ENSTO

FROST PROTECTION SYSTEMS
DON'T SLIP UP ON SAFETY

FROST PROTECTION SYSTEMS HELP KEEP YOUR PROPERTY'S MAIN ACCESS ROUTES AND PIPES SAFE AND FUNCTIONING

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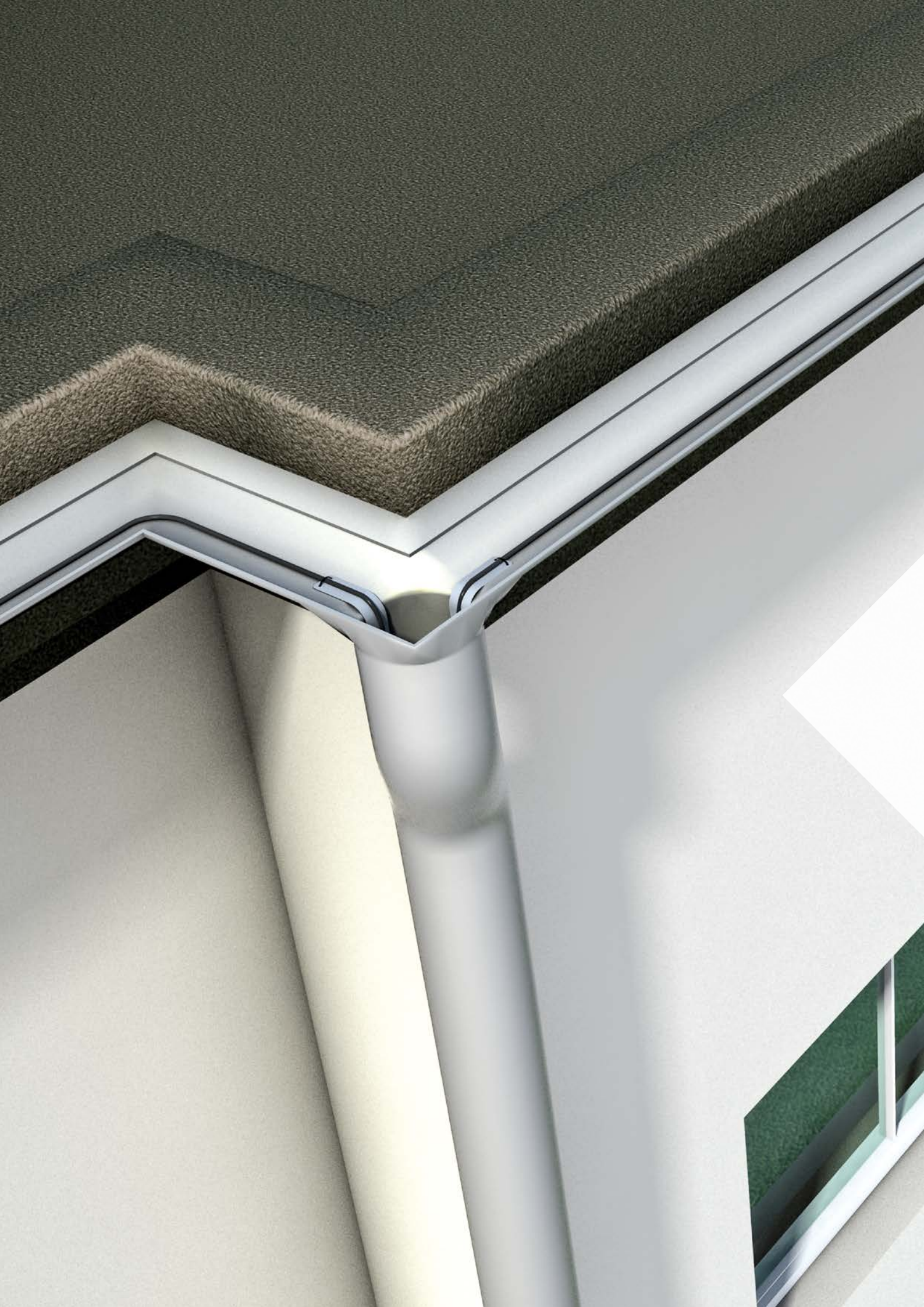

Frost protection systems

An effective solution

Our frost protection systems are designed to work even in harsh Nordic weather conditions. Frost protection systems help keep your property's main access routes and pipes safe and functioning. It is also important to us that our products are reliable and easy to use. The high quality of our products ensures their reliable operation for years to come.

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Heating cables

For outdoor areas and water supply and drain pipes

Effective frost protection improves the safety and usability of your property and prevents cold temperatures from causing damage to it. Electric frost protection systems offer an energy-efficient solution for your water supply and drain pipes, rainwater systems and outdoor areas. To ensure energy-efficiency, a correct cable and rated power and suitable control system must be selected.

Tash constant wattage cables offer a cost-efficient and reliably frost protection solution for outdoor areas, pipes and containers. These cables retain their output throughout their life cycle. Typical applications include frost protection for concrete ramps, entrances and footpaths laid directly on the ground. The cable can also be used to prefabricate frost protection mesh, which speeds up installation.

The self-limiting Optiheat heating cables are ideal for water supply and drain pipes, rainwater systems, roofs and stairs. Typically, a self-limiting cable's output adjusts in line with the ambient temperature, preventing it from overheating and ensuring constant heating for the application. Another typical characteristic of a self-limiting cable is that its power decreases slightly over time and therefore the heating control should be designed well to extend the cables' service life.

Frost protection for outdoor areas

With Tash constant wattage cables, you can ensure that the access routes and outdoor areas of your property remain safe to use. These easy-to-install single-conductor cables are an ideal choice for applications of any size.

Frost protection for water supply and drain pipes

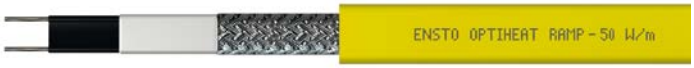
The self-limiting Optiheat 10 cable and the Plug'n Heat installation-ready cable made from it help prevent damage caused by frozen pipes. The cables are primarily installed outside the pipe but placing them inside the pipe is also permitted.

Frost protection for rainwater systems

With the self-limiting Optiheat 20/40 cable, you can prevent water from freezing in your building's gutters and downpipes. Heavy, solid blocks of ice may damage building structures and cause a risk of injury to anyone present in the surroundings. The Tash constant wattage cable can also be used in rainwater systems. Both cables come with UV protection.

Frost protection for ramps and challenging applications

With the high-capacity self-limiting Optiheat RAMP cable, you can keep your concrete ramps safe to use even in the harshest winter conditions.



Dimensioning of heating cables

An effective frost protection solution for outdoor areas can be created with the Tash constant wattage cable or the self-limiting Optiheat cable.

Dimensioning and selection

The table contains information on the dimensioning of frost protection solutions and the selection of the master thermostat. More detailed dimensioning instructions are available in the system descriptions.

			Cables					Control		
	Cable's max. power per meter W/m	Output W/m or W/m²	OPTIHEAT 10	OPTIHEAT 20/40	OPTIHEAT RAMP	TASH	PLUG'N HEAT	ECO500	ECO900*	ECO910
Frost protection for water pipes		**> 1.3 x heat loss**								
Plastic pipe	10		*				*	*		
Plastic, installation inside the pipe	10		*				*	*		
Metal pipe	20		*	*		*	*	*		
Frost protection for drain pipes		**> 1.3 x heat loss**								
Plastic pipe, installation on pipe surface	10		*				*	*		
Metal pipe, installation on pipe surface	20		*	*		*	*	*		
Frost protection for rainwater systems										
Plastic gutter	10		*			*			*	*
Metal gutter	20	20–60 W/m		*		*			*	*
Roof valleys > 300 mm	20	200 W/m²		*		*			*	*
Frost protection for outdoor areas										
Footpaths (protected from wind)		150–200			*	*			*	*
Footpaths (unprotected from wind)		200–250			*	*			*	*
Outdoor stairs and areas in front of entrances		200–300			*	*			*	*
Parking areas and drives		250–300			*	*			*	*
Loading bays (protected)		250–300			*	*			*	*
Loading bays (unprotected)		300–400			*	*			*	*

* ECO900 requires two sensors (ECOA901+ECOA902 or ECOA903+ECOA904).

In electric frost protection for outdoor areas, such as ramps, footpaths, loading bays and entrances, heating cables are usually installed in gravel or concrete underneath the surface material. The frost protection power can be maximized by insulating the area from below.

If the cables are installed in gravel, the gravel grain size should be about 3 mm. During installation, it is important to ensure that the cable coating is not damaged and that the cable does not shift position when the surface is leveled out. The surfacing material, such as paving stones, concrete or asphalt, is placed on top of the gravel.

When heating cables are installed in concrete, they must be fixed loosely to the rebar mesh with cable ties, for example, while taking care not to damage the cables.

The Tash constant wattage cable and the self-limiting Optiheat cable are suitable for frost protection for outdoor areas.

Tash constant wattage cable

The design stages for frost protection created with Tash cables are:

1. output is determined
2. the cable's maximum load is checked
3. the cable is selected on the basis of output and length
4. the required cable length is calculated
5. the installation interval is determined
6. the total output, output per square meter and cable's output per meter are checked

Tash is a constant wattage cable that is suitable for applications of various shapes and also for large areas. **The Tash cable is always installed as a loop and both ends are connected to a junction box with a cold lead.** (THE PICTURE IS AN APPROXIMATION)

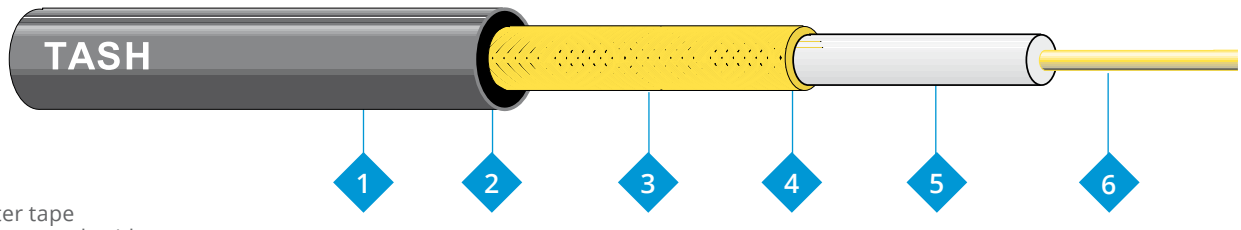
Maximum loads for Tash heating cables	P_{MAX}
Concrete	30 W/m
Gravel	25 W/m
On the surface of a metal pipe	20 W/m
On the surface of a plastic pipe	10 W/m
Metal gutters	20 W/m
Plastic gutters	10 W/m

Cable installation

The Tash constant wattage cable is a single conductor heating cable that may not be connected directly to a junction box; instead a separate connecting cable, a cold lead, must be used. The Tash cable is always installed as a loop with both ends connected to the junction box with a cold lead.

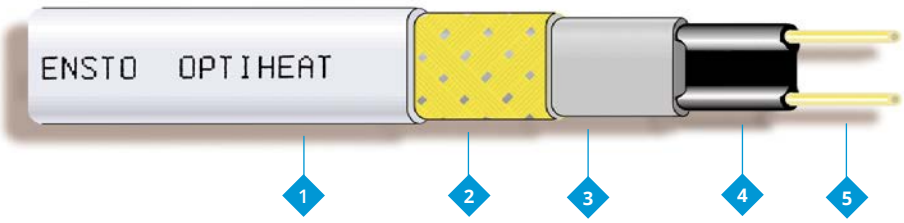
The cable's heating power

The cable's heating output is inversely correlated with its length, i.e., as the length increases, the power decreases and vice versa. In the design of frost protection, it is important to ensure that the cable's installation-specific maximum loads and temperature are not exceeded. For the Tash cable, the maximum operating temperature is 80 °C and the maximum load current is 16 A (Maximum power with the voltage of 230 V is 3,600 W and 6,400 W at a voltage of 400 V).



1. Cover
2. Polyester tape
3. Tinned copper braid
4. Polyester tape
5. Insulation
6. Tinned conducting wire

1. Housing
2. Earthing
3. Insulating layer
4. Self-limiting material
5. Bus wire



Self-limiting Optiheat cable

Two tinned copper wires coated with a semi-conductive coating form the core of the cable. The current runs in the resistor material between the conductors where resistance decreases when the temperature decreases and increases when the temperature increases.

The current and the cable output depend on the temperature. A self-limiting cable strives to maintain a constant temperature regardless of changes in the ambient temperature. Various parts of the cable may be located in different conditions and therefore its power per meter may vary.

While the purchase cost of a self-limiting cable is higher than with a constant wattage cable, the overall cost of a self-limiting cable solution is competitive. This cable is suitable for use in smaller areas and for pipes.

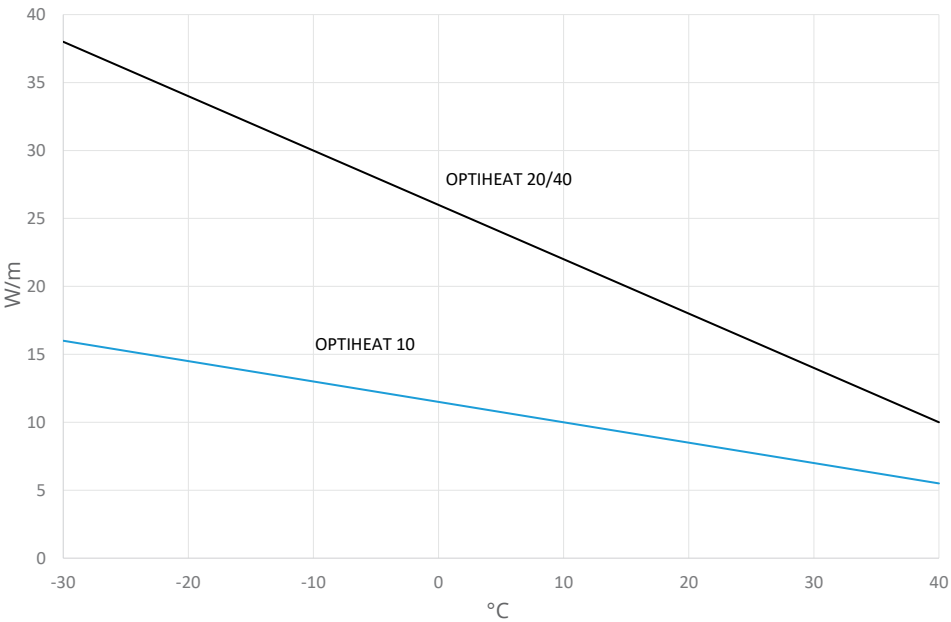
Self-limiting cables can also be cut to size. The total length of the installation is determined on the basis of the rated current of the safety device that protects the cable.

