ENSTO

ELECTRICAL HEATING SOLUTIONS

Building Technology

Ensto provides electricity solutions for

HOMES AND OFFICE BUILDINGS

The Ensto solution range includes electricity products and systems for homes and office buildings. Safety, functionality and energy efficiency are the focal points of R&D at Ensto.

Distribution boards
Standard distribution boards, IT distribution boards

Installation materials
Flush and surface mounting boxes, piping materials

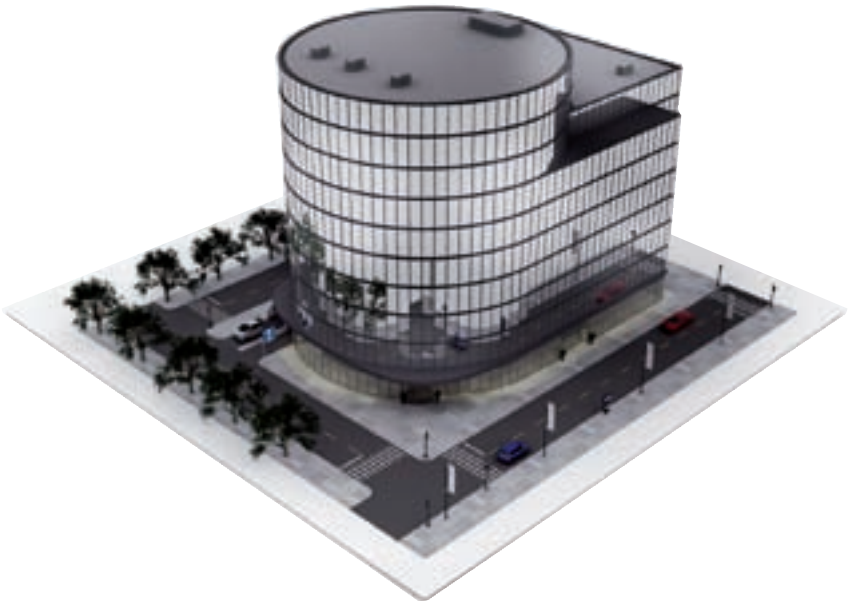
Prefabricated installation systems
EnstoNet

Wiring accessories
Switches, socket outlets, tele & data, duct accessories, dimmers and motion detectors, signal products

Heating
Panel heaters, underfloor heating and heating control

Lighting
Indoor and outdoor lighting, PIR sensor luminaires, lighting control

Control systems
Heating and lighting control, intelligent home control and monitoring



Electrical heating

This brochure provides practical tips for electrical heating solutions, installation as well as benefits home-owners will be enjoying for years to come.

Ensto electrical heating products offer a great combination of comfort, flexibility, safety, reliability, energy efficiency and low cost of investment. Add ease of installation and an almost nonexistent need for maintenance – Ensto electrical heating is clearly the smart choice.

Contents

ELECTRICAL HEATING

– A cost efficient solution for energy efficient buildings

Ensto solutions and products fit all building types, budgets and life-styles. The heating solution has a range of effects on the building process and life-cycle as well as on costs and comfort. No wonder electrical heating has become the favored heating system for new single-family homes, as well as, for renovation objects.

Why electrical heating?

When professionally considering all technical, cost and usage aspects, electrical heating and Ensto solutions fulfil all the requirements given by the builder and the house owner. Ensto know-how and technologies are based on demanding Nordic conditions where efficient, economical and reliable heating is very important.

- High energy efficiency and cost savings
- Electricity transforms efficiently into heat
- Small initial investment when compared with other heating solutions
- Low overall operating costs compared to other heating systems
- Easy and fast installation for new buildings and renovation objects
- Minimal maintenance
- Easily adjustable control and optimised energy consumption
- Comfortable, evenly distributed heat
- Heating control reacts to other heat sources, keeping an even temperature in all conditions
- If a fault occurs it will not damage the structures
- Versatile solutions for different building types, designs, life-styles and comfort expectations
- Safe and will not be damaged if frozen

GREENER BY DEGREES

– Energy efficiency through control and adjustment

The owners of residential buildings and authorities demand better energy efficiency. This means building with thicker insulation and energy efficient walls, doors and windows. As a result, the demand for heating in low and passive energy houses decreases, and therefore electrical heating is the easy and cost efficient solution. Electricity gives you the best adjustability and comfort. Ensto heating solutions offer many possibilities to improve the energy efficiency of buildings at any time.

Energy efficiency and comfortable heating will be achieved by the following:

- Correct sizing
- An appropriate system with quality devices
- Proper installation of the heating system and commissioning
- Correct usage and maintenance

What makes electrical heating energy efficient?

- A well insulated energy efficient building in combination with a reliable electrical heating system brings a permanent reduction in energy consumption
- Underfloor heating is both comfortable and energy efficient: A large warm floor area provides better thermal comfort than heaters. This allows a reduction in room temperature by 1–2 °C and a cutting of heating costs by 5–10 %
- Reacts quickly to changes in temperature
- Easy and effective to combine with other heat sources such as sunlight, fireplace or heat pumps according to the needs of the room
- Can easily be controlled with KNX home automation and other control systems, which efficently reduce and optimise energy usage
- By using temperature reduction running costs can be lowered significantly

Greener by degrees

Finding the right solution for new buildings and renovations

When choosing a heating system, the total costs, low maintenance, safety, personal preferences and user-friendliness have a significant influence on decision-making.

A heating system is a long-term investment, and its reliability is a major comfort factor. Naturally, the choice also has a great influence on energy efficiency.

Criteria	Feature
Costs	• Energy pricing and tariff structures • Maintenance, construction and running costs • Expectation of energy price development • Total energy consumption
Benefits of the heating system	• Easy to use • Reliable in daily use • Thermal comfort • Health and safety • Possibility to design interiors with fewer limitations • Possibility to use additional heat sources
Investment costs	• Building, renovation and subscriber costs • Other related costs (insulation, space requirements etc.) • Life time expectancy

Renewing a heating system

Renewing or changing a functioning heating system is usually needed when living comfort and energy efficiency have to be increased. Before the final decision is made, the following needs must also be taken into account: What kind of structural improvements does the building require, and is there a need for better ventilation and air conditioning.

Heating should be planned in the same way as for a new house, when

- changing the whole heating system
- improving the structures (better insulation, windows etc.)
- enlargement of the building
- changing the purpose of the building
- improving the ventilation system

Tip:

Floor structures should be insulated to ensure that the heat flow is directed upwards. Otherwise, the heat flow will also be directed downwards. This will remarkably improve the energy efficiency of the building.

Object of renewal	Need/problem	Solution
Bathroom renovation	• Reduction of humidity • Increased comfort	• Ventilation • Underfloor heating
Existing underfloor heating	• Not working	• Measurement of heating cable and thermostat. Repair/change non-working products
Cold floor	• Increasing comfort	• Underfloor heating
Updating of old panel heaters	• Lower heater surface temperature • Ticking thermostat • Heater in poor condition	• Change the panel heaters
Changing or renewing the heating system	• Old obsolete system	• Electrical heating solution

Designing an electrical heating system

Finding a successful heating solution is not just a question of the right heating devices – there are also many other factors that affect the designing e.g. structures and surfaces, heating control, adjustments, and other heat sources.

Heat losses in buildings

The building's heat loss forms the starting point when designing a heating system. To plan an efficient heating system, a heat loss calculation is needed for each room. Room specific wattage is the result of the calculation, enabling the right choice of devices.

To make a heat loss calculation, the following is the minimum information needed:

- the area of each building element in square metres
- the thermal transmittance of each building element
- the design temperatures (external, internal)
- ventilation system data
- external air exchange rate

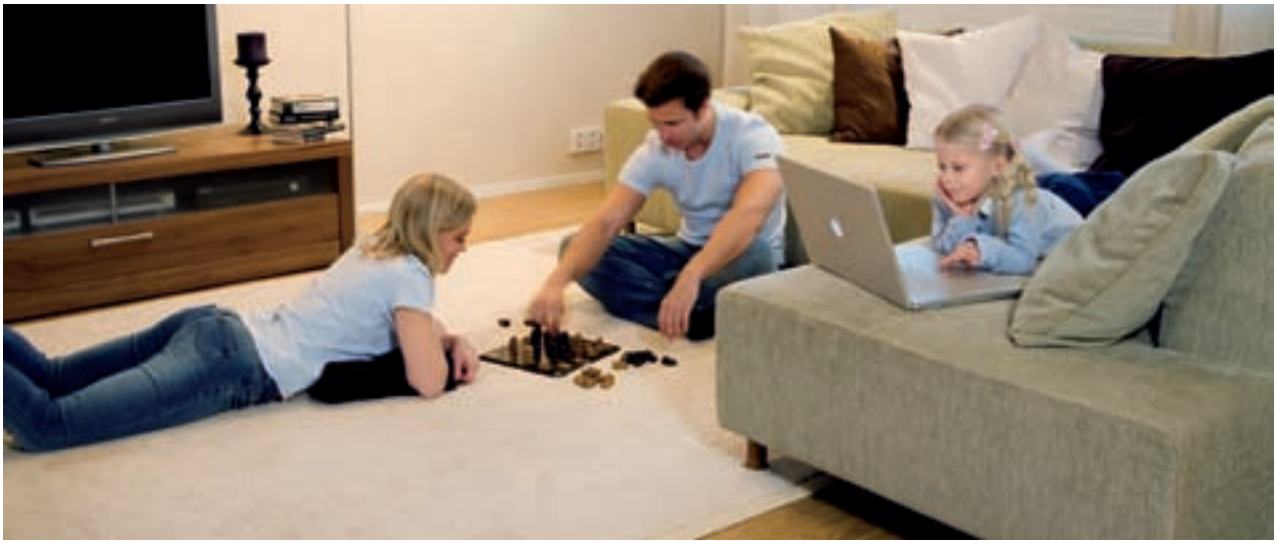
Heat loss in a new detached house with normal insulation is typically 15 to 25 W/m^3 (~ 45 to 70 W/m^2). Whereas, in low-energy houses, the heating requirement may be below 10 W/m^3.

Panel Heaters

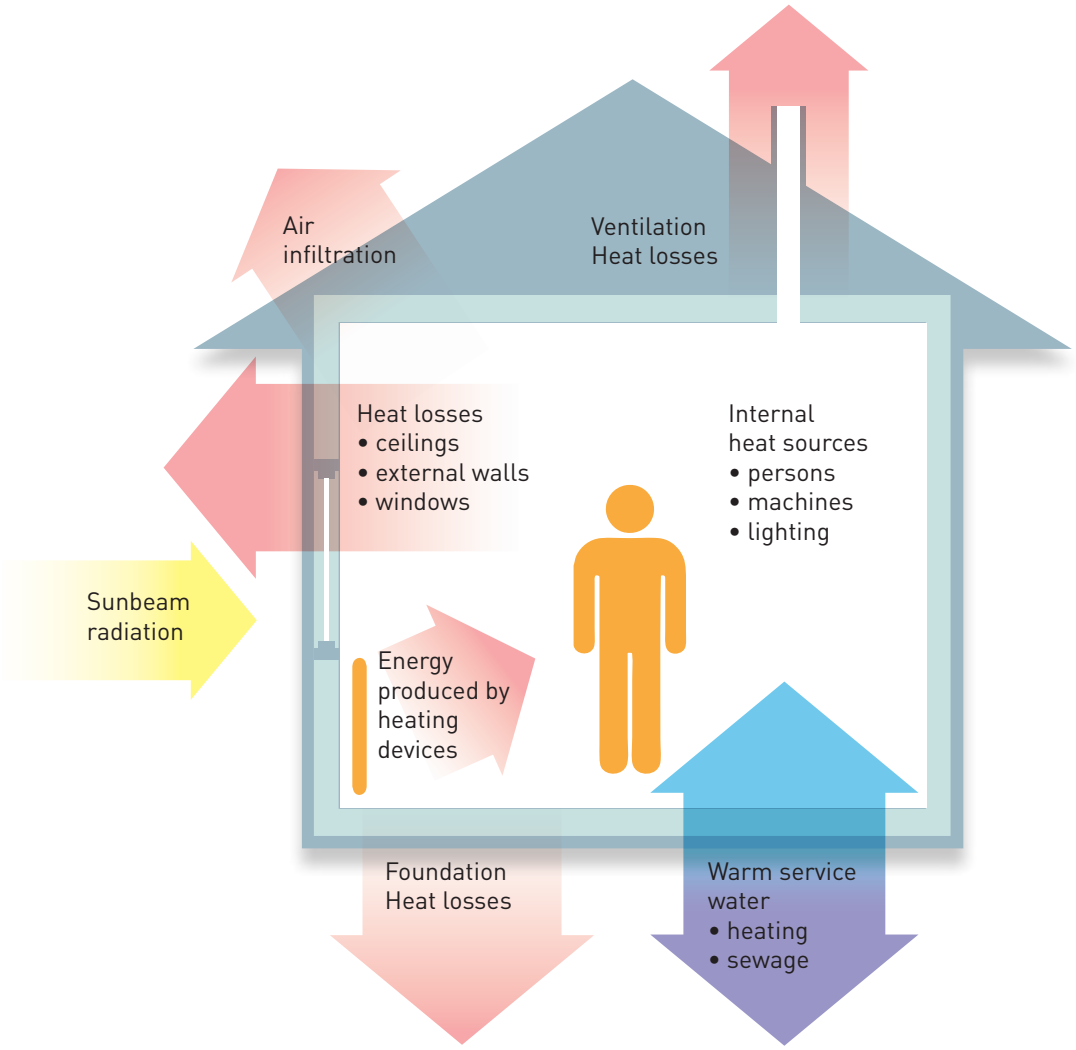
Panel heaters have nearly 100 % efficiency, so they can be chosen based on room-specific heat loss. The heater's width should, however, be close to the width of the window.

Underfloor Heating

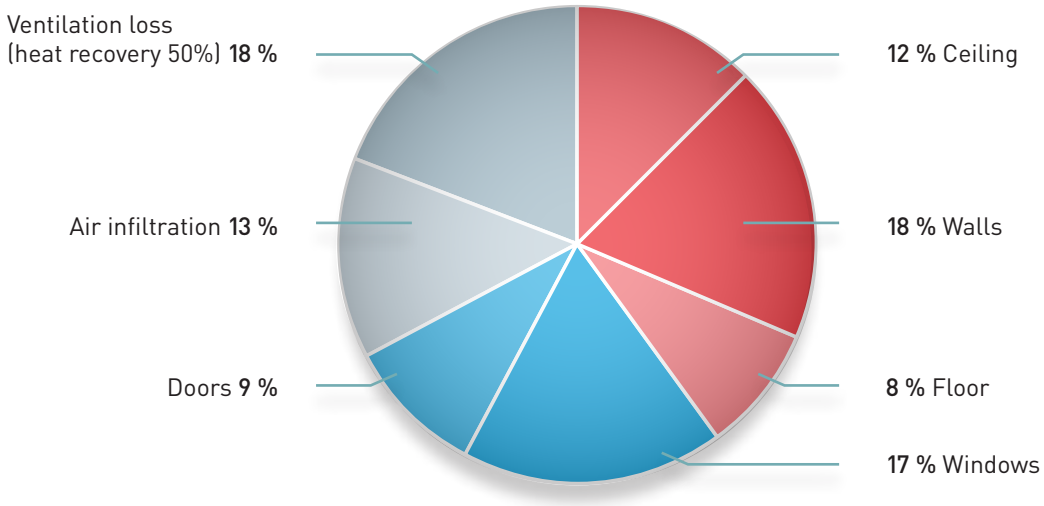
In addition to heat loss, suitable installation spacing must be taken into consideration when designing underfloor heating. The recommended installation power for continuously operating underfloor heating is around 70 to 100 W/m^2 for concrete floors and 70 to 80 W/m^2 for wooden and plasterboard floors. The cable type used for concrete floors has a power-per-meter rating of 20 W/m. In wooden and plasterboard floors, and in spaces with very low heat loss, 10 W/m cable can also be used. When designing underfloor heating, you should check whether sufficient heating power is conducted from the floor to the room without unpleasant rises in floor surface temperature (conducted power around 10 W/m^2 K). In order to guarantee sufficient power, the installation area of underfloor heating should be around 80 to 90 % of the room's surface area.



