HIGHBORN



Silicon Carbide (SIC) Heating Element

Molybdenum disilicide (Mosi2) heating element

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硅碳棒

Silicon Carbide (SIC) Heating Element

硅碳棒（碳化硅加热元件）是选用高纯度绿色六方碳化硅为原料，经挤压成型高温再结晶而成的棒状或管状体。碳化硅颗粒结构使其在工业和实验室使用显示出独特性能，在各种应用条件下尤其在氧化和腐蚀性气体环境中有着最佳的使用寿命不用任何支撑，硅碳棒元件可在 1600℃条件下垂直或水平安装使用而不变形，为窑炉设计及使用提供了极大方便。 并可在不间断生产的情况下进行元件更换，在连续操作生产领域内，硅碳棒元件就更显现出此特征，其高负荷承受力特性适用于小容积高功率的环境。因此它被广泛应用于磁性材料、粉末冶金、陶瓷、玻璃、分析化验、有色金属和机械等工业的各种高温电炉及其它电加热设备上。

Silicon carbon rod (silicon carbide resistance heating element) is made of high purity green hexagonal silicon carbide as raw material, which is extruded and recrystallized at high temperature. Silicon carbide particles structure used in industrial and laboratory shows its special performance, under the condition of various applications especially in the oxidation and corrosive gas environment with the best service life without any support, silicon carbon rod element can be used in vertical or horizontal installation under the condition of 1600 ℃ and not deformation, provides great convenience for kiln design and use. In the field of continuous operation, silicon carbide element shows this characteristic especially. Its high load bearing characteristics are suitable for small volume and high power environment. Therefore, it is widely used in magnetic materials, powder metallurgy, ceramics, glass, analysis, non-ferrous metals and machinery and other industries of a variety of high temperature electric furnace and other electric heating equipment.

具体型号，规格敬请联系我们，我们将会为您做出最专业的选择，提供最专业的服务！

Specific models, specifications please contact us, we will make the most professional choice for you, to provide the most professional service!

我们的硅碳棒采用国际先进的生产工艺和技术，发热部与冷端用一种特殊的碳化硅粘接剂熔接而成，在高温下对焊接处进行第二次硅化处理，从而进行了固化并大大提高了焊接强度，给客户提供了无忧患的高品质产品。同时由于发热部的阻值远高于冷端，具有优良的热冷端电阻比，高效节能的特性。

Our silicon carbon rod adopts the international advanced production process and technology, the hot part and the cold end are fused with a special silicon carbide adhesive, and the welding part is silicified for the second time at high temperature, so as to solidify and greatly improve the welding strength, so as to provide customers with high-quality products without any problems. At the same time, because the resistance value of the heating part is much higher than that of the cold end, it has excellent resistance ratio of the hot and cold end and high efficiency and energy saving characteristics.

棒体在干燥洁净的空气条件下，硅碳棒的棒体温度可达 1600℃， 但在其他气体环境下有所限制。

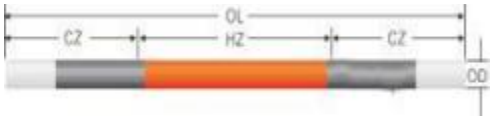
In dry and clean air, the rod temperature of silicon carbon rod can reach 1600℃, but it is limited in other gas environment.

碳化硅加热元件的产品型号 （单位mm）

Product model of silicon carbide heating element

DH & DL & ED Type Sic heating element

等直径硅碳棒



型号 DH/ DL/ED-type silicon carbide rod

直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

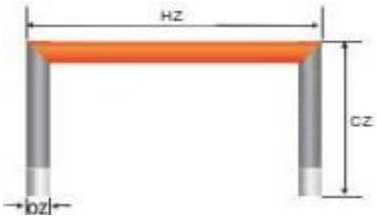
冷端长度 Cold end length, mm (CZ)

全长 Overall length, mm (OL)

单支硅碳棒电阻 Single silicon carbon rod resistance , Ω

M type Sic heating element

门型硅碳棒



单支硅碳棒电阻

Single silicon carbon rod resistance , Ω

直径 Diameter, mm (OZ)

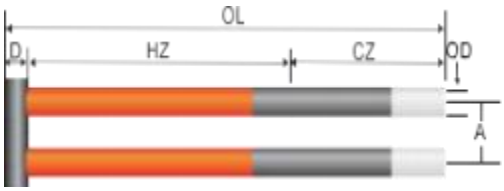
发热区长度 Hot zone length, mm (HZ)

冷端长度 Cold end length, mm (CZ)

U & CU type Sic heating element

U 型硅碳棒/粗横端型硅碳棒/

粗横端打孔硅碳棒

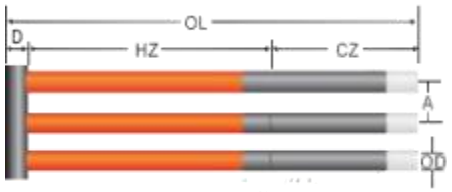


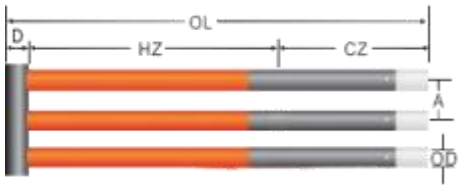




W type Sic heating element

W 型硅碳棒/W 型打孔硅碳棒





单支硅碳棒电阻

Single silicon carbon rod resistance， Ω

型号 U & CU-type silicon carbide rod

直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

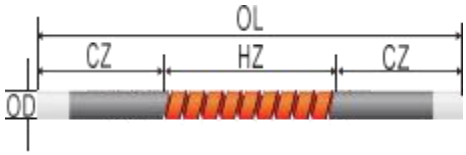
冷端长度 Cold end length, mm (CZ)

中心距 Center distance (A)

横端 Connecting bridge， mm(D)

SG type Sic heating element

单螺纹硅碳棒



单支硅碳棒电阻

Single silicon carbon rod resistance， Ω

型号 SC-type silicon carbide rod

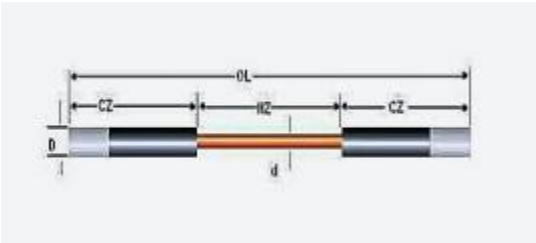
直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

冷端长度 Cold end length, mm (CZ)

DB type Sic heating element

粗端型/哑铃型/大头型硅碳棒



单支硅碳棒电阻

Single silicon carbon rod resistance， Ω

型号 SC-type silicon carbide rod

直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

冷端长度 Cold end length, mm (CZ)

单支硅碳棒电阻

Single silicon carbon rod resistance， Ω

型号 W-type silicon carbide rod

直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

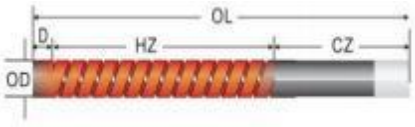
冷端长度 Cold end length, mm (CZ)

中心距 Center distance (A)

横端 Connecting bridge， mm(D)

SGR type Sic heating element

双螺纹硅碳棒



单支硅碳棒电阻

Single silicon carbon rod resistance， Ω

型号 SGR-type silicon carbide rod

直径 Diameter, mm (OD)

发热区长度 Hot zone length, mm (HZ)

冷端长度 Cold end length, mm (CZ)

硅碳棒的物理性质

Physical property of SIC heating element

密度 Bulk density	2.6~2.8g/cm3	抗折强度 bend strength	>300kg
硬度 hardness	>9MOH’ S	抗拉轻度 Tensile strength	>150kg/cm³
气孔率 porosity rate	<30%	辐射率 radiance	0.85

硅碳棒的化学性质

Chemical property of SIC heating element

1.元件的抗氧化性

Antioxidant property of SIC heating element

元件在空气中使用到 800℃时开始氧化. 温度达到 1000-1300℃时，发热部表面生成一层二氧化硅保护膜，1300℃时结晶出方石英，在 1 500℃时，保护膜达到一定的厚度。从而使元件的氧化速度变得极为缓慢，趋于稳定 。如果继续升温至 1627℃以上时，则保护膜受到破坏，氧化速度显著增加，造成元件过早损坏。

The element start to being oxidized when heat to 800℃ in air, and a sio2 protect film will be generated in surface of hot zone when temperature get to 1000-1300℃, cristobalite will be crystallized at 1300℃, the protect film get to a certain thickness when the temperature get 1500℃ which make the oxidation speed being very slowly to stable. If continue to heat to over 1627℃, the protect film will be damaged and oxidation speed will be more rapid evidently and make the element damaged earlier.

元件在使用过程中虽然氧化极为缓慢，但长时间运行仍然会导致电阻值增大，这种现象叫做“老化”。为了减缓“老化”速度，我们在制造过程中以独特的技术， 在发热部的表面潦上了保护层，明显的增强了元件的抗氧化性能，延长了使用寿命。

Through the element will be oxidized very slowly in the course of application, it also will make the resistance increased following long time application, this phenomena calls aging, in order to lower the aging speed, we use special technology to spread a protect film on the surface of hot zone in the course of production , which enhance the antioxidant property of element evidently and lengthen the service life.

2.碱和碱性金属氧化物对元件的影响

The effects of alkali and alkaline metal oxide to elements

在 1300℃左右，碱和碱性金属氧化物与碳化硅发生反应，生成硅酸盐，称为碱化学侵蚀，会明显影响元件发热的红热程度。

The alkali and alkaline metal oxide will react with SIC at about 1300℃ and generate silicate, which calls alkali-chemical corrosion, and can influence the glowing of element.

3.熔化金属对元件的影响

The effect to element from melting metal

部分金属如钴、镍、铬等在高温熔化状态 。可以对元件造成侵蚀，影响元件的寿命。

Some metals such as cobalt, nickel , chrome and so on, can corrode the element in high temperature melting state and affect the service life of elements.

