YANTAI TORCH SPECIAL HIGH
TEMPERATURE CERAMICS CO., LTD

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Torch Special High Temperature Ceramics English Two-dimensional Code

Torch Special High Temperature Ceramics Chinese Two-dimensional Code

Inherit Technology and
Dedicate to Excellence

$MoSi_2$ Electric Heating Elements of Yantai Torch

Instruction Manual

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Company Profile

Yantai Torch Special High Temperature Ceramics Co., Ltd. is a high-tech enterprise with independent intellectual property rights specializing in the R&D and professional production of molybdenum silicide series products. The company has introduced the most advanced process technology in the field of new material synthesis to produce molybdenum silicide series products with the world's top quality level.

We persistently adhere to our enterprise tenet "Inherit Technology and Dedicate to Excellence" and carry forward our enterprise spirit "Dare to Be the First, Press Forward with Indomitable Will" by providing quality products and perfect service for general domestic and foreign customers with advanced technology, excellent equipment and scientific management. And we are exerting ourselves to be a reliable and prestigious supplier in the worldwide new material field.

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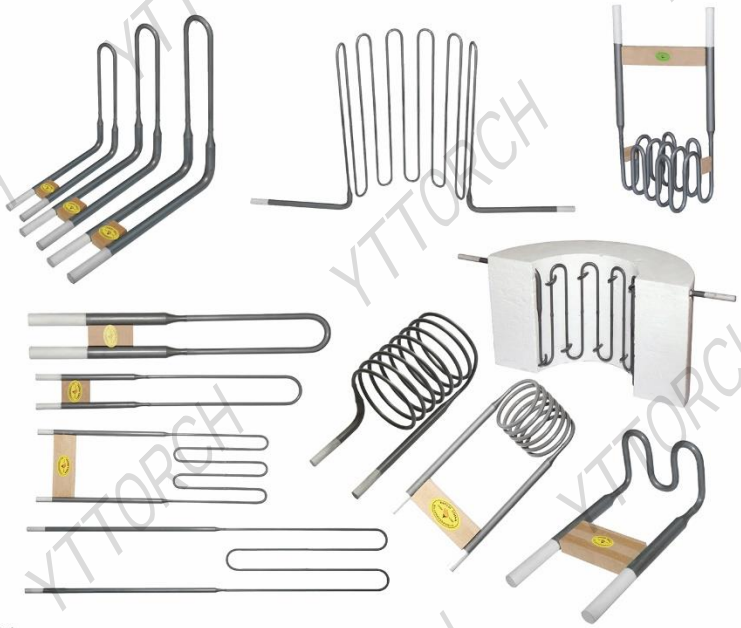
I. Brief Introduction of $MoSi_2$ Material

The molybdenum silicide was found in 1906. Under different conditions, the silicon and molybdenum can be formed Mo_5Si, Mo_5Si_3 and $MoSi_2$. Among them, the $MoSi_2$ can form a thin and adhesive protective layer of quartz glass (SiO_2) on its surface to prevent further oxidation under high temperature. $MoSi_2$ has good high temperature oxidation resistance and excellent electrical conductivity. With melting point of 2030℃ and density of 6.3g/cm^3 and various good high temperature performance, it is identified as a kind of ultra high temperature structural material with great potentiality.

$MoSi_2$ is a kind of chemical compound of silicon and molybdenum. Due to the small difference in the radius of the two atoms and the close electronegativity, it has properties similar to those of metals and ceramics. At the low-temperature stage, the $MoSi_2$ material has high strength but high brittleness (similar to ceramic), when the temperature reaches 1000℃ and above, it also has metal like soft plasticity.

The $MoSi_2$ was mainly applied as coating protection material that is resistant to high temperature and corrosion on metallic matrix surface at early stage. It was firstly used in coating of spare parts of gas turbines, combustion chambers of jet motors and guided missiles. At present, the $MoSi_2$ material is mostly used in high temperature electric heating elements, bubble pipes of glass tank furnace, thermocouple-protection tubes and high temperature resistance and oxidation resistance powder.



II. Introduction of Yantai Torch $MoSi_2$ Series Products

1. Classification of Yantai Torch $MoSi_2$ Electric Heating Elements

Type	Product Serial No.	Judgment Standard (Air Environment)	Product Features	Application Range
Heating Element	TC1700	Element Temperature 1700℃	Compact and good element protective layer; Common $MoSi_2$ products apply to low temperature electric furnaces, especially special atmosphere electric furnaces	Al_2O_3, SiO_3 and other materials sintering
	TC1800	Element Temperature 1800℃	Compact and good element protective layer; The product density and heat resistance improve greatly comparing with TC1700 products; Furnace temperature: within 1650℃	High-purity materials (Al_2O_3, SiO_2, ZrO_2, Y_2O_3 and ITO) sintering
	MR1800		Compact and good element protective layer; The high temperature strength is slightly higher than TC1800 products; Furnace temperature: within 1700℃.	
	TC1850	Element Temperature 1850℃	High compactness and purity; The temperature resistance degree improves and it can bear large surface load	Dental materials (MgO, Y_2O_3 and ZrO_3) sintering
	TC1900	Element Temperature 1850℃	High compactness and purity; Good high temperature strength; Very thin protective layer with good performance; Can bear large surface load	High temperature electric furnaces having special requirements on high temperature strength and protective layer of electric heating elements

2. Introduction of Specialized Yantai Torch Heating Element

Product Name	Main Features	Application	Maximum Operating Temperature
Dedicated Heating Element for Special Atmosphere	1. The compact and complete element protective layer can well resist the corrosion of special atmosphere; 2. The protective layer has strong regeneration capacity under oxidation environment and high temperature conditions.	Electric furnaces under non-oxidizing atmosphere	Element temperature 1700° C

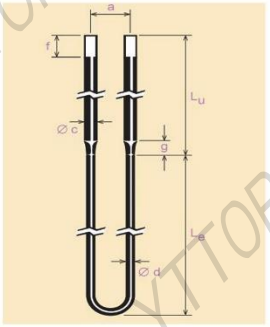
Specialized Heating Element for Dental Furnace	1. The heating element has high purity, which can reduce the impurity content to the utmost extent; 2. The product has good high temperature strength, which can bear greater surface load under high temperature; 3. The product can adapt to electric furnaces with frequent use and fast temperature increasing and decreasing; 4. The protective layer of heating element is thin and compact, which can avoid it falling off during using to a large extent.	Precise electric furnaces having higher requirement on heating elements such as electric furnaces for dentistry; Electric furnaces with fast temperature increasing and decreasing, frequent use and short sintering period	Element temperature: 1850° C (air environment)
Specialized Heating Element for Semiconductor	1. This product is precision machining with higher heating power and it can provide uniform thermal field for electric furnaces; 2. Corresponding shapes can be manufactured based on operating requirement of customers. This product can maintain a certain performance in use with long service life; 3. Comparing with the metal wire, it can bear greater surface load and rapid temperature increasing system (fast cooling and temperature increasing); 4. It can match with various dimensions of wafers from small size to large size, multi-application. 5. It can ensure the cleanness of relevant equipment if being used under high temperature.	Electric furnaces for semiconductor wafers; Cylinder-shaped electric furnaces;	Element temperature: 1700°C (air environment)
Specialized Heating Element for ITO	1. It is specially designed for ITO electric furnaces and it can bear greater surface load; 2. The product has high purity and the impurity content is reduced to the utmost extent so as to ensure the cleanness of electric furnaces; 3. The junction state between the heating element protective film and matrix surface is improved through special treatment so that the protective film is not easy to fall off when using the heating element; 4. The junction state between the heating element protective film and element matrix surface is very good so that it is very suitable for high oxidizing gas atmosphere furnaces; 5. Good high temperature strength and low deformation probability.	ITO target material sintering electric furnaces	Element temperature: 1800°C (air environment)

3.Range of Yantai Torch $MoSi_2$ Electric Heating Elements

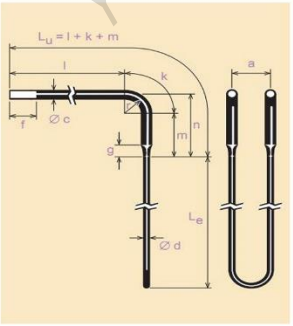
Product Standard Specifications		TC1700	1800		TC1850	TC1900
Hot Zone(Le) Diameter-mm	Cold Zone(Lu) Diameter-mm		TC1800	MR1800		
3	6	√	√	√	√	√
4	9	√	√	√	√	√
6	12	√	√	√	√	√
9	18	√	√	√	√	×
12	24	√	√	×	×	×

● Note: the above types are standard products.6.If special diameter or specification is required, it can be negotiated (such as hot zone (Le) diameter 5mm or 7mm or hot zone (Le) diameter 6mm and cold zone (Lu) diameter 9mm).

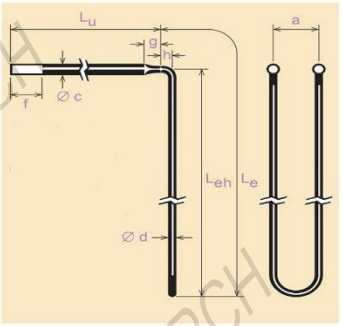
4.Dimensionof Yantai Torch $MoSi_2$ Electric Heating Elements



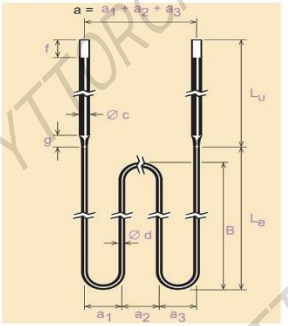
U- Shape



Lu bent 90 °



Le bent 90 °



W-Shape

Parameters of Processing Standards

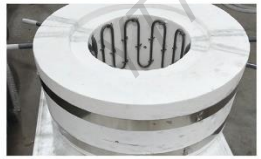
Element Specification	d-mm	C-mm	a-mm		g-mm	f-mm	h-mm	n-mm	
			Standard	Minimum				Standard	Minimum
3/6	3	6	25	10	15	30	10	40	35
4/9	4	9	25	18	20	30	10	50	45
6/12	6	12	50	25	25	45	15	90	60
9/18	9	18	60	40	32	75	20	135	80
12/24	12	24	80	45	40	100	35	150	120

5.Yantai Torch Heating Modules and Special-Shaped $MoSi_2$ Products

Torch heating modules consist of vacuum formed ceramic fiber material with the integral Yantai Torch $MoSi_2$ heating element. The heating modules includes spirals (YTMU), half cylinders (YTHC) and flat panels. Customers could choose the appropriate module according to the requirements, or customize the module according to the specific requirements.




5.1Features of Heating Module




- The temperature of oxidation atmosphere furnace can reach 1550℃;
- Can be adapt to rapid temperature rise and fall;
- Provide high quality uniform thermal field;
- The module is easy to install and can be assembled and used flexibly;
- Various shapes can be customized according to the needs of electric furnace.

5.2Application Fields of Heating Module:

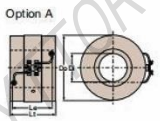
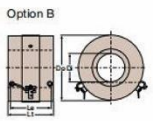
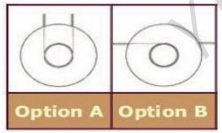
Metal products heat treatment and processing, glass industry (feeding and melting link), ceramic industry, electronic industry (single crystal growth furnace, diffusion furnace, ITO sintering), etc.

5.3Yantai Torch Heating Module Series Product Type:

Yantai Torch heating module can be customized with different shapes and powers according to the furnace type and sinter, and the requirements of thermal field and power can be satisfied by different shape and diameter of heating elements.

5.3.1Yantai Torch Heating Module Series Product - YTMU

Option A　　Option B

YTMU-Φ3/6 Heating Element, Element Temperature 1500℃, Furnace Temperature 1400℃, Surface Loading 8.2w/cm², Current 42A

Type	Module Type	Refractory Size			Furnace Effective Diameter/mm	Element Electrical Parameters			Shape Data of Heating Element		
		Height/mm	ID/mm	OD/mm		Voltage-V	Resistance-Ω	Power-W	Turns	Pitch/mm	Cold End Center Distance/mm
YTMU40	A	250	40	240	30	34.5	0.821	1450	13.5	15	203
	B					35.7	0.850	1500	14	15	210
YTMU60	A	250	60	260	50	50.1	1.192	2100	13.5	15	203
	B					51.9	1.235	2180	14	15	210
YTMU80	A	250	80	280	70	65.7	1.563	2760	13.5	15	203
	B					68.1	1.620	2860	14	15	210
YTMU100	A	250	100	300	90	81.3	1.935	3410	13.5	15	203
	B					84.2	2.005	3540	14	15	210
YTMU125	A	250	125	325	115	100.7	2.399	4230	13.5	15	203
	B					104.4	2.487	4390	14	15	210
YTMU150	A	250	150	350	140	120.2	2.863	5050	13.5	15	203
	B					124.7	2.968	5240	14	15	210
YTMU200	A	250	200	400	190	159.2	3.791	6690	13.5	15	203
	B					165.1	3.930	6930	14	15	210

Note: Size of heating modules can be customized according to the customer requirement, heating element could be TC1700, TC1800 or MR1800 type.

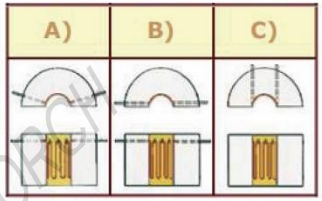
YTMU-Φ3/6 Heating Element, Element Temperature 1600℃, Furnace Temperature 1500℃, Surface Loading 9.4w/cm², Current 43A

Type	Module Type	Refractory Size			Furnace Effective Diameter/mm	Element Electrical Parameters			Shape Data of Heating Element		
		Height/mm	ID/mm	OD/mm		Voltage-V	Resistance-Ω	Power-W	Turns	Pitch/mm	Cold End Center Distance/mm
YTMU40	A	250	40	240	30	38.5	0.895	1650	13.5	15	203
	B					39.9	0.927	1710	14	15	210
YTMU60	A	250	60	260	50	55.9	1.301	2410	13.5	15	203
	B					58.0	1.348	2490	14	15	210
YTMU80	A	250	80	280	70	73.4	1.707	3160	13.5	15	203
	B					76.1	1.769	3270	14	15	210
YTMU100	A	250	100	300	90	90.8	2.113	3910	13.5	15	203
	B					94.2	2.190	4050	14	15	210
YTMU125	A	250	125	325	115	112.7	2.620	4840	13.5	15	203
	B					116.8	2.716	5020	14	15	210
YTMU150	A	250	150	350	140	134.5	3.128	5780	13.5	15	203
	B					139.4	3.243	5990	14	15	210
YTMU200	A	250	200	400	190	178.1	4.143	7660	13.5	15	203
	B					184.7	4.295	7940	14	15	210

Note: Size of heating modules can be customized according to the customer requirement, heating element type MR1800.

Φ4/9 or Φ6/12 heating element could meet higher power requirement.

5.3.2Yantai Torch Heating Module Series Product – YTHC



YTHC-Φ3/6 Heating Element, Element Temperature 1500℃, Furnace Temperature 1400℃, Surface Loading 8.2w/cm², Current 42A

Type	Module Type	Refractory Size			Furnace Effective Diameter/mm	Element Electrical Parameters			Shape Data of Heating Element	
		Height/mm	ID/mm	OD/mm		Voltage-V	Resistance-Ω	Power-W	Total Number of U Shape	Height of Heating Element/mm
YTHC100	A/B/C	200	100	300	85	22.4	0.533	940	7	150
YTHC150	A/B/C	200	150	350	135	34.0	0.809	1427	11	150
YTHC200	A/B/C	200	200	400	185	45.6	1.086	1916	15	150
YTHC250	A/B/C	200	250	450	235	57.4	1.366	2409	19	150
YTHC300	A/B/C	200	300	500	285	68.9	1.641	2895	23	150
YTHC400	A/B/C	200	400	600	385	86.8	2.066	3644	29	150

Note: Size of heating modules can be customized according to the customer requirement, heating element could be TC1700, TC1800 or MR1800 type.

YTHC-Φ3/6 Heating Element, Element Temperature 1600℃, Furnace Temperature 1500℃, Surface Loading 9.4w/cm², Current 43A

Type	Module Type	Refractory Size			Furnace Effective Diameter/mm	Element Electrical Parameters			Shape Data of Heating Element	
		Height/mm	ID/mm	OD/mm		Voltage-V	Resistance-Ω	Power-W	Total Number of U Shape	Height of Heating Element/mm
YTHC100	A/B/C	200	100	300	85	25.5	0.607	1072	7	150
YTHC150	A/B/C	200	150	350	135	38.8	0.924	1629	11	150
YTHC200	A/B/C	200	200	400	185	52.2	1.242	2191	15	150
YTHC250	A/B/C	200	250	450	235	65.6	1.562	2756	19	150
YTHC300	A/B/C	200	300	500	285	78.9	1.878	3313	23	150
YTHC400	A/B/C	200	400	600	385	99.3	2.365	4172	29	150

Note: Size of heating modules can be customized according to the customer requirement, heating element type MR1800.

Φ4/9, Φ6/12 , 9/18 or 12/24 heating element could meet higher power requirement

5.3.3 Yantai Torch Heating Module Series Product – Flat Panels

Flat panels heating modules can be customized 3/6, 4/9, 6/12, 9/18 or 12/24 heating elements according to the power demand.

5.3.4 Yantai Torch $MoSi_2$ Heating Element for Semiconductor Diffusion Furnace (Oxidation Furnace) – FTPS

Yantai Torch $MoSi_2$ heating element for vertical diffusion furnace (oxidation furnace) of semiconductor wafer (FTPS) characterized by high strength at room temperature and good toughness which convenient installation and transportation, better service life, good temperature uniformity and fast heating rate. The main production models of this kind of heating elements are: VOS-40-017, VOS-56-002, VOS-56-003, VOS-56-101(P), etc. Yantai Torch has advanced production technology and equipment to ensure the stability and uniformity of all types of heating elements. This series of heater has been widely recognized and praised by customer.

6.Classification of Yantai Torch Bubble Pipes

The bubble pipes of $MoSi_2$ material have thermal shock resistance, high temperature resistance and oxidation resistance. Therefore, they are not easy to be corroded in glass solutions and they do not contaminate glass solutions, they are the best choice for bubbling of glass tank furnace at clarification stage.
The model of Yantai torch bubble pipes is as follow, for special models, please provide technical parameters for specific consultation.

Hole Diameter-mm	Outer Diameter-mm	Quantity of Inner Hole
3	12	1
1		4
2		2
3	14	1
1		4 | 5
1	16	5
5	10	1
8	14	1

Note: Thermocouple-protection tubes can be processed by those with hole diameter above 5mm.

