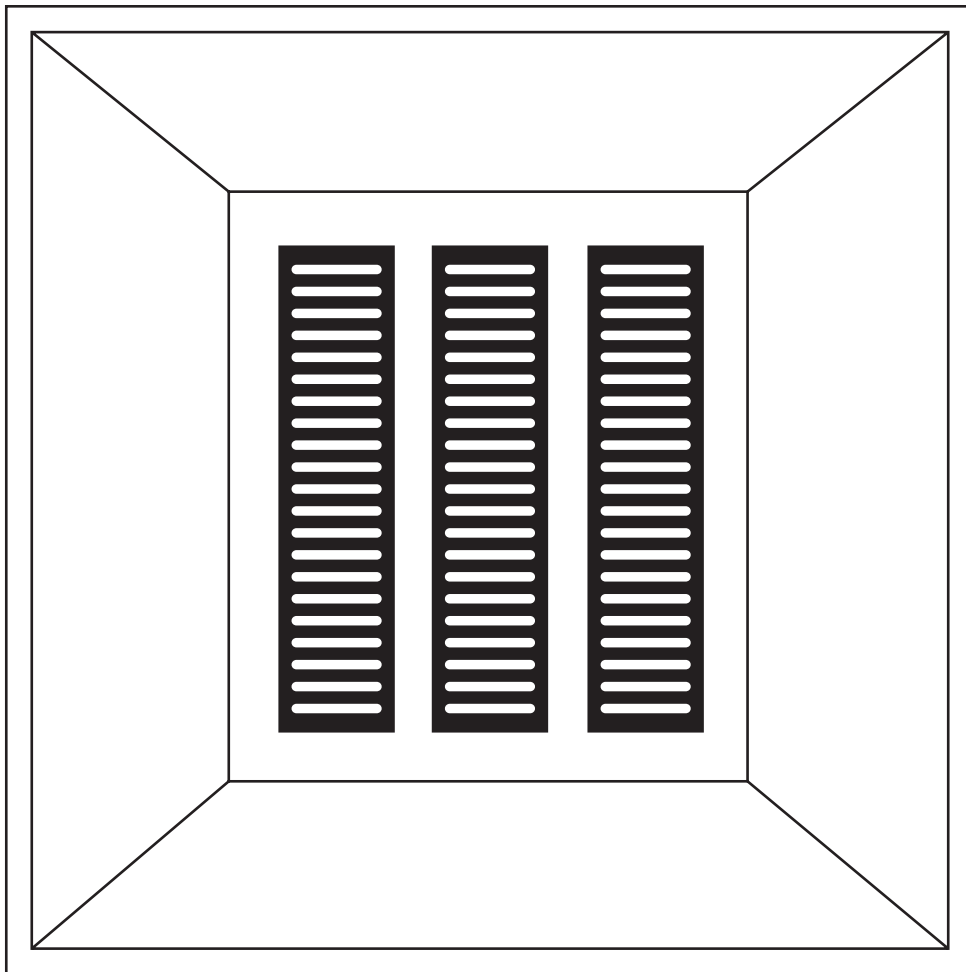


# MORE PAD INDOOR

ELECTRICAL INDOOR  
RADIANT HEATING SYSTEM



## ELECTRICAL INDOOR RADIANT HEATING SYSTEM

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- **Maximum self-adjusted temperature at 30°C.**
  - **Suitable for radiant heating of floors, walls and/or ceilings of rooms, also for discontinuous use.**
  - **Suitable for heating and defrosting mirrors.**
  - **Suitable for radiant heating of wet areas, shower cubicles, caldarium areas with any type of final finish.**
  - **Maintenance-free.**
  - **Self-adjusting system with automatic load modulation when the maximum surface temperature is reached.**
- 

### WHAT IS MORE PAD INDOOR?

It is a radiant heating system based on the use of a very thin (1.2 mm) mat made with a modulating and self-adjusting semiconductor technopolymer, which heats up when electric current passes. The reaction triggered is a molecular vibration of the nanoparticles that generates progressive heating of the semiconducting polymer.

As the temperature of the mat increases, the nanoparticles contained in the polymer compound move away from each other resulting in a progressive decrease in electrical continuity; the closer the temperature approaches the maximum threshold reached by the polymer, the lower the electrical absorption through the mat.

This characteristic, called PTC (positive temperature coefficient), uses the heating of the material to limit the current flowing through it (and therefore electrical consumption) as a result of progressive temperature increase.

Therefore, for the same end effect (temperature of the heating element), using this semiconductor technology significantly reduces overall power consumption compared to a similar heater with electrical conductors operating with heating resistors, thanks to the natural, automatic modulation and self-adjustment of the end temperature without any thermostatic control and limiting element.

## PAD INDOOR “IN BRIEF”

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**FUNCTIONAL PRINCIPLE**

- semiconductor technopolymer, modulating and self-regulating, with heating by the passage of electric current by molecular vibration
- 

**APPLICATION**

- Integration of domestic heating systems;
  - Heating of wet rooms (shower rooms, tepidarium, wellness areas, etc.);
  - Heating of rooms not served by air conditioning;
  - Heating of rooms in discontinuous use with danger of frost;
  - Heating of motor homes, caravans and boats;
  - Heating of surfaces subject to fogging (mirrors in bathrooms, wellness areas, etc.);
  - Evaporation of water from internal walkways for anti-slip safety;
- 

**INSTALLATION**

- Can be installed on the floor, wall or ceiling.
- 

**FLOOR FINISH**

- Dry with a floating floor or glued to a desolidarising sheathing.
  - Other finishes on screed or fibre-reinforced levelling compound
- 

**WALL/CEILING FINISH**

- Plastering with water-based cement mortar that can be smoothed over reinforcement mesh;
  - Ceramic wall tiles glued onto levelling compounds;
  - Dry application of plasterboard;
- 

**ROUTINE MAINTENANCE**

- None
- 

**SAFETY**

- System with electrical insulation class III SELV;
  - Can be installed in the bathroom and shower compartment in zone 1 as per IEC 64-8;
- 

**ELECTROMAGNETIC COMPATIBILITY**

- The system does not generate electromagnetic phenomena during operation
-

## 2. INFORMATION AND WARNINGS

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### 2.1 IDENTIFICATION OF PICTOGRAMS

The symbols below, together with their associated wording, indicate the potential risk arising from failure to comply with the prescription to which they have been combined.



**Warning**

Warns that failure to comply with the requirement entails a risk of damage to the equipment constituting the mixing unit.



**Danger**  
Risk of electric shock

Warns that there is a risk of electric shock if not observed.



**Danger**

Warns that failure to comply with the requirement entails a risk of harm to persons, animals and/or property.

### 2.2 WARNINGS BEFORE INSTALLATION

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**Danger**

PAD INDOOR is a radiant climate control system with electrically powered heating elements embedded in the building envelope.

Before using the system, read the warnings in this manual carefully, as they provide important information on safe installation, operation and maintenance.



**Warning**

Use of the system for purposes other than those specified is not allowed.

Keep this manual in a safe place for further reference, especially when ordering spare parts.



**Warning**

PAD INDOOR is powered by the building's electrical system.

- Check that the operating conditions of your system (voltage and power) are within the functional limits of the air conditioning system.
- Check that the power supply is adequately protected as described in the following Chapter 9 PAD INDOOR system installation;

Before installation, make sure that the electrical system, if any, has been carried out in a workmanlike manner by requesting the "Declaration of Conformity" and the relevant mandatory attachments.

## 2.3 GENERAL WARNINGS FOR SAFE USE

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**Danger**  
Risk of electric shock

Improper installation can cause damage to people, animals or property.

The manufacturer is not liable for damage caused by installation errors, non-compliance with these instructions and improper use of the system and individual devices.



**Danger**

Also note the following:

- If the degree of protection does not allow it, do not get the equipment wet and do not install it unprotected, in humid environments or near jets or splashes of water or other liquids.
- Due to the presence of very hot parts (power drivers), do not place paper and/or plastic objects on the equipment or in its immediate vicinity;
- Packaging parts (plastic bags, expanded polystyrene, etc.) must not be left within the reach of children as they are potential sources of danger.
- The operation of the control and monitoring equipment as well as the handling of the entire appliance must be prevented by children and incapacitated persons;
- Due to the presence of hot parts, contact burns are possible;
- Allow hot equipment (power drivers) to cool down adequately before any maintenance work;
- However, use all protective measures necessary to reduce the possibility of injury



**Danger**

Any work on the electrical circuit, regarding ordinary or extraordinary maintenance operations, must be carried out by professionally specialised personnel authorised according to Italian Ministerial Decree 37/2008;



**Warning**

Refrain from conducting work yourself;

It is strongly recommended to follow the maintenance instructions for the best operation of the system and, if parts of the system have to be replaced, to use the original spare parts supplied by the manufacturer



**Danger**  
Risk of electric shock

Before carrying out any cleaning and maintenance work, make sure that:

- The power supply is switched off by means of the thermomagnetic circuit breaker located on the power supply line of the air conditioning system.
- It is very dangerous to operate the system without any component, especially if this is a safety guard or mechanical and/or electrical safety device;
- Under no circumstances should the air-conditioning system be started up by unqualified personnel during maintenance operations;



**Danger**

In the event of a fault or malfunction of the equipment, switch off the power supply by means of the line protection circuit breaker;

Do not tamper with the system's equipment.



**Pericolo**

For reactivation and/or repair, contact the company that issued the declaration of conformity, or alternatively contact your local electrical installer if there are no warranty claims.

**Warning**

AD INDOOR is a mat that self-modulates electrical consumption and self-adjusts maximum surface temperature;

Absorption and surface temperature depend on the ability of the environment to absorb the energy released by the mat.

**Danger**

The lower the starting temperature, the higher the initial absorption (see chapter 7) and the lower the surface temperature reached. During room temperature optimisation, the absorption will decrease and the surface temperature will rise to about 30°C, with the room temperature at about 20°C. If the room temperature tends to rise, the mat's self-modulating capacity will further reduce consumption as it has reached its natural self-regulating limit of approximately 30°C.

Self-modulation depends on the semiconductor material and is limited to maximum 50% of initial consumption; therefore, if the area of action of the mat is covered with an obstruction that almost completely prevents heat exchange, the surface temperature may reach 54°C.