Maximum installation lengths at working temperatures at which the cable temperature is the same as the ambient temperature.

Optiheat 10	10 A	16 A	32 A
On the pipe surface +10 °C	100 m	125 m	-
On the pipe surface 0 °C	95 m	120 m	-
On the pipe surface -15 °C	80 m	115 m	-
On the pipe surface -20 °C	75 m	110 m	
In water 0 °C	55 m	65 m	
Optiheat 20/40			
On the pipe surface +10 °C	68 m	109 m	129 m
On the pipe surface ±0 °C	57 m	92 m	119 m
On the pipe surface -10 °C	50 m	79 m	111 m
On the pipe surface -20 °C	44 m	70 m	104 m
In water 0°C	29 m	46,5 m	93 m
Optiheat RAMP			
In concrete -10 °C	18 m	28 m	55 m

The cable resistance is low when the cable is cold. Because of this, when voltage is switched on, a peak current that is 2–3 times higher than the nominal current arises in the cable. The protective device must be dimensioned in line with the lowest operating temperature. The circuit breaker protecting the circuit must of the C type.

Power levels:
Optiheat 10 nominal output 10W/m on the pipe surface at 10 °C, 16 W/m in water at 0 °C.
Optiheat 20/40 nominal output 20W/m on the pipe surface at 10 °C, 40 W/m in water at 0 °C.
Optiheat RAMP nominal output 50W/m at 10 °C, 110W/mm in concrete at 5 °C.



Changes in the output of the Optiheat 10 and Optiheat 20/40 heating cables in relation to the temperature on the pipe surface.

With our ECO control devices, the frost protection function switches on when necessary in an energy-efficient manner. Our control devices are suitable for controlling frost protection for pipes, outdoor areas and challenging applications.

Frost protection control

Energy-saving control devices for various applications

ECO500 controls frost protection for pipes

The ECO500 thermostat is used to control frost protection for pipes. When the heating cable is installed inside the water pipe, the sensor is mounted on the pipe's top surface whereas with an external heating cable, the sensor must be mounted onto the opposite side of the pipe, in the area that is expected to remain the coldest. The thermostat's temperature adjustment range is +2 °C...+35 °C.

A thermostat for frost protection in pipes

ECO910 is used to control frost protection in outdoor areas and rainwater systems

Th ECO910 is equipped with two temperature sensors: a ground sensor and a sensor that measures the air temperature. Both of these sensors are used in frost protection for outdoor areas. In rainwater systems, only the sensor for the air temperature is used. The thermostat is mounted on a DIN rail and its control range is -30 °C...+15 °C.

A DIN-rail mounted thermostat with two sensors

ECO900 for controlling challenging frost protection solutions

ECO900 is a fully automated control device used to control frost protection in outdoor areas and rainwater systems. Its sensors detect snow, ice, humidity and temperature, making it an ideal solution for frost protection systems in changing conditions. The control device is mounted on a junction box on a DIN rail. Its LCD display shows real-time information on temperature and humidity. Various sensors are connected to the device in line with its use. To operate, it requires two sensors (ECOA901+ECOA902 or ECOA903+ECOA904).

Fully automatic control device on a DIN rail

Easy-to-install and reliable frost protection.

Mounting and installation accessories

Ensure safe installation and excellent usability

An easy-to-install and reliable frost protection solution can be created with Tash and Optiheat cables and the mounting and installation accessories designed for them.

Optiheat jointing kit

Strain relief clamp

Downpipe clip

Support chain

Tash jointing kit

Pressure inlet

Fixing strip

Gutter clip

Mounting strip

Tash accessories

With the Tash jointing kits, terminating ends, branching joints, extensions and connections sealed with shrink accessories can be connected to cold leads. Either MMJ or an MCMK cable can be used as the cold lead, depending on the installation environment.

Optiheat accessories

With the Optiheat jointing kits, terminating ends, branching joints, extensions, cold lead connections and connections sealed with shrink accessories can be connected to a junction box. The cable is laid from the installation location to the junction box either as it is or in a protective tube. The jointing accessories also include a pressure inlet for inserting cables into the water pipe.

Mounting accessories and strain relief clamps

Mounting accessories include strain relief clamps and fixtures for fixing cables to downpipes and gutters. The mounting strips can be used to make a frost protection mesh from Tash cables, which speeds up installation and ensures that the installation intervals remain stable.

Selecting mounting and installation accessories

In the table, you can find information that will help you select your accessories. Selecting the correct accessories ensures that your frost protection solution works properly in your application conditions.

Frost protection for water pipes	Accessories	OPTIHEAT 10	OPTIHEAT 20/40	TASH	PLUG'N HEAT
Plastic pipe	EFPLP1 Jointing kit	*			
	EFPLP2 Jointing kit	*			
	EFPLP4 Jointing kit			*	
Plastic, installation inside the pipe	EFPLV1 Inlet	*			*
	EFPLP1 Jointing kit	*			
	EFPLP2 Jointing kit	*			
Metal pipe	ALU50 Aluminum tape	*	*	*	
	EFPLP1 Jointing kit	*	*		
	EFPLP2 Jointing kit	*	*		
	EFPLP4 Jointing kit			*	

Frost protection for drainpipes, installation on pipe surface					
Plastic pipe	EFPLP1 Jointing kit	*			
	EFPLP2 Jointing kit	*			
	EFPLP4 Jointing kit			*	
Metal pipe	ALU50 Aluminum tape	*	*	*	*
	EFPLP1 Jointing kit	*	*		
	EFPLP2 Jointing kit	*	*		
	EFPLP4 Jointing kit			*	

Frost protection for rainwater systems	Accessories	OPTIHEAT 20/40	OPTIHEAT RAMP	TASH
Plastic gutter	PPN6 Mounting strip			*
	PPN10 Clip	*		*
	PPN12 Clip	*		*
	VP300 Strain relief clamp	*		*
	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*
	RTS199 fixing chain for the downpipe	*		*
Metal gutter	PPN6 Mounting strip			*
	PPN10 Clip	*		*
	PPN12 Clip	*		*
	VP300 Strain relief clamp	*		*
	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*
	RTS199 fixing chain for the downpipe	*		*
Roof valleys	PPN6 Mounting strip			*
	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*

Frost protection for outdoor areas				
Installation in gravel	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*
Installation in concrete	XBC1230 Mounting strip	*	*	*
	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*
	EFPLP5 Jointing kit		*	
Installation on top of concrete	XBC1230 Mounting strip	*	*	*
	EFPLP1 Jointing kit	*		
	EFPLP2 Jointing kit	*		
	EFPLP4 Jointing kit			*
	EFPLP5 Jointing kit		*	

Fast and efficient frost protection

Frost protection for outdoor areas

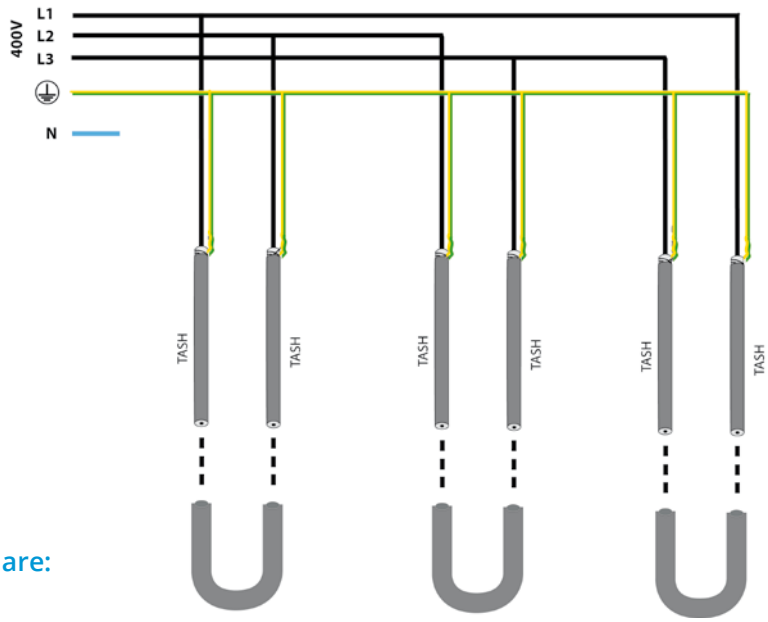
Dimensioning and design

Installation location		Output, W/m²
Footpaths (protected from wind)		150–200
Footpaths (unprotected from wind)		200–250
Outdoor stairs and areas in front of entrances		200–300
Parking areas and drives		250–300
Loading bays (protected)		250–300
Loading bays (unprotected)		300–400
Heating cable type	**Properties**	**Application**
Self-limiting cable (Optiheat)	Easy to dimension and install. Expensive cable.	Small areas, concrete structures, stairs, etc.
Constant wattage cable (Tash)	Cost-efficient cable. Requires meticulous design.	Large outdoor areas of irregular shape, concrete structures, stairs etc.

In the frost protection solutions for outdoor areas, the output per square meter is determined by factors such as the intended use and structures.

In the design of a frost protection solution, the starting point is always the conditions of the installation location and the structure of the area to be heated. The route for melting water must be planned in collaboration with the other designers so that the water does not cause problems elsewhere.

The heating cable is selected on the basis of the installation area and the required heating output. Self-limiting cables (Optiheat) and constant wattage cables (Tash) can be used as heating cables.



Tash 400v connection

The stages of the frost protection design process are:

- the cable type is selected
- the suitable output per meter and resistance (Tash) are selected
- the installation interval is determined
- the control system is selected

10 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	30	176	52	308
8	26	203	45	356
10	23	230	40	400
12	21	252	37	432
14	19	278	34	471
16	18	294	32	500
18	17	311	30	533
20	16	331	28	571
22	16	331	27	593
24	15	353	26	615
26	14	378	25	640
28	14	378	24	667
30	13	407	23	696

6 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	38	232	67	398
8	33	267	58	460
10	30	294	52	513
12	27	327	47	567
14	25	353	44	606
16	23	383	41	650
18	22	401	38	702
20	21	420	37	721
22	20	441	35	762
24	19	464	33	808
26	18	490	32	833
28	18	490	31	860
30	17	519	30	889

Tash cable tables

The tables show cable-specific maximum lengths at specific per meter loads. From the tables, you can also see the outputs in accordance with lengths. The values were measured with the switching voltages of 230 V and 400 V The table can be used to determine which Tash cable would be the ideal frost protection solution for a long pipe or an outdoor area.

3 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	54	327	94	567
8	47	375	82	650
10	42	420	73	731
12	38	464	67	796
14	35	504	62	860
16	33	534	58	920
18	31	569	54	988
20	30	588	52	1,026
22	28	630	49	1,088
24	27	653	47	1,135
26	26	678	45	1,185
28	25	705	44	1,212
30	24	735	42	1,270

1.5 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	77	458	133	802
8	66	534	115	928
10	59	598	103	1,036
12	54	653	94	1,135
14	50	705	87	1,226
16	47	750	82	1,301
18	44	802	77	1,385
20	42	840	73	1,461
22	40	882	70	1,524
24	38	928	67	1,592
26	37	953	64	1,667
28	35	1,008	62	1,720
30	34	1,037	60	1,778

1 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	94	563	163	982
8	81	653	141	1,135
10	73	725	126	1,270
12	66	802	115	1,391
14	61	867	107	1,495
16	58	912	100	1,600
18	54	980	94	1,702
20	51	1,037	89	1,798
22	49	1,080	85	1,882
24	47	1,126	82	1,951
26	45	1,176	78	2,051
28	43	1,230	76	2,105
30	42	1,260	73	2,192

0.82 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	104	620	180	1,084
8	90	717	156	1,251
10	80	806	140	1,394
12	73	884	128	1,524
14	68	949	118	1,654
16	63	1,024	110	1,774
18	60	1,075	104	1,876
20	57	1,132	99	1,971
22	54	1,195	94	2,076
24	52	1,241	90	2,168
26	50	1,290	87	2,243
28	48	1,344	83	2,351
30	46	1,402	81	2,409

0.65 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	117	696	203	1,213
8	101	806	176	1,399
10	90	904	157	1,568
12	83	981	143	1,721
14	76	1,071	133	1,851
16	71	1,146	124	1,985
18	67	1,215	117	2,104
20	64	1,272	111	2,218
22	61	1,334	106	2,322
24	58	1,403	101	2,437
26	56	1,453	97	2,538
28	54	1,507	94	2,619
30	52	1,565	91	2,705

0.45 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	140	840	243	1,463
8	121	972	211	1,685
10	108	1,088	189	1,881
12	99	1,187	172	2,067
14	92	1,278	159	2,236
16	86	1,367	149	2,386
18	81	1,451	141	2,522
20	77	1,527	133	2,673
22	73	1,610	127	2,800
24	70	1,679	122	2,914
26	67	1,755	117	3,039
28	65	1,809	113	3,147
30	63	1,866	109	3,262

0.32 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	166	996	289	1,730
8	144	1,148	250	2,000
10	129	1,281	219	2,283
12	117	1,413	204	2,451
14	109	1,517	189	2,646
16	102	1,621	177	2,825
18	96	1,722	167	2,994
20	91	1,817	158	3,165
22	87	1,900	151	3,311
24	83	1,992	144	3,472
26	80	2,066	139	3,597
28	77	2,147	133	3,759
30	74	2,234	129	3,876

0.21 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	205	1,229	356	2,140
8	177	1,423	309	2,466
10	159	1,584	276	2,761
12	145	1,737	252	3,023
14	124	1,880	233	3,270
16	125	2,015	218	3,495
18	118	2,135	206	3,699
20	112	2,249	195	3,907
22	107	2,354	186	4,096
24	102	2,470	178	4,280
26	98	2,570	171	4,456
28	95	2,652	165	4,618
30	92	2,738	159	4,792

0.17 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	228	1,365	396	2,377
8	197	1,580	343	2,744
10	176	1,768	307	3,066
12	161	1,933	280	3,361
14	149	2,088	259	3,634
16	139	2,239	243	3,873
18	131	2,375	229	4,110
20	125	2,489	217	4,337
22	119	2,615	207	4,547
24	114	2,730	198	4,753
26	109	2,855	190	4,954
28	105	2,964	183	5,143
30	102	3,051	177	5,317

0.1 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	297	1,781	516	3,101
8	257	2,058	447	3,579
10	230	2,300	400	4,000
12	210	2,519	365	4,384
14	194	2,727	338	4,734
16	182	2,907	316	5,063
18	171	3,094	298	5,369
20	163	3,245	283	5,654
22	155	3,413	270	5,926
24	149	3,550	258	6,202
26	143	3,699	248	6,452
28	138	3,833	239	6,695
30	133	3,977	231	6,926

0.05 Ω/m

W/m	230 V length/m	Power/ W	400 V length/m	Power/ W
6	420	2,519	730	4,384
8	364	2,907	632	5,063
10	325	3,255	566	5,654
12	297	3,562	516	6,202

Frost protection for car ramps

Frost protection for a car ramp with the Tash cable, heavy traffic

On steep ramps and ramps with heavy traffic, heating cables should be installed in the entire area of the ramp. If the area slants in some particular spots, the routes that water runs down must be protected against freezing.