Standard description: TCG17-Φ3×Φ12×800 (3-Hole Diameter; 12-Outer Diameter; 800-Length)
TCG17-Φ1×4×Φ14×800 (1-Hole Diameter; 4-Quantity of Inner Hole; 14-Outer Diameter; 800-Length)
Standard f=45mm, could be adjusted according to customer requirements.

7.Yantai Torch $MoSi_2$ Powder

The $MoSi_2$ powder is mainly used in high temperature resistance and oxidation resistance coating. It can also be compounded with other materials to improve performance.

Power Purity	Particle Size		Principal Phase	Second Phase	Main Impurity Composition			
	D_{50}	D_{90}			Fe	Al	Ca	O
≥99%	<5.0μm	<15μm	$MoSi_2$	Mo_5Si_3	<0.1%	0.01%	0.011%	0.2%

Ⅲ. Performances of Yantai Torch $MoSi_2$ Electric Heating Elements

1.Physical Performance of Yantai Torch $MoSi_2$ Products

Type	Density-g/cm^3	Bending Strength under Room Temperature-MPa	Hardness-GPa	Compression Strength-MPa	Water Absorption-%	Thermal Elongation-%
TC1700	5.8±0.1	450	11	>1500	≤0.2%	4
TC1800	6.0±0.1	500	12	>1500	≤0.2%	4
MR1800	5.9±0.1	430	11.5	>1500	≤0.2%	4
TC1850	6.6±0.1	460	11	>1500	≤0.2%	4
TC1900	7.0±0.1	360	10.5	>1500	≤0.2%	4

2.Relationship between Resistivity and Temperature

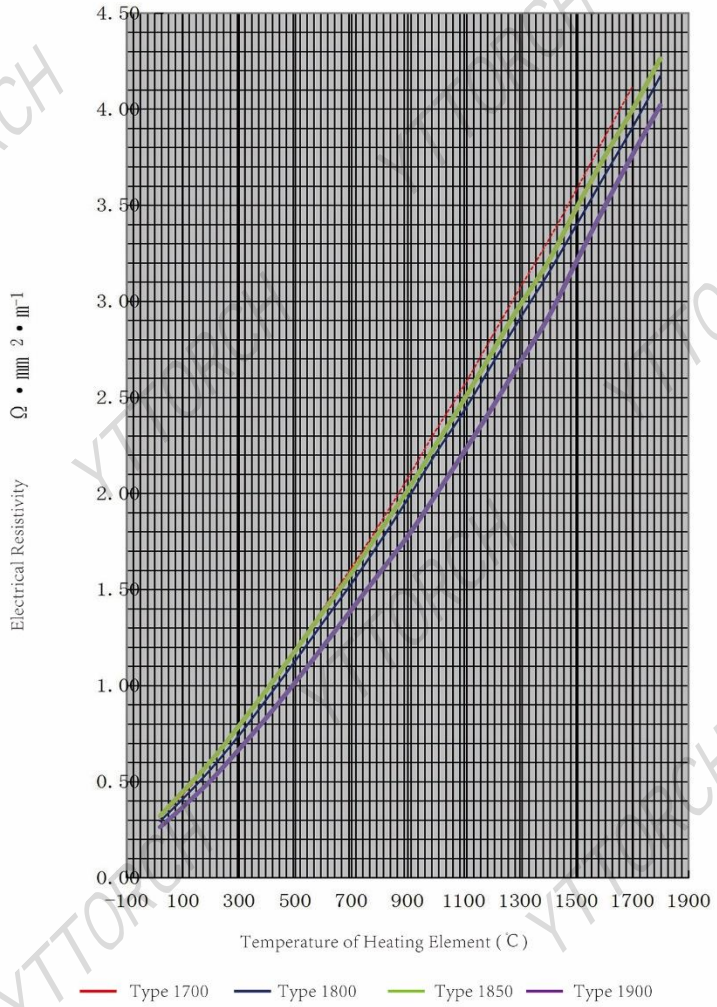
$MoSi_2$ electric heating element is a kind of metal ceramic resistance element, the resistivity increases rapidly with the increase of temperature. It means that when the element is connected to a constant voltage, the power at lower temperature will be higher and will gradually decrease with the increase of temperature, thus shortening the time for the furnace to reach the operating temperature. In addition, with the decrease of the power of the components, the danger of overheating of the components themselves will be reduced.

Based on the material characteristics of $MoSi_2$ electric heating element, special attention should be paid to the design of control system.
(1)The element resistance at 20℃ is 11 times lower than that at 1500℃. Therefore, if full voltage is applied at start-up, a peak current of 11 times the rated current will flow through the element. It will result in fast melt burn out or thyristor failure.
(2)Molybdenum Disilicide material is brittle at Low temperatures, which means that excessive current may cause electromagnetic forces large enough to break the element.

Temperature Comparison Table of Electrical Resistivity of Heating Elements

Temperature (℃)	Electrical Resistivity 1700 Type(Ω·mm^2/m)	Electrical Resistivity 1800 Type(Ω·mm^2/m)	Electrical Resistivity 1850 Type(Ω·mm^2/m)	Electrical Resistivity 1900 Type(Ω·mm^2/m)
20	0.306	0.286	0.321	0.263
100	0.448	0.398	0.447	0.366
200	0.622	0.550	0.605	0.506
300	0.816	0.724	0.789	0.666
400	1.020	0.907	0.980	0.835
500	1.224	1.102	1.179	1.015
600	1.418	1.306	1.384	1.203
700	1.632	1.509	1.584	1.393
800	1.846	1.714	1.800	1.584
900	2.071	1.918	2.014	1.774
1000	2.285	2.142	2.249	1.990
1100	2.499	2.366	2.484	2.212
1200	2.734	2.601	2.731	2.442
1300	2.968	2.836	2.978	2.680
1400	3.223	3.050	3.203	2.913
1500	3.488	3.315	3.481	3.202
1600	3.743	3.570	3.749	3.488
1700	4.029	3.805	3.995	3.759
1800		4.060	4.263	4.019

Variation Curve with Temperature of Electrical Resistivity



3.Maximum Operating Temperature of $MoSi_2$ Electrical Heating Elements in Different Service Environment

Atmosphere	Type 1700	Type1800	Type1850	Type1900
Air	1700	1800	1830	1850
Nitrogen	1600	1700	1700	1700
Argon, Helium	1600	1700	1700	1700
Dry hydrogen dewpoint -80℃	1150	1150	1150	1150
Moist hydrogen dewpoint 20℃	1450	1450	1450	1450
Exogas (Ex. 10% CO_2, 5% CO and 15% H_2)	1600	1700	1700	1700
Endogas (Ex. 40% H_2 and 20% CO)	1400	1450	1450	1450
Cracked and partially burnt ammonia (8% H_2)	1400	1450	1450	1450

Ⅳ.Precautions for Installation of $MoSi_2$ Electrical Heating Elements

$MoSi_2$ electric heating element is a kind of metal ceramic material, which is similar to ceramic at room temperature. It has great brittleness and low impact strength. Therefore, care should be taken during transportation and installation to prevent damage. It has soft plasticity at high temperature. Generally used for electric furnace, the u-shaped element is mostly vertically suspended to the top of the furnace by fixing clamp. The purpose of such kind of installation is to avoid mechanical stress adding to the electrical heating element, which may lead to component fracture.

In selecting and installing $MoSi_2$ heating element, please pay attention to the following dimensions:

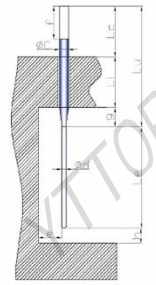


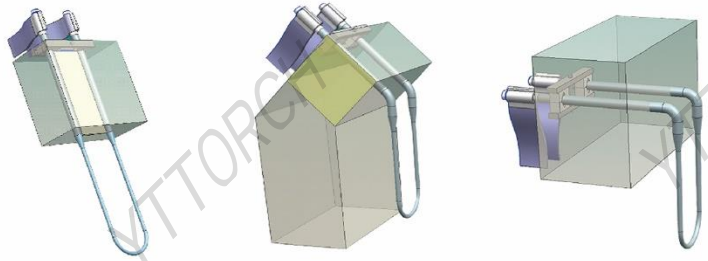
Figure 1. Installation parameters for common U-shaped heating element in furnace

1.Top Distance (Lc)

The furnace top part Lc of electric heating element cold end is mainly used to install the fixture and connecting wire of electric heating element. Therefore, the data of this part varies from different electrical heating elements. Please refer to the following data:

Items \ Element Specifications	Φ3/6	Φ4/9	Φ6/12	Φ9/18	Φ12/24
Furnace Top Size-Lc	50	50	75	125	150
Transition Section Length-g	15	20	25	32	40
Cold Zone Length-Lu	Lc+Li+g				

● Note: In above table, Lc is the minimum value, it's suggested to lengthen it based on actual furnace conditions, Li is the thickness of the furnace top
The cone part (g) of the terminal should be fully below the hot face of the lining and extend into the furnace to prevent the heat of the tapered part from being released, resulting in the damage.



U-shape　　Lu45 °　　Lu90 °

2.Distance to Bottom (h)

In order to prevent the elements from coming into contact with any material deposited on the bottom of the furnace and to compensate for the elongation of the elements at high temperatures, the recommended vertical distance h between the element bend and the furnace floor should be at least: h≥Le/20　　Min. h=10mm

3.Distance to Wall (e)

Working under high temperature, affected by electromagnetic force and other factors, there will be certain deformation on electrical heating element hot end. It is important that the distance between wall and heating zone of the element be large enough to avoid contact. In the case of long elements at high temperatures, electromagnetic forces and bad centering when installing the elements may cause the elements to come in contact with the walls, causing damage.
The minimum distance, e, between the heating zone of the element and the furnace walls depends on the length of element.
When installed along the wall, please refer to the following data:

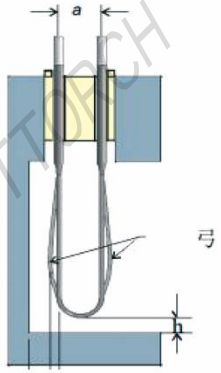
Hot end length-Le	＞1000mm	300～1000mm	＜300mm
Distance from hot end to furnace wall-e	Min. 50mm	Le/20	Min. 15mm

4. Precautions for Installation and Distribution

Due to the high-temperature soft plasticity of the electric heating element, when the working current is large, the hot end will arch outward under the action of magnetic force. If the installation and setting are improper, the two adjacent heating bodies will touch with each other, or the heating body will touch with the furnace wall. Therefore, attention should be paid to when designing the electric furnace and heating element.
$MoSi_2$ heating element are mostly single U-shaped or multi U-shaped combination. The flow of current in the elements generates electromagnetic force, resulting in repulsive force on both side of the U-shaped. After power on, when the heating zone reaches the softening temperature, the distance a(center distance)between the elements increases by electromagnetic repulsive force.
The two legs of the heating part (hot end) of the new element are regular and parallel, but the used element, especially the element after long-term use, will have obvious bow deformation at the hot end, which is actually the direct embodiment of the influence of electromagnetic force on components.

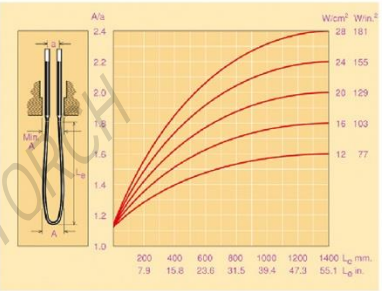
New Element

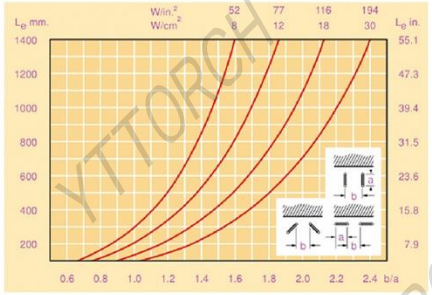
Used Element



Schematic diagram of element affected by electromagnetic force

Please refer to the following graphs for specific solutions:





The longer the hot end of the element and the higher the surface load, the greater the shape variable of the hot end. Therefore, please set the furnace and electrical heating element according to the calculating methods in the graphs during design and installation. We suggest that users reduce the surface load of $MoSi_2$ heating elements as much as possible during the design and use of $MoSi_2$ heating elements (according to actual situation of the electric furnace, the largest number of heating elements should be arranged in the design stage, and the larger diameter of the hot end should be selected). The suggested surface load of YT Torch 1700 type element is below 13.5w/cm² under 1300℃ furnace temperature. The suggested surface load of YT Torch 1800 type element is below 11.5w/cm² under 1600℃ furnace temperature. And the suggested surface load of YT Torch 1850 type products is below 12 w/cm² under 1720℃furnace temperature . If conditions permitting, lower surface load will significantly improve the service life of heating element, reduce the temperature gap between electrical heating element and furnace, and guarantee the uniformity of electric furnace thermal field.

5.The Electrical Heating Element Fixed Clamp and Connection Belt Installation note

Pictures of the electrical heating element fixed clamp and connection belt are shown in Figure 1:

Figure 1 Heating element fixed clamp and connection belt

The installation steps are shown in Figure 2:
Remove the packaging pitch plate of the electrical heating element and adjust the size of the hole of the fixed clamp to let the electrical heating element cold end go through.

Figure 2 Electrical heating element and fixed clamp

Adjust the position of the electrical heating element and the fixed clamp and tighten the fixing screws on the clamp (as shown in Fig. 3).The electrical heating element is very brittle in cold state, pay attention not to twist the electrical heating element and avoid brittle fracture. Spray aluminum parts should stay a little above the clamp to avoid extreme temperature on these parts causing low temperature oxidation and aluminum melts and erodes the cold end.

Figure 3 Tighten the fixing screws

Tighten screws of fixed clamp. Otherwise, as the electric furnace temperature increases, the fixing screws may loosen as a result of thermal expansion and cause the heating element slides by gravity, the heat end distorts and even element fracture. Therefore, during the initial installation, the screws should be tightened again after electric furnace heating up, (If the heating cycle is short, please tighten again after cooling.)
Installation of Connection Belt: Adjust the connection belt hole to make it slightly larger than the diameter of the cold end. Fix the connection belt to spray aluminum parts, and fasten the screws. Thermal expansion and cold contraction of aluminum belt or screws also happens to this part in use, resulting poor contact between connection belt and electrical heating element, and then generates heat or electric arc, which may lead to low-temperature oxidation or arc fusing of elements.Therefore, the fixing screws on the connection belt also have to be fastened again after the electric furnace is started to avoid such problems in this part.
The following picture shows the common form of installing heating element on the top of refractory fiber furnace. The furnace top is slotted, and the thermal insulation module is installed in the middle of the cold end of element. After installation, the whole is inserted in to the furnace from the furnace top.

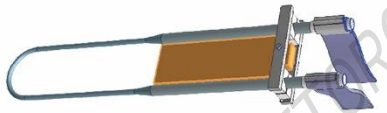


Figure 4 Connection belt installation

V. Precautions for Use of $MoSi_2$ Electrical Heating Elements

$MoSi_2$ materials possess excellent high temperature oxidation resistance, conductivity, high temperature stability, convenient to use and control, and other excellent performance. Due to its own characteristics, attention must be paid during use, otherwise, the $MoSi_2$ electric heating elements are easily damaged by improper use.

1.Low Temperature Oxidation Property

$MoSi_2$ material has excellent high temperature oxidation resistance, but low-temperature oxidation and pulverization will occur at low temperature, especially 400-700℃. Therefore, please avoid element long-term working in the rage of 400-700℃ degree.

2.Resistance Property of $MoSi_2$ Electrical Heating Elements

From the foregoing section 3.2, we' ve learnt that the electrical resistivity of $MoSi_2$ electrical heating element increases with temperature increase. And the resistivity at high temperature is about 10 times that at low temperature.

Compared with metal heating wire , the $MoSi_2$ heating element has much lower electrical resistance and works with low voltage and high current, thus transformer is generally required. The problem is that the electrical resistance of a $MoSi_2$ heating element at low temperature is about 1/10 of that at high temperature. If a large voltage is directly loaded, the current will be 10 times that of the element at high temperature, which will cause a large current impact on the electric control part and heating element. This situation generally occurs at the beginning of power transmission and temperature rise of the electric furnace. When the furnace temperature cannot keep up with the set temperature, the power regulator will have the maximum power output, causing the Low temperature and low electrical resistance heating element to load large voltage and make high current (it takes a certain time for heating element to rise temperature). Generally, we design the component loading voltage do not over 1/3 of the working voltage at low temperature stage. Or limit the current do not exceed the specified operating current of the component.

Here we give an example to show how to set the control parameters of the temperature control meter. For example, there is an electric furnace with 9pcs Φ 6/12 heating elements, which are divided into three groups and each group with three heating elements in star connection. The working parameters of a single element are: 10V-150A-1500W, the transformer output voltage loaded on the three heaters is 35V, the current is 180A, and thyristor regulation (power regulator). Heating system and temperature control meter parameters are set as follows:

Heating System		Temperature Control Meter		Remarks
Heating time-min	Specified Temperature -℃	Power Limiting -F	Maximum Output Voltage -V	
30	300	20～30%	7～10.5	Mainly to limit output voltage of the initial heating section to prevent large current impact, and if there is current limiting function, recommended to set the current not to exceed 150A.
60	1000	100%	35	
60	1500	100%	35	
.....	.....	.....	.....	

In this way, it can effectively prevent large current impact in the initial heating stage. Especially when the heating element is used for a long time, the internal structure of the heating element will change and become greater in brittleness. If the current impact is large, the heating element is very brittle to fracture, so this setting should be more cautious.

The resistance property of the $MoSi_2$ heating element does not change with the using time, so that the old and the new elements can be used at the same time, which can greatly reduce the cost.

3. High Temperature Softening Property of $MoSi_2$ Electrical Heating Element

From the previous chapter, we know that the $MoSi_2$ material has higher intensity but higher brittleness (similar to ceramics) at low temperature. When the temperature reaches more than 1000 °C, it also has metal-like soft plasticity. As $MoSi_2$ electrical heating elements are usually operating at higher temperatures, we should consider the impact of its soft plasticity, to avoid element damage by high temperature deformation.

For example, if the elements are used horizontally, the working temperature should be reduced accordingly, because the temperature getting higher, the soft plasticity would become greater which will bring large deformation. The support of the flat plate and the heat dissipation of the elements should be considered. The deformation caused by gravity of L-shape elements shall be considered, which will cause the element to touch the furnace wall and damage. Therefore, special attention shall be paid in design and installation stage.

4.The Protective Film Characteristic of $MoSi_2$ Electric Heating Element

The surface protective film of $MoSi_2$ electric heating element is a layer of SiO_2 glass film, which can prevent the internal $MoSi_2$ matrix material from continuously oxidizing at high temperature. This is the high temperature oxidation resistance characteristic of $MoSi_2$ material. However, due to the difference in expansion coefficient between the surface SiO_2 glass film and the $MoSi_2$ matrix material, the protective film will peel off during the cooling or heating in an intermittent oxidation atmosphere furnace. This is own characteristics of the $MoSi_2$ electrical heating element. After the SiO_2 glass film falls off and is used in the oxidizing atmosphere again, the surface protective film will be generated again, this is the self-healing function of protective film.

