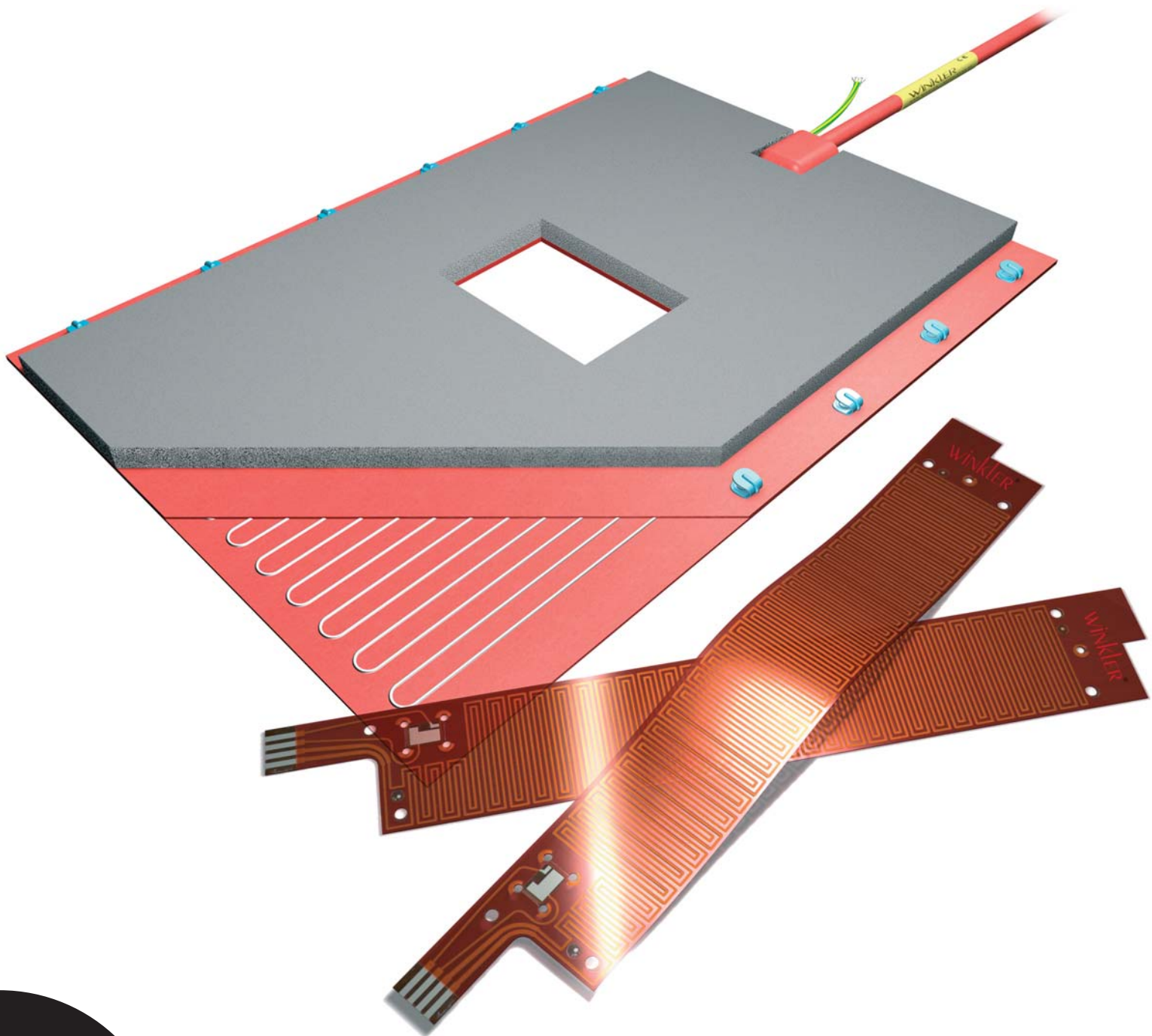




winkler®



SILICONE HEATERS AND HEATING FOILS

2009-06



SILICONE HEATERS

Short description

Our silicone heaters consist of heat conductor tracks – made of wire, stranded wire or etched foil – which are embedded between two strong, moisture- and temperature-resistant silicone layers with glass fabric reinforcement. The entire appliance is vulcanized to form a homogeneous entity.

