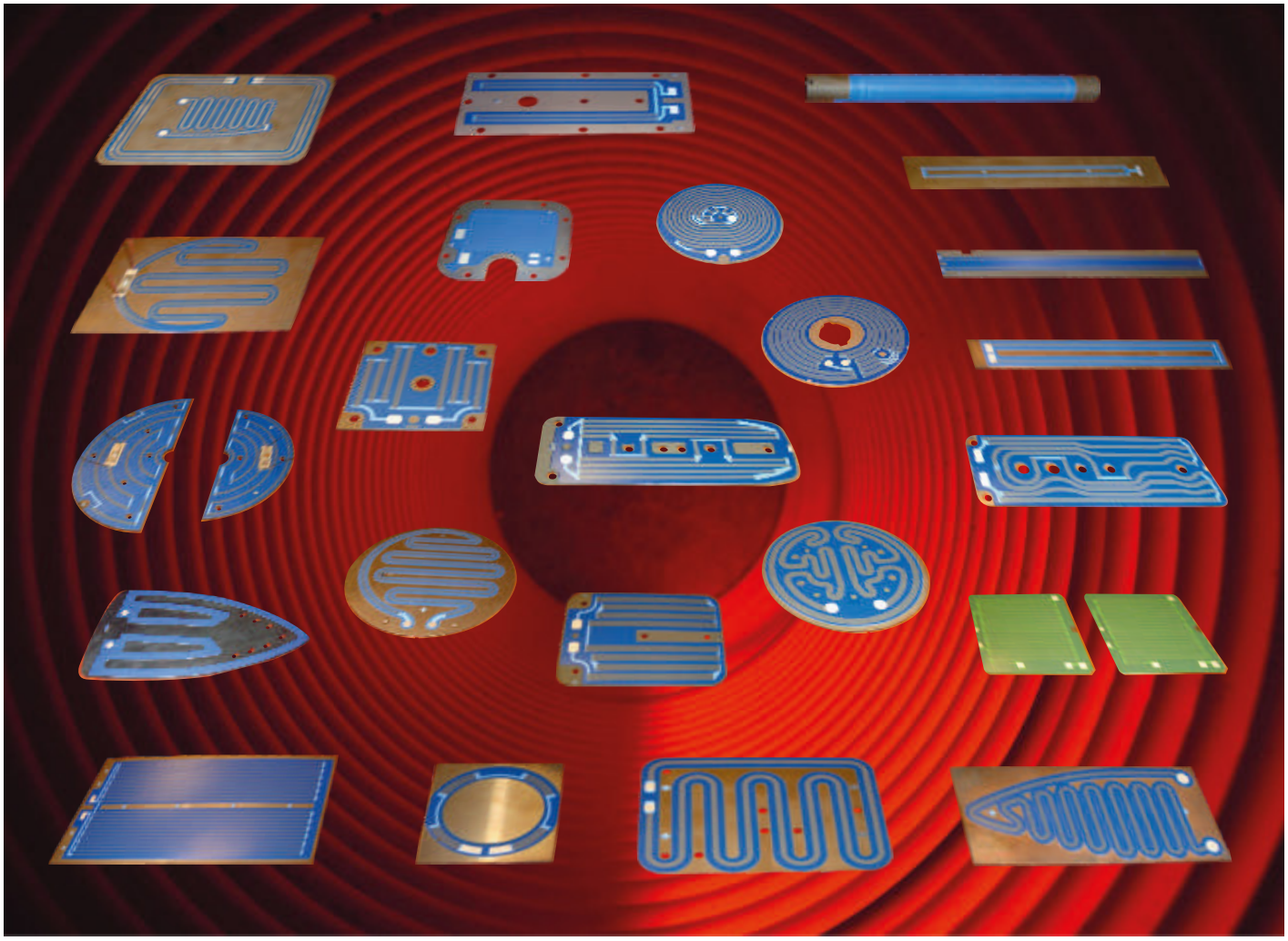
THICK FILM HEATING ELEMENTS - CHARACTERISTICS

Backer Elektro CZ a.s. is leading manufacturer of electrical tubular heating elements in the Czech Republic. The company, established more than 60 years ago, has been a member of multinational concern NIBE Industrier AB since 2001. Our heating elements are used in a number of applications, such as in household appliances, railway transport, gastro-facilities, machinery and many other industrial sectors. In addition to traditional tubular heating elements, we produce also thick film heating elements in mass, low-series, as well as special single-piece production.