Ⅵ.Electrical Technical Manual of $MoSi_2$ Heating Element

When designing the electrical control system of $MoSi_2$ electric heating element, several characteristics of $MoSi_2$ material should be fully considered: resistance characteristics, ceramic characteristics, high temperature soft plasticity and so on.

1.Control of $MoSi_2$ Electric Heating Element

The low cold resistivity characteristics of $MoSi_2$ heating element implies that full operational voltage connot be applied to a cold furnace. In the past, only tapped transformers were available, allowing a reduced voltage to be applied when the furnace was cold, and then the voltage was gradually increased as the elements heated up, thus maintaining currents within manageable levels.

With the advent of modern thyristor (SCR) power control units and the various feedback control features available today, we now have a reasonably economical and reliable means of limiting the start-up currents and taking full advantage of Silicon molybdenum heating element's rapid heat-up capability.

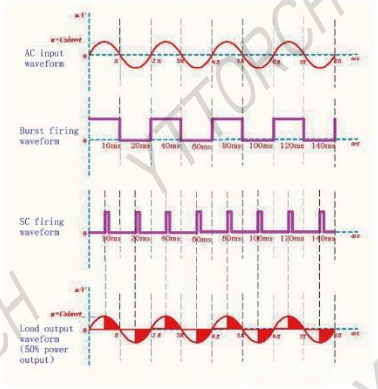
Today furnaces equipped with $MoSi_2$ heating elements are controlled in the following ways:

(1) Thyristor control;
(2) Combined control of thyristor and transformer;
(3) Tap transformer;
(4) High frequency linear DC switching power supply;
(5) Other control modes: such as contactor switch, changing the element connection, and on/off control etc.

Among them, the combination of thyristor, thyristor and transformer are the most commonly used control methods.

Thyristor control

• Phase-angle firing →



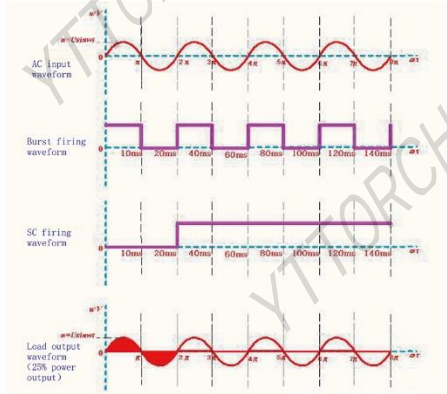
In phase-angle firing, the power is controlled by allowing the thyristors to conduct for a part of the AC cycle only. The thyristor should have a current ramp turn on function and RMS (Root Mean Square) current limit facility. It should be noted that this is not the same as the ramp function of the temperature controller.

The thyristor starts to conduct with a small conduction angle, and then it increases towards maximum conduction during a number of periods. The more power needed, the larger part of the sinusoid is allowed to pass through the thyristors. If maximum permitted current is attained before full wave, the current limit facility does not permit further increase of the conduction angle.

It is essential that the current is both measured and limited in the RMS method. The reason for this phenomenon is that in phase-shifting triggering, it is a working state under the distorted current waveform, and then the RMS method of current measuring is the only way to obtain a correct and meaningful value.

Phase shift triggering is to control the conduction angle of thyristor to control the conduction flux of thyristor. The output waveform is chopped, resulting in voltage distortion and RF interference, which may cause the failure of sensitive electronic equipment.

• Burst Firing

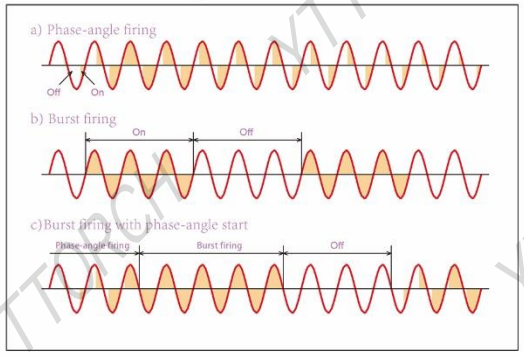


Burst firing is to firing the thyristor when crossing the zero point. Because the alternating current has positive and negative half cycles, it must pass through the zero point during the process from positive half cycle to negative half cycle or from negative half cycle to positive half cycle. Change the number of conduction cycles within a certain time to change the average output power of the thyristor and realize the effect of adjusting the load power, cycle number refers to a complete change of AC, that is, the time experienced by a sinusoidal waveform is called a cycle. This kind of motor output is similar to PWM signal regulation. The more conduction times in a certain time, the greater the average output power. As shown in the figure above, the cycle burst firing the output of all signals, and 25% of the output waveform.

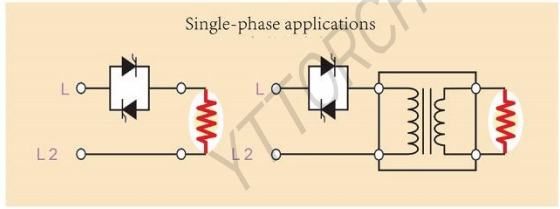
The burst firing principle is to change the cycle number of thyristor conduction, and the output waveform is still sine wave, which has less pollution to the power grid; The disadvantage of burst firing is that it is prone to low-frequency interference. Because the work is intermittent, it is easy to flicker. It is not suitable for loads with obvious variable resistance and requiring continuous and stable current in cold state, such as silicon molybdenum and silicon carbon heating elements.

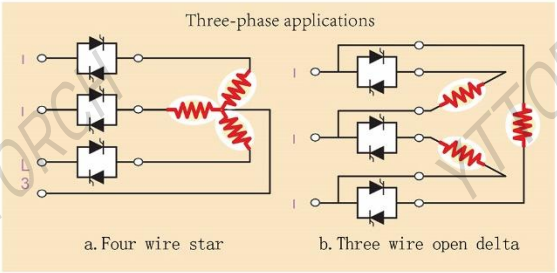
• Burst firing with phase-angle start

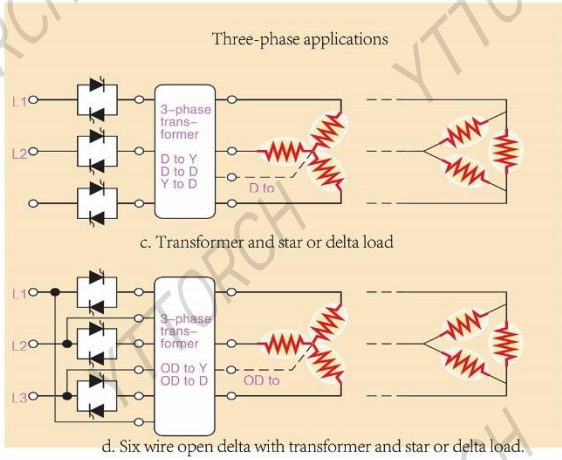
A usual method of dealing with the disadvantages of phase-angle firing and burst firing is to use a combination of them. Phase-angle firing is used during the heating up of the furnace so that the current can be sufficiently limited without using a step-down transformer with different voltage taps. When the furnace reaches a preset temperature below furnace temperature, an automatic switch is turned to burst firing mode. In this way negligible radio frequency interference is created once the furnace is hot. (See the figure below)



Applications with thyristor







2.Selection of Thyristor and Transformer

(1) Thyristor selection

→ Voltage level: determine the voltage level of the control system according to the power of the electric furnace and the local power supply system, so as to determine the voltage level of the thyristor;

→ Rated power: different manufacturers have different suggestions on the matching and selection of thyristor and electric furnace power. The rated power (current) of thyristor is at least 25% higher than the rated power (current) of electric furnace. For specific selection, please refer to the selection suggestions of manufactures.

(2) Transformer selection

Transformer rated power = element rated power * 1.2

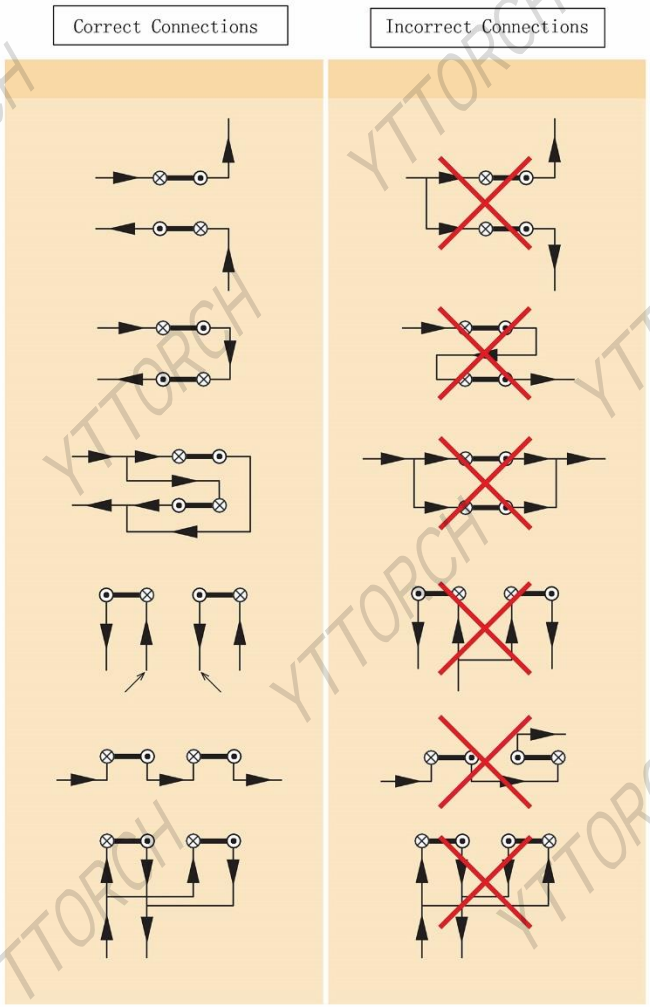
3.Suggestions on Electrical Wiring of $MoSi_2$ Heating Element.

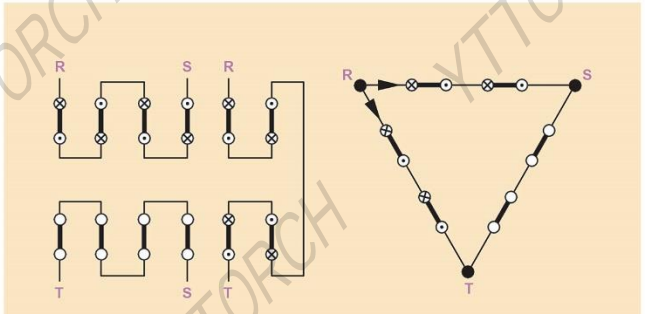
Current passing through two parallel conductors produces an electromagnetic force between them. If the current flows in the same direction in the two conductors, there is an attracting force. If two adjacent $MoSi_2$ heating elements are connected to the same power supply, the current will flow in the same direction and the two adjacent legs will attract each other. When the heating elements reach 1200℃, they will soften and be pulled together by electromagnetic force. When the two heating elements are in contact, they will be damaged.

The influence of electromagnetic force must be considered in the element layout of single-phase, two-phase and three-phase circuits. $MoSi_2$ heating elements are usually placed on both sides of the furnace or around the circle of the cylindrical furnace. Be sure not to connect adjacent components to the same power cord.

In two-phases or three-phases, the same rule applies. Two adjacent elements shall not be connected to a common voltage supply. Intermediate ground connection or Y- connection, the center of star connection can be connected to the terminal legs of adjacent components. The current flows in the same direction, the connecting points should be combined in such a way that the currents in the adjacent shanks of two $MoSi_2$ heating elements have a phase displacement of 120 degrees.

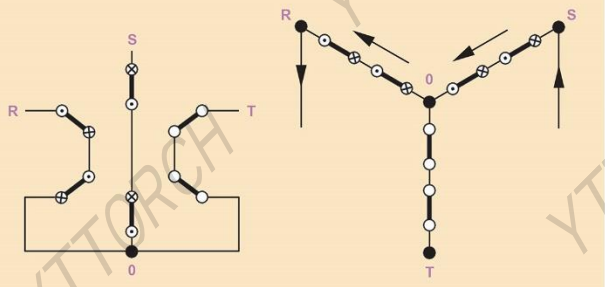
Wiring Diagram of $MoSi_2$ Heating Element:





Consider that the current enters in R and flows to S and T. Momentarily no current is passing through the leg ST. Then the same procedure starting from S and T is followed.

Delta-connected arrangement

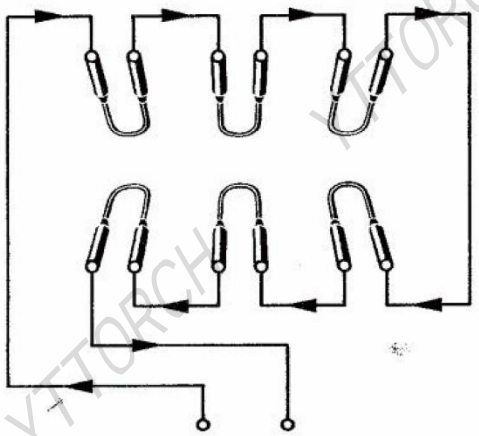


Consider that the current enters in S and flows through 0 to R. Then the same procedure starting from T and then R is followed.

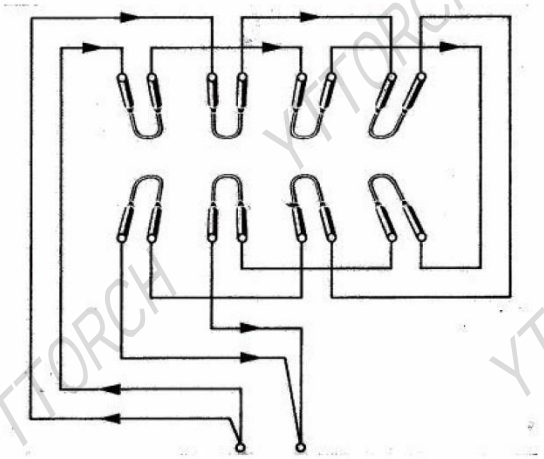
Star connected arrangement

The following pictures are based on the physical wiring method of phase for reference.

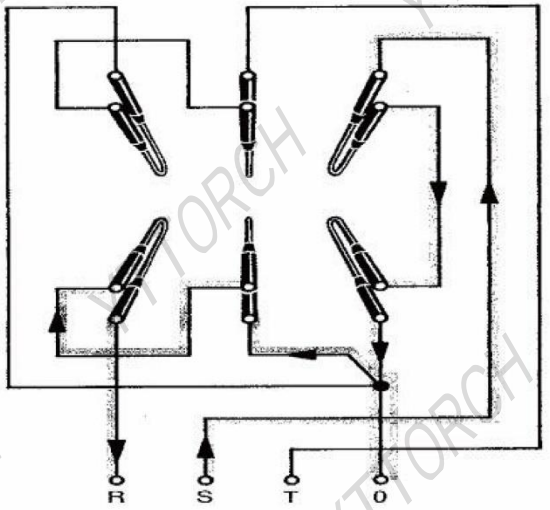
Single-phase connection

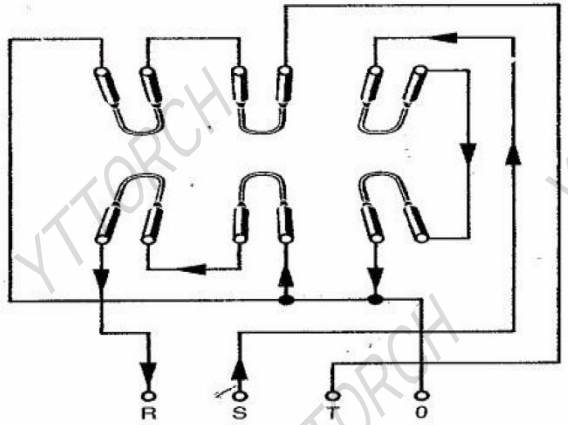


Double single-phase connection

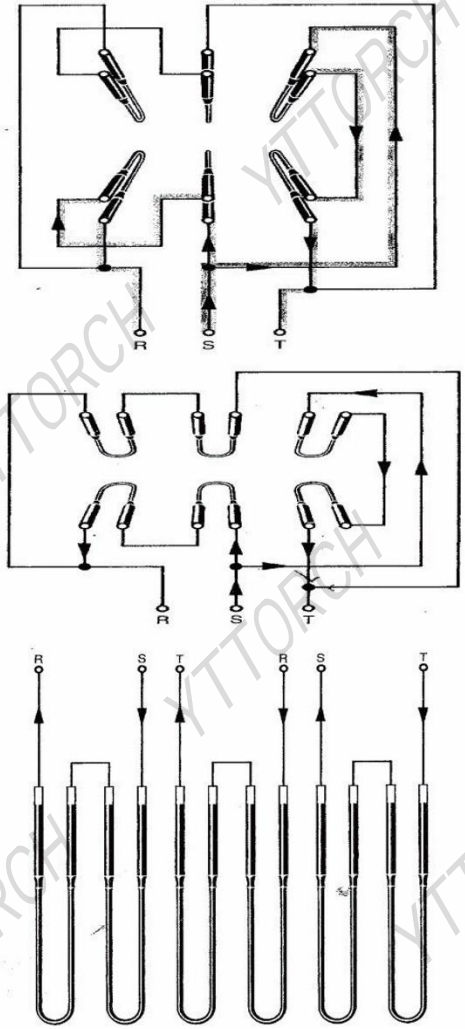


Three-phase Y (Star) connection





Three-phase △ (Delt) connection



4.Temperature Measuring Element

The type of thermocouple used for temperature control depends on the furnace temperature. K-type thermocouple has good stability below 1200℃ and can be used in many heat treatment furnaces. Temperature measurements above 1200℃ usually use thermocouples made of platinum - platinum / rhodium.

Thermocouples age faster the higher the furnace temperature is. Problems with temperature corrosion and overheated $MoSi_2$ elements are often related to ageing thermocouples.

By alloying platinum with rhodium, the usable temperature increases. The high content of rhodium in both shanks gives the highest permissible furnace temperature.

When the rhodium content is increased, the electromotive force decreases and this affects the accuracy of the measurement. When thermocouples are utilized at the maximum classifying temperature, it is important to check the electromotive force frequently in order to avoid increased furnace temperature due to the ageing. In the high-temperature furnace operating at the furnace temperature above 1750 ℃, using Pt / 20% Rh-Pt / 40% Rh, it has been found that the electromotive force will be reduced significantly after only 4-5 hours at the furnace temperature. By the time this has occurred, the thermocouple has become more stable and the change is slower with time. This thermocouple has a low thermoelectric output and small changes can lead to large variations in the furnace temperature and element temperature with subsequent element problems.