硅碳棒在不同气氛下使用温度和表面负荷控制

Control of applied temperature and surface load of SIC heating element under different atmosphere

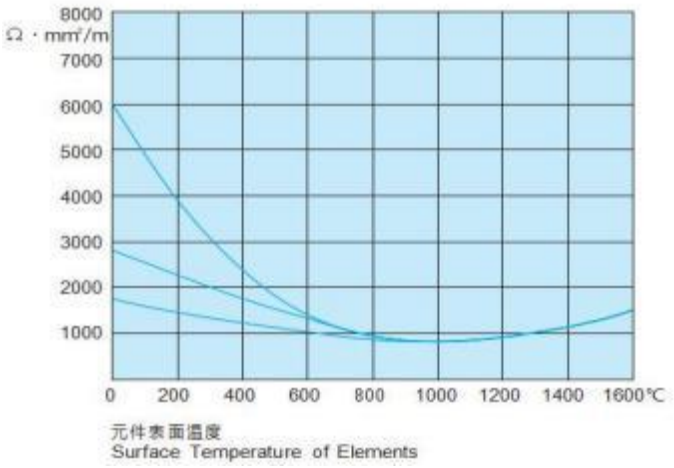
气氛 Atmosphere	炉温 Furnace Temp (℃)	表面负荷 Surface Load (w/m^2)	对元件的影响 Effect to the element	解决方法 Solution
氨 Ammonia	1290	3.8	与 SIC 作用生成甲烷减少 SiO2 保护膜 The chemical reaction with SIC generates methane which can reduce SIO2 protective film	露点激活 Dew point activation
二氧化碳 CO2	1450	3.1	侵蚀 Corroding sic	用石英管保护 Protecting with quartz tube
18%一氧化碳 18%CO	1500	4.0	无影响 No effect	
20%一氧化碳 20%CO	1370	3.8	吸附碳粒影响 SiO2 保护膜 Adsorbing grains affects SIO2 protective film	
卤素 Halogen	704	3.8	侵蚀碳化硅减少 SiO2 保护膜 Corroding SIC to reduce SIO2 protective film	用石英管保护 Protecting with quratz tube
碳氢化合物 Hydrocarbon	1310	3.1	吸附碳粒而致热污染 Adsorbing C grains causes hot pollution	送进充分的空气 Filling with enough air
氢 Hydrogen	1290	3.1	与 SiC 作用生成甲烷减少 SiO2 保护膜 The chemical reaction with SIC generates methane which can reduce SIO2 protective film	露点激活 Dew point activation
甲烷 Methane	1370	3.1	吸附碳粒而至热污染 Adsorbing C grains causes hot pollution	
氮 N	1370	3.1	与 SiC 反应形成氮化硅绝缘层 Reacting with SIC forms SiN insulating layer	
钠 Na	1310	3.8	侵蚀碳化硅 corroding SIC	用石英管保护 Protecting with quartz tube
二氧化硫 SO2	1310	3.8	侵蚀碳化硅 Corroding SIC	用石英管保护 Protecting with quartz tube
真空 Vacuum	1204	3.8		
氧 Oxygen	1310	3.8	碳化硅被氧化 SIC is oxidized	
水（不同含量） Water (different content)	1090-1370	3.1~3.6	与 SiC 作用生成硅的水化物 Reacting with SIC forms hydrate of Si	

硅碳棒的电气特性

Electrical properties of SIC heating element

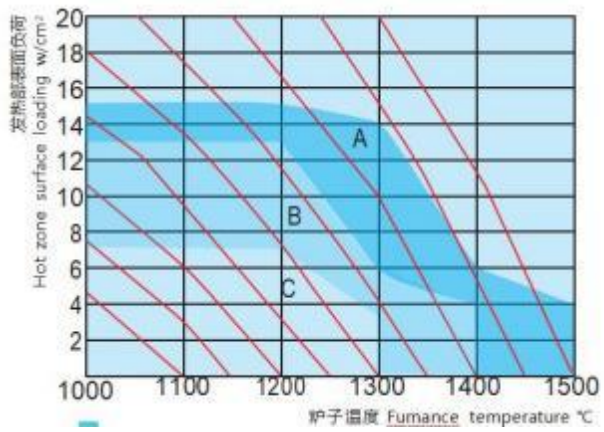
元件具有较大的比电阻，在空气中加热，元件发热部表面温度达到 1050℃左右时， 电阻率为 600—14000 Ω .mm² /m 。元件的电阻值随着温度的升高而变化，从室温到 800℃为负值、800℃以上为正值特性曲线。

SIC heating element have rather large specific resistance . When it is heated in air and the surface temperature of the hot zone reaches 1050℃， the resistance rate is 600-1400 mm2/ mm and its resistance value changes as the temperature rises which is negative value from room- temperature to 800℃ and is positive value nature over 800℃ .



根据炉子的结构、气氛和温度正确地选择元件的表面负荷是达到最佳使用寿命的关键。下图示出了元件辐射在不受阻碍情况下的炉温、元件温度与表面负荷之间的关系。

The key factor to the optimum service life of the element is to select the surface load of the element correctly according to the furnace construction, atmosphere and temperature . The figure shows the relation between furnace temperature, element temperature and element surface load under the condition that the element radiation is not obstructed.



推荐的元件表面负荷

Recommendation surface load

炉温 Furnace temperature	1100	1200	1300	1350	1400	1450
发热部表面负荷 Surface load of hot zone (w/cm²)	<17	<13	<9	<7	<5	<4

硅碳棒附件

Accessories of SIC heating element



蝴蝶夹编织带



蝴蝶夹铝带

（卡具尺寸，样式敬请联系我们，我们将为您做出最专业的选择 。）

1.硅碳棒具有陶瓷的脆性；在运输、开箱、安装、更换、存储过程中要轻拿轻放，严禁强力震动或机械敲打，以免断损。

AS the element is as brittle as ceramic at room temperature, be careful in the course of transportation, opening , installation, replacement and storage. Strong vibration and mechanical shock are not allowed in order to avoid any damage.

2.硅碳棒安装使用前先检查冷端部标记的电阻(Ω)值．如字迹不清，须重新测试，测试方法是将硅碳棒通电加热升温至 1050℃的高温时测得的电压， 电流， 以欧姆定律求的电阻。

The nominal resistance value written on the cold end should be inspected before installation. If it is not clear to identify, new test is needed. All Yuhao heating elements are tested at 1050℃， in open air.Thus you can get the voltage and current and caculate the resistance according to Ohm ’ s law.

3.硅碳棒使用时每组棒应进行高温阻值配阻，配阻的电值允差为： ≥ Φ 12mm 棒配阻， 电阻值允差为≤0.2Ω， ≤ Φ 8mm 棒配阻， 电阻值允差为≤0.5Ω。

To match elements by resistance into groups, merely select elements with similar or nearly similar test amperages. When the outside diameter is ≥ Φ 12mm, the tolerance is ≤0.2Ω, when ≤ Φ8mm, ≤0.5Ω.

4.使用硅碳棒必须配置调压器或可控硅调压器及电压、电流表和温度自动控制仪表等。使用中经常观察仪表(电压表，电流表，温度表等)读数是否正常，出现异常及时查找原因采取相应措施 。经常观察夹具是否松动，冷

端是否因氧化而变黑以及热端是否发热不均匀。

To use the elements, temperature control is very important-the higher the temperature, the shorter the element life. You should prepare the adjustable transformer or silicon controlled transformer, voltage meter, current meter and auto-control temperature meter etc. Frequently observing ammeter, voltmeter and thermometer readings and to see if they are normal. Also frequently observing if the clamp is loose. If cold end is black because of oxidation and if the heating and redness of hot zone are uniform.

5. 在使用过程中因棒氧化，电阻则逐渐增加，这种现象叫老化现象。棒老化后会造成炉温降低，为保持炉温正常 。应提高使用电压，当电压提高到所用电压器最高限度仍不能满足要求时 . 可停炉改变棒的接线方式再继续使用。

During the working the voltage should be increased to maintain the furnace normal temperature because the resistance value will go up gradually because of the oxidation of element. When the voltage gets to the maximum of the adjustable transformer, the furnace should be stopped and change the way of wire connection and then continue to work.

6. 新炉开始送电时 ，为了防止断棒，应采用电炉额定功率的 1/2 空送一段时间 ，一切正常后再逐渐升高电压 . 要按电炉升温规范升温， 以免因功率过高炸断硅碳棒。

During startup, apply minimum voltage (lowest transformer tap setting) to the elements. This is usually 1/2 of the nominal full-load voltage. Any silicon carbide element may be weakened or fractured by heat shock if excessive voltage is applied in bringing the furnace up to temperature too rapidly. Increase voltage as required to obtain heat up schedule, but do not exceed full-load voltage.

7. 新炉或久未使用的电炉（窑），在使用之前必须烘炉（窑）. 烘炉（窑）时尽可能用旧棒或其它热源。

If the furnace is new or has not been used for a long time, it must be dried before the operation. When drying them, it is better to use old elements or other heating elements.

8. 炉子在长期运行过程中，个别元件由于某种原因而损坏需要更换时，要根据当时元件阻值增长情况，选出阻值适宜的元件，不可任意取新元件替换 。若元件损坏过多或阻值增长过大，无法达到所需炉温时最好全部更换成新元件。换下来的元件重新测标其电阻（用电压表、 电流表） 。配阻用在低温区。

In the course of long operation of the furnace, if any individual heating element is damaged owing to certain reason, it should be changed, you should replace it with proper one whose resistance value corresponds to that of the old one, never use a new heating element random. If the heading element is much damaged or its resistance value increases too much and can not reach the furnace temperature, it is better to replace the heating elements with new ones. Test and mark the resistance value of the old elements that have been replaced (with voltmeter and ammeter) and distribute them in low temperature area.

9. 水蒸气会促使硅碳棒加速老化。若在加热过程中有水分排出，窑炉上需留有排气孔。炉内有其他腐蚀气氛的，在允许的情况下，也要在窑炉上留有排气孔。

Water vapor can quicken the aging of elements. If there is water ejection, the furnace should have holes to eject water vapor or other waste gases in order to prolong the elements service life.

10. 棒的存放过程中. 要注意防潮。如发现棒端喷铝处变质潮解，经表面处理后可重新喷铝。如无喷铝条件. 可在棒喷铝段缠裹几层铝箔即可。

The storage is moisture proof , if the sprayed aluminum is decomposed to be metamorphic because of the moisture , spray aluminum again after surface treatment. If spraying aluminum is not allowed, wrap several layers of aluminum foil.

11. 硅碳棒最好连续使用，连续使用可以提高棒的寿命。

The working life of elements is long when used continuously while it is short when used intermittently.

12. 窑炉内气氛的控制很重要。硅碳棒在氢气中使用，棒体会变脆缩短寿命 。硅碳棒与碱金属、碱、硅盐、硼化物等接触会产生腐蚀，所以要避免它们与棒体接触。

Atmosphere control is important, the element becomes brittle to shorten the service life in hydrogen. The element can be corroded by alkali, alkaline metal, silicate and boride so the contact should be avoided.

影响硅碳棒使用寿命的主要因素

The main factors that affect the service life of the silicon carbon rod

1.使用温度 Usage temperature

硅碳棒温度越高寿命越短 。特别是在炉膛温度超过 1600℃以后，氧化速度加快，硅碳棒的使用寿命变短，所以请尽量不要让硅碳棒表面温度过高，即有必要缩小炉膛温度与硅碳棒温度之差。

The shorter life under the higher temperature , oxidation accelerates and the life shortens especially when the furnace chamber temperature exceeds 1600 ℃ . Therefore , it is recommended the surface temperature should be kept as low as possible when in use. Namely , it is necessary to minimize the difference in temperature between inside the furnace chamber and the elements.