Heat losses and heat sources in buildings



The heat loss distribution of the building



Heating control and adjustment

Fast responding heating control is important for both living comfort and energy efficiency. The most common control requirements are temperature according to room usage and purpose, and the possibility to reduce temperature when away.

Controlling continuous heating

Continuous heating systems are usually non storage-based. Heating can be planned to respond quickly to changing needs by using thermostats or other control systems. Continuous heating of a concrete floor is controlled, depending on the room, either solely by floor or as a combination of floor and room temperature. With highly conductive flooring materials such as clinker, the floor temperature can be the deciding factor. The speed and accuracy of underfloor heating depends on the structure: Slab thickness and flooring material.

Control systems

Control systems make it possible to adjust different heating methods using the same devices (e.g. combined floor and panel heating). This also enables adjusting of the storage heating according to the outside temperature. Nowadays, control systems can be remotely operated e.g. by SMS-messages or through the Internet.

Heating method	Control method	Features
Panel heaters	Heater specific thermostat	• Even room temperature • Fast response time to the heating requirements • Available as master or slave heaters • Temperature reduction control can be controlled with any phase (230 V)
Underfloor heating	Underfloor heating thermostat	• Floor temperature is controlled by the floor sensor • Floor temperature can be set according to heating requirements • Temperature reduction control can be controlled with any phase (230 V)
Underfloor heating	Combination thermostat	• Floor surface temperature can be limited • Heating according to air temperature • Floor temperature changes according to heating requirements • Temperature reduction control can be controlled with any phase (230 V)

Controlling and adjusting panel heaters

Panel heaters are controlled by heater specific thermostats – electronic or mechanical – often with a built-in temperature reduction function. The reduction function is available in panel heaters with electronic thermostats and is driven by a separate home/away switch or by a control system. The function can be fixed (5 °C) or adjustable (2–20 °C) depending on the panel heater type. Temperature reduction can be controlled with any phase (230 V).

Electronic thermostats are accurate and silent, which makes them ideal for living rooms and bedrooms. Mechanical thermostats are less expensive and better withstand network disturbances. They are used in locations affected by severe weather (thunderstorms) or a low quality electricity supply. When using mechanical thermostats, a slight sound will be heard when the heating is switched on or off.

Controlling and adjusting underfloor heating

Underfloor heating is a stabile heating method. The heating power of underfloor heating is directly relative to the temperature difference between the floor and the air. The bigger the difference, the greater the transferred heat. Underfloor heating is controlled either by a underfloor or combination thermostat. The choice is based on the usage of underfloor heating and the calculation of power losses as well as comfortability.

The following questions will help in choosing the right thermostat:

- Is underfloor or ceiling heating used?
- Do the flooring materials used (wood, parquet or laminate) require a thermostat with temperature limitation?
- How much power (W) should be controlled by one device?
- What are the room temperature stability requirements?
- What is the best cost-benefit ratio, a normal underfloor heating thermostat (ECO10) or a dual-mode (ECO16)?
- What is the purpose of the room?
- What should be the design and colour of the thermostat?

Product key for thermostats

E	**E**nsto
CO	**CO**ntrol
10	**10** A (2300 W)
16	**16** A (3600 W)
F	**F**loor
R	**R**oom
FR	**F**loor/**R**oom combination
J	**J**ussi
E	**E**lko
I	**I**mpressivo
D	**DIN** rail mounting

PANEL HEATERS

– A cost efficient and reliable solution

Heaters are a common solution for the heating of different areas because they are easy to install and replace with new ones. A comfortable level of temperature is reached quickly as most of the energy consumed is transformed into heat. Heaters are suitable for new buildings, renovations, and as an additional heat source.

Common features

All Ensto heaters are safe because of low surface temperature and automatic overheating protection. Heaters with electronic thermostats are accurate, energy efficient, silent and give excellent comfort thanks to even heat distribution. All heaters are made of hot-dip zinc coated steel so they do not rust. Heaters are available in different lengths and heights.

All heaters are double insulated class II devices. The heaters are easily controlled with an on/off switch and a numbered temperature scale. Heaters respond quickly to temperature changes caused by other heat sources and have good efficiency, because they primarily heat room air instead of house structures.

Heaters Beta (RAL9010) and Tupa (RAL9002)

Beta-heaters

Beta heaters can be installed in dry and damp areas (IP21). The heaters also have a low surface temperature because of the X-shaped heating element. The heaters can be used as wall mounted or free standing (with separate feet).

Beta M

- Mechanical thermostat and plug
- Accurate temperature control with +/-0.5 °C thermostat accuracy
- Mechanical thermostat is better to withstand network disturbances

Beta E

- Electronic thermostat
- Connection box or plug
- Temperature reduction (5 °C) in models with a connection box
- Extremely accurate and completely silent electronic thermostat, accuracy +/-0.1 °C
- Fast reaction to temperature changes increases comfort and ensures an even room temperature
- The surface temperature of the heater is low because of the electronic thermostat

Panel heater with plug

Free standing heater with separate feet

Tupa-heaters

Tupa-heaters can be installed in dry and damp areas (IP20, IP24). The product family consists of Taso, Lista, Peta and Roti heaters.

- Connection box
- The heater can be installed also by using a separate connection cable kit (plug)
- Extremely accurate and completely silent electronic thermostat, accuracy +/-0.1 °C
- Adjustable temperature reduction control between 2-20 °C from the set value
- Can be controlled by a separate home/away switch or e.g. by a building automation system (230 V by any phase)
- Can be controlled individually with a device thermostat
- Taso and Lista heaters are available with or without a thermostat (master/slave)

TASO (IP20) Basic heater for homes and holiday homes

LISTA (IP20) A low profile heater under large windows

PETA (IP20) A cover-proofed heater with manually resetable over-heating protection e.g. for walk-in closets

ROTI (IP24) A splash-proof heater suitable for bathrooms, saunas, cellars and garages

Sizing and installation of panel heaters Beta IP21

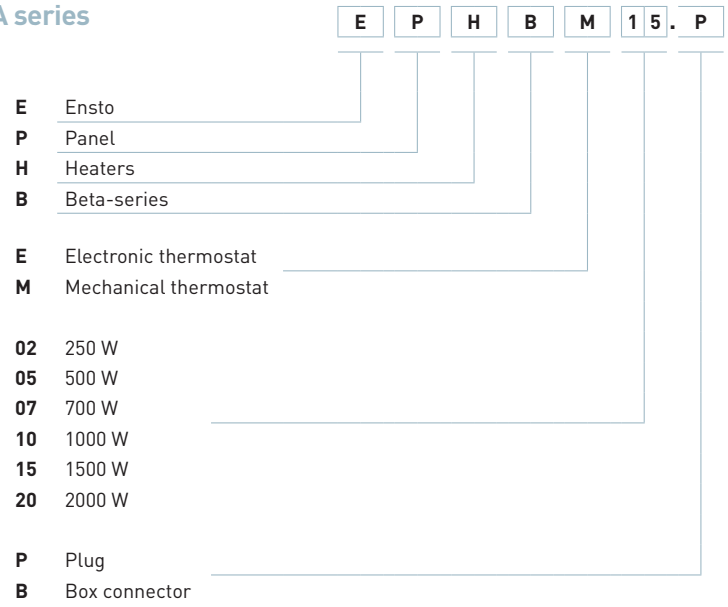
The following tables are sizing values for reference only. The room area (room height 2.5 meters) or the room volume must be known.

A rule of thumb with standard insulation is 15-35 W/m^3. For low energy houses it is 15 W/m^3 or even lower.

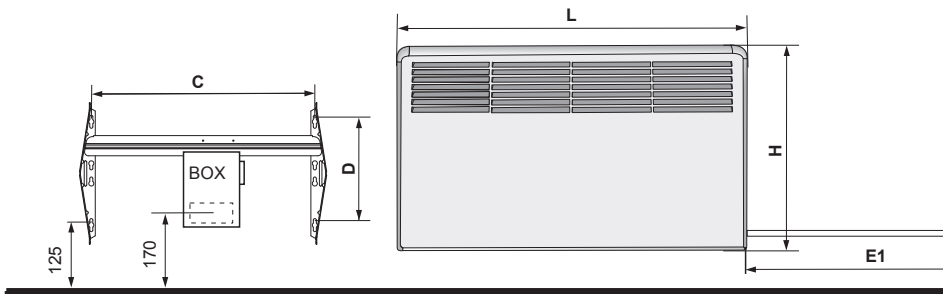
OUTPUT/W	AREA TO BE HEATED (m²) WHEN SIZING OUTPUT IS			VOLUME OF ROOM TO BE HEATED (m³)		
	15 W (m²)	25 W (m²)	35 W (m²)	15 W (m³)	25 W (m³)	35 W (m³)
250	7	4	3	17	10	7
500	13	8	6	33	20	14
750	20	12	9	50	30	21
1000	27	16	11	67	40	29
1500	40	24	17	100	60	43
2000	53	32	23	133	80	57

TYPE	P (W)	U (V)	LENGTH	HEIGHT	WALL BRACKET		PLUG
			L (mm)	H (mm)	C (mm)	D (mm)	E1 (mm)
EPHBM02/EPHBE02	250	230	451	389	300	205	1000
EPHBM05/EPHBE05	500	230	585	389	300	205	1000
EPHBM07/EPHBE07	750	230	719	389	440	205	1000
EPHBM10/EPHBE10	1000	230	853	389	440	205	1000
EPHBM15/EPHBE15	1500	230	1121	389	700	205	1800
EPHBM20/EPHBE20	2000	230	1523	389	1000	205	1800

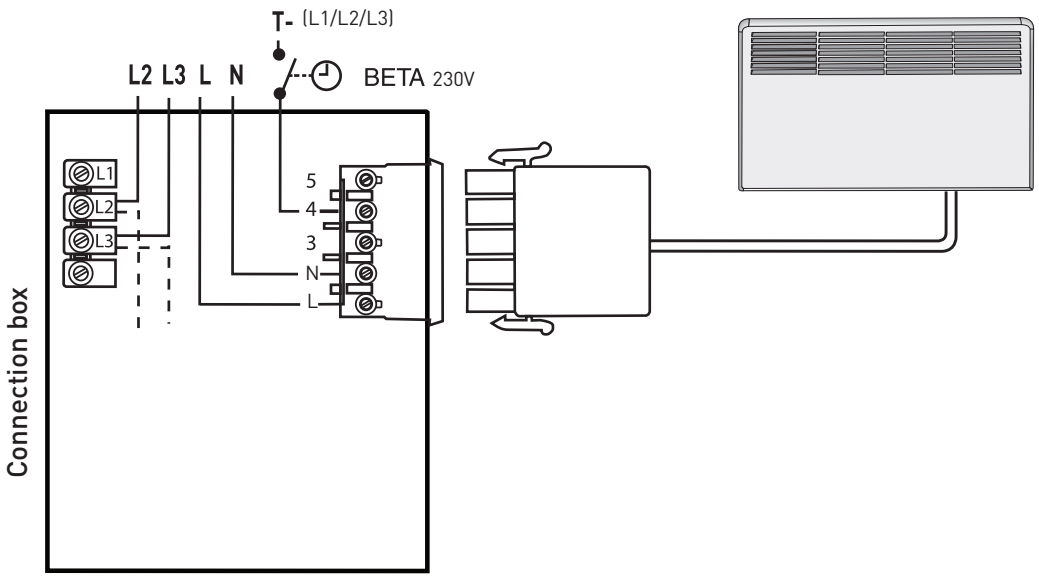
Product code key for BETA series



Sizing and installation of panel heaters Beta IP21



U(V) = 230V + 10%, -15%, 50Hz



Sizing and installation of panel heaters Taso, Lista, Roti and Peta

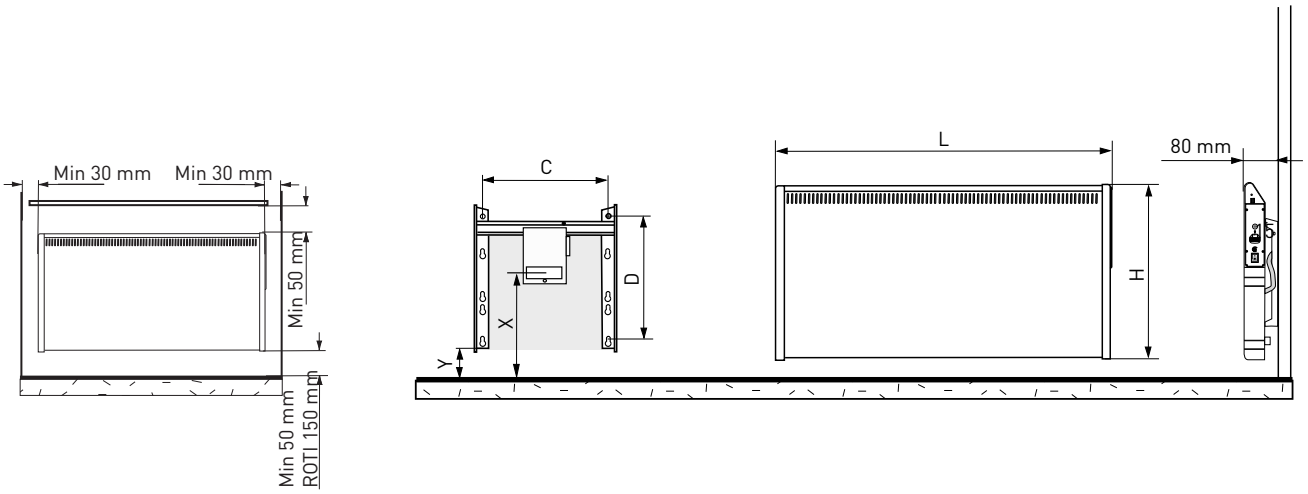
The following tables are sizing values for reference only. The room area (room height 2.5 meters) or the room volume must be known.

A rule of thumb with standard insulation is 15-35 W/m^3. For low energy houses it is 15 W/m^3 or even lower.