Areas of application and use

In all sectors of industry as well as in research, wherever the operator needs fast handling and simple installation. The heaters are used for:

- Temperature maintenance
- Heating up

Advantages

- Systematic and even heat distribution
- Flexibility
- High mechanical strength thanks to glass fabric reinforcement
- Short heating-up period
- Moisture resistant
- Easy, uncomplicated installation and mounting
- Ready for connection

- Unrestricted choice of flat shapes
- Any type of perforation, as required
- Easy-to-clean surface

Options

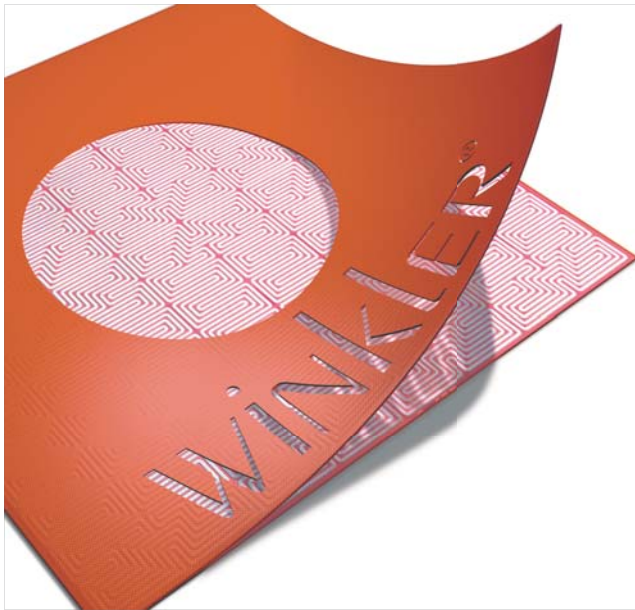
- Integration of temperature sensors
- Self-adhesive surface
- Choice of connection systems
- Reinforced insulation
- Integration of protective conductor

In the temperature range up to 200 °C, the structure of silicone heaters offers a number of mechanical, electrical and thermic advantages compared with heating mats comprising sewn-on heat conductors. The smooth silicone surface allows a good contact with the heated object, even on curved geometries, and is extremely easy to clean. The close heat conductor routing enables a high heat output as well as fast heating up and reaction times. Shape, performance profile and number of heating zones can be optimized for specific applications. Silicone heaters retain their flexibility, even with temperatures down to -40 °C.

TYPES OF PRODUCTION

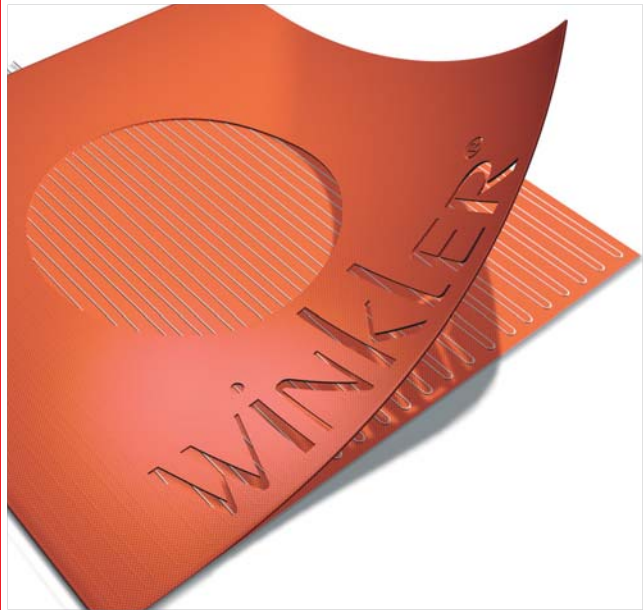
Etching technique

The heat conductor tracks are etched out of a homogeneous metal layer. Only economically viable for larger batch sizes.



Winding technique

This involves hand-winding of thin resistance wires. Used for small batch sizes.



CONTOUR

Flat or round vulcanized



Rectangular / round / irregular



With / without perforations



For small batch sizes, simple geometries can be produced manually, whereas tools will be necessary for complex geometries and larger batch sizes (additional tool costs, drawing required).