**Warning**

An obstruction that could prevent the almost complete heat exchange of the PAD

INDOOR mat is a condition that is difficult to recreate in reality. The building structures on which the mat is placed always allow for the dispersion of the energy not released to the environment. In any case, it is advisable, when laying on the floor, that the flat parts of the furniture are always fitted with feet to facilitate heat transfer to the room.

**Danger**

## 2.4 GENERAL INFORMATION

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- PAD INDOOR is an electric radiant heating system;
- PAD INDOOR consists of a thin mat, electrically powered at very low voltage, that self- modulates electrical consumption and self- adjusts maximum surface temperature;
- PAD INDOOR is not an amorphous thin film extruded resistor in cable, traditional or carbon conductor;
- The heating of the mat takes place thanks to the molecular vibration of the technopolymer making up the semiconductor mat;
- Thermal expansion of the nanoparticles gradually reduces electrical absorption, thereby self-limiting the surface temperature;
- Heated surfaces do not run the risk of overheating when covered;
- The maximum surface temperature is compatible with the surface temperature limits of the flooring currently in force (UNI EN 1264);
- PAD INDOOR is a radiant system that can be combined with very low inertia finishes, with final thicknesses limited to just 15 mm (dry finish with plasterboard wall panel, or application of ceramic coating with bonding);
- The response times of the PAD INDOOR system are the same as those of a similar hydronic radiant system, and depend on the mass to be energised and the average starting radiant temperature. Normally, in a residential environment, the wait for the design surface temperature to be reached is about 15...20 minutes for a very low inertia finish;
- The PAD INDOOR system, like any radiant system, must provide for the interruption of heat conduction in the direction opposite to the radiant transfer into the room. For this reason, it is essential that the surface on which the system will be installed is adequately insulated. If there are no specific requirements, provide an insulating layer of at least 20 mm EPS from the rest of the building envelope;

## 2.5 GENERAL INFORMATION ON LOGISTICS

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- The mat is produced in 30-metre rolls, each of which is tested to verify the nameplate power consumption;
- Check that the boxes have not been damaged, are not wet or damp and above all that they do not have a manufacturing date prior to 5 years from the year of installation;
- When opening the package, avoid using blades or cutters to avoid unintentionally cutting into the product contents;
- Protect against UV radiation (like all polymers it is photosensitive);

## 2.6 GENERAL INFORMATION FOR INSTALLATION

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- Read the labels on the packaging to check that the product is correct for the installation being carried out;
- Installation must be carried out by qualified personnel who have been trained in advance, including with the aid of this manual;
- Avoid direct contact of the technopolymer with aluminium and/or aluminium alloy components to prevent possible interaction with the molecular vibration of the technopolymer;
- The PAD INDOOR can be cut to size as there is no minimum length required;
- Any scraps can be reused by electrically wiring them together to give electrical continuity between the mat portions;
- It can be cut or drilled, in case of interference with obstacles (e.g. electrical boxes), as long as the lateral electrical conductors are not interrupted;
- It can be nailed and/or stapled for fixing to the substrate at any point, taking care to avoid affecting the lateral electrical conductors;
- It can also be curved and bent at right angles (between slats) to fit the profile to be heated;
- Do not allow metal parts that pass through or touch the mat (e.g. paper clips, drywall screws, etc.) to come into contact with metal masses. If this were to happen, the area in which contact takes place could be subject to a significant reduction in surface temperature due to the alteration of the transit of electrical energy;
- Avoid contact with solvents as well as with glues and two-component mortars that could compromise the long-term stability of the technopolymer;
- The surface of the mat can be covered with any type of building finish (including tiles, natural stone, parquet, cement mortar plaster, laminate and carpet); the transfer of thermal energy must take place by contact between the layers that interpose themselves with the environment to be heated;

## 2.7 GENERAL INFORMATION ON ELECTRICAL INSTALLATION

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- The electrical wiring must be sized and executed in accordance with Italian Presidential Decree 37/08 and subsequent amendments and integrations;
- The installation must be carried out by a qualified installer, following the rules of art set out in the current technical regulations for the installation of electrical systems as well as in this installation manual, using certified products that allow the declaration of conformity to be issued;
- If the rooms served by a single electric meter exceed the size or installed power limits laid down in Italian Ministerial Decree 37/08, the electrical dimensioning of the system and the related project must be drawn up and signed by a qualified professional registered with a professional association;
- The PAD INDOOR heating system, consisting of the radiant mat and its accessories, such as self-amalgamating tape, crocodile crimp terminals and power supply drivers 320 and 600, enables the creation of an electrical system in insulation class III SELV to allow installation in special environments such as wet rooms and shower compartments



## 2.8 GENERAL INFORMATION ON ENERGY EFFICIENCY

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- The PAD INDOOR system complies with the requirements imposed by European Regulation 1188/2015 Annex II Table II on the energy efficiency of electric heating systems incorporated in the interior finish of the building envelope;
- In order to comply with the ErP Directive 2009/125/EC, as well as with current legislation on energy containment in buildings, the mat must be associated with an electronic room temperature control, with at least daily division into several time bands for controlling at least two levels of room temperature (chronothermostat);
- In combination with the RBM MORE advanced thermoregulation system, associate the PAD INDOOR system with the control of window opening as well as the remote function control APP;
- The control drivers included in the PAD system accessories are optimised for the correct operation of the mat, with the inclusion of a soft start curve that attenuates the absorption peak at switch-on;

## 2.9 - IDENTIFICATION OF THE MANUFACTURER-DISTRIBUTOR

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This manual provides the technical information necessary for the installation, use and maintenance of the air-conditioning system PAD INDOOR.

For any further clarification, the customer can contact the manufacturer's Technical Sales Support:

**RBM S.p.A. - Via S.Giuseppe, 1 - 25075 NAVE ( BRESCIA ) - ITALY**

**Tel ++39 030 2537211 - Fax ++39 030 2531799**

**info@rbm.eu**

### 3. SYSTEM COMPONENTS

The components of the PAD INDOOR system are listed below in this manual.  
 For further accessories that are not strictly related to the PAD INDOOR system, which may be necessary for the installation of underfloor heating systems, refer to the general RBM MORE catalogue.

**PRODUCT TABLE**

	Series	Description
	3857	Electric heating mat with very low voltage 36 VDC and low consumption, made of self-modulating semi-conducting technopolymer for radiant heating on floors, walls and ceilings, with double copper conductor cord embedded in the technopolymer Width 310 mm - Supplied in rolls, length 10 or 30 m
	3970	Feeder to control very low voltage current modulating utilities with constant output voltage 230VAC/36VDC - Power output 320 W - watertight IP65 SELV
	3858.A	Feeder to control very low voltage current modulating utilities with constant output voltage 230VAC/36VDC - Power output 600 W - watertight IP65 SELV
	3858.B	Feeder to control very low voltage current modulating utilities with constant output voltage 230VAC/36VDC - Power output 1000W
	3859	Protective, thermally conductive sheet, to be laid over the Pad Indoor mat, when the floor installation involves aggressive cements and adhesives and/or when the laying distance exceeds 150 mm in order to favour the uniformity of the surface temperature. Width 700 mm - Supplied in rolls, length 20 m
	3860	Crimp terminal to connect the part of the mat to the electrical distribution cables. Supplied in packs of 20 or 200 pcs.
	3862	Crimping clamp with flat jaws.
	3861	Double-sided, self-amalgamating bituminous tape for dielectric sealing of the areas affected by the crimping between terminal, electrical cable and technopolymer. Width 30 mm - Supplied in rolls, length 20 m

## 4. TECHNICAL FEATURES

### Mat PAD INDOOR

Semiconductor material	PE	
Conductor material	Copper braid	
Braid equivalent section	5	mm <sup>2</sup>
Mat specific weight	1,15	Kg/m <sup>2</sup>
Width	310	mm
Thickness	1,2	mm
Roll Lenght	10/30	m
Nominal temperature (at 20°C)	29,8	°C
Max temperature (with limited heat exchange with the environment)	54	°C
Electrical power supply	36	V DC
Rated input power (at 10°C)	28,8	W
Absorption reduction (when reaching final temp)	-50	%
Length max. single branch power supply	7	m

### DRIVER of power supply 320W

Electrical power supply	90...305	VAC
Controllable rated power	320	W
Absorption	8.9	A
Feeder driver consumption in stand-by	0.5	W
Full load efficiency	94.6	%
Adjustable output voltage	36	VDC
Feeder electrical protection	IP 65	
Type of protection	SELV	
Short-circuit protection	YES	
Overload protection	YES	
Overvoltage protection	YES	
Overtemperature protection	YES	
Soft-start curve for starting load limitation	YES	
Remote on-off consent	YES	
Working environment temperature	-40..+70	°C
Max. ambient working temperature (peaks)	90	°C
Dimensions (LxDxH)	252x90x43.8	mm
Feeder weight	1.9	kg

**DRIVER  
of power supply  
600W**

Electrical power supply	90 ÷ 305	VAC
Controllable rated power	601,2	W
Absorption	16,7	A
Feeder driver consumption in stand-by	0,5	W
Full load efficiency	96	%
Adjustable output voltage	30,6 ÷ 37,8	VDC
Feeder electrical protection	IP 65	
Type of protection	SELV	
Short-circuit protection	YES	
Overload protection	YES	
Overvoltage protection	YES	
Over-temperature protection	YES	
Soft-start curve for starting load limitation	YES	
Remote on-off consent	YES	
Working environment temperature	-40 ÷ +55	°C
Max. ambient working temperature (peaks)	90	°C
Dimensions (LxDxH)	280x144x48,5	mm
Feeder weight	3,9	kg

**DRIVER  
of power supply  
1000W**

Electrical power supply	90 ÷ 264	VAC
Controllable rated power	1.008	W
Absorption	28	A
Feeder driver consumption in stand-by	0,2	W
Full load efficiency	95,5	%
Adjustable output voltage	36 ÷ 43,2	VDC
Short-circuit protection	YES	
Overload protection	YES	
Overvoltage protection	YES	
Over-temperature protection	YES	
Soft-start curve for starting load limitation	YES	
Remote on-off consent	YES	
Working environment temperature	-30 ÷ +50	°C
Max. ambient working temperature (peaks)	50	°C
Dimensions (LxDxH)	240x111,4x41	mm
Feeder weight	1,74	kg

ErP Directive - Regulation EU/1188/2015

System information for electrically powered domestic room heaters built into the building envelope

