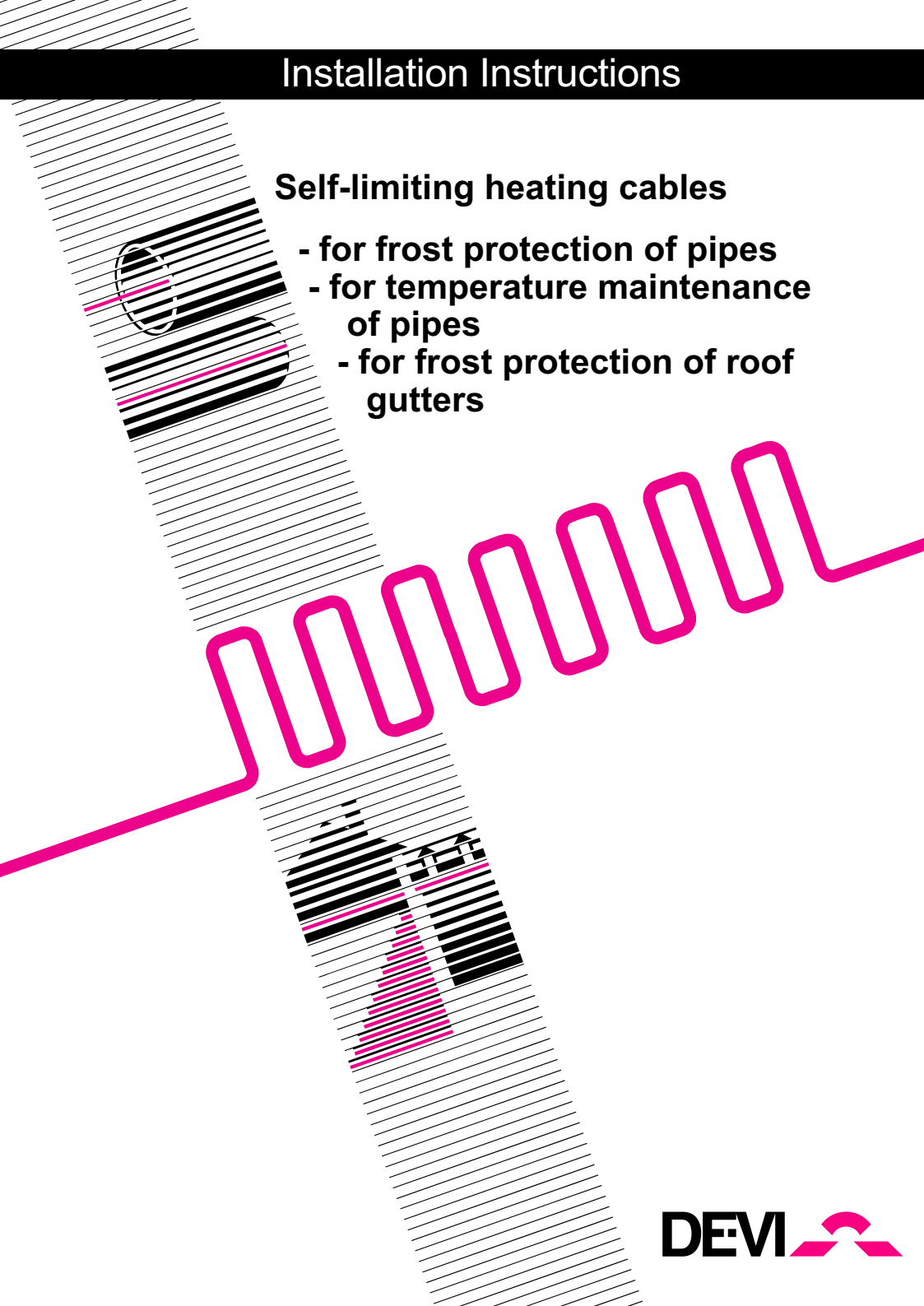
Installation Instructions

Self-limiting heating cables

- for frost protection of pipes
- for temperature maintenance of pipes
- for frost protection of roof gutters



DEVI

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Self-limiting heating cables

There are 5 types of **DEVI** self-limiting heating cables with various effects depending on the application.
The heating cables are mainly used for ice and snow melting on roofs, in gutters and down pipes, for frost protection of pipes and for temperature maintenance of the hot-water supply.

These are the areas which will be discussed in this installation instruction.

Should you need further information about the application of self-limiting heating cables or other **DEVI** products, please see the **DEVI** heating cable compendiums.

