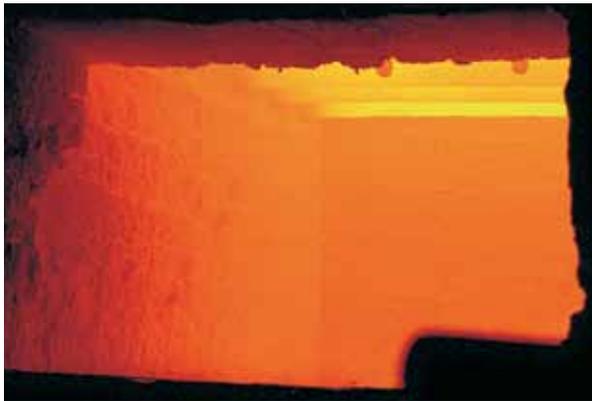


# Kanthal® Global® SG and SR

## Silicon carbide heating elements

Kanthal Global SG and SR are Sandvik's highest performance silicon carbide (SiC) heating elements, designed to exceed the requirements of today's most demanding high-temperature processes.



### SPECIAL FEATURES

- Unparalleled resistance to oxidation and chemical attack
- Excellent performance at element temperatures up to 1650°C (3000°F)
- Repeatable and reliable results in the most aggressive high temperature processes

### Applications

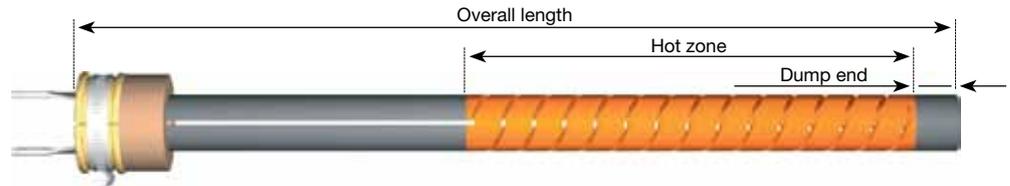
Kanthal Global SG and Kanthal Global SR elements are ideally suited to most types of high-temperature equipment, including:

- High-temperature laboratory furnaces
  - Creep testing, MOR and DTA
  - General purpose box and tube furnaces
- Melting and holding of non ferrous metals
  - Crucible or reverberatory
  - Immersion heater
- Glass feeders
- Batch and continuous furnaces to 1600°C (2910°F)
  - Alumina ceramics
  - Electronics components
  - Tin oxide electrodes
  - Luminous powders
  - Powder metal sintering





Kanthal® Globar® SG element.



Kanthal Globar SR element.

Each element is tubular, and comprises a high resistance hot zone, and low resistance cold ends, that pass through the walls of the furnace. Machining the tube with one or more helical cuts creates the hot zone. This increases the resistance, by extending the length and reducing the

cross sectional area of the current path. The cold ends are sprayed at the ends with w, to form a low resistance contact. Kanthal® Globar® SR elements have a 2-start helical cut, and are supplied complete with a terminal assembly at one end.

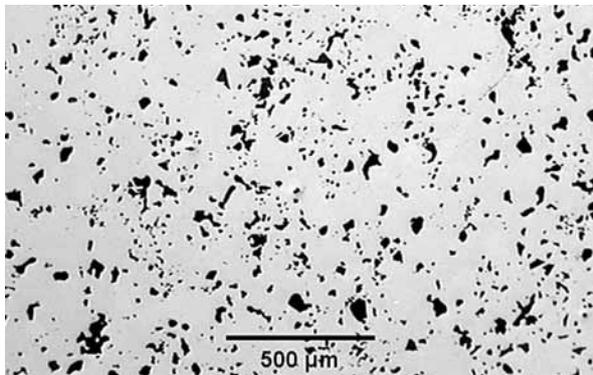
**Typical material properties**

Element type	Density		Porosity %	4-pt bending strength MPa
	g/cm <sup>3</sup>	lb/in <sup>3</sup>		
Standard density	2.30	0.08	25.0	50
Kanthal® Globar® SG and SR	2.85	0.10	8.5	100

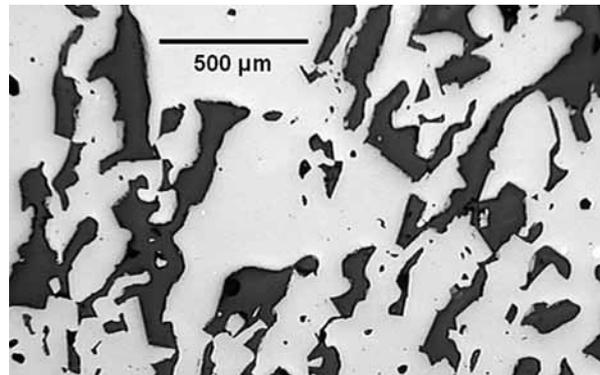
**Material structure and performance**

The high density of Kanthal Globar SG and SR elements is the main feature that contributes to their superior performance. Not only is the structure less porous than conventional elements, but many of the pores are closed, and inaccessible to the process gas. This limits the rate of reaction, and extends the element life, even under the most aggressive conditions.