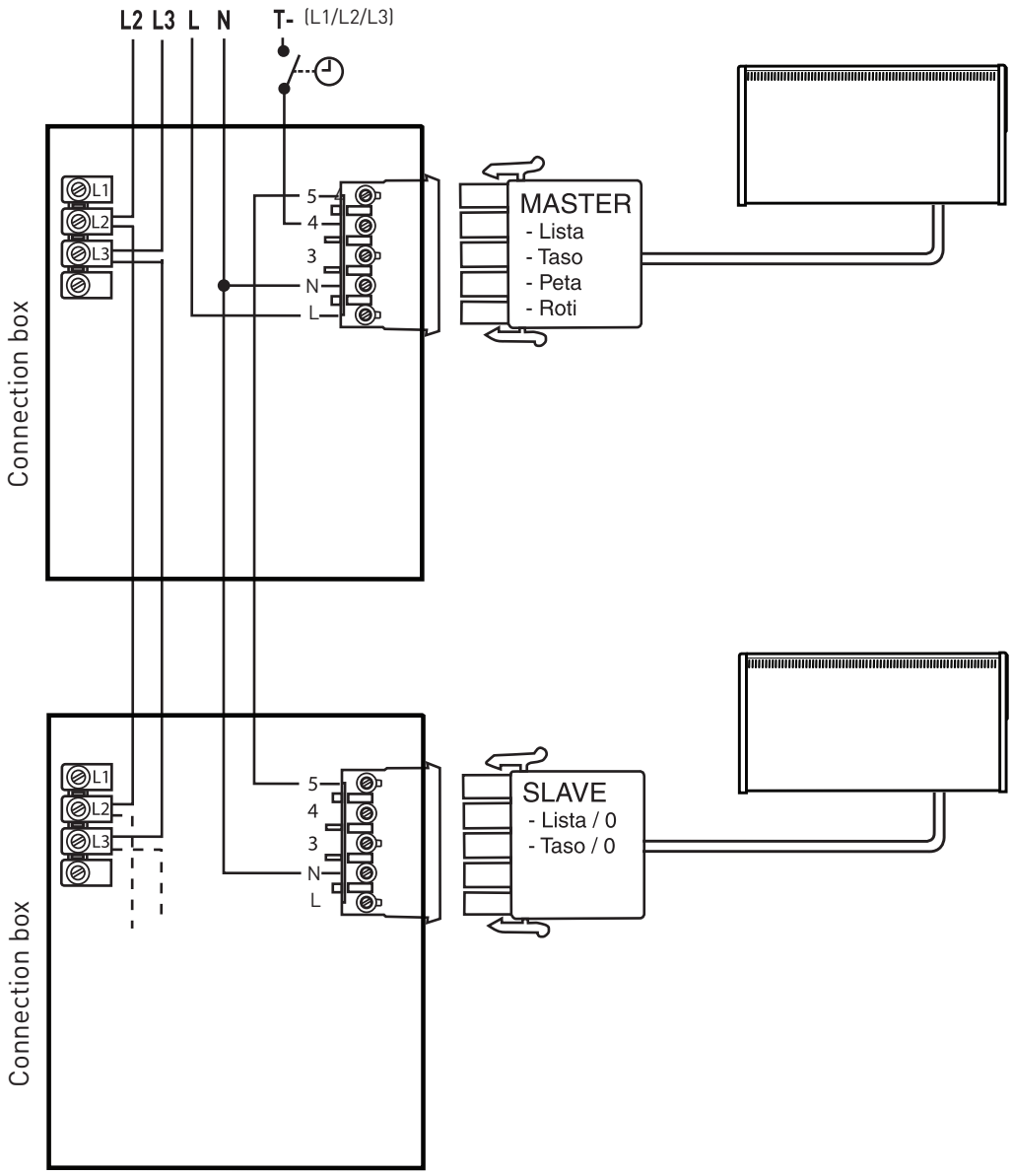
OUTPUT/W	AREA TO BE HEATED (m²) WHEN SIZING OUTPUT IS			VOLUME OF ROOM TO BE HEATED (m³)		
	15 W (m²)	25 W (m²)	35 W (m²)	15 W (m³)	25 (m³)	35 (m³)
150	4	2	2	10	6	4
200	5	3	2	13	8	6
350	9	6	4	23	14	10
500	13	8	6	33	20	14
550	15	9	6	37	22	16
700	19	11	8	47	28	20
800	21	13	9	53	32	23
900	24	14	10	60	36	26
1000	27	16	11	67	40	29
1200	32	19	14	80	48	34

TYPE	P (W)	U (V)	LENGTH	HEIGHT	WALL BRACKET				IP
			L (mm)	H (mm)	C (mm)	D (mm)	X (mm)	Y (mm)	
TASO2	200	230	300	400	100	280	75...200	70	20
TASO3	350	230	500	400	225	280	75...200	70	20
TASO5	550	230	800	400	300	280	75...200	70	20
TASO8	800	230	1100	400	600	280	75...200	70	20
TASO10	1000	230	1370	400	600	280	75...200	70	20
TASO12	1200	230	1670	400	1200	280	75...200	70	20
LISTA2	200	230	500	200	225	90	75	70	20
LISTA3	350	230	800	200	300	90	75	70	20
LISTA5	500	230	1100	200	600	90	75	70	20
LISTA7	700	230	1370	200	600	90	75	70	20
LISTA9	900	230	1670	200	1200	90	75	70	20
ROTI1	150	230	300	400	100	280	200...270	170	24
ROTI3	350	230	500	400	225	280	200...270	170	24
ROTI5	500	230	810	400	300	280	200...270	170	24
ROTI7	700	230	1100	400	600	280	200...270	170	24
PETA2	200	230	500	200	225	90	75	70	20
PETA3	350	230	500	400	225	280	75	70	20

Sizing and installation of panel heaters Taso, Lista, Roti and Peta



U(V) = 230V + 10%, -15%, 50Hz



UNDERFLOOR HEATING

– Comfortable and evenly distributed warmth

Underfloor heating is suitable for almost all floor structures and is an excellent solution for new buildings and renovations. Underfloor heating is invisible and has no effect on interior design. A warm floor always feels pleasant.

Solutions for all needs

Underfloor heating is suitable for most floor structures and flooring materials as a sole or combined heating solution. Heat storing and the implementation can be either direct, indirect or a combination of both. Underfloor heating and efficient ventilation in damp areas helps reduce the risk of moisture damage. As underfloor heating provides a higher operative temperature, it is possible to lower the room temperature by 1–2 °C without compromising comfort. This will save 5–10 % in heating costs.

ThinKit with thermostat

Tassu and Tassu S underfloor heating cables

Tassu and Tassu S are maintenance-free products for long-term solutions for dry and damp areas. Tassu cable is available as 20 W/m and is used primarily for new concrete floor structures.

Tassu S cable is available as 10 W/m and is used for renovations and together with wooden floor structures. Both Tassu-cables are preterminated twin conductor cables with a PVC-sheath.

Tassu

Thin solutions for renovations and thin floor structures

Ensto thin solutions, ThinMat and ThinKit, are easy and fast to install directly on top of an existing floor.

ThinKit

- Ideal for small and cramped areas
- Cable must always lay on top of a fireproof material
- Round cable does not twist when fastened
- Installations must always be covered with levelling compound

Cable diameter 4.2 mm

ThinMat

- Can also be installed on top of wooden floor surfaces (e.g. chipboard and plywood)
- ThinMat 100 W/m² is sufficient for comfort heating in dry and damp indoor conditions. Whereas, ThinMat 160 W/m² is used for structures with less insulation and when concrete, stone or clinker is used as a flooring material
- Wooden surface material can not be used with ThinMat 160 W/m²
- The cable is totally inside a strongly adhesive mesh that prevents the cable from floating during casting
- Standard width 50 cm
- Installations must always be covered with levelling compound

The low height of the products minimizes additional increase in floor height. Products are easy and fast to install with low total costs and are suitable for concrete, stone and clinker and, with certain limitations, for wood, laminate and parquet.

Cable diameter 3.4 mm

Designing underfloor heating

Basic planning assumptions:

1. Adequate heating power throughout the cold season

- Power of constant underfloor heating cables is > 1.2 x thermal loss of the calculated area
- Power of partially storing underfloor heating cables is > 1.4 x the thermal loss of the calculated area

2. Floor surface temperature should feel comfortable in use

- Even heat across the living quarters, cable laying distance 10–30 cm
- Adequate floor temperature during warm seasons – not too hot during cold seasons

3. Floor temperature must not damage the flooring materials

- The right choice of flooring materials
- The right choice of temperature according to the flooring material

4. Adequate response speed to changing heating needs

- Concrete thickness 80–100 mm

Selecting heating cables

Choose the right cable type, power output and installation method to suit the flooring material and structure. See the "Sizing and selection chart". Cable installation depth, surfacing and distance between two cables can also affect the system. Local regulations must be taken into account.

Installing underfloor heating to an existing building

The floor structure must be first inspected to determine the best installation method and heating solution. Adding underfloor heating is easy when the floor surfaces are being replaced or the whole floor construction is opened in order to improve insulation. In damp areas (new floor construction), underfloor heating cable is always laid under a waterproofing membrane.
The laying distance between heating cables should be 10–20 cm to provide an even surface temperature.

Sizing

Based on the selection of the desired power/m², the installation spacing for Tassu, Tassu S and ThinKit cables can be found from the tables below.
Installation spacing can also be calculated based on the following formula:

$$\text{Installation spacing} = \frac{\text{Surface area/m}^2}{\text{Cable length/m}}$$

Example:
The floor area to be heated is 11 m² and the selected cable is the Tassu12 with a length of 54 meters. The installation spacing is:

$$\text{Installation spacing} = \frac{11\ \text{m}^2}{54\ \text{m}} = 0.2\ \text{m} = 20\ \text{cm}$$

Power per surface area is calculated using the following formula:

$$\text{Power/W/m}^2 = \frac{\text{Cable power/W}}{\text{Floor surface area/m}^2}$$

$$\text{Power/W/m}^2 = \frac{1160\ \text{W}}{11\ \text{m}^2} = 105.4\ \text{W/m}^2$$

Tassu (20 W/m)

Bending radius min. 40 mm

Power per area	Installation spacing/cm
60	33
70	29
80	25
90	22
100	20
110	18
120	17
130	15
140	14
150	13

TassuS (10W/m)

Bending radius 40 mm

Power per area	Installation spacing/cm
60	17
70	14
80	13
90	11
100	10
110	9

ThinKit (10 W/m)

Bending radius 25 mm

Power per area	Installation spacing/cm
60	17
70	14
80	13
90	11
100	10
110	9
120	8.5
130	7.5
140	7
150	6.5

Sizing and selection chart

Floor material	Heating cable				
	Tassu	Tassu S	ThinKit	ThinMat	
	20 W/m	10 W/m	10 W/m	100 W/m²	160 W/m²
New construction					
Concrete					
Low heat-loss space	••	•••	•	•	◦
Concrete floor, single cast	•••	••	◦	◦	◦
Concrete floor, doublecast	••	•••	•••	•••	•
Wood	◦	•••	◦	◦	◦
Plaster board	◦	•••	•••	◦	◦
Renovation					
Concrete					
Concrete/Parquet	◦	••	•••	••	◦
Concrete/Tile	•	••	•••	•••	•••
Plaster board	•	•••	•••	••	◦
Wood	◦	•••	◦	◦	◦
Chipboard and Plywood/Tile	◦	◦	◦	•••	•••

••• recommended •• suitable • can be used ◦ not suitable

Electric partial storage heating

By using lower priced electricity (night time), heat can be stored in the concrete slab. This stored heat will transfer into the room during the day.

The concrete slab is heated with heating cables. The heat is transferred to the room creating a comfortable feeling. The heating characteristics are affected by the thickness of the concrete slab, cable installation depth and flooring material.

Ensto heating cables are suitable for both single and two stage casting concrete floors. Storage heating is mostly used in rooms with high heat resistance floor surfaces such as wood, vinyl mats and fitted carpets. Ensure sufficient concrete slab mass for partial storage underfloor heating. Consider if complementary heating is required. Tassu cable is ideal when using partial storage heating. Output power should be 80–150 W/m², cable spacing 15–25 cm and installation depth 5–10 cm.

Correct temperatures

To obtain maximum cosiness and comfort, the following floor surface temperatures are recommended:

Wood and cork surface	23–27 °C
Vinyl mat	26–28 °C
Ceramic tiles or concrete surface	26–28 °C
Laminate	23–27 °C

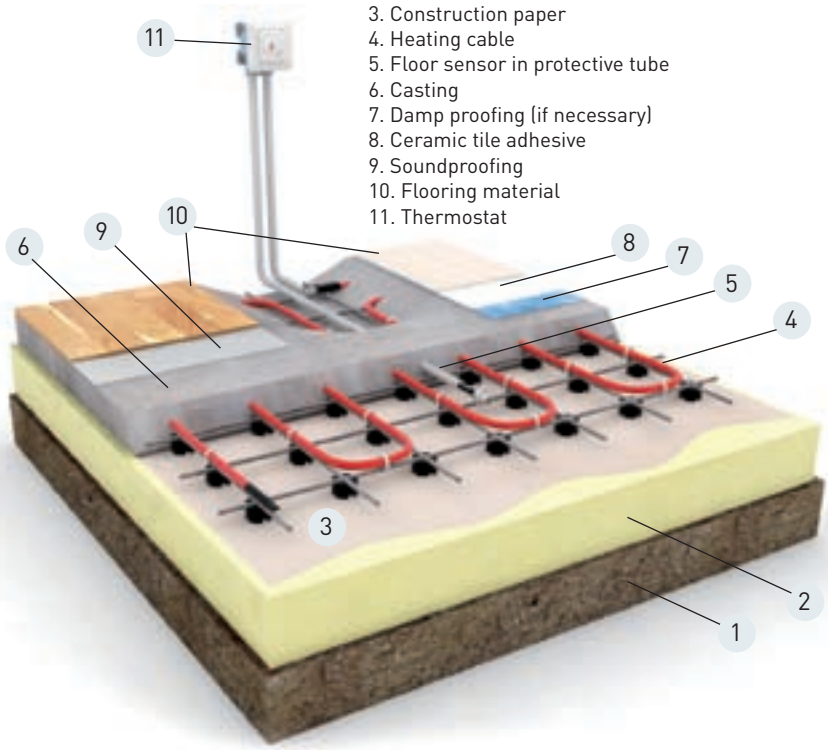
The maximum floor temperature can be limited by using an ECO16FR thermostat. If you have doubts concerning the temperatures, please contact the manufacturer of the flooring material.

Note! Thick wood flooring is a good insulation material.