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

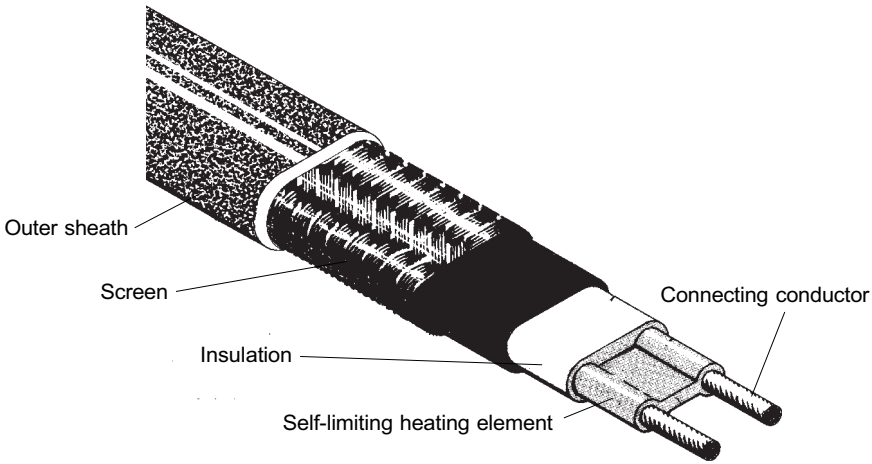
When the connecting conductors are connected to the mains, a current goes through the temperature dependant resistant element which will then heat. As the element is heated the resistance value rises causing the current to decline and heating is reduced. This explains the self-limiting effect.

This regulation of the output takes independently place 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 give off a certain amount of effect, it is recommended to connect the heating cable via a thermostat to disconnect when heating is not required.

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



Cable specifications

Cable	Color	Application	Effect	Dimension	Sheath
devi-iceguard	Black	Roof and gutter	18 W/m at. 0ºC*	6 x 12 mm	Polyolefin UV
devi-pipeguard	Blue	On pipes	10 W/m at 10ºC	6 x 12 mm	Polyolefin UV
devi-pipeguard	Black	On pipes	15 W/m at 10ºC	6 x 12 mm	Polyolefin UV
devi-pipeguard	Red	On pipes	25 W/m at 10ºC	6 x 12 mm	Polyolefin UV
devi-pipeheat	Blue	On/in pipes	10 W/m at 10ºC	6 x 8 mm	Hylar UV
devi-hotwatt	Red	On pipes	8 W/m at 55ºC	6 x 12 mm	Polyolefin UV

** Effect in ice approx. 30 W/m.*

Voltage 230 V AC ~
Capacitive leak current 30 mA per km. heating cable
Max. temperature ON = 65ºC. Max. temperature OFF = 85ºC.

- Stated effect is measured at the cable installed on pipe under insulation.
- When self-limiting cables are installed in the open, the effect may be reduced by approx. 50%.
- When self-limiting cables are surrounded by thermal conducting materials (water/concrete, etc.) the effect may double in relation to the nominal value.
- When planning the installation it must be considered that self-limiting cables may reduce the operational effect during several years.

General installation instructions

1. The heating cable must only be used in the manners recommended by **DEVI** and should be properly connected to the main electrical source.
2. Connection of the heating cable must be done by an authorised electrician.
3. The maximum effect for the different installations and operating effects must be observed.
4. The heating cable must be protected against excess strain and tension.
5. The surface onto which the heating cable is to be installed must be clean and free for sharp objects.
6. The heating cables bending diameter must not be less than 50 mm. The cable must only be bend on the flat side.
7. The heating cables screen must be earthed in accordance with the local electricity laws.
8. For reduction of electricity consumption, we strongly recommend that it is possible to switch off the heating cable if this is longer than approx. 3 m., i.e. by using a **devireg**® thermostat (see „Regulation“).
9. At low temperatures the heating cable can become stiff and difficult to work with. This problem can be solved by connecting the cable to the mains for a brief period of time.
10. After installation the cable insulation resistance must be measured.

