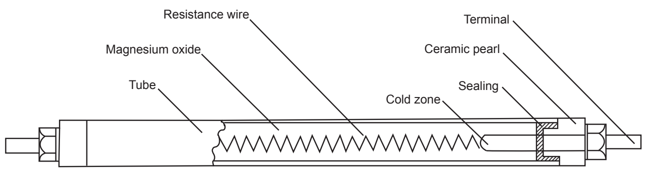
HEATING ELEMENTS

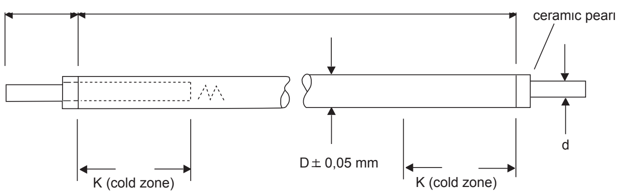
Heating elements are often produced to customer-specific requirements.

Heating elements are used for applications such as ovens, cookers and griddles and for warming up tools and machinery. These heating elements are very flexible and can be bent to suit the application.

Heating Group's compressed heating elements comprise three components:

- a special alloy resistance wire which is centered in the tube (resistance wire can be CrNI or DSD)
- magnesium oxide for electrical insulation
- steel tube cap, material depending on application





TUBE TYPES

Heating Group has a broad range of steel types which make it possible to supply products for more or less all applications. The table on page 2 shows the stocked steel types, maximum length, temperature range and terminal options.

COLD ZONE

The cold zones at the tube ends may vary from 35mm up to 1200mm depending on the choice of terminal and tube type.

SEALING

The heating element is sealed to prevent the magnesium oxide from absorbing moisture and thereby causing a transition point in the heating element. Two types of sealant are used, depen-ding on how high temperature the seal may be subject to.

- silicone: max. 180°C
- polyurethane: max. 120°C

Silicone can only be used in continuous operation in which the heating element is not exposed to moisture, as silicone is not diffusion-proof so moisture transfer is possible. Polyurethane is diffusion-proof and bonds well to metal.

Certification

The heating elements are standard produced according to the CE marking. Optional the elements can also be produced with UL ore CSA certification.

MAY 2013

TUBE TYPES

Material	Dimension	Max. surface temperature	Max. tube length	Ø2.5 pin	Ø3.5 pin	M4 steel	M4 stainless steel	M6 stainless steel
Copper	Ø6.25	150	3860	x				
Copper	Ø8.50	150	6500	x	x	x	x	
Copper	Ø10.2	150	7750	x	x	x	x	
AISI 304	Ø6.25	750	3700	x				
AISI 304	Ø8.50	750	6780	x	x	x	x	
AISI 321	Ø6.25	750	3700	x				
AISI 321	Ø8.50	750	6780	x	x	x	x	
AISI 321	Ø10.2	750	7750	x	x	x	x	
AISI 309	Ø8.50	900	6780	x	x	x	x	
AISI 316L	Ø6.25	750	3700	x				
AISI 316L	Ø8.50	750	6780	x	x	x	x	
AISI 316L	Ø10.2	750	7750	x	x	x	x	
AISI 316L	Ø12.7	750	6930					x
Inconell 600	Ø8.50	980	6780	x	x	x	x	
Incoloy 800	Ø6.25	800	3700	x				
Incoloy 800	Ø8.50	800	6780	x	x	x	x	
Incoloy 800	Ø10.2	800	7750	x	x	x	x	
Incoloy 800	Ø12.7	800	6930					x
Incoloy 825	Ø6.25	750	3700	x				
Incoloy 825	Ø8.50	750	6780	x	x	x	x	
Incoloy 825	Ø12.7	750	6930					x
SMO 254	Ø8.50	400	6780	x	x	x	x	
Titanium	Ø8.50	650	7000	x	x	x	x	
Titanium	Ø12.7	650	6930					x

MAY 2013

APPLICATIONS

Of course, when choosing a tube cap material, the medium to be heated has a significant part to play. The surface load, W/cm², is another factor. If the surface load is too high, the heating element will overheat and burn. In the case of certain medium where the heat transmission is particularly high, a significantly higher surface load than in air can be accepted, just as the media may make specific demands of the tube cap material on account of corrosion problems.

