

E-ENERGY CARBON

Electric surface heating system



Installation instructions & operating manual

Power supply unit BASIC EI 300 W AP/UP

INSTALLATION SKETCH:

Please keep this document in a safe place



☐ Heating foil

☐ Control unit

☒ Thermo sensor

☐ Transformer

Installation instructions & operating manual

E-ENERGY CARBON

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1. Delivery condition

The **E-ENERGY CARBON** panel heating system can be used as a full heating system, auxiliary heating or for surface tempering can be used in the renovation (e.g. mould prevention).

1.1 Scope of delivery

- E-ENERGY CARBON power supply unit BASIC EI 300 W AP/UP
- Installation instructions & operating manual

The following additional products are required for the complete E-ENERGY CARBON system:

- Assembled heating foils from 60 to 290 W/m²
- E-ENERGY CARBON room thermostat

2. Information for users

Please read these operating instructions carefully before installation and follow the instructions. The **E-ENERGY CARBON** system can be used by children aged 8 years and older and by persons with reduced physical, sensory or mental abilities or lack of experience and knowledge, if have been supervised or instructed in the safe use of the device and the resulting understand the resulting dangers. Children must not play with the device. Cleaning and user maintenance must not be carried out by children without supervision.

A copy of the operating instructions must be kept in the circuit distribution box. In case of change of ownership the Please inform the subsequent owner about the installation. In humid/wet rooms DIN VDE 0100 part 701 be taken into account. If the **E-ENERGY CARBON** heating foil is installed under e.g. a tiled floor (preferably underneath the sealing) in a humid/wet area (e.g. shower), this area does not count as protection area 0, 1 or 2 according to DIN VDE 0100 part 701. Installation is permitted under these conditions.

2.1 Safety instructions

- Please read this manual carefully and completely before you start the installation.
- Transport: To protect all parts from damage, they should remain in their original packaging until they reach the installation site. Internal parts can be damaged by shock and fall.
- Damaged equipment or parts must not be put into operation.
- Do not remove the safety labels and type plates.
- The individual components may only be installed in closed rooms.
- All assembly and installation work must always be carried out in a de-energised state.
- he circuit for connecting the power supply unit must be sufficiently dimensioned and fused for installation. When operating the heating system, this circuit must not be overloaded.
- The device is not ready for operation when delivered and must first be connected to a control unit, e.g. room thermostat, by a qualified electrician.

- The control unit / room thermostat must be sufficiently dimensioned for the switching current.
- Protect the unit from moisture, heavy dust, aggressive liquids and vapours.
- Always ensure sufficient heat dissipation (distance to thermal insulation) and ventilation.
- Never connect several units in parallel on the output side.
- Compare all technical data of the products used. These must match or be within the specified range. The power rating specified on the transformer must not be exceeded.
- Not suitable for children and persons with physically and/or psychologically limited abilities.
- Never open the device. Danger to life exists and connected components can be destroyed.

2.2 General information

The **E-ENERGY CARBON** system is tested for safety. When working on the heating system, the operating instructions must be handed over to the installer for information. The **E-ENERGY CARBON** system can be installed inconspicuously in ceilings, walls or floors. For installation, an installation plan must be drawn up to locate and position the heating foils, power supply units, electrical supply lines and, if necessary, the temperature sensor (see sketch 3.1). In order to ensure the optimum functionality of the system, qualified dimensioning and planning (e.g. heating load calculation DIN EN 12831) is recommended. In the case of wall or floor surfaces, care must be taken to ensure that the heating surfaces are not misaligned. In this case, check the corresponding product labelling (manufacturer's approval for electric panel heating) and observe the thickness and thermal conductivity λ [W/(mK)] or the resulting thermal resistance $R\lambda$ [m²K/W]. The maximum thermal resistance of the floor covering, including the underlay belonging to the floor covering, must not exceed the value of $R\lambda = 0.15$ m²K/W.

Optimum and rapid heat distribution is achieved with very thin coverings (wallpaper, plaster systems, ceramic coverings).

Material	Thickness [mm]	Thermal conductivity λ [W/(mk)]	Thermal resistance $R\lambda$ [m ² K/W]
Ceramic tiles	13	1,05	0,012
Natural stone tiles	12	1,2	0,010
Carpet	–	–	0,07 - 0,17
Disadvantage fleece	6,5	0,54	0,12
Linoleum	2,5	0,17	0,015
PVC flooring	2,0	0,20	0,010
Real wood parquet	11 - 14	0,09 - 0,12	0,055 - 0,076
Laminate	9	0,17	0,05
Cork-cork laminate	3 - 10	0,12 - 0,10	0,027 - 0,102

Planning guidelines for floor coverings on underfloor heating.

The system is operated with safety extra-low voltage 36V and thus offers a maximum of electrical safety. The connection of the power supply unit to the house mains, as well as the installation of the temperature controller and the electrical connection of the heating foils may only be carried out by a qualified electrician.

2.3 Function and application

The **E-ENERGY CARBON** system is a foil heating system for walls, ceilings and floors that is optimised for radiant heat. It is characterised by a very low installation height and ensures extremely rapid heating of individual areas directly on the surface. It can be used in the most diverse areas, e.g. in living rooms, loft conversions, fitness and sauna areas, conservatories, seating areas, mould prevention etc. Application.

In general with radiant heating systems, it makes sense to control the actual surface temperature of the heating element by means of a temperature controller with a thermosensor. Use one controller per room and, for floor installation, additionally one temperature sensor to detect and limit the surface temperature at the heating surface. The heating foil is generally suitable for the subsequent insertion of holes with a maximum size of 70 mm (see sketch under 3.1). Also observe the minimum distance of 50 mm between the holes (max. 5 cut-outs per 1 m) and 20 mm to the copper conductors (see 3.1). The copper strip on the heating track must not be damaged or cut.

2.4 Operation

The **E-ENERGY CARBON** system impresses with its easy installation and operation.

To achieve the comfortable temperature, the controller is set to the desired value. The

Room temperature control is then automatic. The actual surface temperature, or heating-up

The maximum speed of the heating surfaces depends on the respective covering and the thermal insulation of the substrate and can deviate from the set room temperature.

When selecting the room thermostats, the specifications of the Ecodesign Directive 2009/125/EC must be observed.

All **E-ENERGY CARBON** room thermostats comply with the Ecodesign Directive 2009/125/EC

2.5 Maintenance

The **E-ENERGY CARBON** heating system is maintenance-free. In the event of a malfunction, the following steps can help:

- Please check the temperature controller, e.g. the fault indication on the display.
- Check the fuse on the power supply unit.
- Check the fuse of the power supply and the in-house fuses or the earth-leakage circuit breaker.