Max. cable length at different ambient temperatures

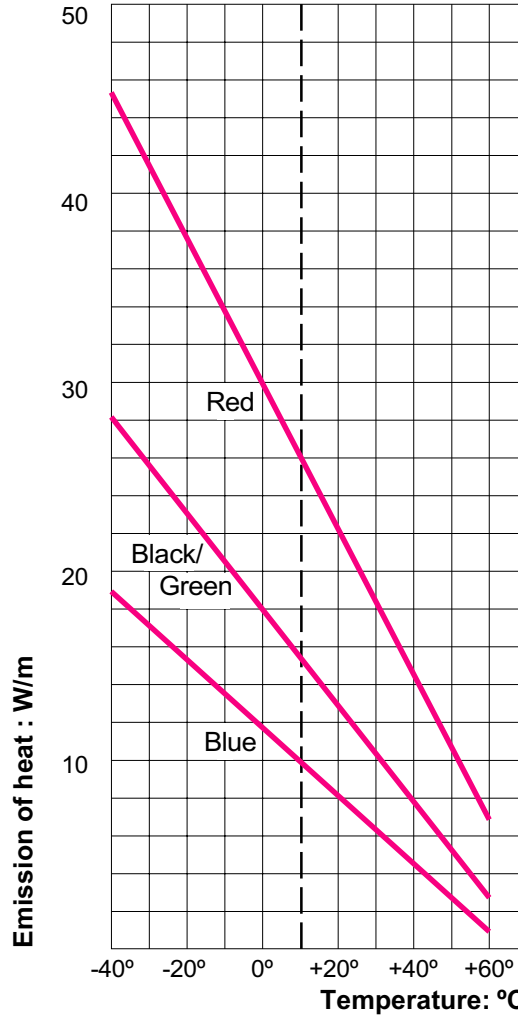
	Blue					Black				
	Fuse*					Fuse*				
	13 A	**16 A**	20 A	32 A	40 A	**13 A**	**16 A**	20 A	32 A	40 A
Ambient temperature	**Max. heating cable length at 230 V**									
	m	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**
-20ºC	107	133	167	267	333	69	87	109	174	217
-10ºC	114	143	178	286	357	80	100	125	200	250
0ºC	133	167	208	333	417	89	111	139	222	278
+10ºC	160	200	250	400	500	107	133	167	267	333

	Red					Green				
	Fuse*					Fuse*				
	13 A	**16 A**	20 A	32 A	40 A	**13 A**	**16 A**	20 A	32 A	40 A
Ambient temperature	**Max. heating cable length at 230 V**									
	m	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**
-20ºC	42	53	66	105	132	42	53	66	105	132
-10ºC	47	59	74	118	147	47	59	74	118	147
0ºC	53	67	83	133	167	53	67	83	133	167
+10ºC	64	80	100	160	200	64	80	100	160	200

** Fuses with C-characteristic*

The stated maximum lengths for self-limiting heating cables are determined not only from the power consumption of the cable during normal circumstances but mainly from the power consumption when starting which can be as much as 1.8 times the current during normal use.

Blue: 10 W/m at 10ºC
Black: 15 W/m at 10ºC
18 W/m at 0ºC
36 W/m in ice
Green: 15 W/m at 10ºC
Red: 8 W/m at 55ºC



Frost protection of pipes

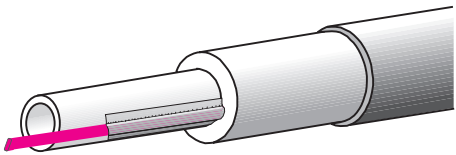
Table for choice of cable for frost protection of pipes

Frost protection: +5ºC		Pipe diameter: DN(mm) / "(inch)											
Dt	Insulation (0,035 W/m²Kº)	to 20 ¾"	25 1"	40 1¼"	50 1½"	65 2"	80 2½"	90 3"	100 4"	125 5"	150 6"	200 8"	250 10"
25º	10 mm	black	black	black	red	red	red	X	X	X	X	X	X
25º	15 mm	blue	blue	black	black	red	red	red	red	X	X	X	X
25º	20 mm	blue	blue	blue	blue	black	black	red	red	red	red	X	X
25º	25 mm	blue	blue	blue	blue	black	black	black	black	red	red	X	X
25º	30 mm	blue	blue	blue	blue	blue	black	black	black	black	red	red	X
25º	40 mm	blue	blue	blue	blue	blue	blue	blue	black	black	black	red	red
25º	50 mm	blue	blue	blue	blue	blue	blue	blue	blue	black	black	black	red

Blue: 10 W/m at 10ºC
Black/Green: 15 W/m at 10ºC
Red: 25 W/m at 10ºC
X = improve insulation, or use more cables (effect - see table on page 6).

Frost protection: *+5º*
Surrounding temp.: *-20º*
Dt = +5º to -20º = *25ºC*
Max. wind velocity: *10 m/s*

Installation on pipes:
devi-pipeguard *and* ***devi-flexheat***
- When installing **devi-pipeguard** on pipes the cable can be secured to the pipe with aluminium tape. Furthermore, it is recommended that the entire cable is covered with aluminium tape to ensure efficient heat transfer to the pipe.
- The cable must be placed optimal on the underside of the pipe, and it is recommended always to insulate the pipe to reduce the heat loss.



Installation in pipes
devi-pipeheat
Installation of **devi-pipeheat** in pipes is energy-saving, because the cable is in direct contact with the water which must be heated.

- Although, please note that in this case the cable MUST be connected via a fault current RCD relay, and it must be possible to disconnect the cable.
- NEVER install the cable in taps and valves.

