Silcarb®

MOSIL ELEMENTS FOR HIGH TEMPERATURES

THE **COMPANY** SILCARB

- Silcarb, An ISO 9001-2008 Company is India's premier indigenous manufacturer of Silicon Carbide Heating Elements, with its plant located at Bangalore, South India

- Silcarb's 'ALPHA ROD' Silicon Carbide Heating Elements Series is made of Re-Crystallized Alpha Silicon Carbide

- Silcarb's 'Ultra Spiral' Silicon carbide heating element are made of Reaction bonded Silicon Carbide

- 'Alpha Rods' and 'Ultra Spiral Elements' are available in different Configurations for connections from two ends or from one end

GENERAL DESCRIPTION

MOSIL 1800 is a High Density Material consisting of molybdenum disilicide ($MoSi_2$) and Self forming glaze of silicon dioxide (SiO_2). It can be used upto Furnace Temperature of 1800°c. These Elements do not Age and have a Long Service Life.

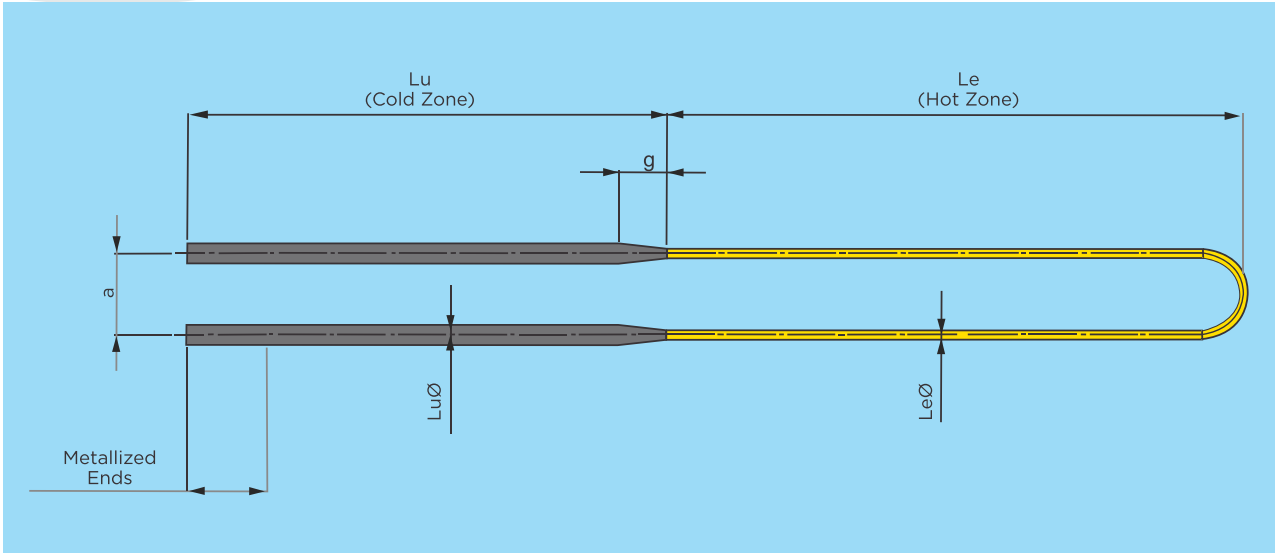
At Temperature of around 1200°c the Element becomes Ductile. It is Brittle at Temperature below 1200°c.

The elements are U shaped and are mostly used suspended with the bottom of the "U" down. The element consists of two cold ends (Lu) and a U-shaped hot section (Le). The cold ends are twice the diameter of the hot section and are attached by a weld. The extremities of the cold ends are metallized with aluminium to provide a low-resistance contact area to which the end zones are made with flat braided aluminium straps.

The elements are offered in two grades:-

Type MOSIL-31 used for maximum element temperature of 1700°c

Type MOSIL-33 used for maximum element temperature of 1800°c



STANDARD ELEMENT SIZE

Element Le/Lu	"a" Distance Between Legs		"g" Taper Length	Le Hot Zone	Lu Cold Zone	Metallized Ends
mm	MIN (mm)	STD (mm)	mm	mm	mm	mm
3/6	20	25	15	As per customer requirement	As per customer requirement	25
4/9	20	25	18			40
6/12	40	50	25			40
9/18	50	60	30			75
12/24	60	80	40			100