Heating in concrete structures

1-stage casting

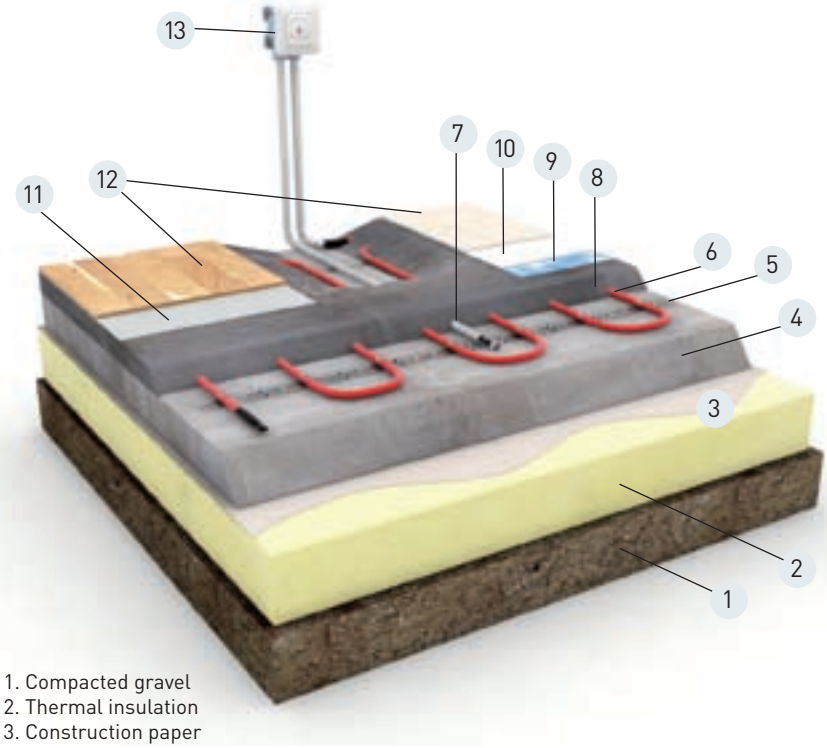
- With 1-stage casting, attach the heating cable directly to the reinforcement mesh
- Be careful not to damage the cable or change the laying distance
- It is recommended that a layer of insulation is placed under the underfloor heating structure to reflect the heat flow upwards into the room
- During casting, you can make sure the full length of the cable is installed in a medium of equal thermal conductivity, by gently lifting the mesh and the cable to avoid possible air pockets
- Tassu cable is ideal for the this floor construction. For well-insulated low-energy houses also Tassu S can be used



1. Compacted gravel
2. Thermal insulation
3. Construction paper
4. Heating cable
5. Floor sensor in protective tube
6. Casting
7. Damp proofing (if necessary)
8. Ceramic tile adhesive
9. Soundproofing
10. Flooring material
11. Thermostat

2-stage casting

- Recommended for concrete floors of a thickness over 100 mm
- The reinforced steel grid and the electrical conduit pipes can be installed within the first casting layer (> 6 cm)
- Lay the cable on top of the first cast, after it has dried
- Secure the heating cable in place with fixing strips XBC1230 (cut to required length) attached to the concrete. The sensor of the thermostat must be installed in a protection tube placed between the heating cables
- The thickness of the second cast depends on the desired storage characteristics and the flooring material
- With tile and stone floors, place the cables deeper for even surface temperature
- With wood flooring, the temperature will be consistent even when the cable is closer to the surface
- All Ensto floor heating cables can be used for the this construction

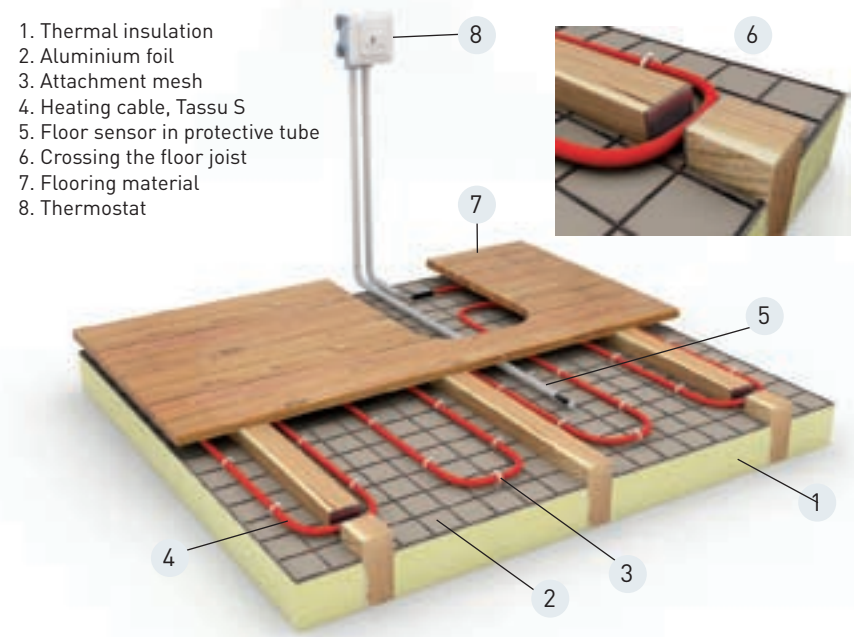


1. Compacted gravel
2. Thermal insulation
3. Construction paper
4. First casting
5. Fixing strip
6. Heating cable
7. Floor sensor in protective tube
8. Second casting
9. Damp proofing (if necessary)
10. Ceramic tile adhesive
11. Soundproofing
12. Flooring material
13. Thermostat

Structures are described in accordance with the Finnish installation method

Heating in wooden structures

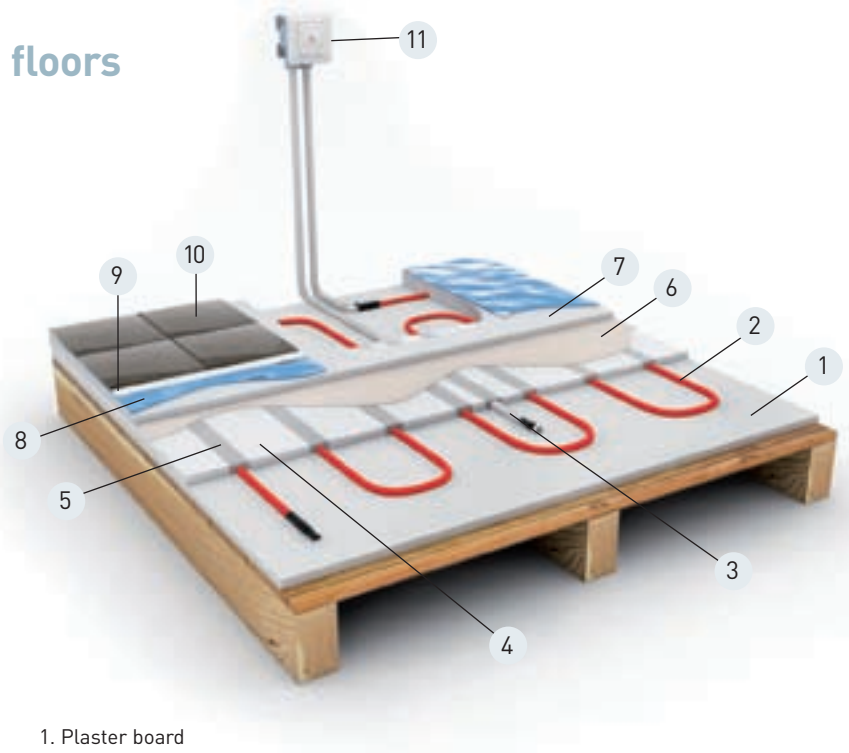
- Although they have very limited heat storage capacity, underfloor heating works well with wooden floors
- Suitable for base and intermediate floors
- Use only a heating cable that has the right structure and power (10 W/m) for your installation method. The maximum heat load with materials such as wood, parquet and laminate is 80 W/m^2
- Only Tassu S cable can be used
- The heating cable is attached to a steel mesh situated between the insulation and the flooring material. The sensor of the thermostat must be installed in a protection tube at the floor joint/ floor material connection point without touching the cables
- The mesh prevents the heating cable from sinking into the insulation and, therefore, prevents the cable from overheating



- You must leave a gap of 30 mm between the cable and flooring material and a similar space between the cable and any flammable materials such as wood
- When installing the cable across the floor joists, cut out a notch and place a protective metal plate where the cable crosses the runner

Heating in plasterboard floors

- Place strips of plasterboard on the top of the extra strong plasterboard that covers the whole floor. The width of the strips is related to the heating power needed (W/m^2)
- A typical output is 70–100 W/m^2 corresponding to a cable spacing of between 10–14 cm
- Carefully install a low-power (10 W/m) heating cable between the strips. The sensor of the thermostat must be installed in a protection tube covered with plaster between the heating cables
- Fill in the grooves with mineral-based plaster
- Place an extra strong plasterboard layer on top of everything
- Tassu S and ThinKit cables are recommended to this construction.
- Local building regulations must be followed



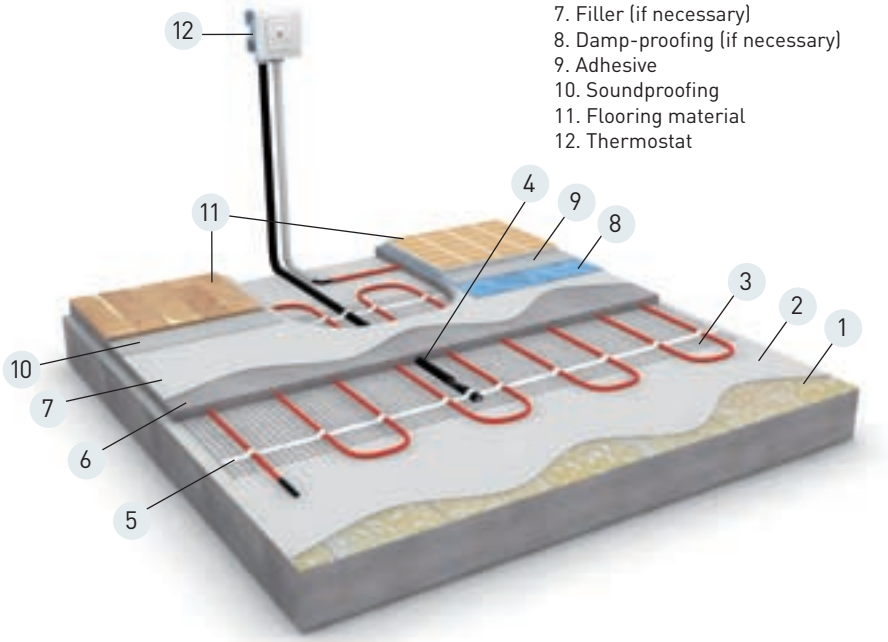
1. Plaster board
2. Heating cable
3. Floor sensor in protective tube
4. Plasterboard strips
5. Grooves for heating cable filled with mineral based filler
6. Filler (if necessary)
7. Extra-hard plasterboard
8. Damp-proofing (if necessary)
9. Ceramic tile adhesive
10. Flooring material
11. Thermostat

Structures are described in accordance with the Finnish installation method

Heating for renovations and thin floor constructions

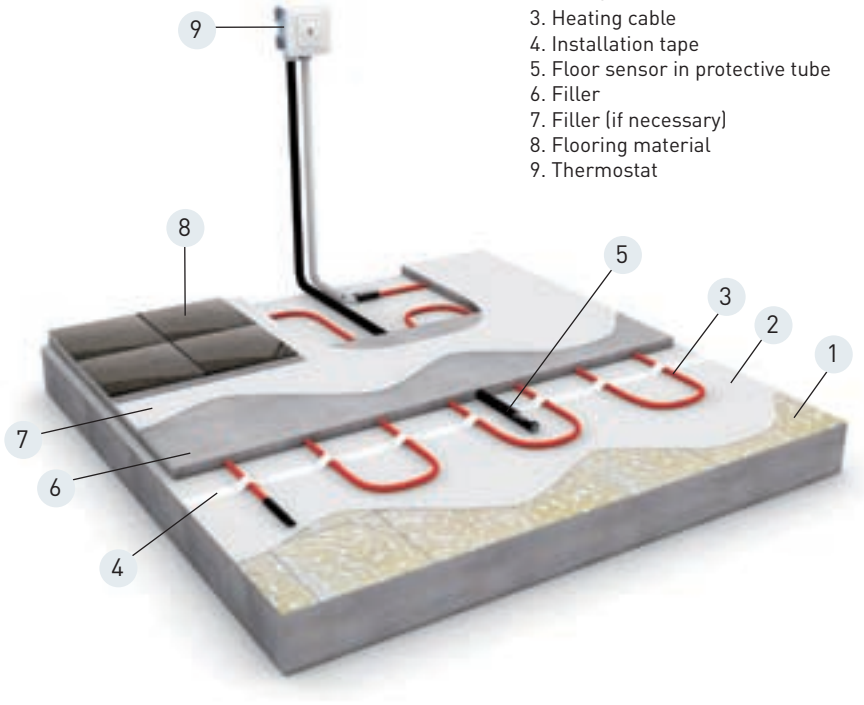
- Heating mats can be installed directly on the top of the existing floor surface. No glue is needed because the mat is attached easily to the floor surface with a self adhesive mesh. The laying direction can be varied by just cutting the mesh and bending the cable. The sensor of the thermostat must be installed in a protection tube between the heating cables without it touching them. Cover the mat with filler and install the actual flooring material after the filler has dried
- ThinMat can also be installed on plywood and similar materials

1. Old floor
2. Primer
3. Heating mat
4. Floor sensor in protective tube
5. Installation tape
6. Filler
7. Filler (if necessary)
8. Damp-proofing (if necessary)
9. Adhesive
10. Soundproofing
11. Flooring material
12. Thermostat



- ThinKit heating cables can be installed directly on top of the existing fireproof floor surface (not on wood). Cables can be installed with tape, fixing strips or glue. The sensor of the thermostat must be installed in a protection tube between the heating cables without touching them. Cover the cables with filler and install the actual flooring material after the filler has dried

1. Old floor
2. Primer
3. Heating cable
4. Installation tape
5. Floor sensor in protective tube
6. Filler
7. Filler (if necessary)
8. Flooring material
9. Thermostat



ThinKit and ThinMat are designed especially for renovations where the floor height is crucial. If the floor height does not limit the installation, then Tassu S can be used.

Structures are described in accordance with the Finnish installation method

Underfloor heating checklist

- The cable is not installed under closets or similar fixtures
- The cable laying distance is within given specifications
- The cable bending radius has to be a minimum of 40 mm for Tassu-cables and a minimum of 25 mm for ThinKit-cables
- Cables must not touch each other
- The cable lies fully in a homogenously heat conductive substance across its length
- Do not install cable inside insulation material to prevent the cable from overheating
- The installation surface must be clean and free of harmful particles
- The cable must not be fed through expansion joints or in areas with a risk of slab breaking or overheating (e.g. the minimum distance to a sauna stove or fireplace is 0.5 m)
- Flooring material must be suitable for underfloor heating – ask the manufacturer of the flooring material
- Cable element lengths intended for underfloor heating are not allowed to be shortened
- A 30 mA residual current circuit breaker (RCCB) must be used in all areas
- The bending radius of the thermostat sensor protection pipe must be such that the sensor element can be replaced, if necessary. The sensor must be installed between the heating cables without touching them
- The underfloor heating cable installation spacing should be smaller close to windows, doors and areas where heat loss is greatest
- Concrete takes approximately 30 days to dry, while levelling plaster takes approximately one week. Always follow the instructions given by the concrete manufacturers concerning the drying time

THERMOSTATS

- Energy savings and comfort

By using reliable and accurate thermostats, the temperature in each room stays even and comfortable. At the same time, energy and money can be saved. Stylish and easy-to-use Ensto thermostats are available in the Jussi and Impressivo series. Screwless connectors make connecting fast and reliable.