Model identifier: PAD INDOOR					
Data	Symbol	Value	Unit	Data	Unit
<b>Thermal power</b>				<b>Type of heat output, only for electric storage space heating appliances (indicate only one option)</b>	
Nominal heat output	Pnom	0,03	kW	manual thermal load control, with integrated thermostat	NO
Minimum heat output (indicative)	Pnom	0,012	kW	manual control of the heat load with feedback of the ambient and/or external temperature	NO
Maximum continuous heat output	Pnom	0,03	kW	electronic heat load control with room and/or outside temperature feedback	NO
<b>Auxiliary power consumption</b>				fan-assisted heat output	NO
At nominal heat output	elmax	0,035	kW	<b>Type of heat output/room temperature control (indicate only one option)</b>	
At minimum heat output	elmax	0,035	kW	single-stage heat output without room temperature control	NO
In stand-by mode		0,035	kW	two or more manual steps without room temperature control	NO
$\eta_s = 38,9\% > 38\%$				with room temperature control via mechanical thermostat	NO
				with electronic room temperature control	NO
				with electronic room temperature control and daily timer	NO
				with electronic room temperature control and weekly timer	YES
				<b>Other control options (multiple options can be selected)</b>	
				room temperature control with presence detection	NO
				room temperature control with detection of open windows	YES
				with remote control option	YES
				with adaptive start-up control	YES
				with operating time limitation	NO
				with black globe thermometer	NO
Contacts		RBM SpA - via S.Giuseppe 1 - NAVE (BS) - ITALIA			

## 5. CERTIFICATIONS

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EC declaration of conformity with directives:

- EU Regulation 1188/2015 implementing Directive 2009/125/EC (ErP) with regard to ecodesign requirements for space heating appliances.
- Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU.
- Directive on waste electrical and electronic equipment (WEEE) 2012/19/EU.
- Electromagnetic Compatibility (EMC) Directive 2014/30/EU.
- EU Regulation 305/2011 on construction products, reaction to fire of the heating element according to EN 13505-1:2019 (Fire classification of construction products and building elements - Part 1), Classification E, Efl.

## 6. POSSIBLE APPLICATIONS

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The main information concerning the possible applications of the PAD INDOOR system in the rooms to be heated is given below:

application	advantages and limitations
	<p>The very low thermal inertia of the radiant element, in the case of dry installation, allows for quick adjustment of the system. Excellent in cases of intermittent or discontinuous management. Direct bonding of the flooring is possible after applying a layer of adhesive with or without a self-levelling cement additive to even out the laying surface.</p>
	<p>The very low thermal inertia of the radiant element allows for fast system adjustments. It is possible to apply the heating element and sandwich it dry with a plasterboard finishing panel. Excellent in cases of intermittent or discontinuous management. Excellent in the case of renovations and additions to rooms without a heating system, as a result of the non-invasive work required.</p>
	<p>The very low thermal inertia of the radiant element allows for fast system adjustments. The heating element can be applied with a plastered, tiled or drywall finish. Excellent in cases of intermittent or discontinuous management. Excellent for heating shower cubicles, integrating bathrooms and anti-fogging heating of mirrors.</p>

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## 6.1 LEGISLATIVE INFORMATION

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In the case of renovation or energy refurbishment, it is possible to derogate from the minimum internal living space height of 10 cm.

This possibility is of fundamental importance when it is necessary to insert a radiant floor or ceiling system inside an existing building.

### Italian Ministerial Decree 26.06.2015 - Annex 1, art. 2.3.4

In existing buildings that have undergone major renovations or energy redevelopment as defined in Article 2, paragraph 1, letters l-vicies ter) and l-vicies quater) of the Italian legislative decree, with the specifications set out in paragraphs 1.3 and 1.4 of this Annex, in the case of the installation of heating systems equipped with radiant floor or ceiling panels and in the case of insulation from the inside, the minimum heights of the living quarters provided for in the first and second paragraphs of Italian Ministerial Decree of 5 July 1975 **may be derogated from, up to a maximum of 10 centimetres.**

**However, in mountain municipalities above 1,000 metres above sea level, the minimum height of habitable rooms may be reduced to 2.55 metres, taking into account local climatic conditions and the local building type**

Specifically, the energy requalification activities of a building fall within the normal activities of routine or extraordinary maintenance as stated in

### Italian Legislative Decree 192.2005 - art. 2 definitions

**l-vicies ter) “energy requalification of a building”** an existing building undergoes energy requalification when the work, however named, including but not limited to: routine maintenance, renovation and conservative restoration, falls into types other than those indicated in letter l-vicies quater); (\* )

(\* ) the different types concern so-called “major renovation” with work being performed on a surface area 25% larger than the building envelope

## 6.2 APPLICATION DETAILS

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### INTERFERENCE MANAGEMENT

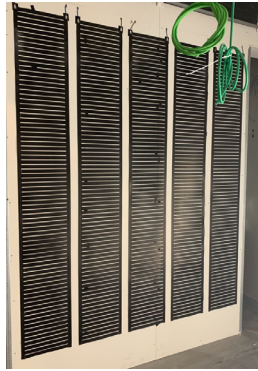
he PAD INDOOR is a semiconductor. As the power conducting element is missing, it can be interrupted at will in the event of interference with fixed elements such as light centres, socket boxes, etc.

Only preserve the integrity of the lateral electrical conductors embedded in the technopolymer.



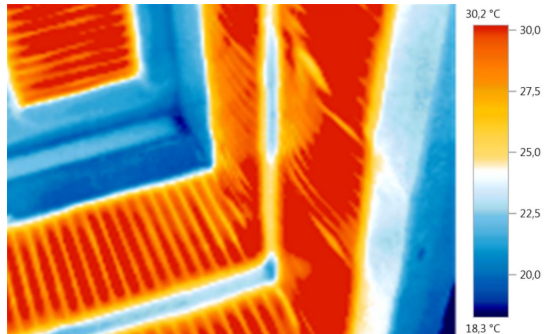
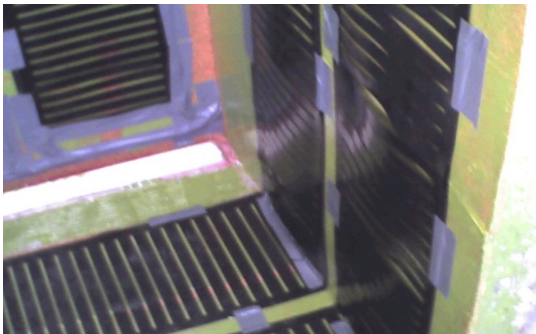
**INTEGRATION AND ELIMINATION OF FOGGING**

Example of wall heating with bonded mirror fixed with silicone.



**CALDARIUM AND SHOWER AREAS**

The PAD INDOOR has a complete ability to adhere to the shapes of seats and false ceilings with the possibility of covering them with any type of finish. This makes it possible to safely create wellness zones, even in normal shower cubicles.



**6.3 REGULATORY INFORMATION**

**Special environments and applications IEC standard 64-8 part 7**

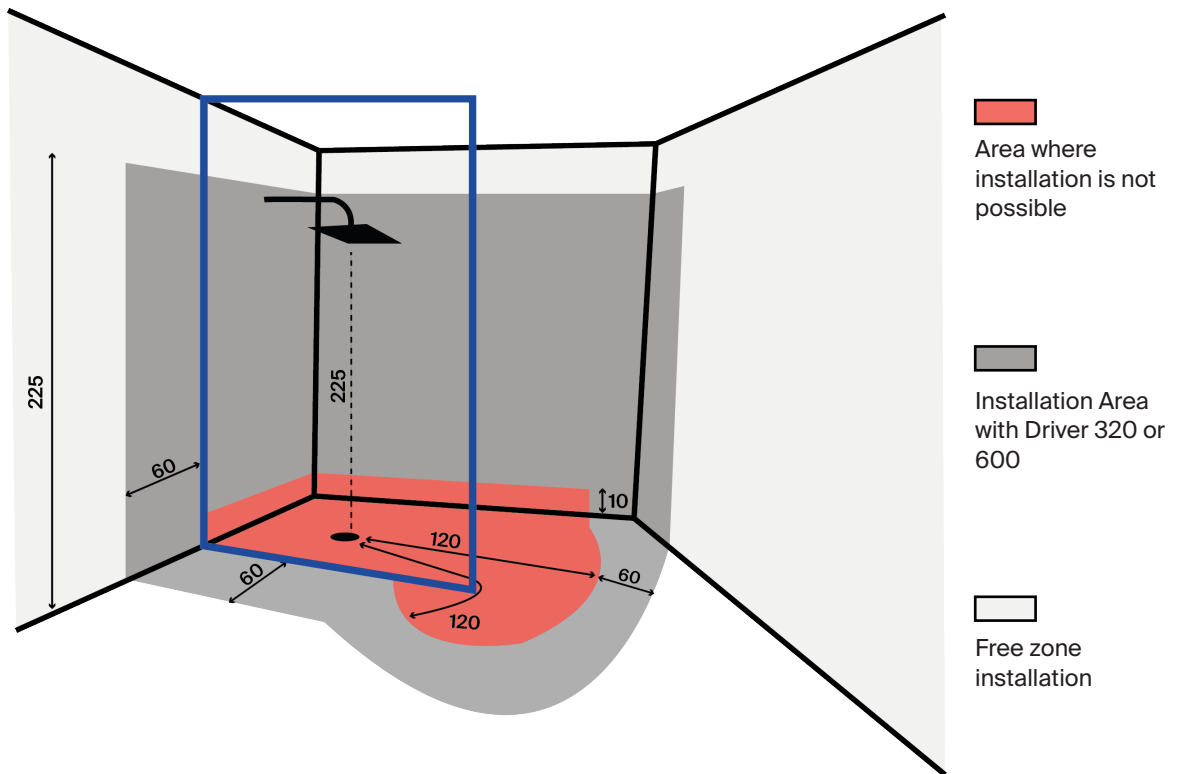
Bathrooms have special environmental conditions that lead to greater risks, especially related to the possibility of electrocution through direct and indirect contact by the user. The rules for installation in these rooms depend

on the identification of danger zones defined by the position of the bath and/or shower within the room in question.

This determines the volumes, called “zones”, within which the electrical installation and components must meet certain minimum characteristics.