If the fault remains unchanged, notify an authorised electrician or your specialist dealer. In general, it is recommended that the system be checked by an approved electrician after five years.

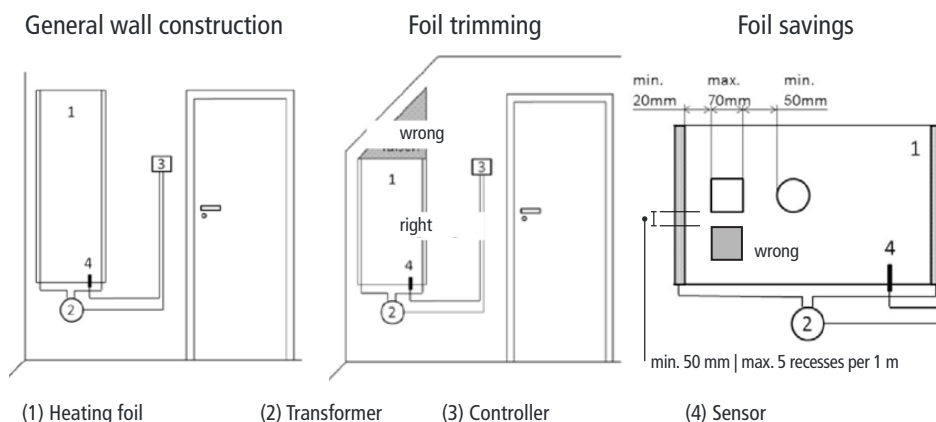
3. Installation of heating foils

3.1. Preparation

The **E-ENERGY CARBON** systems are suitable for indoor use on ceilings, walls and floors. The selection of the heating surface to be used depends on the later intended storage space for furniture and coverings as well as an optimal heat input. Please refer once again to point 2.2 of the operating instructions.

The **E-ENERGY CARBON** heating foil is not designed for installation as a storage heating system and therefore cannot be used for installation within the floor screed. The closer the heating foil is installed to the surface of the room, the faster the heating system reacts and emits the pleasant heat radiation into the room.

To facilitate your personal planning and documentation of the installation work, you should use the installation sketch (page 2). The heating foils are contacted on both sides and can be subsequently shortened into two individual foils. If the foil is to be used in its entire length, remove the contacts at one end of the foil (see sketch 3.1). The foil must always be contacted electrically at the pre-assembled contacts.



3.2. Installation

This section refers to the laying of the film. The laying of the cables and electrical connections is explained in the section Electrical connection. Take into account the minimum processing temperature of +5 °C.

For walls below 2.3 m in height and in ceilings that are inclined less than 45° to the vertical, the heating foil should be approx. 15 cm shorter than the length of the mounting surface. If necessary, the heating foil can be divided once vertically to the copper tracks. The resulting resistance values can be taken from the resistance values depending on the length. Always cut only from the uncontacted side of the heating foil.

Any other improper damage to the film, such as tears caused by sharp objects or kinks, is not permitted. For this reason, keep the heating foil in its rolled state in the packaging until installation (observe minimum bending radius, see Technical Data). After installation, however, holes can be made as described in Section 2.3 Function and Application. Warning: Note that screws may only be inserted into the heating surface if they are installed with plastic

plugs for electrical insulation. In addition, two screws must not be fitted with an electrically conductive material (e.g. metal picture frame, metal trim, metal shelving system). Do not use nails.

3.2.1. Pretreatment of the substrate

The heating foil can be applied to any load-bearing, clean and level surface made of inorganic materials such as stone, screed, plaster, etc. or organic materials such as wood, cork, plastic (possibly with surface primer / adhesion promoter), etc. The substrate and top layer materials must be suitable for the use of an electric panel heating system. If in doubt, contact the manufacturer of these materials.

Irregular surfaces are to be avoided (e.g. visible wood/stone - brickwork). Under certain circumstances, the surface must be levelled in advance with levelling plaster or levelling compound. Special care must be taken to ensure that no sharp projections such as stones, screw heads, nails or similar protrude from the substrate.

On walls and ceilings, drywall panels and wood-based panels must be installed to bridge cracks in the joint area. When installing on the floor, dry screeds and wood-based panels must always be laid in two layers and offset.

For a floating installation without gluing, e.g. between screed and laminate, we recommend approx. 2 mm of levelling cork layer or glass fibre fleece should be laid under the heating foil.

3.2.2. Thermal insulation

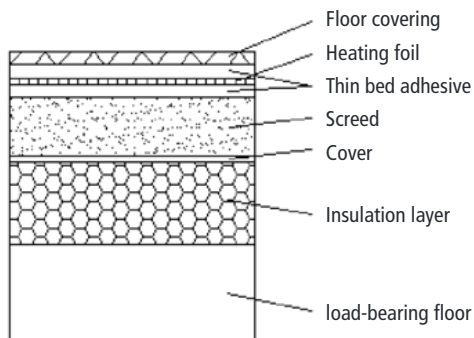
Thermal insulation in the floor and wall area is recommended to reduce the heat emission into the masonry and the floor. In order to limit the downward heat flow, the following minimum ratio of the heat transfer coefficient of the floor structure above the insulation layer and the heat transfer coefficient for all layers below the load distribution layer must be maintained (according to EN 50559:2013-12):

- Mezzanine floor, above heated rooms: $U_{\max}$: 1.25 W/(m²*K)
- Mezzanine floors above partially heated rooms: $U_{\max}$: 0.75 W/(m²*K)
- basement ceilings, walls and ceilings against unheated rooms as well as ceilings and walls that are connected to the ground border: $U_{\max}$: 0.35 W/(m²*K)

The insulation layers under the floor construction should be selected according to the following table. Minimum heat transfer coefficients must be observed. Only standardised insulation materials suitable for underfloor heating may be used. The compressibility of the insulation layer must not exceed 5 mm. If several layers are used, the compressibility of the individual layers must be added together.

	$U_{\max}$ W/(m ² *L)	$R_{\min}$ m ² *K/W
Mezzanine floors above heated rooms	1,25	0,75
Mezzanine floors above partially heated rooms	0,75	1,25
Heating surfaces between outside air or ground	0,35	2,86
Basement ceilings, walls or ceilings against unheated rooms	0,35	2,86

Minimum heat transfer coefficient and minimum thermal resistance of components.



Thermal insulation and laying as direct heating in thin-bed adhesive.

3.2.3 Installation methods

There are three different types of installation:

- (A) Embedding the film between inorganic layers with dispersion fillers or dispersion plaster systems such as Schönox FS, Brillux PM1881 or Maxit K+B.
- (B) Bonding of the film between inorganic and organic layers with all types of flexible adhesives as described under (A).
- (C) Floating installation on floor and ceiling as top layer under the top layer.