2.表面负荷 Surface load

表面负荷密度指棒的发热部单位表面积所允许承载的额定功率 。 表面负荷密度=额定功率（W）/发热部表面积（cm_2 ）实践证明：负荷密度大则棒体表面温度高， 电阻增长快， 硅碳棒的寿命短 。 因此， 硅碳棒表面温度负荷密度、炉内气氛、温度与硅碳棒老化速度成正比，与硅碳棒的寿命成反比。

The surface load density (w/cm_2) is expressed in terms of the electric power applied per square centimeter of the heating surface. As experience proves that the larger the surface load density(electric power) of the element, the higher temperature,the shorter life of the elements. Thus the surface load density, the furnace atmosphere and temperature are in proportion to the element aging speed and inversely proportional to the element service life.

3.窑炉运行方式 The furnace operation mode

硅碳棒在连续式窑炉与间歇式窑炉中，前者的寿命较长 。硅碳棒在使用中表面氧化生成二氧化硅薄膜，长时间使用使二氧化硅薄膜增加，硅碳棒阻值也随之增加 。二氧化硅薄膜在结晶临界点（ 1270℃） 附近发生异常膨胀、收缩 。因在间歇式窑炉中间断使用总在此温度上下浮动，所以反复破二氧化硅薄膜，加速氧化 。因此停电炉温降至室温时经常急剧增加电阻。

Silicon carbide rod in continuous furnace and intermittent furnace, the former longer life. The surface of the silicon carbon rod is oxidized to generate silicon dioxide film in use. Using for a long time will increase the silicon dioxide film and the resistance of the silicon carbon rod will also increase. The silicon dioxide film expands and contracts abnormally near the critical point of crystallization (1270 ℃). Because of the intermittent use in the furnace always fluctuate in this temperature, so repeatedly broken silicon dioxide film, accelerate the oxidation. So power failure furnace temperature to room temperature often dramatically increase resistance.

硅碳棒安装运行须知

Installation and operation of silicon carbide rod

硅碳棒可以看作是简单电阻负载和正常的基本电路定律应用：如，V 是电压，I 是安培，W 是瓦特，R 是电阻（Ω）

Silicon rods can be thought of as simple resistive loads and normal applications of basic circuit laws: V for voltage, I for amperes, W for watts, and R for resistance （Ω）

V = IR = √WR = W/I　　W = VI = I2R = V2/R　　I = V/R = √W/R = W/V　　R= V/I = V2/W = W/I2

在推荐的方式下，对硅碳棒进行安装、连接和控制是很重要的，能保证硅碳棒寿命最大化。

It is important to install, connect and control the rods in the recommended manner to maximize the life of the rods.

硅碳棒安装

Silicon carbon rod mounting

硅碳棒与硅碳棒中心之间的最小距离应为元件直径的 2 倍，但 2.5~3 倍为最佳，硅碳棒中心与炉壁之间的最小距离应为硅碳棒直径的 1.5 倍，硅碳棒中心与被加热物之间的距离至少应为硅碳棒直径的 2 倍。

The minimum distance between the center of the silicon carbon rod and the element diameter should be 2 times, but 2.5~3 times is the best, the minimum distance between the center of the silicon carbon rod and the furnace wall should be 1.5 times the diameter of the silicon carbon rod, and the distance between the center of the silicon carbon rod and the heated object should be at least 2 times the diameter of the silicon carbon rod.

硅碳棒连接

Silicon carbon rod connection

硅碳棒可以并联，串联或两者混合连接。并联是理想的方式，硅碳棒电阻的任何微小变化随着使用会趋于一致。然而， 串联方式下，这个变化趋于增加从而导致硅碳棒寿命缩减。

The rods can be connected in parallel, series, or a mixture of the two. Parallel connections are ideal, and any small changes in the resistance of the rods tend to be uniform over time. However, in tandem mode, this variation tends to increase resulting in reduced rod life.

硅碳棒的电阻增加相当慢，如果硅碳棒电阻值匹配好的话，最多可以串联 4 支 。炉温超过 1400 度，建议串联的硅碳棒限制在 2 支。

The resistance of silicon rods increases very slowly, and up to four rods can be connected in series if their resistance values are well matched. When the furnace temperature exceeds 1400 degrees, it is recommended to limit the number of connected silicon rods to two.

两者混联通常作为一个有效的折中方案，这种情况下， 串联的几组应并联。硅碳棒任何情况下都不能将并联的几组串联，因为一个硅碳棒坏掉将导致这一组上剩余的其他硅碳棒超载。

Mixing the two is usually an effective compromise, in which case the series groups should be paralleled. The rods should never be connected in series in parallel because the failure of one rod will overload the remaining rods in the set.

三相连接包括星形连接和角形连接 。当用星形连接时，建议 4 线供电， 以保证相电压平衡，而与相电阻无

关。如果必须使用 3 线星形连接，那么相电阻必须紧密匹配。

3 phase connections include star connection and angle connection. With star connection, 4 lines power supply is recommended in order to keep phase voltage in balance, having nothing to do with resistance; if star connection with 3 lines is utilized, phase voltage must be matched very closely.

电阻值的匹配

To match resistance value

串联下建议硅碳棒电阻范围彼此控制在+/-5%内，并联时硅碳棒电阻可以控制+/-10%范围内 。如果任何硅碳棒在很短时间内就不能工作或断掉，可以用新硅碳棒替换，但最好挑选电阻较高的硅碳棒 。如果硅碳棒已经使用了相当长时间，整组硅碳棒都要换掉，否则新的或旧的硅碳棒就要承载过高的负荷，导致其过早的损坏。

It is recommended that the resistance ranges of the silicon carbide rods be controlled within +/-5% of each other in series and within +/-10% of each other in parallel. If any silicon rod fails or breaks within a short time, it can be replaced with a new one, preferably one with a high resistance. If the rods have been used for a considerable period of time, the entire set must be replaced, otherwise the new or old rods will carry too much load, resulting in premature failure.

把一个炉子上的硅碳棒分成一定数量的小控制组是一个不错的办法， 以简化将来对电阻进行匹配 。比如，一个炉子装 48 支硅碳棒，分成 6 支 8 组就比分成 16 支 3 组要有弹性的多，匹配电阻就要简单的多。

It is a good idea to divide the silicon rods on a furnace into a number of small control groups to simplify future resistance matching. For example, a furnace with 48 silicon rods, divided into six groups of eight, is much more flexible than 16 groups of three, and matching resistances is much easier.

当替换一组硅碳棒后，必须在启动前保证电源供给设备的电压输出减小到正确的值，因为硅碳棒过载，即便是很短的时间，也会造成不可挽回的损失 。老的硅碳棒可以保留下来，随后搭配其他使用一样时间的硅碳棒使用。如果可能，替换下来的每一支硅碳棒的电压和电流读值都记录下来，增加后的电阻值标在硅碳棒的端部，以便以后匹配电阻。

When replacing a set of silicon rods, it is important to ensure that the voltage output of the power supply device is reduced to the correct value before starting, because overloading of silicon rods, even for a short time, can cause irreparable damage. The old rods can be kept and used later with other rods that last the same amount of time. If possible, the voltage and current readings for each replaced rod are recorded and the added resistance is marked on the end of the rod for later resistance matching.

预留电压

Voltage reserve

为补偿硅碳棒随使用而增加的电阻，要提供可调节的电源供给 。总的电压预留要根据硅碳棒的电阻率增加和期待的寿命， 但通常在新硅碳棒需要的电压基础上预留 50%到 100%。

An adjustable power supply shall be provided to compensate for the increased resistance of the silicon rod with use. The total voltage reservation is based on the increase in the resistivity of the silicon rod and the expected lifetime, but typically 50 to 100 percent of the voltage required for a new silicon rod is reserved.

比如，新的硅碳棒共需要 110V 的电压，那么 110~220V 的电压范围就预留了 100%，而 110~165V 就是预留了 50%。

For example, if the new silicon rod requires a total voltage of 110 v, 100 percent of the voltage range 110 to 220V is reserved, and 50 percent of the voltage range 110 to 165V is reserved.

当硅碳棒长时间工作在 1400℃或超过 1400℃， 或者炉子自身的情况会导致硅碳棒在低温下电阻增长率过高， 应预留 100%电压。相反，如果硅碳棒温度非常低，或者炉子只是偶尔的使用，预留 50%或更少一些也是可以的。

When the silicon carbide rod is operated at or above 1400℃ for a long time, or the furnace itself may cause the resistance growth rate of the silicon carbide rod to be too high at low temperature, the 100% voltage should be reserved. Conversely, if the rod temperature is very low or the furnace is used only occasionally, a reserve of 50% or less is acceptable.

电源供应

Power supply devices

硅碳棒一般需要使用可调节的电源供应， 以保证设计的功率能够保持贯穿硅碳棒的整个寿命过程 。所用的设备类型可能影响硅碳棒的性能，是否能获得硅碳棒最好的寿命，有赖于选择正确的电源供应。

Silicon rods generally require an adjustable power supply to ensure that the designed power is maintained throughout the life of the rod. The type of equipment used may affect the performance of the silicon carbide rod. The best life of the silicon carbide rod depends on the selection of the right power supply.

硅碳棒参考数据

Reference date of SIC heating elements

等直径硅碳棒　ED Type SIC heating element （产品所有电阻值均为热阻值）

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
12	150	150	450	56	41	896	1.85
	200	200	600	75	50	1200	2.10
	250	200	650	94	63	1504	2.62
	300	200	700	113	75	1808	3.15
14	200	200	600	88	41	1408	1.22
	250	250	750	110	51	1760	1.50
	300	250	800	132	62	2112	1.80
	350	200	750	154	73	2462	2.14
	400	250	900	176	82	2816	2.10

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
16	300	250	800	150	62	2400	1.60
	350	350	1050	176	70	2816	1.75
	400	350	1100	200	80	3200	2.00
	450	250	950	225	90	3600	2.25
	500	250	1000	250	100	4000	2.50
	600	250	1100	300	120	4800	3.00
20	300	400	1100	188	59	3008	1.14
	400	350	1100	251	76	4016	1.45
	500	400	1300	314	97	5056	1.85
	600	400	1400	376	114	6016	2.15
	700	400	1500	439	138	7024	2.70
	800	300	1400	502	148	7530	2.90
	900	300	1500	565	162	8475	3.10
25	300	300	900	236	53	3776	0.75
	400	450	1300	314	71	5024	1.00
	500	400	1300	392	90	6272	1.30
	600	400	1400	470	108	7520	1.55
	700	400	1500	550	120	8250	1.75
	800	400	1600	627	134	9705	1.90
	900	300	1500	705	151	10575	2.16
	1000	300	1600	785	168	11775	2.40
30	400	300	1000	380	63	5700	0.70
	500	300	1100	470	80	7050	0.90
	600	400	1400	570	92	8550	1.00
	700	450	1600	660	109	9900	1.20
	800	500	1800	750	125	11250	1.40
	900	400	1700	850	140	12750	1.53
	1000	300	1600	940	153	14100	1.65
	1100	300	1700	1035	168	15525	1.82
32	356	280	916	355	52	5315	0.50
	406	280	966	405	59	6060	0.57
	457	280	1017	456	66	6820	0.64
	508	280	1068	507	73	7585	0.71
	559	280	1119	557	80	8345	0.78
	610	280	1170	608	88	9110	0.85
	660	280	1220	659	95	9855	0.92
	711	280	1271	709	103	10615	0.99
	762	280	1322	760	110	11380	1.06
	813	394	1601	811	117	12140	1.13
	864	394	1652	861	124	12900	1.20