When the heating cable is installed in/ on pipes it should be clearly marked with a warning text!. E.g.:

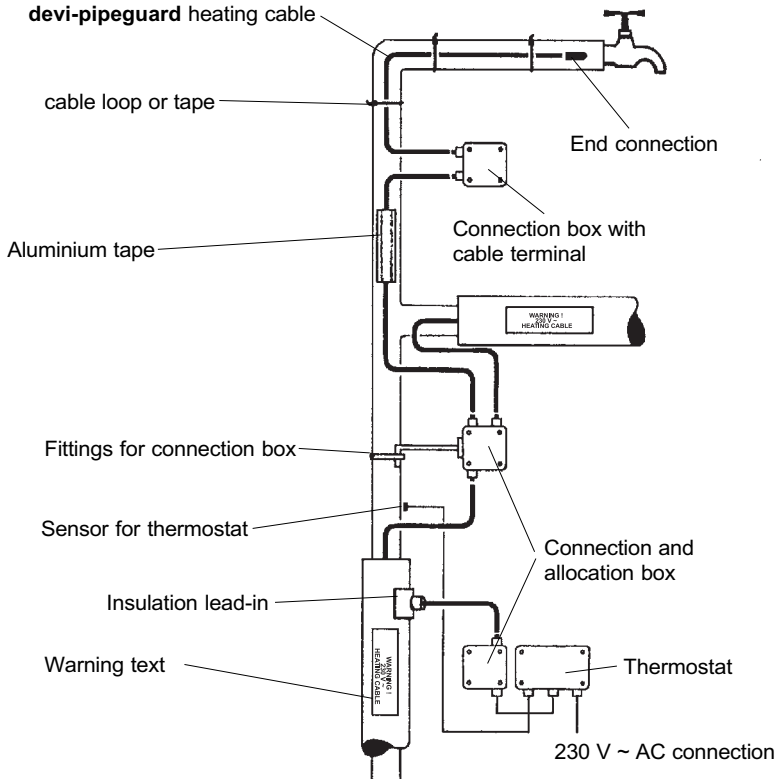
WARNING!
230V AC HEATING CABLE

Frost protection of pipes

Table for heat loss from pipes

Pipe diameter (")		½	¾	1	1¼	1½	2	2½	3	4	6	8	10
(mm)		15	20	25	32	40	50	65	80	100	150	200	250
Dt (°K)		Heat loss per meter pipe (W/m) at different pipe lengths											
10 mm Insulation (0,035 W/m²K°)	**20°**	7,2	8,4	10	12	13,4	16,2	19	23	29	41	52	64
	30°	10,7	12,6	15	18	20,2	24,4	29	34	43	61	78	95
	40°	14,3	16,8	20	24	26,8	32,5	38	45	57	81	104	127
	60°	21,5	24,2	30	36	40,2	48,7	58	68	86	122	156	191
20 mm Insulation (0,035 W/m²K°)	**20°**	4,6	5,3	6,1	7,2	7,9	9,4	11	13	16	22	29	34
	30°	6,8	7,9	9,1	10,8	11,9	14,2	16	19	24	33	42	51
	40°	9,1	10,6	12,2	14,4	15,8	18,8	22	25	32	44	56	68
	60°	13,6	15,7	18,2	21,6	23,9	28,2	33	38	48	67	84	103
30 mm Insulation (0,035 W/m²K°)	**20°**	3,6	4,1	4,7	5,5	6	7	8	9	11	16	20	24
	30°	5,4	6,1	7,1	8,2	9	10,6	12	14	17	24	30	36
	40°	7,3	8,3	9,5	10,9	12	14	16	19	23	31	40	48
	60°	10,9	12,4	14,2	16,4	18	21	24	28	34	47	59	72
40 mm Insulation (0,035 W/m²K°)	**20°**	3,1	3,5	4	4,6	4,9	5,8	7	8	9	12	16	19
	30°	4,7	5,3	6	6,8	7,4	8,6	10	11	14	19	23	28
	40°	6,2	7,1	7,9	9,1	10	11,5	13	15	18	25	31	37
	60°	9,4	10,6	12	13,7	14,9	17,3	20	22	27	37	46	56

Example of installation



Installation

Handling of the heating cable:

If the heating cable is delivered on a cable drum you should use a reliable holder to the drum when unrolling the cable.

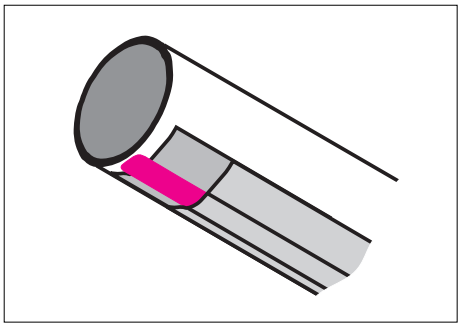
Pull the heating cable straight of the drum. Avoid pulling violently, breaking or squeezing the heating cable.