INDOOR PAD INSTALLATION ( refer to IEC 64-8 PART 7 )



**Electrical characteristics of the PAD INDOOR system**

- Supply voltage 36 VDC
- Insulation class class III SELV
- Protection class IPX7

Class III with SELV protection is solely achieved by coupling the Indoor PAD with the 320 or 600 DRIVER.

The installation of the PAD INDOOR system must therefore be excluded (see orange area):

- within the volume of the tank;
- within the volume of the shower tray;

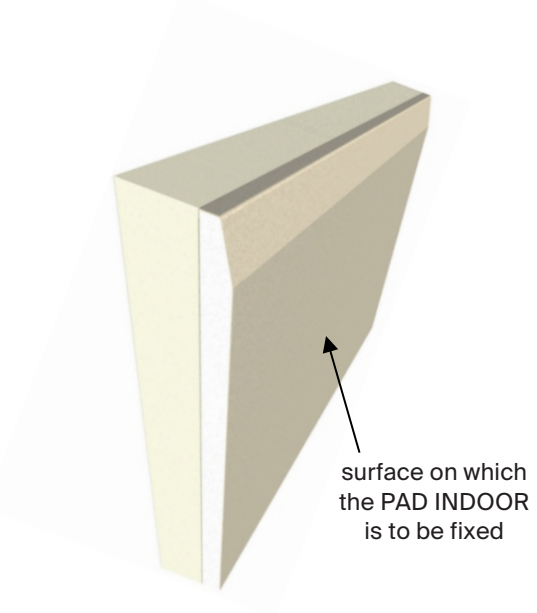
If there is no shower tray, the area to be excluded is the area within a radius of 1.2 m from the shower head and a height of 10 cm.

Outside these volumes, it is possible to install the PAD INDOOR and the corresponding power lines.

**! Warning**

Regardless of the intended installation, whether floor, wall or ceiling, the PAD system must be separated from the building envelope in the same way as any radiant air conditioning system. This requirement is supplementary to any thermo-technical dimensioning related to the energy efficiency of the building-installation system.

To enable the radiant system to be thermally decoupled from the building envelope, it may be sufficient, for example for the wall or ceiling, to install a sheet of plasterboard pre-coupled with an EPS insulation panel, with a minimum thickness of 20 mm.

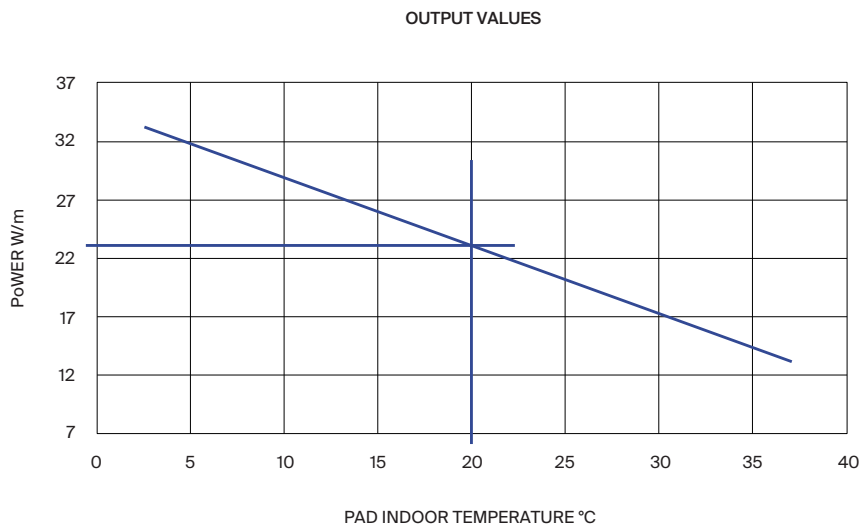


## 7. DIMENSIONING

### Power output of the PAD INDOOR mat

The nominal nameplate power, corresponding to the power consumption value at 36VDC, is delivered at a temperature between 5 and 10 C, the value at which the building envelope is normally placed in non-heated or frost-free conditions.

The chart below shows the self-adjusting capacity of the technopolymer as the contact temperature of the mat changes.



Model	Linear Power W/m	Active area m <sup>2</sup> /m	Maximun yield W/m <sup>2</sup>	yield W/m <sup>2</sup> as a function of the distance in mm between mats						
				mm	25	50	100	150	200	250
PAD INDOOR	25	0.31	80	W/m <sup>2</sup>	75	75	60	55	50	40

**For dimensioning, proceed in the following logical sequence:**

- Determine the peak demand, in W, of the room to be heated;
- Calculate the development in metres of PAD INDOOR as a function of the W/m yield; increase the development by at least 30% to take into account the share of energy dispersed towards the separation insulation with the building envelope.
- Choose the type of installation (floor, wall, ceiling) and, depending on the surface available, determine the number of strips of PAD OUTDOOR to be laid; it is advisable to keep the distance between one mat and the next between 25 and 250 mm; if the surface finish is to be fixed mechanically (e.g. plasterboard or parquet strips), preferably lay the mat at right angles to the direction of fixing of the finish itself.
- Determine the peak electrical power by multiplying the total development in metres of PAD OUTDOOR by the nominal electrical power absorbed at 10°C;
- To determine the number of power supplies required to drive the system, divide the total electrical power determined in point 4) by the electrical power that can be delivered by the drivers available from the system accessories.
- For the correct choice of power supply driver, it is advisable that the electrical power that can be supplied is at least 90% of the maximum electrical power that can be supplied by the driver. For example, the 1000 W driver can supply 900 W of PAD INDOOR;
- If the PAD is to supply power to wet areas that can be classified as special environments, it is necessary to use only power supply drivers capable of raising the protection of the electrical system to SELV (Safety Extra Low Voltage);
- Determine the installation position of the driver in order to proceed with the dimensioning of the extra-low voltage power lines; the cable route must be as short as possible in order to limit voltage drop as much as possible.

**! Warning**

This sizing method is intended to provide rapid sensitivity on the necessary heating amount to meet the peak thermal requirements of the environment. This method does not replace the thermo-technical calculation, which must consider the emission value towards the environment as well as the limitation constituted by the thermal resistance of the finishing element.

**Information for electrical dimensioning:**

- For the DC extra-low voltage line, provide one or more distribution backbones for connecting, in parallel, the 36VDC output of the power supply driver to the junction boxes to be located near the PAD INDOOR mats to be powered;
- Each junction box must contain a distribution manifold from which the power cord of each mat is derived. Each cord shall feed a length of PAD INDOOR not exceeding 7 metres.
- The maximum voltage drop recommended by IEC 64/8 is 4 % from the point of delivery to the last consumer, normally divided into 1.5 % for the line from the measuring instrument (meter) and 2.5 % for the internal electrical distribution;
- For the 36VDC extra-low voltage line downstream of the distribution drivers, it is preferable to dimension the line so that the total voltage drop of the line does not exceed 0.5 VDC. However, it is possible to correct the output voltage of the driver within the range given in the technical characteristics section.
- The following tables can be used for an initial awareness of power line dimensioning:

power W power matching the size of the driver	cable length m	cable cross section mm2 unipolar type H07V-K or FS17 450/750V
600	5	6
600	10	10
600	15	16
600	20	16
1000	5	10
1000	10	16
1000	15	25

Example: If we were to imagine a wall heating system consisting of 9 strips of PAD INDOOR, each 2 metres long (60 W) and connected to a 600W power supply driver, we could assume the following line combinations:

<b>PAD INDOOR power cord length m</b>	<b>length of DRIVER connection backbone m</b>	<b>cord section mm2 unipolar type H07V-K or FS17 450/750V</b>	<b>backbone section mm2 unipolar type H07V-K or FS17 450/750V</b>
20	-	2,5	-
10	5	2,5	10
5	10	2,5	16

Regardless of the size of the rooms and the electrical power installed, the electrical system to be built must always be preceded by the project drawn up as provided for by Italian Ministerial Decree 37/2008 art. 5 comma 1;

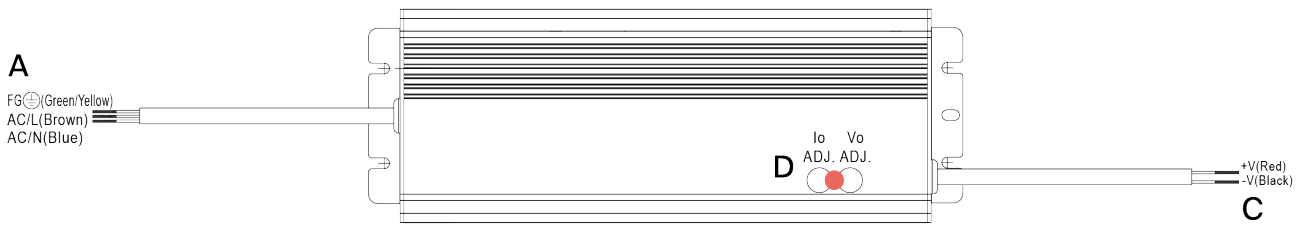
## 8. POWER SUPPLY DRIVERS

- The PAD INDOOR must be supplied via the system’s power supply DRIVERS;
- DRIVER 320, DRIVER 600 and DRIVER 1000 are rectifier transformers with the output line, 36 VDC side, protected against short circuit, overload, overvoltage and overtemperature;
- The DRIVER 320, DRIVER 600 and DRIVER 1000 allow adjustment of the output voltage value by means of a specific trimmer;

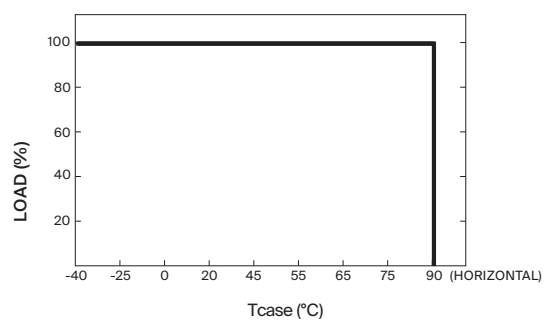
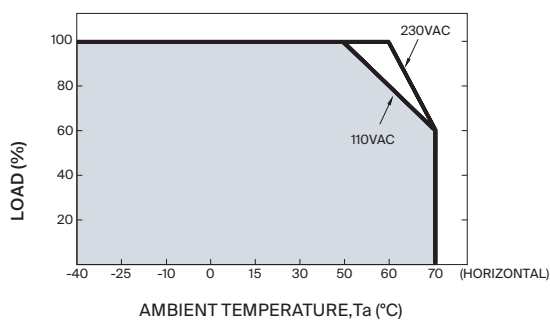
### DRIVER 320

It is a watertight version of the equipment to be preferred if:

- The location must be in a humid place and/or with the possibility of surface condensation;
- The environment in which it is located lacks or has limited ventilation for the correct operation of the equipment (false ceiling, built-in electrical box, etc.);
- A maximum of 10 m of PAD mat must be fed.
- When the heating system is installed in a special environment where SELV safety is required, such as wet rooms or bathrooms.