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
32	914	394	1702	912	131	13650	1.27
	1016	394	1804	1013	145	15170	1.40
	1067	394	1855	1063	153	15930	1.47
	1118	394	1906	1115	160	16690	1.54
	1448	406	2260	1442	217	21620	2.17
	1499	381	2261	1493	224	22380	2.25
35	400	400	1200	440	67	6600	0.68
	500	400	1300	550	84	8250	0.85
	600	400	1400	660	100	9900	1.02
	700	400	1500	770	117	11550	1.19
	800	400	1600	880	134	13200	1.36
	900	400	1700	990	151	14850	1.53
	1000	400	1800	1100	167	16500	1.69
	1100	400	1900	1210	184	18150	1.87
	1200	400	2000	1320	201	19800	2.04
	1300	400	2100	1430	218	21450	2.21
	1400	400	2200	1540	234	23100	2.38
	1500	400	2300	1650	251	24750	2.55
	1600	300	2200	1760	263	25520	2.72
	1700	300	2300	1870	280	27115	2.89
38	406	280	966	487	54	7285	0.40
	457	280	1017	547	61	8200	0.45
	508	280	1068	608	67	9115	0.49
	559	280	1119	669	74	10030	0.54
	610	280	1170	730	80	10950	0.59
	660	280	1220	791	86	11840	0.63
	711	280	1271	851	93	12760	0.68
	762	280	1322	912	100	13675	0.73
	813	394	1601	973	106	14590	0.78
	864	394	1652	1034	113	15505	0.83
	914	394	1702	1095	119	16400	0.87
	965	280	1525	1155	126	17320	0.92
	990	358	1706	1185	131	17775	0.96
	1016	394	1804	1216	132	18230	0.97
	1118	394	1906	1338	146	20060	1.07
	1219	394	2007	1459	159	21875	1.16
	1312	394	2100	1581	172	23705	1.26
	1422	394	2210	1702	186	25520	1.36

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
40	500	400	1300	628	75	9420	0.60
	600	400	1400	753	90	11295	0.72
	700	400	1500	880	105	13200	0.84
	800	400	1600	1005	118	14573	0.96
	900	400	1700	1130	133	16385	1.08
	1000	400	1800	1255	148	18198	1.20
	1100	400	1900	1381	163	20025	1.32
	1200	400	2000	1506	177	21837	1.44
	1300	400	2100	1630	192	23635	1.56
	1400	400	2200	1760	207	25520	1.68
	1500	400	2300	1880	222	27260	1.80
	1600	300	2200	2010	236	29145	1.91
	1700	300	2300	2140	250	31030	2.02
45	508	280	1068	708	61	10625	0.36
	559	394	1347	780	68	11690	0.40
	610	305	1220	851	74	12760	0.43
	660	293	1246	921	81	13805	0.47
	711	394	1499	992	87	14970	0.51
	762	394	1550	1063	93	15935	0.55
	813	394	1601	1134	99	17000	0.59
	864	394	1652	1205	104	18070	0.61
	914	394	1702	1275	112	19115	0.65
	965	394	1753	1346	118	20180	0.70
	991	419	1829	1382	120	20725	0.69
	1016	394	1804	1417	122	21250	0.70
	1118	419	1956	1560	136	23380	0.80
	1219	432	2083	1700	148	25490	0.87
	1270	394	2058	1772	155	26560	0.92
	1295	381	2057	1806	155	27082	0.89
	1321	394	2109	1843	161	27625	0.95
	1372	394	2160	1914	168	28690	1.00
	1422	394	2210	1984	173	29740	1.03
	1473	394	2261	2055	180	30805	1.07
	1524	394	2312	2126	186	31870	1.10
	1575	419	2413	2197	192	32940	1.15
	1626	394	2414	2268	197	34005	1.17
	1676	420	2516	2338	205	35050	1.24
	1829	280	2389	2551	218	38250	1.24
	2437	420	3277	3401	291	50985	1.66

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
50	1000	400	1800	1570	127	21980	0.73
	1500	400	2300	2360	191	33040	1.10
	1700	400	2500	2670	216	37520	1.24
	2000	400	2800	3140	253	43960	1.46
54	508	305	1118	862	62	12920	0.30
	533	229	991	904	66	13555	0.32
	559	305	1169	948	69	14220	0.33
	610	305	1220	1035	75	15515	0.36
	660	305	1270	1120	80	16785	0.38
	686	280	1246	1164	84	17450	0.40
	711	305	1321	1206	88	18085	0.42
	762	305	1372	1293	93	19380	0.44
	813	419	1651	1379	99	20675	0.49
	864	419	1702	1466	105	21975	0.51
	914	420	1754	1551	112	23250	0.54
	965	419	1803	16371	116	24545	0.57
	1016	419	1854	1724	123	25840	0.60
	1067	419	1905	1810	129	27140	0.63
	1118	419	1956	1897	135	28435	0.66
	1143	394	1391	1939	139	29070	0.67
	1168	420	2008	1982	142	29710	0.69
	1219	458	2135	2068	147	31005	0.71
	1270	419	2108	2155	153	32300	0.74
	1321	419	2159	2241	159	33600	0.77
	1372	419	2210	2328	166	34895	0.80
	1422	420	2262	2412	171	36170	0.82
	1473	419	2311	2499	179	37465	0.85
	1499	229	1957	2543	175	38125	0.80
	1524	394	2312	2585	184	38760	0.89
	1575	419	2413	2671	189	40060	0.90
	1626	419	2464	2758	196	41355	0.94
	1651	267	2185	2801	198	41990	0.93
	1676	420	2516	2843	202	42630	0.97
	1727	419	2565	2930	207	43925	0.99
	1778	419	2616	3016	213	45220	1.01
	1880	305	2490	3189	225	47815	1.06
	1981	254	2489	3361	238	50385	1.12
	2032	242	2516	3447	244	51680	1.15

Dia 直径（mm）	Length 长度（mm）			Hot zone Surface area 热端表面积（cm²）	Nominal Loading 额定负荷（at 1050℃）		
	Hot zone 热 端	Cold end 冷 端	Total 全长		Voltage 电压（V）	Power 功率（W）	Resistance 电阻（Ω）
54	2083	330	2743	3537	250	52980	1.18
	2108	267	2642	3576	253	53615	1.19
	2134	241	2616	3620	255	54275	1.20
	2159	445	3049	3663	260	54910	1.23
	2286	343	2972	3878	274	58140	1.29
	2311	420	3151	3921	279	58780	1.32
	2413	267	2947	4094	290	61370	1.37
	2438	420	3278	4136	295	62010	1.40

粗端型硅碳棒　DB Type SIC heating element （产品所有电阻值均为热阻值）

Hot zone 热端		Cold end 冷端		Total 全长（mm）	Resistance 电阻（Ω）	不同温度时最大允许的负荷值、功率、 电压、 电流 Maximum allowable load value, power, voltage and current at different temperatures					
Dia 直径（mm）	Length 长度（mm）	Dia 直径（mm）	Length 长度（mm）			1100℃	1200℃	1250℃	1300℃	1350℃	1400℃
8	150	14	150	450	3.60	900	790	675	520	380	190
						57/15.8	53/14.7	49/13.8	43/12.0	37/10.3	26/7.2
	180	14	60	300	4.40	1080	950	815	635	460	230
						69/15.7	65/14.7	60/13.8	53/12.0	45/10.2	32/2.7
	180	14	150	480	4.40	1080	950	815	635	460	230
						69/15.7	65/14.7	60/13.8	53/12.0	45/10.2	32/2.7
14	200	22	250	700	1.80	2110	1850	1570	1230	880	440
						62/34.0	58/32.0	53/29.6	47/26.6	40/22.0	28/15.7
	250	22	250	750	2.20	2640	2310	1980	1540	1100	550
						76/34.7	71/32.6	66/30.0	58/26.6	49/22.4	35/15.8
	250	22	350	950	2.20	2640	2310	1980	1540	1100	550
						76/34.7	71/32.6	66/30.0	58/26.6	49/22.4	35/15.8
	300	22	250	800	2.60	3160	2770	2370	1850	1320	650
						90/34.8	85/32.6	78/30.4	69/26.7	59/22.4	41/15.8
	300	22	350	1000	2.60	3160	2770	2370	1850	1320	650
						90/34.8	85/32.6	78/30.4	69/26.7	59/22.4	41/15.8
	400	22	250	900	3.50	4200	3680	3150	2450	1750	875
						121/34.7	113/32.5	105/30.0	93/26.4	78/22.5	55/15.9
	400	22	350	1100	3.50	4200	3680	3150	2450	1750	875
						121/34.7	113/32.5	105/30.0	93/26.4	78/22.5	55/15.9
18	250	28	250	750	1.30	3370	2960	2540	1970	1410	700
						66/51.2	62/47.8	57/44.5	51/38.8	43/32.8	30.23.3
	250	28	350	950	1.30	3370	2960	2540	1970	1410	700
						66/51.2	62/47.8	57/44.5	51/38.8	43/32.8	30/23.3