PROPERTIES

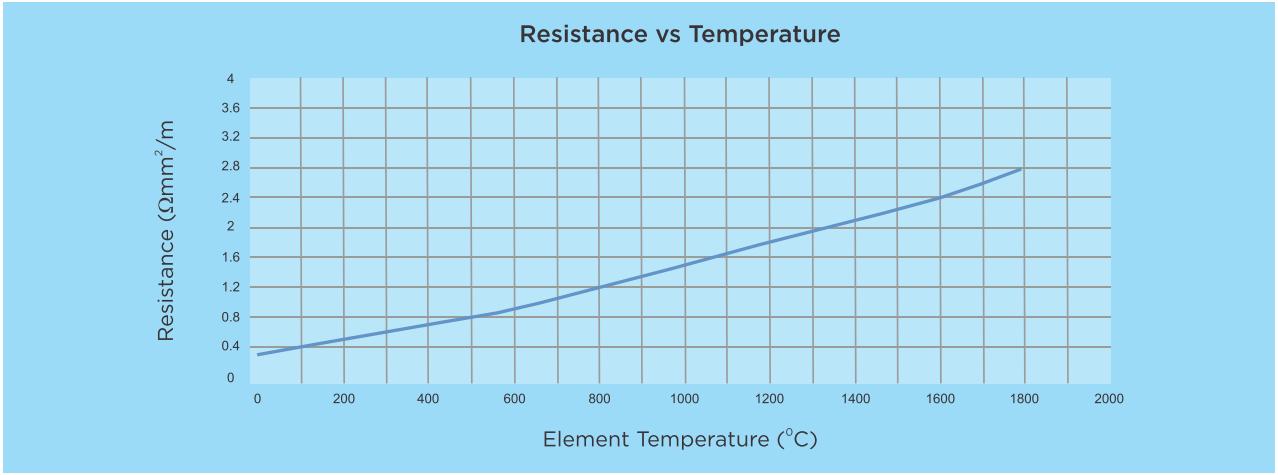
- MOSIL 1800 Elements have good Electrical Conductivity and can also with stand corrosion and Oxidation. It does not get effected by Thermal Shock
- A Yellowish Powder occurs on the Element Surface when exposed to Air at Temperature of 500^{0}c, Due to oxidation this does not affect the MOSIL 1800 Elements
- The Presence of Sulphur Dioxide with Impurity might occur in atmosphere which does not affect the MOSIL 1800 Elements
- They have a high power rating, example 22.6w/cm^2 at 1450^{0}c furnace temperature. This high power makes possible rapid increase in furnace temperature
- The elements can be used continuously or intermittently
- Multiple elements can be connected in series
- New and old elements can be operated in the same Furnace
- They provide long service life, ease of replacement and low maintenance cost
- In Carburizing Furnaces, the element temperature is normally kept below 1400^{0}c. If Carbon is built up it leads to element failure. Regular removal of the carbon is done by firing the Furnace under Oxidizing condition

MECHANICAL AND PHYSICAL CHARACTERSTICS OF MOLYBDENUM DISILICIDE

Density		5.6 g/cm^3
Porosity		~1%
Thermal conductivity	20 – 600°c 601 – 1200°c	30W/m-°K 15W/m-°K
Coefficient of linear expansion		7.5 x 10-^{6} °c
Specific heat capacity at 20°c		420J/Kg- °K
Emissivity		0.7 – 0.8
Resistivity		*Refer Graph1

RESTIVITY

The Restivity of the element increases with Temperature. Hence will have Low Resistance at Room Temperatures. As Temperature rises, the Resistance increases. Refer Resistance vs Temp chart below



Graph - 1

FIRST FIRING

The new elements to be operated at 1200°c or higher quickly in air, so that glaze (SiO_2) is formed. If operated at a surface temperature at 500°c to 700°c range for any length of time before the glaze is formed the elements will be destroyed.

ELEMENT OPERATING **TEMPERATURE**

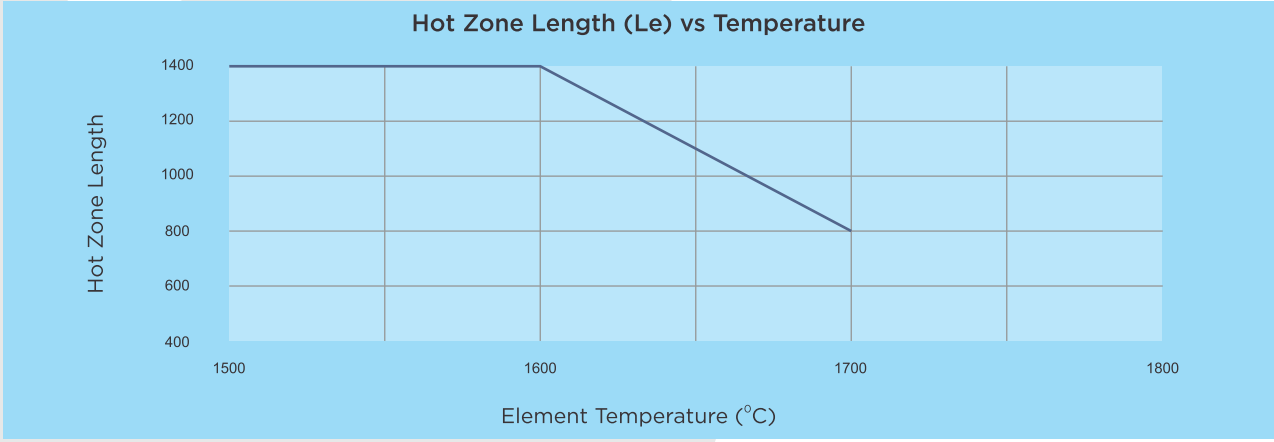
These Elements can be operated at temperatures up to 1800°c in an oxidizing atmosphere. The Table below shows the maximum recommended element temperature for various atmosphere.