Surface temperatures

The surface temperature must not exceed 180 °C or 200 °C, as applicable, during continuous operation. The required temperature is maintained by a suitable temperature control system, but it can also be limited by selecting an appropriate wattage. However, a number of other factors need to be taken into account too.

The accompanying table offers a rough guideline with regard to temperatures resulting from a specific heating power in W/cm². These temperatures occur without temperature control and with only slight heat dissipation due entirely to radiant heat.

The listed surface temperatures were measured under the following conditions:

- Silicone heating element vulcanized on aluminium plate
- Horizontal position
- Temperature measurement at the top of the plate
- Ambient temperature 20 °C
- No air movement
- Heating period 20 minutes

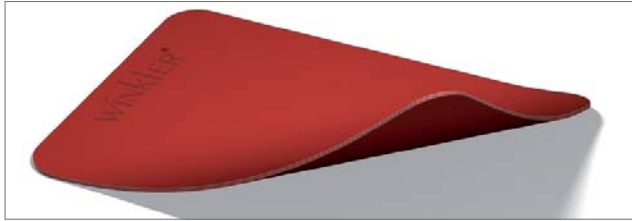
In the case of higher heat output per unit area, the temperatures may be significantly higher. This can destroy the heater if the heat dissipation is insufficient.

SURFACE TEMPERATURES

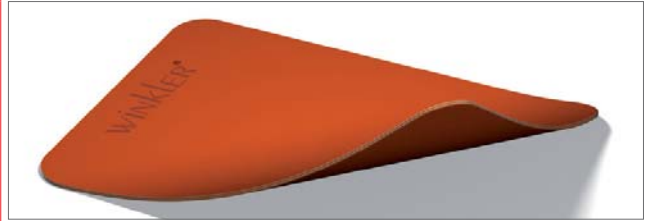
Heating power in W/cm ²	Surface temperature in °C
0,10	70
0,15	90
0,20	105
0,25	121
0,30	135
0,35	150
0,40	164
0,45	176
0,50	188
0,55	200

MATERIAL

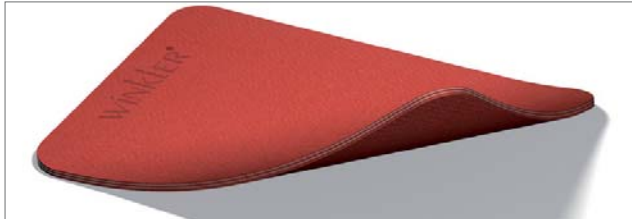
N-Material: silicone-coated glass fabric
Maximum temperature: 180 °C
Thickness: 1,1 mm standard; optional 0,8 / 1,5 mm



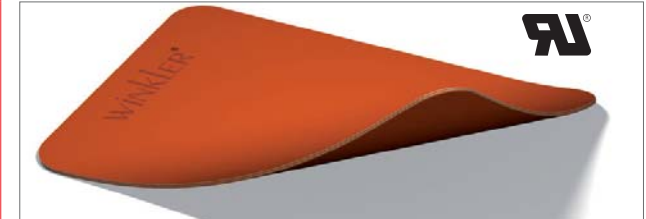
P-Material: silicone-coated glass fabric with textile structure
Maximum temperature: 200 °C
Thickness: 1,5 mm



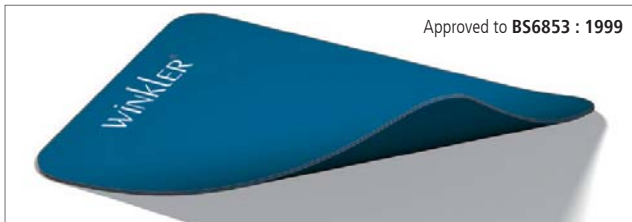
F-Material: Fabric-reinforced silicone material; highly flexible silicone material
Maximum temperature: 180 °C
Thickness: 2,2 mm



U-Material: silicone-coated glass fabric with UL approval
Maximum temperature: 180 °C
Thickness: 1,1 mm



R-Material: silicone-coated glass fabric;
Maximum temperature: 180 °C
Thickness: 1,0 mm to 1,5 mm



MOUNTING OPTIONS

Type K: Velcro fastening (T_{max} = 80 °C)
 For detachable, fast and uncomplicated mounting