For high-temperature furnace, we recommend two thermocouple positions close to each other in the roof. One thermocouple for the controller and the SCR, the other to to check the operating thermocouple and the actual furnace temperature.

	Maximum Operating Temperature	
	Countinuous° C	Intermittent ° C
Pt/ Pt 10 Rh, Graduation S	1400	1650
Pt/ Pt 13 Rh, Graduation R	1400	1650
Pt 6 Rh / Pt 30 Rh, Graduation B	1500	1800
Pt 20 Rh / Pt 40 Rh	1600	1800

VI. Electrical Parameters of Yantai Torch $MoSi_2$ Electirical Heating Elements

Heating Element Temperature: 1550℃ Power: W Furnace Temperatur: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 58A Working Voltage: V Surface Load: 16W/cm² Center Distance: 25mm

1700Type Φ3/Φ6 U-Shape Working Parameters

Hot End Length Le→ / Cold End Length Lu →

mm	50	75	100	125	140	160	180	200	225	250	280	315	350	400
100	260	335	410	486	531	591	652	712	787	863	953	1058	1164	1315
	0.077	0.100	0.122	0.144	0.158	0.176	0.194	0.212	0.234	0.256	0.283	0.315	0.346	0.391
	4.5	5.8	7.1	8.4	9.2	10.2	11.2	12.3	13.6	14.9	16.4	18.2	20.1	22.7
125	272	347	422	498	543	603	664	724	799	875	965	1070	1176	1327
	0.081	0.103	0.126	0.148	0.161	0.179	0.197	0.215	0.238	0.260	0.287	0.318	0.350	0.394
	4.7	6.0	7.3	8.6	9.4	10.4	11.4	12.5	13.8	15.1	16.6	18.5	20.3	22.9
150	284	359	434	510	555	615	676	736	811	887	977	1082	1188	1339
	0.084	0.107	0.129	0.152	0.165	0.183	0.201	0.219	0.241	0.264	0.290	0.322	0.353	0.398
	4.9	6.2	7.5	8.8	9.6	10.6	11.6	12.7	14.0	15.3	16.8	18.7	20.5	23.1
200	309	384	459	535	580	640	701	761	836	912	1002	1107	1213	1364
	0.092	0.114	0.137	0.159	0.172	0.190	0.208	0.226	0.249	0.271	0.298	0.329	0.361	0.405
	5.3	6.6	7.9	9.2	10.0	11.0	12.1	13.1	14.4	15.7	17.3	19.1	20.9	23.5
250	333	408	483	559	604	664	725	785	860	936	1026	1131	1237	1388
	0.099	0.121	0.144	0.166	0.180	0.197	0.215	0.233	0.256	0.278	0.305	0.336	0.368	0.413
	5.7	7.0	8.3	9.6	10.4	11.5	12.5	13.5	14.8	16.1	17.7	19.5	21.3	23.9
300	354	429	504	580	625	685	746	806	881	957	1047	1152	1258	1409
	0.105	0.128	0.150	0.172	0.186	0.204	0.222	0.240	0.262	0.284	0.311	0.343	0.374	0.419
	6.1	7.4	8.7	10.0	10.8	11.8	12.9	13.9	15.2	16.5	18.1	19.9	21.7	24.3
350	376	451	526	602	647	707	768	828	903	979	1069	1174	1280	1431
	0.112	0.134	0.156	0.179	0.192	0.210	0.228	0.246	0.268	0.291	0.318	0.349	0.380	0.425
	6.5	7.8	9.1	10.4	11.2	12.2	13.2	14.3	15.6	16.9	18.4	20.2	22.1	24.7
400	400	475	550	626	671	731	792	852	927	1003	1093	1198	1304	1455
	0.119	0.141	0.164	0.186	0.199	0.217	0.235	0.253	0.276	0.298	0.325	0.356	0.388	0.432
	6.9	8.2	9.5	10.8	11.6	12.6	13.6	14.7	16.0	17.3	18.8	20.7	22.5	25.1
450	423	498	573	649	694	754	815	875	950	1026	1116	1221	1327	1478
	0.126	0.148	0.170	0.193	0.206	0.224	0.242	0.260	0.282	0.305	0.332	0.363	0.394	0.439
	7.3	8.6	9.9	11.2	12.0	13.0	14.0	15.1	16.4	17.7	19.2	21.1	22.9	25.5
500	446	521	596	672	717	777	838	898	973	1049	1139	1244	1350	1501
	0.132	0.155	0.177	0.200	0.213	0.231	0.249	0.267	0.289	0.312	0.339	0.370	0.401	0.446
	7.7	9.0	10.3	11.6	12.4	13.4	14.4	15.5	16.8	18.1	19.6	21.5	23.3	25.9

Heating Element Temperature: 1550℃ Power: W Furnace Temperatur: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 90A Working Voltage: V Surface Load: 16W/cm² Center Distance: 25mm

1700Type Φ4/Φ9 U-Shape Working Parameters

Hot End Length Le→ / Cold End Length Lu →

mm	50	75	100	125	140	160	180	200	225	250	280	315	350	400	450	500
100	330	430	531	631	691	772	852	932	1033	1133	1254	1395	1535	1736	1937	2138
	0.041	0.053	0.065	0.078	0.085	0.095	0.105	0.115	0.128	0.140	0.155	0.172	0.190	0.214	0.239	0.264
	3.7	4.8	5.9	7.0	7.7	8.6	9.5	10.4	11.5	12.6	13.9	15.5	17.1	19.3	21.5	23.8
125	343	443	544	644	704	785	865	945	1046	1146	1267	1408	1548	1749	1950	2151
	0.042	0.055	0.067	0.080	0.087	0.097	0.107	0.117	0.129	0.142	0.156	0.174	0.191	0.216	0.241	0.266
	3.8	4.9	6.0	7.2	7.8	8.7	9.6	10.5	11.6	12.7	14.1	15.6	17.2	19.4	21.7	23.9
150	355	455	556	656	716	797	877	957	1058	1158	1279	1420	1560	1761	1962	2163
	0.044	0.056	0.069	0.081	0.088	0.098	0.108	0.118	0.131	0.143	0.158	0.175	0.193	0.217	0.242	0.267
	3.9	5.1	6.2	7.3	8.0	8.9	9.7	10.6	11.8	12.9	14.2	15.8	17.3	19.6	21.8	24.0
200	381	481	582	682	742	823	903	983	1084	1184	1305	1446	1586	1787	1988	2189
	0.047	0.059	0.072	0.084	0.092	0.102	0.111	0.121	0.134	0.146	0.161	0.178	0.196	0.221	0.245	0.270
	4.2	5.3	6.5	7.6	8.2	9.1	10.0	10.9	12.0	13.2	14.5	16.1	17.6	19.9	22.1	24.3
250	406	506	607	707	767	848	928	1008	1109	1209	1330	1471	1611	1812	2013	2214
	0.050	0.062	0.075	0.087	0.095	0.105	0.115	0.124	0.137	0.149	0.164	0.182	0.199	0.224	0.249	0.273
	4.5	5.6	6.7	7.9	8.5	9.4	10.3	11.2	12.3	13.4	14.8	16.3	17.9	20.1	22.4	24.6
300	437	537	638	738	798	879	959	1039	1140	1240	1361	1502	1642	1843	2044	2245
	0.054	0.066	0.079	0.091	0.099	0.108	0.118	0.128	0.141	0.153	0.168	0.185	0.203	0.228	0.252	0.277
	4.9	6.0	7.1	8.2	8.9	9.8	10.7	11.5	12.7	13.8	15.1	16.7	18.2	20.5	22.7	24.9
350	461	561	662	762	822	903	983	1063	1164	1264	1385	1526	1666	1867	2068	2269
	0.057	0.069	0.082	0.094	0.102	0.111	0.121	0.131	0.144	0.156	0.171	0.188	0.206	0.231	0.255	0.280
	5.1	6.2	7.4	8.5	9.1	10.0	10.9	11.8	12.9	14.0	15.4	17.0	18.5	20.7	23.0	25.2
400	486	586	687	787	847	928	1008	1088	1189	1289	1410	1551	1691	1892	2093	2294
	0.060	0.072	0.085	0.097	0.105	0.115	0.124	0.134	0.147	0.159	0.174	0.191	0.209	0.234	0.258	0.283
	5.4	6.5	7.6	8.7	9.4	10.3	11.2	12.1	13.2	14.3	15.7	17.2	18.8	21.0	23.3	25.5
450	457	532	607	683	728	788	849	909	984	1060	1150	1255	1361	1512	1662	1813
	0.056	0.066	0.075	0.084	0.090	0.097	0.105	0.112	0.122	0.131	0.142	0.155	0.168	0.187	0.205	0.224
	5.1	5.9	6.7	7.6	8.1	8.8	9.4	10.1	10.9	11.8	12.8	13.9	15.1	16.8	18.5	20.1
500	482	557	632	708	753	813	874	934	1009	1085	1175	1280	1386	1537	1687	1838
	0.059	0.069	0.078	0.087	0.093	0.100	0.108	0.115	0.125	0.134	0.145	0.158	0.171	0.190	0.208	0.227
	5.4	6.2	7.0	7.9	8.4	9.0	9.7	10.4	11.2	12.1	13.1	14.2	15.4	17.1	18.7	20.4

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 160A Working Voltage: V Surface Load: 16W/cm² Center Distance: 50mm

1700Type Φ6/Φ12 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu → mm	125	160	180	200	220	250	300	350	400	450	500	560	630	670	710	800	900	1000
150	1002	1221	1346	1471	1596	1784	2097	2410	2722	3035	3348	3723	4161	4411	4661	5224	5850	6475
	0.039	0.048	0.053	0.057	0.062	0.070	0.082	0.094	0.106	0.119	0.131	0.145	0.163	0.172	0.182	0.204	0.229	0.253
	6.3	7.6	8.4	9.2	10.0	11.2	13.1	15.1	17.0	19.0	20.9	23.3	26.0	27.6	29.1	32.7	36.6	40.5
200	1042	1261	1386	1511	1636	1824	2137	2450	2762	3075	3388	3763	4201	4451	4701	5264	5890	6515
	0.041	0.049	0.054	0.059	0.064	0.071	0.083	0.096	0.108	0.120	0.132	0.147	0.164	0.174	0.184	0.206	0.230	0.255
	6.5	7.9	8.7	9.4	10.2	11.4	13.4	15.3	17.3	19.2	21.2	23.5	26.3	27.8	29.4	32.9	36.8	40.7
250	1082	1301	1426	1551	1676	1864	2177	2490	2802	3115	3428	3803	4241	4491	4741	5304	5930	6555
	0.042	0.051	0.056	0.061	0.065	0.073	0.085	0.097	0.109	0.122	0.134	0.149	0.166	0.175	0.185	0.207	0.232	0.256
	6.8	8.1	8.9	9.7	10.5	11.7	13.6	15.6	17.5	19.5	21.4	23.8	26.5	28.1	29.6	33.2	37.1	41.0
280	1102	1321	1446	1571	1696	1884	2197	2510	2822	3135	3448	3823	4261	4511	4761	5324	5950	6575
	0.043	0.052	0.056	0.061	0.066	0.074	0.086	0.098	0.110	0.122	0.135	0.149	0.166	0.176	0.186	0.208	0.232	0.257
	6.9	8.3	9.0	9.8	10.6	11.8	13.7	15.7	17.6	19.6	21.5	23.9	26.6	28.2	29.8	33.3	37.2	41.1
300	1122	1341	1466	1591	1716	1904	2217	2530	2842	3155	3468	3843	4281	4531	4781	5344	5970	6595
	0.044	0.052	0.057	0.062	0.067	0.074	0.087	0.099	0.111	0.123	0.135	0.150	0.167	0.177	0.187	0.209	0.233	0.258
	7.0	8.4	9.2	9.9	10.7	11.9	13.9	15.8	17.8	19.7	21.7	24.0	26.8	28.3	29.9	33.4	37.3	41.2
350	1162	1381	1506	1631	1756	1944	2257	2570	2882	3195	3508	3883	4321	4571	4821	5384	6010	6635
	0.045	0.054	0.059	0.064	0.069	0.076	0.088	0.100	0.113	0.125	0.137	0.152	0.169	0.179	0.188	0.210	0.235	0.259
	7.3	8.6	9.4	10.2	11.0	12.2	14.1	16.1	18.0	20.0	21.9	24.3	27.0	28.6	30.1	33.7	37.6	41.5
400	1202	1421	1546	1671	1796	1984	2297	2610	2922	3235	3548	3923	4361	4611	4861	5424	6050	6675
	0.047	0.056	0.060	0.065	0.070	0.078	0.090	0.102	0.114	0.126	0.139	0.153	0.170	0.180	0.190	0.212	0.236	0.261
	7.5	8.9	9.7	10.4	11.2	12.4	14.4	16.3	18.3	20.2	22.2	24.5	27.3	28.8	30.4	33.9	37.8	41.7
450	1242	1461	1586	1711	1836	2024	2337	2650	2962	3275	3588	3963	4401	4651	4901	5464	6090	6715
	0.049	0.057	0.062	0.067	0.072	0.079	0.091	0.103	0.116	0.128	0.140	0.155	0.172	0.182	0.191	0.213	0.238	0.262
	7.8	9.1	9.9	10.7	11.5	12.7	14.6	16.6	18.5	20.5	22.4	24.8	27.5	29.1	30.6	34.2	38.1	42.0
500	1282	1501	1626	1751	1876	2064	2377	2690	3002	3315	3628	4003	4441	4691	4941	5504	6130	6755
	0.050	0.059	0.064	0.068	0.073	0.081	0.093	0.105	0.117	0.129	0.142	0.156	0.173	0.183	0.193	0.215	0.239	0.264
	8.0	9.4	10.2	10.9	11.7	12.9	14.9	16.8	18.8	20.7	22.7	25.0	27.8	29.3	30.9	34.4	38.3	42.2
560	1322	1541	1666	1791	1916	2104	2417	2730	3042	3355	3668	4043	4481	4731	4981	5544	6170	6795
	0.052	0.060	0.065	0.070	0.075	0.082	0.094	0.107	0.119	0.131	0.143	0.158	0.175	0.185	0.195	0.217	0.241	0.265
	8.3	9.6	10.4	11.2	12.0	13.2	15.1	17.1	19.0	21.0	22.9	25.3	28.0	29.6	31.1	34.7	38.6	42.5
650	1412	1631	1756	1881	2006	2194	2507	2820	3132	3445	3758	4133	4571	4821	5071	5634	6260	6885
	0.055	0.064	0.069	0.073	0.078	0.086	0.098	0.110	0.122	0.135	0.147	0.161	0.179	0.188	0.198	0.220	0.245	0.269
	8.8	10.2	11.0	11.8	12.5	13.7	15.7	17.6	19.6	21.5	23.5	25.8	28.6	30.1	31.7	35.2	39.1	43.0

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 160A Working Voltage: V Surface Load: 16W/cm² Center Distance: 150mm

1700Type Φ6/Φ12 W-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu → mm	180	200	250	280	315	355	410	450	500	600	650	700	750
350	2684	2925	3528	3890	4312	4794	5457	5939	6542	7748	8351	8954	9557
	0.105	0.114	0.138	0.152	0.168	0.187	0.213	0.232	0.256	0.303	0.326	0.350	0.373
	16.8	18.3	22.0	24.3	26.9	30.0	34.1	37.1	40.9	48.4	52.2	56.0	59.7
400	2724	2965	3568	3930	4352	4834	5497	5979	6582	7788	8391	8994	9597
	0.106	0.116	0.139	0.154	0.170	0.189	0.215	0.234	0.257	0.304	0.328	0.351	0.375
	17.0	18.5	22.3	24.6	27.2	30.2	34.4	37.4	41.1	48.7	52.4	56.2	60.0
450	2764	3005	3608	3970	4392	4874	5537	6019	6622	7828	8431	9034	9637
	0.108	0.117	0.141	0.155	0.172	0.190	0.216	0.235	0.259	0.306	0.329	0.353	0.376
	17.3	18.8	22.5	24.8	27.4	30.5	34.6	37.6	41.4	48.9	52.7	56.5	60.2
500	2804	3045	3648	4010	4432	4914	5577	6059	6662	7868	8471	9074	9677
	0.110	0.119	0.142	0.157	0.173	0.192	0.218	0.237	0.260	0.307	0.331	0.354	0.378
	17.5	19.0	22.8	25.1	27.7	30.7	34.9	37.9	41.6	49.2	52.9	56.7	60.5
520	2824	3065	3668	4030	4452	4934	5597	6079	6682	7888	8491	9094	9697
	0.110	0.120	0.143	0.157	0.174	0.193	0.219	0.237	0.261	0.308	0.332	0.355	0.379
	17.6	19.2	22.9	25.2	27.8	30.8	35.0	38.0	41.8	49.3	53.1	56.8	60.6
560	2844	3085	3688	4050	4472	4954	5617	6099	6702	7908	8511	9114	9717
	0.111	0.121	0.144	0.158	0.175	0.194	0.219	0.238	0.262	0.309	0.332	0.356	0.380
	17.8	19.3	23.0	25.3	27.9	31.0	35.1	38.1	41.9	49.4	53.2	57.0	60.7
600	2880	3121	3724	4086	4508	4990	5653	6135	6738	7944	8547	9150	9753
	0.112	0.122	0.145	0.160	0.176	0.195	0.221	0.240	0.263	0.310	0.334	0.357	0.381
	18.0	19.5	23.3	25.5	28.2	31.2	35.3	38.3	42.1	49.7	53.4	57.2	61.0
630	2920	3161	3764	4126	4548	5030	5693	6175	6778	7984	8587	9190	9793
	0.114	0.123	0.147	0.161	0.178	0.196	0.222	0.241	0.265	0.312	0.335	0.359	0.383
	18.2	19.8	23.5	25.8	28.4	31.4	35.6	38.6	42.4	49.9	53.7	57.4	61.2
710	2980	3221	3824	4186	4608	5090	5753	6235	6838	8044	8647	9250	9853
	0.116	0.126	0.149	0.164	0.180	0.199	0.225	0.244	0.267	0.314	0.338	0.361	0.385
	18.6	20.1	23.9	26.2	28.8	31.8	36.0	39.0	42.7	50.3	54.0	57.8	61.6

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 300A Working Voltage: V Surface Load: 16W/cm² Center Distance: 60mm