Example

The ramp is 9 meters long and 4 meters wide, and therefore has an area of 36 m². Because no insulation was installed underneath the concrete surface, the rated power of 400 W/m² is used. The entire ramp is to be heated, giving us the total heating output of 36 m² x 400 W/m² = 14.4 kW. With a switching voltage of 400 V and three cables, the output for a single cable is 4,800 W. If the cables are installed in concrete, a Tash cable with an output per meter of 30 W/m can be sought from the table. Tash 0.21 ohm/m is selected as the cable at the length of 159 m. In this case, the cable installation interval is 36 m²/ (3*159 m) = 0.075 m=7.5 cm. According to the table, the output of a single cable is 4,792 W, with the total output of the frost protection solution being 14.4 kW.

ECO900 is selected as the control system because high heating output is required and the functionality of the solution is pivotal. The ECOA901 snow and ice sensor must be used in outdoor areas and it must be installed outside the heated area. In addition, the ECOA902 temperature and humidity sensor, installed within the heated area, must also be used.

For ramps with heavy traffic, heating cables must be installed in the entire area of the ramp (installation in concrete). On a sloping area, melting water running down the ramp must also be prevented from freezing.
(THE PICTURE IS AN APPROXIMATION)

Frost protection for car ramps, light traffic

If the ramp is not in heavy use, heating the wheel tracks suffices, which helps reduce the need for energy.

Example 1, realization with the Tash cable

The ramp is 9 meters long and 4 meters wide, and therefore has an area of 36 m². The wheel tracks are 0.5 m wide and therefore the area to be heated is only 9 m². The ramp is not in heave use and therefore the rated power of 300 W/m² is used. The total heating output is 9 m² x 300 W/m² = 2.7 kW. A switching voltage of 230 V and a single cable can be used. If the cable is installed in concrete, a Tash cable with an output per meter of 30 W/m can be sought from the table. Tash 0.21 ohm/m is selected as the cable with the length of 92 m. Therefore, the cable installation interval is 9 m²/ 92 m = 0.098 m = 9.8 cm.

For control, the ECO910 thermostat is used because the required heating output is low and the ramp is not in heavy use.

The ground sensor is placed between the heating cables in a protective tube. The air sensor is placed by a wall, for example, where it is not exposed to direct sunlight.

When the ramp is not in heavy use, installing cables under the wheel tracks is enough. On a sloping area, melting water running down the ramp must also be prevented from freezing.
(THE PICTURE IS AN APPROXIMATION)

Example 2, realization with the Optiheat cable

The ramp is 9 meters long and 4 meters wide, and therefore has an area of 36 m². The wheel tracks are 0.5 m wide and therefore the area to be heated is only 9 m². The ramp is not in heavy use and therefore the rated power of 300 W/m² is used. The total heating output is 9 m² x 300 W/m² = 2.7 kW. A switching voltage of 230 V and a single Optiheat 20/40 cable can be used. With an outdoor temperature of about 0°C, the cable's output per meter (Pk) is about 25 W/m. Therefore, the cable length is 2700 W/25 W/m=108 m.
This gives us a cable installation interval of 9 m²/ 108 m = 0.083 m=8.3 cm. For control, the ECO910 thermostat is used because the required heating output is low and the ramp is not in heavy use.

Frost protection for outdoor areas

Installation

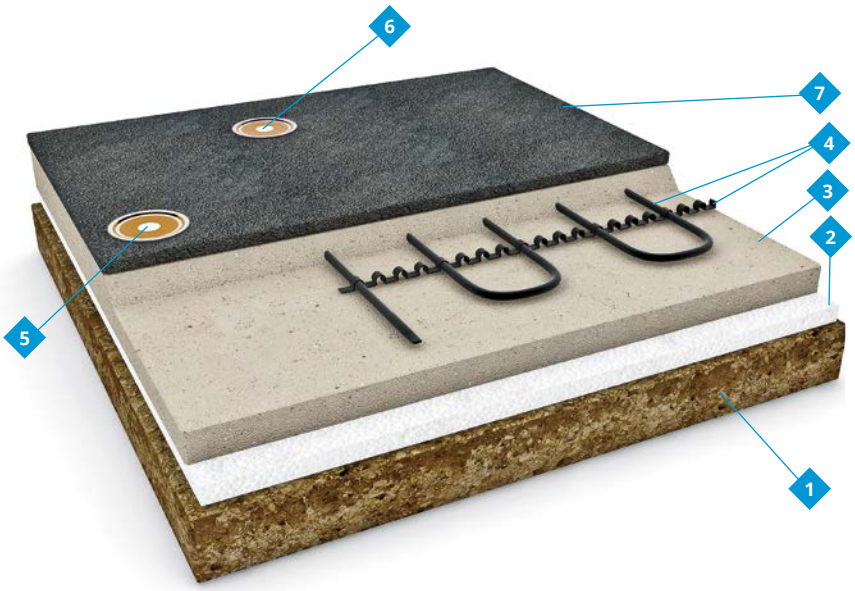
Heating cables are usually installed in gravel or concrete underneath the surface material to be heated (NOTE! not directly in asphalt). The frost protection power can be utilized most efficiently by insulating the area from below.

The heating cable is installed at a depth of 5 cm to prevent damage to it from vehicles, for example.

Installation in gravel

In an area that will be covered with paving stones or asphalt, the heating cable is placed in sand underneath the surface material. The gravel grain size is 3 mm. The Tash constant wattage cable is used as the heating cable.

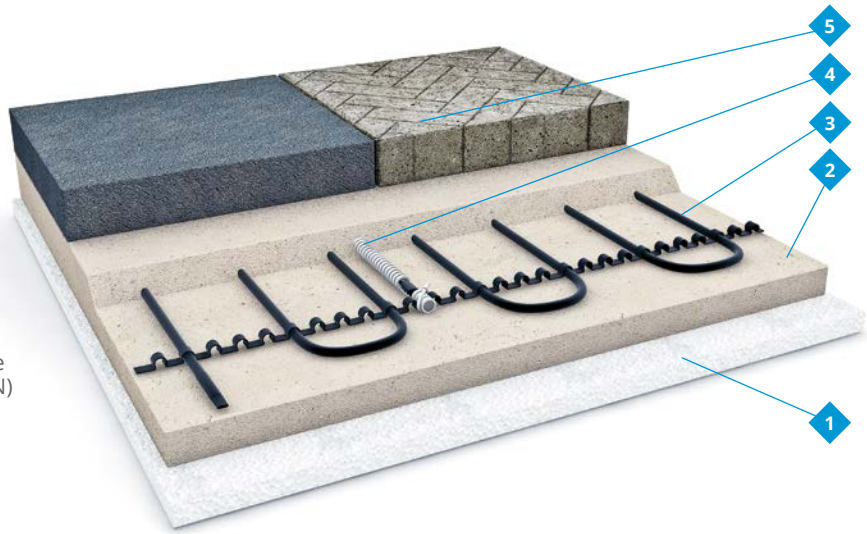
A thin layer of sand is spread over the cable and levelled out cautiously to prevent the cable from coming loose from the clips and suffering damage. The surfacing material, such as paving stones, concrete or asphalt, is placed on top of the gravel.



Installation of the Tash heating cable in gravel under concrete. Insulation is installed under the gravel.

1. Soil/gravel
2. Insulation
3. Gravel (or concrete)
4. Tash heating cable
5. ECOA901 Snow and ice sensor (NOTE! Installed outside the heated area)
6. ECOA902 Snow and ice sensor (NOTE! Installed inside the heated area)
7. Asphalt

(THE PICTURE IS AN APPROXIMATION)

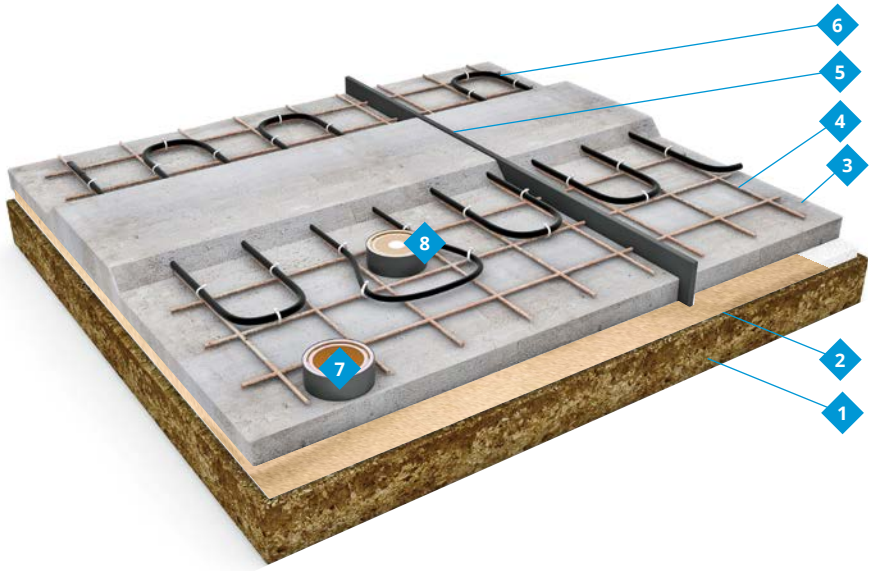


1. Insulation
2. Gravel
3. Tash heating cable
4. ECO910 temperature sensor
5. Paving stones, asphalt or concrete

(THE PICTURE IS AN APPROXIMATION)

Installation in concrete

The heating cable is fixed to the rebar mesh with cable ties, for example, while taking care not to damage the cable coating. To enable troubleshooting and repair, the cable is placed above the mesh. The heating cable must not run over expansion joints. Installation areas are designed so that only cold leads cross over the expansion joints.



Installation of the Tash heating cable in concrete with an expansion joint. No insulation is installed under the concrete

1. Soil/gravel
2. Gravel
3. Concrete
4. Rebar mesh
5. Expansion joint. Only cold leads run over expansion joints or alternatively, separate heating circuits are used
6. Tash heating cable
7. ECOA901 Snow and ice sensor (NOTE! Installed outside the heated area)
8. ECOA902 Snow and ice sensor (NOTE! Installed inside the heated area)

(THE PICTURE IS AN APPROXIMATION)

1. Insulation
2. Heating cable
3. Rebar mesh
4. Concrete
5. ECO910 temperature sensor

(THE PICTURE IS AN APPROXIMATION)

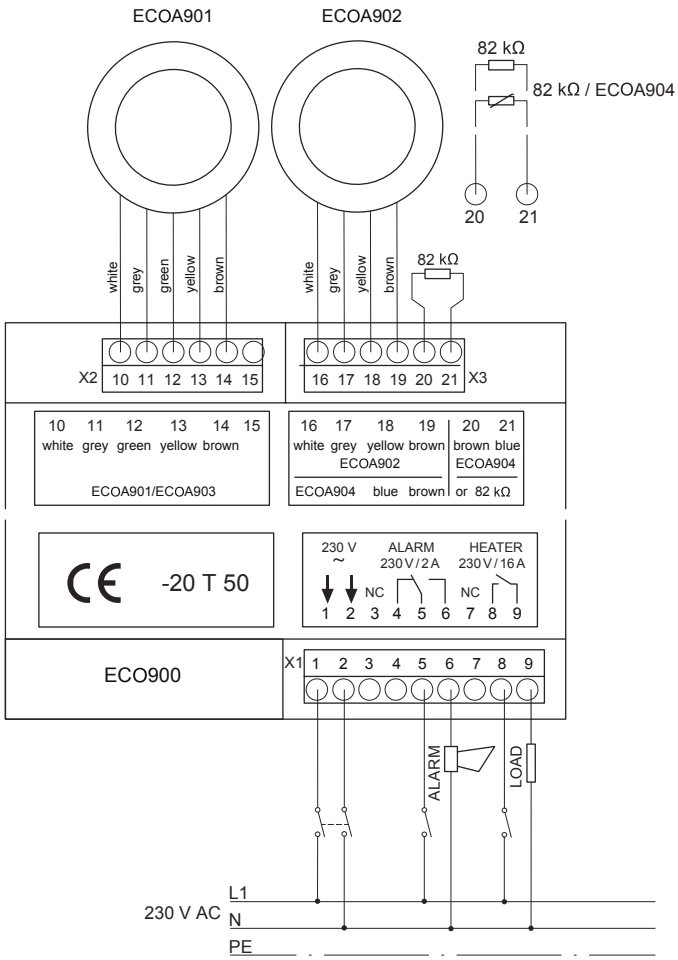
Frost protection for parking areas

With the Tash constant wattage cable

The parking area is surfaced with concrete and its area to be heated is 155 m². 300 W/m² is selected as the output, giving us a total rated output of 155 m² x 300 W/m² = 46.5 kW. Divided evenly over three phases, we get 46.5 kW/3=15.4 kW. This cannot be achieved with a single cable because the Tash cable's maximum current is 16 A and therefore the maximum output at a voltage of 230 V is 3,600 W and 6,400 W at 400 V. Because of this, the load for each phase must be divided over three cables, with each cable being configured to with a rated output of 15.4 kW/3 = 5.13 kW. From the table, we can select the 183 meter-long Tash 0.17 ohmm cable, with an output of 5,143kW at 400 V and an output per meter of 28 W/m. This is suitable output for a Tash cable installed in concrete. The overall heating output is 9*5.143 kW=46.3 kW and the total length of the nine cables is 9*183 m=1,647 m. The installation interval is 155 m2 / 1,647 m=0.09 m = 9 cm.

