KANTHAL

Kanthal® Globar® SG & SR

Silicon Carbide Heating Elements

Kanthal Globar SG & SR are Kanthal's highest performance silicon carbide (SiC) heating elements, designed to exceed the demands of today's most demanding high temperature processes.

Kanthal Globar SG & SR are made from high density, reaction bonded SiC that provides:

- Unparalleled resistance to oxidation and chemical attack.
- Excellent performance at operating temperatures, from 400 – 1650˚C (750 – 3000˚F).
- Repeatable and reliable results in the most aggressive high temperature processes.

Applications

Kanthal Globar SG and Kanthal Globar 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 & Holding of Non Ferrous Metals**
  Crucible or Reverberatory
  Immersion heater
- **Glass Feeders**
- **Batch and Continuous Furnaces to 1600˚C** (2912˚F)
  Alumina ceramics
  Electronics Components
  Tin Oxide Electrodes
  Luminous Powders
  Powder Metal Sintering

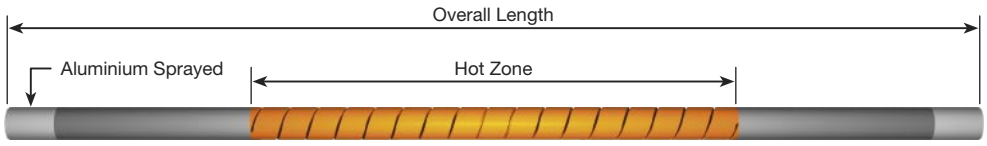


Fig. 1a. Kanthal Globar SG element

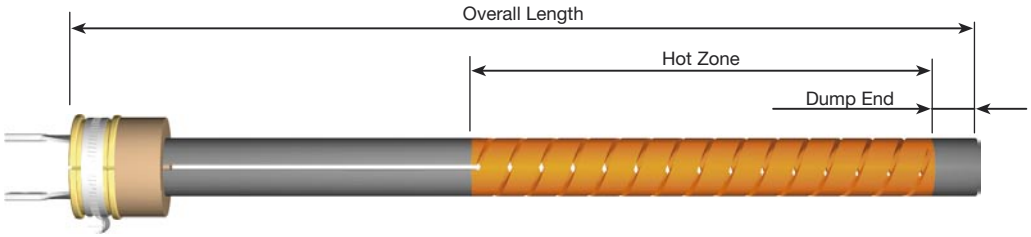


Fig. 1b. Kanthal Globar SR element

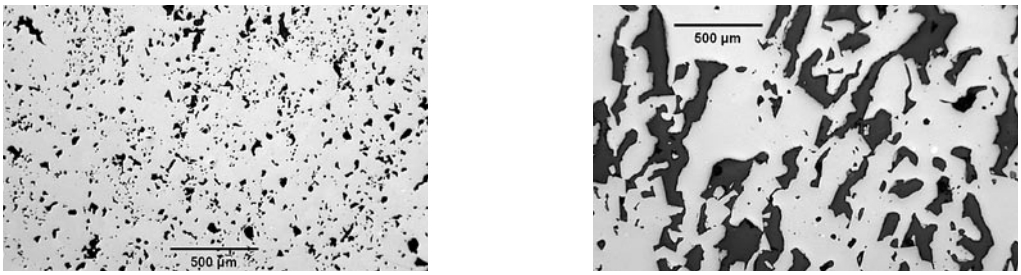
Each element is tubular, and comprises a high resistance hot zone, and low resistance cold ends, that pass through the walls of the furnace. Machining the tube with one or more helical cuts creates the hot zone. This increases the resistance, by extending the length and reducing the cross sectional area of the current path. The cold ends are sprayed at the ends with aluminium, 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.

Element Type	Density (g/cm³)	Porosity (%)	4-pt Bending Strength (MPa)
Standard Density	2.30	25.0	50
Globar SG & SR	2.85	8.5	100

Table 1 Typical Material Properties

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 (Table 1), but many of the pores are closed (Fig. 2), and inaccessible to the process gas. This limits the rate of reaction, and extends the element life, even under the most aggressive conditions.



a. Kanthal Globar SG *b. Std Density Bar*

Fig. 2 Micrographs of SiC Elements

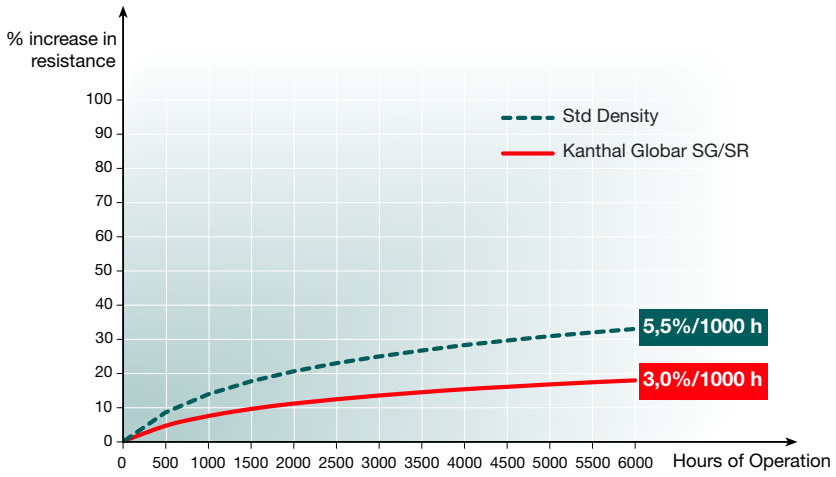


Fig. 3 Typical change in resistance with time at 1400°C (2552°F) (Continuous operation in an air atmosphere)

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, recrystallised elements (Fig.3). 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 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 & SR elements display the typical Resistance vs Temperature characteristics of alpha silicon carbide (Fig. 4). Although consistent between 900˚C (1652˚F) up to a maximum of about 1600˚C (2912˚F), the curve is variable between ambient temperature and 800˚C (1472˚F). At room temperature, the resistance may be several times the resistance at 1000˚C (1832˚F), and element resistance must always be measured at elevated temperatures. Each standard Kanthal Globar SG & SR element is calibrated at a test voltage, calculated to raise the temperature of a nominal resistance element to 1000˚C (1832˚F), and the standard tolerance on resistance is ±10% for Kanthal Globar SG elements and ±20% for Kanthal Globar SR elements.