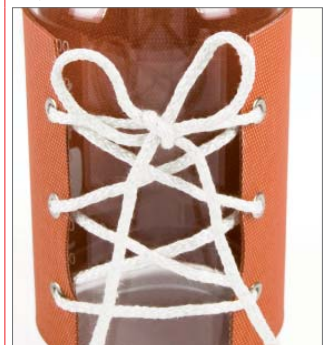
Type A: Self-adhesive foil (T_{max} = 180 °C)
 For permanent fixing, not intended for removal



Type S: Hooks and tension springs (T_{max} = 200 °C)
 For detachable, yet firm fastening



Type E: Eyelets (T_{max} = 200 °C)
 For detachable, yet firm tying – with temperature resistant cord



CONTROL

Thermal switch

To prevent excess temperature (not suitable for precise temperature control)



Sensor pocket

To fit a sensor for electronic control



CONNECTION

Silicone cable

Two-core or multi-core; with or without protective conductor terminal (where a protective conductor is incorporated in the cable, it is designed to earth the heated object); IP 64 possible.



Leads

Cross-section and length depending on application (for protected installation and extra-low voltage)

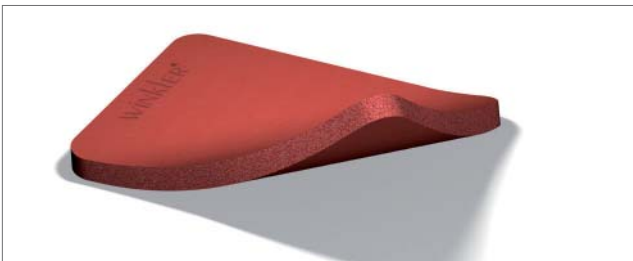


INSULATING FOAM

Material: Silicone foam, closed-cell; **standard type, red**

Maximum temperature: 200 °C

Thickness: 8 mm



Material: silicone foam, closed-cell, white

Maximum temperature: : 200 °C

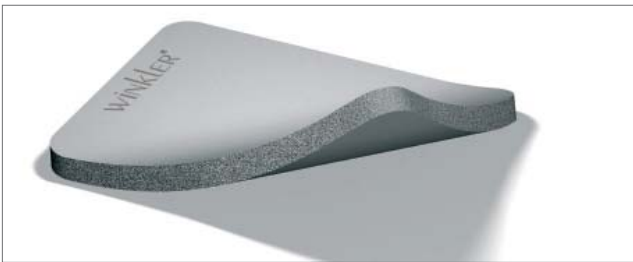
Thickness: 5 mm



Material: silicone foam, closed-cell, grey

Maximum temperature: : 200 °C

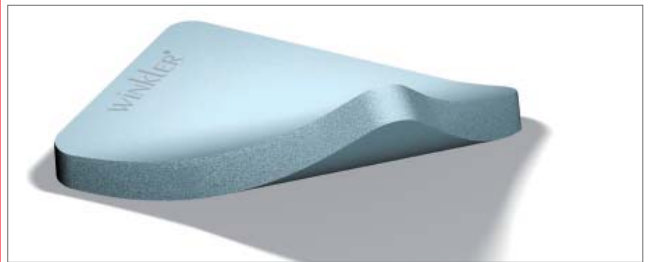
Thickness: 8 mm



Material: silicone foam, closed-cell, blue

Maximum temperature: 200 °C

Thickness: 12 mm



Other thicknesses available on request.

HEATING FOILS

Short description

Our heating foils consist of a thin heat-conductor layer etched along specific routes and embedded between two strong, moisture- and temperature-resistant insulating foils. More elaborate designs can be composed of several heating or insulating layers and thus optimized for specific applications.

Areas of application and use

In all sectors of industry as well as in research, wherever the user requires very precise heat distribution and simple installation.

- Temperature maintenance
- Heating up

Advantages

- Systematic and even heat distribution
- Flexibility
- Extremely thin
- Small mass
- Short heating-up period
- Moisture resistant
- Easy, uncomplicated installation and mounting
- Ready for connection
- Unrestricted choice of flat shapes
- Any type of perforation, as required
- Easy-to-clean surface

Options

- Fitting of temperature sensors
- Self-adhesive surface
- Choice of connection systems

A flexible solution – Heating foils have various clear advantages making them an ideal solution where conventional heating installations would be technically impossible or too expensive. They are of course equally suitable for many standard heating tasks.