In cases (A) - (B), the foil is to be worked in the thin-bed method in a moist adhesive bed without air bubbles. To do this, apply the adhesive bed 1-2 mm thick to the substrate, then carefully press the foil into the still damp bed with a plastic trowel. The copper contact strips always face the wall. After the heating foil has been glued in, a complete covering layer (filler, plaster system, tile, etc.) of at least 2 mm must be applied. If several heating foils are to be laid next to each other, it must be ensured that a minimum distance of 20 mm is maintained between the individual foils.

It must be ensured that the foil is not laid over expansion joints.

If several heating strips are to be laid floating next to each other according to installation method (C), it must be ensured that the heating strips are secured against slipping with adhesive tape and that a minimum distance of 20 mm is maintained between the individual foils. The heating tracks and copper contact strips must not touch or cross each other when laid in multiple tracks. The ends/joints of the foil must always be taped with insulating adhesive tape (even with uncut strips). For the installation of the controller and sensor, see section Electrical connection.

Notice

Further information can be found in the QR code on the back

3.2.4. Installation under tiles

Before the tiles are bonded, the heating foil must be completely laid with flexible tile adhesive using a thin-bed method and a 1-2 mm thick top layer. The surface must be dried according to the instructions of the adhesive manufacturer. When laying several strips, ensure that the surface is level.

Sealings in wet areas are applied above the heating foil.

3.2.5. Ceiling installation

When installing the **E-ENERGY CARBON** heating foil in a suspended ceiling or if it is accessible from a roof space, a warning sign „Ceiling heating direct acting“ must be attached to the ceiling access opening.

3.2.6 Use in humid/wet rooms

When used in humid/wet rooms, the requirements of DIN VDE 0100 Part 701 must be observed. The transformer and the other components are basically suitable for use in damp and wet rooms, but may only be installed outside protection area 2.

4. Electrical connection

The installation of the electrical components may only be carried out by an approved electrician. For the heating system, an all-pole disconnecting device from the mains with a contact opening width of at least 3 mm per pole in the fixed installation must be provided. Before commissioning the application, all connections and screws must be checked.

A residual current switch (RCD with 30 mA) is necessary as indirect protection against accidental contact.

At the quick-pressure terminals of the Basic EI 300 W AP/UP power supply unit, a maximum of 300 W must be connected. The maximum lengths of the individual heating tracks are:

E-ENERGY CARBON FLEECE – 36 W/lfm (60 W/m ²)	max. 8,3 m
E-ENERGY CARBON FLEECE – 66 W/lfm (110 W/m ²)	max. 4,5 m
E-ENERGY CARBON FLEECE – 132 W/lfm (220 W/m ²)	max. 2,2 m
E-ENERGY CARBON FLEECE S – 25 W/lfm (145 W/m ²)	max. 12 m
E-ENERGY CARBON FLEECE S – 50 W/lfm (290 W/m ²)	max. 6 m
E-ENERGY CARBON PET – 69 W/lfm (115 W/m ²)	max. 4,4 m

Even when both pairs of terminals are used, the rated power of the power supply unit must not exceed 300 W must not be exceeded.

By means of the floor sensor connection set the temperature sensor is as close as possible to the heating foil surface to be installed. The metal end cap of the connection set must be taped with insulating tape to avoid residual currents. The temperature sensor is connected to the room thermostat (see operating instructions). Connection and commissioning must be carried out by a qualified electrician.

Attention: If the measured resistance values deviate by more than 15% from the output value, damage to the contacts or the heating foil must be expected. In this case you must not put the heating system into operation.

The power supply unit can be installed surface-mounted or flush-mounted. Adequate ventilation must always be provided. The ambient temperature must not exceed the maximum value of +40 °C. A minimum distance of 50 mm between power supply unit and foil must be maintained. The maximum cable length on the secondary side of the power supply unit must not exceed

10 m with 2.5 mm² cable

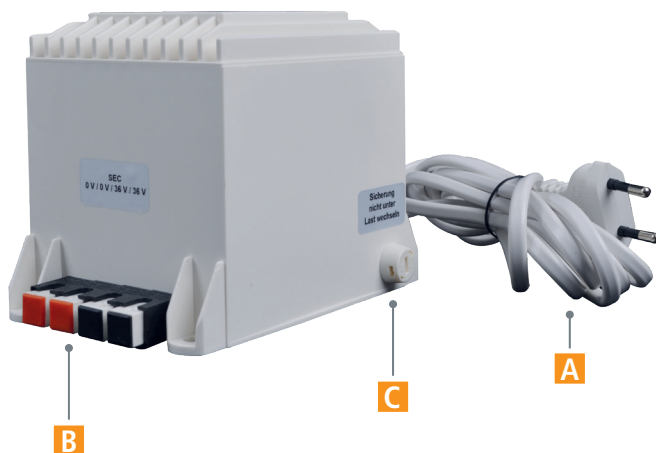
We recommend the use of our PUR twin cable for surface and flush mounting.

The electrical cables must be laid in accordance with the currently valid DIN VDE 0100.

4.1. Overview power supply of E-ENERGY CARBON (see Figure 1)

- A** Connection cable approx. 2.0 m long with Euro flat plug
- B** Quick release terminals 1.0 mm² to 4.0 mm²
- C** Internal transformer fuse (replaceable microfuse T 2.0 A)

Figure 1



4.2. Installation of transformer

The E-ERGY CARBON power supply unit BASIC EI 300 W AP/UP is referred to as a device in this manual.

The device may only be installed in closed rooms. It is designed for surface-mounted and suitable for flush mounting and must be protected against moisture, heavy dust, aggressive liquids and vapours.

Always ensure sufficient heat dissipation (distance to thermal insulation) and ventilation.

An ambient temperature of no more than 40 °C must not be exceeded.

Any interventions or changes to the power supply lead to the exclusion of the guarantee or warranty and can destroy the system! The warranty is void if the fault is due to an accident, use of force, incorrect connection, penetration of liquids, poor maintenance or misuse is. The warranty is also void in the event of damage caused by thunderstorms or other voltage variations.

Select the installation site taking into account the safety instructions and the following aspects carefully:

- The maximum cable length between the heating track and the unit is 10 m (2.5 mm²).
Place the unit so that all heating tracks are accessible with the available cable length.
- Fix the product with the 4 fixing holes on a firm, secure surface.
The surface must be such that the weight of the device is safely supported.
- Do not mount the device upside down.
- The circuit must not be overloaded by the rated current in heating mode.
- Leave a space of at least 50 mm in all directions around the transformer during installation.
Never cover the transformer and always ensure sufficient ventilation.
- The transformer fuse (microfuse) must be accessible.