Underfloor heating thermostats

Underfloor heating thermostats are used together with electrical underfloor heating cables and they control the heating system through a sensor placed in the floor construction. Underfloor heating thermostats are most suitable when the floor surface material is ceramic tile. The thermostat can be located outside the heated area – only the floor sensor must be inside the heated area. All underfloor heating thermostats have a fixed temperature reduction function and the hysteresis of the floor temperature is ± 0.5 °C.
The ECO10F thermostat is used for mounting flush in the wall. When installing the thermostat in damp areas, the ECOAC44 protective casing must be used (IP44). Screwless connectors make connecting fast and reliable.
The adjustment range of the temperature can be limited using the adjustment knob limiters.
The ECO16FD thermostat is used for DIN-rail mounting. The floor sensor can be extended by up to 25 meters.

DIN-rail mounting

Impressivo

Jussi

Ceiling heating thermostats ECO10R

The flush mounted ECO10R room thermostat is used to control ceiling heating. The thermostat responds fast and accurately to room temperature variations providing an even temperature.
The thermostat is equipped with a built-in temperature sensor.
The adjustment range of the temperature can be limited with the limiters of the adjustment knob.

Jussi

Combination thermostats for underfloor and ceiling heating ECO16FR

The flush mounted ECO16FR thermostat is used for controlling either underfloor or ceiling heating. Underfloor heating can be controlled based on floor temperature (floor mode) or room temperature (room mode).
In combination mode, the thermostat uses floor and room temperatures to control the heating. It is also possible to set the maximum value for the floor surface temperature to protect sensitive floor surface materials such as wood, parquet or laminate.
Ceiling heating is controlled based only on room temperature.
The adjustment range of the temperature can be limited by using the adjustment knob limiters.
The combination thermostat is the best solution for bedrooms and living rooms because of the fast and accurate response to temperature variations. When the floor surface material is ceramic tile, it is recommended to use a combination thermostat in floor mode.

Impressivo

Jussi

Thermostats for flush and surface mounting

Ensto thermostats are available in Jussi and the Impressivo series. The Jussi serie is white and has timeless design. The Impressivo serie is cost-efficient and easy to install.

Impressivo thermostats are delivered in parts and it is possible to choose between different colours and cover frames.

Jussi for flush mounting

Everything needed for installation and use in one package

Jussi for surface mounting

Jussi-termostats can be surface mounted by using surface mounting box

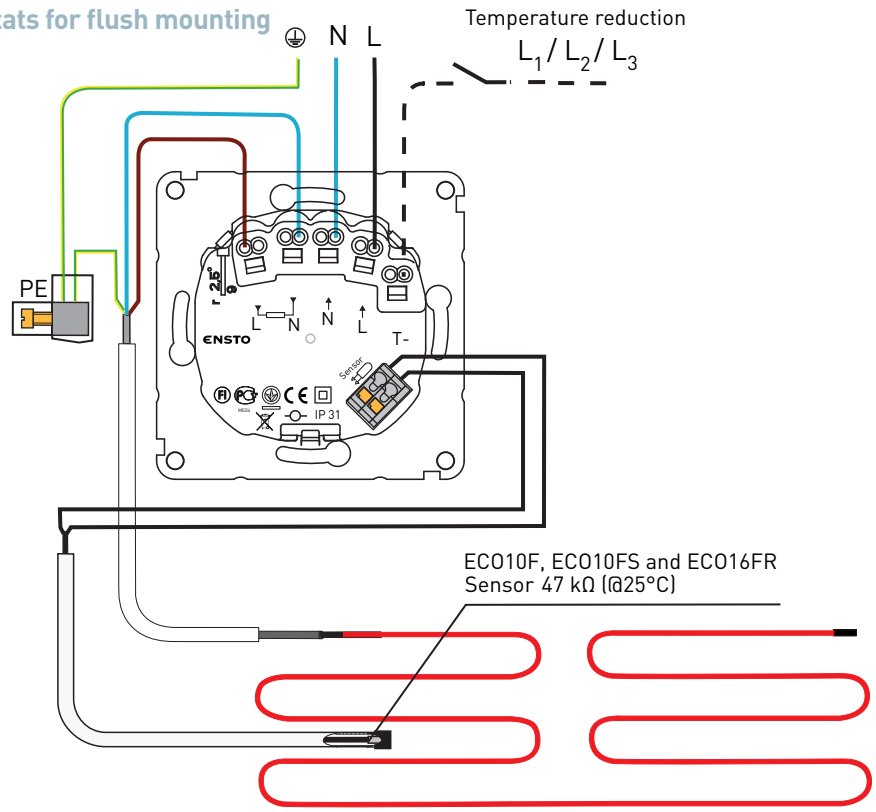
Impressivo for flush mounting

Insert + Cover frame + Centre plate = Product ready for installation and use

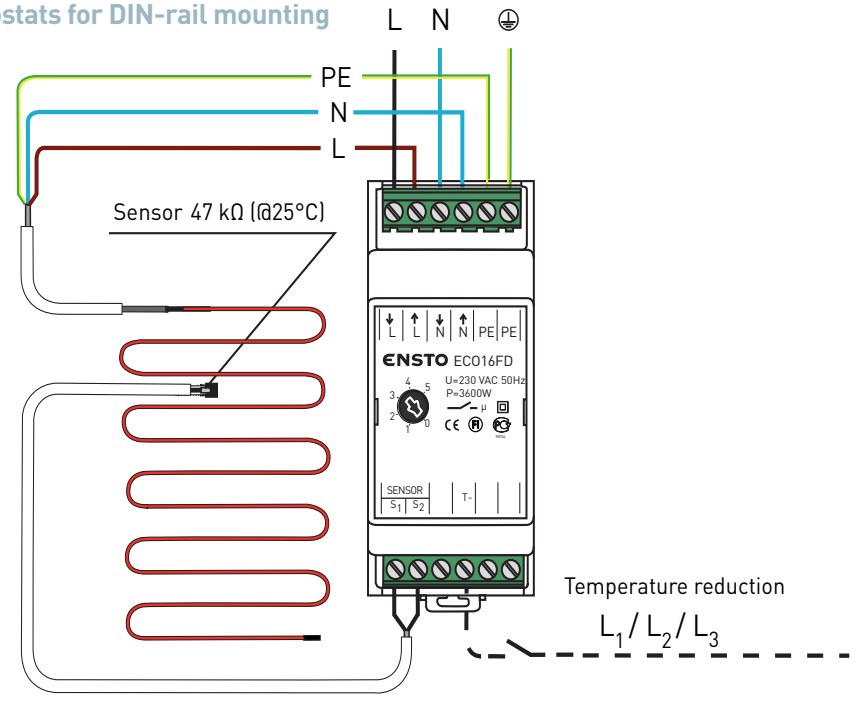
Impressivo colours: white, aluminium, grey and anthracite

Connection diagrams for thermostats

ECO thermostats for flush mounting



ECO16FD thermostats for DIN-rail mounting



HEATING SOLUTIONS

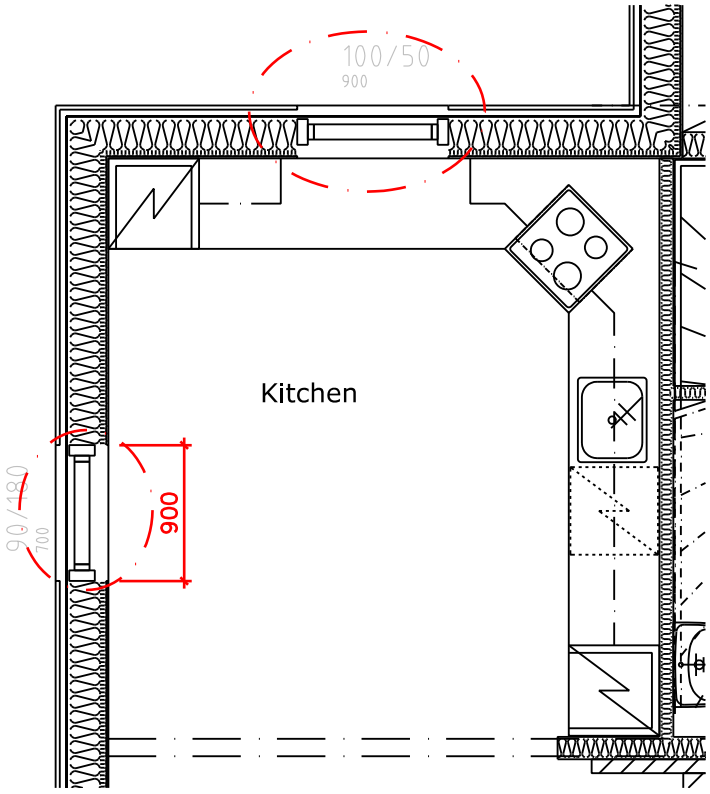
– Two different solutions for the same building

A heating system is a long term investment and its reliability is a major comfort factor. To build a heating system, you need to calculate the heating power requirements for each room. Ensto heating solutions in combination with good insulation brings a permanent reduction in energy consumption.

Planning a heating system with panel heaters

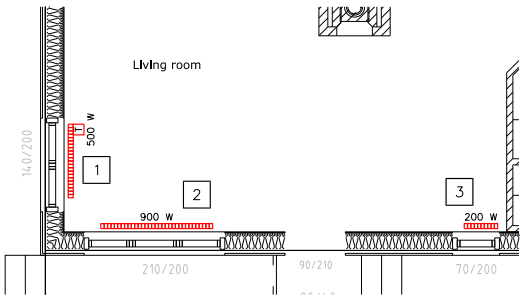
- Calculating heat losses for each room
- Checking all window sizes

There should not be any barrier above Tupa-heater which could prevent rising of heat (needed holes or notch on the table board).



Heaters in kitchen

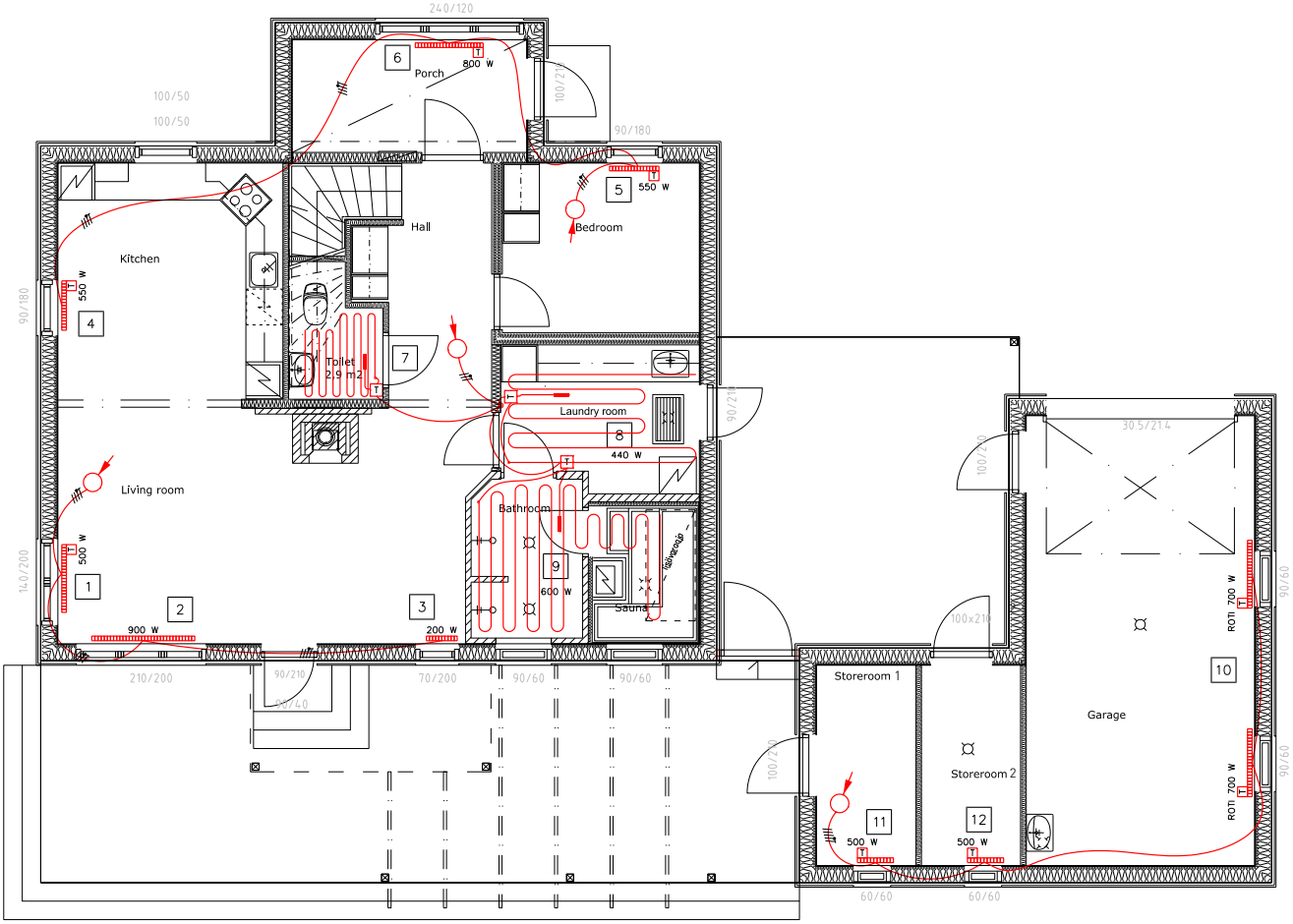
If there are many Tupa-heaters in the same room, you can use one thermostat controlled heater that drives connected slave heaters. Remember to check heater type specific highest allowed power.