Customized design – The optimum foil heater for your requirements is calculated using specially developed computer programs. Heat distribution and surface load are adapted to the specific application.

Etching – Our etching and test facilities are of a high technical standard and ensure reliable quality.

Processing – The foil layers are bonded together homogeneously during constant temperature and pressure cycles. Subsequently, they are die-cut to the precise shape desired.

Due to their specific structure, heating foils possess a number of fundamental mechanical, electrical and thermic advantages compared with conventional heating systems: The minimal thickness results in a correspondingly low weight and modest space requirements; it also enables a snug fit, even on curved surfaces. The small mass permits fast changes in temperature and thus offers good control qualities. The plane geometry of the heat conductor ensures an even transfer of heat and fast heating-up with low surface loads. This considerably prolongs the lifetime of the heating element. Furthermore, the arrangement of the heat conductor allows high power concentrations over a relatively small area. Shape, performance profile and number of heating zones can be optimized for specific applications. Standardized manufacturing processes ensure an even and reproducible quality with minimal tolerances. We select high-quality base materials, perfectly adapted to the relevant field of application and temperature range.

As manufacturers we are able to offer short delivery times and flexibility, even for special systems. Series production results in favourable unit prices and this is also valid for smaller quantities.

TECHNICAL DATA

Structure:

Carrier layer: Polyimide (Kapton®) 50 µm

Heating resistor: CuNi 44 (Isotan®) 50 µm or 20 µm

Covering layer: Polyimide (Kapton®) 50 µm

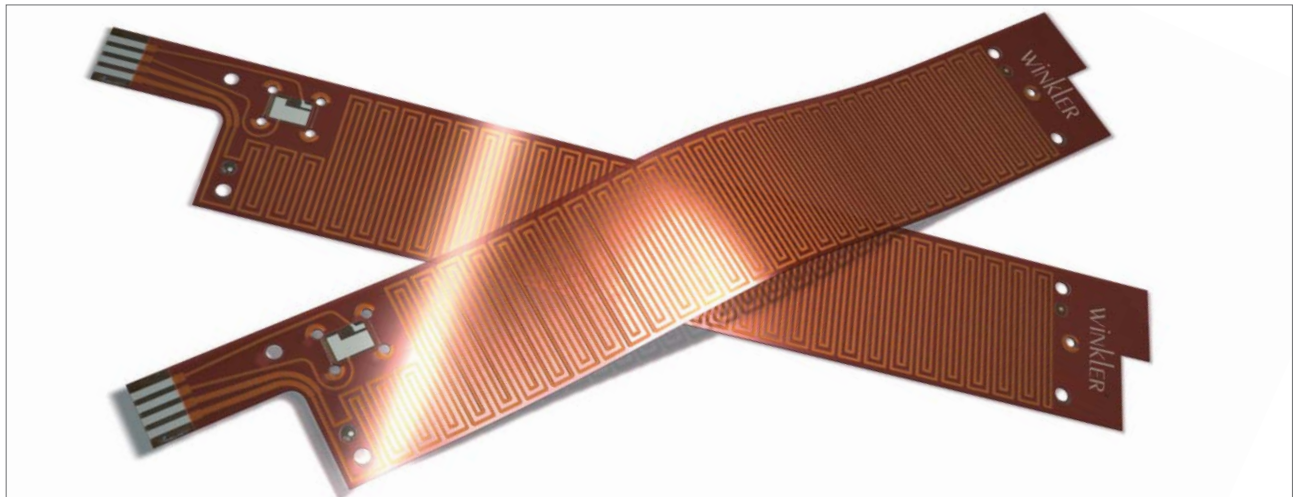
Adhesive layer: 3M type 467 MP 50 µm

Temperature resistance:

Up to approx. 150 °C continuous temperature in the case of adhesive foil mounting