4.3 Connection of mains voltage and room thermostat

The primary side is fused with 2 A.

For connection to the supply voltage, the following specifications must be observed:

Supply voltage 230 VAC, 50/60 Hz

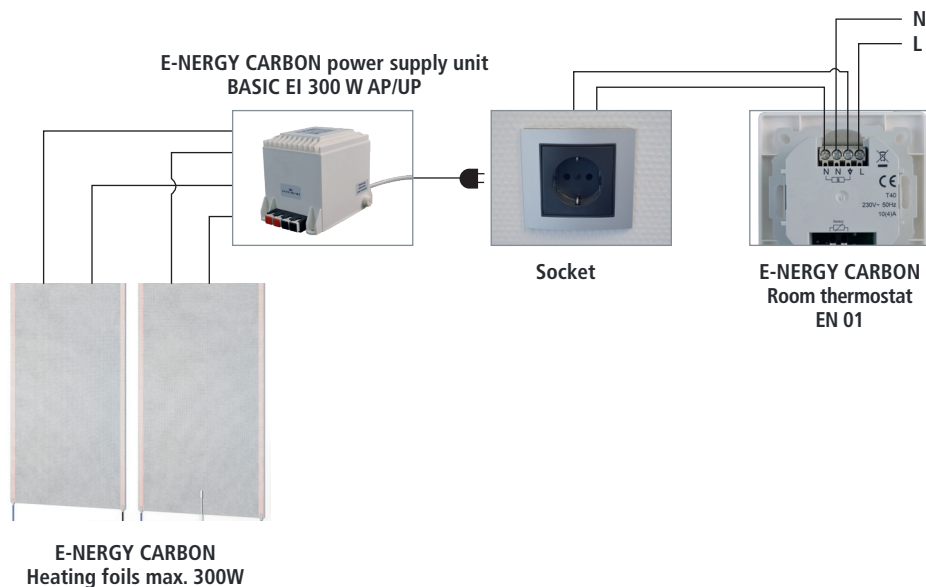
- The circuit for the connection must be adequately dimensioned and fused.
When operating the heating system, this circuit must not be overloaded.
- Circuit breaker: 16 A (Check total load of the circuit. A separate supply line is recommended)
- All assembly and installation work must always be carried out in a de-energized state.
The device is not ready for operation when delivered and must first be connected to a control unit e.g. room thermostat can be connected.
- The room thermostat or switching relay must be sufficiently dimensioned and suitable for the switching current.



Before carrying out electrical work, the power supply must be disconnected and secured against being switched on again. The electrical installation may only be carried out by competent persons or carried out in accordance with the applicable legal requirements. The installation must comply with national and/or local electrical regulations. An earth-leakage circuit breaker (nominal residual current ≤ 30 mA) is required for each circuit.

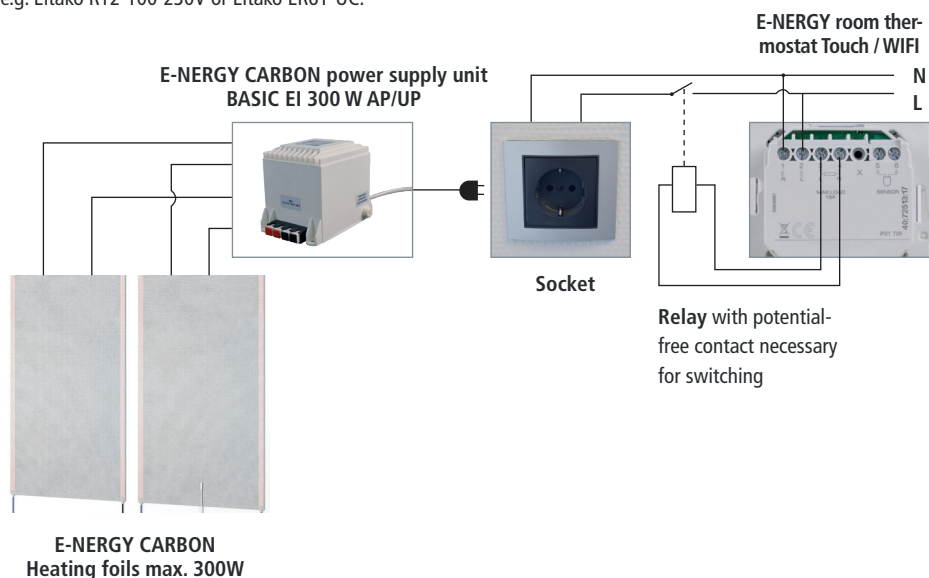
Variant 1: Connection to a room thermostat via a socket

Note: With this variant, the room thermostat (e.g. E-ENERGY room thermostat EN 01) must be sufficiently dimensioned for the inductive switching current of the unit.



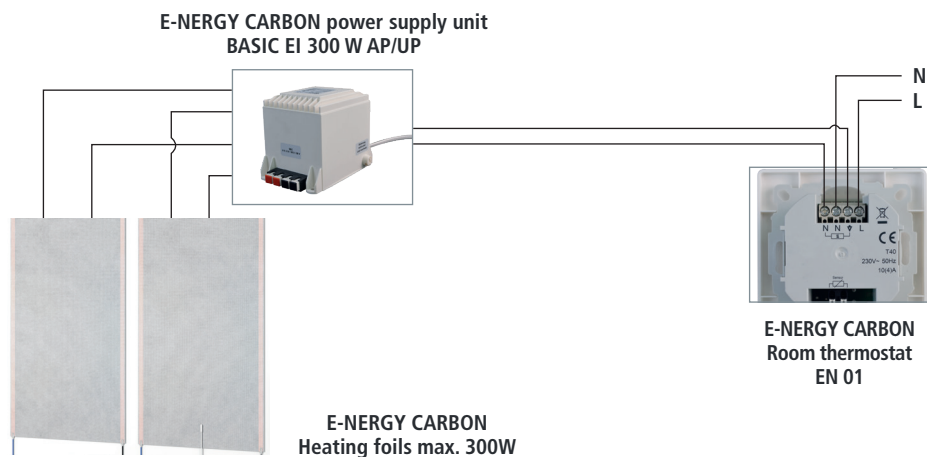
Variant 2: Connection to a room thermostat via socket and relay

Note: With this variant, the room thermostat (e.g. E-ENERGY room thermostat Touch or WIFI) is not sufficiently dimensioned for the inductive switching current of the device. The load of the device is switched via a relay e.g. Eltako R12-100-230V or Eltako ER61-UC.