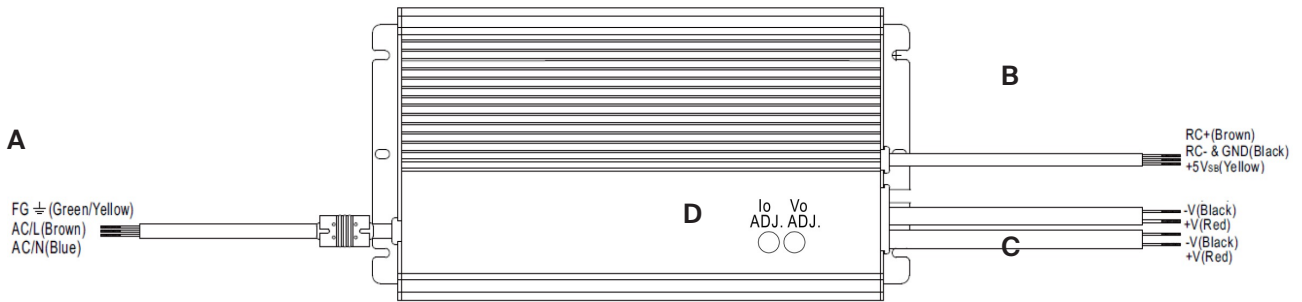
<b>A</b> IN line power supply	AC/L	brown	230 VAC line connection
	AC/N	blue	
	FG	yellow- green	
<b>C</b> OUT power supply PAD	-V	black	Connection PAD INDOOR Line 300 W
	+V	red	
<b>D</b> adjustment trimmer	Output voltage adjustment trimmer highlighted in red. Replace the cap to restore the IP grade.		



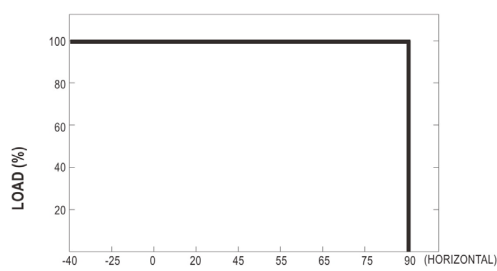
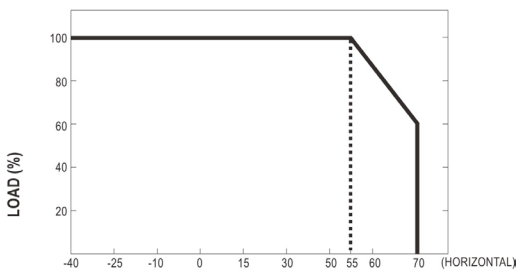
**DRIVER 600**

It is a watertight version of the equipment to be preferred if:

- The location must be in a humid place and/or with the possibility of surface condensation;
- The environment in which it is located lacks or has limited ventilation for the correct operation of the equipment (false ceiling, built-in electrical box, etc.);
- The heating system is installed in a special environment where SELV safety is required;
- When the heating system is installed in a special environment where SELV safety is required, such as wet rooms or bathrooms

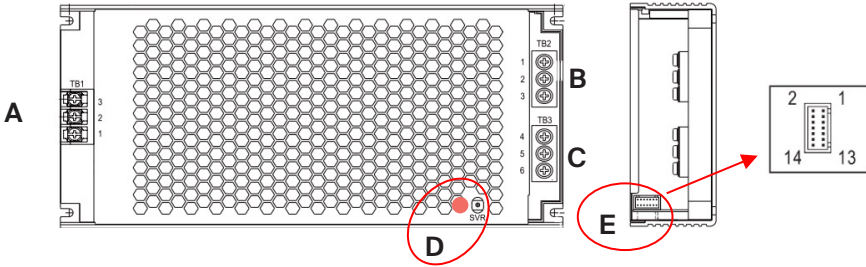


<b>A</b> IN line power supply	AC/L brown	230 VAC line connection
	AC/N blue	
	FG yellow-Green	
<b>B</b> Auxiliary OUT	RC + brown	Remote ON-OFF consent
	RC - black	Closed contact = OFF
	+5V yellow	do not connect
<b>C</b> OUT power supply PAD	-V black	Connection PAD INDOOR Line 300 W
	+V red	
	-V black	Connection PAD INDOOR Line 300 W
	+V red	
<b>D</b> adjustment trimmer	Output voltage adjustment trimmer highlighted in red. Replace the cap to restore the IP grade.	

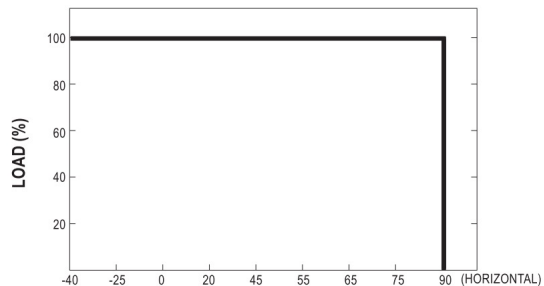
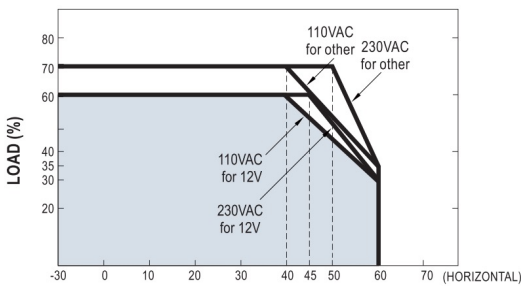


**DRIVER 1000**

This is an “open” version of the appliance, which is preferable if it can be installed in ventilated rooms, favouring vertical installation to facilitate convective exchange and avoid dust deposits.



<b>A</b>	IN line power supply	1	AC/L	230 VAC line connection
		2	AC/N	
		3	⊥	
<b>B</b>	Auxiliary OUT	1	+V	PAD INDOOR connection Use one or more terminals
		2	+V	
		3	+V	
<b>C</b>	OUT power supply PAD	4	-V	PAD INDOOR connection Use one or more terminals
		5	-V	
		6	-V	
<b>D</b>	adjustment trimmer	Output voltage adjustment trimmer highlighted in red.		
<b>C</b>	Auxiliary terminal board Uncalled terminals should not be used	1	PV	bridged
		2	PV-DIS	
		7	remote ON-OFF	Remote consent ON-OFF Closed contact = ON
		8	GND	
		13	Vccs	bridged
14	PC-DIS			



**! Warning**

When choosing the location of the power supply DRIVER and the materials in contact with the equipment, consider compatibility with the maximum temperature that the enclosure can reach..



**Warning**

**In order to ensure optimal conditions and a long service life for the power drivers, it is important to:**

- Install them so that the heat is dissipated effectively;
- Do not locate the power supply in a place where the ambient temperature tends to exceed 25°C;
- The power supply must not be covered with insulating material;
- Although they are extremely quiet, it is preferable not to place the power supply in “quiet” areas or within partitions separating bedrooms or reading rooms;
- Avoid anchoring power supplies on large surfaces that can transmit vibrations;
- Although shielded against interference transmission, it is recommended that power supplies are not placed in the vicinity of monitors and television sets;
- The power supply unit must be positioned so that it is easily accessible for maintenance and repair;
- Always refer to the specific use and maintenance manual that can be downloaded using the QR on the driver’s packaging box;

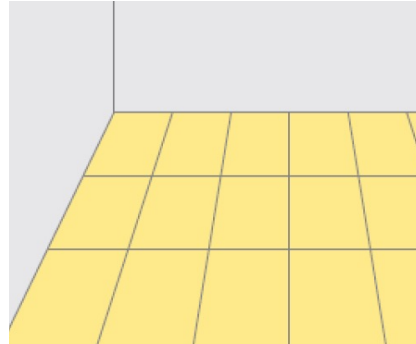


## 9. PAD INDOOR SYSTEM INSTALLATION

Check the flatness and cleanliness of the insulation required for thermal decoupling between the radiant system and the building envelope.

In the case of underfloor installation, a vapour barrier should be laid underneath the insulation layer to protect against rising damp.

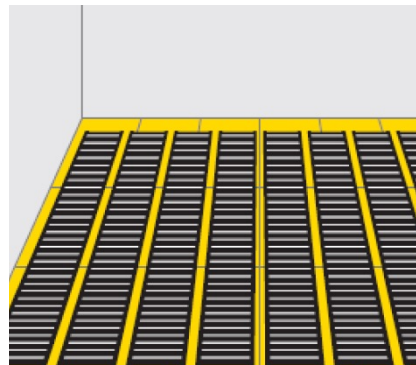
Install the insulation layer as specified in the project (minimum 20 mm), checking that it is laid correctly according to the standards provided by the manufacturer.



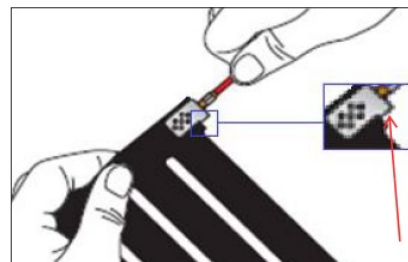
In the case of a ceiling or floor system, apply a perimeter joint to absorb thermal expansion.

- Cut the heating mat into strings of the length specified in the installation plan.
- Position the strings according to the centre distances specified in the installation plan.
- When laying on the floor, lay an electrical cable duct along the side chosen for the wiring of the mats, to be incorporated into the insulation layer, in which the electrical wiring cables are laid as shown in the plan.

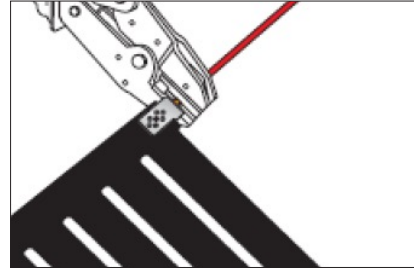
**WARNING:** Take care that there are no metal or conductive parts in direct contact with the polymer or power cords (screws, wire mesh, pipes, structures, etc.).