When unrolling, the heating cable must not fit over sharp objects or edges.
Treading on the cables and crossing the cables with vehicles should be avoided, as this may damage the cables !

Installing the heating cable:

The installation of the heating cable must take place at full length along the pipe. This is not only time-saving when installing the cable, you also prevent installation defects and any damages during the work with the thermal insulation.

First attach a strip of aluminium tape to the pipe, and then the heating cable is secured on top of this with a new strip of aluminium tape.



The heating cable is easily located underneath the insulation.

Heating cables can only be wrapped in a spiral if this is requested by the installation instruction.

Do not cut the heating cable till it has been secured to the pipe.

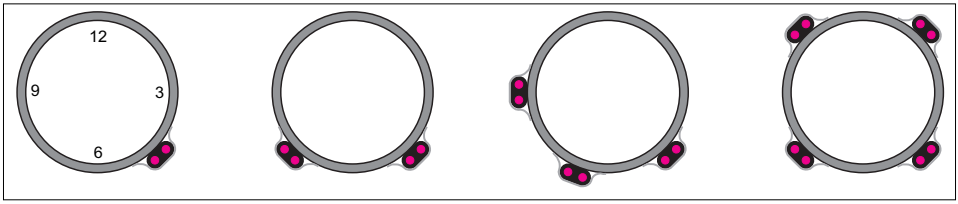
Remember to include additional cable length when connecting the connections, T-devirations and cable terminals (about 0,5 m each).

Securing the heating cable to the pipe:

- Fasten the cable to the pipe with a distance of min. 200 mm with aluminium tape or strips.
- Please consider the following when choosing tape or strips:
- When using strips you should consider the temperature resistance and resistance against chemical influences of the strip.
- Never secure the cable with metal.
- Never use PVC insulating tape or tape containing PVC or VC!
- Always use aluminium tape when requested by the installation instruction. When using aluminium tape the heat transfer is improved but the heating power is also increased.

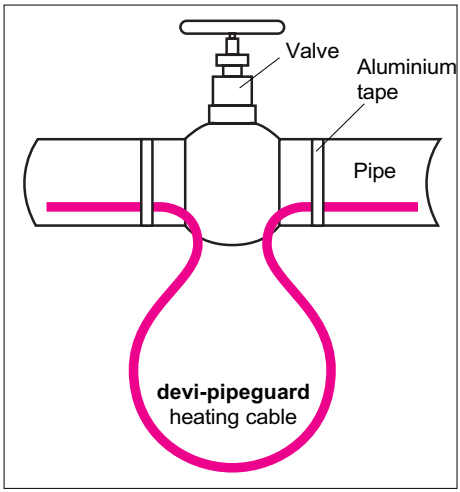
Installation of the cable at full length along the pipe:

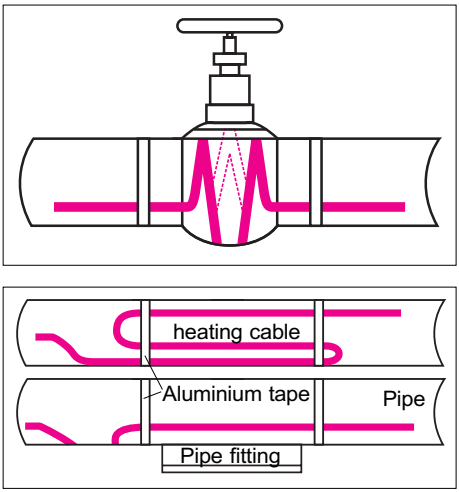
- Install the heating cable on the pipe as shown below.
- On horizontal pipes the heating cable must not be positioned on the top half of the pipe. Thus mechanical strain of the heating cable is prevented when e.g. the insulators are working along the pipe.



Installation on specials, flanges and pumps:

- Always observe the minimum tolerable bending diameter (50 mm) !
- 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.
- As there is a larger heat requirement on specials, valves, etc. the necessary cable length must also be increased.





Installation on valves and fixed points on the pipe.

Installing accessories:

- Observe the installation instructions to the accessories carefully.

IMPORTANT:
Never interconnect the two conductors otherwise a short circuit will occur !

- Install the cable terminal and the contact before you install the power connection.

- The connection boxes must be installed in an easily assessable place.

- After installing the cable terminal, leads, T-devirations and connection you should test these by means of measurement of the insulating resistance to make sure that they are correctly installed.