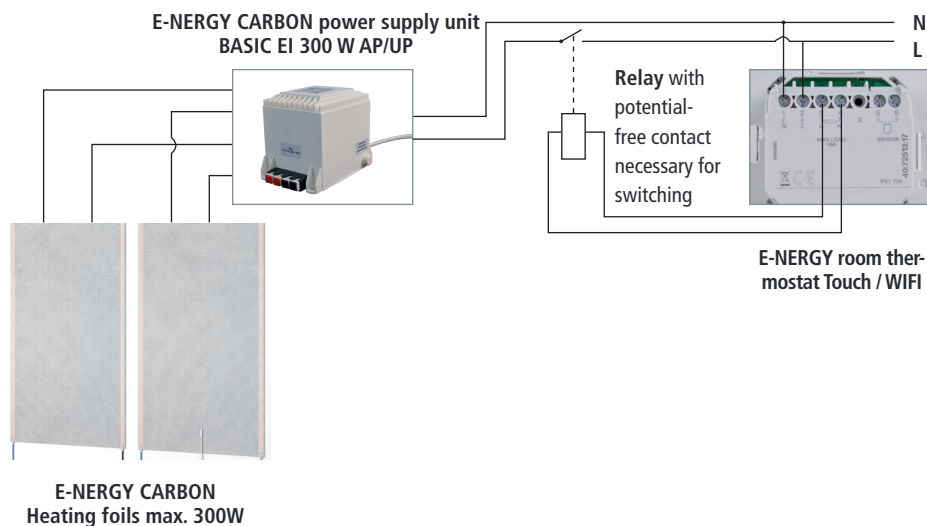
Variant 3: Fixed connection to a room thermostat

Note: With this variant, the room thermostat (e.g. E-ENERGY room thermostat EN 01) must be sufficiently dimensioned for the inductive switching current of the unit. The unit is permanently connected to a room thermostat without plug (cut off plug).



Variant 4: Fixed connection to a room thermostat via relay

Note: With this variant, the room thermostat (e.g. E-ENERGY room thermostat Touch or WIFI) is not sufficiently dimensioned for the inductive switching current of the device. The load of the device is switched via a relay e.g. Eltako R12-100-230V or Eltako ER61-UC. The device is permanently connected to a relay without a connector (cut off the connector).



4.4 Heating circuit connection

Please note the following: After the heating tracks have been laid, the connecting cables can be connected to the secondary side of the unit. To do this, connect the quick-release clamps (Figure 1, Letter B) to the connection lines of the heating tracks.

A maximum of 300 W heating power may be connected to the power supply unit. The maximum power of 300 W can either be connected to one pair of terminals or divided between both pairs of terminals.

4.5 Electrical commissioning

The electrical installation work on the device is now complete. Carefully check again that the installation work has been carried out. For commissioning, switch the supply circuit back on.

After the circuit has been activated and if the installation is correct, the room thermostat will be activated.

When the room thermostat gives the signal for heating, the unit switches on. When the heating cycle is completed, the unit switches off again.

Test function: To start a test run of the heating system, increase the temperature on the room thermostat until the heating cycle is started. By reducing the temperature, heating operation is ended again. After successful start-up, set the room thermostat correctly. For details on setting the temperature, refer to the relevant instructions for the room thermostat.

5. Commissioning

After a minimum drying time of the adhesive (see manufacturer's recommendation) and after electrical commissioning, the **E-ENERGY CARBON** heating system can be heated up for the first time. Now attach the warning label supplied in the immediate vicinity of the heating foil so that it is clearly visible and place the operating instructions in the distribution box or a suitable location.

6. Fault diagnosis

If the device does not function or malfunctions, the following possible causes should help to solve the problem. If the listed causes do not eliminate the malfunction, contact your contracting party. Observe the safety instructions. Before checking electrical components or when performing electrical work, the power supply must be disconnected and secured against being switched on again.

The electrical inspection and installation may only be carried out by competent persons (qualified electricians) in accordance with the applicable legal requirements. Never open the device. There is danger to life and connected components can be destroyed.

Possible cause	Remedy
Heating mode not activated	Check the settings on the room thermostat
Power supply interrupted	Check all cable connections and terminals. Check the circuit breaker
Triggering the device fuse	Check the device fuse and replace it with an identical T 2.0 A microfuse if necessary
Triggering of the safety temperature switch by heat accumulation	Check the temperature of the transformer and make sure adequate aeration

7. Technical data

E-ENERGY CARBON power supply unit BASIC EI 300 W AP/UP	
Nominal power	300W
Nominal voltage primary	230 V AC 50/60 Hz
Nominal voltage secondary	36 V AC (SELV, Safety Extra Low Voltage)
Secondary amperage	8,33 A
Connection primary	Connection cable approx. 2.0 m long with Euro flat plug
Connection secondary	Quick release terminals 1.0 mm ² to 4.0 mm ²
Internal safety temperature switch	110°C automatic resetting
Internal transformer fuse	replaceable microfuse T 2.0 A
Security measure	FI protective circuit 30 mA (on-site)
Ambient temperature	Max. 40°C
Insulation material class	E
Housing protection class	IP40
Dimensions (L x W x H)	approx. 134/101 x 91 x 100 mm ³ (without connecting cable)
Weight	ca. 3,4 kg
Type	EI core, encapsulated in a plastic housing
Protection class IEC/EN	II reinforced insulation
EU Conformity	CE mark, according to EN 61558-2-6 and European Low voltage directive 2014/35/EU, RoHS 2011/65/EU
Waste management	 WEEE-Reg.-Nr. : DE 97703783

E-ENERGY CARBON room thermostat	
see installation and operating instructions Room thermostat	

E-ENERGY CARBON heating foils

Voltage	36 V	
Heating foil dimension, width	FLEECE & PET: 59 cm, 54 cm (net heating width) FLEECE S: 17 cm, 12 cm (net heating width)	
Maximum length	E-ENERGY CARBON FLEECE – 36 W/lfm (60 W/m ²) max. 8,3 m E-ENERGY CARBON FLEECE – 66 W/lfm (110 W/m ²) max. 4,5 m E-ENERGY CARBON FLEECE – 132 W/lfm (220 W/m ²) max. 2,2 m E-ENERGY CARBON FLEECE S – 25 W/lfm (145 W/m ²) max. 12 m E-ENERGY CARBON FLEECE S – 50 W/lfm (290 W/m ²) max. 6 m E-ENERGY CARBON PET – 69 W/lfm (115 W/m ²) max. 4,4 m	
Nominal limit temperature	+ 70 °C	
Minimum processing temperature	+ 5 °C	
Minimum bending radius	R10 mm	
Material	PET film with carbon fibres and fillers	
Connection cable	2,5 mm ²	
Secondary line between power supply unit and heating foil	2.5 mm ² , max. 10 m length	
Max. Thermal resistance	Rλ for floor covering: 0,15 m ² K/W	

Explanation of symbols:



a)



b)



c)



d)



e)

- a) Disposal note: The product must not be disposed of in general household waste! Recycling via electronic-disposal of the municipal collection points.
- b) Permissible installation as ceiling heating (direct acting)
- c) Permitted installation as underfloor heating (direct acting)
- d) Read the operating instructions, follow the instructions
- e) Protection class II

Only a maximum of 300 W may be connected to the quick-pressure terminals of the BASIC EI 300 W AP/UP power supply unit.