Hot zone 热端		Cold end 冷端		Total 全长 (mm)	Resistance 电阻（Ω）	不同温度时最大允许的负荷值、功率、 电压、 电流 Maximum allowable load value, power, voltage and current at different temperatures					
Dia 直径 (mm)	Length 长度 (mm)	Dia 直径 (mm)	Length 长度 (mm)			1100℃	1200℃	1250℃	1300℃	1350℃	1400℃
18	300	28	250	800	1.70	4080	3570	3060	2380	1700	850
						83/49.2	78/45.8	72/42.5	64/37.2	54/31.5	38/22.4
	300	28	350	1000	1.70	4080	3570	3060	2380	1700	850
						83/49.2	78/45.8	72/42.5	64/37.2	54/31.5	38/22.4
	400	28	250	900	2.30	5400	4740	4060	3160	2260	1130
						111/48.6	104/45.6	97/41.9	85/37.2	72/31.4	51/22.2
	400	28	350	1100	2.30	5400	4740	4060	3160	2260	1130
						111/48.6	104/45.6	97/41.9	85/37.2	72/31.4	51/22.2
	500	28	350	1200	2.70	6800	5960	5100	3840	2860	1420
						135/50.4	127/47.0	117/43.6	102/37.6	88/32.5	62/23.0
	600	28	250	1100	3.40	8150	7140	6130	4760	3400	1700
						166/49.0	156/45.7	144/42.7	127/37.6	107/31.8	76/22.4
	600	28	350	1300	3.40	8150	7140	6130	4760	3400	1700
						166/49.0	156/45.7	144/42.7	127/37.6	107/31.8	76/22.4
	800	28	250	1300	4.60	10800	9500	8140	6340	4530	2260
						222/48.8	208/45.7	193/42.1	171/37.1	144/31.5	102/22.1
	800	28	350	1500	4.60	10800	9500	8140	6340	4530	2260
						222/48.8	208/45.7	193/42.1	171/37.1	144/31.5	102/22.1
25	300	35	400	1100	1.00	6040	4880	4080	3150	2180	1175
						77.8/77.8	66.9/66.9	64/64	56.2/56.2	46.7/46.7	34.3/34.3
	400	35	400	1200	1.34	7350	6920	5660	4400	3140	1760
						99/76	95/73	86/66	76/58	64/49	48/36.5
30	500	45	400	1300	1.10	10800	9870	8450	6570	4700	2350
						109/99	104/95	96/88	85/77.3	72/65.4	51/46.2
	600	45	600	1800	1.28	13500	11800	10300	7900	5660	2820
						132/102	123/96	116/89	102/77.5	86/66	61/46.5
	1000	45	500	2000	2.10	22000	19800	17000	13200	9400	4700
						214/103	204/97	189/90	160/79	140/67	100/47

U 型硅碳棒 U Type SIC heating element （产品所有电阻值均为热阻值）

Dia 直径（mm）	Nominal Loading 额定负荷（at 1050℃）			
	Hot Zone 热端		Cold End 冷端	
	Ω/mm	W/mm	Ω/mm	W/mm
12	0.01684	11.30	0.00110	0.60
14	0.01360	13.19	0.00090	0.80
16	0.00993	15.07	0.00080	1.00
20	0.00652	18.84	0.00040	1.10
25	0.00432	23.55	0.00030	1.20
30	0.00298	28.26	0.00020	1.30
32	0.00256	29.86	0.00013	1.40
35	0.00271	32.97	0.00015	1.50
38	0.00173	35.89	0.00009	1.60
40	0.00212	37.68	0.00010	1.70
45	0.00114	41.82	0.00007	1.80

单螺纹硅碳棒 SC Type SIC heating element （产品所有电阻值均为热阻值）

Dia 直径（mm）	Nominal Loading 额定负荷（at 1050℃）			
	Hot Zone 热端		Cold End 冷端	
	Ω/mm	W/mm	Ω/mm	W/mm
12	0.02660	5.65	0.00576	0.25
14	0.02567	6.59	0.00450	0.30
16	0.02094	7.54	0.00387	0.50
20	0.01677	9.42	0.00291	0.60
25	0.01365	11.78	0.00174	0.93
30	0.01020	14.13	0.00120	0.95
32	0.00942	14.93	0.00114	0.97
35	0.00669	16.49	0.00096	0.98
38	0.00642	17.95	0.00075	0.99
40	0.00624	18.84	0.00072	1.00
45	0.00546	20.91	0.00066	1.02

双螺纹硅碳棒 SCR Type SIC heating element （产品所有电阻值均为热阻值）

Dia 直径（mm）	Nominal Loading 额定负荷（at 1050℃）			
	Hot Zone 热端		Cold End 冷端	
	Ω/mm	W/mm	Ω/mm	W/mm
16	0.03153	7.54	0.00791	1.40
18	0.02158	8.48	0.00430	1.70
20	0.02302	9.42	0.00384	1.60
25	0.01969	11.78	0.00328	1.75
30	0.01523	14.13	0.00190	1.75
32	0.01341	14.93	0.00152	1.85
35	0.01224	16.49	0.00150	2.00
38	0.01103	17.95	0.00116	2.00
40	0.00905	18.84	0.00100	2.10
45	0.00960	20.91	0.00079	2.10
54	0.00636	25.43	0.00073	2.30

槽型硅碳棒 SLOT Type SIC heating element （产品所有电阻值均为热阻值）

Dia 直径（mm）	Nominal Loading 额定负荷（at 1050℃）			
	Hot Zone 热端		Cold End 冷端	
	Ω/mm	W/mm	Ω/mm	W/mm
18	0.01938	8.48	0.00129	0.56
20	0.01420	9.42	0.00095	0.63
25	0.00902	11.78	0.00060	0.79
30	0.00615	14.13	0.00040	0.94

硅钼棒

Molybdenum disilicide (Mosi2) heating element

硅钼棒是一种以硅化钼为基础的电阻发热组件，其在氧化气氛下加热到高温，表面生成一层致密的石英玻璃膜，保护其不再氧化。因此，其具有独特的高温抗氧化性 。在氧化气氛下，其最高温度可达 1800℃，其适用温度为 500-1700℃。

应用：可以用作陶瓷、磁性材料、玻璃、冶金、耐火材料等工业高温炉的加热元件。

Molybdenum disilicide (Mosi2) heating element is a resistance heating component basic on molybdenum silicide,it is used in high temperature under the oxidizing atmosphere, it looks like glass in it's surface and form a light SiO_2 , glass film which can protect the element not to be oxidized. So this kind of element has unique effect for resisting oxidization in the high temperature. Ii is used to the highest temperature up to 1800 ℃ during oxidizing atmosphere. And the applicable temperature is 500-1700℃。

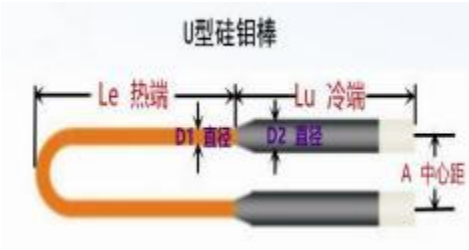
Application: It can be used for the heater of industry high-temperature furnace in ceramic, magnet, glass ,metallurgy, refractory etc.

硅钼棒主要分为 1700 级和 1800 级，等级不同所达到的温度也不同，可根据客户的最高使用温度进行选购。

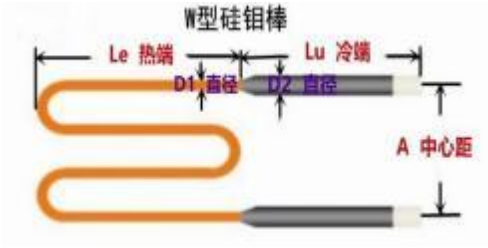
Silicon molybdenum bar is mainly divided into 1700 grade and 1800 grade, the temperature of different grades is also different, can be selected according to the highest temperature of the customer.

硅钼棒产品型号 （单位 mm)

U 型
U Type



W 型
W Type

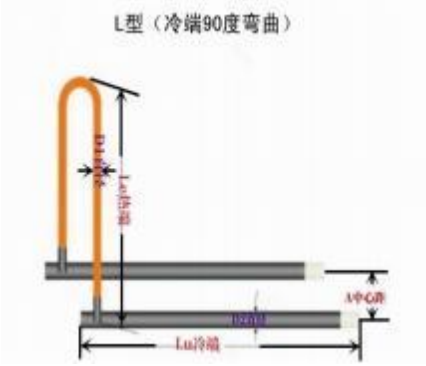


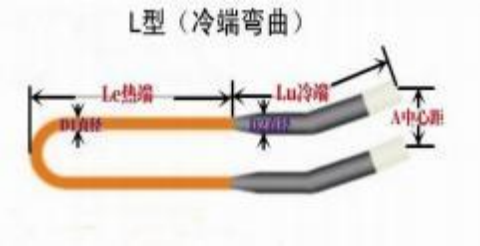
材料等级 Material Grade：1700 级 & 1800 级
Diameter of Hot Zone 热端直径（D1）：mm
Diameter of Cold Zone 冷端直径（D2）：mm
Length of Hot Zone 热端长度（Le）：mm
Length of Cold Zone 冷端长度（Lu）：mm
Center Distance 中心距（A）：mm

***示例：1700 级 U 型硅钼棒，D1：6，D2：12，Le:800，Lu：800，A：50。（单位 mm）**
则为：1700 级 U 型硅钼棒，热端直径：6，冷端直径：12，热端长度：800，冷端长度：800，中心距：50。（单位 mm）
简述方式为：6/12*800*800*50（单位 mm）即为直径*热端*冷端* 中心距

U 型直角

U-shaped right Angle





材料等级 Material Grade：1700 级 & 1800 级

Diameter of Hot Zone 热端直径（D1）：mm

Diameter of Cold Zone 冷端直径（D2）：mm

Length of Hot Zone 热端长度（Le）：mm

Length of Cold Zone 冷端长度（Lu）：mm

Center Distance 中心距（A）：mm

***示例：1700 级 U 型直角硅钼棒，D1：6，D2：12，Le :800，Lu：800，A：50。（单位 mm）**

则为：1700 级 U 型直角硅钼棒，热端直径：6，冷端直径：12，热端长度：800，冷端长度：800，中心距：50。（单位 mm）

简述方式为：6/12*800*800*50（单位 mm）即为直径*热端*冷端*中心距

硅钼棒的物理特性

Physical properties of silicon molybdenum rods

体积密度 Bulk density	抗折强度 Flexural strength	维氏硬度 Vickers hardness	气孔率 Porosity	吸水率 Bibulous rate	热伸长率 Thermal elongation
5.5~5.6g/cm³	15-25kg/cm²	(HV)570kg/mm²	7.4%	1.2%	4%

硅钼棒的化学性质

Chemical properties of silicon molybdenum rods

硅钼棒在高温氧化气氛下，表面会生成一层石英保护层防止二硅化钼继续氧化。当元件温度大于 1700℃时，石英保护层融化，元件在氧化气氛下继续使用，石英保护层重新生成。二硅化钼不宜在 400℃-700℃的温度范围内长期使用，否则元件会因低温的强烈氧化作用而粉化。

Molybdenum silicon rod in high temperature oxidation atmosphere, the surface will form a layer of quartz protective layer to prevent molybdenum disilicide oxidation. When the element temperature is greater than 1700℃, the quartz protective layer melts, the element continues to be used in an

oxidizing atmosphere, and the quartz protective layer is regenerated. Molybdenum disilicide should not be used in the temperature range of 400℃-700℃ for a long time, otherwise the element will be pulverized due to strong oxidation at low temperature.