The ECOA901 snow and ice sensor must be installed outside the heated area, while the ECOA902 temperature and humidity sensor is installed within the heated area. (THE PICTURE IS AN APPROXIMATION)

ECO900 is selected as the control system because high heating output is required and the functionality of the solution is pivotal. With the ECO900 system, the ECOA901 snow and ice sensor must be used in frost protection for ground areas and it must be installed outside the heated area. In addition, the ECOA902 temperature and humidity sensor, installed within the heated area, must also be used.



Frost protection for stairs

With the Tash constant wattage cable

Example

Ten steps, with a step width of 1 m and installation area width of 0.9 m, a step depth of 0.5 m and a rise of 0.15 m.

The area to be heated is 10 x 0.9 m x 0.5 m = 4.5 m². With the rated output of 300 W/m², the total output is 4.5 m² x 300 W/m² = 1,350 W. The Tash cable's maximum output when installed in concrete is 30 W/m. If dimensioning is carried out solely based on the output, a 48 meter-long Tash 0.82 ohm/m cable with an output of 1,344 W at 230 V and an output per meter of 28 W/m is selected from the table. The installation interval is 4.5 m²/48 m=0.09 m=9 cm.

For stairs, the step dimensions should be taken into account in the cable selection. If five cable loops are installed for each step, the overall cable length is 5*0.85 m*10=42.5 m (NOTE! A reserve for the cable's return route 0.9 m -> 0.85 m). The length of cable required for the risers is 9*0.15 m=1.35 m. Because Tash is a single-conductor cable, each heating cable has two cold leads. If you want to have both cold lead connection points in the same location to make connecting them easier, the cable length must be increased so that the cable can be brought back along all the steps. Therefore, the length of the additional cable is 10*0.5 m+9*0.15 m=6.35 m. In this case, the cable's total length is 50.2 m.

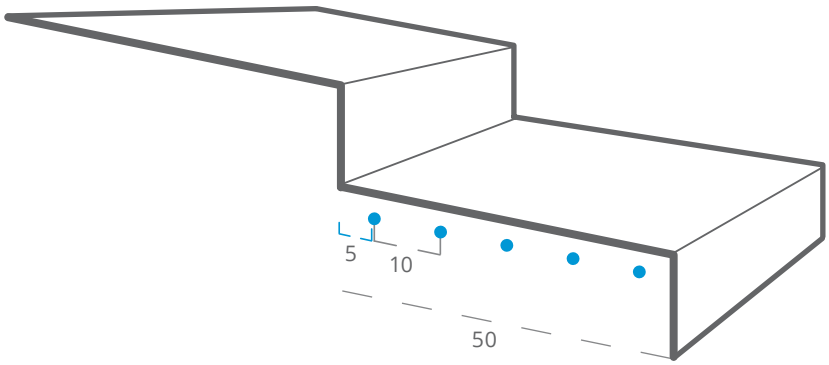
Therefore, the heating cable's total length is:
- steps 10 x (0.85 m * 5) = 42.5 m
- risers 9 x 0.15 m = 1.35 m
- return to the connection point
  10 x 0.5 + 9 x 0.15 = 6.35 m
- a total of 50.2 meters

With that amount of the Tash 0.82 omh/m cable, selected from the table, the resistance is 50.2 m * 0.82 ohm/m=41.16 ohm. This cable's output is 230 V * 230 V /41.16 ohm=1,285 W, which is close to the initial power requirement and gives the output per meter of 25.5 W/m, which is permitted for installations in concrete.

The cold leads may also be slightly longer, which means that the cable loop does not have to be completed using the heating cable; instead, the cold lead can be laid along an easier route.

Heating can be controlled with an ECO900 or ECO910 thermostat installed in the central unit.

Tash constant wattage cables are always installed into a loop and the conductor is always connected to the junction box with a cold lead. (THE PICTURE IS AN APPROXIMATION)



● The Tash cable begins 5 cm from the edge of the step. Thereafter, the installation interval is 10 cm.

Cold room floors

Cold rooms and freezer rooms where the temperature is always below -20 °C cool their surroundings even if their floor is well insulated. This results in a risk of damage from frost or freezing to structures that come into contact with the ground.

A sufficient output for cold room floor structures is 15–20 W/m² with a maximum cable installation interval of 50 cm.

The floor structure's U value, the target ground temperature, and the cold room temperature affect the downward heat loss.

Example

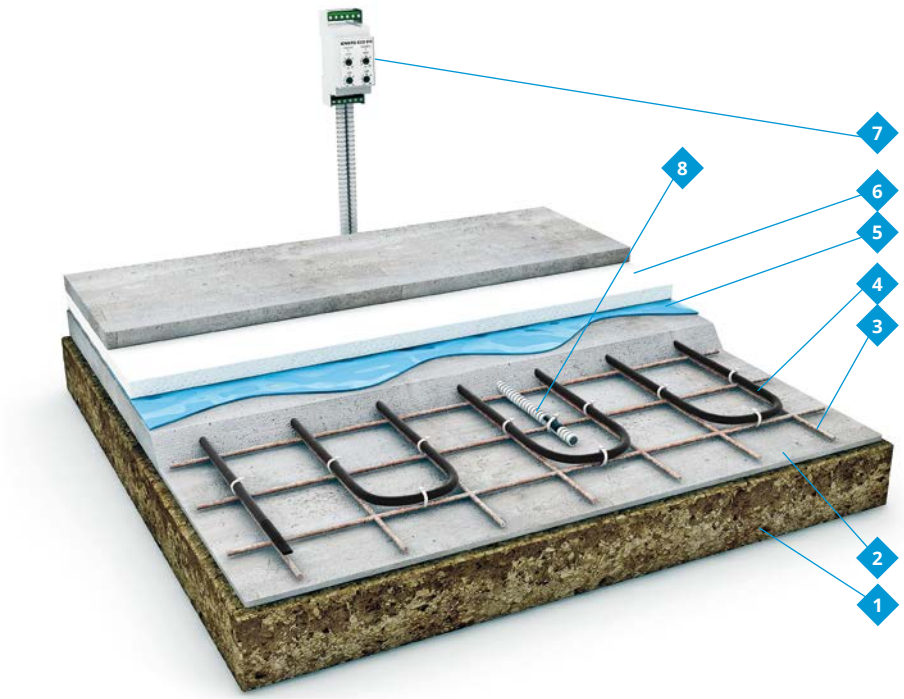
Cold room temperature -25 °C
Ground temperature +4 °C
Floor structure's U value 0.1 W/m² °C

Heat loss:
Φ/A = 29 °C x 0.1 W/m² °C = 2.9 W/m²

Φ/A=dt*U
dT= temperature difference between the cold room and the ground
U= thermal transmittance of the floor structure, U value

The cables are installed in a similar manner to standard concrete floors. For safety reasons, the use of two parallel loops and a thermostat is recommended. The cables must be installed at least 5 cm below the insulation because the goal is to prevent the ground below the insulation from freezing. If the space has expansion joints, the installation areas for the heating cables must be designed so that only cold leads run over the joints.

Doors and openings for them are also prone to freezing and therefore their structures must be protected against freezing with heating cables (Optiheat). This helps prevent damage to the structures and ensures that the doors work flawlessly and close properly.



1. Soil/gravel
2. Concrete
3. Rebar mesh
4. Tash or Tassu heating cable
5. Moisture barrier
6. Insulation
7. ECO910 thermostat
8. Temperature sensor, installed between cable loops

(THE PICTURE IS AN APPROXIMATION)

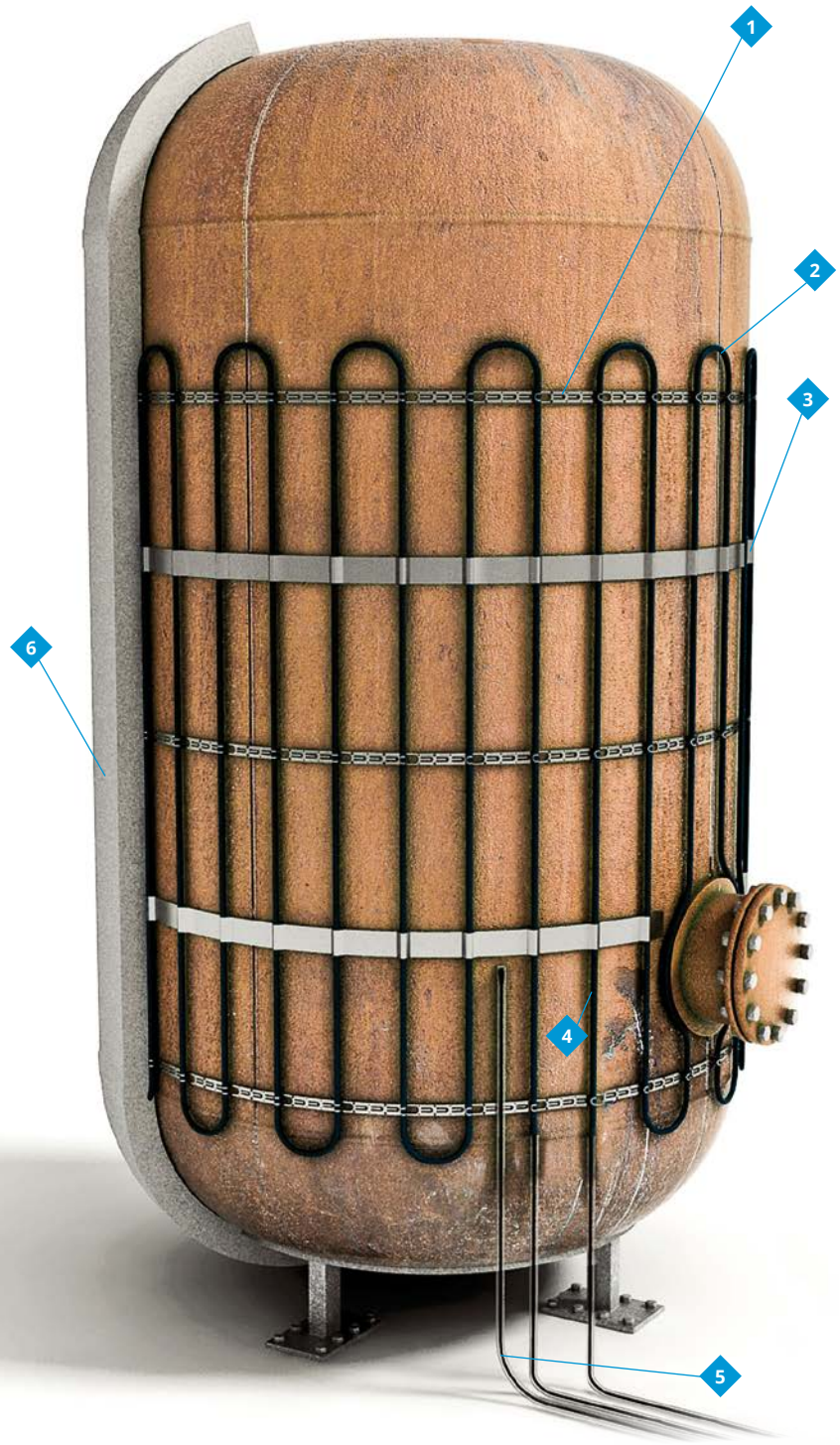
Maintenance of tank temperature

Tanks must be heated if the fluid in them must remain runny or must not freeze. Heating cables can be used for this purpose. Heating also prevents damage to the structures from freezing.

When selecting a cable, attention must be paid to all the losses of heat occurring from the tank and the foundation below it. Heat losses depend on the tank shape, size, type (fixed or with legs), insulation thickness, the target temperature and the ambient temperature. The tank's pipes must also be protected against freezing and be insulated. About a third of the tank from the top may be left without heating cables but the tank must be insulated meticulously.

The ECO500 or ECO910 thermostats can be used as the control device.

Typically, some of the fluid enters the areas outside the tank. Because of this, the matter of whether the fluid is corrosive to the cable must be considered and the cable must be selected accordingly. If the tank contains volatile fluids, it may be given a classification that results in the need for special arrangements.