Master-slave connection with Tupa-panel heaters

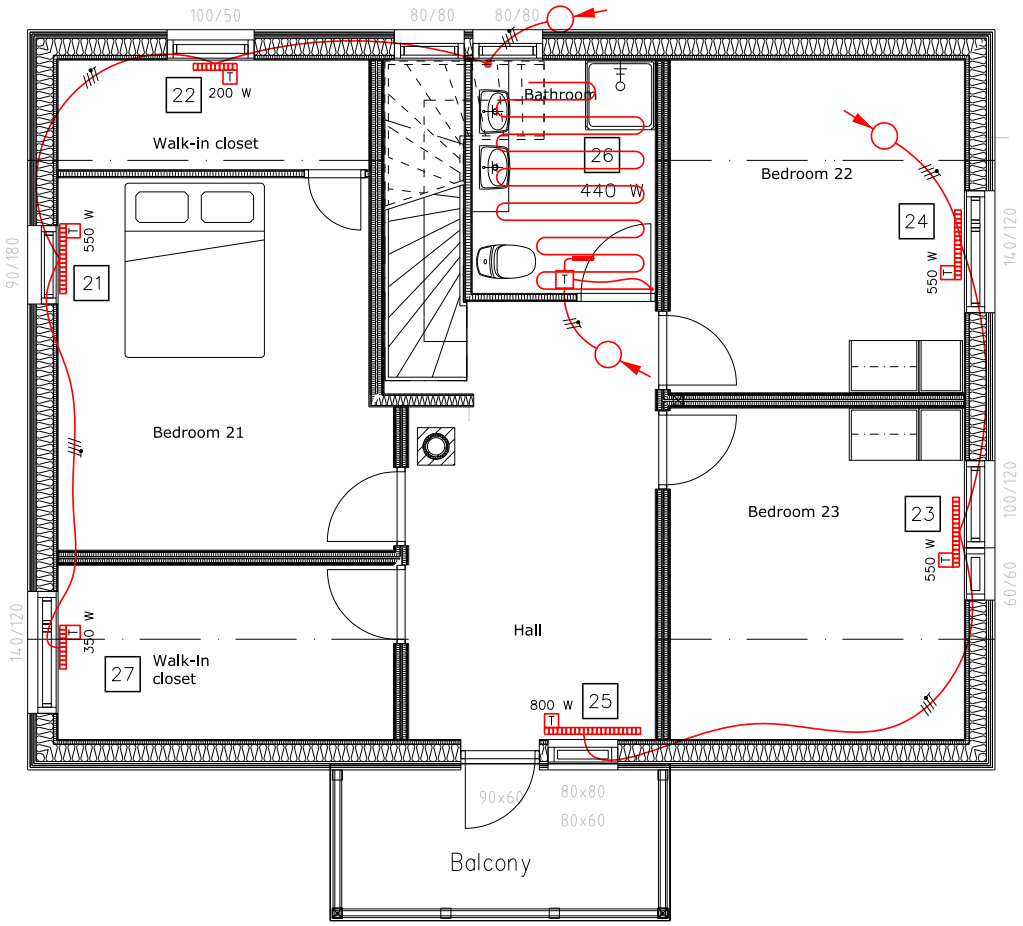
Example A
Panel heaters in main areas and underfloor heating in damp areas (ceramic tiles)

Panel heaters are generally placed under windows. Windows have a higher heat conductivity, resulting in larger heat loss and colder air at that point. Cold air is heavier than warm which makes it flow down, creating an airflow – a draught – and a heater placed on a windowless wall may increase it. When choosing a heater, in addition to having the right power, try to match the heater's and window's width. A too short heater can cause cold downflows at both ends and a too wide will not look good. Also check the minimum distance from structures.



Code	Room	Heat losses [W]	Type	Power [W]	Amount	Inst. area m²	Length	Resistance [Ω]	Power/sqrm [W/m²]	Distance [m]	Control
	Living room+hall	1381			1						
1	Living room		LISTA5	500	1						Electr.
2	Living room		LISTA9.0	900	1						Slave
3	Living room		LISTA2.0	200	1						Slave
4	Kitchen	552	TASO5	550	1						Electr.
5	Bedroom	383	TASO5	550	1						Electr.
6	Porch	617	TASO8	800	1						Electr.
7	Toilet	39	EFHTK1	130	1	1.35	13.5	402	100	0.10	ECO10FJ
8	Laundry room	287	TASSU4	440	1	4.3	20	127	102	0.22	ECO10FJ
9	Bathroom + sauna	382	TASSU6	600	1	6	29	88	100	0.21	ECO10FJ
10	Garage	1498	ROTI7	700	2						Electr.
11	Storeroom 1	417	EBHBM05P	500	1						Mech.
12	Storeroom 2	324	EBHBM05P	500	1						Mech.
Total Ground Floor		**5880**		**6370**							

Low-energy house built in Finland year 2008, 165 m², 750 m³



Placing panel heaters

Control switch attributes:

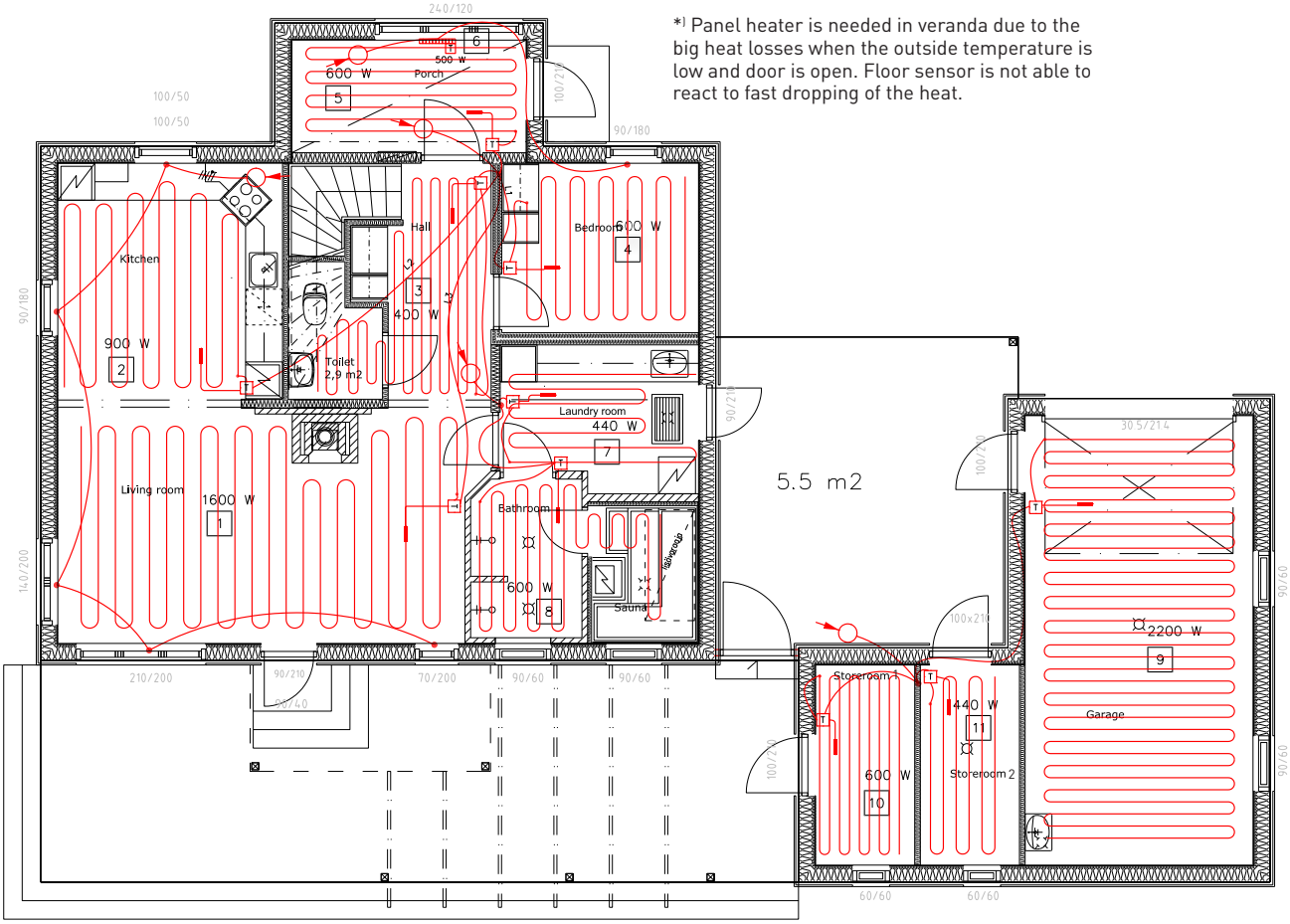
Control of partially storing heating solution:

- Temperature control
- Temperature reduction with home/away-switch

Code	Room	Heat losses [W]	Type	Power [W]	Amount	Inst. area m²	Length	Resistance [Ω]	Power/sqrm [W/m²]	Distance [m]	Control
21	Bedroom 21	501	TASO5	550	1						Electr.
22	Walk-in closet 1	221	PETA2	200	1						Electr.
23	Bedroom 23	513	TASO5	550	1						Electr.
24	Bedroom 22	507	TASO5	550	1						Electr.
25	Hall	644	TASO8	800	1						Electr.
26	Bathroom	175	TASSU4	440	1	4.3	20	127	102	0.22	ECO10FJ
27	Walk-in closet 2	361	PETA3	350	1						Electr.
Total Second Floor		**2922**		**3440**							
Total [W]		**8802**		**10510**							

Low-energy house built in Finland year 2008, 165 m², 750 m³

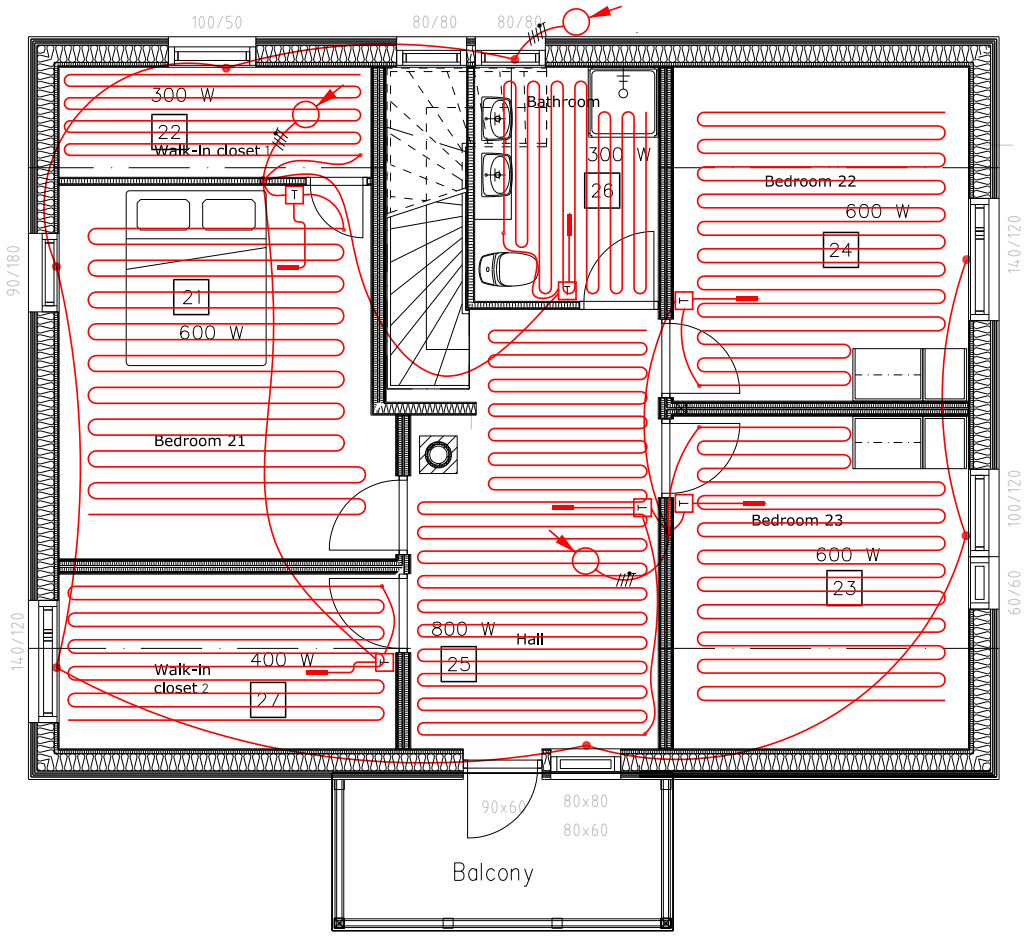
Example B
Underfloor heating in all areas



*) Panel heater is needed in veranda due to the big heat losses when the outside temperature is low and door is open. Floor sensor is not able to react to fast dropping of the heat.

Code	Room	Heat losses [W]	Type	Power [W]	Amount	Inst. area m²	Length	Resistance [Ω]	Power/sqrm [W/m²]	Distance [m]	Control
1	Living room	1261	TASSU16	1600	1	19	72	34	84	0.26	ECO16FRJ
2	Kitchen	552	TASSU9	900	1	10.5	40	61	86	0.26	ECO16FRJ
3	Hall	120	TASSU4S	400	1	6.7	42	127	60	0.16	ECO16FRJ
	Toilet	39									
4	Bedroom	383	TASSU6	600	1	6.7	29	88	90	0.23	ECO16FRJ
5	Porch *)	617	TASSU6	600	1	5.4	29	88	111	0.19	ECO16FRJ
6			EBHBE05B	500	1						Electr.
7	Laundry room	287	TASSU4	440	1	4.3	20	120	102	0.22	ECO10FJ
8	Bathroom	156									
	Sauna	227	TASSU6	600	1	6	29	88	100	0.20	ECO10FJ
9	Garage	1498	TASSU22	2200	1	21	106	24	105	0.20	ECO16FJ
10	Storeroom 1	417	TASSU6	600	1	4.5	29	88	133	0.15	ECO10FJ
11	Storeroom 2	324	TASSU4	440		4.3	20	120	102	0.22	ECO10FJ
Total Ground Floor		**5880**		**7280**							

Low-energy house built in Finland year 2008, 165 m², 750 m³



Underfloor heating solution

Control switch attributes:

Control of heating solution:

- By a temperature boost command during storing period, thermostat ECO16

Temperature boost command

ECO16 thermostat enables temperature boost during storing period by informing the slave thermostats.

- Temperature can be set according to real needs
- The temperature is allowed to increase 1-5 °C from the set level during storing period
- Temperature drop function cannot be used together with boost command
- A partially storing heating system can be used on ground floor areas with concrete floors.

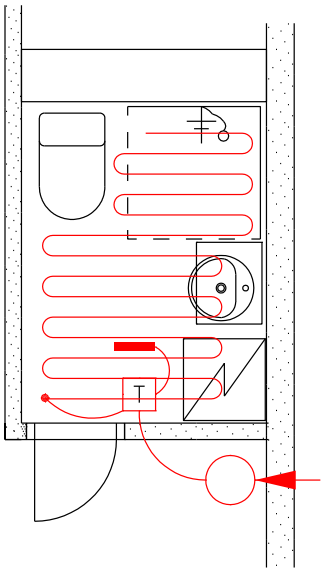
Code	Room	Heat losses [W]	Type	Power [W]	Amount	Inst. area m²	Length	Resistance [Ω]	Power/sqrm [W/m²]	Distance [m]	Control
21	Bedroom 21	501	TASSU6S	600	1	9	59	90	67	0.15	ECO16FRJ
22	Walk-in closet 1	221	TASSU3S	300	1	4.3	29	175	70	0.15	ECO16FRJ
23	Bedroom 23	513	TASSU6S	600	1	9	59	90	67	0.15	ECO16FRJ
24	Bedroom 22	507	TASSU6S	600	1	9	59	90	67	0.15	ECO16FRJ
25	Hall	644	TASSU8S	800	1	12	79	90	67	0.15	ECO16FRJ
26	Bathroom	175	TASSU3S	300	1	4.3	29	175	70	0.15	ECO10FJ
27	Walk-in closet 2	361	TASSU4S	400	1	6.1	42	127	66	0.15	ECO16FRJ
Total Second Floor		**2922**		**3600**							
Total [W]		**8802**		**10880**							

Low-energy house built in Finland year 2008, 165 m², 750 m³

Example C
Bathroom renovations with underfloor heating solutions

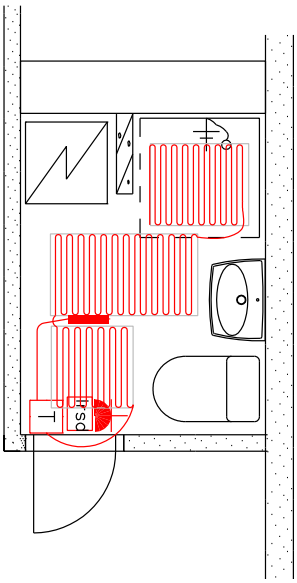
A bathroom can be made more comfortable by installing ThinKit-cables or ThinMat in it. Underfloor heating can be installed only on areas where people walk if there is an other heat source. ThinMat is used especially when installing on existing flooring. ThinKit heating cable is a good solution for small and cramped areas.