All silicon carbide elements will increase in resistance over time at elevated temperatures, but the rate at which this occurs is much lower using Kanthal Globar SG and SR elements than with conventional, recrystallized elements. Kanthal Globar SG and SR elements generally have a much higher resistance than comparable sizes of rod element, and this, combined with their low rate of resistance change over time, ensures that most systems



Micrographs of SiC elements, Kanthal Globar SG.



Micrographs of SiC elements, standard density bar.

can be operated directly from the local supply voltage. In most instances transformers are not required, and low cost control can be achieved using solid state contactors or thyristors (SCRs).

**Electrical characteristics**

Kanthal Globar SG and SR elements display the typical resistance vs temperature characteristics of alpha silicon carbide. Although consistent between 900°C (1650°F) up to a maximum of about 1600°C (2910°F), the curve is variable between ambient temperature and 800°C (1470°F). At room temperature, the resistance may be several times the resistance at 1000°C (1830°F), and element resistance must always be measured at elevated temperatures.

Each standard Kanthal Globar SG and SR element is calibrated at a test voltage, calculated to raise the temperature of a nominal resistance element to 1000°C (1830°F), and the standard tolerance on resistance is ±10% for Kanthal Globar SG elements and ±20% for Kanthal Globar SR elements.

**Manufacture and quality**

Conventional silicon carbide heating elements are manufactured using a recrystallization process, where there is no increase in density during firing. In contrast, Kanthal Globar SG and SR elements are made by a unique, reaction-sintering process, where an extruded mixture of silicon carbide, carbon and selected additives is fired with silicon at over 2000°C (3630°F) to form a secondary phase of SiC. As the reaction-formed SiC has a volume 2.3 times higher than the carbon it replaces, a significant increase in density is achieved. Each element is fired again, at over 2500°C (4530°F), evaporating any residual silicon, and bonding together the primary and secondary phases of silicon carbide.

The result is a tough, oxidation resistant material, with controlled resistance and uniform heating characteristics.

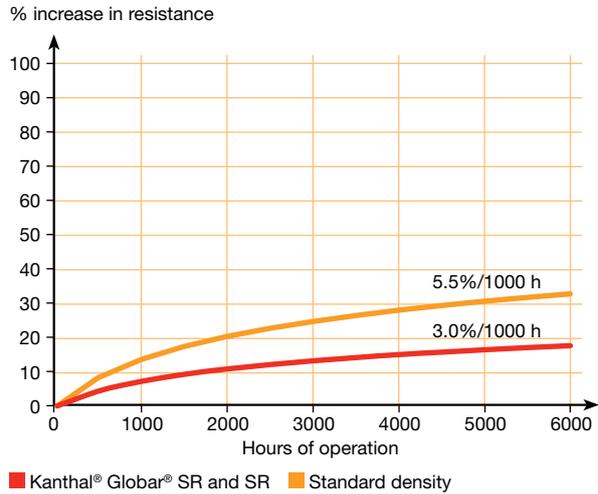
**Element loading**

The rating of Kanthal Globar SG and SR elements is dependent on temperature of operation and atmosphere, and is expressed in W/cm<sup>2</sup> (W/in<sup>2</sup>) of the hot zone surface area. In air, elements typically are loaded at up to 11 W/cm<sup>2</sup> (71.0 W/in<sup>2</sup>) at furnace temperatures up to 1350°C (2460°F), reducing to about 3 W/cm<sup>2</sup> (19.35 W/in<sup>2</sup>) at 1600°C (2910°F).