- Remove a small portion of polymer in the corner next to the braid, to make it easier to position the crimp terminal so that it remains in line with the braid of the upright embedded in the polymer.
- Insert the stripped cable (single-core 2.5 mm<sup>2</sup> cord) over a length of 1 cm so that it reaches the first teeth of the crimp terminal.



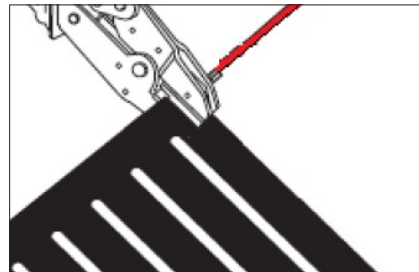
- Remove a small portion of polymer in the corner next to the braid, to make it easier to position the crimp terminal so that it remains in line with the braid of the upright embedded in the polymer.
- If necessary, flatten the copper strands of the polymer-bonded cord in order to reduce their thickness and facilitate bundling between the crimp clamp and the braid itself.



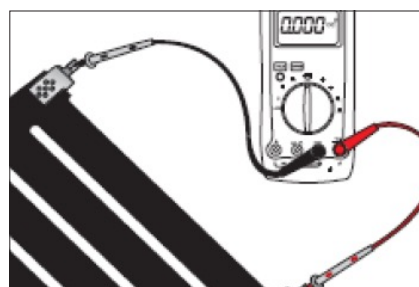
**!** **Warning**

The crimp terminal has an eyelet sized to accommodate a 2.5 mm<sup>2</sup> cross-section cord. Always prefer parallel connection (or series connection, to connect several pieces of PAD up to a maximum length of 7 metres) avoiding the use of multiple connections from the same pole (in and out from the same terminal).

- Now crimp the terminal as shown in the figure in several places, checking that it is perfectly flat and mechanically tight.
- Carry out the same operation on the other upright using a different coloured cord (for the extra-low voltage line, use red and black), so that the two uprights and their polarities can be easily distinguished;
- Mark the wire pair with an identification number so that it can be identified within the junction and junction box.



- Before continuing with the electrical wiring, check the electrical resistance between the terminals
- Using a tester, the resistance between the terminals should be 0 ohms, which is a sign of perfect electrical wiring.



- Connect the cables in parallel with each other in the sequence shown in the image opposite.
- Alternate the colours of the cables on the strings side by side so that they always have the same colour next to each other (red-black... black-red... red-black, etc.)



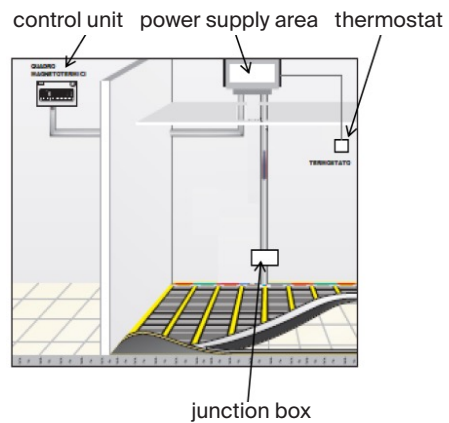
**LOW VOLTAGE SIDE**

Provide a dedicated 230VAC line, which can be disconnected, to supply the radiant heating system.

Provide upstream thermal-magnetic protection with adequate breaking capacity and differential protection  $I_{dn} \leq 30 \text{ mA}$ ; provide for grounding of the primary of the power supply drivers.

**EXTRA-LOW VOLTAGE SIDE**

The 36VDC lines from the power supply drivers are protected against short circuits, overload, **overvoltage and overtemperature**

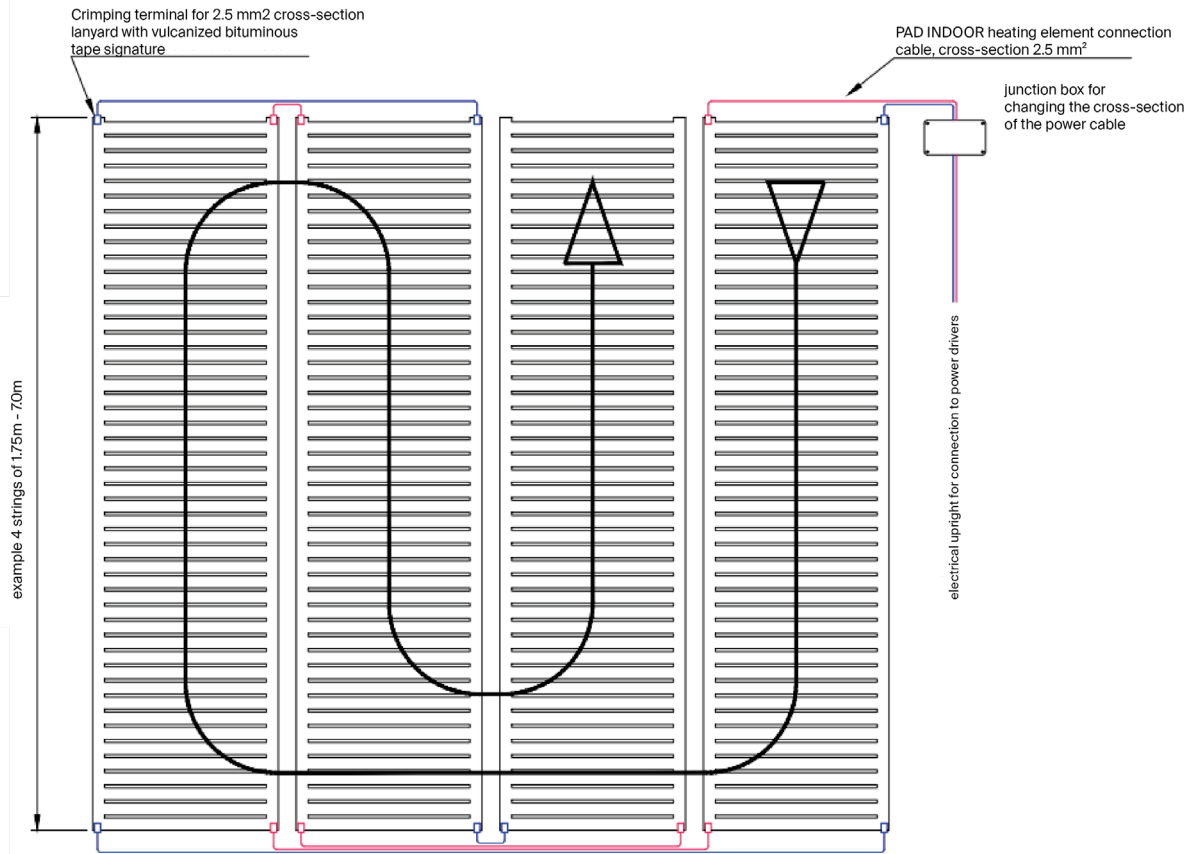


**Warning**

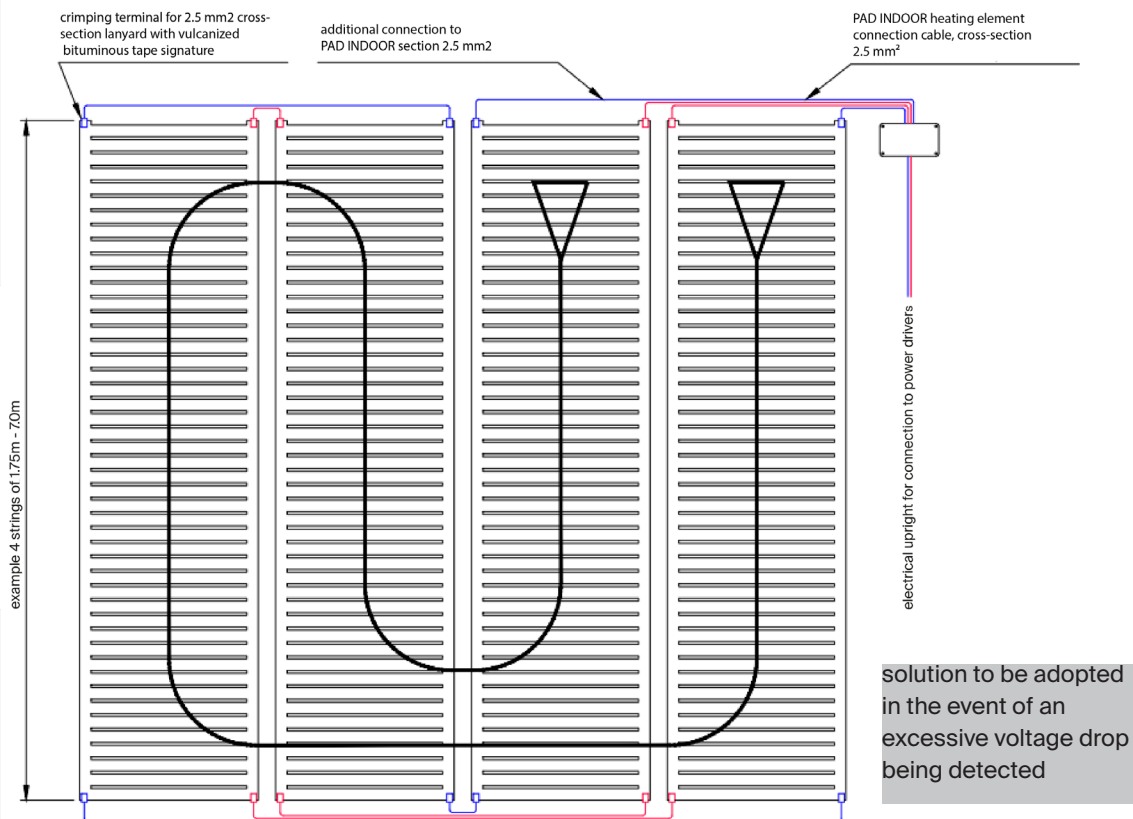
**EXTRA-LOW VOLTAGE SIDE**

If it is necessary to install a junction box inside the bathroom area, or similar, for joining the supply cords of the mats with the backbone coming from the driver, this must always be located in zone 3.