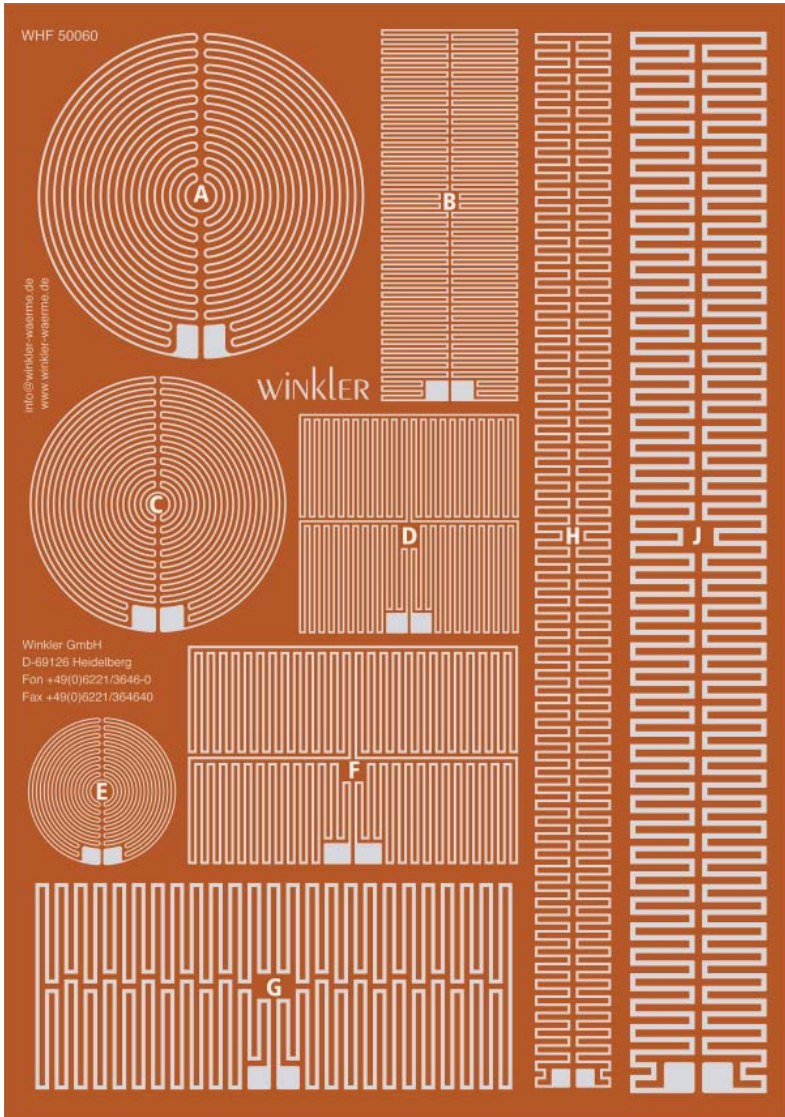
Up to approx. 180 °C continuous temperature in the case of non adhesive foil

Up to approx. 200 °C continuous temperature in the case of additional mechanical mounting



Foil material: Polyimide (Kapton®), polyester, and others	Insulation test: Proof voltage, depending on application
Heat conductor material: metallic conductive materials, e.g. nickel alloys, copper, etc.	Protection standard: IP 64 where required
Foil thickness: From 0.2 mm to several mm depending on application	Foil size: Ranging from a few cm ² to large-format heaters; max. width 500 mm
Min. bending radius: Depending on thickness and type of material employed, minimum 0.5 mm	Connection system: Soldering, crimping, large contact area, etc.
Temperature range: Up to 200 °C (higher temperatures on request)	Connecting lead: Stranded wire, wire; bare or insulated with PTFE, silicone, PVC, etc.
Nominal voltage: Variable, from extra-low voltage to 500 V	Mounting options: Self-adhesive foil, glue, shrink film, mechanical pressing
Nominal power: From low surface load to 2 W/cm ² , depending on heat dissipation	Temperature control: By controller and thermal cut-out.
Our heating foils are customized from design to manufacture. Please contact us for further details.	

Special care must be taken in the case of operation under reduced pressure. Small air pockets may result in larger areas becoming detached, and this will then produce overheating. Please contact us for advice regarding operation under vacuum conditions.



Foil material: Polyimide (Kapton®), Temperature range: Up to 150 °C

Experiment sheet for heating foils WOF 50060

Our experiment sheet, size DIN A4, comprises nine heating circuits of different dimensions. The individual foils may be used for experimental setups, non-standard applications or similar situations where a customized system would not be economic in view of the small number required.