1. Fixing strip
2. Tash heating cable
3. Aluminum tape
4. Heating cable/cold lead joint
5. Sensor
6. Insulation

(THE PICTURE IS AN APPROXIMATION)

Frost protection for pipe systems

Dimensioning and selection

Design phases for frost protection for pipes are:

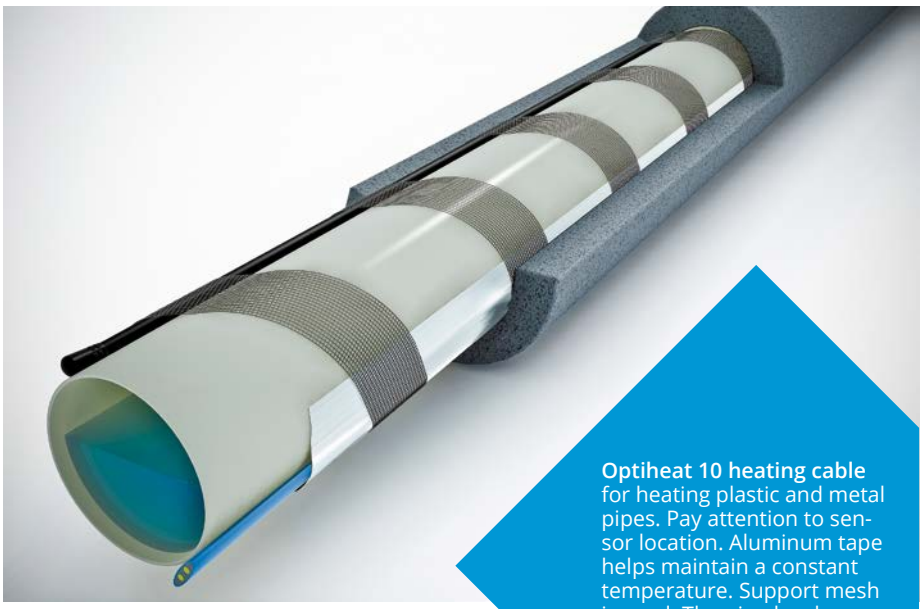
1. Heat losses from the pipe are determined (from the table or through calculations)
2. Heating output is determined 1.3–1.5 x the heat loss
3. Heating cable length is calculated
4. Suitable cable resistance is determined through calculations or on the basis of the table
5. The cable type that yields a sufficient output is selected
6. The total output is checked to ensure that it is sufficient and that the cable's maximum power per meter is not exceeded
7. If the maximum limit is exceeded, the length of the cable is increased so that the pipe is heated by a larger number of cable loops.

The heating power and cable type for a pipe system is determined on the basis of pipe material, size, and heat losses.

With a Tash constant wattage cable, to be noted:

- the cable's maximum power per meter (plastic pipe 10 W/m, metal pipe 20 W/m)
- the cable does not cross over itself
- cables are usually installed lengthwise along the pipe
- the cable is always installed as a loop, with two cables installed for a pipe
- the cable is always connected to the junction box with a cold lead

Pipe material	Cable's max power per meter W/m	Heating cable
Plastic	10	Optiheat 10 Plug´n Heat Tash
Metal	20	Optiheat 10 Optiheat 20/40 Plug´n Heat Tash
Cables inside a pipe for drinking water		Plugn Heat



Optiheat 10 heating cable for heating plastic and metal pipes. Pay attention to sensor location. Aluminum tape helps maintain a constant temperature. Support mesh is used. The pipe has been insulated. (THE PICTURE IS ONLY AN APPROXIMATION)

Pipe heat loss table

(W/meter of pipe)

Instructions for interpreting the table

Pipe heat loss table

A safety factor of 1.3–1.5 is added to the values in the table. The pipe heat loss table shows the output per meter that is required for the cable to keep water from freezing in the pipe.

1. The first column contains the pipe's outside diameter
2. The second column shows the insulation thickness
3. In the following columns, the temperature 20 °C...60 °C refers to the temperature difference between the pipe and its surroundings. Therefore, when protecting a pipe in a region where temperature drops to -30 °C at their coldest, the relevant information can be found in the 40 °C column. Here, the thermal conductivity of the insulation is 0.035 W/m². (Rock wool +10 °C)

Note! The support loops and valves are not factored into the dimensioning.

Example calculation

The plastic pipe's outer diameter is 48 mm, the insulation thickness is 50 mm and the temperature difference is 35 °C. This results in a heat loss of 7.8 W/m. With a safety factor of 1.4, the rated output is 7.8 x 1.4 = 10.92 W/m. Because the cable's maximum load per meter is 10 W/m on the surface of a plastic pipe, Optiheat 10 is selected as the heating cable. This can also be calculated:

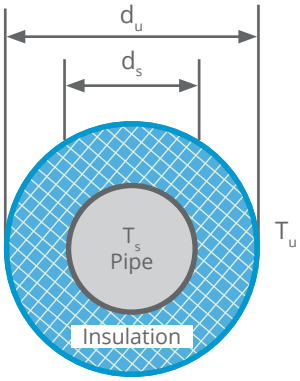
Heat loss from an insulated pipe

$$\Phi = \frac{2\pi\lambda_{insulation}}{\ln\left(\frac{d_u}{d_s}\right)} * (T_s - T_u)$$

Φ	Heat loss from the pipe (W)
$\lambda_{insulation}$	Insulation's heat conductivity (W/mK)
d_u	External diameter (m)
d_s	Pipe diameter (m)
T_s	Pipe temperature
T_u	Ambient temperature

Insulation

Insulation is the main factor determining the heat loss from a pipe. You need less heating power if you use more insulation. When used correctly, insulation keeps lost heat within the pipe.



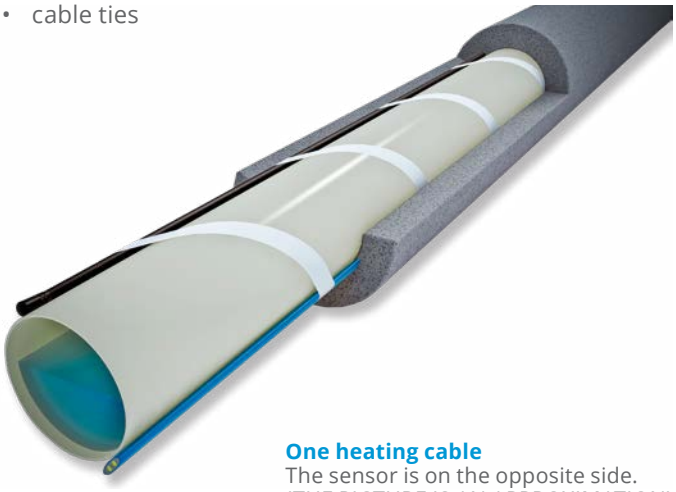
Temperature difference $T_s - T_u$

Pipe's outer diameter ø/mm	Insulation thickness	20 °C	30 °C	40 °C	50 °C	60 °C
14	20	3.3	4.9	6.5	8.1	9.8
	30	2.6	4.0	5.3	6.6	7.9
	40	2.3	3.5	4.6	5.8	6.9
	50	2.1	3.1	4.2	5.2	6.3
21	20	4.1	6.2	8.2	10.3	12.4
	30	3.3	4.9	6.5	8.1	9.8
	40	2.8	4.2	5.6	7.0	8.4
	50	2.5	3.8	5.0	6.3	7.5
27	20	4.8	7.3	9.7	12.1	14.5
	30	3.8	5.6	7.5	9.4	11.3
	40	3.2	4.8	6.4	8.0	9.6
	50	2.8	4.3	5.7	7.1	8.5
	80	2.3	3.4	4.5	5.7	6.8
34	20	5.7	8.5	11.3	14.1	17.0
	30	4.3	6.5	8.6	10.8	13.0
	40	3.6	5.5	7.3	9.1	10.9
	50	3.2	4.8	6.4	8.0	9.6
	80	2.5	3.8	5.1	6.3	7.6
42	30	5.0	7.4	9.9	12.4	14.9
	40	4.1	6.2	8.2	10.3	12.4
	50	3.6	5.4	7.2	9.0	10.8
	80	2.8	4.2	5.6	7.0	8.4
48	30	5.4	8.1	10.8	13.6	16.3
	40	4.5	6.7	9.0	11.2	13.5
	50	**3.9**	**5.9**	**7.8**	**9.8**	**11.7**
	80	3.0	4.5	6.0	7.5	9.0
60	30	6.3	9.5	12.7	15.9	19.0
	40	5.2	7.8	10.4	13.0	15.6
	50	4.5	6.7	9.0	11.2	13.5
	80	3.4	5.1	6.8	8.5	10.2
76	30	7.6	11.3	15.1	18.9	22.7
	40	6.1	9.2	12.2	15.3	18.3
	50	5.2	7.9	10.5	13.1	15.7
	80	3.9	5.8	7.8	9.7	11.6
	100	3.4	5.1	6.8	8.5	10.2
89	30	8.5	12.8	17.1	21.3	25.6
	40	6.9	10.3	13.7	17.1	20.6
	50	5.8	8.8	11.7	14.6	17.5
	80	4.3	6.4	8.6	10.7	12.8
	100	3.7	5.6	7.5	9.3	11.2
114	30	10.4	15.6	20.8	26.0	31.2
	40	8.3	12.4	16.5	20.7	24.8
	50	7.0	10.5	14.0	17.5	21.0
	80	5.0	7.5	10.0	12.5	15.0
	100	4.3	6.5	8.7	10.9	13.0
168	40	11.3	16.9	22.6	28.2	33.9
	50	9.4	14.1	18.8	23.5	28.3
	80	6.6	9.9	13.1	16.4	19.7
	100	5.6	8.4	11.2	14.0	16.8
	120	5.0	7.4	9.9	12.4	14.9
219	40	14.1	21.2	28.3	35.3	42.4
	50	11.7	17.5	23.4	29.2	35.1
	80	8.0	12.0	16.0	20.0	24.1
	100	6.8	10.2	13.6	16.9	20.3
	120	5.9	8.9	11.9	14.9	17.8
273	40	17.1	25.7	34.2	42.8	51.3
	50	14.1	21.1	28.2	35.2	42.3
	80	9.5	14.3	19.1	23.8	28.6
	100	8.0	12.0	16.0	20.0	24.0
	120	7.0	10.5	13.9	17.4	20.9

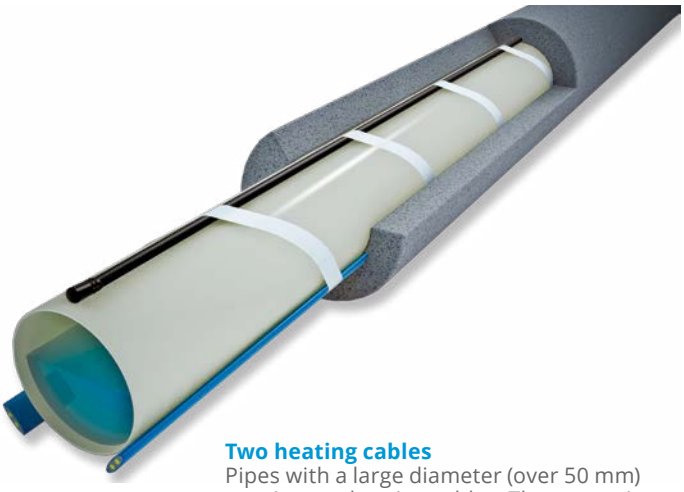
Frost protection for pipe systems
Installation

Heating cable outside the pipe
The heating cable is mounted on the bottom surface of a horizontal pipe (at the 5 o'clock position). When two cables are used, they are mounted on the bottom surface of the pipe at the 5 o'clock and 7 o'clock positions. The heating cable is fixed so that it runs flush against the pipe. The sensor of the thermostat that controls the heating is mounted onto the opposite side from the heating cable.

It can be affixed with:
- aluminum tape which is placed lengthwise on the pipe and levels out the temperature (ALU50)
- cable ties

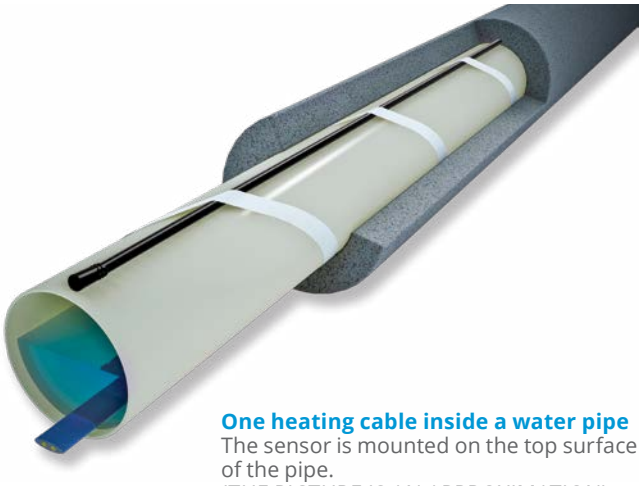


One heating cable
The sensor is on the opposite side.
(THE PICTURE IS AN APPROXIMATION)



Two heating cables
Pipes with a large diameter (over 50 mm) require two heating cables. The sensor is mounted on the top surface of the pipe.
(THE PICTURE IS AN APPROXIMATION)

Heating cable inside the pipe
The Optiheat 10 heating cable installed inside the pipe is placed in the pipe with a pressure inlet (EFPLV1). In a horizontal installation, the cable is fixed to the bottom surface of the pipe. The thermostat sensor is mounted on the top surface of the pipe.



One heating cable inside a water pipe
The sensor is mounted on the top surface of the pipe.
(THE PICTURE IS AN APPROXIMATION)

EFPLV1 pressure inlet
For inserting the Optiheat 10 heating cable into a water pipe.