Thick film heating elements are suitable for contact heating of planar surfaces, resp. liquids through planar wall. Newly we provide in our product range a thick film heating element on tube, which may be used in applications requiring heating of flowing liquid.

BENEFITS OF HEATING BY THICK FILM HEATING ELEMENT AS COMPARED TO OTHER HEATING METHODS

- The element on sheet ensures significantly better heat transfer to flat wall as compared to tubular element
- Quick temperature rise time - energy savings
- Easy assembly and disassembly - cost savings
- Possible high surface load - tens of W/cm^2
- Inner surface of heated vessel remain smooth and easily washable
- Very suitable for heating of aggressive liquids
- No need to discharge the vessel content during maintenance
- Heating through sufficiently large area may effectively prevent burning of content to the vessel surface

MAIN APPLICATION AREAS

Household electric appliances

Medical and laboratory devices

Gastro-facilities

Mini-breweries

Industrial vessels and storage tanks

Automotive

PRODUCTION TECHNOLOGY

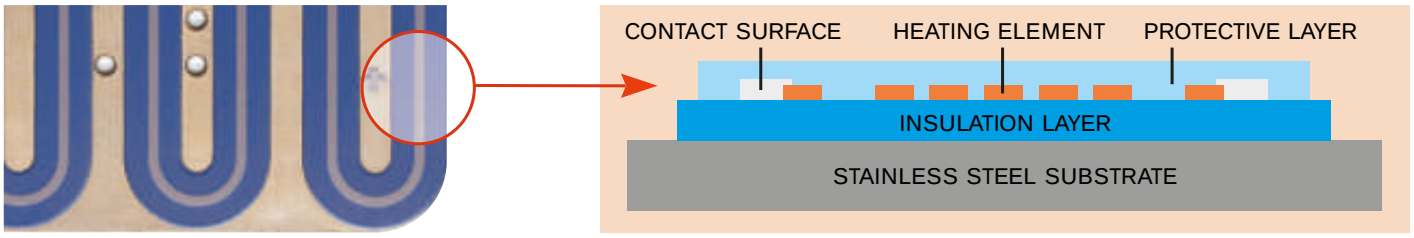
Thick film heating elements are manufactured in a completely different way than ordinary tubular heating elements. A thick film heating element consists of a stainless steel substrate (plate), on which an insulation layer (meets the requirements for dielectric strength) is printed, then a layer of resistive paste, followed by a contact and connective layer, and finally all these layers are covered with top insulation layer (providing just protection against mechanical damage, does not meet the requirements for dielectric strength). The individual layers are applied by screen printing and each layer is dried and fired afterwards. Maximum protection from dirt and dust is essential through the whole production process. Production runs in air-conditioned areas meeting the requirements for rooms with high air purity class.

Thus precisely manufactured thick film heating elements feature a quick temperature rise, an extremely low thermal capacity and minimum temperature fluctuations. Their high efficiency of 70 - 95 % depends on the mode of operation (direct or indirect heating).

At Backer Elektro CZ, substrates made of stainless steel according to standards AISI 430 (DIN 1.4016), AISI 304 (DIN 1.4301), AISI 444 (DIN 1.4521) and Titan Grade 2 (DIN 3.7035) are used. The substrate (printing area) must be flat, but can be of various shapes and can contain openings manufactured in advance (before the printing process).

The elements operate at standard line voltage (up to 400 V). Thick film heating elements feature very high surface power density - up to tens W/cm^2. Nevertheless, their operation conditions should be adjusted according to the particular application - adequate heat transfer should be provided so that the surface temperature does not exceed 300 °C (requirements to higher temperature must be consulted with our Technical Department).