不同气氛对硅钼棒温度的影响

Effect of different atmosphere on temperature of silicon molybdenum rod

气氛 Atmosphere	元件的最高使用温度 The Maximum Using Temperature of Element	
	1700 等级 1700 Grade	1800 等级 1800 Grade
二氧化氮、二氧化碳、氧气、空气 NO_2, CO_2, O_2, Air	1700° C	1800° C
氦气、氩气、氖气 He, Ar , Ne	1650° C	1750° C
二氧化硫 SO_2	1600° C	1700° C
一氧化碳、氢气 CO, H_2	1500° C	1600° C
潮湿的氢气 Wet H_2	1400° C	1500° C
干燥的氢气 Dry H_2	1350° C	1450° C

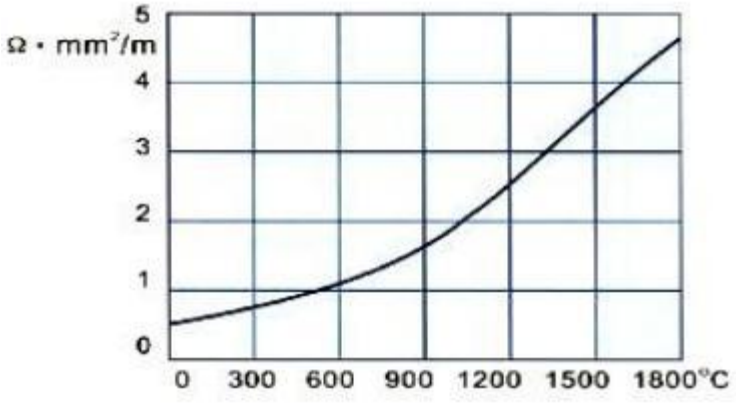
硅钼棒电气性质

Electric property

1. 电阻特性 Resistance Property

硅钼棒电阻率随着温度升高而迅速增加（见下图）。在正常操作情况下，元件电阻一般不随使用时间的长短而变化，因此，新旧元件可以混合使用。

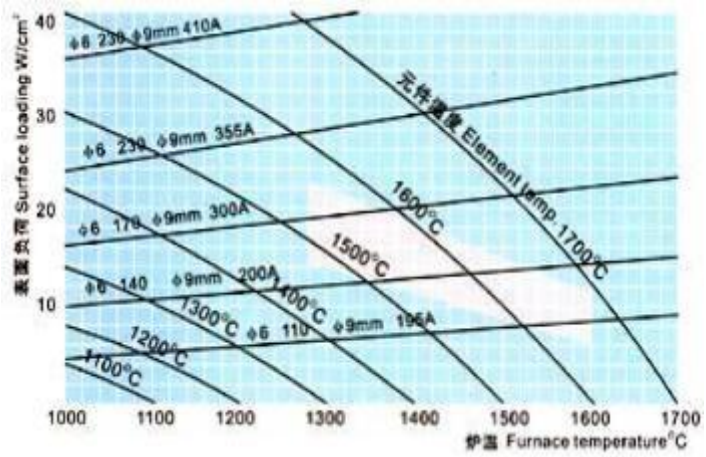
The resistivity of element rapidly rises as the temperature rises. Under normal operating conditions, generally the element resistance doesn't change with the service life changing, so the old elements can be mixed used.



2. 表面负荷 Surface Load

根据炉子的结构、温度和气氛而正确地选择元件的表面负荷是达到最佳使用寿命的关键。下图表明了发热元件辐射在不受阻碍的情况下，炉温、元件温度和表面负荷的关系。阴影部分为常用的表面负荷----温度范围。

According to the structure, the temperature and atmosphere in the correct choice of components surface load is the key element to the highest life. The picture shows that the relation among the furnace temperature, the element temperature and surface load under the circumstance that the thermal radiation component is uncrossed. The shaded part is for common surface load ------the temperature range



3. 建议的表面负荷 Recommend Surface Load

炉温 (℃) Furnace Temp (℃)	1400	1500	1600	1650	1700
热端表面负荷 (w/cm2) Hot end surface load (w/cm2)	<18	<15	<12	<10	<8

硅钼棒附件

Silicon molybdenum rod attachment



(陶瓷夹铝带) (陶瓷夹铝编织带) (陶瓷夹双排铝编织带)

（卡具尺寸，样式敬请联系我们，我们将为您做出最专业的选择。）

硅钼棒安装建议

Silicon molybdenum rod installation suggestions

1.硅钼棒在常温下脆性较大，高温时又有可塑性，故 U 型硅钼棒最好是垂直悬挂安装。

这样的安装的目 的就是避免将机械应加力到元件发热端上，否则容易引起元件断裂。若需要水平安装，请选用高温耐火材料支撑，把硅钼棒水平放置。

Molybdenum silicon in the room temperature brittleness is greater, high temperature and plasticity, so the U-shaped molybdenum silicon is best vertical hanging installation.

The purpose of such installation is to avoid applying mechanical stress to the heating end of the component, otherwise it is easy to cause component fracture. If horizontal installation is required, please choose high-temperature refractory support and place the silicon molybdenum rod horizontally.

2.为避免局部过热，硅钼棒下端圆锥部分一定要伸到炉膛内部。

To avoid local overheating, silicon molybdenum rods bottom cone part must be stretched into the furnace.

3.为了避免应力传到硅钼棒上，导线长度应略大于硅钼棒和母线间的直线距离。

The wire length should be slightly larger than the straight line distance between the silicon molybdenum rod and the bus to avoid stress transfer to the silicon molybdenum rods.

4.硅钼棒的卡具上的螺丝不能一次拧得太紧，待硅钼棒升到高温时，再次拧紧，因为这时硅钼棒有一定的可塑性不易折断。

The screw on the clamp of the silicon molybdenum rod can not be screwed too tight at one time, and when the silicon molybdenum rod rises to high temperature, it is tightened again, because the silicon molybdenum rod has a certain plasticity and is not easy to break.

5.一般夹头温度不能超过 200℃， 夹头导线与硅钼棒接触电压应低于 0.1V。

Generally, the chuck temperature can not exceed 200℃, and the contact voltage between the chuck wire and the silicon molybdenum rod should be less than 0.1V.

6.为避免辐射热传到夹头，夹头下端和塞砖上面的距离不应小于 50mm。

To avoid the transmission of radiant heat to the chuck, the distance between the lower end of the chuck and the top of the plug brick should not be less than 50mm

7.为避免损坏，直径为Φ6/12mm 的硅钼棒不能长期使用 170A 的电流，直径为Φ9/18mm 的硅钼棒不能长期使用 300A 的电流。

To avoid damage, the silicon molybdenum rod with diameter of Φ6/12mm cannot use 170A current for a long time, and the silicon molybdenum rod with diameter of Φ9/18mm cannot use 300A current for a long time.

硅钼棒更换建议

Silicon molybdenum rod replacement advice

1.更换硅钼棒必须轻拿轻放，因为硅钼棒比较脆，很容易因为外力断掉。

The replacement of the silicon molybdenum rod must be handled lightly, because the silicon molybdenum rod is relatively brittle and easy to break because of external force.

2.硅钼棒的变形率一般在 4%，所以硅钼棒热端底部必须离炉底间隙超过硅钼棒长度的 4%，放置高温因为下垂造成硅钼棒触底变形。

The deformation rate of silicon molybdenum rod is generally 4%, so the gap between the hot end of the silicon molybdenum rod and the bottom of the furnace must exceed 4% of the length of the silicon molybdenum rod, and the silicon molybdenum rod will be deformed when placed at high temperature because of sagging.

3.硅钼棒的固定夹紧需要在使用过后再紧一遍，还必须经常检查一下夹具，确保硅钼棒夹具没有松动。

Fixed clamping silicon molybdenum rods need to close it again after use, also must always check the jig, ensure no loose silicon molybdenum rods clamp.

4.在操作过程中发现元件损坏，应首先确定位置，同时准备好组合元件。然后将损坏的元件夹头导线与母线连接的螺丝松开，清理开陶瓷棉，连用穿转一起拔出来，再将新组合元件从炉顶插入，连接好导线，堵好陶瓷棉即可升温。

If the element is damaged during operation, the location should be determined first and the combined element should be prepared at the same time. Then loosen the screw connecting the damaged component chuck wire and the bus bar, clean up the ceramic wool, pull out the new combined component from the furnace top, connect the wire, and plug the ceramic wool to heat up.

硅钼棒炉子的操作

Operation of Furnace

1.炉子的干燥 Drying of Furnace

新筑成的或长期不用的炉子在使用前需要干燥，一般干燥温度为 100℃-200℃，而元件长期在低温下使用将会引起低温氧化。小型炉子干燥时间短，几个小时对元件影响不大。大型炉子干燥时间长，需要注意，最好使用其他发热元件烘炉。为了通风，最好将炉门打开，随着温度升高可以半开，到 1000℃以上完全关闭炉门。

The newly constructed or long-term unused furnace needs to be dried before use, the general drying temperature is 100℃-200℃, and the long-term use of components at low temperatures will cause low temperature oxidation. Small furnaces have a short drying time, and a few hours have little effect on the components. Large furnace drying time is long, need to pay attention to, it is best to use other heating elements oven. In order to ventilate, it is best to open the furnace door, which can be half open as the temperature rises, and completely close the furnace door above 1000℃

2.炉子的启动 Starting of Furnace

如果炉子干燥好了或者不需要干燥，即可按照下面步骤启动升温：

If the stove is dry or does not need to be dry, start heating by following the steps below:

小型炉子（功率＜100KW） Small Furnace (Power <100KW)		大型炉子（功率 100KW-500KW） Big Furnace (Power 100KW-500KW)	
炉温 Furnace Temperature ℃	电压 Voltage	炉温 Furnace Temperature ℃	电压 Voltage

20-150	1/3 工作电压 1/3 Working Voltage	20-300	1/3 工作电压 1/3 Working Voltage
150-500	2/3 工作电压 2/3 Working Voltage	300-700	2/3 工作电压 2 /3 Working Voltage
500-工作温度 500-Working Temperature	全工作电压 Full Working Voltage	700-工作温度 700-working Temperature	全工作电压 Full Working Voltage

硅钼棒参考数据

Silicon molybdenum rod reference data

1700 等级 6/12mm 的 U 型元件 Class 1700 6/12mm U-elements

热端 Le / 冷端 Lu	150	180	200	250	300	350	400	450	500	550	600
150	987	1152	1262	1536	1810	2084					
	0.044	0.051	0.056	0.068	0.080	0.093					
	6.6	7.7	8.4	10.2	12.1	13.9					
200	1025	1189	1299	1573	1848	2122	2396				
	0.046	0.053	0.058	0.070	0.082	0.094	0.106				
	6.8	7.9	8.7	10.5	12.3	14.1	16.0				
250	1062	1227	1337	1611	1885	2159	2433	2708			
	0.047	0.056	0.059	0.072	0.084	0.096	0.108	0.120			
	7.1	8.2	8.9	10.7	12.6	14.4	16.2	18.1			
270	1077	1242	1352	1626	1900	2174	2448	2723	2997		
	0.048	0.055	0.060	0.072	0.084	0.097	0.109	0.121	0.133		
	7.2	8.3	9.0	10.8	12.7	14.5	16.3	18.2	20.0		
300	1100	1264	1374	1648	1923	2197	2471	2745	3019	3294	3568
	0.049	0.056	0.061	0.073	0.085	0.098	0.110	0.122	0.134	0.146	0.159
	7.3	8.4	9.2	11.0	12.8	14.6	16.5	18.3	20.1	22.0	23.8
350	1137	1302	1412	1686	1960	2234	2508	2783	3057	3331	3605
	0.051	0.058	0.063	0.075	0.087	0.099	0.111	0.124	0.136	0.148	0.160
	7.6	8.7	9.4	11.2	13.1	14.9	16.7	18.6	20.4	22.2	24.0
400	1175	1339	1449	1723	1998	2272	2546	2820	3094	3369	3643
	0.052	0.060	0.064	0.077	0.089	0.101	0.113	0.125	0.138	0.150	0.162
	7.8	8.9	9.7	11.5	13.3	15.1	17.0	18.8	20.6	22.5	24.3