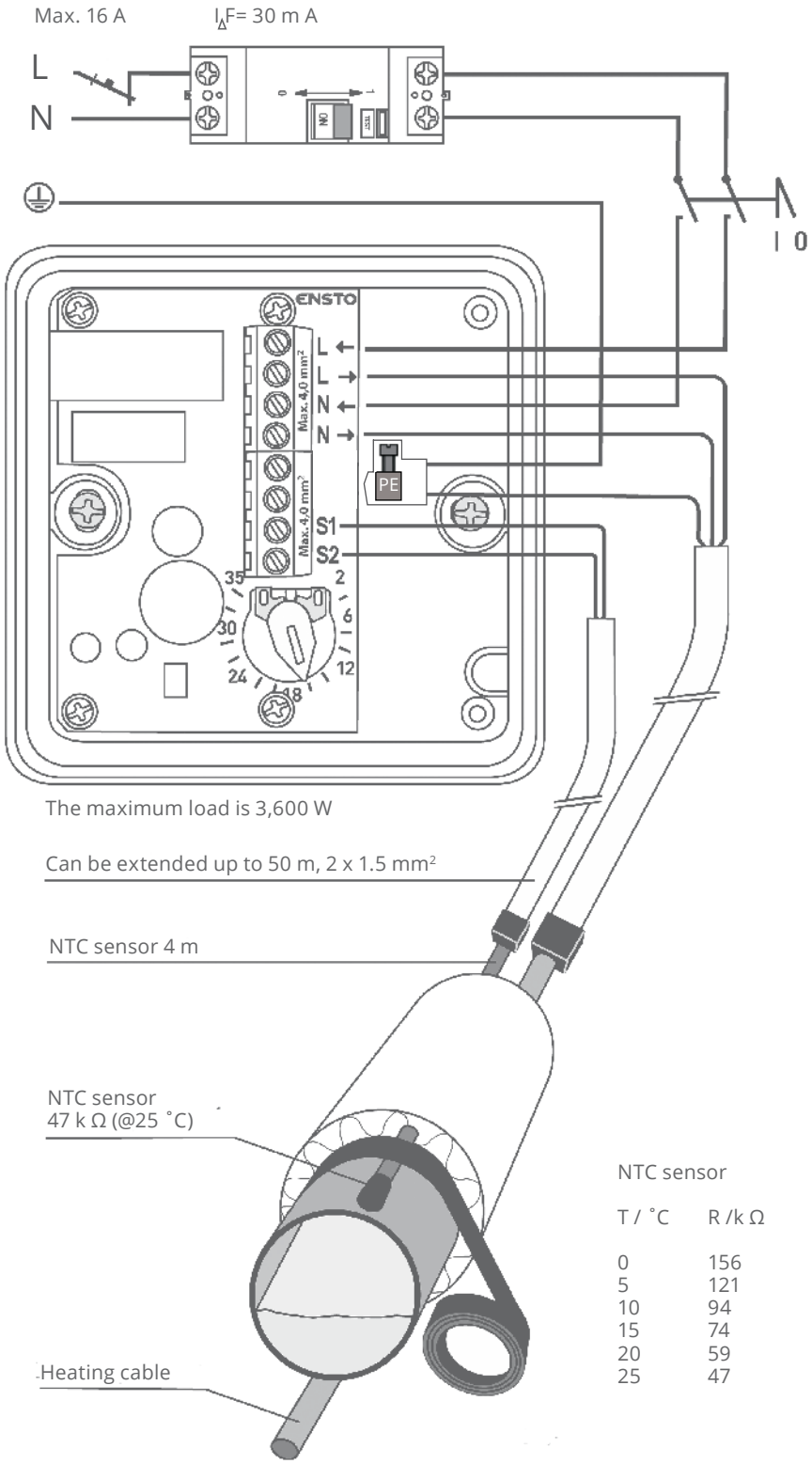
Control of frost protection for pipe systems

with the ECO500 thermostat

Frost protection for the pipe system is controlled via a switch. The thermostat switches on the heat only when it is required to help save energy. Without a thermostat, a self-limiting cable has a shorter service life because it is continuously switched on.

Plug'n Heat cables can be connected directly to a socket and the heat can be switched on when necessary.

Heating realized with a constant wattage cable (Tash) is always controlled with a thermostat. The sensor of the thermostat is mounted onto it on the opposite side from the cable.



NTC sensor

T / °C	R / k Ω
0	156
5	121
10	94
15	74
20	59
25	47

Frost protection for water pipes

With heating cables, you can prevent the water pipes in your property from freezing and causing water damage.

Near exterior walls, the impact of thermal bridges can be prevented by heating and insulating the water pipe and its shut-off valve.

The heating power and cable type for a pipe system is determined on the basis of pipe material, size and heat losses. The amount of heat loss is affected by the pipe size, installation environment and the amount and type of insulation.

The calculated heat loss is based on the assumption that the insulation remains dry and it does not have gaps. In design, the safety factor of 1.3–1.5 x heat loss is used (from the table on page 19).

A self-limiting heating cable (Optiheat) and a constant wattage heating cable (Tash) are suitable for protecting pipes against freezing. The heating cables' maximum outputs are presented in the table on page 27.

Primarily, heating cables are installed on the exterior surface of the water pipe, but, when necessary, they can also be installed inside the pipe (not in drains). If the cable is installed inside a pipe for drinking water, a heating cable approved for the purpose must be used.

Near exterior walls, the formation of thermal bridges can be prevented by heating and insulating the pipe, water meter and shut-off valve. (THE PICTURE IS ONLY AN APPROXIMATION)

A heating cable installed inside the pipe can be placed in the pipe via a pressure inlet (EFPLV1). (THE PICTURE IS ONLY AN APPROXIMATION)

Plug'n Heat

Plug'n Heat cables are equipped with a plug. They are coated with polyethylene and approved for use with foodstuffs, making them suitable for installation inside a pipe for potable water. Heating cables are inserted into a pipe via the EFPLV1 pressure inlet. Thanks to the plug, the cables can be connected directly to a socket and heating can be switched on when necessary. Heating cables must always be protected with a 30 mA residual current protection switch located either in the junction box or the socket.

Frost protection for valves

(also applies to pipe brackets)

The standard frost protection dimensioning suffices. By the valve, an extra loop is made to compensate for the heat loss from the valve core. The valve and the pipe must be insulated. The extra loop also provides flexibility if the valve has to be replaced for some reason.

Frost protection for rainwater systems

Dimensioning and selection

In narrow gutters and in areas where temperatures do not remain much below zero for long periods, the rated power of about 20 W/m suffices (i.e., one Tash cable per gutter). Higher heating output can only be achieved with additional cables.

In large applications, we recommend using the Tash cable and a control system. The use of a control system is also recommended with self-limiting cables to minimize energy consumption, prevent the cable from aging prematurely and to ensure a long service life.

	Gutter width mm	Output per meter of gutter W/m	Output for the area to be heated w/m²
Gutter			
Horizontal / vertical	< 150	20–60	
Gutter			
Horizontal	> 150		200
Roof valley	> 150		200

Installation and control

A frost protection system for a rainwater system consists of a heating cable, mounting accessories, and heating control devices.

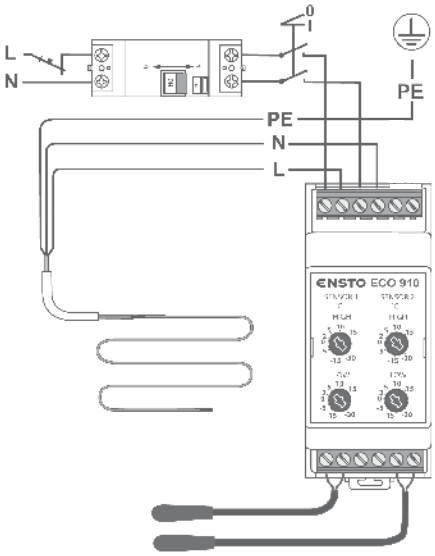
At the top of the downpipe, the cable is fixed with a strain relief clamp. In long downpipes (>10 m), a support chain or wire must be used, otherwise the cable's weight may damage the bend in the pipe. The cable must be affixed to the gutter with clips.

Optiheat cables do not have to be affixed to the gutter but they should be placed inside it.

The Tash constant wattage cables are always affixed to the gutters. In the horizontal sections, plastic mounting strips or clips must be used.

When the rainwater drains on rooftops are protected against freezing, damage caused by freezing to drains and roof structures can be prevented. When heating a drain, the cable must reach relatively far into the warm area to prevent downpipes from freezing. Usually, rainwater drains have a factory-fitted heating cable for which power supply must be arranged.

Heating cables	Thermostats	Sensors	Connection Accessories	Mounting Accessories
Optiheat 20/40	ECO900	ECOA903 + ECOA904	EFPLP1 EFPLP2 EFPLP3	VP300 PPN10 PPN12 RTS199
	ECO910			
TASH	ECO900	ECOA903 + ECOA904	EFPLP4	VP300 PPN6 PPN10 PPN12 RTS199
	ECO910			



NTC sensor

T / °C	R / k Ω
0	156
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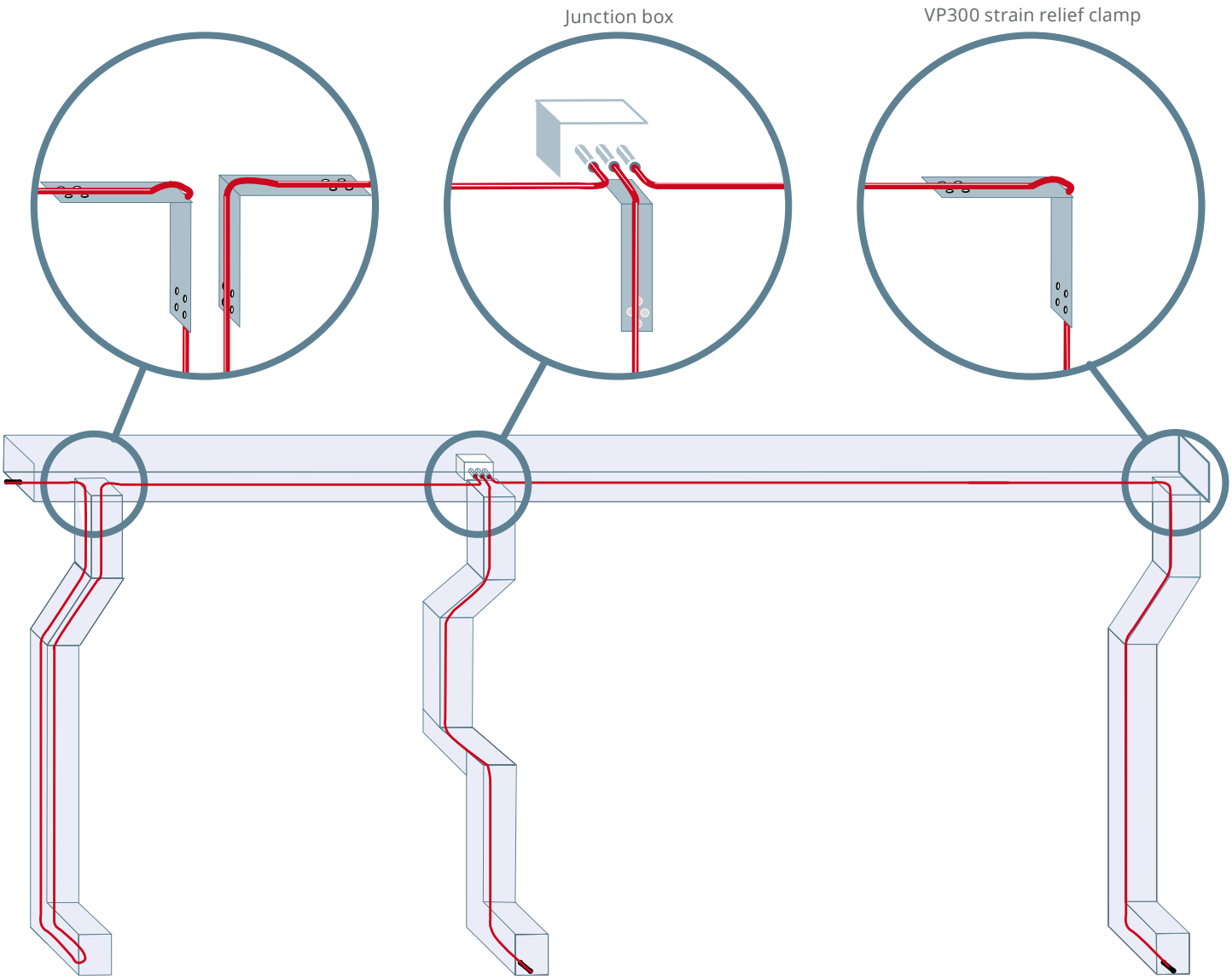


The heating cable and sensor are fixed with the PPN6 mounting strip. The VP300 strain relief clamp at the top of the downpipe. In long downpipes, a support chain or wire must be used to carry some of the cable's weight. The rainwater system must be kept clear of debris. (THE PICTURE IS ONLY AN APPROXIMATION)

Frost protection for rainwater systems in a detached house

With the Optiheat heating cable

Frost protection for gutters design and installation

The Optiheat 20/40 heating cable's output per meter is 28 W/m–24 W/m at an ambient temperature of -5°C...+5 °C. In water, the output is 40 W/m.

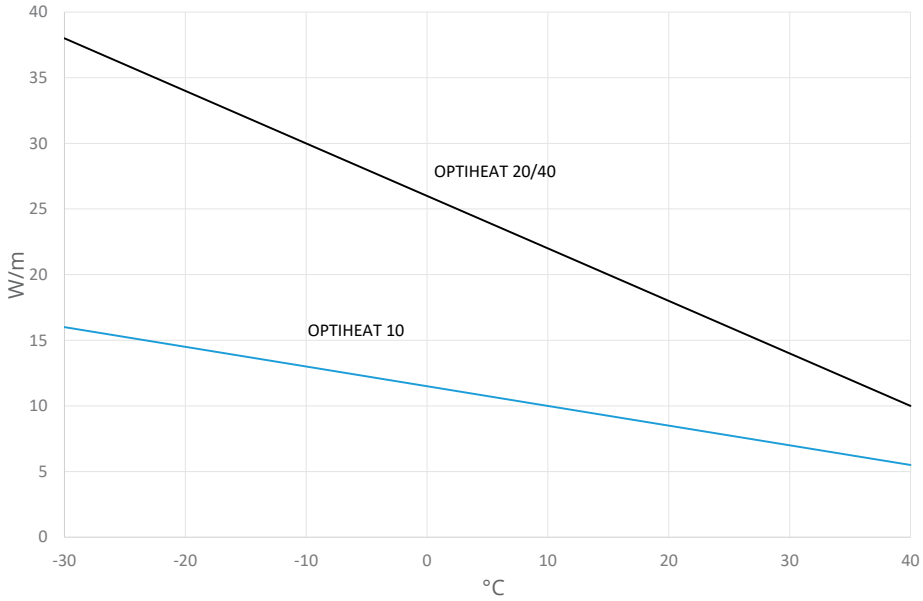
Therefore, one or more heating cables is installed in the gutter and downpipe to achieve the desired output. In regions where winters are not extremely cold, a single heating cable suffices for narrow gutters and in colder areas and with wide gutters (diameter over 150 mm), more than one cable is required.

