

## Application of SEFAR® PowerHeat

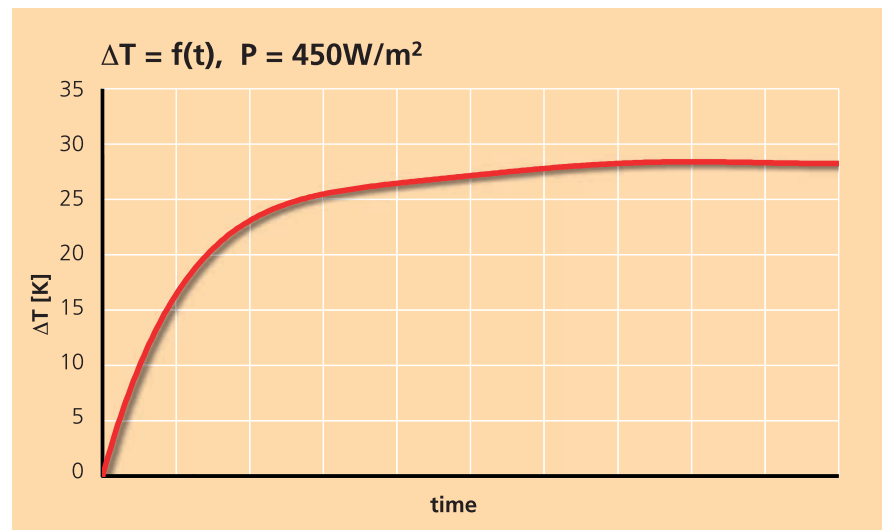
**SEFAR® PowerHeat fabric is one of the thinnest heating fabrics on the market. It is made of PET monofilaments and conductive fibers. The conductive fibers are available with insulation and in various qualities.**



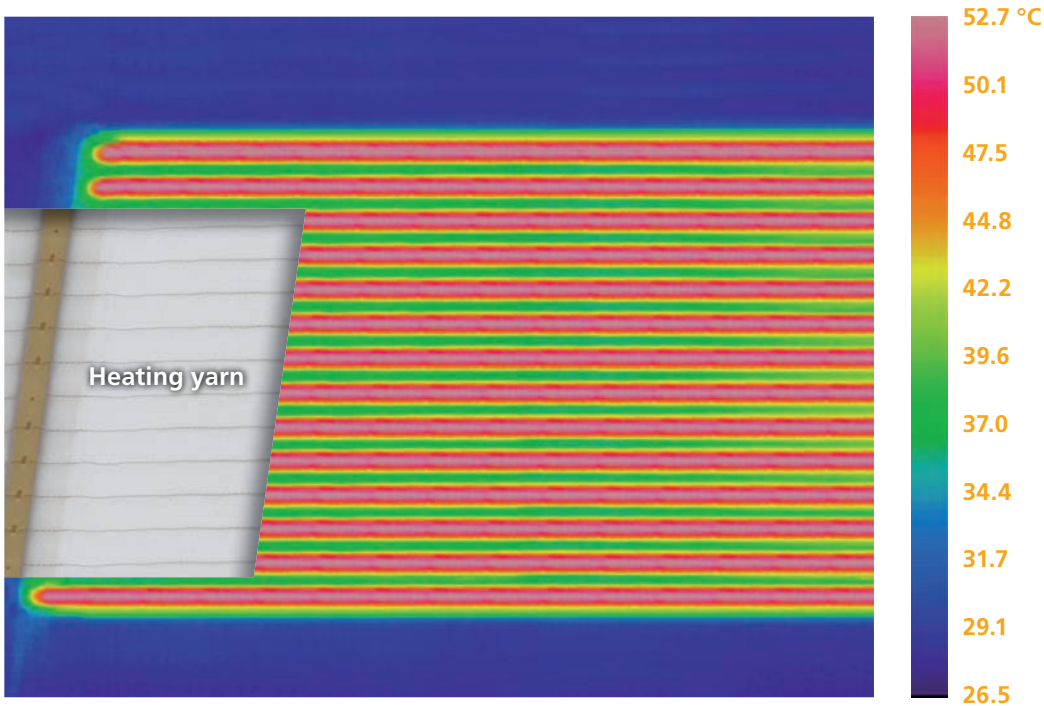
### The main advantages of SEFAR® PowerHeat