ThinKit and ThinMat must always be installed under the damp proof membrane. Insulation is always recommended under the underfloor heating.



Floor heating
EFHTK1,5/ThinKit
P=150 W/Un=230 V
Legth 14,5 m
Distance 12 cm
Power/sqrm 83 W/m2
R=356 ohm

ThinKit heating cable is a good solution for small and cramped areas. ThinKit available with or without thermostat.



Floor heating
EFHTM160.2/ThinMat160
P=320 W/Un=230 V
Length (mat) 2 m
Power/sqrm 160 W/m2
R=165 ohm

ThinMat is used especially when installing on existing flooring. ThinMat 160 does not include thermostat.

The heating system must always be sized according to local climate and regulations.
N.B. The example is based on Finnish building practise and climate.

Tips for renovations

If using parquet flooring check with the manufacturer allowed maximum temperature;

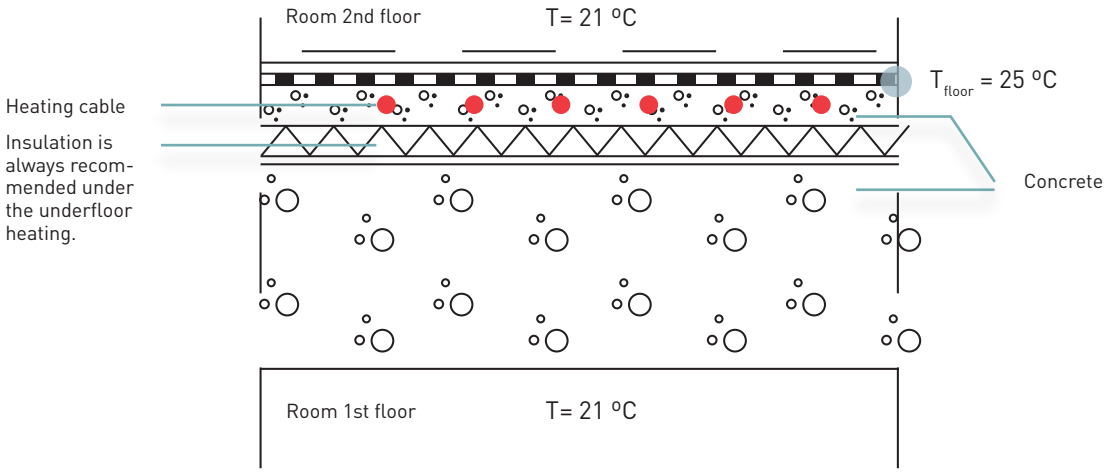
- thickness or parquet; 20 mm > temperature in the bottom of parquet is approximately 10 °C higher than the room temperature
- thickness or parquet; 28 mm > temperature in the bottom of parquet is approximately 12 °C higher than the room temperature

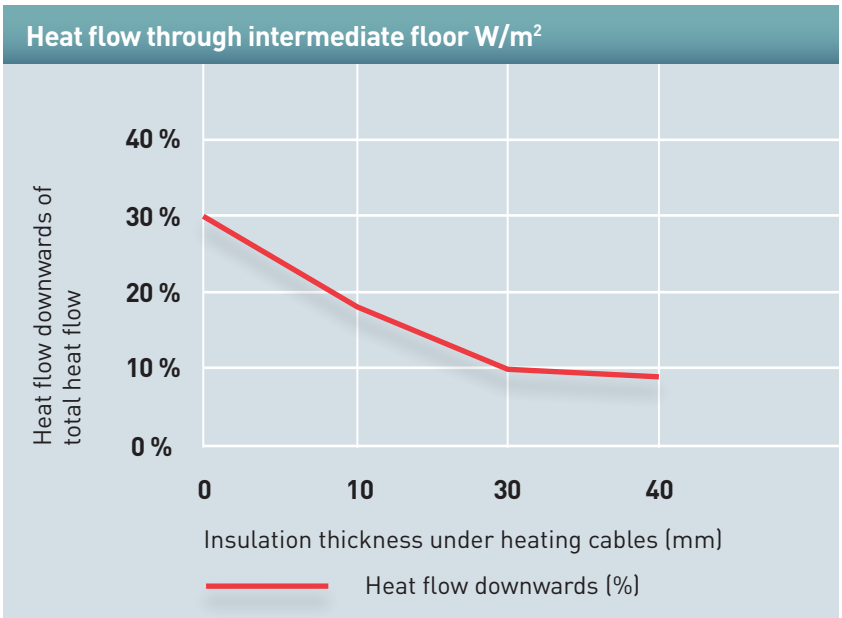
Replacing panel heaters during renovation

An easy job in an already electrically heated house when using new ones of similar power and construction.

- Inspect the condition of the old cabling and control system
- Try to match heater and window widths
- If insulation and/or windows have not been upgraded, use equal or higher heating power
- When adding new heaters to old heating group cabling, always check not to exceed the capacity of cables, fuses and other safety switches
- Check the safety distance requirements of the new heaters

Influence of polystyrene insulation to heat flow downwards





HEATING PRODUCTS

Underfloor Heating EFH

Panel Heaters EPH

ECO Heating Control

Index

Underfloor Heating EFH

Tassu-underfloor heating cable

By using TASSU underfloor heating cables, a direct or partial storage floor heating can be carried out. The direct underfloor heating is used in wet or damp areas, where the floormaterial is low thermal resistant, e.g. clinker. The direct underfloor heating is suitable also in other areas as the only heating form. The partial storage underfloor heating is used for example in living rooms and kitchens. The output per square meter should be 80-150 W/m², the installation distance 15 – 25 cm and the installation depth 5-10 cm. The heating cable is a preterminated twin-conductor cable with a PVC sheath. The lowest installation temperature is -15°C. The output of the cable is 20W/m with a nominal voltage of 230V. The heating cable is supplied with a cold lead of 2.5 meter.

TYPE	CODE	DESCRIPTION	PACK.QTY
TASSU2	64 100 81 682 639	11 m, 1,5-3,0 m², 240 W	1/60
TASSU3	64 186 77 631 696	15 m, 2,0-3,5 m², 300 W	1/60
TASSU4	64 100 81 682 646	20 m, 3,0-5,0 m², 440 W	1/60
TASSU6	64 100 81 682 653	29 m, 4,5-7,5 m², 600 W	1/60
TASSU9	64 100 81 682 660	40 m, 6,0-11,0 m², 900 W	1/60
TASSU12	64 100 81 682 677	54 m, 8,0-15,0 m², 1200 W	1/30
TASSU16	64 100 81 682 684	72 m, 11,0-20,0 m², 1600 W	1/30
TASSU18	64 100 81 682 189	86 m, 12,0-22,0 m², 1800 W	1/30
TASSU22	64 100 81 682 691	106 m, 15,0-27,0 m², 2200 W	1/30

Tassu S -underfloor heating cables

The TASSU S underfloor heating cables are used in plasterboard floors, wooden floors and in renovation, where the cable is installed on top of the old floor. The output per square meter should be 70 – 100 W/m², the installation distance 9 – 20 cm and the installation depth 2.5 cm. The heating cable is a preterminated twin-conductor cable with a PVC sheath. The lowest installation temperature is -15 °C. The output of the cable is 10W/m with a nominal voltage of 230V. The heating cable is supplied with a cold lead of 2.5 meter.

TYPE	CODE	DESCRIPTION	PACK.QTY
TASSU1S	64 100 81 682 806	16 m, 1,5-2,0 m², 165 W	1/60
TASSU3S	64 100 81 682 820	29 m, 2,0-3,5 m², 300 W	1/60
TASSU4S	64 100 81 682 844	42 m, 3,5-5,0 m², 400 W	1/60
TASSU6S	64 100 81 682 868	59 m, 5,0-7,0 m², 600 W	1/30
TASSU8S	64 100 81 682 882	79 m, 7,0-9,0 m², 800 W	1/30
TASSU11S	64 100 81 682 905	106 m, 8,0-12,0 m², 1100 W	1/30

ThinKit with thermostat

ThinKit is designed to be used as floor heating in small and cramped areas. The cable is round with a diameter of only 4.2 mm. The small diameter enables the use of less casting material during installation. ThinKit may be used together with a wide range of flooring material but the cable should always be laid upon fireproof material and have to be covered with levelling compound. The sizes of ThinKit cover an area of 1–20.6 m². ThinKit contains heating cable, a thermostat with Jussi and Elko compatible cover frames and center plates, flexible plastic tube and installation tape. The thermostat, ECO10FSJ+E, has an operating range of 10–35 °C. IP31. The length of the cold lead is 3 m.

TYPE	CODE	DESCRIPTION	PACK.QTY
EFHTK1+T	64 186 77 635 847	13,5 m, 0,9-1,6 m², 130 W + T	1/60
EFHTK1.5+T	64 186 77 635 854	14,5 m, 1,0-1,9 m², 150 W + T	1/60
EFHTK2+T	64 186 77 635 861	22,5 m, 1,5-2,8 m², 220 W + T	1/60
EFHTK3+T	64 186 77 635 878	28,5 m, 1,9-3,5 m², 280 W + T	1/60
EFHTK4+T	64 186 77 635 885	40 m, 2,7-5,0 m², 400 W + T	1/60
EFHTK5+T	64 186 77 635 892	45 m, 3,0-5,6 m², 450 W + T	1/60
EFHTK7+T	64 186 77 635 908	70 m, 4,6-8,6 m², 690 W + T	1/60
EFHTK8+T	64 186 77 635 915	78,5 m, 5,2-9,8 m², 780 W + T	1/60
EFHTK10+T	64 186 77 635 922	98 m, 6,5-12,3 m², 980 W + T	1/30
EFHTK11+T	64 186 77 635 939	110 m, 7,3-13,8 m², 1100 W + T	1/30
EFHTK16+T	64 186 77 635 946	165 m, 11,0-20,6 m², 1650 W + T	1/30

ThinKit without thermostat

ThinKit is designed to be used as floor heating in small and cramped areas. The cable is round with a diameter of only 4.2 mm. The small diameter enables the use of less casting material during installation. ThinKit may be used together with a wide range of flooring material but the cable should always be laid upon fireproof material and have to be covered with levelling compound. The sizes of ThinKit cover an area of 1–20.6 m². ThinKit contains heating cable, flexible plastic tube and installation tape. The length of the cold lead is 3 m.

TYPE	CODE	DESCRIPTION	PACK.QTY
EFHTK1	64 186 77 636 790	13,5 m, 0,9-1,6 m², 130 W	1/60
EFHTK1.5	64 186 77 636 806	14,5 m, 1,0-1,9 m², 150 W	1/60
EFHTK2	64 186 77 636 813	22,5 m, 1,5-2,8 m², 220 W	1/60
EFHTK3	64 186 77 636 820	28,5 m, 1,9-3,5 m², 280 W	1/60
EFHTK4	64 186 77 636 837	40 m, 2,7-5,0 m², 400 W	1/60
EFHTK5	64 186 77 636 844	45 m, 3,0-5,6 m², 450 W	1/60
EFHTK7	64 186 77 636 851	70 m, 4,6-8,6 m², 690 W	1/60
EFHTK8	64 186 77 636 868	78,5 m, 5,2-9,8 m², 780 W	1/60
EFHTK10	64 186 77 636 875	98 m, 6,5-12,3 m², 980 W	1/30
EFHTK11	64 186 77 636 882	110 m, 7,3-13,8 m², 1100 W	1/30
EFHTK16	64 186 77 636 899	165 m, 11,0-20,6 m², 1650 W	1/30

Underfloor Heating EFH

ThinMat-underfloor heating mat – 100 W/m² with thermostat

Lower power per square meter, 100 W/m², is sufficient for comfort heating in dry and damp indoor conditions. Wood, parquet, laminate, concrete, stone or clinker can be used for surface material. Suitable for installation on top of chipboard but have to be covered with levelling compound. The package includes a floor heating mat, floor heating thermostat, adhesive aluminium tape, a sensor and a flexible installation tube for the sensor. The temperature range of the thermostat ECO10FSJ+E is 10 - 35 °C, IP31. The rated voltage is 230 V. Lowest installation temperature, + 5 °C. ThinMat width is 48 cm. The length of the cold lead is 4 m.

TYPE	CODE	DESCRIPTION	PACK.QTY
EFHTM100.1+T	64 186 77 636 691	2 m, 1 m², 100 W + T	1/40
EFHTM100.15+T	64 186 77 636 707	3 m, 1,5 m², 150 W + T	1/40
EFHTM100.2+T	64 186 77 636 714	4 m, 2 m², 200 W + T	1/40
EFHTM100.3+T	64 186 77 636 721	6 m, 3 m², 300 W + T	1/40
EFHTM100.4+T	64 186 77 636 738	8 m, 4 m², 400 W + T	1/40
EFHTM100.5+T	64 186 77 636 745	10 m, 5 m², 500 W + T	1/40
EFHTM100.6+T	64 186 77 636 752	12 m, 6 m², 600 W + T	1/40
EFHTM100.8+T	64 186 77 636 769	16 m, 8 m², 800 W + T	1/24
EFHTM100.10+T	64 186 77 636 776	20 m, 10 m², 1000 W + T	1/24
EFHTM100.12+T	64 186 77 636 783	24 m, 12 m², 1200 W + T	1/24

ThinMat-underfloor heating mat – 100 W/m² without thermostat

Lower power per square meter, 100 W/m², is sufficient for comfort heating in dry and damp indoor conditions. Wood, parquet, laminate, concrete, stone or clinker can be used for surface material. Suitable for installation on top of chipboard but have to be covered with levelling compound. The package includes a floor heating mat, adhesive aluminium tape, and a flexible installation tube for the sensor. The rated voltage is 230 V. Lowest installation temperature, + 5 °C. ThinMat width is 48 cm. The length of the cold lead is 4 m.

TYPE	CODE	DESCRIPTION	PACK.QTY
EFHTM100.1	64 186 77 635 366	2 m, 1 m², 100 W	1/40
EFHTM100.15	64 186 77 635 373	3 m, 1,5 m², 150 W	1/40
EFHTM100.2	64 186 77 635 380	4 m, 2 m², 200 W	1/40
EFHTM100.3	64 186 77 635 397	6 m, 3 m², 300 W	1/40
EFHTM100.4	64 186 77 635 403	8 m, 4 m², 400 W	1/40
EFHTM100.5	64 186 77 635 410	10 m, 5 m², 500 W	1/40
EFHTM100.6	64 186 77 635 427	12 m, 6 m², 600 W	1/40
EFHTM100.8	64 186 77 635 441	16 m, 8 m², 800 W	1/24
EFHTM100.10	64 186 77 636 189	20 m, 10 m², 1000 W	1/24
EFHTM100.12	64 186 77 636 196	24 m, 12 m², 1200 W	1/24

ThinMat-underfloor heating mat – 160 W/m² without thermostat

More power, 160 W/m², is required in less insulated premises with concrete, stone or clinker flooring. Installation below wooden, parquet or laminate surfaces or on top of chipboards is not recommended. The package includes a floor heating mat, adhesive aluminium tape and a flexible installation tube for the sensor. The rated voltage is 230 V. Lowest installation temperature, + 5 °C. ThinMat width is 48 cm. The length of the cold lead is 4 m.