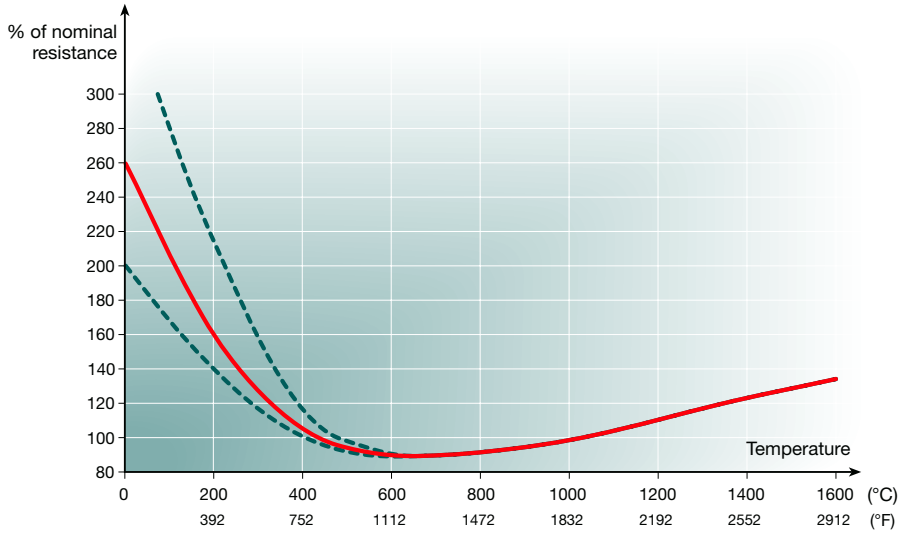


Fig. 4 Typical Resistance/Temperature Curve

Manufacture and Quality

Conventional silicon carbide heating elements are manufactured using a recrystallisation process, where there is no increase in density during firing. In contrast, Kanthal Globar SG & 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 (3632˚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 (4532˚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/cm² (W/in²) of the hot zone surface area. In air, elements typically are loaded at up to 11 W/cm² (71.0 W/in²) at furnace temperatures up to 1350°C (2462°F), reducing to about 3 W/cm² (19.35 W/in²) at 1600°C (2912°F).

The lower the surface load, the lower will be the element temperature, and elements in industrial furnaces typically will be loaded at between 5 and 8 W/cm² (19.35 and 51.6 W/in²) to optimise performance.

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

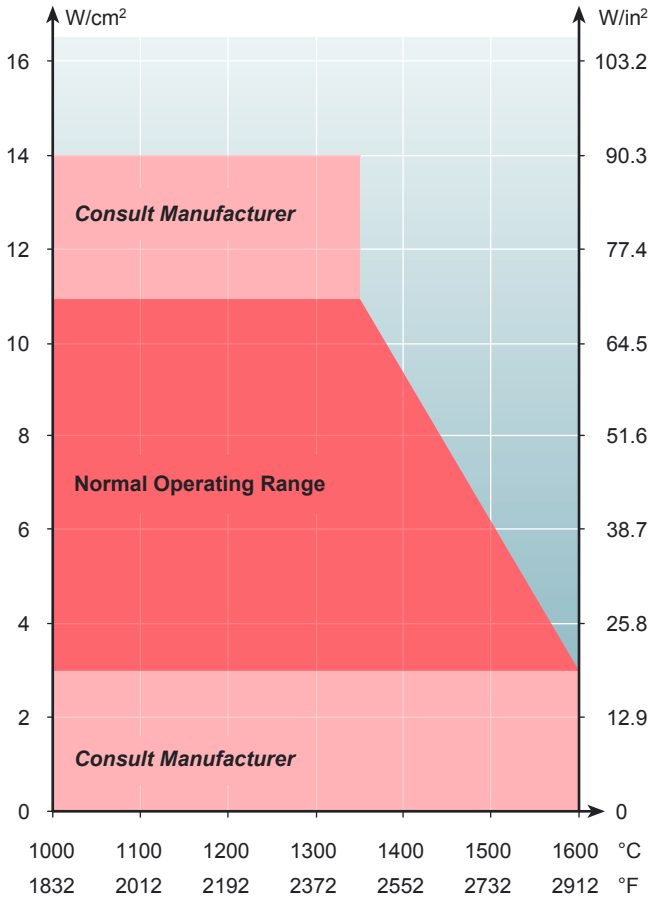


Fig. 5 Surface loading chart

Installation

There are no special requirements for handling and installing Kanthal Globar SG elements, and the methods detailed in the Kanthal Globar SD Technical Data Book should be followed.

Kanthal Globar SR elements are suitable for both horizontal and vertical installation. Where Kanthal Globar 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 Globar 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 Globar 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

Kanthal Globar 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

Commercial and Technical Support

For further information about Kanthal Globar elements, please contact your local Kanthal Company or Representative, or direct your enquiries directly to Kanthal Limited.

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