The installation of the heating cable is initiated from the horizontal gutter, with the cable reaching the bottom of the downpipe. The Optiheat can be in the gutter without fixing it. At the top of the downpipe, the cable must be fixed with a strain relief clamp (VP300).

The Optiheat 20/40 heating cables can be connected to a junction box directly. When necessary, a cold lead, which is connected to the heating cable with a joint kit, can be used.

In the Optiheat cables, the inrush current is about 1.5-2.5 x working current. Because about 57 meters of heating cable can be connected to a circuit protected by a 10 A circuit breaker, heating is connected to two circuits. The ECO910 or ECO900 thermostats can be used to control heating. See connection diagram on pages 33 and 38.

Optiheat heating cables' temperature/power diagrams



Changes in the output of the Optiheat 10 and Optiheat 20/40 heating cables in relation to the ambient temperature. Optiheat Ramp approx. 50 W/m/10 °C (110 W/m in concrete at 5 °C)

Maximum installation lengths

Optiheat 10	10 A	16 A	32 A
On the pipe surface +10 °C	100 m	125 m	-
On the pipe surface 0 °C	95 m	120 m	-
On the pipe surface -15 °C	80 m	115 m	-
On the pipe surface -20 °C	75 m	110 m	
In water 0 °C	55 m	65 m	
Optiheat 20/40			
On the pipe surface +10 °C	68 m	109 m	129 m
On the pipe surface ±0 °C	57 m	92 m	119 m
On the pipe surface -10 °C	50 m	79 m	111 m
On the pipe surface -20 °C	44 m	70 m	104 m
Optiheat RAMP			
In concrete -10 °C	18 m	28 m	55 m

Cables' maximum installation lengths at certain working temperatures at which the cable temperature is the same as the ambient temperature.

Example:
A detached house

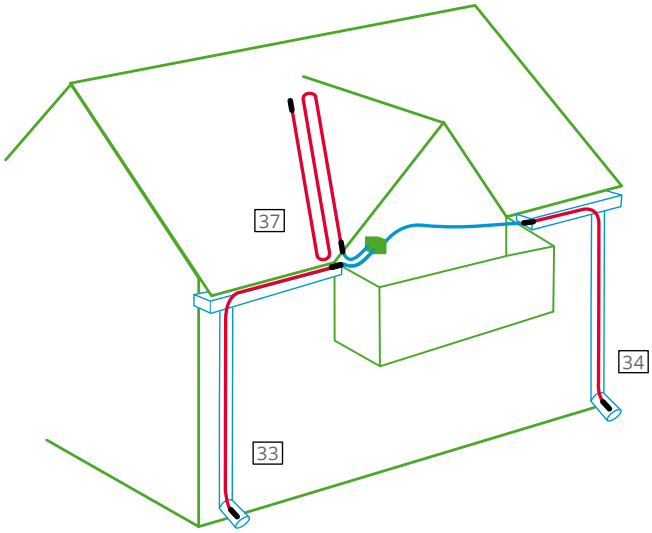
Design and installation of frost protection for roof valleys

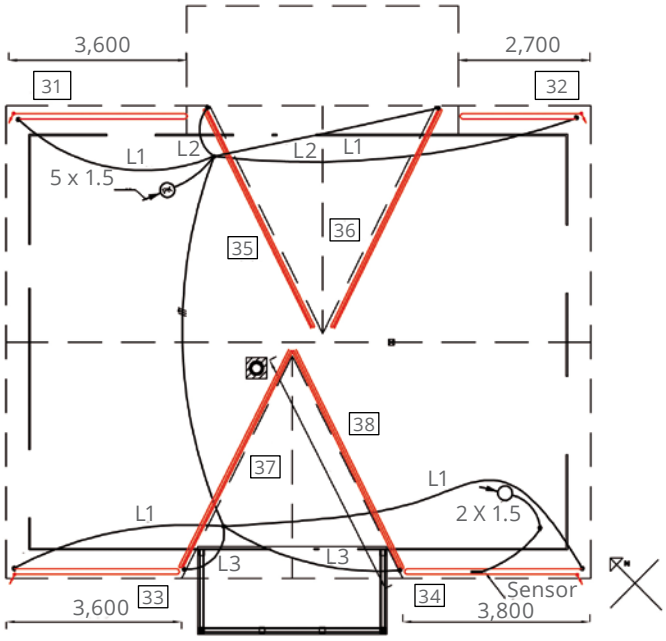
Ice that may accumulate in corners can be melted with a heating cable installed in the roof valley. An output of about 200 W/m² is used, which in this example means 60 W/meter of the valley. In this case, 16 meters of the Optiheat 20/40 cable is installed (point 37 in the picture). For the design of the installation, the cable length is compared with the Optiheat 20/40 cable's maximum installation length.

	Power gutter length W/m		Optiheat 20/40 cable, pcs
Horizontal gutter	40		2
Downpipe	20		1
Roof valley	60		3
Pos.	**Horizontal gutter, m**	**Downpipe, m**	**Heating cable length, m**
31	3.6	5.8	(2 x 3.6 + 5.8) = 13.0
32	2.7	5.8	(2 x 2.7 + 5.8) = 11.2
33	3.6	5.8	(2 x 3.6 + 5.8) = 13.0
34	3.8	5.8	(2 x 3.8 + 5.8) = 13.4
Total			50.6
Pos.	**Valley length, m**	**Valley width, m**	**Heating cable length, m**
35	5.2	0.3	320W / 20W/m = 16 m
36	5.2	0.3	320W / 20W/m = 16 m
37	5.2	0.3	320W / 20W/m = 16 m
38	5.2	0.3	320W / 20W/m = 16 m
Total			64

Example calculation:

Valley area: 5.2 m x 0.3 m = 1.6 m²
Required heating power: 1.6 m2 x 200W/m² = 320W
Heating cable length: 320W / 20W/m = 16 m
Installation interval: 1.6 m² / 16 m = 0.1 m = 10 cm.





Frost protection for rainwater systems in an industrial hall

With the Tash constant wattage cable

The rated power for a gutter is from 20–60 W/m; for this example, 30 W/m is used. The Tash cable's output in a metal gutter may not exceed 20 W/m, and therefore an output per meter of 15W/m is selected and the cable is installed doubled into a loop. This gives the desired output per meter of 30 W/m and the cable's start and end points are in the same location.

Example calculation

Gutter length (A + B):
4 x 25 m + 2 x 5.8 m + 3 x 6.7 m
≈ 132 m

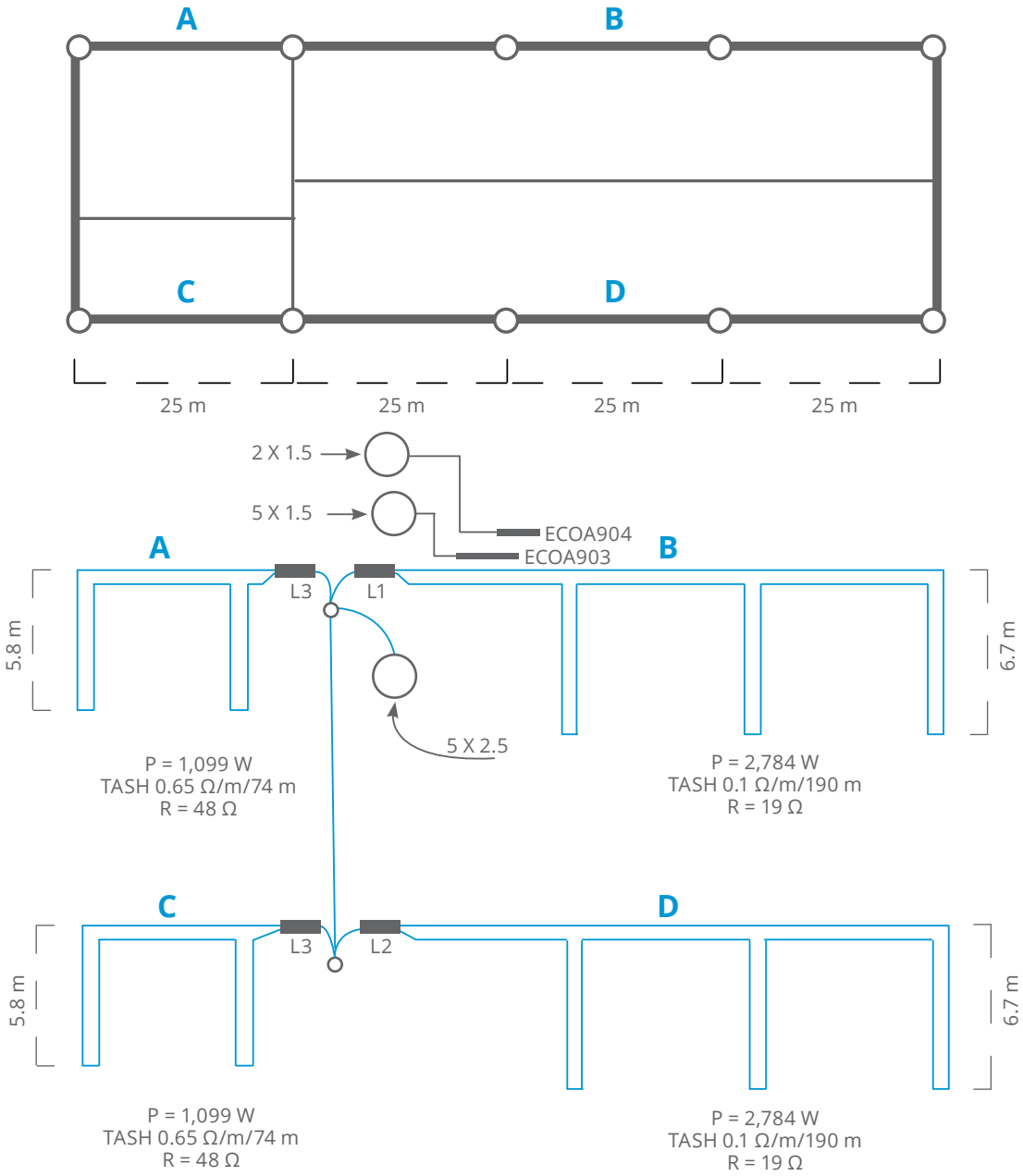
The heating cable's total length (A+B).
Note. the cable is doubled into a loop.
length 2 x 132 m = 264 m

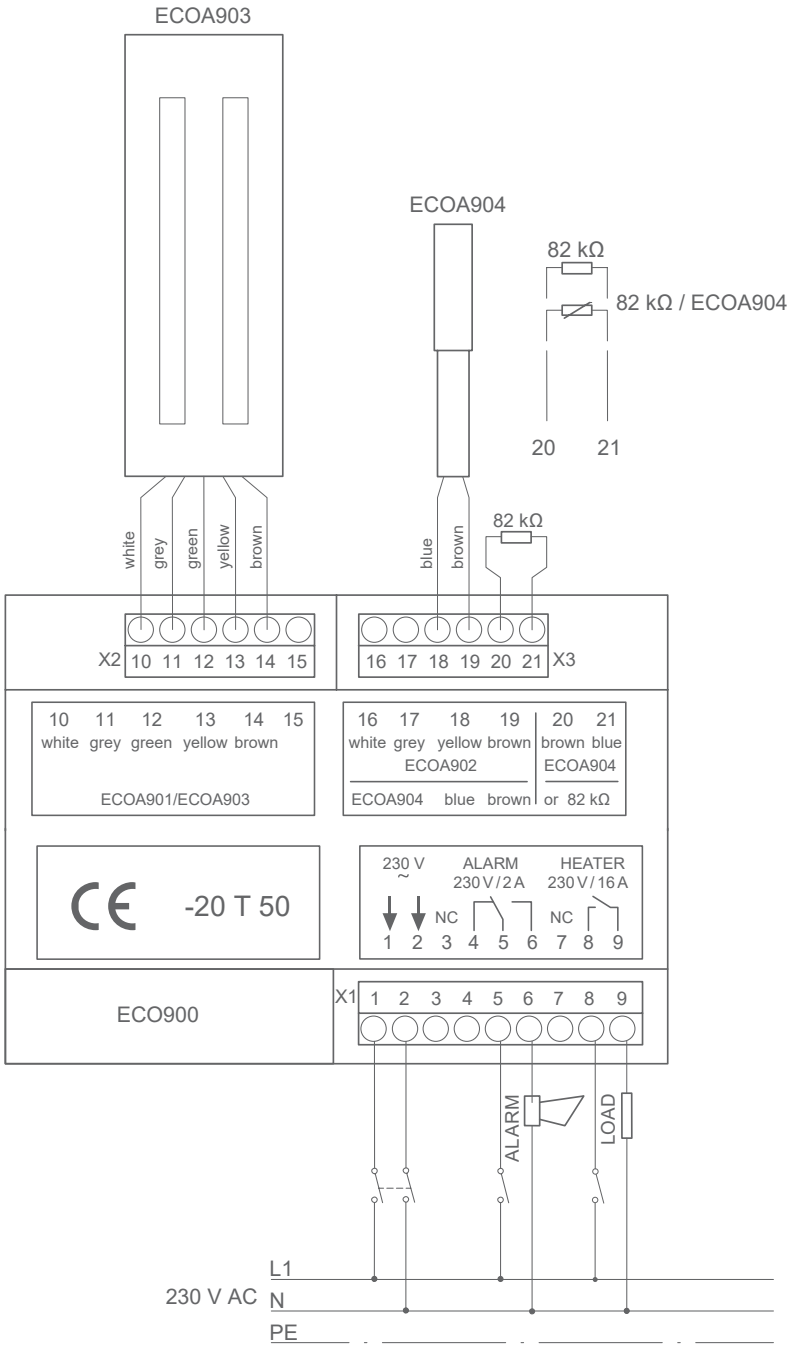
Heating power P(A+B)
= 15 W/m x 264 m = 3,960 W

Total output
P(A+B+C+D)=2*3,960 W=7,920 W

The heating must be connected to 3 x 16 A circuits.