Atmosphere	MOSIL-31 °C	MOSIL-33 °C
Air	1700	1800
Nitrogen	1600	1700
Argon, Helium	1600	1700
Dry Hydrogen, dewpoint -80°c	1150	1150
Moist Hydrogen, dewpoint 20°c	1450	1450
Exogas	1600	1700
Endogas	1400	1450
Disassociated ammonia	1400	1400

*Any members of the Halogen group will attack the silicon dioxide on the element, therefore should be avoided

OBTAINING THE LENGTH **OF** THE **HOT ZONE(Le)**

The molybdenum disilicide softens at temperatures over 1200°c therefore will elongate when suspended vertically the heating element can be destroyed if it comes in contact with the floor of the furnace while hot and under power. To allow for the increase in Length and keep it a safe distance above the floor, the hot zone (Le) must be shorter than the heated chamber height.

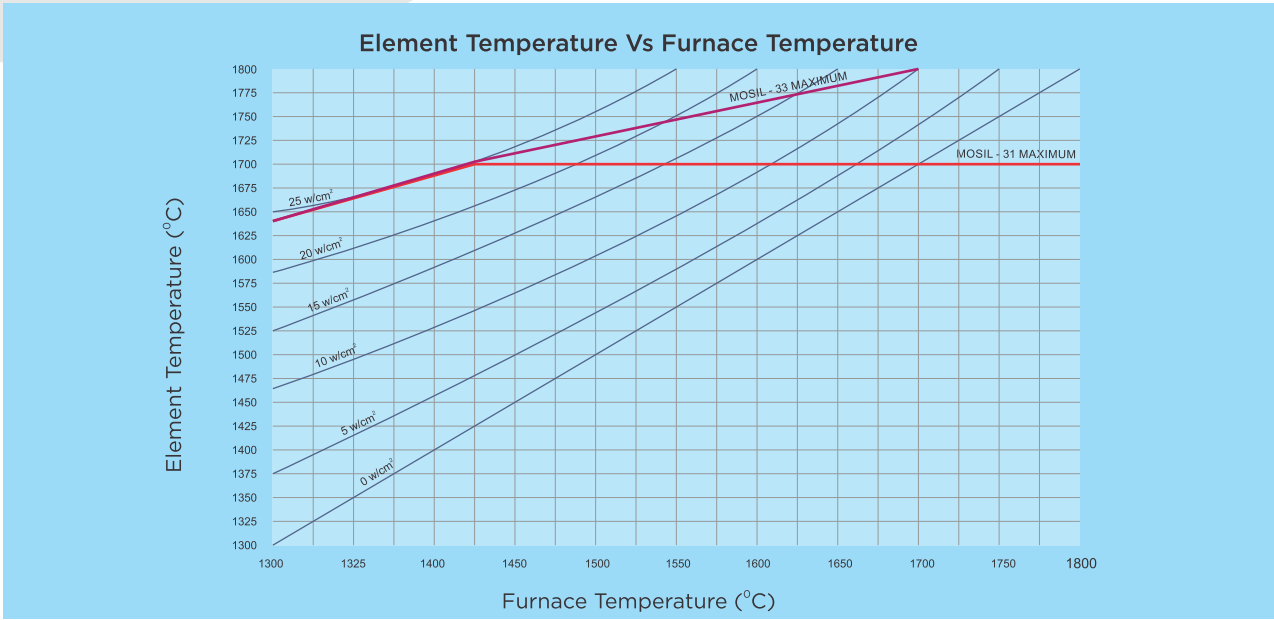


Graph - 2

* The following are maximum length limitations on the hot zone
3/6 and 4/9 maximum Le = 400mm • 6/12, 9/18 and 12/24 maximum Le = 1400mm

OBTAINING THE WATT LOADING

The element surface temperature depends on the furnace temperature and the watt loading. When determining watt loading the maximum furnace temperature and the atmosphere are used.



Graph - 3

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