- After installing the boxes you should make sure that:

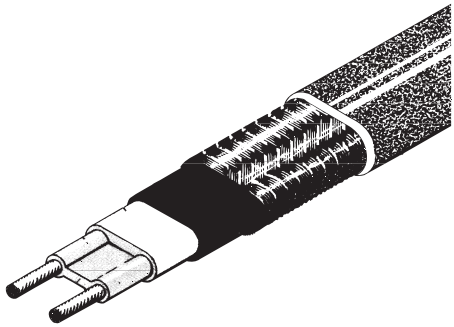
  - suitable and tolerable couplings and safety plugs are used.

  - couplings and safety plugs are secured.

  - the box is secured.

devi-hotwatt

Comfort heating of the hot-water supply with devi-hotwatt self-limiting electrical heating cables.



Traditional installations can only meet the requirements of hot water in all taps immediately if there is circulation in the pipe system.
This circulation entails several disadvantages, such as noise and wear in the pipes.

devi-hotwatt ensures economical and easy projecting of future hot-water supplies.

What can devi-hotwatt offer?

Savings when circulation in the pipe system is unnecessary. Additional pumps, specials and pipelines can be avoided - less space requirements during installation.

Economical - only small energy consumption for maintaining the desired hot-water temperature.

Automatic compensation for heat loss along the pipe.

Simple handling:
- **devi-hotwatt** is cut at the installation location and is installed straight on the pipe.
- Systems with **devi-hotwatt** is easy to extend without problems.
- Unused sections of the system can be disconnected.

You will have hot water immediately
- and thus avoid unnecessary waste of water.

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devi-hotwatt maintains the hot-water temperature at approx. 55ºC provided that the conditions descriped on next page are meet.

Calculation of cable length

	Heated pipe length
+	Number of connections x 0.3 m heating cable
+	Number of specials x 0.5 m heating cable
+	Number of T-devirations x 1 m heating cable
+	Heating cable length for flanges, fittings and measured pipe extentions
=	Length of the heating cable (m)

Pipe diameter and belonging insulation

mm	15	20	25	32	40	50	65
Inch	½"	¾"	1"	1¼"	1½"	2"	2½"
belonging minimum insulation thickness							
mm	20	20	30	30	40	50	65

Conditions for table:

Ambient temperature = min. 18ºC
Insulation = min. 0.035 W/m²Kº

If these conditions cannot be observed, please contact **DEVI** *for advice.*

Installation

- Current standards and directives according to the Local Regulations must be observed.

- A fault current RCD relay 30 mA is recommended.
Max. 500 m heating cable per fault current relay 30 mA.

- The cable must always be controlled by a thermostat with a wire sensor. The cable temperature may under no circumstances exceed 65 ºC when turned on and 85ºC when turned off. The sensor is to be placed on the tube under the insulation.

- The cable may only be used for installations with pipes of metal.

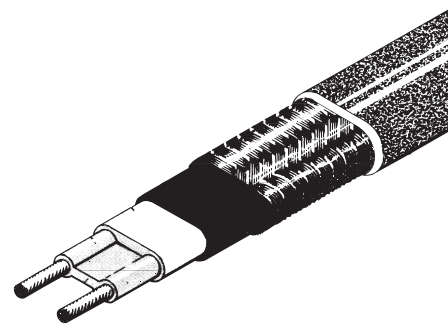
- The sizing should be calculated carefully from the dimensions of the pipe, insulation and desired pipe temperature

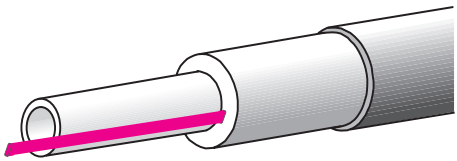
devi-pipeguard & devi-iceguard

Many buildings are insufficiently protected against frost damage. The frost attacks especially gutters and down pipes and all kinds of pipes, especially sanitary installations.

With **devi-pipeguard** and **devi-iceguard** you can attain a frost protection which is efficient and easy to install. The heating cable can be cut at the installation location.

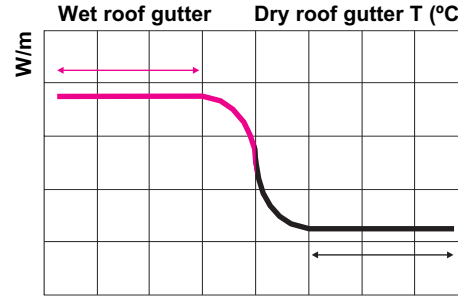
devi-pipeguard and **devi-iceguard** are self-limiting heating cables.





devi-pipeguard is developed especially for frost protection of pipes. The polyolefin outer sheath is highly resistant to harsh environmental conditions and corrosion and it also serves as a protection against mechanical influences.

devi-iceguard secures against ice formations in roof gutters.
- No water damages on/in the house.
- No falling icicles or icebound roof gutters.
- No risks for pedestrians.
- No repair costs after winter.