In this example, the control system is ECO900 + ECOA903 + ECOA904.





Example	Loop A (= LOOP C)	Loop B (=LOOP D)
Gutter length + downpipe height	25 m + 2 x 5.8 m ≈ 37 m	3 x 25 + 3 x 6.7 m ≈ 95 m
Required power 30 W/m	1,110 W	2,850 W
Heating cable length	2 x 37 m = 74 m	2 x 95 m = 190 m
Heating cable resistance	230V*230 V/1,110 W/74 m=0.64 ohm/m	230V*230 V/2,850 W/190 m=0.1 ohm/m
The heating cable is selected	Tash 0.65 Ω/m	Tash 0.1 Ω/m
Output	1,099 W	2,784 W
Total output (A+B+C+D)	2 x (1,099 W + 2,784 W) = 7,766 W	

Frost protection

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for heating cables 41
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Product data

Plug'n Heat heating cable

A heating cable with a plug for keeping pipes, water meters, and other applications susceptible to freezing clear of ice. This cable is made from the self-limiting Optiheat 10 cable. It can also be installed inside pipes for potable water. Nominal voltage 230 V. Output 10 W/m on the pipe surface 10 °C, 16W/m in water 0 °C. Connecting cable length of 2.5 m. IP68. If the Plug'n Heat heating cable is installed inside a water supply pipe, the EFPLV1 pressure inlet is required as an accessory.

Product code	STK electrical number	GTIN code	Item	Pcs/pallet
EFPPH2	81 684 22	64 100 81 684 220	Heating cable 2 m, 20 W	1/110
EFPPH3	81 684 23	64 186 77 638 671	Heating cable 3 m, 30 W	1/110
EFPPH4	81 684 24	64 100 81 684 244	Heating cable 4 m, 40 W	1/110
EFPPH5	81 684 25	64 186 77 638 688	Heating cable 5 m, 50 W	1/110
EFPPH6	81 684 26	64 100 81 684 268	Heating cable 6 m, 60 W	1/110
EFPPH8	81 684 28	64 186 77 638 695	Heating cable 8 m, 80 W	1/110
EFPPH10	81 684 30	64 100 81 684 305	Heating cable 10 m, 100 W	1/110
EFPPH12	81 684 32	64 186 77 638 701	Heating cable 12 m, 120 W	1/110
EFPPH15	81 684 35	64 100 81 684 350	Heating cable 15 m, 150 W	1/110
EFPPH20	81 684 40	64 100 81 684 404	Heating cable 20 m, 200 W	1/110

Tash single conductor heating cables

Tash constant wattage cables for frost protection in outdoor areas, pipes and tanks. The cover is made of chemical-resistant HFFR material. Max. load 30 W/m (concrete), 25 W/m (gravel), 20 W/m (pipe surface). Operating temperature with voltage 80 °C, momentarily 160 °C Max. switching voltage 500 V. Max. current 16 A. Cable class M2. Min. bending radius 5 x the cable outer diameter, about 30mm. Min. installation temperature -10 °C. Tash is connected to a junction box with a cold lead.

Product code	STK electrical number	GTIN code	Item	m/reel
TASH0.05	04 301 55	64 100 04 301 555	Tash constant wattage cable, 0.05 ohm/m	1/2000
TASH0.1	04 301 50	64 100 04 301 500	Tash constant wattage cable, 0.1 ohm/m	1/2000
TASH0.17	04 301 56	64 100 04 301 562	Tash constant wattage cable, 0.17 ohm/m	1/2000
TASH0.21	04 301 51	64 100 04 301 517	Tash constant wattage cable, 0.21 ohm/m	1/2000
TASH0.32	04 301 32	64 100 04 301 326	Tash constant wattage cable, 0.32 ohm/m	1/2000
TASH0.45	04 301 57	64 100 04 301 579	Tash constant wattage cable, 0.45 ohm/m	1/2000
TASH0.65	04 301 59	64 100 04 301 593	Tash constant wattage cable, 0.65 ohm/m	1/2000
TASH0.82	04 301 58	64 100 04 301 586	Tash constant wattage cable, 0.82 ohm/m	1/2000
TASH1	04 301 66	64 100 04 301 661	Tash constant wattage cable, 1.0 ohm/m	1/2000
TASH1.5	04 301 60	64 100 04 301 609	Tash constant wattage cable, 1.5 ohm/m	1/2000
TASH3	04 301 61	64 100 04 301 616	Tash constant wattage cable, 3 ohm/m	1/2000
TASH6	04 301 63	64 100 04 301 630	Tash constant wattage cable, 6.0 ohm/m	1/2000
TASH10	04 301 64	64 100 04 301 647	Tash constant wattage cable, 10 ohm/m	1/2000

Self-limiting Optiheat frost protection cables

The Ensto Optiheat frost protection cables are suitable for frost protection in water supply and drain pipes, rainwater systems, roofs, stairs and small outdoor areas. Switching voltage 230V. Min. bending radius EFPO10 25 mm, EFPO20 25 mm, EFPORAMP 50 mm. EFPO10 output 10W/m on the pipe surface at +10 °C, 16W/m in water at 0 °C. EFPO20 output 20W/m on the pipe surface at +10 °C, 40 W/m in water at 0 °C. EFPORAMP output 50W/m at +10 °C, 110 W/m in concrete at +5 °C.

Product code	STK electrical number	GTIN code	Item	m/reel
EFPO10	04 313 10	64 100 04 313 107	Optiheat 10, power 10 W/m, blue	1/350
EFPO20	04 313 20	64 186 77 639 180	Optiheat 20/40, power 20 W/m, black	1/300-1000
EFPO20.250	04 313 02	64 186 77 639 197	Optiheat 20/40, power 20 W/m, black	1/250
EFPORAMP	04 313 32	64 186 77 639 159	Optiheat Ramp, power 50 W/m, yellow	1/250

Tash accessories

The EFPLP4 jointing kit is designed for extending a Tash frost protection cable or connecting it to a cold lead and for repairing the TASSU underfloor heating cable.

Product code	STK electrical number	GTIN code	Item	Pcs/packet
EFPLP4	04 313 94	64 186 77 630 767	Extension and repair kit for Tash and Tassu cables	1/50

Optiheat accessories (Plug'n Heat, Optiheat 10 and Optiheat 20)

The EFPLP1 jointing kit with a terminating end and jointing and shrinking accessories for connecting a cable seamlessly to the cold lead (MMJ or MCMK). The EFPLP2 jointing kit for connecting the heating cable to a junction box includes the terminating end. The cable is laid from the installation location to the junction box either as it is or in a protective tube. The kit includes a cable-shaped rubber seal. The EFPLP3 jointing kit for seamlessly connecting a heating cable to another heating cable. The EFPLV1 pressure inlet for installing the Optiheat 10 and Plug'n Heat cables inside a water pipe.

Product code	STK electrical number	GTIN code	Item	Pcs/packet
EFPLP1	81 682 93	64 186 77 630 002	Connecting cold lead + terminating end	1/20
EFPLP2	81 682 91	64 186 77 630 019	Optiheat cable junction box connection + terminating end	1/20
EFPLP3	81 682 92	64 186 77 630 026	Joint Opti-Opti	1/20
EFPLV1	04 313 91	64 186 77 630 033	Pressure inlet for installing the Optiheat 10 and Plug'n Heat cables inside a water pipe	1/12

Optiheat accessories (Optiheat Ramp)

The EFPLP5 jointing kit with the terminating end and jointing and shrinking accessories for connecting a cable seamlessly to the cold lead (MMJ or MCMK).

Product code	STK electrical number	GTIN code	Item	Pcs/packet
EFPLP5	04 313 95	64 186 77 639 333	Optiheat Ramp Jointing kit	1/20

Mounting and installation accessories for heating cables

ALU50 aluminum tape for fixing heating cables. The XBC1230 metal fixing strip for fixing all heating cables and securing them at the correct installation interval. The PPN6 mounting strip for fixing Tash cables and securing them at the correct installation intervals. The PPN10 plastic cable clip for securing the Tash cable to the downpipe. The PPN12 plastic cable clip for securing the Tash and Optiheat 20 cables to the gutter. The VP300 strain relief clamp for use with heating cables installed in downpipes. The RTS199 support chain for use with heating cables installed in downpipes longer than 10 m; can be attached directly to the PPN10 clip.

Product code	STK electrical number	GTIN code	Item	Pcs/packet
ALU50	52 493 22	64 186 77 631 702	Aluminum tape, 50 mm x 50 m	1/10
XBC1230	13 290 02	64 100 13 290 024	Metal mounting strip, 12 mm x 20 m	1/10
PPN6	13 290 60	64 186 77 631 771	Plastic mounting strip for the Tash cable, 5.5 m	1/100
PPN10	13 035 00	64 186 77 637 766	Cable clip for down downpipe (25 pcs)	25/300
PPN12	13 035 01	64 186 77 637 773	Cable clip for gutter or roof (25 pcs)	25/100
VP300	14 043 99	64 186 77 632 082	Strain relief clamp for downpipes	1/20
RTS199	13 035 04	47 421 52 001 486	Support chain for the PPN10 spacing clip, stainless steel, 100m	1/1

ECO500 thermostat

For controlling frost protection of pipes. When the heating cable is installed inside the water pipe, the sensor is mounted on the top surface of the pipe. When an external heating cable is used, the sensor must be mounted onto the opposite side of the pipe from the cable, in the area that is expected to remain the coldest. Nominal current 16 A res. Max. load 3600 W. Adjustment range +2 °C...+35 °C. Sensor cable length 4 m, can be extended 50 m MMJ 2 x 1.5 mm². Sensor 47 kohm / 25 °C. Housing e.g. AP9, IP65.

Product code	STK electrical number	GTIN code	Item	Pcs/packet
ECO500	26 213 80	64 186 77 635 830	Electronic thermostat, 3,600 W, for controlling frost protection for pipes	1/12

ECO910 thermostat

A DIN rail-mounted frost protection thermostat with two sensors. Ideal for controlling frost protection for outdoor areas, ramps, roofs and rainwater systems. Both sensors are used in frost protection for outdoor areas, while in rainwater systems, only one sensor is used. Thermostat adjustment range – 30...+ 15 °C, IP20. Input voltage of 230 V. Maximum load of 16 A. Sensor 47 kohm / 25 °C. Sensor cable length of 4 m (can be extended up to 50 m).

Product code	STK electrical number	GTIN code	Item	Pcs/packet
ECO910	26 213 60	64 186 77 636 141	Frost protection thermostat, 16 A, two sensors	1/12

ECO900 thermostat

A fully automated control system for snow and frost protection that can be used with snow + ice sensors and temperature + humidity sensors. An LCD screen that displays real-time humidity and temperature data. Finnish, Swedish, German, English, French and Czech as languages. Automated troubleshooting and potential-free contact in the case of a flaw. Post-heating and operating hour calculator. Manual control as an option. Requires two sensors to operate. Mounted on a DIN rail. 230 V.

Product code	STK electrical number	GTIN code	Item	Pcs/pallet
ECO900	26 213 20	64 186 77 630 866	A control system for frost protection in outdoor areas and rainwater systems	1/180
ECOA901	26 213 21	64 186 77 630 873	Heated snow and ice sensor for the ground	1/128
ECOA902	26 213 22	64 186 77 630 880	Temperature and humidity sensor for the ground	1/128
ECOA903	26 213 23	64 186 77 630 897	Heated snow and ice sensor for eaves	1/180
ECOA904	26 213 24	64 186 77 630 903	Temperature sensor for eaves	1/180

Catalogues

In accordance with the product code

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EFPPH2	40
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EFPPH3	40
EFPPH4	40
EFPPH5	40
EFPPH6	40
EFPPH8	40
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PPN12	41
PPN6	41
RTS199	41
TASH0.05	40
TASH0.1	40
TASH0.17	40
TASH0.21	40
TASH0.32	40
TASH0.45	40
TASH0.65	40
TASH0.82	40
TASH1	40
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TASH10	40
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04 313 95	41
13 035 00	41
13 035 01	41
13 035 04	41
13 290 02	41
13 290 60	41
14 043 99	41
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26 213 22	42
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26 213 60	42
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52 493 22	41
81 682 91	41
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64 100 04 301 661	40
64 100 04 313 107	40
64 100 13 290 024	41
64 100 81 684 220	40
64 100 81 684 244	40
64 100 81 684 268	40
64 100 81 684 305	40
64 100 81 684 350	40
64 100 81 684 404	40
64 186 77 630 002	41
64 186 77 630 019	41
64 186 77 630 026	41
64 186 77 630 033	41
64 186 77 630 767	41
64 186 77 630 866	42
64 186 77 630 873	42
64 186 77 630 880	42
64 186 77 630 897	42
64 186 77 630 903	42
64 186 77 631 702	41
64 186 77 631 771	41
64 186 77 632 082	41
64 186 77 635 830	42
64 186 77 636 141	42
64 186 77 637 766	41
64 186 77 637 773	41
64 186 77 638 671	40
64 186 77 638 688	40
64 186 77 638 695	40
64 186 77 638 701	40
64 186 77 639 159	40
64 186 77 639 180	40
64 186 77 639 197	40
64 186 77 639 333	41

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