1700Type Φ9/Φ18 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	125	160	180	200	220	250	300	350	400	450	500	560	600	710	800	900	1000
200	1646	1962	2143	2324	2505	2776	3228	3680	4133	4585	5037	5579	5941	6936	7750	8654	9559
	0.018	0.022	0.024	0.026	0.028	0.031	0.036	0.041	0.046	0.051	0.056	0.062	0.066	0.077	0.086	0.096	0.106
	5.5	6.5	7.1	7.7	8.3	9.3	10.8	12.3	13.8	15.3	16.8	18.6	19.8	23.1	25.8	28.8	31.9
250	1696	2012	2193	2374	2555	2826	3278	3730	4183	4635	5087	5629	5991	6986	7800	8704	9609
	0.019	0.022	0.024	0.026	0.028	0.031	0.036	0.041	0.046	0.051	0.057	0.063	0.067	0.078	0.087	0.097	0.107
	5.7	6.7	7.3	7.9	8.5	9.4	10.9	12.4	13.9	15.4	17.0	18.8	20.0	23.3	26.0	29.0	32.0
280	1746	2062	2243	2424	2605	2876	3328	3780	4233	4685	5137	5679	6041	7036	7850	8754	9659
	0.019	0.023	0.025	0.027	0.029	0.032	0.037	0.042	0.047	0.052	0.057	0.063	0.067	0.078	0.087	0.097	0.107
	5.8	6.9	7.5	8.1	8.7	9.6	11.1	12.6	14.1	15.6	17.1	18.9	20.1	23.5	26.2	29.2	32.2
300	1766	2082	2263	2444	2625	2896	3348	3800	4253	4705	5157	5699	6061	7056	7870	8774	9679
	0.020	0.023	0.025	0.027	0.029	0.032	0.037	0.042	0.047	0.052	0.057	0.063	0.067	0.078	0.087	0.097	0.108
	5.9	6.9	7.5	8.1	8.7	9.7	11.2	12.7	14.2	15.7	17.2	19.0	20.2	23.5	26.2	29.2	32.3
350	1816	2132	2313	2494	2675	2946	3398	3850	4303	4755	5207	5749	6111	7106	7920	8824	9729
	0.020	0.024	0.026	0.028	0.030	0.033	0.038	0.043	0.048	0.053	0.058	0.064	0.068	0.079	0.088	0.098	0.108
	6.1	7.1	7.7	8.3	8.9	9.8	11.3	12.8	14.3	15.8	17.4	19.2	20.4	23.7	26.4	29.4	32.4
400	1866	2182	2363	2544	2725	2996	3448	3900	4353	4805	5257	5799	6161	7156	7970	8874	9779
	0.021	0.024	0.026	0.028	0.030	0.033	0.038	0.043	0.048	0.053	0.058	0.064	0.068	0.080	0.089	0.099	0.109
	6.2	7.3	7.9	8.5	9.1	10.0	11.5	13.0	14.5	16.0	17.5	19.3	20.5	23.9	26.6	29.6	32.6
450	1916	2232	2413	2594	2775	3046	3498	3950	4403	4855	5307	5849	6211	7206	8020	8924	9829
	0.021	0.025	0.027	0.029	0.031	0.034	0.039	0.044	0.049	0.054	0.059	0.065	0.069	0.080	0.089	0.099	0.109
	6.4	7.4	8.0	8.6	9.2	10.2	11.7	13.2	14.7	16.2	17.7	19.5	20.7	24.0	26.7	29.7	32.8
500	1966	2282	2463	2644	2825	3096	3548	4000	4453	4905	5357	5899	6261	7256	8070	8974	9879
	0.022	0.025	0.027	0.029	0.031	0.034	0.039	0.044	0.049	0.054	0.060	0.066	0.070	0.081	0.090	0.100	0.110
	6.6	7.6	8.2	8.8	9.4	10.3	11.8	13.3	14.8	16.3	17.9	19.7	20.9	24.2	26.9	29.9	32.9
560	2016	2332	2513	2694	2875	3146	3598	4050	4503	4955	5407	5949	6311	7306	8120	9024	9929
	0.022	0.026	0.028	0.030	0.032	0.035	0.040	0.045	0.050	0.055	0.060	0.066	0.070	0.081	0.090	0.100	0.110
	6.7	7.8	8.4	9.0	9.6	10.5	12.0	13.5	15.0	16.5	18.0	19.8	21.0	24.4	27.1	30.1	33.1
650	2106	2422	2603	2784	2965	3236	3688	4140	4593	5045	5497	6039	6401	7396	8210	9114	10019
	0.023	0.027	0.029	0.031	0.033	0.036	0.041	0.046	0.051	0.056	0.061	0.067	0.071	0.082	0.091	0.101	0.111
	7.0	8.1	8.7	9.3	9.9	10.8	12.3	13.8	15.3	16.8	18.3	20.1	21.3	24.7	27.4	30.4	33.4
700	2156	2472	2653	2834	3015	3286	3738	4190	4643	5095	5547	6089	6451	7446	8260	9164	10069
	0.024	0.027	0.029	0.031	0.033	0.037	0.042	0.047	0.052	0.057	0.062	0.068	0.072	0.083	0.092	0.102	0.112
	7.2	8.2	8.8	9.4	10.0	11.0	12.5	14.0	15.5	17.0	18.5	20.3	21.5	24.8	27.5	30.5	33.6
800	2256	2572	2753	2934	3115	3386	3838	4290	4743	5195	5647	6189	6551	7546	8360	9264	10169
	0.025	0.029	0.031	0.033	0.035	0.038	0.043	0.048	0.053	0.058	0.063	0.069	0.073	0.084	0.093	0.103	0.113
	7.5	8.6	9.2	9.8	10.4	11.3	12.8	14.3	15.8	17.3	18.8	20.6	21.8	25.2	27.9	30.9	33.9

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 300A Working Voltage: V Surface Load: 16W/cm² Center Distance: 150mm

1700Type Φ9/Φ18 W-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	180	200	220	250	300	350	400	450	500	560	600	720	800
400	4140	4502	4864	5406	6310	7215	8119	9023	9928	11013	11736	13907	15354
	0.046	0.050	0.054	0.060	0.070	0.080	0.090	0.100	0.110	0.122	0.130	0.155	0.171
	13.8	15.0	16.2	18.0	21.0	24.0	27.1	30.1	33.1	36.7	39.1	46.4	51.2
450	4190	4552	4914	5456	6360	7265	8169	9073	9978	11063	11786	13957	15404
	0.047	0.051	0.055	0.061	0.071	0.081	0.091	0.101	0.111	0.123	0.131	0.155	0.171
	14.0	15.2	16.4	18.2	21.2	24.2	27.2	30.2	33.3	36.9	39.3	46.5	51.3
500	4240	4602	4964	5506	6410	7315	8219	9123	10028	11113	11836	14007	15454
	0.047	0.051	0.055	0.061	0.071	0.081	0.091	0.101	0.111	0.123	0.132	0.156	0.172
	14.1	15.3	16.5	18.4	21.4	24.4	27.4	30.4	33.4	37.0	39.5	46.7	51.5
560	4290	4652	5014	5556	6460	7365	8269	9173	10078	11163	11886	14057	15504
	0.048	0.052	0.056	0.062	0.072	0.082	0.092	0.102	0.112	0.124	0.132	0.156	0.172
	14.3	15.5	16.7	18.5	21.5	24.5	27.6	30.6	33.6	37.2	39.6	46.9	51.7
650	4380	4742	5104	5646	6550	7455	8359	9263	10168	11253	11976	14147	15594
	0.049	0.053	0.057	0.063	0.073	0.083	0.093	0.103	0.113	0.125	0.133	0.157	0.173
	14.6	15.8	17.0	18.8	21.8	24.8	27.9	30.9	33.9	37.5	39.9	47.2	52.0
700	4430	4792	5154	5696	6600	7505	8409	9313	10218	11303	12026	14197	15644
	0.049	0.053	0.057	0.063	0.073	0.083	0.093	0.103	0.114	0.126	0.134	0.158	0.174
	14.8	16.0	17.2	19.0	22.0	25.0	28.0	31.0	34.1	37.7	40.1	47.3	52.1
800	4530	4892	5254	5796	6700	7605	8509	9413	10318	11403	12126	14297	15744
	0.050	0.054	0.058	0.064	0.074	0.084	0.095	0.105	0.115	0.127	0.135	0.159	0.175
	15.1	16.3	17.5	19.3	22.3	25.3	28.4	31.4	34.4	38.0	40.4	47.7	52.5

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 470A Working Voltage: V Surface Load: 16W/cm² Center Distance: 80mm

1700Type Φ12/Φ24 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	180	225	250	300	350	400	450	500	560	650	700	800	900	1000
280	2873	3416	3717	4320	4923	5526	6128	6731	7455	8540	9143	10349	11554	12760
	0.014	0.016	0.018	0.020	0.023	0.026	0.029	0.032	0.035	0.040	0.043	0.049	0.055	0.060
	6.2	7.4	8.1	9.4	10.7	12.0	13.3	14.6	16.2	18.6	19.9	22.5	25.1	27.7
315	2943	3486	3787	4390	4993	5596	6198	6801	7525	8610	9213	10419	11624	12830
	0.013	0.016	0.017	0.020	0.023	0.025	0.028	0.031	0.034	0.039	0.042	0.047	0.053	0.058
	6.3	7.4	8.1	9.3	10.6	11.9	13.2	14.5	16.0	18.3	19.6	22.2	24.7	27.3
350	3013	3556	3857	4460	5063	5666	6268	6871	7595	8680	9283	10489	11694	12900
	0.014	0.016	0.017	0.020	0.023	0.026	0.028	0.031	0.034	0.039	0.042	0.047	0.053	0.058
	6.4	7.6	8.2	9.5	10.8	12.1	13.3	14.6	16.2	18.5	19.8	22.3	24.9	27.4
400	3093	3636	3937	4540	5143	5746	6348	6951	7675	8760	9363	10569	11774	12980
	0.014	0.016	0.018	0.021	0.023	0.026	0.029	0.031	0.035	0.040	0.042	0.048	0.053	0.059
	6.6	7.7	8.4	9.7	10.9	12.2	13.5	14.8	16.3	18.6	19.9	22.5	25.1	27.6
450	3173	3716	4017	4620	5223	5826	6428	7031	7755	8840	9443	10649	11854	13060
	0.014	0.017	0.018	0.021	0.024	0.026	0.029	0.032	0.035	0.040	0.043	0.048	0.054	0.059
	6.8	7.9	8.5	9.8	11.1	12.4	13.7	15.0	16.5	18.8	20.1	22.7	25.2	27.8
500	3253	3796	4097	4700	5303	5906	6508	7111	7835	8920	9523	10729	11934	13140
	0.015	0.017	0.019	0.021	0.024	0.027	0.029	0.032	0.035	0.040	0.043	0.049	0.054	0.059
	6.9	8.1	8.7	10.0	11.3	12.6	13.8	15.1	16.7	19.0	20.3	22.8	25.4	28.0
560	3343	3886	4187	4790	5393	5996	6598	7201	7925	9010	9613	10819	12024	13230
	0.015	0.018	0.019	0.022	0.024	0.027	0.030	0.033	0.036	0.041	0.044	0.049	0.054	0.060
	7.1	8.3	8.9	10.2	11.5	12.8	14.0	15.3	16.9	19.2	20.5	23.0	25.6	28.1
600	3413	3956	4257	4860	5463	6066	6668	7271	7995	9080	9683	10889	12094	13300
	0.015	0.018	0.019	0.022	0.025	0.027	0.030	0.033	0.036	0.041	0.044	0.049	0.055	0.060
	7.3	8.4	9.1	10.3	11.6	12.9	14.2	15.5	17.0	19.3	20.6	23.2	25.7	28.3
650	3493	4036	4337	4940	5543	6146	6748	7351	8075	9160	9763	10969	12174	13380
	0.016	0.018	0.020	0.022	0.025	0.028	0.031	0.033	0.037	0.041	0.044	0.050	0.055	0.061
	7.4	8.6	9.2	10.5	11.8	13.1	14.4	15.6	17.2	19.5	20.8	23.3	25.9	28.5
710	3573	4116	4417	5020	5623	6226	6828	7431	8155	9240	9843	11049	12254	13460
	0.016	0.019	0.020	0.023	0.025	0.028	0.031	0.034	0.037	0.042	0.045	0.050	0.055	0.061
	7.6	8.8	9.4	10.7	12.0	13.2	14.5	15.8	17.4	19.7	20.9	23.5	26.1	28.6

Heating Element Temperature: 1550℃ Power: W Furnace Temperature: 1300℃ Element Resistance (1550℃): Ω
Heating Element Curren: 470A Working Voltage: V Surface Load: 16W/cm² Center Distance: 180mm

1700Type Φ12/Φ24 W-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	180	225	250	300	350	400	450	500	560	600	650	720
450	5542	6627	7230	8436	9642	10848	12053	13259	14706	15671	16876	18564
	0.025	0.030	0.033	0.038	0.044	0.049	0.055	0.060	0.067	0.071	0.076	0.084
	11.8	14.1	15.4	17.9	20.5	23.1	25.6	28.2	31.3	33.3	35.9	39.5
500	5622	6707	7310	8516	9722	10928	12133	13339	14786	15751	16956	18644
	0.025	0.030	0.033	0.039	0.044	0.049	0.055	0.060	0.067	0.071	0.077	0.084
	12.0	14.3	15.6	18.1	20.7	23.3	25.8	28.4	31.5	33.5	36.1	39.7
560	5712	6797	7400	8606	9812	11018	12223	13429	14876	15841	17046	18734
	0.026	0.031	0.034	0.039	0.044	0.050	0.055	0.061	0.067	0.072	0.077	0.085
	12.2	14.5	15.7	18.3	20.9	23.4	26.0	28.6	31.7	33.7	36.3	39.9
600	5782	6867	7470	8676	9882	11088	12293	13499	14946	15911	17116	18804
	0.026	0.031	0.034	0.039	0.045	0.050	0.056	0.061	0.068	0.072	0.077	0.085
	12.3	14.6	15.9	18.5	21.0	23.6	26.2	28.7	31.8	33.9	36.4	40.0
650	5862	6947	7550	8756	9962	11168	12373	13579	15026	15991	17196	18884
	0.027	0.031	0.034	0.040	0.045	0.051	0.056	0.061	0.068	0.072	0.078	0.085
	12.5	14.8	16.1	18.6	21.2	23.8	26.3	28.9	32.0	34.0	36.6	40.2
710	5942	7027	7630	8836	10042	11248	12453	13659	15106	16071	17276	18964
	0.027	0.032	0.035	0.040	0.045	0.051	0.056	0.062	0.068	0.073	0.078	0.086
	12.6	15.0	16.2	18.8	21.4	23.9	26.5	29.1	32.1	34.2	36.8	40.3

Heating Element Temperature: 1700℃ Power: W Furnace Temperature: 1600℃ Element Resistance (1700℃): Ω
Heating Element Curren: 47A Working Voltage: V Surface Load: 11.5W/cm² Center Distance: 25mm

1800Type Φ3/Φ6 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	75	100	125	140	160	180	200	225	250	280	315	355	400	450	500
50	198 0.089 4.2	255 0.115 5.4	312 0.141 6.6	346 0.157 7.4	392 0.177 8.3	437 0.198 9.3	483 0.219 10.3	540 0.245 11.5	597 0.270 12.7	666 0.301 14.2	746 0.338 15.9	837 0.379 17.8	940 0.426 20.0	1054 0.477 22.4	1168 0.529 24.9
75	204 0.093 4.4	262 0.118 5.6	319 0.144 6.8	353 0.160 7.5	399 0.180 8.5	444 0.201 9.5	490 0.222 10.4	547 0.248 11.6	604 0.274 12.9	673 0.305 14.3	753 0.341 16.0	844 0.382 18.0	947 0.429 20.1	1061 0.480 22.6	1175 0.532 25.0
100	211 0.096 4.5	268 0.121 5.7	325 0.147 6.9	360 0.163 7.7	405 0.184 8.6	451 0.204 9.6	497 0.225 10.6	554 0.251 11.8	611 0.277 13.0	679 0.308 14.5	759 0.344 16.2	851 0.385 18.1	954 0.432 20.3	1068 0.483 22.7	1182 0.535 25.1
125	218 0.099 4.6	275 0.125 5.9	332 0.150 7.1	367 0.166 7.8	412 0.187 8.8	458 0.207 9.7	504 0.228 10.7	561 0.254 11.9	618 0.280 13.1	686 0.311 14.6	766 0.347 16.3	858 0.388 18.2	960 0.435 20.4	1075 0.486 22.9	1189 0.538 25.3
140	222 0.101 4.7	275 0.125 5.9	332 0.150 7.1	367 0.166 7.8	412 0.187 8.8	458 0.207 9.7	504 0.228 10.7	561 0.254 11.9	618 0.280 13.1	686 0.311 14.6	766 0.347 16.3	858 0.388 18.2	960 0.435 20.4	1075 0.486 22.9	1189 0.538 25.3
160	228 0.103 4.8	285 0.129 6.1	342 0.155 7.3	376 0.170 8.0	422 0.191 9.0	467 0.212 9.9	513 0.232 10.9	570 0.258 12.1	627 0.284 13.3	696 0.315 14.8	776 0.351 16.5	867 0.393 18.4	960 0.435 20.4	1075 0.486 22.9	1198 0.542 25.5
180	233 0.105 5.0	290 0.131 6.2	347 0.157 7.4	381 0.173 8.1	427 0.193 9.1	473 0.214 10.1	519 0.235 11.0	576 0.261 12.2	633 0.286 13.5	701 0.317 14.9	781 0.354 16.6	873 0.395 18.6	975 0.442 20.8	1090 0.493 23.2	1204 0.545 25.6
200	238 0.108 5.1	296 0.134 6.3	353 0.160 7.5	387 0.175 8.2	433 0.196 9.2	478 0.217 10.2	524 0.237 11.1	581 0.263 12.4	638 0.289 13.6	707 0.320 15.0	787 0.356 16.7	878 0.397 18.7	981 0.444 20.9	1095 0.496 23.3	1209 0.547 25.7
250	252 0.114 5.4	309 0.140 6.6	366 0.166 7.8	401 0.181 8.5	446 0.202 9.5	492 0.223 10.5	538 0.243 11.4	595 0.269 12.7	652 0.295 13.9	720 0.326 15.3	800 0.362 17.0	892 0.404 19.0	994 0.450 21.2	1109 0.502 23.6	1223 0.554 26.0
300	266 0.120 5.7	323 0.146 6.9	380 0.172 8.1	414 0.187 8.8	460 0.208 9.8	506 0.229 10.8	551 0.250 11.7	608 0.275 12.9	665 0.301 14.2	734 0.332 15.6	814 0.368 17.3	905 0.410 19.3	1008 0.456 21.4	1122 0.508 23.9	1236 0.560 26.3
350	279 0.126 5.9	336 0.152 7.2	393 0.178 8.4	428 0.194 9.1	473 0.214 10.1	519 0.235 11.0	565 0.256 12.0	622 0.282 13.2	679 0.307 14.4	748 0.338 15.9	827 0.375 17.6	919 0.416 19.5	1022 0.462 21.7	1136 0.514 24.2	1250 0.566 26.6