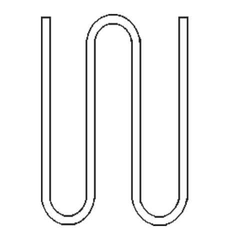
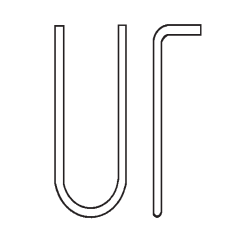
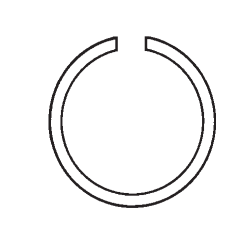
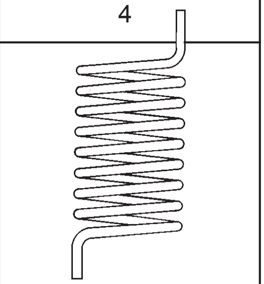
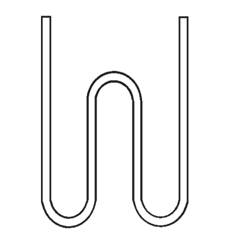
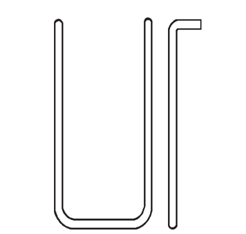
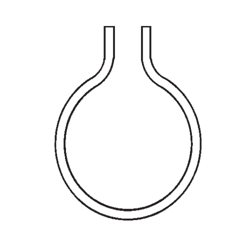
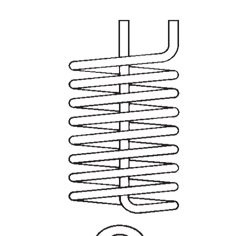
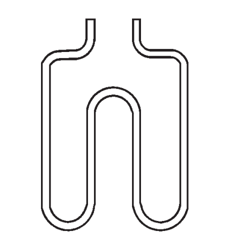
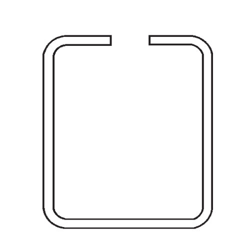
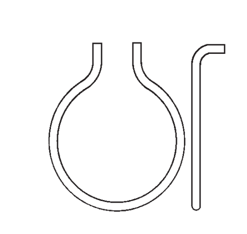
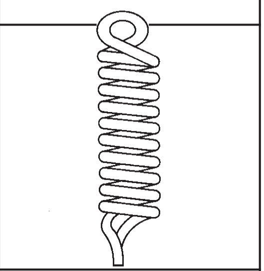
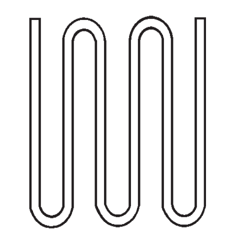
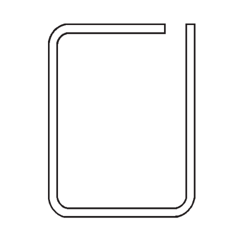
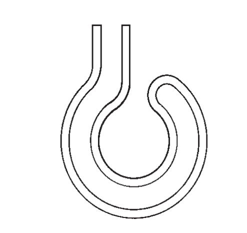
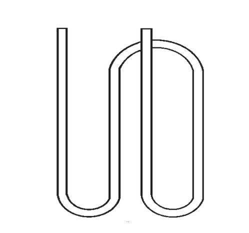
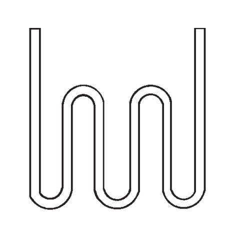
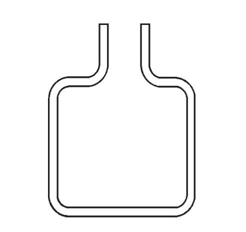
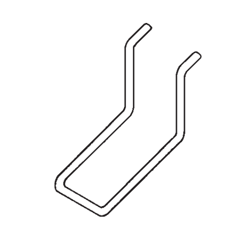
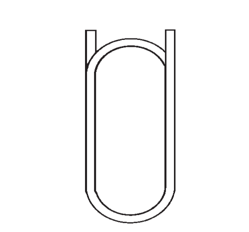
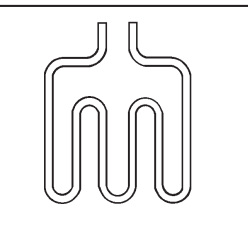
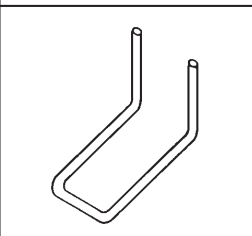
Likewise the media may demand a particularly low surface temperature due to – for example – a risk of fire or coating problems. The issue of corrosion can often be resolved by contac-ting a supplier of chemicals.

This guideline table specifies the recommended maximum sur-face load in W/cm² for various heating purposes in connection with the most suitable tube cap materials.

Heating materials		**Tube cap materials**									
Liquid media	**Max. W/cm²**	**CU**	**AISI 304**	**AISI 309**	**AISI 316**	**AISI 321**	**INC 600**	**INC 800**	**INC 825**	**SMO 254**	**Tita-nium**
Water, stagnant	6-10	x							x	x	x
Water, moving	10-15	x							x	x	x
Alkaline bath	4-6								x	x	x
Water-dissolved acids and salts	1-2								x	x	x
Phosphating bath	2-4										
Ammonia and ammonium chloride bath	2-3								x	x	x
Oil, thin	1-3		x		x				x	x	x
Oil, thick	1-1½		x		x						
Wax and lacquers	0.5		x		x						
Gaseous media											
Air, stationary	1-3		x	x	x	x	x	x			
Air, moving	5		x	x	x	x	x	x			
Steam 100°C	2-4	x				x		x	x	x	
Steam 250°C	1-3					x		x	x	x	
Steam 500°C	1-3							x	x		
Flue gas 300°C	1-3				x	x	x	x	x	x	
Solid media (e.g. steel plate)											
Without regulation	1-½		x	x	x	x	x	x	x		
Embedded in metal	4-6		x	x	x	x	x	x	x		
With regulation	8-10		x	x	x	x	x	x	x		
Laid in track	3-6		x	x	x	x	x	x	x		

MAY 2013

BENDING SKETCHES

	1	2	3	4
Q				
R				
S				
T				
U				
V			There are many different ways of bending heating elements. Take a look at the table and find the bend drawing that suits your requirements – or send us a drawing of your own!	