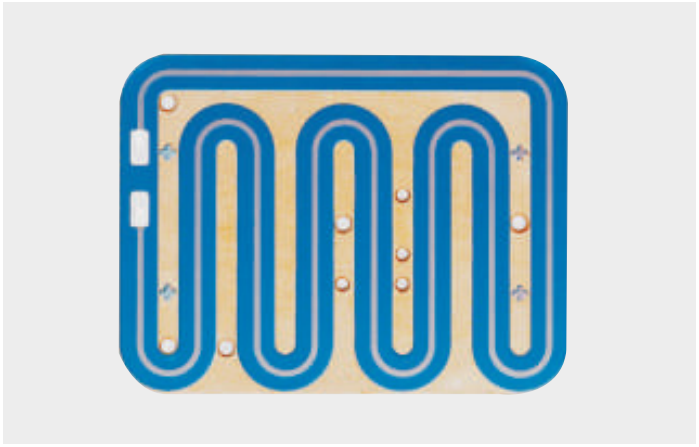
Thick film heating elements feature a significant PTC effect (its resistance rises with rising temperature, so its power decreases consecutively). Thus, resistance at room temperature and nominal voltage are specified as technical parameters for thick film heating elements.

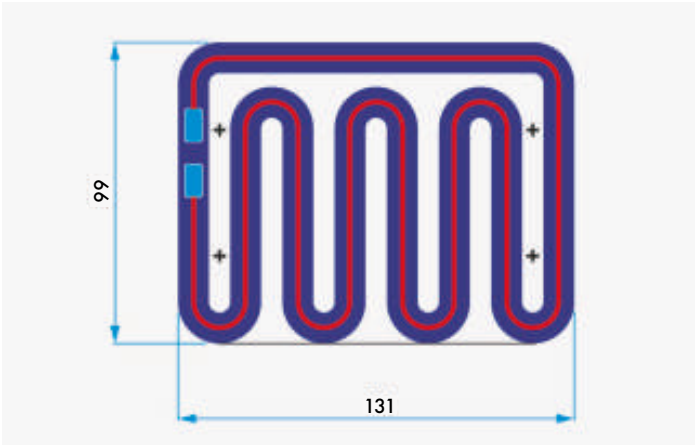


In most cases the heating is solved by use of standard-manufactured thick film heating elements. In case the heating of particular application requires brand-new element design, Backer Elektro CZ is ready to ensure development, processing of documentation and subsequent production.

STANDARD - MANUFACTURED ELEMENTS

Heating element No. 1

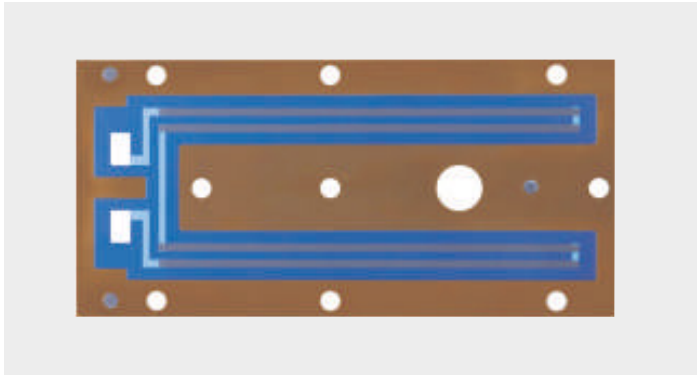


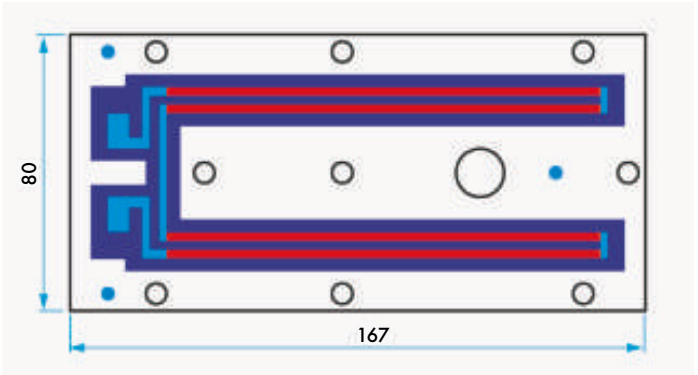


Input power at 230V	680 W
Input power range at 230 V	approx. 600 - 1200 W
Input power tolerance	+5 / -10 %
Substrate outer dimensions	131 x 99 mm