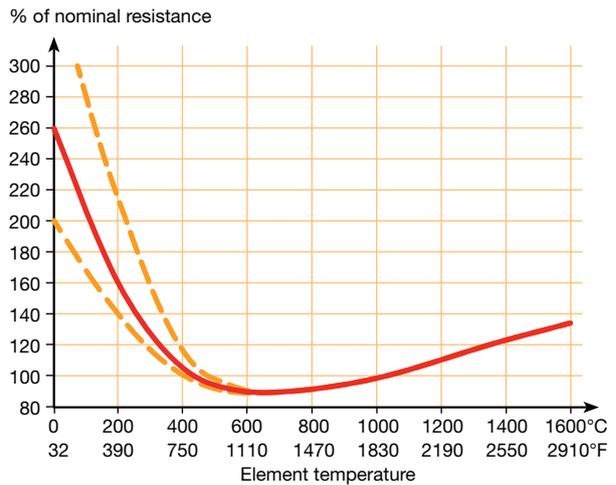
The lower the surface load, the lower will be the element temperature, and elements in industrial furnaces typically will be loaded at between 3 and 8 W/cm<sup>2</sup> (19.35 and 51.6 W/in<sup>2</sup>) to optimize performance.

Higher loadings are possible in some cases, but technical advice should be obtained first.

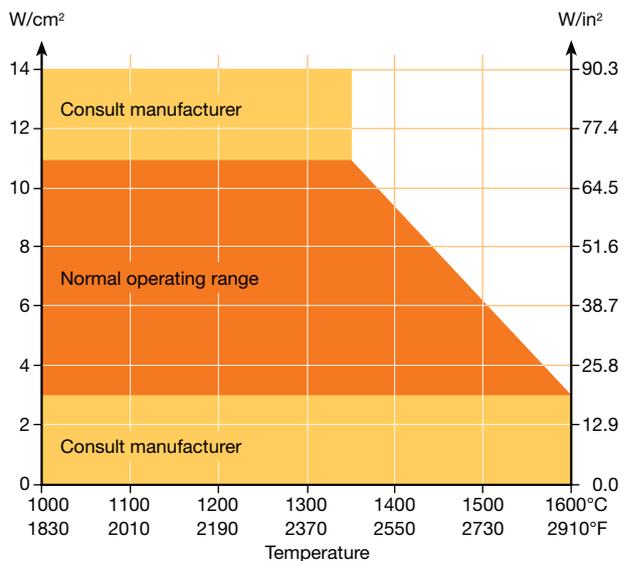
**Typical change in resistance with time at 1400°C (2550°F)**



**Typical resistance/temperature curve**



**Surface loading chart**



### Installation

There are no special requirements for handling and installing Kanthal® Global® SG elements, and the methods detailed in Kanthal Global SD technical data book should be followed.

Kanthal Global SR elements are suitable for both horizontal and vertical installation. Where Kanthal Global SR elements are mounted horizontally and the dump end is to be supported, a longer than standard dump end length should be specified when ordering. Horizontal SR elements must always be installed so that the slots in the cold ends are horizontal. Kanthal Global SR should not be used where any conductive deposit is likely to occur, as a short circuit may develop across the slots or spirals, resulting in premature failure.

### Element nomenclature

Kanthal Global SG elements are specified as: Type – construction – diameter – hot zone – overall – nominal resistance – tolerance on resistance, e.g. SGO-1-32-425-950-1.53-1010 (dimensions in mm).

Kanthal Global SR elements are specified as: Type – construction – diameter – hot zone – overall – dump end – nominal resistance – tolerance on resistance, e.g. SRO-1-25-150-400-13-3.54-2020 (dimensions in mm).

### Commercial and technical support

For further information about Kanthal Global elements, please contact your local Sandvik company or representative, or send your enquiries directly to Sandvik Heating Technology UK.

### Sandvik Group

The Sandvik Group is a global high technology enterprise with 47,000 employees in 130 countries. Sandvik's operations are concentrated on three core businesses: Sandvik Tooling, Sandvik Mining and Construction and Sandvik Materials Technology – areas in which the group holds leading global positions in selected niches.

### Sandvik Materials Technology

Sandvik Materials Technology is a world-leading manufacturer of high value-added products in advanced stainless steels and special alloys, and of medical implants, steel belt-based systems and industrial heating solutions.

Kanthal is a Sandvik owned brand, under which world class heating technology products and solutions are offered. Sandvik, Kanthal and Global are trademarks owned by Sandvik Intellectual Property AB.

### Quality management

Sandvik Materials Technology has quality management systems approved by internationally recognized organizations. We hold, for example, the ASME Quality Systems Certificate as a materials organization, approval to ISO 9001, ISO/TS 16949, ISO 17025, and PED 97/23/EC, as well as product approvals from TÜV, JIS and Lloyd's Register.

### Environment, health and safety

Environmental awareness, health and safety are integral parts of our business and are at the forefront of all activities within our operation. We hold ISO 14001 and OHSAS 18001 approvals.

Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice.

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