E-ENERGY CARBON FLEECE – 36 W/lfm (60 W/m ²)	max. 8,3 m
E-ENERGY CARBON FLEECE – 66 W/lfm (110 W/m ²)	max. 4,5 m
E-ENERGY CARBON FLEECE – 132 W/lfm (220 W/m ²)	max. 2,2 m
E-ENERGY CARBON FLEECE S – 25 W/lfm (145 W/m ²)	max. 12 m
E-ENERGY CARBON FLEECE S – 50 W/lfm (290 W/m ²)	max. 6 m
E-ENERGY CARBON PET – 69 W/lfm (115 W/m ²)	max. 4,4 m

The power supply unit can be installed surface-mounted or flush-mounted. Adequate ventilation must always be provided. The ambient temperature must not exceed the maximum value of +40 °C.

The secondary cable between the power supply unit and the heating foil must not exceed 10 m with a cable cross-section of 2.5 mm².

8. Resistance values as a function of length*

Length	FLEECE 36 W/lfm (60 W/m ²)	FLEECE 66 W/lfm (110 W/m ²)	FLEECE 132 W/lfm (220 W/m ²)	FLEECE S 25 W/lfm (145 W/m ²)	FLEECE S 50 W/lfm (290 W/m ²)	PET 69 W/lfm (115 W/m ²)
0,1 m	365,84 Ω	199,06 Ω	99,53 Ω	516,00 Ω	262,80 Ω	188,30 Ω
0,2 m	182,92 Ω	99,53 Ω	49,77 Ω	258,00 Ω	131,40 Ω	94,15 Ω
0,3 m	121,95 Ω	66,35 Ω	33,18 Ω	172,00 Ω	87,60 Ω	62,77 Ω
0,4 m	91,46 Ω	49,77 Ω	24,88 Ω	129,00 Ω	65,70 Ω	47,08 Ω
0,5 m	73,17 Ω	39,81 Ω	19,91 Ω	103,20 Ω	52,56 Ω	37,66 Ω
0,6 m	60,97 Ω	33,18 Ω	16,59 Ω	86,00 Ω	43,80 Ω	31,38 Ω
0,7 m	52,26 Ω	28,44 Ω	14,22 Ω	73,71 Ω	37,54 Ω	26,90 Ω
0,8 m	45,73 Ω	24,88 Ω	12,44 Ω	64,50 Ω	32,85 Ω	23,54 Ω
0,9 m	40,65 Ω	22,12 Ω	11,06 Ω	57,33 Ω	29,20 Ω	20,92 Ω
1,0 m	36,58 Ω	19,91 Ω	9,95 Ω	51,60 Ω	26,28 Ω	18,83 Ω
1,1 m	33,26 Ω	18,10 Ω	9,05 Ω	46,91 Ω	23,89 Ω	17,12 Ω
1,2 m	30,49 Ω	16,59 Ω	8,29 Ω	43,00 Ω	21,90 Ω	15,69 Ω
1,3 m	28,14 Ω	15,31 Ω	7,66 Ω	39,69 Ω	20,22 Ω	14,48 Ω
1,4 m	26,13 Ω	14,22 Ω	7,11 Ω	36,86 Ω	18,77 Ω	13,45 Ω
1,5 m	24,39 Ω	13,27 Ω	6,64 Ω	34,40 Ω	17,52 Ω	12,55 Ω
1,6 m	22,87 Ω	12,44 Ω	6,22 Ω	32,25 Ω	16,43 Ω	11,77 Ω
1,7 m	21,52 Ω	11,71 Ω	5,85 Ω	30,35 Ω	15,46 Ω	11,08 Ω
1,8 m	20,32 Ω	11,06 Ω	5,53 Ω	28,67 Ω	14,60 Ω	10,46 Ω
1,9 m	19,25 Ω	10,48 Ω	5,24 Ω	27,16 Ω	13,83 Ω	9,91 Ω
2,0 m	18,29 Ω	9,95 Ω	4,98 Ω	25,80 Ω	13,14 Ω	9,42 Ω
2,1 m	17,42 Ω	9,48 Ω	4,74 Ω	24,57 Ω	12,51 Ω	8,97 Ω
2,2 m	16,63 Ω	9,05 Ω	4,52 Ω	23,45 Ω	11,95 Ω	8,56 Ω
2,3 m	15,91 Ω	8,65 Ω		22,43 Ω	11,43 Ω	8,19 Ω

*If the measured resistance values deviate more than 15 % from the initial value, damage to the contacts or the heating foil. In this case you must not start up the heating system.