Frost protection of roofs

During periods with cold and precipitation dangerous and damaging ice formations are often formed on the roof, in roof gutters and down pipes, especially when the temperature is around freezing point.
Later, when the weather changes the melt water cannot be carried off which often causes damages on buildings.
These problems can be prevented with **devi-iceguard** heating cables installed on the roof and in gutters and down pipes.

Concerning roof constructions with low slope it is often sufficient to install **devi-iceguard** in roof gutter and down pipe to ensure an efficient draining off of the melt water.

Concerning roof constructions with high slope it is often necessary also to install the heating cable on the lowest section of the roof.
If the roof is supplied with snow fence the cable can be installed from this to the roof edge with advantage.

Concerning valleys, the cable must be mounted in the valley. To achieve efficient protection the C-C distance should not exceed 15 cm.

For control of roof systems an ordinary **devireg**® 610 thermostat, a **devireg**® 316 differential thermostat or a **devireg**® 810 thermostat with moisture automatics.

Installation:
In many ordinary roof gutters it is sufficient to install one cable length in roof gutter and down pipe.

Typically, the cables should be installed with a C-C distance of approx. 15 cm. To ensure the distance spacing clips can be used (see accessories on page 17).

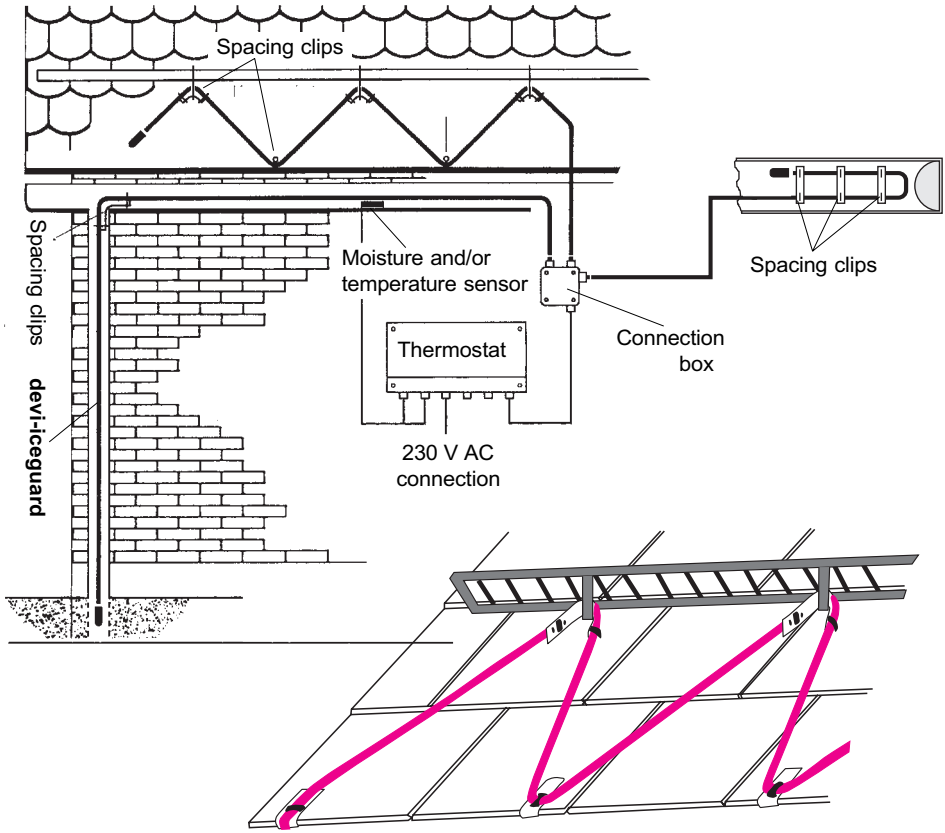
With the above mentioned installation the system will typically ensure ice and snow melting down to a temperature of approx. -10ºC.
If you want to frost protect the roof down to -20ºC, a general rule will be to double the effect, and for -30ºC to triple the effect.

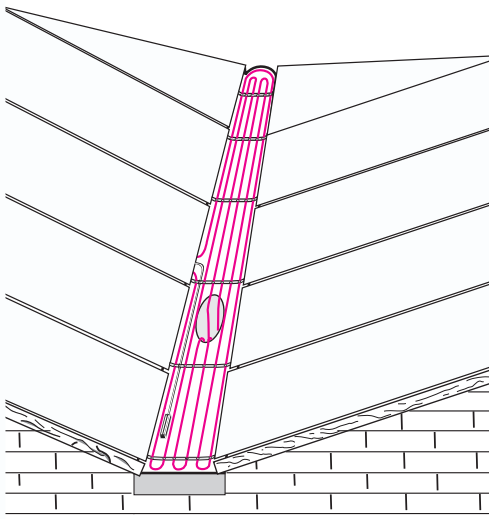
If the cable lies across an edge etc. the spacing clips can be used to relieve strain on the cables, e.g. where the cable enters the down pipe.