Substrate material	Stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	1.5 mm

Heating element No. 2

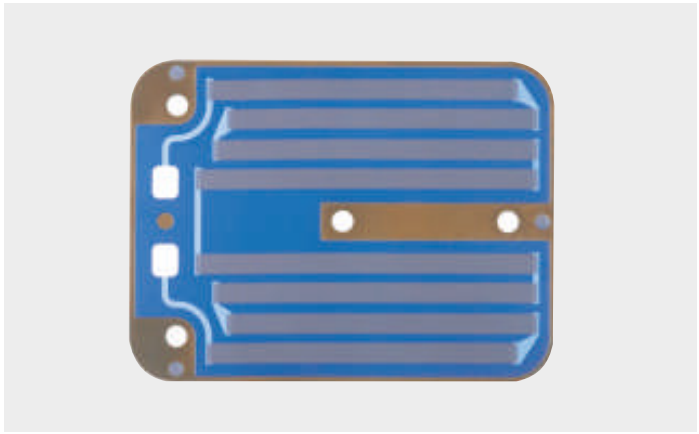


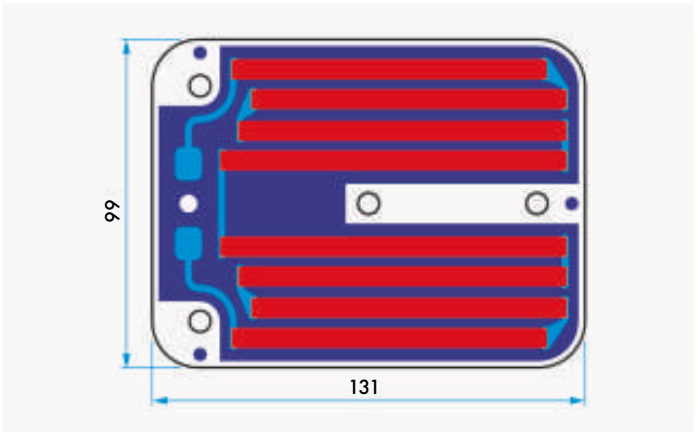


Input power at 230 V	1200 W
Input power range at 230 V	approx. 600 - 1200 W
Input power tolerance	+5 / -10 %
Substrate outer dimensions	167 x 80 mm

Substrate material	Stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	2 mm

Heating element No. 3





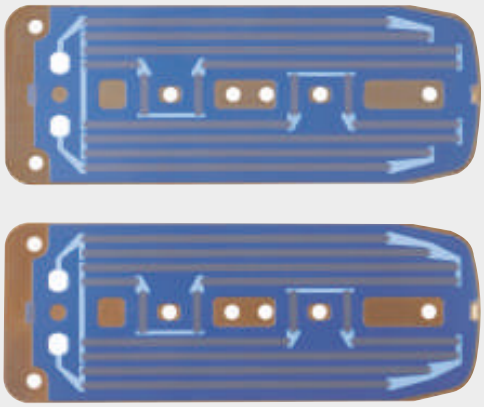
Input power range at 230 V	2000 - 4000 W
Input power tolerance	+5 / -10 %
Substrate outer dimensions	131 x 99 mm

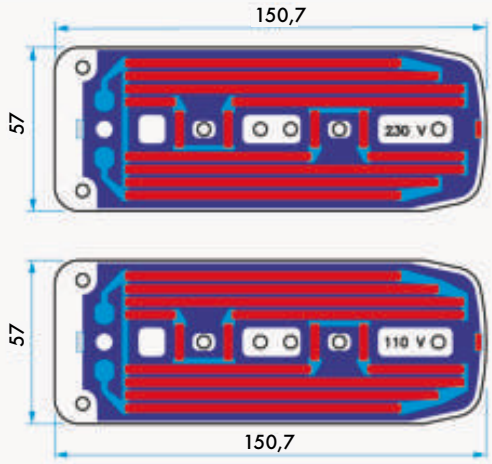
Substrate material	Stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	2 mm