8. Resistance values as a function of length*

Length	FLEECE 36 W/lfm (60 W/m ²)	FLEECE 66 W/lfm (110 W/m ²)	FLEECE 132 W/lfm (220 W/m ²)	FLEECE S 25 W/lfm (145 W/m ²)	FLEECE S 50 W/lfm (290 W/m ²)	PET 69 W/lfm (115 W/m ²)
2,4 m	15,24 Ω	8,29 Ω		21,50 Ω	10,95 Ω	7,85 Ω
2,5 m	14,63 Ω	7,96 Ω		20,64 Ω	10,51 Ω	7,53 Ω
2,6 m	14,07 Ω	7,66 Ω		19,85 Ω	10,11 Ω	7,24 Ω
2,7 m	13,55 Ω	7,37 Ω		19,11 Ω	9,73 Ω	6,97 Ω
2,8 m	13,07 Ω	7,11 Ω		18,43 Ω	9,39 Ω	6,73 Ω
2,9 m	12,62 Ω	6,86 Ω		17,79 Ω	9,06 Ω	6,49 Ω
3,0 m	12,19 Ω	6,64 Ω		17,20 Ω	8,76 Ω	6,28 Ω
3,1 m	11,80 Ω	6,42 Ω		16,65 Ω	8,48 Ω	6,07 Ω
3,2 m	11,43 Ω	6,22 Ω		16,13 Ω	8,21 Ω	5,88 Ω
3,3 m	11,09 Ω	6,03 Ω		15,64 Ω	7,96 Ω	5,71 Ω
3,4 m	10,76 Ω	5,85 Ω		15,18 Ω	7,73 Ω	5,54 Ω
3,5 m	10,45 Ω	5,69 Ω		14,74 Ω	7,51 Ω	5,38 Ω
3,6 m	10,16 Ω	5,53 Ω		14,33 Ω	7,30 Ω	5,23 Ω
3,7 m	9,89 Ω	5,38 Ω		13,95 Ω	7,10 Ω	5,09 Ω
3,8 m	9,63 Ω	5,24 Ω		13,58 Ω	6,92 Ω	4,96 Ω
3,9 m	9,38 Ω	5,10 Ω		13,23 Ω	6,74 Ω	4,83 Ω
4,0 m	9,15 Ω	4,98 Ω		12,90 Ω	6,57 Ω	4,71 Ω
4,1 m	8,92 Ω	4,86 Ω		12,59 Ω	6,41 Ω	4,59 Ω
4,2 m	8,71 Ω	4,74 Ω		12,29 Ω	6,26 Ω	4,48 Ω
4,3 m	8,51 Ω	4,63 Ω		12,00 Ω	6,11 Ω	4,38 Ω
4,4 m	8,31 Ω	4,52 Ω		11,73 Ω	5,97 Ω	4,28 Ω
4,5 m	8,13 Ω	4,42 Ω		11,47 Ω	5,84 Ω	
4,6 m	7,95 Ω			11,22 Ω	5,71 Ω	
4,7 m	7,78 Ω			10,98 Ω	5,59 Ω	
4,8 m	7,62 Ω			10,75 Ω	5,48 Ω	
4,9 m	7,47 Ω			10,53 Ω	5,36 Ω	
5,0 m	7,32 Ω			10,32 Ω	5,26 Ω	
5,1 m	7,17 Ω			10,12 Ω	5,15 Ω	
5,2 m	7,04 Ω			9,92 Ω	5,05 Ω	
5,3 m	6,90 Ω			9,74 Ω	4,96 Ω	
5,4 m	6,77 Ω			9,56 Ω	4,87 Ω	
5,5 m	6,65 Ω			9,38 Ω	4,78 Ω	
5,6 m	6,53 Ω			9,21 Ω	4,69 Ω	
5,7 m	6,42 Ω			9,05 Ω	4,61 Ω	
5,8 m	6,31 Ω			8,90 Ω	4,53 Ω	
5,9 m	6,20 Ω			8,75 Ω	4,45 Ω	

*If the measured resistance values deviate more than 15 % from the initial value, damage to the contacts or the heating foil. In this case you must not start up the heating system.

8. Resistance values as a function of length*

Length	FLEECE 36 W/lfm (60 W/m ²)	FLEECE 66 W/lfm (110 W/m ²)	FLEECE 132 W/lfm (220 W/m ²)	FLEECE S 25 W/lfm (145 W/m ²)	FLEECE S 50 W/lfm (290 W/m ²)	PET 69 W/lfm (115 W/m ²)
6,0 m	6,10 Ω			8,60 Ω	4,38 Ω	
6,1 m	6,00 Ω			8,46 Ω		
6,2 m	5,90 Ω			8,32 Ω		
6,3 m	5,81 Ω			8,19 Ω		
6,4 m	5,72 Ω			8,06 Ω		
6,5 m	5,63 Ω			7,94 Ω		
6,6 m	5,54 Ω			7,82 Ω		
6,7 m	5,46 Ω			7,70 Ω		
6,8 m	5,38 Ω			7,59 Ω		
6,9 m	5,30 Ω			7,48 Ω		
7,0 m	5,23 Ω			7,37 Ω		
7,1 m	5,15 Ω			7,27 Ω		
7,2 m	5,08 Ω			7,17 Ω		
7,3 m	5,01 Ω			7,07 Ω		
7,4 m	4,94 Ω			6,97 Ω		
7,5 m	4,88 Ω			6,88 Ω		
7,6 m	4,81 Ω			6,79 Ω		
7,7 m	4,75 Ω			6,70 Ω		
7,8 m	4,69 Ω			6,62 Ω		
7,9 m	4,63 Ω			6,53 Ω		
8,0 m	4,57 Ω			6,45 Ω		
8,1 m	4,52 Ω			6,37 Ω		
8,2 m	4,46 Ω			6,29 Ω		
8,3 m	4,41 Ω			6,22 Ω		
8,4 m				6,14 Ω		
8,5 m				6,07 Ω		
8,6 m				6,00 Ω		
8,7 m				5,93 Ω		
8,8 m				5,86 Ω		
8,9 m				5,80 Ω		
9,0 m				5,73 Ω		
9,1 m				5,67 Ω		
9,2 m				5,61 Ω		
9,3 m				5,55 Ω		
9,4 m				5,49 Ω		
9,5 m				5,43 Ω		

*If the measured resistance values deviate more than 15 % from the initial value, damage to the contacts or the heating foil. In this case you must not start up the heating system.

8. Resistance values as a function of length*

Length	FLEECE 36 W/lfm (60 W/m ²)	FLEECE 66 W/lfm (110 W/m ²)	FLEECE 132 W/lfm (220 W/m ²)	FLEECE S 25 W/lfm (145 W/m ²)	FLEECE S 50 W/lfm (290 W/m ²)	PET 69 W/lfm (115 W/m ²)
9,6 m				5,38 Ω		
9,7 m				5,32 Ω		
9,8 m				5,27 Ω		
9,9 m				5,21 Ω		
10,0 m				5,16 Ω		
10,1 m				5,11 Ω		
10,2 m				5,06 Ω		
10,3 m				5,01 Ω		
10,4 m				4,96 Ω		
10,5 m				4,91 Ω		
10,6 m				4,87 Ω		
10,7 m				4,82 Ω		
10,8 m				4,78 Ω		
10,9 m				4,73 Ω		
11,0 m				4,69 Ω		
11,1 m				4,65 Ω		
11,2 m				4,61 Ω		
11,3 m				4,57 Ω		
11,4 m				4,53 Ω		
11,5 m				4,49 Ω		
11,6 m				4,45 Ω		
11,7 m				4,41 Ω		
11,8 m				4,37 Ω		
11,9 m				4,34 Ω		
12,0 m				4,30 Ω		

*If the measured resistance values deviate more than 15 % from the initial value, damage to the contacts or the heating foil. In this case you must not start up the heating system.

9. Warranty and guarantee

1.) We provide a warranty for our **E-ENERGY CARBON** panel heating system in accordance with the provisions of the German Civil Code. For private end customers, the statutory warranty period is 2 years. We grant a warranty period of 5 years for system components that are permanently connected to the building, such as the **E-ENERGY CARBON** heating foils. For companies, the following amounts deviate from this the warranty period is one year.