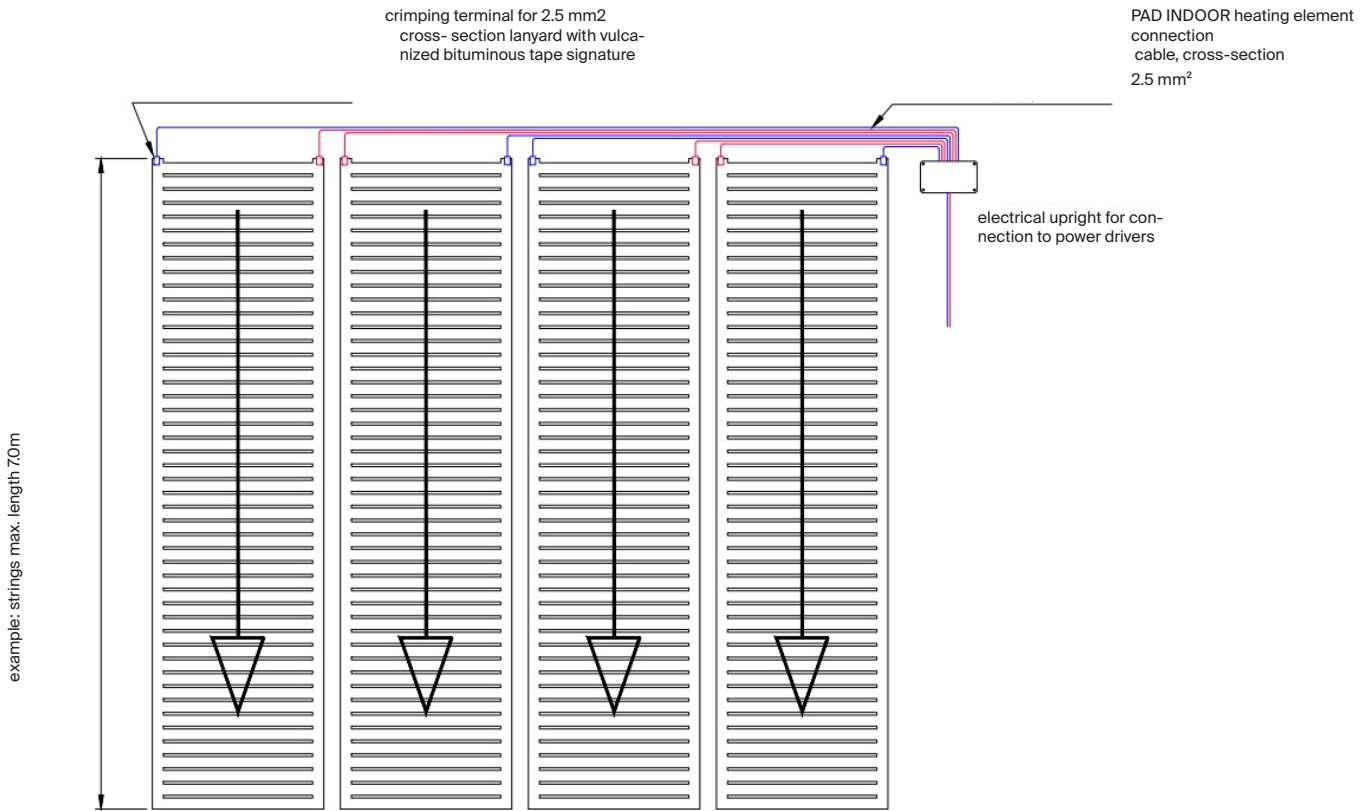
- If the power supply driver with SELV protection is not used, the PAD INDOOR system can still be installed inside the bathroom area, or similar, in zones 1-2-3, provided it is covered by a metal mesh, or a metal screen, earthed and connected to the supplementary equipotential bonding.
- It is advisable not to feed the polymer if it is rolled up or overlapped or has a length of more than 7 metres.



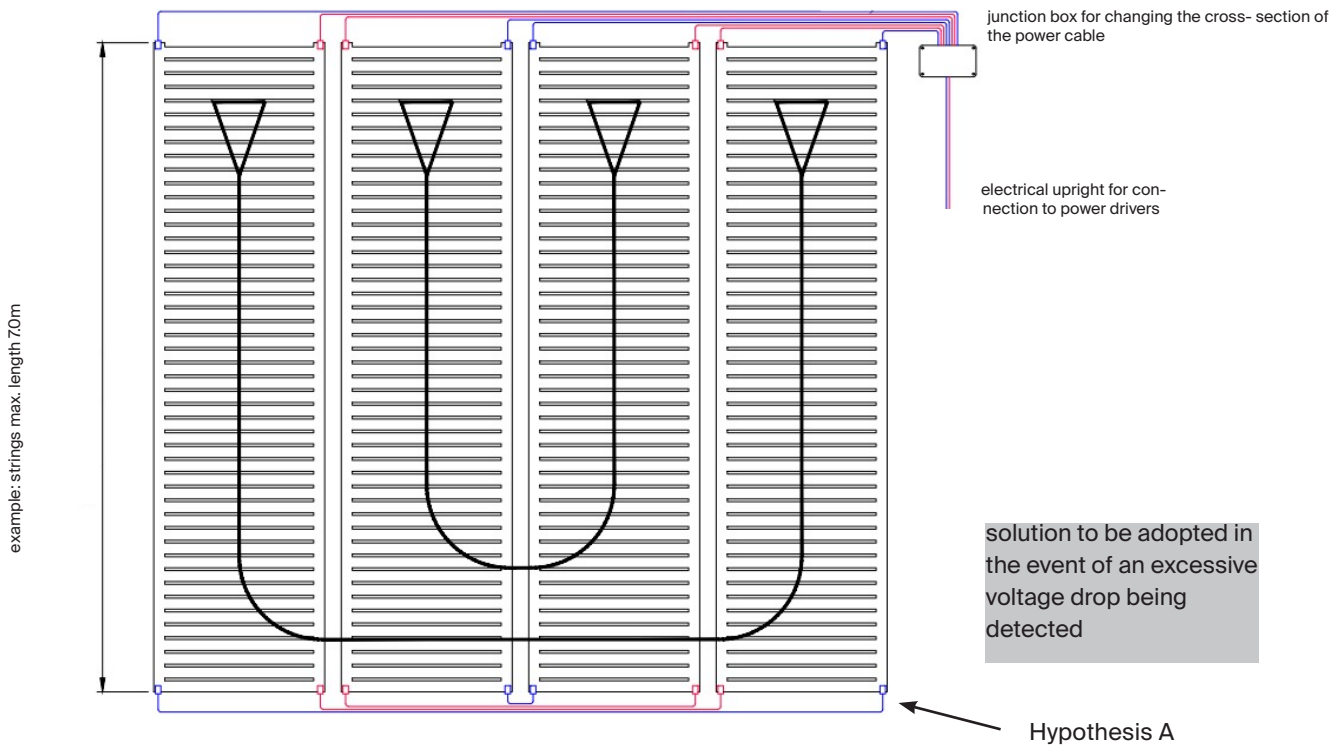
It is possible to wire several strings of PAD INDOOR in SERIES, whose overall length does not exceed the maximum length of 7 metres



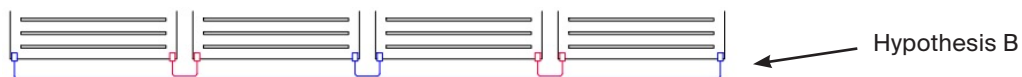
It is possible to wire several strings of PAD INDOOR in SERIES/PARALLEL, whose overall length does not exceed the maximum length of 7 metres

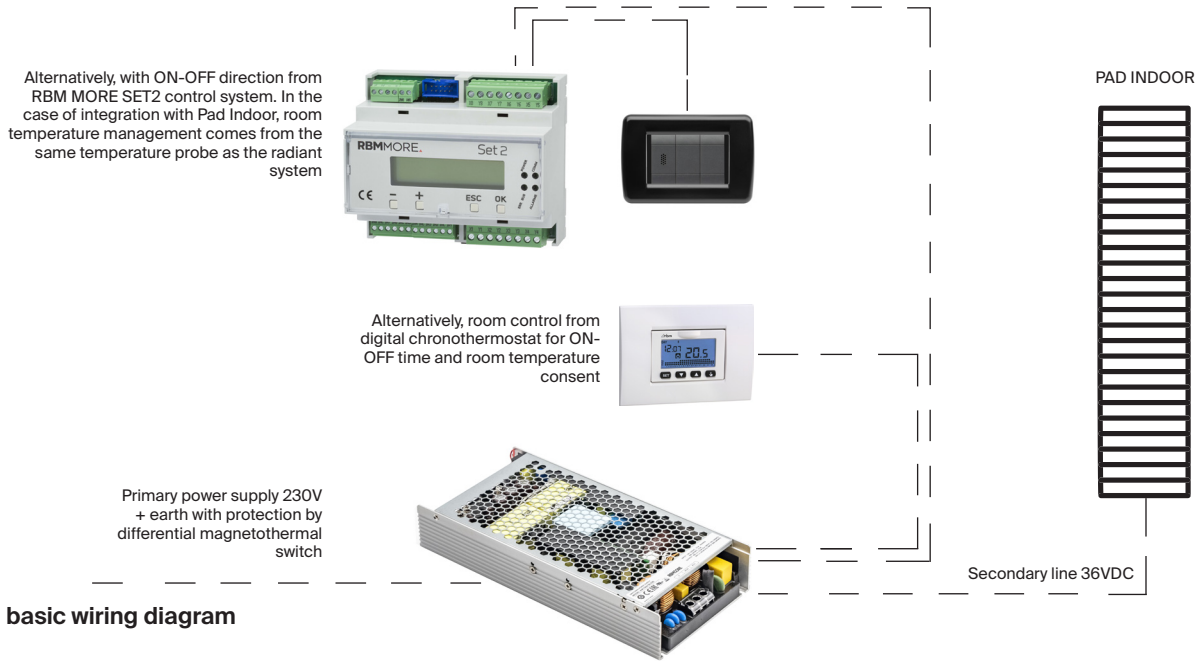


PARALLEL of several strings of PAD INDOOR, each with a maximum length of 7 metres, is possible



RIES/PARALLEL of several strings of PAD INDOOR, each with a maximum length of 7 metres, is possible





**! Warning**

**BEFORE PROCEEDING WITH THE REMAINING STEPS PERFORM THE FOLLOWING FUNCTIONAL CHECKS TO BE REPEATED FOR EACH POWER SUPPLY DRIVER:**

- primary circuit driver input voltage control (230 V AC)
- driver output voltage control sub-circuit (36.0 V DC)
- secondary circuit voltage control to junction box (.....V DC)
- secondary circuit voltage control at crimp terminals (... ..V DC)
- secondary circuit voltage control at the end of the string (35.5 V DC)

**if necessary, adjust the voltage adjustment trimmer to correct the output value from the power supply driver.**

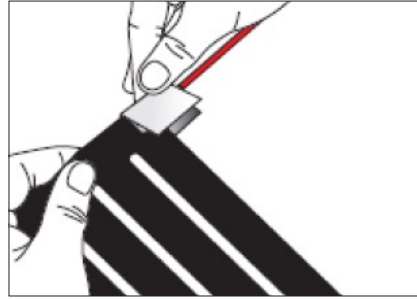
The purpose of the tests is to check whether there are any joints or connections which generate excessive resistance resulting in an excessive voltage drop.