功率 Power：W
热电阻 Resistance：Ω
工作电压 voltage：V

热端 Le / 冷端 Lu	150	180	200	250	300	350	400	450	500	550	600
450		1377	1487	1761	2035	2309	2583	2858	3132	3406	3680
		0.061	0.066	0.078	0.090	0.103	0.115	0.127	0.139	0.151	0.164
		9.2	9.9	11.7	13.6	15.4	17.2	19.1	20.9	22.7	24.5
500				1798	2073	2347	2621	2895	3169	3444	3718
				0.080	0.092	0.104	0.116	0.129	0.141	0.153	0.165
				12.0	13.8	15.6	17.5	19.3	21.1	23.0	24.8
550					2110	2384	2658	2933	3207	3481	3755
					0.094	0.106	0.118	0.130	0.143	0.155	0.167
	条件 Condition：				14.1	15.9	17.7	19.6	21.4	23.2	25.0
600	元件温度 Element temp： 1500℃				2148	2422	2696	2970	3244	3519	3793
	炉子温度 Furnace temp： 1300℃				0.095	0.108	0.120	0.132	0.144	0.156	0.169
	电流 Amperage： 150A				14.3	16.1	18.0	19.8	21.6	23.5	25.3
650	表面负荷 Surface load： 15W/ cm^2						2733	3008	3282	3556	3830
							0.121	0.134	0.146	0.158	0.170
							18.2	20.1	21.9	23.7	25.5
700							2771	3045	3319	3594	3868
							0.123	0.135	0.148	0.160	0.172
							18.5	20.3	22.1	24.0	25.8

1700 级 9/18mm 的 U 型元件　Class 1700 9/18mm U-shaped elements

热端 le / 冷端 lu	150	180	200	250	300	350	400	450	500	550	600	650	700	750	800
250	1596	1841	2005	2414	2822	3231	3640	4049	4458	4866	5275	5684	6093	6502	6910
	0.021	0.024	0.027	0.032	0.037	0.043	0.048	0.054	0.059	0.064	0.070	0.075	0.081	0.086	0.091
	5.8	6.7	7.3	8.8	10.3	11.7	13.2	14.7	16.2	17.7	19.2	20.7	22.2	23.6	25.1
300	1653	1899	2062	2471	2880	3289	3697	4106	4515	4924	5333	5741	6150	6559	6968
	0.022	0.025	0.027	0.033	0.038	0.043	0.049	0.054	0.060	0.065	0.071	0.076	0.081	0.087	0.092
	6.0	6.9	7.5	9.0	10.5	12.0	13.4	14.9	16.4	17.9	19.4	20.9	22.4	23.9	25.3
350	1711	1956	2120	2529	2937	3346	3755	4164	4573	4981	5390	5799	6208	6617	7025
	0.023	0.026	0.028	0.033	0.039	0.044	0.050	0.055	0.060	0.066	0.071	0.077	0.082	0.087	0.093
	6.2	7.1	7.7	9.2	10.7	12.2	13.7	15.1	16.6	18.1	19.6	21.1	22.6	24.1	25.5
400	1768	2014	2177	2586	2995	3404	3812	4221	4630	5039	5448	5856	6265	6674	7083
	0.023	0.027	0.029	0.034	0.040	0.045	0.050	0.056	0.061	0.067	0.072	0.077	0.083	0.088	0.094
	6.4	7.3	7.9	9.4	10.9	12.4	13.9	15.3	16.8	18.3	19.8	21.3	22.8	24.3	25.8
450		2071	2235	2644	3052	3461	3870	4279	4688	5096	5505	5914	6323	6732	7140
		0.027	0.030	0.035	0.040	0.046	0.051	0.057	0.062	0.067	0.073	0.078	0.084	0.089	0.094
		7.5	8.1	9.6	11.1	12.6	14.1	15.6	17.0	18.5	20.0	21.5	23.0	24.5	26.0
500			2292	2701	3110	3519	3927	4336	4745	5154	5563	5971	6380	6789	7198
			0.030	0.036	0.041	0.047	0.052	0.057	0.063	0.068	0.074	0.079	0.084	0.090	0.095
			8.3	9.8	11.3	12.8	14.3	15.8	17.3	18.7	20.2	21.7	23.2	24.7	26.2

热端 le / 冷端 lu	150	180	200	250	300	350	400	450	500	550	600	650	700	750	800
550				2759	3167	3576	3985	4394	4803	5211	5620	6029	6438	6847	7255
	功率 Power W			0.036	0.042	0.047	0.053	0.058	0.064	0.069	0.074	0.080	0.085	0.091	0.096
	电阻 Resistance Ω			10.0	11.5	13.0	14.5	16.0	17.5	19.0	20.4	21.9	23.4	24.9	26.4
600	电压 Voltage V			2816	3225	3634	4042	4451	4860	5269	5678	6086	6495	6904	7313
				0.037	0.043	0.048	0.053	0.059	0.064	0.070	0.075	0.080	0.086	0.091	0.097
				10.2	11.7	13.2	14.7	16.2	17.7	19.2	20.6	22.1	23.6	25.1	26.6
650					3282	3691	4100	4509	4918	5326	5735	6144	6553	6962	7370
					0.043	0.049	0.054	0.060	0.065	0.070	0.076	0.081	0.087	0.092	0.097
					11.9	13.4	14.9	16.4	17.9	19.4	20.9	22.3	23.8	25.3	26.8
700	条件 Condition:				3340	3749	4157	4566	4975	5384	5793	6201	6610	7019	7428
	元件温度 Element temperature				0.044	0.050	0.055	0.060	0.066	0.071	0.077	0.082	0.087	0.093	0.098
	1500℃				12.1	13.6	15.1	16.6	18.1	19.6	21.1	22.6	24.0	25.5	27.0
750	炉子温度 Furnace temperature 1300℃					3806	4215	4624	5033	5441	5850	6259	6668	7077	7485
	电流 Current 275A					0.050	0.056	0.061	0.067	0.072	0.077	0.083	0.088	0.094	0.099
	表面负荷 Surface load 14.5W/cm^2					13.8	15.3	16.8	18.3	19.8	21.3	22.8	24.2	25.7	27.2
800						3864	4272	4681	5090	5499	5908	6316	6725	7134	7543
						0.051	0.056	0.062	0.067	0.073	0.078	0.084	0.089	0.094	0.100
						14.0	15.5	17.0	18.5	20.0	21.5	23.0	24.5	25.9	27.4

1700 级 6/12 的 W 型元件　Class 1700 6/12 W elements

热端 le / 冷端 Lu	315	355	410	500	620	730	800	820	1000
470	4053	4503	5121	6133	7481	8718	9505	9729	11753
	0.180	0.200	0.228	0.273	0.333	0.387	0.422	0.432	0.522
	27.0	30.0	34.1	40.9	49.9	58.1	63.4	64.9	78.4
500	4076	4525	5144	6155	7504	8740	9527	9752	11775
	0.181	0.201	0.229	0.274	0.334	0.388	0.423	0.433	0.523
	27.2	30.2	34.3	41.0	50.0	58.3	63.5	65.0	78.5
520	4091	4540	5159	6170	7519	8755	9542	9767	11790
	0.182	0.202	0.229	0.274	0.334	0.389	0.424	0.434	0.524
	27.3	30.3	34.4	41.1	50.1	58.4	63.6	65.1	78.6
560	4121	4570	5189	6200	7549	8785	9572	9797	11820
	0.183	0.203	0.231	0.276	0.336	0.390	0.425	0.435	0.525
	27.5	30.5	34.6	41.3	50.3	58.6	63.8	65.3	78.8
580	4136	4585	5204	6215	7564	8800	9587	9812	11835
	0.184	0.204	0.231	0.276	0.336	0.391	0.426	0.436	0.526
	27.6	30.6	34.7	41.4	50.4	58.7	63.9	65.4	78.9
600	4151	4600	5219	6230	7579	8815	9602	9827	11850
	0.184	0.204	0.232	0.277	0.337	0.392	0.427	0.437	0.527
	27.7	30.7	34.8	41.5	50.5	58.8	64.0	65.5	79.0

热端 le / 冷端 Lu	315	355	410	500	620	730	800	820	1000
630	4173	4623	5241	6253	7601	8838	9625	9849	11873
	0.185	0.205	0.233	0.278	0.338	0.393	0.428	0.438	0.528
	27.8	30.8	34.9	41.7	50.7	58.9	64.2	65.7	79.2

条件 Condition:
元件温度 Element temperature 1500℃
炉子温度 Furnace temperature 1300℃
电流 Current 150A
表面负荷 Surface load 14.5W/cm^2

功率 Power W
电阻 Resistance Ω
电压 Voltage V

1700 级 9/18 的 W 型元件　　Class 1700 9/18 W element

热端 le / 冷端 lu	315	355	410	500	620	730	800	820	1000
470	5904	6562	7468	8949	10925	12736	13889	14218	17181
	0.078	0.087	0.099	0.118	0.144	0.168	0.184	0.188	0.227
	21.5	23.9	27.2	32.5	39.7	46.3	50.5	51.7	62.5
500	5938	6597	7502	8984	10960	12771	13923	14252	17216
	0.079	0.087	0.099	0.119	0.145	0.169	0.184	0.188	0.228
	21.6	24.0	27.3	32.7	39.9	46.4	50.6	51.8	62.6
520	5961	6620	7525	9007	10983	12794	13946	14275	17239
	0.079	0.088	0.100	0.119	0.145	0.169	0.184	0.189	0.228
	21.7	24.1	27.4	32.8	39.9	46.5	50.7	51.9	62.7
560	6007	6666	7571	9053	11029	12840	13992	14321	17285
	0.079	0.088	0.100	0.120	0.146	0.170	0.185	0.189	0.229
	21.8	24.2	27.5	32.9	40.1	46.7	50.9	52.1	62.9
580	6030	6689	7594	9076	11052	12863	14015	14344	17308
	0.080	0.088	0.100	0.120	0.146	0.170	0.185	0.190	0.229
	21.9	24.3	27.6	33.0	40.2	46.8	51.0	52.2	62.9
600	6053	6712	7617	9099	11075	12886	14038	14367	17331
	0.080	0.089	0.101	0.120	0.146	0.170	0.186	0.190	0.229
	22.0	24.4	27.7	33.1	40.3	46.9	51.0	52.2	63.0
630	6088	6746	7652	9133	11109	12920	14073	14402	17365
	0.080	0.089	0.101	0.121	0.147	0.171	0.186	0.190	0.230
	22.1	24.5	27.8	33.2	40.4	47.0	51.2	52.4	63.1