EXAMPLES OF POSSIBLE SOLUTIONS OF HEATING ELEMENTS

Not standards - special delivery conditions

Heating element No.4

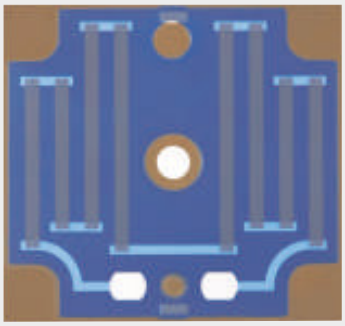


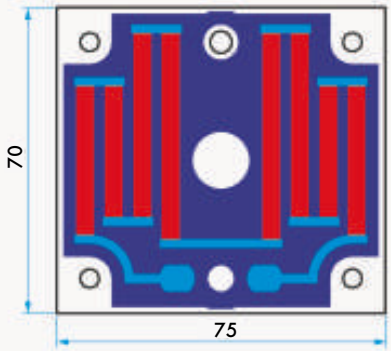


Input power range at 230 V and 110 V	500 - 1000 W
Input power tolerance	+5 / -10 %
Substrate outer dimensions	151 x 57 mm

Substrate material	stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	min. 2 mm

Heating element No.5





Input power range at 12 - 48 V	5 - 200 W
Input power tolerance	+5 / -10 %
Substrate outer dimension	75 x 70 mm

Substrate material	stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	min. 1 mm

Heating element No.6

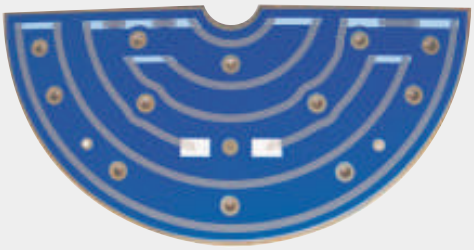
Input power range at 230 V	500 - 1000 W
Input power tolerance	+5 / -10 %
Substrate diameter	145 mm

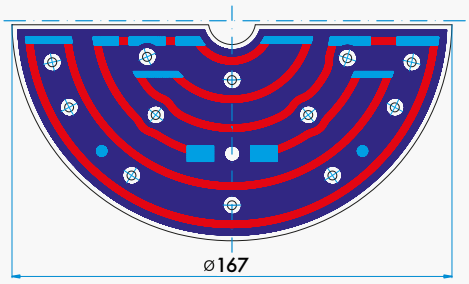
Substrate material	stainless steel
	DIN 1.4016, AISI 430
Substrate thickness	min. 2 mm

EXAMPLES OF POSSIBLE SOLUTIONS OF HEATING ELEMENTS

Not standards - special delivery conditions

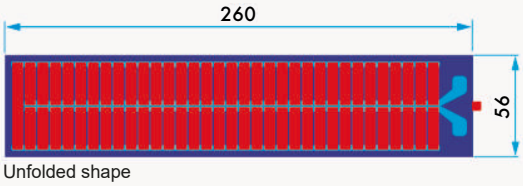
Heating element No. 7





Input power range at 230V	1000 - 2000 W	Substrate material	stainless steel
Input power tolerance	+5 / -10 %		DIN 1.4016, AISI 430
Substrate diameter	167 mm and 200 mm	Substrate thickness	min. 1.5 mm

Heating element No. 8

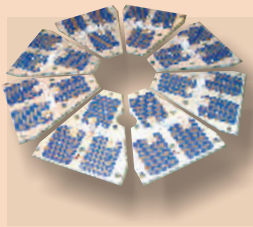


Unfolded shape

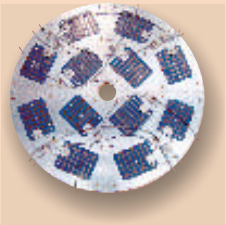
Input power range at 230 V	1000 - 2000 W	Tube material	stainless steel
Input power tolerance	+5 / -10 %		DIN 1.4301, AISI 304
Outer tube diameter	20 mm	Tube wall thickness	1 mm