Heating Element Temperature: 1700℃ Power: W Furnace Temperature: 1600℃ Element Resistance (1700℃): Ω
Heating Element Curren: 70A Working Voltage: V Surface Load: 11.5W/cm² Center Distance: 25mm

1800Type Φ4/Φ9 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	75	100	125	140	160	180	200	225	250	280	315	355	400	450	500
50	248 0.051 3.5	321 0.065 4.6	393 0.080 5.6	437 0.089 6.2	495 0.101 7.1	553 0.113 7.9	611 0.125 8.7	683 0.139 9.8	756 0.154 10.8	843 0.172 12.0	944 0.193 13.5	1060 0.216 15.1	1191 0.243 17.0	1336 0.273 19.1	1481 0.302 21.2
75	255 0.052 3.6	328 0.067 4.7	400 0.082 5.7	444 0.091 6.3	502 0.102 7.2	560 0.114 8.0	618 0.126 8.8	690 0.141 9.9	763 0.156 10.9	850 0.173 12.1	951 0.194 13.6	1067 0.218 15.2	1198 0.244 17.1	1343 0.274 19.2	1488 0.304 21.3
100	262 0.054 3.7	335 0.068 4.8	407 0.083 5.8	451 0.092 6.4	509 0.104 7.3	567 0.116 8.1	625 0.128 8.9	697 0.142 10.0	770 0.157 11.0	857 0.175 12.2	958 0.196 13.7	1074 0.219 15.3	1205 0.246 17.2	1350 0.276 19.3	1495 0.305 21.4
125	269 0.055 3.8	342 0.070 4.9	414 0.085 5.9	458 0.093 6.5	516 0.105 7.4	574 0.117 8.2	632 0.129 9.0	704 0.144 10.1	777 0.159 11.1	864 0.176 12.3	965 0.197 13.8	1081 0.221 15.4	1212 0.247 17.3	1357 0.277 19.4	1502 0.307 21.5
140	273 0.056 3.9	346 0.071 4.9	419 0.085 6.0	462 0.094 6.6	520 0.106 7.4	578 0.118 8.3	636 0.130 9.1	709 0.145 10.1	781 0.159 11.2	868 0.177 12.4	970 0.198 13.9	1086 0.222 15.5	1216 0.248 17.4	1361 0.278 19.4	1506 0.307 21.5
160	279 0.057 4.0	352 0.072 5.0	424 0.087 6.1	468 0.095 6.7	526 0.107 7.5	584 0.119 8.3	642 0.131 9.2	714 0.146 10.2	787 0.161 11.2	874 0.178 12.5	975 0.199 13.9	1091 0.223 15.6	1222 0.249 17.5	1367 0.279 19.5	1512 0.309 21.6
180	285 0.058 4.1	357 0.073 5.1	430 0.088 6.1	473 0.097 6.8	531 0.108 7.6	589 0.120 8.4	647 0.132 9.2	720 0.147 10.3	792 0.162 11.3	879 0.179 12.6	981 0.200 14.0	1097 0.224 15.7	1227 0.251 17.5	1372 0.280 19.6	1518 0.310 21.7
200	290 0.059 4.1	363 0.074 5.2	435 0.089 6.2	479 0.098 6.8	537 0.110 7.7	595 0.121 8.5	653 0.133 9.3	725 0.148 10.4	798 0.163 11.4	885 0.181 12.6	986 0.201 14.1	1103 0.225 15.8	1233 0.252 17.6	1378 0.281 19.7	1523 0.311 21.8
250	304 0.062 4.3	377 0.077 5.4	449 0.092 6.4	493 0.101 7.0	551 0.112 7.9	609 0.124 8.7	667 0.136 9.5	739 0.151 10.6	812 0.166 11.6	899 0.183 12.8	1001 0.204 14.3	1117 0.228 16.0	1247 0.255 17.8	1392 0.284 19.9	1537 0.314 22.0
300	318 0.065 4.5	391 0.080 5.6	463 0.095 6.6	507 0.103 7.2	565 0.115 8.1	623 0.127 8.9	681 0.139 9.7	753 0.154 10.8	826 0.169 11.8	913 0.186 13.0	1015 0.207 14.5	1131 0.231 16.2	1261 0.257 18.0	1406 0.287 20.1	1551 0.317 22.2
350	332 0.068 4.7	405 0.083 5.8	477 0.097 6.8	521 0.106 7.4	579 0.118 8.3	637 0.130 9.1	695 0.142 9.9	767 0.157 11.0	840 0.171 12.0	927 0.189 13.2	1029 0.210 14.7	1145 0.234 16.4	1275 0.260 18.2	1420 0.290 20.3	1565 0.319 22.4

Heating Element Temperature: 1700℃ Power: W Furnace Temperature: 1600℃ Element Resistance (1700℃): Ω

Heating Element Curren: 130A Working Voltage: V Surface Load: 11.5W/cm² Center Distance: 50mm

1800Type Φ6/Φ12 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	140	160	180	200	225	250	280	315	355	400	450	500	560	630	720	815	850	900
125	771 0.046 5.9	864 0.051 6.6	957 0.057 7.4	1050 0.062 8.1	1167 0.069 9.0	1284 0.076 9.9	1424 0.084 11.0	1587 0.094 12.2	1773 0.105 13.6	1983 0.117 15.3	2217 0.131 17.1	2450 0.145 18.8	2730 0.162 21.0	3056 0.181 23.5	3476 0.206 26.7	3919 0.232 30.1	4082 0.242 31.4	4315 0.255 33.2
140	778 0.046 6.0	872 0.052 6.7	965 0.057 7.4	1058 0.063 8.1	1175 0.070 9.0	1291 0.076 9.9	1431 0.085 11.0	1595 0.094 12.3	1781 0.105 13.7	1991 0.118 15.3	2224 0.132 17.1	2458 0.145 18.9	2737 0.162 21.1	3064 0.181 23.6	3484 0.206 26.8	3927 0.232 30.2	4090 0.242 31.5	4323 0.256 33.3
160	789 0.047 6.1	882 0.052 6.8	975 0.058 7.5	1069 0.063 8.2	1185 0.070 9.1	1302 0.077 10.0	1442 0.085 11.1	1605 0.095 12.3	1792 0.106 13.8	2002 0.118 15.4	2235 0.132 17.2	2468 0.146 19.0	2748 0.163 21.1	3074 0.182 23.6	3494 0.207 26.9	3937 0.233 30.3	4100 0.243 31.5	4334 0.256 33.3
180	799 0.047 6.1	892 0.053 6.9	986 0.058 7.6	1079 0.064 8.3	1196 0.071 9.2	1312 0.078 10.1	1452 0.086 11.2	1615 0.096 12.4	1802 0.107 13.9	2012 0.119 15.5	2245 0.133 17.3	2478 0.147 19.1	2758 0.163 21.2	3085 0.183 23.7	3505 0.207 27.0	3948 0.234 30.4	4111 0.243 31.6	4344 0.257 33.4
200	810 0.048 6.2	903 0.053 6.9	996 0.059 7.7	1089 0.064 8.4	1206 0.071 9.3	1323 0.078 10.2	1463 0.087 11.3	1626 0.096 12.5	1812 0.107 13.9	2022 0.120 15.6	2256 0.133 17.4	2489 0.147 19.1	2769 0.164 21.3	3095 0.183 23.8	3515 0.208 27.0	3958 0.234 30.4	4121 0.244 31.7	4355 0.258 33.5
225	823 0.049 6.3	916 0.054 7.0	1009 0.060 7.8	1102 0.065 8.5	1219 0.072 9.4	1336 0.079 10.3	1476 0.087 11.4	1639 0.097 12.6	1825 0.108 14.0	2035 0.120 15.7	2269 0.134 17.5	2502 0.148 19.2	2782 0.165 21.4	3108 0.184 23.9	3528 0.209 27.1	3971 0.235 30.5	4134 0.245 31.8	4368 0.258 33.6
250	836 0.049 6.4	929 0.055 7.1	1022 0.060 7.9	1115 0.066 8.6	1232 0.073 9.5	1349 0.080 10.4	1489 0.088 11.5	1652 0.098 12.7	1838 0.109 14.1	2048 0.121 15.8	2282 0.135 17.6	2515 0.149 19.3	2795 0.165 21.5	3121 0.185 24.0	3541 0.210 27.2	3984 0.236 30.6	4147 0.245 31.9	4381 0.259 33.7
280	851 0.050 6.5	945 0.056 7.3	1038 0.061 8.0	1131 0.067 8.7	1248 0.074 9.6	1364 0.081 10.5	1504 0.089 11.6	1668 0.099 12.8	1854 0.110 14.3	2064 0.122 15.9	2297 0.136 17.7	2530 0.150 19.5	2810 0.166 21.6	3137 0.186 24.1	3557 0.210 27.4	4000 0.237 30.8	4163 0.246 32.0	4396 0.260 33.8
315	869 0.051 6.7	963 0.057 7.4	1056 0.062 8.1	1149 0.068 8.8	1266 0.075 9.7	1383 0.082 10.6	1522 0.090 11.7	1686 0.100 13.0	1872 0.111 14.4	2082 0.123 16.0	2315 0.137 17.8	2549 0.151 19.6	2829 0.167 21.8	3155 0.187 24.3	3575 0.212 27.5	4018 0.238 30.9	4181 0.247 32.2	4414 0.261 34.0
355	890 0.053 6.8	984 0.058 7.6	1077 0.064 8.3	1170 0.069 9.0	1287 0.076 9.9	1403 0.083 10.8	1543 0.091 11.9	1707 0.101 13.1	1893 0.112 14.6	2103 0.124 16.2	2336 0.138 18.0	2569 0.152 19.8	2849 0.169 21.9	3176 0.188 24.4	3596 0.213 27.7	4039 0.239 31.1	4202 0.249 32.3	4435 0.262 34.1
400	914 0.054 7.0	1007 0.060 7.7	1100 0.065 8.5	1194 0.071 9.2	1310 0.078 10.1	1427 0.084 11.0	1567 0.093 12.1	1730 0.102 13.3	1917 0.113 14.7	2126 0.126 16.4	2360 0.140 18.2	2593 0.153 19.9	2873 0.170 22.1	3199 0.189 24.6	3619 0.214 27.8	4062 0.240 31.2	4225 0.250 32.5	4459 0.264 34.3
450	940 0.056 7.2	1033 0.061 7.9	1126 0.067 8.7	1220 0.072 9.4	1336 0.079 10.3	1453 0.086 11.2	1593 0.094 12.3	1756 0.104 13.5	1943 0.115 14.9	2152 0.127 16.6	2386 0.141 18.4	2619 0.155 20.1	2899 0.172 22.3	3225 0.191 24.8	3645 0.216 28.0	4088 0.242 31.4	4251 0.252 32.7	4485 0.265 34.5
500	966 0.057 7.4	1059 0.063 8.1	1152 0.068 8.9	1246 0.074 9.6	1362 0.081 10.5	1479 0.088 11.4	1619 0.096 12.5	1782 0.105 13.7	1969 0.116 15.1	2178 0.129 16.8	2412 0.143 18.6	2645 0.157 20.3	2925 0.173 22.5	3251 0.192 25.0	3671 0.217 28.2	4114 0.243 31.6	4277 0.253 32.9	4511 0.267 34.7

Heating Element Temperature: 1700℃ Power: W Furnace Temperature: 1600℃ Element Resistance (1700℃): Ω

Heating Element Curren: 245A Working Voltage: V Surface Load: 11.5W/cm² Center Distance: 60mm

1800Type Φ9/Φ18 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	160	180	200	225	250	280	315	355	400	450	500	550	600	650	700	750	800	850	900	1000
200	1407 0.023 5.7	1552 0.026 6.3	1696 0.028 6.9	1876 0.031 7.7	2056 0.034 8.4	2272 0.038 9.3	2524 0.042 10.3	2812 0.047 11.5	3136 0.052 12.8	3496 0.058 14.3	3856 0.064 15.7	4217 0.070 17.2	4577 0.076 18.7	4937 0.082 20.2	5297 0.088 21.6	5657 0.094 23.1	6017 0.100 24.6	6378 0.106 26.0	6738 0.112 27.5	7458 0.124 30.4
250	1449 0.024 5.9	1593 0.027 6.5	1737 0.029 7.1	1917 0.032 7.8	2097 0.035 8.6	2313 0.039 9.4	2565 0.043 10.5	2853 0.048 11.6	3177 0.053 13.0	3538 0.059 14.4	3898 0.065 15.9	4258 0.071 17.4	4618 0.077 18.8	4978 0.083 20.3	5338 0.089 21.8	5698 0.095 23.3	6059 0.101 24.7	6419 0.107 26.2	6779 0.113 27.7	7499 0.125 30.6
280	1473 0.025 6.0	1618 0.027 6.6	1762 0.029 7.2	1942 0.032 7.9	2122 0.035 8.7	2338 0.039 9.5	2590 0.043 10.6	2878 0.048 11.7	3202 0.053 13.1	3562 0.059 14.5	3922 0.065 16.0	4283 0.071 17.5	4643 0.077 19.0	5003 0.083 20.4	5363 0.089 21.9	5723 0.095 23.4	6083 0.101 24.8	6444 0.107 26.3	6804 0.113 27.8	7524 0.125 30.7
315	1502 0.025 6.1	1646 0.027 6.7	1790 0.030 7.3	1971 0.033 8.0	2151 0.036 8.8	2367 0.039 9.7	2619 0.044 10.7	2907 0.048 11.9	3231 0.054 13.2	3591 0.060 14.7	3951 0.066 16.1	4311 0.072 17.6	4672 0.078 19.1	5032 0.084 20.5	5392 0.090 22.0	5752 0.096 23.5	6112 0.102 24.9	6472 0.108 26.4	6833 0.114 27.9	7553 0.126 30.8
355	1535 0.026 6.3	1679 0.028 6.9	1823 0.030 7.4	2003 0.033 8.2	2184 0.036 8.9	2400 0.040 9.8	2652 0.044 10.8	2940 0.049 12.0	3264 0.054 13.3	3624 0.060 14.8	3984 0.066 16.3	4344 0.072 17.7	4705 0.078 19.2	5065 0.084 20.7	5425 0.090 22.1	5785 0.096 23.6	6145 0.102 25.1	6505 0.108 26.6	6866 0.114 28.0	7586 0.126 31.0
400	1572 0.026 6.4	1716 0.029 7.0	1861 0.031 7.6	2041 0.034 8.3	2221 0.037 9.1	2437 0.041 9.9	2689 0.045 11.0	2977 0.050 12.2	3301 0.055 13.5	3661 0.061 14.9	4021 0.067 16.4	4382 0.073 17.9	4742 0.079 19.4	5102 0.085 20.8	5462 0.091 22.3	5822 0.097 23.8	6182 0.103 25.2	6542 0.109 26.7	6903 0.115 28.2	7623 0.127 31.1
450	1614 0.027 6.6	1758 0.029 7.2	1902 0.032 7.8	2082 0.035 8.5	2262 0.038 9.2	2478 0.041 10.1	2730 0.045 11.1	3018 0.050 12.3	3342 0.056 13.6	3703 0.062 15.1	4063 0.068 16.6	4423 0.074 18.1	4783 0.080 19.5	5143 0.086 21.0	5503 0.092 22.5	5863 0.098 23.9	6224 0.104 25.4	6584 0.110 26.9	6944 0.116 28.3	7664 0.128 31.3
500	1655 0.028 6.8	1799 0.030 7.3	1943 0.032 7.9	2123 0.035 8.7	2303 0.038 9.4	2519 0.042 10.3	2771 0.046 11.3	3059 0.051 12.5	3384 0.056 13.8	3744 0.062 15.3	4104 0.068 16.8	4464 0.074 18.2	4824 0.080 19.7	5184 0.086 21.2	5545 0.092 22.6	5905 0.098 24.1	6265 0.104 25.6	6625 0.110 27.0	6985 0.116 28.5	7705 0.128 31.5
560	1704 0.028 7.0	1848 0.031 7.5	1992 0.033 8.1	2173 0.036 8.9	2353 0.039 9.6	2569 0.043 10.5	2821 0.047 11.5	3109 0.052 12.7	3433 0.057 14.0	3793 0.063 15.5	4153 0.069 17.0	4514 0.075 18.4	4874 0.081 19.9	5234 0.087 21.4	5594 0.093 22.8	5954 0.099 24.3	6314 0.105 25.8	6674 0.111 27.2	7035 0.117 28.7	7755 0.129 31.7
600	1737 0.029 7.1	1881 0.031 7.7	2025 0.034 8.3	2206 0.037 9.0	2386 0.040 9.7	2602 0.043 10.6	2854 0.048 11.6	3142 0.052 12.8	3466 0.058 14.1	3826 0.064 15.6	4186 0.070 17.1	4547 0.076 18.6	4907 0.082 20.0	5267 0.088 21.5	5627 0.094 23.0	5987 0.100 24.4	6347 0.106 25.9	6707 0.112 27.4	7068 0.118 28.8	7788 0.130 31.8
650	1779 0.030 7.3	1923 0.032 7.8	2067 0.034 8.4	2247 0.037 9.2	2427 0.040 9.9	2643 0.044 10.8	2895 0.048 11.8	3183 0.053 13.0	3507 0.058 14.3	3867 0.064 15.8	4228 0.070 17.3	4588 0.076 18.7	4948 0.082 20.2	5308 0.088 21.7	5668 0.094 23.1	6028 0.100 24.6	6389 0.106 26.1	6749 0.112 27.5	7109 0.118 29.0	7829 0.130 32.0
700	1820 0.030 7.4	1964 0.033 8.0	2108 0.035 8.6	2288 0.038 9.3	2468 0.041 10.1	2684 0.045 11.0	2936 0.049 12.0	3224 0.054 13.2	3549 0.059 14.5	3909 0.065 16.0	4269 0.071 17.4	4629 0.077 18.9	4989 0.083 20.4	5349 0.089 21.8	5709 0.095 23.3	6070 0.101 24.8	6430 0.107 26.2	6790 0.113 27.7	7150 0.119 29.2	7870 0.131 32.1
750	1861 0.031 7.6	2005 0.033 8.2	2149 0.036 8.8	2329 0.039 9.5	2509 0.042 10.2	2725 0.045 11.1	2978 0.050 12.2	3266 0.054 13.3	3590 0.060 14.7	3950 0.066 16.1	4310 0.072 17.6	4670 0.078 19.1	5030 0.084 20.5	5391 0.090 22.0	5751 0.096 23.5	6111 0.102 24.9	6471 0.108 26.4	6831 0.114 27.9	7191 0.120 29.4	7912 0.132 32.3

YANTAI TORCH SPECIAL HIGH TEMPERATURE CERAMICS CO., LTD.