- Customer-specific designs: dimensions, voltage, heating power, cabling
- Quick heating up due to low intrinsic mass
- No hotspots
- Electrically insulated
- Energy efficient: high temperature/power ratio
- Homogeneous surface temperature
- Up to 1000 W/m<sup>2</sup> heating power dissipation when exposed to air
- Several kW/m<sup>2</sup> heating power dissipation feasible when exposed to liquids and composites
- Light-weight
- High air permeability (> 8000 l/m<sup>2</sup>/s, depending on fabric design)
- Soft: can be placed closely to surface that needs to be heated up
- Compatible with injection mold and thermoforming processes
- Can be pleated
- Controlled temperature by using temperature sensors

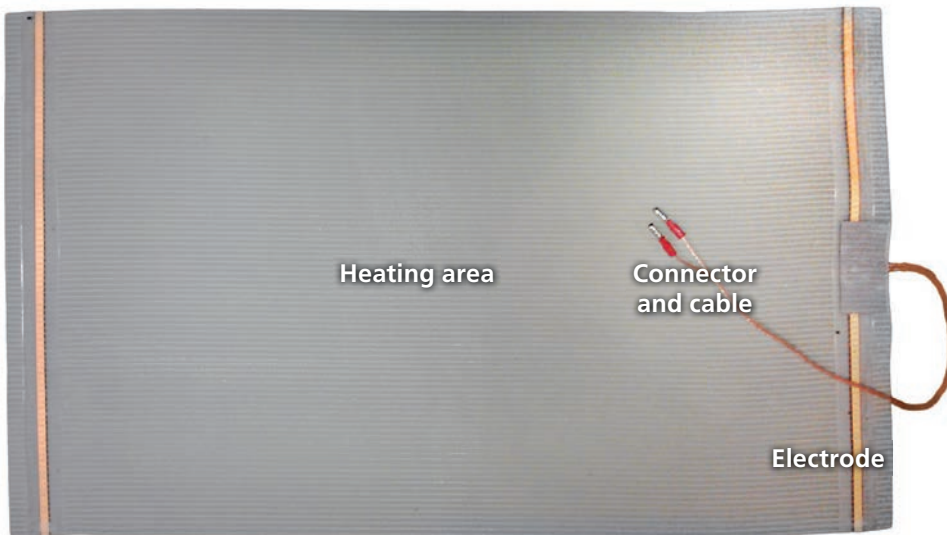
### Quick heating up, example curve



	Fabric properties
Thickness	100 – 300 μm
Weight	< 90 g/m <sup>2</sup>
Heating fibers	Copper alloys Stainless steel Strands Twisted filaments Tinsel Conductively plated filaments
Heating fiber make-up	Uninsulated Electrically insulated



Thermo-Image of a SEFAR® PowerHeat fabric panel



SEFAR® PowerHeat fabric panel

**Sefar supports you by defining your product according to your needs**

- Fabric size and heating area (length x width)
- Supply voltage
- Heating power
- Temperature requirements
- Cable/connector
- Strain-relief
- Optional lamination of a thermal insulation layer, e.g. fleece

## Examples of applications for SEFAR® PowerHeat

### Lounge Chair

Product

Chairs equipped with the heating system

- SEFAR® PowerHeat panels integrated in the upholstery
- Designed for outdoor usage
- Environment-friendly warming system
- Saves up to 90% energy compared with usual warming systems
- Control electronics integrated in armrest



### Reusable patient warming system

Product

Reusable patient warming system

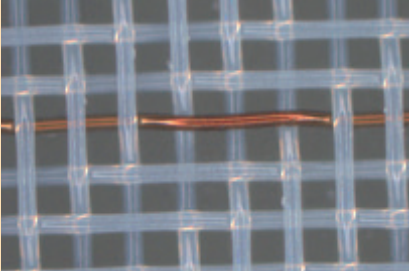

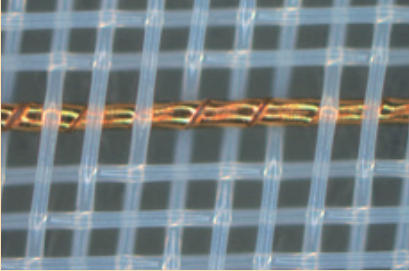
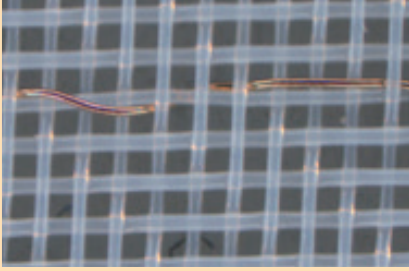
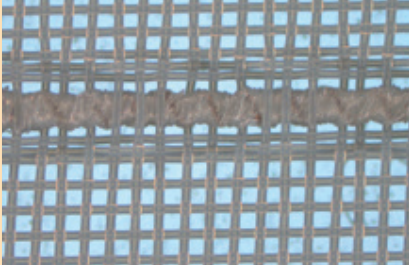
- For pre-operative, peri-operative and post-operative situations in operating theatres, recovery rooms, ICUs, wards
- Various blankets and mattresses for adult, pediatric and neonatal patients
- Multiple, highly accurate independent working temperature sensors on all heating elements
- Minimized power consumption of 150 W only (during warm-up)
- X-ray compatible