EXAMPLES OF REALISED APPLICATIONS

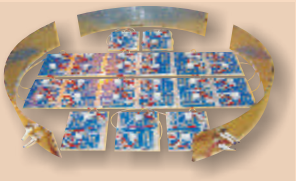
Mini-brewery



Round-bottom vessel



Heating of bottom by heating elements and walls by band heaters



Machine part heating

Liquid bath

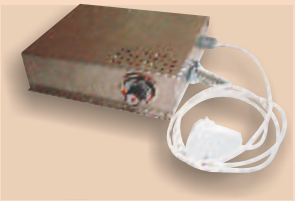
Air heating

Oil bath

Vessel with aggressive liquid

Heating in production line

Thick film heating element with control

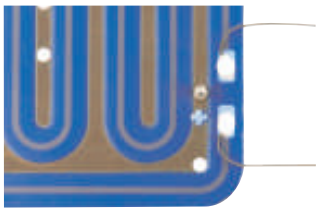


Detail of thick film heating element with control

Waxing iron

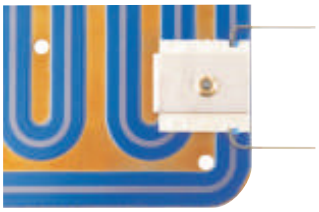
STANDARD CONTACT SYSTEMS

Type A



Sealed wires without insulation and temperature limits

Type B



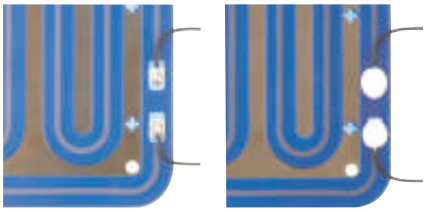
Contact junction secured mechanically, height approx. 8 - 10 mm above the printed area of the element

EXAMPLES OF POSSIBLE OUTLET SOLUTIONS

Type C

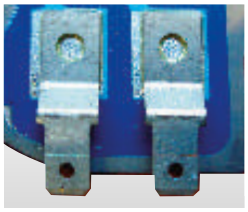
Without terminal leads (for customer specific spring contact system)

Type D



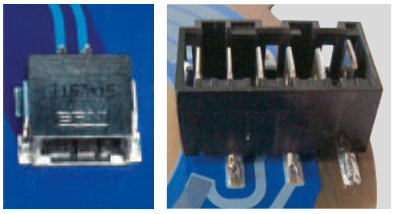
Soldered terminal leads (insulated wires) with temperature resistance up to 150 °C at the soldering point, contact junction secured with epoxy resin, height approx. 3 - 5 mm above the printed area of the element

Type E



Soldered FASTON connectors

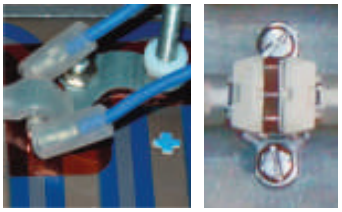
Type F



Connector terminal board

EXAMPLE CONNECTIONS OF SENSORS AND FUSES

Type 1

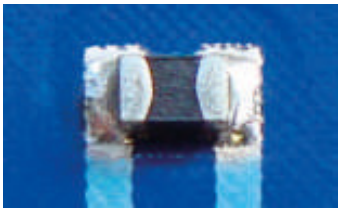


Mechanical fixing

Type 2

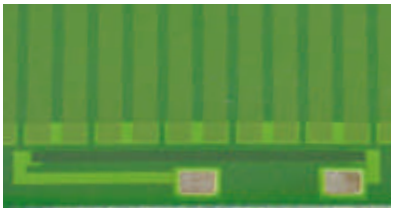
Soldered sensors

Type 3



SMD elements

Type 4



Printed special paths with clear PTC effect