Heating Element Temperature: 1700℃ Power: W Furnace Temperature: 1600℃ Element Resistance (1700℃): Ω
Heating Element Curren: 360A Working Voltage: V Surface Load: 11.5W/cm² Center Distance: 80mm

1800Type Φ12/Φ24 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	180	200	225	250	280	315	355	400	450	500	550	600	650	700	750	800	850	900	1000
200	1957 0.0151 5.4	2136 0.0165 5.9	2359 0.0182 6.6	2583 0.0199 7.2	2851 0.0220 7.9	3164 0.0244 8.8	3522 0.0272 9.8	3924 0.0303 10.9	4371 0.0337 12.1	4818 0.0372 13.4	5265 0.0406 14.6	5713 0.0441 15.9	6160 0.0475 17.1	6607 0.0510 18.4	7054 0.0544 19.6	7501 0.0579 20.8	7948 0.0613 22.1	8395 0.0648 23.3	9290 0.0717 25.8
250	2007 0.0155 5.6	2186 0.0169 6.1	2409 0.0186 6.7	2633 0.0203 7.3	2901 0.0224 8.1	3214 0.0248 8.9	3572 0.0276 9.9	3974 0.0307 11.0	4421 0.0341 12.3	4868 0.0376 13.5	5315 0.0410 14.8	5762 0.0445 16.0	6210 0.0479 17.2	6657 0.0514 18.5	7104 0.0548 19.7	7551 0.0583 21.0	7998 0.0617 22.2	8445 0.0652 23.5	9339 0.0721 25.9
280	2037 0.0157 5.7	2215 0.0171 6.2	2439 0.0188 6.8	2663 0.0205 7.4	2931 0.0226 8.1	3244 0.0250 9.0	3602 0.0278 10.0	4004 0.0309 11.1	4451 0.0343 12.4	4898 0.0378 13.6	5345 0.0412 14.8	5792 0.0447 16.1	6240 0.0481 17.3	6687 0.0516 18.6	7134 0.0550 19.8	7581 0.0585 21.1	8028 0.0619 22.3	8475 0.0654 23.5	9369 0.0723 26.0
315	2072 0.0160 5.8	2250 0.0174 6.3	2474 0.0191 6.9	2697 0.0208 7.5	2966 0.0229 8.2	3279 0.0253 9.1	3636 0.0281 10.1	4039 0.0312 11.2	4486 0.0346 12.5	4933 0.0381 13.7	5380 0.0415 14.9	5827 0.0450 16.2	6274 0.0484 17.4	6722 0.0519 18.7	7169 0.0553 19.9	7616 0.0588 21.2	8063 0.0622 22.4	8510 0.0657 23.6	9404 0.0726 26.1
355	2111 0.0163 5.9	2290 0.0177 6.4	2514 0.0194 7.0	2737 0.0211 7.6	3006 0.0232 8.3	3319 0.0256 9.2	3676 0.0284 10.2	4079 0.0315 11.3	4526 0.0349 12.6	4973 0.0384 13.8	5420 0.0418 15.1	5867 0.0453 16.3	6314 0.0487 17.5	6761 0.0522 18.8	7209 0.0556 20.0	7656 0.0591 21.3	8103 0.0625 22.5	8550 0.0660 23.7	9444 0.0729 26.2
400	2156 0.0166 6.0	2335 0.0180 6.5	2559 0.0197 7.1	2782 0.0215 7.7	3051 0.0235 8.5	3364 0.0260 9.3	3721 0.0287 10.3	4124 0.0318 11.5	4571 0.0353 12.7	5018 0.0387 13.9	5465 0.0422 15.2	5912 0.0456 16.4	6359 0.0491 17.7	6806 0.0525 18.9	7254 0.0560 20.1	7701 0.0594 21.4	8148 0.0629 22.6	8595 0.0663 23.9	9489 0.0732 26.4
450	2206 0.0170 6.1	2385 0.0184 6.6	2609 0.0201 7.2	2832 0.0219 7.9	3100 0.0239 8.6	3413 0.0263 9.5	3771 0.0291 10.5	4174 0.0322 11.6	4621 0.0357 12.8	5068 0.0391 14.1	5515 0.0426 15.3	5962 0.0460 16.6	6409 0.0495 17.8	6856 0.0529 19.0	7303 0.0564 20.3	7751 0.0598 21.5	8198 0.0633 22.8	8645 0.0667 24.0	9539 0.0736 26.5
500	2256 0.0174 6.3	2435 0.0188 6.8	2659 0.0205 7.4	2882 0.0222 8.0	3150 0.0243 8.8	3463 0.0267 9.6	3821 0.0295 10.6	4223 0.0326 11.7	4671 0.0360 13.0	5118 0.0395 14.2	5565 0.0429 15.5	6012 0.0464 16.7	6459 0.0498 17.9	6906 0.0533 19.2	7353 0.0567 20.4	7800 0.0602 21.7	8248 0.0636 22.9	8695 0.0671 24.2	9589 0.0740 26.6
560	2316 0.0179 6.4	2495 0.0193 6.9	2718 0.0210 7.6	2942 0.0227 8.2	3210 0.0248 8.9	3523 0.0272 9.8	3881 0.0299 10.8	4283 0.0331 11.9	4730 0.0365 13.1	5178 0.0400 14.4	5625 0.0434 15.6	6072 0.0469 16.9	6519 0.0503 18.1	6966 0.0538 19.4	7413 0.0572 20.6	7860 0.0607 21.8	8307 0.0641 23.1	8755 0.0676 24.3	9649 0.0745 26.8
600	2356 0.0182 6.5	2535 0.0196 7.0	2758 0.0213 7.7	2982 0.0230 8.3	3250 0.0251 9.0	3563 0.0275 9.9	3921 0.0303 10.9	4323 0.0334 12.0	4770 0.0368 13.3	5218 0.0403 14.5	5665 0.0437 15.7	6112 0.0472 17.0	6559 0.0506 18.2	7006 0.0541 19.5	7453 0.0575 20.7	7900 0.0610 21.9	8347 0.0644 23.2	8794 0.0679 24.4	9689 0.0748 26.9
650	2406 0.0186 6.7	2585 0.0199 7.2	2808 0.0217 7.8	3032 0.0234 8.4	3300 0.0255 9.2	3613 0.0279 10.0	3971 0.0306 11.0	4373 0.0337 12.1	4820 0.0372 13.4	5267 0.0406 14.6	5715 0.0441 15.9	6162 0.0475 17.1	6609 0.0510 18.4	7056 0.0544 19.6	7503 0.0579 20.8	7950 0.0613 22.1	8397 0.0648 23.3	8844 0.0682 24.6	9739 0.0751 27.1
700	2456 0.0189 6.8	2635 0.0203 7.3	2858 0.0221 7.9	3082 0.0238 8.6	3350 0.0258 9.3	3663 0.0283 10.2	4021 0.0310 11.2	4423 0.0341 12.3	4870 0.0376 13.5	5317 0.0410 14.8	5764 0.0445 16.0	6212 0.0479 17.3	6659 0.0514 18.5	7106 0.0548 19.7	7553 0.0583 21.0	8000 0.0617 22.2	8447 0.0652 23.5	8894 0.0686 24.7	9788 0.0755 27.2

Heating Element Temperature: 1820℃ Power: W Furnace Temperature: 1720℃ Element Resistance (1820℃): Ω
Heating Element Curren: 46A Working Voltage: V Surface Load: 12W/cm² Center Distance: 25mm

1850Type Φ3/Φ6 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	90	100	125	140	160	180	200	225	250	280	315	355	400	450	500
50	235 0.111 5.1	258 0.122 5.6	316 0.149 6.9	351 0.166 7.6	397 0.188 8.6	443 0.210 9.6	490 0.231 10.6	548 0.259 11.9	606 0.286 13.2	675 0.319 14.7	756 0.358 16.4	849 0.401 18.5	954 0.451 20.7	1070 0.505 23.3	1186 0.560 25.8
75	241 0.114 5.2	264 0.125 5.7	322 0.152 7.0	357 0.169 7.8	404 0.191 8.8	450 0.213 9.8	496 0.235 10.8	554 0.262 12.0	612 0.289 13.3	682 0.322 14.8	763 0.361 16.6	856 0.404 18.6	960 0.454 20.9	1076 0.509 23.4	1192 0.563 25.9
100	248 0.117 5.4	271 0.128 5.9	329 0.155 7.1	364 0.172 7.9	410 0.194 8.9	456 0.216 9.9	503 0.238 10.9	561 0.265 12.2	619 0.292 13.5	688 0.325 15.0	770 0.364 16.7	862 0.408 18.7	967 0.457 21.0	1083 0.512 23.5	1199 0.566 26.1
125	254 0.120 5.5	277 0.131 6.0	335 0.159 7.3	370 0.175 8.0	417 0.197 9.1	463 0.219 10.1	509 0.241 11.1	567 0.268 12.3	625 0.296 13.6	695 0.328 15.1	776 0.367 16.9	869 0.411 18.9	973 0.460 21.2	1089 0.515 23.7	1205 0.570 26.2
140	258 0.122 5.6	281 0.133 6.1	339 0.160 7.4	374 0.177 8.1	420 0.199 9.1	467 0.221 10.1	513 0.243 11.2	571 0.270 12.4	629 0.297 13.7	699 0.330 15.2	780 0.369 17.0	873 0.412 19.0	977 0.462 21.2	1093 0.517 23.8	1209 0.571 26.3
160	263 0.124 5.7	287 0.135 6.2	345 0.163 7.5	379 0.179 8.2	426 0.201 9.3	472 0.223 10.3	518 0.245 11.3	576 0.272 12.5	634 0.300 13.8	704 0.333 15.3	785 0.371 17.1	878 0.415 19.1	973 0.460 21.2	1089 0.515 23.7	1214 0.574 26.4
180	269 0.127 5.8	292 0.138 6.3	350 0.165 7.6	385 0.182 8.4	431 0.204 9.4	477 0.226 10.4	524 0.247 11.4	582 0.275 12.6	640 0.302 13.9	709 0.335 15.4	790 0.374 17.2	883 0.417 19.2	988 0.467 21.5	1103 0.521 24.0	1219 0.576 26.5
200	274 0.129 6.0	297 0.140 6.5	355 0.168 7.7	390 0.184 8.5	436 0.206 9.5	483 0.228 10.5	529 0.250 11.5	587 0.277 12.8	645 0.305 14.0	714 0.338 15.5	796 0.376 17.3	888 0.420 19.3	993 0.469 21.6	1109 0.524 24.1	1225 0.579 26.6
250	287 0.136 6.2	310 0.147 6.7	368 0.174 8.0	403 0.190 8.8	449 0.212 9.8	496 0.234 10.8	542 0.256 11.8	600 0.284 13.0	658 0.311 14.3	727 0.344 15.8	809 0.382 17.6	901 0.426 19.6	1006 0.475 21.9	1122 0.530 24.4	1238 0.585 26.9
300	300 0.142 6.5	323 0.153 7.0	381 0.180 8.3	416 0.197 9.0	462 0.218 10.0	509 0.240 11.1	555 0.262 12.1	613 0.290 13.3	671 0.317 14.6	740 0.350 16.1	822 0.388 17.9	914 0.432 19.9	1019 0.481 22.1	1135 0.536 24.7	1251 0.591 27.2
350	313 0.148 6.8	336 0.159 7.3	394 0.186 8.6	429 0.203 9.3	475 0.225 10.3	522 0.247 11.3	568 0.268 12.3	626 0.296 13.6	684 0.323 14.9	754 0.356 16.4	835 0.394 18.1	927 0.438 20.2	1032 0.488 22.4	1148 0.542 25.0	1264 0.597 27.5

Heating Element Temperature: 1820℃ Power: W Furnace Temperature: 1720℃ Element Resistance (1820℃): Ω
Heating Element Curren: 69A Working Voltage: V Surface Load: 12W/cm² Center Distance: 25mm

1850Type Φ4/Φ9 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	90	100	125	140	160	180	200	225	250	280	315	355	400	450	500
50	299	329	403	448	508	567	627	701	776	865	970	1089	1223	1372	1521
	0.063	0.069	0.085	0.094	0.107	0.119	0.132	0.147	0.163	0.182	0.204	0.229	0.257	0.288	0.319
	4.3	4.8	5.8	6.5	7.4	8.2	9.1	10.2	11.2	12.5	14.1	15.8	17.7	19.9	22.0
75	306	336	410	455	514	574	634	708	783	872	976	1096	1230	1379	1528
	0.064	0.070	0.086	0.096	0.108	0.121	0.133	0.149	0.164	0.183	0.205	0.230	0.258	0.290	0.321
	4.4	4.9	5.9	6.6	7.5	8.3	9.2	10.3	11.3	12.6	14.2	15.9	17.8	20.0	22.1
100	313	342	417	462	521	581	640	715	789	879	983	1102	1237	1386	1535
	0.066	0.072	0.088	0.097	0.109	0.122	0.135	0.150	0.166	0.185	0.207	0.232	0.260	0.291	0.322
	4.5	5.0	6.0	6.7	7.6	8.4	9.3	10.4	11.4	12.7	14.2	16.0	17.9	20.1	22.2
125	319	349	424	468	528	588	647	722	796	886	990	1109	1243	1392	1541
	0.067	0.073	0.089	0.098	0.111	0.123	0.136	0.152	0.167	0.186	0.208	0.233	0.261	0.292	0.324
	4.6	5.1	6.1	6.8	7.7	8.5	9.4	10.5	11.5	12.8	14.3	16.1	18.0	20.2	22.3
140	323	353	428	473	532	592	651	726	800	890	994	1113	1247	1396	1545
	0.068	0.074	0.090	0.099	0.112	0.124	0.137	0.152	0.168	0.187	0.209	0.234	0.262	0.293	0.325
	4.7	5.1	6.2	6.8	7.7	8.6	9.4	10.5	11.6	12.9	14.4	16.1	18.1	20.2	22.4
160	329	359	433	478	538	597	657	731	806	895	1000	1119	1253	1402	1551
	0.069	0.075	0.091	0.100	0.113	0.125	0.138	0.154	0.169	0.188	0.210	0.235	0.263	0.294	0.326
	4.8	5.2	6.3	6.9	7.8	8.7	9.5	10.6	11.7	13.0	14.5	16.2	18.2	20.3	22.5
180	334	364	439	483	543	603	662	737	811	901	1005	1124	1258	1407	1556
	0.070	0.076	0.092	0.102	0.114	0.127	0.139	0.155	0.170	0.189	0.211	0.236	0.264	0.296	0.327
	4.8	5.3	6.4	7.0	7.9	8.7	9.6	10.7	11.8	13.1	14.6	16.3	18.2	20.4	22.6
200	340	370	444	489	548	608	668	742	817	906	1010	1130	1264	1413	1562
	0.071	0.078	0.093	0.103	0.115	0.128	0.140	0.156	0.172	0.190	0.212	0.237	0.265	0.297	0.328
	4.9	5.4	6.4	7.1	7.9	8.8	9.7	10.8	11.8	13.1	14.6	16.4	18.3	20.5	22.6
250	353	383	458	502	562	622	681	756	830	920	1024	1143	1277	1426	1575
	0.074	0.080	0.096	0.106	0.118	0.131	0.143	0.159	0.174	0.193	0.215	0.240	0.268	0.300	0.331
	5.1	5.6	6.6	7.3	8.1	9.0	9.9	11.0	12.0	13.3	14.8	16.6	18.5	20.7	22.8
300	367	397	471	516	576	635	695	769	844	933	1038	1157	1291	1440	1589
	0.077	0.083	0.099	0.108	0.121	0.133	0.146	0.162	0.177	0.196	0.218	0.243	0.271	0.302	0.334
	5.3	5.8	6.8	7.5	8.3	9.2	10.1	11.2	12.2	13.5	15.0	16.8	18.7	20.9	23.0
350	381	410	485	530	589	649	709	783	858	947	1051	1170	1305	1454	1603
	0.080	0.086	0.102	0.111	0.124	0.136	0.149	0.164	0.180	0.199	0.221	0.246	0.274	0.305	0.337
	5.5	5.9	7.0	7.7	8.5	9.4	10.3	11.3	12.4	13.7	15.2	17.0	18.9	21.1	23.2

YANTAI TORCH SPECIAL HIGH TEMPERATURE CERAMICS CO., LTD.