MAY 2013

FINISHES

The illustrations show typical end pieces used for heating elements and electric heater cartridges. There are lots of other options available, too, so please contact our technical sales team for more information.

M4 treaded bolt on Ø8.5 and Ø10.2 tubes.
M6 treaded bolt on Ø12.7 tube only.

Single spade 6.3 mm.

Single spade with 45° or 90° angle bend.

Double spade, straight.

Double spade, 90° angle.

Fitted with an insulated flex or stranded wire.
High-temperature flex for up to 400°C is stocked.

End piece with welded cable and shrink flex.

Fully cast end piece with polyurethane for outstanding seal.

MAY 2013

DIMENSIONING

Diagrams/curves are used to indicate the maximum permitted surface load (W/cm²) as a function of the operating/ambient temperature. These curves act merely as a guideline as the heat passing between the elements will have a part to play. If the heating elements are used in a duct heater, the length of this will also have an influence.

Example 1 (see the diagram below)
We wish to find out what maximum permitted surface load is applicable to the heating element, working on the basis of the following information:

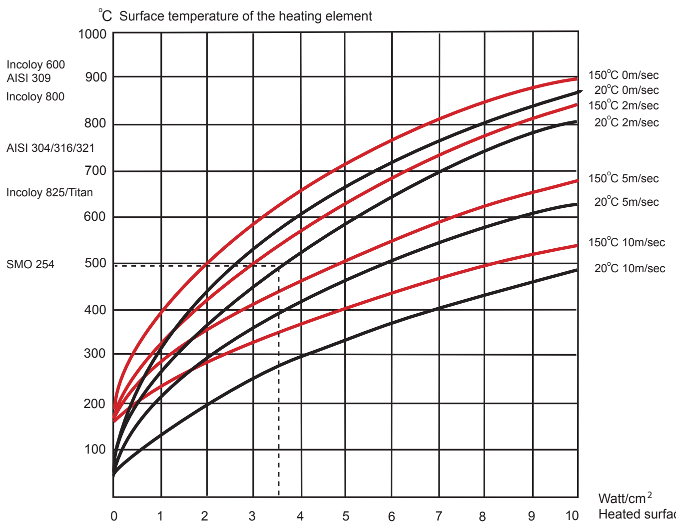
- the duct heater has an input temperature of 20°C
- the air speed is 2 m/sec.
- AISI 304 is used (indicated to be able to withstand 700-800°C
- a maximum permitted surface temperature of 500°C is selected for safety reasons

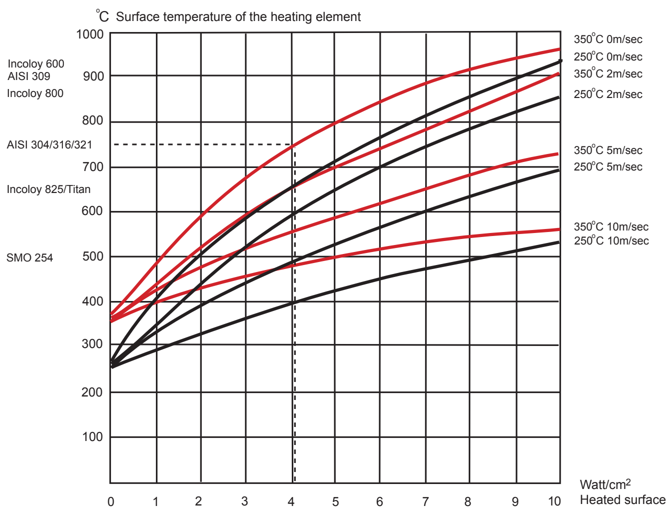
Which is the correct surface load for this element?
We select the curve 20°C 2 m/sec and follow it down to 500°C. A maximum permitted surface load of 3.5 W/cm² can be seen. If this is too low, it is possible to select a faster airflow of 5 m/sec, for example, which would give a value of 5.8 W/cm², or else less stringent requirements for a safety temperature of 500°C could be selected.

Example 2 (see the diagram below)
What would the maximum permitted surface load be if we have an AISI 316 heating element and the following operating condi-tions are prevalent?

- operating temperature of 350°C
- the heating element is located in stationary air, 0 m/sec.

We select the curve 350°C 0 m/sec and follow it until we see AISI 316. We can see a maximum permitted surface load of 4 W/cm². If a different type of steel is selected, such as Incoloy 800, the surface load increases to 6.4 W/cm².





MAY 2013