With positive electrical checks, check after about 15 minutes that the polymer is correctly heated. Using an infrared camera, check that all strings are uniformly at temperature.

Using the self-amalgamating bitumen tape supplied (series 3861), insulate the copper parts of the cable and the crimp terminal from oxidation.

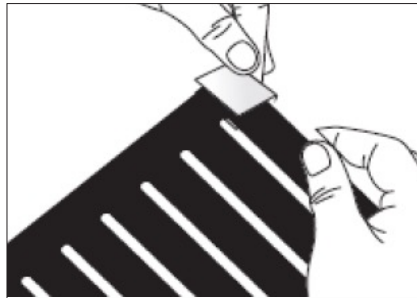
Press well to release the air trapped in the “sandwich” in order to make the bituminous parts adhere to make the contact watertight.

Use only self-amalgamating bituminous tape to maintain the CE certification of the PAD INDOOR product as it has been tested in conjunction with the use of this specific tape.



Similarly, also insulate the cuts in the end of the string, as shown in the photo, to prevent oxidation of the braid on the upright at the cut point.

Do not use any other type of tape as too aggressive thinners may lead to deterioration of the polymer forming the heating mat.



The self-amalgamating double-sided butyl tape reinforced with polyester mesh in bituminous adhesive has the following functions:

- Dielectric sealing of the areas affected by the crimping between the terminal, electrical cable and technopolymer.
- Antioxidant protection of the electrical cable and terminal.
- electric protection IP X7.

**!** **Warning**

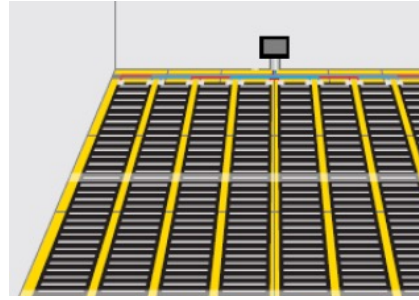
The following precautions must be taken when applying the bituminous tape:

- Make sure that the parts that will be sealed are clean and free of dust and impurities.
- Apply the tape with an ambient temperature and the components to be sealed between 5 and 40°C.

**Valid for floor, wall or ceiling**

Fasten the strings with metal staples on both sides and at each metre, taking care to lap only the outside of the polymer by 2/3 mm, without touching the braids of the electrical struts.

Alternatively, use plastic nails or paper tape about 5 cm long. The only purpose of fixing is to prevent the mat from shifting during the subsequent finishing stages

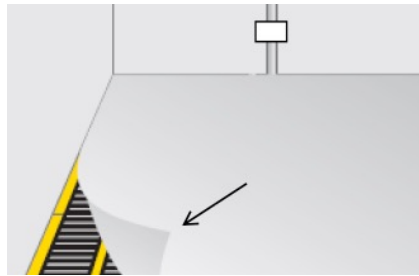


Another alternative to staples and nails to temporarily secure mats to the substrate, is solvent-free reinforced double-sided tape, such as MAPEI Mapecontact, 240 mm wide.

**Valid for floor ONLY**

The protective sheet is to be laid over the entire floor surface, when the floor installation involves aggressive cements and adhesives and/or when the laying centre distance exceeds 150 mm in order to favour the uniformity of the surface temperature. Along the joint lines of the sheet, overlap at least 5 cm.

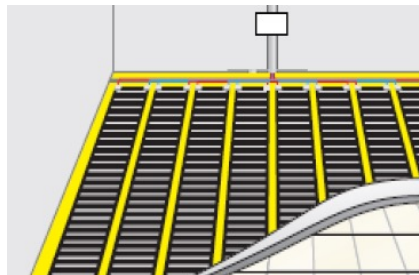
Use tape (packing tape or similar) to seal the edges of the protective sheet, preventing mortar or glue from penetrating underneath.



**Valid for floor ONLY**

It is always advisable to use a self-levelling water-based cement screed, with a minimum thickness of 2 cm, suitable for radiant floor systems. The self-levelling agent must be used to eliminate any irregularities caused by the wiring, as well as to prevent the joints from sagging. For the installation steps and instructions, follow the guidelines given by the manufacturer of the screed and the installer of the surface finish; the thickness of the self-levelling agent will depend on the type and size of the finish.

Wait for the self-levelling agent to dry completely to avoid abnormal shrinkage and cracking, then switch the system on again in the test cycle for at least 24 hours.



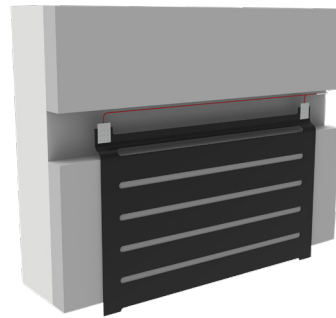
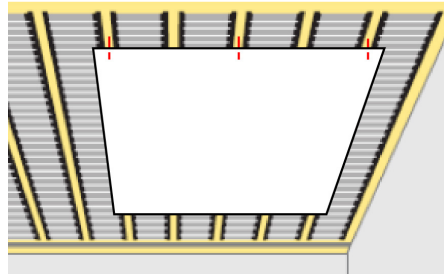


**Valid for the wall and/or ceiling  
Plasterboard finish**

The string centre distance will depend on the peak thermal power to be delivered; if there are no specific requirements, it is advisable to ensure a longitudinal centre distance of approximately 400 mm (axis-axis), a measurement that matches the majority of metal counter spreader structures (structure present in the case of false ceilings).

In order to prevent the formation of bumps and bulges on the final surface of the plasterboard caused by the passage of cables and crimping terminals, it is advisable to remove part of the PAD INDOOR support surface at the crimping area of the electrical terminal so that it does not generate thickness.

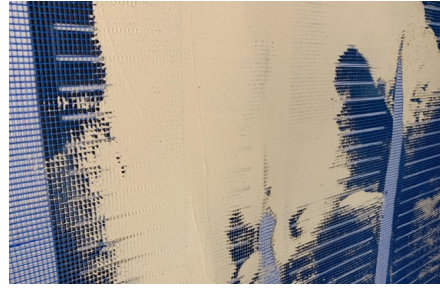
If the wall does not allow electrical cables to be passed inside the false wall or ceiling (laying close to the “sandwich” sheet), it is advisable to remove a strip of plasterboard of about 50 mm to accommodate the crimping area as well as to facilitate passing the electrical cables. Once the electrical wiring and functional test have been completed, finish by laying plasterboard counter-sheets to hold the PAD INDOOR strings inside the “sandwich”. Ensure perfect adherence between the PAD INDOOR and the counter-slab by correctly anchoring the latter to the spreader structure or the floor.



**Valid for wall only**

Temporarily secure mats to the substrate with solvent-free reinforced double-sided tape, such as MAPEI Mapecontact, 240 mm wide.

Once the electrical wiring and functional test is complete, finish by laying a 5x5 mm section fibreglass mesh reinforcement for coats, to be fixed with (stainless steel) metal clips or plastic dowels for coats.



Apply several coats of water- or latex-based cement mortar that has sufficient elasticity to withstand the normal temperature fluctuations typical of an external coating, as well as avoiding chemical aggression to the polymer.

**Warning**

Proceed with the subsequent application of the desired finish, taking care to ensure complete adhesion of the finish to the radiant substrate

**Example of stratigraphy:**

1. application on the masonry and PAD INDOOR of a layer of solvent-free acrylic primer for absorbent and non-absorbent substrates, even with residues of old adhesives (such as Mapei Eco Prim T)
2. 1 mm of reinforced glass fibre mesh 10x10 (such as MAPEI Mapegrid G)
3. a layer of pre-blended, two-component, fibre-reinforced, highly ductile, non-combustible cementitious mortar with pozzolanic reactivity binder based, 5 to 25 mm thick (such as MAPEI Planitop HDM Maxi). The thickness to be applied depends on the degree of unevenness of the substrate.
4. for surfaces to be tiled, proceed with laying with adhesive
5. a final coat of fine-textured, hydrophobic cementitious smoothing compound for concrete, plastic, glass and porcelain cladding, 1 to 3 mm thick (such as MAPEI Planitop 200).

Follow the instructions given by the manufacturer of the finishing products for the installation steps and methods.

## 10.DISPOSAL

For the polymer: CER170411  
For electrical equipment: CER160216

**WEEE Waste Electrical and Electronic Equipment**

Italian Legislative Decree 25 July 2005, no.151 "Implementation of Directives 2002/95/EC, 2002/96/EC and 2003/108/EC and subsequent amendments and integrations concerning the reduction of the use of hazardous substances in electrical and electronic equipment, as well as waste disposal".

The crossed-out wheelie bin symbol on the equipment, or on its packaging, indicates that the product, at the end of its useful life, must be collected separately from other waste and taken to separate collection centres. The cost for separate disposal of this end-of-life equipment was originally paid for by the manufacturer, organised and managed by the manufacturer.

The user who wishes to dispose of the equipment included in this system should, therefore, take it to an authorised centre for separate collection.

Appropriate separate collection for subsequent recycling, treatment and environmentally sound disposal of discarded equipment contributes to avoiding any negative effects on the environment and health while promoting the reuse and/or recycling of the materials the equipment is made of. Illegal disposal of the product by the holder will result in the application of administrative sanctions as provided for by the legislation in force.

RBM spa reserves the right to improve and change the products described and relevant technical data at any moment and without prior notice. The information and images contained in this document are intended for information purposes only, are not binding and in any case do not exempt the user from strictly following the regulations in force and good practice standards.

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