2.) In addition, we give a 5-year guarantee on our **E-ENERGY CARBON** surface heating foils, which follows the statutory warranty period. This guarantee applies to end customers who use our **E-ENERGY CARBON** system as a new product and refers to the surface heating foils. In addition, it is a prerequisite for making a claim under the

warranty that the system installation and electrical connection has been carried out by a specialist technician. In order to make a claim under the warranty, the customer must submit the warranty card completed and signed by the specialist technician, which is issued during installation, and the installation plan with a copy of the invoice. If these documents are not submitted, the warranty cannot be claimed. The warranty period starts from the date of the end customer invoice.

The warranty service of mfh systems first of all includes a check whether a warranty claim exists. Should a warranty claim exist, mfh systems can determine the way in which the fault is to be remedied. mfh systems is at liberty to refund the proven invoice amount for the heating foil, to repair the **E-ENERGY CARBON** surface heating foils itself, or to have them repaired by a third party and to bear the costs incurred. Furthermore, mfh systems is entitled to deliver a comparable system from mfh systems or from a third-party supplier as a replacement. Further claims of the customer in the event of a warranty case do not exist. mfh systems does not assume, for example, the costs for installation and removal, costs for additional craftsmanship or costs and expenses incurred by the customer through the removal of the malfunction during the warranty period. In addition, mfh systems will not assume the costs for the services of a possibly required emergency service within the scope of the guarantee. The warranty does not cover damage to the **E-ENERGY CARBON** heating foil that is not caused by a defect in the **E-ENERGY CARBON** heating foil. The warranty therefore does not cover damage or defects that have occurred due to incorrect laying or installation, incorrect operation or improper use or due to wear and tear. Claims under the warranty are also only valid if only system components approved by mfh systems for use with the **E-ENERGY CARBON** system, such as power supplies, control systems, etc., are used. The warranty also does not cover the remedying of defects or damage caused by faulty further processing and/or maintenance, weather conditions or other natural phenomena. Claims of the customer for compensation for indirect or consequential damages are not covered by the warranty. As long and as far as warranty services are provided by mfh systems or third parties initiated by mfh systems, this does not lead to an extension of the granted warranty period of 5 years.

3.) The warranty claim with regard to **E-ENERGY CARBON** films can only be made within 11 years from the date of production of the **E-ENERGY CARBON** surface heating foils. After this period, claims under the warranty are excluded. Also excluded are claims for warranty services as long as and to the extent that these would have to be provided outside the European Union.

Test report

The warranty is only valid if the warranty card is completely filled out.

1. Please measure the resistance of all tracks before installation and compare it with the label. For cut heating foils, the resistance values can be taken from the technical data. This measured value in the installation plan for each make a note of the heating track and write it down on the warranty card. Maximum deviation 15 %.
2. Please measure the resistance of all tracks after installation and compare with the measured value before. The note the second measured value in the installation plan for each heating track and note it on the warranty card.

9 GARANTIE-KARTE

9 WARRANTY CARD

Kunde

Customer

Name
NameEinbauort (Raum)
Fitting (Room)Straße
Address☐ Decke
Ceiling☐ Wand
Wall☐ Boden
Floor

PLZ/Ort

Postcode/town/city

Telefon

Telephone no.

Auftragsgeber

Contact name

Elektroinstallateur

Electrician

Verlegedatum

Fitting date

Installationsdatum

Installation date

Firmenstempel + Unterschrift des Elektroinstallateur
Company stamp + electrician's signature

Resistance values

Room	Lane no.	Length	Performance	Resistance before mounting	Resistance after mounting
	1	cm	W/m ²	Ω	Ω
	2	cm	W/m ²	Ω	Ω
	3	cm	W/m ²	Ω	Ω
	4	cm	W/m ²	Ω	Ω
	5	cm	W/m ²	Ω	Ω
	6	cm	W/m ²	Ω	Ω
	7	cm	W/m ²	Ω	Ω
	8	cm	W/m ²	Ω	Ω
	9	cm	W/m ²	Ω	Ω
	10	cm	W/m ²	Ω	Ω
	11	cm	W/m ²	Ω	Ω
	12	cm	W/m ²	Ω	Ω
	13	cm	W/m ²	Ω	Ω
	14	cm	W/m ²	Ω	Ω
	15	cm	W/m ²	Ω	Ω
	16	cm	W/m ²	Ω	Ω

Date _____

Signature _____

10. EC declaration of conformity

Products:

E-ENERGY CARBON power supply BASIC EI 300 W AP/UP,
E-ENERGY CARBON FLEECE - 36 W/lfm (60 W/m²),
E-ENERGY CARBON FLEECE - 66 W/lfm (110 W/m²),
E-ENERGY CARBON FLEECE - 132 W/lfm (220 W/m²),
E-ENERGY CARBON FLEECE S - 25 W/lfm (145 W/m²),
E-ENERGY CARBON FLEECE S - 50 W/lfm (290 W/m²),
E-ENERGY CARBON PET - 69 W/lfm (115 W/m²)

It is hereby confirmed that the above mentioned products comply with the essential requirements laid down in the Council Directive on the approximation of the laws of the Member States

on electromagnetic compatibility (2014/30/EU)

EN 55014-1:2014-05

EN 61000-3-2:2010

EN 55014-2:2009-06

EN 61000-3-3:2014-03

and on the Low Voltage Directive (2014/35/EU)

EN 61558-1 (2005) | EN 61558-1/A1 (2009) | EN 61558-2-6 (2009)

IEC 61558-1 (2005) | IEC 61558-1/AMD1 (2009) | IEC 61558-2-6 (2009)

DIN EN 61558-1(2006) | DIN EN 61558-1/A1 (2009) | DIN EN 61558-2-6 (2010)

and are defined by RL RoHS2011 11/65 / EG.

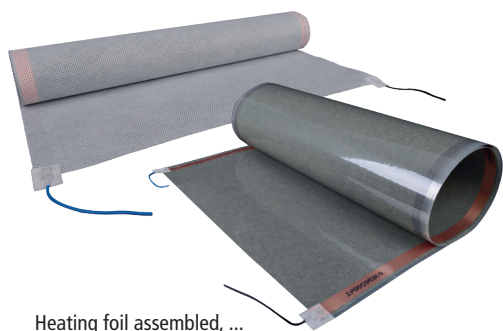
Belm-Vehrte, April 30th 2020



Daniel Shushan

Industrial Engineer | M. Eng.

Managing Partner



Heating foil assembled, ...



... E-ENERGY CARBON room thermostats including temperature sensor,



... and E-ENERGY-CARBON power supply BASIC EI 300 W AP/UP



BDH
Bundesverband der
Deutschen Heizungsindustrie



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