## Overview of Sefar connection technologies

Yarn/wire type	Advantage	Disvantage
<b>TCB spot welding</b> 	<ul style="list-style-type: none"> <li>– Insulated wires connectable</li> <li>– Selective connection of wires (enables use of standard fabrics)</li> <li>– Gas-proof connection</li> <li>– Flexible connection</li> <li>– Quick Implementation</li> <li>– Suitable for prototyping and small series</li> </ul>	<ul style="list-style-type: none"> <li>– Expensive technology</li> <li>– Limited material selection</li> </ul>
<b>Reel-to-Reel soldering</b> 	<ul style="list-style-type: none"> <li>– Quick process</li> <li>– Gas-proof connection</li> <li>– Connection with limited flexibility</li> </ul>	<ul style="list-style-type: none"> <li>– Only bare wires</li> <li>– Limited material selection</li> <li>– All wires will be connected</li> <li>– Fabric must be adapted according to specs</li> </ul>
<b>Crimping</b> 	<ul style="list-style-type: none"> <li>– Most materials can be processed</li> <li>– Quick process</li> <li>– Gas-proof connection</li> <li>– Crimp can be used as mounting aid</li> <li>– Low cost</li> </ul>	<ul style="list-style-type: none"> <li>– Only bare wires</li> <li>– Stiff</li> <li>– All wires will be connected</li> <li>– Fabric must be adapted according to specs</li> </ul>
<b>Hot embossing</b> 	<ul style="list-style-type: none"> <li>– Most materials can be processed</li> <li>– Gas-proof connection</li> <li>– Connection with limited flexibility</li> </ul>	<ul style="list-style-type: none"> <li>– Only bare wires</li> <li>– All wires will be connected</li> <li>– Fabric must be adapted according to specs</li> </ul>
<b>Weaving (busbar in warp direction)</b> 	<ul style="list-style-type: none"> <li>– Most materials can be processed</li> <li>– No swelling due to connection</li> <li>– Very low cost</li> <li>– Flexible connection</li> </ul>	<ul style="list-style-type: none"> <li>– Only bare wires</li> <li>– No gas-proof connection</li> <li>– Application-specific fabric must be manufactured</li> <li>– Only for high quantities and lead times &gt; 3 months</li> </ul>

Conductive yarn selection

Yarn/wire type	Advantage	Disvantage
<b>Plain wire</b> 	<ul style="list-style-type: none"> <li>– Thin</li> <li>– Precisely located</li> <li>– Available with insulation coating</li> <li>– Available with high electrical conductivity</li> </ul>	<ul style="list-style-type: none"> <li>– Mechanical strength given by metal type</li> </ul>
<b>Metal plated multifilament</b> 	<ul style="list-style-type: none"> <li>– Mechanically very robust</li> <li>– Sewable</li> </ul>	<ul style="list-style-type: none"> <li>– Limited electrical conductivity</li> <li>– Big yarn diameter</li> <li>– Plating can peel off</li> <li>– Fibrils can break</li> <li>– Not solderable/weldable</li> <li>– Expensive</li> </ul>
<b>Tinsel</b> 	<ul style="list-style-type: none"> <li>– Mechanically very robust</li> </ul>	<ul style="list-style-type: none"> <li>– Expensive if insulation required</li> </ul>
<b>Twisted yarn</b> 	<ul style="list-style-type: none"> <li>– Increases mechanical strength compared to plain wire</li> </ul>	<ul style="list-style-type: none"> <li>– Undefined located</li> </ul>
<b>Double-twisted yarn</b> 	<ul style="list-style-type: none"> <li>– Increases mechanical strength a lot compared to plain wire</li> <li>– Elastic versions available</li> </ul>	<ul style="list-style-type: none"> <li>– Big yarn diameter</li> </ul>

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