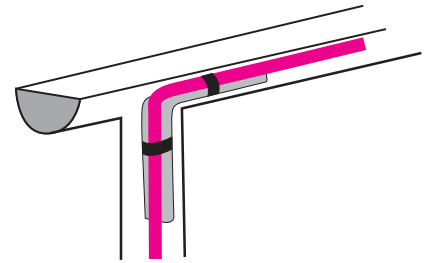
Relief of a cable hanging in the down pipe is necessary when the cable length in the pipe exceeds approx. 25 cm.
The cable in the down pipe should continue to frost-proof depth under the surface of the ground (approx. 1 m).

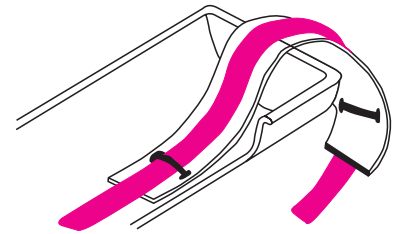
Cables installed on the roof must always be positioned upwards/ downwards and NOT along the roof. The installation can be made with a zigzag pattern as shown on the illustration on the next page.

Use **devifast** to attach the cable to the valley gutters. The fitting band can be attached with liquid asphalt/tar.


Spacing clips
Spacing clips
devi-iceguard
Moisture and/or
temperature sensor
Thermostat
230 V AC
connection
Connection
box
Spacing clips







Regulation

As self-limiting heating cables always draw current regardless of the temperature **DEVI** recommend a thermostat which disconnects the cable in periods where heating is unnecessary in order to save energy.

The optimal control of **DEVI** self-limiting heating cables is achieved by using **devireg®** electronic thermostats.

devireg® thermostats give a quick and effective regulating and take both comfort and economy into consideration.

There is a wide variety of **devireg®** thermostats to choose from according to the demands of the individual installation.

Thermostats

Type	Mounting	Temp. span	Min. Temp. adjust.	Hysteresis	Sensor	Colour
330	DIN-rails	-10º - +10ºC +5º - +45ºC +15º - +30ºC		0.4ºC 0.4ºC 0.4ºC	Wire Wire Built-in	Grey Grey Grey
316	DIN-rails	-10º - 50ºC	-10º - +5ºC	0.2º - 6ºC	Wire	Grey
610	Outdoors splashproof	-10º - 50ºC		0.4ºC	Wire	Polar-white
810	DIN-rails	-15º - +5ºC			Moist + Temp.	Grey

devireg® 316 Frost protection of roof gutters and down pipes
devireg® 330 Frost protection of pipes/hot-water supply
devireg® 610 Frost protection of pipes
devireg® 810 Frost protection of roof gutters and down pipes

Sensors and other accessories

- Wire sensors 2,5 m, 6,0 m and 10,0 m (**devireg®** 330, 316, 610)
- Wire sensor for roofgutter 15 m (**devireg®** 810)
- Moist sensor for roofgutter 15 m (**devireg®** 810)
- **devitime** 301 electronic timer
- Aluminium tape, 38 mm x 50 m rolls with 'WARNING' text
- Spacing clips
- Connection kit to terminal box, including cable terminal
- Connection kit to cold tail including cable teminal
- Fitting set for two heating cables
- Cable glands special packing for PG 16
- **deviclick** DHB 100 connection kit for one heating cable + connection, including cable terminal
- **deviclick** DHB 102 connection kit for two heating cables + connection, including cable terminal
- **deviclick** DHB 104 connection kit for three heating cables + connection, including cable terminal
- **deviclick** DHB 101 fitting set for two heating cables, including cable terminal
- **deviclick** DHB 103 fitting set for three heating cables, including cable terminal
- **deviclick** DHB 105 fitting set for use in connection with horizontal division, including cable terminal

Storage/installation preparation

Storage of self-limiting cables:

- Heating cables and connecting leads must be kept in a clean and dry place.
- Avoid contact with chemicals and petrochemical products during storage of the cables.
- Do not expose the heating cables to mechanical strain.
- The storage temperature may not drop below -40ºC and may not exceed +60ºC.
- Are the heating cables and connecting leads kept in moist rooms or at building sites, they must be protected against moisture - also during storage for a short period (e.g. when installing the cable terminal).

Installation preparation:

Measure the insulating resistance of the heating cable immediately before the installation is begun.

Make sure that the necessary material are present on the building site.

Remove any sharp objects and irregularities on the pipe system so the heating cable are not damaged.

Finished or painted pipes or containers must be completely dry when installing.

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