The pattern can be cut out with scissors or a sharp knife. Care must be taken to ensure that there is still an edge of approximately 1.5 – 2 mm around the active heating area. The cut must on no account interfere with the conductor track. Cutting additional perforations into the patterns of the experiment sheet is not possible for functional reasons.

The various heating elements are designed to produce a specific power of approx. 0.4 W/cm² when operated at an extra-low voltage of 24 V (type E = 12 V). Where objects with small mass need to be heated, it may be appropriate to operate at a lower voltage. Higher operating voltages are possible for heating larger objects made of materials with good heat-conducting properties. **The suitable supply voltage for a given application must be determined by the operator.**

For contacting, leads have to be soldered to the designated soldering areas. Depending on the installation conditions (danger of short-circuiting!), electrical insulation of the soldering area may be required (e.g. using adhesive tape).

The heating elements are provided with adhesive foil designed to resist continuous temperatures **up to approx. 150 °C**. Therefore, they can simply be stuck onto the area to be heated. Just pull off the foil protecting the adhesive layer and press the heating element onto the object (avoid air pockets!).

TECHNICAL DATA OF THE INDIVIDUAL ELEMENTS

Type A	Dimensions: ~ Ø 90 mm el. resistance: ~ 29 Ohms Power at 24 V: ~ 14 W	Type D	Dimensions: ~ 60 x 60 mm el. resistance: ~ 34 Ohms Power at 24 V: ~ 17 W	Type G	Dimensions: ~ 130 x 60 mm el. resistance: ~ 18 Ohms Power at 24 V: ~ 32 W
Type B	Dimensions: ~ 100 x 40 mm el. resistance: ~ 41 Ohms Power at 24 V: ~ 14 W	Type E	Dimensions: ~ Ø 40 mm el. resistance: ~ 24 Ohms Power at 12 V: ~ 6 W	Type H	Dimensions: ~ 280 x 24 mm el. resistance: ~ 15 Ohms Power at 24 V: ~ 38 W
Type C	Dimensions: ~ Ø 70 mm el. resistance: ~ 34 Ohms Power at 24 V: ~ 17 W	Type F	Dimensions: ~ 90 x 60 mm el. resistance: ~ 30 Ohms Power at 24 V: ~ 19 W	Type J	Dimensions: ~ 280 x 40 mm el. resistance: ~ 12 Ohms Power at 24 V: ~ 48 W

If you would like further information or if you have any questions regarding the types of application, our specialists will always be pleased to help you.

Winkler GmbH is an independent, medium-sized company located in Heidelberg (Germany). For 30 years we have been developing and manufacturing a broad range of electric heating solutions for industry and laboratory applications.

We supply reliable and durable products made of high-quality materials.

We are the right partner for innovative and quick answers to your requirements. Customized solutions and flexible manufacturing are our particular strengths. Our experienced specialists will offer you sound advice and - together with you - develop the heating solution tailored to your application.

Winkler - Your heating solution!



Our headquarter



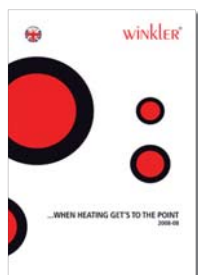
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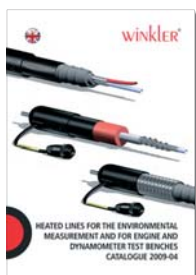
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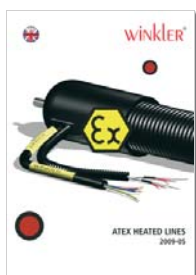
Our product range



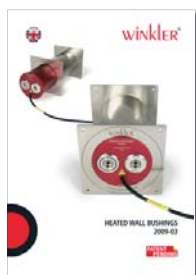
Company presentation



Heated lines & heated hoses



Atex Heated lines



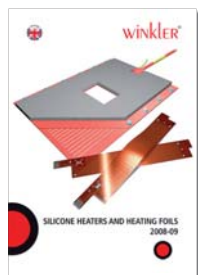
Heated wall bushing



Heated hoses



Heating jackets



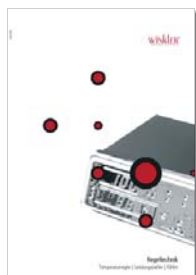
Silicone heaters & heating foils



Laboratory heaters



Drum and IBC heaters



Controller

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