条件 Condition:
元件温度 Element temperature 1500℃
炉子温度 Furnace temperature 1300℃
电流 Current 275A
表面负荷 Surface load 14.5W/cm^2

功率 Power W
电阻 Resistance Ω
电压 Voltage V

1800 级 3/6 的 U 型元件　Class 1800 3/6 U-shaped element

热端 le / 冷端 lu	150	160	200	250	300	350
150	376	440	483	591	698	805
	0.186	0.217	0.239	0.292	0.345	0.398
	8.4	9.8	10.7	13.1	15.5	17.9
200	391	455	498	605	712	820
	0.193	0.225	0.246	0.299	0.352	0.405
	8.7	10.1	11.1	13.4	15.8	18.2
250	405	470	512	620	727	834
	0.200	0.232	0.253	0.206	0.359	0.412
	9.0	10.4	11.4	13.8	16.2	18.5
280	411	475	518	626	733	840
	0.203	0.235	0.256	0.309	0.362	0.415
	9.1	10.6	11.5	13.9	16.3	18.7
300	420	484	527	634	742	849
	0.207	0.239	0.26	0.313	0.366	0.419
	9.3	10.8	11.7	14.1	16.5	18.9

条件 Condition:

元件温度 Elements temp.：1700℃　　功率 Power：W

炉子温度 Furnace temp.：1600℃　　热电阻 Resistance：　Ω

电流 Amperage：45A　　工作电压 Voltage：V

表面负荷 Surface load：11.5W/cm^2

1800 级 4/9 的 U 型元件　Class 1800 4/9 U-shaped elements

热端 le / 冷端 Lu	150	160	200	250	300	350
150	492	579	637	781	925	1070
	0.116	0.137	0.151	0.185	0.219	0.253
	7.6	8.9	9.8	12.0	14.2	16.5
200	507	594	652	796	940	1085
	0.120	0.141	0.154	0.188	0.223	0.257
	7.8	9.1	10.0	12.2	14.5	16.7
250	522	609	667	811	955	1100
	0.124	0.144	0.158	0.192	0.226	0.260
	8.0	9.4	10.3	12.5	14.7	16.9
280	528	615	673	817	961	1106
	0.125	0.146	0.159	0.193	0.228	0.262
	8.1	9.5	10.3	12.6	14.8	17.0
300	537	624	682	826	970	1115
	0.127	0.148	0.161	0.195	0.230	0.264
	8.3	9.6	10.5	12.7	14.9	17.2

条件 Condition:

元件温度 Elements temp.: 1700℃

炉子温度 Furnace temp.: 1600℃

电流 Amperage: 65A

表面负荷 Surface load: 11.5W/cm^2

功率 Power: W

热电阻 Resistance: Ω

工作电压 Voltage: V

1800 级 6/12 的 U 型元件 Class 1800 6/12 U-shaped element

热端 Le / 冷端 Lu	150	180	200	250	300	350	400	450	500	550	600
150	686	800	877	1068	1260	1451					
	0.048	0.056	0.061	0.074	0.087	0.101					
	5.7	6.7	7.3	8.9	10.5	12.1					
200	711	825	902	1093	1285	1476	1667				
	0.049	0.057	0.063	0.076	0.089	0.103	0.116				
	5.9	6.9	7.5	9.1	10.7	12.3	13.9				
250	736	850	927	1118	1310	1501	1692	1884			
	0.051	0.059	0.064	0.078	0.091	0.104	0.118	0.131			
	6.1	7.1	7.7	9.3	10.9	12.5	14.1	15.7			
270	746	860	937	1128	1320	1511	1702	1894	2085		
	0.052	0.060	0.065	0.078	0.092	0.105	0.118	0.132	0.145		
	6.2	7.2	7.8	9.4	11.0	12.6	14.2	15.8	17.4		
300	761	875	952	1143	1335	1526	1717	1909	2100	2292	2483
	0.053	0.061	0.066	0.079	0.093	0.106	0.119	0.133	0.146	0.159	0.172
	6.3	7.3	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.7
350	786	900	977	1168	1360	1551	1742	1934	2125	2317	2508
	0.055	0.063	0.068	0.081	0.094	0.108	0.121	0.134	0.148	0.161	0.174
	6.5	7.5	8.1	9.7	11.3	12.9	14.5	16.1	17.7	19.3	20.9
400	811	925	1002	1193	1385	1576	1767	1959	2150	2342	2533
	0.056	0.064	0.070	0.083	0.096	0.109	0.123	0.136	0.149	0.163	0.176
	6.8	7.7	8.3	9.9	11.5	13.1	14.7	16.3	17.9	19.5	21.1
450		950	1027	1218	1410	1601	1792	1984	2175	2367	2558
		0.066	0.071	0.085	0.098	0.111	0.124	0.138	0.151	0.164	0.178
		7.9	8.6	10.2	11.7	13.3	14.9	16.5	18.1	19.7	21.3
500				1243	1435	1626	1817	2009	2200	2392	2583
				0.086	0.100	0.113	0.126	0.140	0.153	0.166	0.179
				10.4	12.0	13.6	15.1	16.7	18.3	19.9	21.5
550					1460	1651	1842	2034	2225	2417	2608
					0.101	0.115	0.128	0.141	0.155	0.168	0.181
					12.2	13.8	15.4	16.9	18.5	20.1	21.7
600					1485	1676	1867	2059	2250	2442	2633
					0.103	0.116	0.130	0.143	0.156	0.170	0.183
					12.4	14.0	15.6	17.2	18.8	20.3	21.9

条件 Condition:
元件温度 Elements temp.: 1700℃
炉子温度 Furnace temp.: 1600℃
电流 Amperage: 120A
表面负荷 Surface load: 10W/cm^2

1800 级 9/18 的 U 型元件　Class 1800 9/18 U-shaped elements

热端 le / 冷端 lu	150	180	200	250	300	350	400	450	500	550	600	650	700	750	800
250	1106	1278	1393	1679	1966	2253	2540	2827	3114	3401	3687	3974	4261	4548	4835
	0.023	0.260	0.029	0.035	0.041	0.047	0.052	0.058	0.064	0.070	0.076	0.082	0.088	0.094	0.100
	5.0	5.8	6.3	7.6	8.9	10.2	11.5	12.8	14.2	15.5	16.8	18.1	19.4	20.7	22.0
300	1143	1315	1430	1717	2004	2291	2578	2864	3151	3438	3725	4012	4299	4586	4872
	0.024	0.027	0.030	0.035	0.041	0.047	0.053	0.059	0.065	0.071	0.077	0.083	0.089	0.095	0.101
	5.2	6.0	6.5	7.8	9.1	10.4	11.7	13.0	14.3	15.6	16.9	18.2	19.5	20.8	22.1
350	1181	1353	1468	1754	2041	2328	2615	2902	3189	3476	3762	4049	4336	4623	4910
	0.024	0.028	0.030	0.036	0.042	0.048	0.054	0.060	0.066	0.072	0.078	0.084	0.090	0.096	0.101
	5.4	6.1	6.7	8.0	9.3	10.6	11.9	13.2	14.5	15.8	17.1	18.4	19.7	21.0	22.3
400	1218	1390	1505	1792	2079	2366	2653	2939	3226	3513	3800	4087	7374	4661	4947
	0.025	0.029	0.031	0.037	0.043	0.049	0.055	0.061	0.067	0.073	0.079	0.084	0.090	0.096	0.102
	5.5	6.3	6.8	8.1	9.4	10.8	12.1	13.4	14.7	16.0	17.3	18.6	19.9	21.2	22.5
450		1428	1543	1829	2116	2403	2690	2977	3264	3551	3837	4124	4411	4698	4985
		0.029	0.032	0.038	0.044	0.050	0.056	0.062	0.067	0.073	0.079	0.085	0.091	0.097	0.103
		6.5	7.0	8.3	9.6	10.9	12.2	13.5	14.8	16.1	17.4	18.7	20.1	21.4	22.7
500			1580	1867	2154	2441	2728	3014	3301	3588	3875	4162	4449	4736	5022
			0.033	0.039	0.044	0.050	0.056	0.062	0.068	0.074	0.080	0.086	0.092	0.098	0.104
			7.2	8.5	9.8	11.1	12.4	13.7	15.0	16.3	17.6	18.9	20.2	21.5	22.8
550				1904	2191	2478	2765	3052	3339	3626	3912	4199	4486	4773	5060
				0.039	0.045	0.051	0.057	0.063	0.069	0.075	0.081	0.087	0.093	0.099	0.105
				8.7	10.0	11.3	12.6	13.9	15.2	16.5	17.8	19.1	20.4	21.7	23.0
600				1942	2229	2516	2803	3089	3376	3663	3950	4237	4524	4811	5097
				0.040	0.046	0.052	0.058	0.064	0.070	0.076	0.082	0.088	0.093	0.099	0.105
				8.8	10.1	11.4	12.7	14.0	15.3	16.7	18.0	19.3	20.6	21.9	23.2
650					2266	2553	2840	3127	3414	3701	3987	4274	4561	4848	5135
					0.047	0.053	0.059	0.065	0.071	0.076	0.082	0.088	0.094	0.100	0.106
					10.3	11.6	12.9	14.2	15.5	16.8	18.1	19.4	20.7	22.0	23.3
700					2304	2591	2878	3164	3451	3738	4025	4312	4599	4886	5172
					0.048	0.054	0.059	0.065	0.071	0.077	0.083	0.089	0.095	0.101	0.107
					10.5	11.8	13.1	14.4	15.7	17.0	18.3	19.6	20.9	22.2	23.5
750						2628	2915	3202	3489	3776	4062	4349	4636	4923	5210
						0.054	0.060	0.066	0.072	0.078	0.084	0.090	0.096	0.102	0.108
						11.9	13.3	14.6	15.9	17.2	18.5	19.8	21.1	22.4	23.7
800						2666	2953	3239	3526	3813	4100	4387	4674	4961	5247
						0.055	0.061	0.067	0.073	0.079	0.085	0.091	0.097	0.102	0.108
						12.1	13.4	14.7	16.0	17.3	18.6	19.9	21.2	22.5	23.9

功率 Power：W

热电阻 Resistance：　Ω

工作电压 Voltage：V

条件 Condition：

元件温度 Elements temp.：1700℃

炉子温度 Furnace temp.：1600℃

电流 Amperage：220A

表面负荷 Surface load：10W/cm^2