Heating Element Temperature: 1820℃ Power: W Furnace Temperature: 1720℃ Element Resistance (1820℃): Ω
Heating Element Curren: 128A Working Voltage: V Surface Load: 12W/cm² Center Distance: 50mm

1850Type Φ6/Φ12 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	125	160	180	200	225	255	280	315	355	400	450	500	560	630	720
125	715	882	978	1074	1193	1337	1456	1624	1815	2031	2270	2509	2796	3131	3561
	0.044	0.054	0.060	0.066	0.073	0.082	0.089	0.099	0.111	0.124	0.139	0.153	0.171	0.191	0.217
	5.6	6.9	7.6	8.4	9.3	10.4	11.4	12.7	14.2	15.9	17.7	19.6	21.8	24.5	27.8
140	722	890	986	1081	1201	1344	1464	1631	1823	2038	2277	2517	2804	3138	3569
	0.044	0.054	0.060	0.066	0.073	0.082	0.089	0.100	0.111	0.124	0.139	0.154	0.171	0.192	0.218
	5.6	7.0	7.7	8.4	9.4	10.5	11.4	12.7	14.2	15.9	17.8	19.7	21.9	24.5	27.9
160	733	900	996	1091	1211	1355	1474	1642	1833	2048	2287	2527	2814	3149	3579
	0.045	0.055	0.061	0.067	0.074	0.083	0.090	0.100	0.112	0.125	0.140	0.154	0.172	0.192	0.218
	5.7	7.0	7.8	8.5	9.5	10.6	11.5	12.8	14.3	16.0	17.9	19.7	22.0	24.6	28.0
180	743	910	1006	1101	1221	1365	1484	1652	1843	2058	2298	2537	2824	3159	3589
	0.045	0.056	0.061	0.067	0.075	0.083	0.091	0.101	0.112	0.126	0.140	0.155	0.172	0.193	0.219
	5.8	7.1	7.9	8.6	9.5	10.7	11.6	12.9	14.4	16.1	17.9	19.8	22.1	24.7	28.0
200	753	920	1016	1112	1231	1375	1494	1662	1853	2068	2308	2547	2834	3169	3599
	0.046	0.056	0.062	0.068	0.075	0.084	0.091	0.101	0.113	0.126	0.141	0.155	0.173	0.193	0.220
	5.9	7.2	7.9	8.7	9.6	10.7	11.7	13.0	14.5	16.2	18.0	19.9	22.1	24.8	28.1
225	765	933	1029	1124	1244	1387	1507	1674	1866	2081	2320	2559	2846	3181	3612
	0.047	0.057	0.063	0.069	0.076	0.085	0.092	0.102	0.114	0.127	0.142	0.156	0.174	0.194	0.220
	6.0	7.3	8.0	8.8	9.7	10.8	11.8	13.1	14.6	16.3	18.1	20.0	22.2	24.9	28.2
250	778	945	1041	1137	1256	1400	1520	1687	1878	2094	2333	2572	2859	3194	3625
	0.047	0.058	0.064	0.069	0.077	0.085	0.093	0.103	0.115	0.128	0.142	0.157	0.175	0.195	0.221
	6.1	7.4	8.1	8.9	9.8	10.9	11.9	13.2	14.7	16.4	18.2	20.1	22.3	25.0	28.3
280	793	961	1056	1152	1272	1415	1535	1702	1893	2109	2348	2587	2874	3209	3640
	0.048	0.059	0.064	0.070	0.078	0.086	0.094	0.104	0.116	0.129	0.143	0.158	0.175	0.196	0.222
	6.2	7.5	8.3	9.0	9.9	11.1	12.0	13.3	14.8	16.5	18.3	20.2	22.5	25.1	28.4
315	811	978	1074	1170	1289	1433	1552	1720	1911	2126	2366	2605	2892	3227	3657
	0.049	0.060	0.066	0.071	0.079	0.087	0.095	0.105	0.117	0.130	0.144	0.159	0.177	0.197	0.223
	6.3	7.6	8.4	9.1	10.1	11.2	12.1	13.4	14.9	16.6	18.5	20.4	22.6	25.2	28.6
355	831	998	1094	1190	1309	1453	1573	1740	1931	2147	2386	2625	2912	3247	3678
	0.051	0.061	0.067	0.073	0.080	0.089	0.096	0.106	0.118	0.131	0.146	0.160	0.178	0.198	0.224
	6.5	7.8	8.5	9.3	10.2	11.4	12.3	13.6	15.1	16.8	18.6	20.5	22.8	25.4	28.7
400	854	1021	1117	1212	1332	1476	1595	1763	1954	2169	2409	2648	2935	3270	3700
	0.052	0.062	0.068	0.074	0.081	0.090	0.097	0.108	0.119	0.132	0.147	0.162	0.179	0.200	0.226
	6.7	8.0	8.7	9.5	10.4	11.5	12.5	13.8	15.3	16.9	18.8	20.7	22.9	25.5	28.9

Heating Element Temperature: 1820℃ Power: W Furnace Temperature: 1720℃ Element Resistance (1820℃): Ω
Heating Element Curren: 241A Working Voltage: V Surface Load: 12W/cm² Center Distance: 60mm

1850Type Φ9/Φ18 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu ↓

mm	160	180	200	225	250	280	315	355	400	450	500	550	600	650	700
200	1362	1582	1730	1914	2099	2321	2579	2875	3207	3577	3946	4315	4685	5054	5423
	0.023	0.027	0.030	0.033	0.036	0.040	0.044	0.049	0.055	0.062	0.068	0.074	0.081	0.087	0.093
	5.7	6.6	7.2	7.9	8.7	9.6	10.7	11.9	13.3	14.8	16.4	17.9	19.4	21.0	22.5
250	1474	1622	1769	1954	2139	2360	2619	2915	3247	3616	3986	4355	4725	5094	5463
	0.025	0.028	0.030	0.034	0.037	0.041	0.045	0.050	0.056	0.062	0.069	0.075	0.081	0.088	0.094
	6.1	6.7	7.3	8.1	8.9	9.8	10.9	12.1	13.5	15.0	16.5	18.1	19.6	21.1	22.7
280	1498	1646	1793	1978	2163	2384	2643	2939	3271	3640	4010	4379	4749	5118	5487
	0.026	0.028	0.031	0.034	0.037	0.041	0.046	0.051	0.056	0.063	0.069	0.075	0.082	0.088	0.094
	6.2	6.8	7.4	8.2	9.0	9.9	11.0	12.2	13.6	15.1	16.6	18.2	19.7	21.2	22.8
315	1526	1674	1821	2006	2191	2412	2671	2966	3299	3668	4038	4407	4776	5146	5515
	0.026	0.029	0.031	0.035	0.038	0.042	0.046	0.051	0.057	0.063	0.070	0.076	0.082	0.089	0.095
	6.3	6.9	7.6	8.3	9.1	10.0	11.1	12.3	13.7	15.2	16.8	18.3	19.8	21.4	22.9
355	1558	1705	1853	2038	2223	2444	2703	2998	3331	3700	4070	4439	4808	5178	5547
	0.027	0.029	0.032	0.035	0.038	0.042	0.047	0.052	0.057	0.064	0.070	0.076	0.083	0.089	0.096
	6.5	7.1	7.7	8.5	9.2	10.1	11.2	12.4	13.8	15.4	16.9	18.4	20.0	21.5	23.0
400	1594	1741	1889	2074	2259	2480	2739	3034	3367	3736	4106	4475	4844	5214	5583
	0.027	0.030	0.033	0.036	0.039	0.043	0.047	0.052	0.058	0.064	0.071	0.077	0.083	0.090	0.096
	6.6	7.2	7.8	8.6	9.4	10.3	11.4	12.6	14.0	15.5	17.0	18.6	20.1	21.6	23.2
450	1634	1781	1929	2114	2298	2520	2779	3074	3407	3776	4145	4515	4884	5254	5623
	0.028	0.031	0.033	0.036	0.040	0.043	0.048	0.053	0.059	0.065	0.071	0.078	0.084	0.090	0.097
	6.8	7.4	8.0	8.8	9.5	10.5	11.5	12.8	14.1	15.7	17.2	18.7	20.3	21.8	23.3
500	1673	1821	1969	2154	2338	2560	2819	3114	3447	3816	4185	4555	4924	5294	5663
	0.029	0.031	0.034	0.037	0.040	0.044	0.049	0.054	0.059	0.066	0.072	0.078	0.085	0.091	0.098
	6.9	7.6	8.2	8.9	9.7	10.6	11.7	12.9	14.3	15.8	17.4	18.9	20.4	22.0	23.5
560	1721	1869	2017	2202	2386	2608	2866	3162	3494	3864	4233	4603	4972	5341	5711
	0.030	0.032	0.035	0.038	0.041	0.045	0.049	0.054	0.060	0.067	0.073	0.079	0.086	0.092	0.098
	7.1	7.8	8.4	9.1	9.9	10.8	11.9	13.1	14.5	16.0	17.6	19.1	20.6	22.2	23.7
600	1753	1901	2049	2233	2418	2640	2898	3194	3526	3896	4265	4635	5004	5373	5743
	0.030	0.033	0.035	0.038	0.042	0.045	0.050	0.055	0.061	0.067	0.073	0.080	0.086	0.093	0.099
	7.3	7.9	8.5	9.3	10.0	11.0	12.0	13.3	14.6	16.2	17.7	19.2	20.8	22.3	23.8
650	1793	1941	2089	2273	2458	2680	2938	3234	3566	3936	4305	4674	5044	5413	5783
	0.031	0.033	0.036	0.039	0.042	0.046	0.051	0.056	0.061	0.068	0.074	0.080	0.087	0.093	0.100
	7.4	8.1	8.7	9.4	10.2	11.1	12.2	13.4	14.8	16.3	17.9	19.4	20.9	22.5	24.0

Heating Element Temperature: 1800℃ Power: W Furnace Temperature: 1750℃ Element Resistance (1800℃): Ω
Heating Element Curren: 45A Working Voltage: V Surface Load: 9W/cm² Center Distance: 25mm

1900Type Φ3/Φ6 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu ↓

mm	50	100	125	140	160	180	200	225	250	280	315	355	400
125	145	230	272	298	332	365	399	442	484	535	594	662	738
	0.072	0.113	0.134	0.147	0.164	0.180	0.197	0.218	0.239	0.264	0.293	0.327	0.365
	3.2	5.1	6.0	6.6	7.4	8.1	8.9	9.8	10.8	11.9	13.2	14.7	16.4
140	149	234	277	302	336	370	404	446	489	539	599	667	743
	0.074	0.116	0.137	0.149	0.166	0.183	0.199	0.220	0.241	0.266	0.296	0.329	0.367
	3.3	5.2	6.1	6.7	7.5	8.2	9.0	9.9	10.9	12.0	13.3	14.8	16.5
160	154	239	281	307	341	374	408	451	493	544	603	671	747
	0.076	0.118	0.139	0.151	0.168	0.185	0.202	0.223	0.244	0.269	0.298	0.331	0.369
	3.4	5.3	6.2	6.8	7.6	8.3	9.1	10.0	11.0	12.1	13.4	14.9	16.6
180	158	243	286	311	345	379	413	455	498	548	608	676	752
	0.078	0.120	0.141	0.154	0.170	0.187	0.204	0.225	0.246	0.271	0.300	0.334	0.371
	3.5	5.4	6.3	6.9	7.7	8.4	9.2	10.1	11.1	12.2	13.5	15.0	16.7
200	163	248	290	316	350	383	417	460	502	553	612	680	756
	0.080	0.122	0.143	0.156	0.173	0.189	0.206	0.227	0.248	0.273	0.302	0.336	0.374
	3.6	5.5	6.4	7.0	7.8	8.5	9.3	10.2	11.2	12.3	13.6	15.1	16.8
250	176	261	304	329	363	397	431	473	516	566	626	694	770
	0.087	0.129	0.150	0.163	0.179	0.196	0.213	0.234	0.255	0.280	0.309	0.343	0.380
	3.9	5.8	6.7	7.3	8.1	8.8	9.6	10.5	11.5	12.6	13.9	15.4	17.1
300	190	275	317	343	377	410	444	487	529	580	639	707	783
	0.094	0.136	0.157	0.169	0.186	0.203	0.219	0.240	0.261	0.286	0.316	0.349	0.387
	4.2	6.1	7.0	7.6	8.4	9.1	9.9	10.8	11.8	12.9	14.2	15.7	17.4
350	203	288	331	356	390	424	458	500	543	593	653	721	797
	0.100	0.142	0.163	0.176	0.193	0.209	0.226	0.247	0.268	0.293	0.322	0.356	0.394
	4.5	6.4	7.3	7.9	8.7	9.4	10.2	11.1	12.1	13.2	14.5	16.0	17.7

Heating Element Temperature: 1830℃ Power: W Furnace Temperature: 1780℃ Element Resistance (1830℃): Ω
Heating Element Curren: 72A Working Voltage: V Surface Load: 10.5W/cm² Center Distance: 25mm

1900Type Φ4/Φ9 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	50	100	125	140	160	180	200	225	250	280	315	355	400	450	500
125	213	345	411	450	503	556	609	675	741	820	912	1017	1136	1268	1400
	0.041	0.067	0.079	0.087	0.097	0.107	0.117	0.130	0.143	0.158	0.176	0.196	0.219	0.245	0.270
	3.0	4.8	5.7	6.3	7.0	7.7	8.5	9.4	10.3	11.4	12.7	14.1	15.8	17.6	19.4
140	220	352	418	458	510	563	616	682	748	827	919	1025	1143	1275	1407
	0.042	0.068	0.081	0.088	0.098	0.109	0.119	0.132	0.144	0.160	0.177	0.198	0.221	0.246	0.271
	3.1	4.9	5.8	6.4	7.1	7.8	8.6	9.5	10.4	11.5	12.8	14.2	15.9	17.7	19.5
160	228	359	425	465	518	570	623	689	755	834	926	1032	1151	1282	1414
	0.044	0.069	0.082	0.090	0.100	0.110	0.120	0.133	0.146	0.161	0.179	0.199	0.222	0.247	0.273
	3.2	5.0	5.9	6.5	7.2	7.9	8.7	9.6	10.5	11.6	12.9	14.3	16.0	17.8	19.6
180	235	366	432	472	525	577	630	696	762	841	934	1039	1158	1290	1422
	0.045	0.071	0.083	0.091	0.101	0.111	0.122	0.134	0.147	0.162	0.180	0.200	0.223	0.249	0.274
	3.3	5.1	6.0	6.6	7.3	8.0	8.8	9.7	10.6	11.7	13.0	14.4	16.1	17.9	19.7
200	242	374	440	479	532	585	637	703	769	848	941	1046	1165	1297	1429
	0.047	0.072	0.085	0.092	0.103	0.113	0.123	0.136	0.148	0.164	0.181	0.202	0.225	0.250	0.276
	3.4	5.2	6.1	6.7	7.4	8.1	8.9	9.8	10.7	11.8	13.1	14.5	16.2	18.0	19.8
250	256	388	454	494	546	599	652	718	784	863	955	1061	1179	1311	1443
	0.047	0.072	0.084	0.091	0.101	0.111	0.121	0.133	0.145	0.160	0.177	0.196	0.218	0.243	0.267
	3.6	5.4	6.3	6.9	7.6	8.3	9.1	10.0	10.9	12.0	13.3	14.7	16.4	18.2	20.0
300	271	402	468	508	561	613	666	732	798	877	970	1075	1194	1326	1458
	0.052	0.078	0.090	0.098	0.108	0.118	0.129	0.141	0.154	0.169	0.187	0.207	0.230	0.256	0.281
	3.8	5.6	6.5	7.1	7.8	8.5	9.3	10.2	11.1	12.2	13.5	14.9	16.6	18.4	20.2
350	285	417	483	522	575	628	681	747	813	892	984	1089	1208	1340	1472
	0.055	0.080	0.093	0.101	0.111	0.121	0.131	0.144	0.157	0.172	0.190	0.210	0.233	0.258	0.284
	4.0	5.8	6.7	7.3	8.0	8.7	9.5	10.4	11.3	12.4	13.7	15.1	16.8	18.6	20.4

Heating Element Temperature: 1850℃ Power: W Furnace Temperature: 1800℃ Element Resistance (1850℃): Ω
Heating Element Curren: 130A Working Voltage: V Surface Load: 10.5W/cm² Center Distance: 50mm

1900Type Φ6/Φ12 U-Shape Working Parameters

Hot End Length Le→

Cold End Length Lu →

mm	125	160	180	200	225	255	280	315	355	400	450	500	560
140	674	808	888	967	1066	1184	1283	1422	1580	1758	1956	2154	2391
	0.040	0.048	0.053	0.057	0.063	0.070	0.076	0.084	0.093	0.104	0.116	0.127	0.141
	5.2	6.2	6.8	7.4	8.2	9.1	9.9	10.9	12.2	13.5	15.0	16.6	18.4
160	687	821	901	980	1079	1197	1296	1435	1593	1771	1969	2167	2404
	0.041	0.049	0.053	0.058	0.064	0.071	0.077	0.085	0.094	0.105	0.116	0.128	0.142
	5.3	6.3	6.9	7.5	8.3	9.2	10.0	11.0	12.3	13.6	15.1	16.7	18.5
180	700	834	914	993	1092	1210	1309	1448	1606	1784	1982	2180	2417
	0.041	0.049	0.054	0.059	0.065	0.072	0.077	0.086	0.095	0.106	0.117	0.129	0.143
	5.4	6.4	7.0	7.6	8.4	9.3	10.1	11.1	12.4	13.7	15.2	16.8	18.6
200	713	847	927	1006	1105	1223	1322	1461	1619	1797	1995	2193	2430
	0.042	0.050	0.055	0.060	0.065	0.072	0.078	0.086	0.096	0.106	0.118	0.130	0.144
	5.5	6.5	7.1	7.7	8.5	9.4	10.2	11.2	12.5	13.8	15.3	16.9	18.7
225	726	860	940	1019	1118	1236	1335	1474	1632	1810	2008	2206	2443
	0.043	0.051	0.056	0.060	0.066	0.073	0.079	0.087	0.097	0.107	0.119	0.131	0.145
	5.6	6.6	7.2	7.8	8.6	9.5	10.3	11.3	12.6	13.9	15.4	17.0	18.8
250	739	873	953	1032	1131	1249	1348	1487	1645	1823	2021	2219	2456
	0.044	0.052	0.056	0.061	0.067	0.074	0.080	0.088	0.097	0.108	0.120	0.131	0.145
	5.7	6.7	7.3	7.9	8.7	9.6	10.4	11.4	12.7	14.0	15.5	17.1	18.9
280	752	886	966	1045	1144	1262	1361	1500	1658	1836	2034	2232	2469
	0.044	0.052	0.057	0.062	0.068	0.075	0.081	0.089	0.098	0.109	0.120	0.132	0.146
	5.8	6.8	7.4	8.0	8.8	9.7	10.5	11.5	12.8	14.1	15.6	17.2	19.0
315	778	912	992	1071	1170	1288	1387	1526	1684	1862	2060	2258	2495
	0.046	0.054	0.059	0.063	0.069	0.076	0.082	0.090	0.100	0.110	0.122	0.134	0.148
	6.0	7.0	7.6	8.2	9.0	9.9	10.7	11.7	13.0	14.3	15.8	17.4	19.2
355	804	938	1018	1097	1196	1314	1413	1552	1710	1888	2086	2284	2521
	0.048	0.056	0.060	0.065	0.071	0.078	0.084	0.092	0.101	0.112	0.123	0.135	0.149
	6.2	7.2	7.8	8.4	9.2	10.1	10.9	11.9	13.2	14.5	16.0	17.6	19.4
400	830	964	1044	1123	1222	1340	1439	1578	1736	1914	2112	2310	2547
	0.049	0.057	0.062	0.066	0.072	0.079	0.085	0.093	0.103	0.113	0.125	0.137	0.151
	6.4	7.4	8.0	8.6	9.4	10.3	11.1	12.1	13.4	14.7	16.2	17.8	19.6
450	856	990	1070	1149	1248	1366	1465	1604	1762	1940	2138	2336	2573
	0.051	0.059	0.063	0.068	0.074	0.081	0.087	0.095	0.104	0.115	0.126	0.138	0.152
	6.6	7.6	8.2	8.8	9.6	10.5	11.3	12.3	13.6	14.9	16.4	18.0	19.8
500	882	1016	1096	1175	1274	1392	1491	1630	1788	1966	2164	2362	2599
	0.052	0.060	0.065	0.070	0.075	0.082	0.088	0.096	0.106	0.116	0.128	0.140	0.154
	6.8	7.8	8.4	9.0	9.8	10.7	11.5	12.5	13.8	15.1	16.6	18.2	20.0

VII. Overview of $MoSi_2$ Electric Heating Element Accessories

The accessories for $MoSi_2$ electrical heating element mainly include fixing and conducting spare parts (holders and contact straps). The specification of which varies based on the electrical heating element diameter, center distance and other parameters. Generally, we have standard size spare parts and any special requirement may depend on the further communications. Conductive spare parts are weaved aluminum connection belt, the function is to connect heating element and wires, the specific specifications could be selected according to the requirement of users, and the special specifications could be customized.

1. Holders

2. Contact straps

3. Clamp ring and stainless steel clip