TYPE	CODE	DESCRIPTION	PACK.QTY
EFHTM160.1	64 186 77 635 458	2 m, 1 m², 160 W	1/40
EFHTM160.2	64 186 77 635 465	4 m, 2 m², 320 W	1/40
EFHTM160.3	64 186 77 635 472	6 m, 3 m², 480 W	1/40
EFHTM160.4	64 186 77 635 489	8 m, 4 m², 640 W	1/40
EFHTM160.5	64 186 77 635 496	10 m, 5 m², 800 W	1/40
EFHTM160.8	64 186 77 637 063	16 m, 8 m², 1280 W	1/24
EFHTM160.10	64 186 77 637 070	20 m, 10 m², 1600 W	1/24

Fixing equipment

Cable fixing strip XBC1230 is used for fixing the underfloor heating cable.

TYPE	CODE	DESCRIPTION	PACK.QTY
XBC1230	64 100 13 290 024	Galvanised attachment ribbon 20 m, installation gap 30 mm	1/10

Panel Heaters EPH

Taso

A pleasant combination heater designed for homes and holiday homes. The surface temperature of the heaters is less than 70 °C. The heater is equipped with an electronic thermostat (6 – 30 °C) with a possibility of stepless temperature reduction control (2 – 20 °C) from the set value. Max load 1900 W (master + slave). The heaters are double-insulated, class II, separate earthing is not required. IP20.

TYPE	CODE	DESCRIPTION	PACK.QTY
TASO2	64 100 81 272 403	200 W, 400x300 mm	1/72
TASO3	64 100 81 272 410	350 W, 400x500 mm	1/48
TASO5	64 100 81 272 427	550 W, 400x800 mm	1/28
TASO8	64 100 81 272 434	800 W, 400x1100 mm	1/24
TASO10	64 100 81 272 441	1000 W, 400x1370 mm	1/28
TASO12	64 100 81 272 458	1200 W, 400x1670 mm	1/28
TASO-SLAVE HEATERS			
TASO2.0	64 100 81 272 496	200 W/o, 400x300 mm	1/12
TASO3.0	64 100 81 272 502	350 W/o, 400x500 mm	1/24
TASO5.0	64 100 81 272 519	550 W/o, 400x800 mm	1/28
TASO8.0	64 100 81 272 526	800 W/o, 400x1100 mm	1/24
TASO10.0	64 100 81 272 533	1000 W/o, 400x1370 mm	1/28
TASO12.0	64 100 81 272 540	1200 W/o, 400x1670 mm	1/28

Lista

A pleasant combination heater designed for homes and holiday homes. The surface temperature of the heaters is less than 70 °C. The heater is equipped with an electronic thermostat (6 – 30 °C) with a possibility of stepless temperature reduction control (2 – 20 °C) from the set value. Max load 2300 W (control unit + slave). The heaters are double-insulated, class II, separate earthing is not required. Height 200 mm. Surface 80 mm from the wall. IP20.

TYPE	CODE	DESCRIPTION	PACK.QTY
LISTA2	64 100 81 222 453	200 W, 200x500 mm	1/44
LISTA3	64 100 81 222 460	350 W, 200x800 mm	1/43
LISTA5	64 100 81 222 477	500 W, 200x1100 mm	1/44
LISTA7	64 100 81 222 484	700 W, 200x1370 mm	1/54
LISTA9	64 100 81 222 491	900 W, 200x1670 mm	1/54
LISTA-SLAVE HEATERS			
LISTA2.0	64 100 81 222 156	200 W/o, 200x500 mm	1/26
LISTA3.0	64 100 81 222 163	350 W/o, 200x800 mm	1/27
LISTA5.0	64 100 81 222 170	500 W/o, 200x1100 mm	1/44
LISTA7.0	64 100 81 222 187	700 W/o, 200x1370 mm	1/27
LISTA9.0	64 100 81 222 194	900 W/o, 200x1670 mm	1/27

Peta

A cover-up protected heater, for instance for clothes closets. Surface temperature less than 70 °C. The heater is equipped with an electronic thermostat (6 – 30 °C) with a possibility of stepless temperature reduction control (2 – 20 °C) from the set value. Max load 1900 W (control unit + slave). The heaters are double-insulated, class II, separate earthing is not required. Height 200 or 400 mm. Surface 80 mm from the wall. IP20.

TYPE	CODE	DESCRIPTION	PACK.QTY
PETA2	64 100 81 222 606	200 W, 200x500 mm	1/56
PETA3	64 100 81 222 613	350 W, 400x500 mm	1/48

Roti

The splashproof ROTI heaters are designed for damp and wet conditions. Surface temperature less than 70 °C. The heater is equipped with an electronic thermostat (6 – 30 °C) with a possibility of stepless temperature reduction control (2 – 20 °C) from the set value. Max load 1400 W (control unit + slave). The heaters are double-insulated, class II, separate earthing is not required. In the range there are suitable heaters for bathrooms and washing rooms, saunas, basements and garages. Height 400 mm. Surface 80 mm from the wall. IP24.

TYPE	CODE	DESCRIPTION	PACK.QTY
ROTI1	64 100 81 222 750	150 W, 400x300 mm	1/36
ROTI3	64 100 81 222 767	350 W, 400x500 mm	1/48
ROTI5	64 100 81 222 774	500 W, 400x810 mm	1/28
ROTI7	64 100 81 222 781	700 W, 400x1100 mm	1/24

Panel Heaters EPH

Tupa-equipment

Equipment for Taso, Lista, Peta and Roti-heaters. ELTE4 -thermostat is fixed to the heater with four screws. The connection cable with strain relief is equipped with an earthed Euro-plug.

TYPE	CODE	DESCRIPTION	PACK.QTY
ELTE4	64 100 81 222 866	Thermostat ELTE4	1/14
ELTE3	64 100 81 222 859	Thermostat to Tupa-heaters manufctured before 1996	1/14
LJOH	64 186 77 631 757	Connection cable kit to Tupa heaters, 1.5 meter	1/25

Beta-heaters with electronic thermostat and connection box

Beta convector heater with a electronic thermostat (5 – 30 °C) and a connection box. The electronic thermostat ensures a silent and smooth operation of the heater. A fixed temperature reduction of 5 °C from the set temperature is possible. The accuracy of the thermostat is +/- 0.1 °C. Thanks to the control wheel and a simple scale, adjusting the temperature is easy. The surface temperature is less than 60 °C. Height of the heater is 389 mm. Nominal voltage 230 V + 10%, -15%. Protection class IP21.

TYPE	CODE	DESCRIPTION	PACK.QTY
EPHBE02B	64 186 77 635 359	250 W, 389x451 mm	1/40
EPHBE05B	64 186 77 632 020	500 W, 389x585 mm	1/30
EPHBE07B	64 186 77 632 037	750 W, 389x719 mm	1/30
EPHBE10B	64 186 77 632 044	1000 W, 389x853 mm	1/20
EPHBE15B	64 186 77 632 051	1500 W, 389x1121 mm	1/20
EPHBE20B	64 186 77 632 068	2000 W, 389x1523 mm	1/26

Beta-heaters with electronic thermostat and Euro plug

Beta convector heater with a electronic thermostat (5 – 30 °C) and a plug. The electronic thermostat ensures a silent and smooth operation of the heater. The accuracy of the thermostat is +/- 0.1 °C. Thanks to the control wheel and a simple scale, adjusting the temperature is easy. The surface temperature is less than 60 °C. Height of the heater is 389 mm. Nominal voltage 230 V + 10%, -15%. Protection class IP21.

TYPE	CODE	DESCRIPTION	PACK.QTY
EPHBE02P	64 186 77 636 943	250 W, 389x451 mm	1/40
EPHBE05P	64 186 77 636 950	500 W, 389x585 mm	1/30
EPHBE07P	64 186 77 636 967	750 W, 389x719 mm	1/30
EPHBE10P	64 186 77 636 974	1000 W, 389x853 mm	1/20
EPHBE15P	64 186 77 636 981	1500 W, 389x1121 mm	1/20
EPHBE20P	64 186 77 636 998	2000 W, 389x1523 mm	1/26

Beta-heaters with mechanical thermostat and Euro plug

Beta convector heater with a mechanical thermostat (6 – 36 °C) and Euro plug are durable and reliable. The accuracy of the thermostat is +/- 0.5 °C. Thanks to the control wheel and a simple scale, adjusting the temperature is easy. Height of the heater is 389 mm. Nominal voltage 230 V +10%, -15%. Protection class IP21.

TYPE	CODE	DESCRIPTION	PACK.QTY
EPHBM02P	64 186 77 635 786	250 W, 389x451 mm	1/40
EPHBM05P	64 186 77 631 832	500 W, 389x585 mm	1/30
EPHBM07P	64 186 77 631 849	750 W, 389x719 mm	1/30
EPHBM10P	64 186 77 631 856	1000 W, 389x853 mm	1/20
EPHBM15P	64 186 77 631 863	1500 W, 389x1121 mm	1/20
EPHBM20P	64 186 77 631 870	2000 W, 389x1523 mm	1/26

Beta-accessory

Plastic feet for Beta-heaters with plug. Material polypropylene.

TYPE	CODE	DESCRIPTION	PACK.QTY
EPHBAC1	64 186 77 637 001	Feet for Beta-heaters	1/10

ECO Heating Control

Room thermostats

Room heating thermostats for temperature control in individual rooms.

TYPE	CODE	DESCRIPTION	PACK.QTY
ECO10RJ	64 186 77 630 798	Room thermostat 10A, with Jussi electrical fittings	1/12
ECO10RJ+E	64 186 77 630 859	Room heating thermostat 10A, Jussi + Elko fittings	1/12

Underfloor heating thermostats

Underfloor heating thermostats for temperature control in individual rooms. Nominal current 10 A res. Maximum load 10 A. Temperature reduction of 4°C with 230 V control voltage. Nominal voltage 230 V. Control range +10°C... +60°C. The NTC-sensor cable is 4 meter long, max Ø 7.5 mm, and can be extended up to 10 meter. Sensor 47 kohm / 25ºC. Ambient temperature -20ºC...+30ºC. The thermostat has a two-pole switch. The termostats are compatible with JUSSI- and ELKO - electrical fittings. IP31.

TYPE	CODE	DESCRIPTION	PACK.QTY
ECO10FJ	64 186 77 630 774	Underfloor heating thermostat 10A, Jussi	1/12
ECO10FE	64 186 77 630 781	Underfloor heating thermostat 10A, Elko	1/12
ECO10FJ+E	64 186 77 630 835	Underfloor heating thermostat 10A, Jussi + Elko	1/12
ECO10FJMP	64 186 77 630 828	Multipack, 6 pcs. ECO10FJ underfloor heating thermostat, Jussi electrical fittings, 230V	1/80
ECO16FD	64 186 77 636 158	Underfloor heating thermostat 16 A, DIN-rail mounted	1/540
ECOAC44	64 100 35 300 909	Protective casing for ECO10F thermostat, IP44	1/12

Impressivo underfloor heating thermostat

Floor heating thermostat for room-specific temperature adjustment. Nominal current 10 A res. Max 2300 W. 230 V +10 %... -15 %. 50 Hz. Regulating range +10...+60°C. Fixed temperature drop 4ºC. NTC sensor 4 m, max Ø 7,5 mm, can be extended 10 m MMJ 2 x 1,5 mm². Sensor 47 kohm / 25°C. Operating temperature range -20°C...+30°C. IP31. Cover plates 1721F85-81, 1721F85-83, 1721F85-84 or 1721F85-85 are suitable for the frame.

TYPE	CODE	DESCRIPTION	PACK.QTY
ECO10FI.00	64 186 77 635 564	Floor heating thermostat 10 A, Impressivo	1/12
ECO10FI-84	64 186 77 635 588	Cover plate, Impressivo, white	1/10
ECO10FI-85	64 186 77 635 595	Cover plate, Impressivo, grey	1/10
ECO10FI-81	64 186 77 635 601	Cover plate, Impressivo, anthracite	1/10
ECO10FI-83	64 186 77 635 618	Cover plate, Impressivo, aluminium	1/10

Combination thermostats

Combination thermostat can be used as a combination thermostat or only either as a room thermostat or floor heating thermostat. Combination thermostat for room-specific temperature adjustment. Nominal current 16 A res. Max 3600 W. 230 V, +10 %...-15 %. 50 Hz. Control voltage 230 V. Regulation range floor +10°C...+50°C, room +5°C...+35°C. Temperature drop 0...-15°C. Temperature increase 0...+5°C. Floor temperature limits +25°C...+50°C. NTC sensor 4 m, max diameter 7,5 mm, can be extended 10 m MMJ 2 x 1,5 mm². Sensor 47 kohm / 25°C. Operating temperature range -20°C...+30°C. 2-pole switch mechanism, IP30.

TYPE	CODE	DESCRIPTION	PACK.QTY
ECO16FRJ	64 186 77 630 804	Combination thermostat, 16A, with Jussi electrical fittings, 230V	1/12
ECO16FRE	64 186 77 630 811	Combination thermostat, 16A, with Elko electrical fittings, 230V	1/12
ECO16FRJ+E	64 186 77 630 842	Combination thermostat, 16A, with Jussi + Elko electrical fittings, 230V	1/12

Impressivo combination thermostat

Combination thermostat for room-specific temperature adjustment. Nominal current 16 A res. Max 3600 W. 230 V, +10 %...-15 %. 50 Hz. Control voltage 230 V. Regulation range floor +10°C...+50°C, room +5°C...+35°C. Temperature drop 0...-15°C. Temperature increase 0...+5°C. Floor temperature limits +25°C...+50°C. NTC sensor 4 m, max diameter 7,5 mm, can be extended 10 m MMJ 2 x 1,5 mm². Sensor 47 kohm / 25°C. Operating temperature range -20°C...+30°C. 2-pole switch mechanism, IP30. Cover frames 1721F85-81, 1721F85-83, 1721F85-84 or 1721F85-85 are suitable for the frame.

TYPE	CODE	DESCRIPTION	PACK.QTY
ECO16FRI.00	64 186 77 635 571	Combination thermostat 16 A, Impressivo	1/10
ECO16FRI-84	64 186 77 635 625	Cover plate, Impressivo, white	1/10
ECO16FRI-85	64 186 77 635 632	Cover plate, Impressivo, grey	1/10
ECO16FRI-81	64 186 77 635 649	Cover plate, Impressivo, anthracite	1/10
ECO16FRI-83	64 186 77 635 656	Cover plate, Impressivo, aluminium	1/10

Index of product types

Index of EAN-codes

CMP-01182-ASDW/12/2008/4000/Command/Hämeen Kirjapaino Oy

ENSTO

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