ZHENGZHOU CHIDA FURNACE MATERIAL CO.,LTD
B1506,NO.7 DONGQING STREET,
ZHENGZHOU HI-TECH INDUSTRIAL DEVELOPMENT AREA HENAN,CHINA 450001
TEL: 86-371-67991791 FAX: 86-371-67980707
EMAIL:INFO@SIC-MOSI2.CN

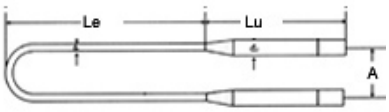
Zhen Zhou Chida Furnace Material Co.,Ltd

——Introduction of $MoSi_2$ Heating elements

General description

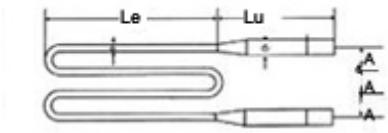
$MoSi_2$ heating element is a kind of resistance heating element basically made of high pure Molybdenum Disilicide .In oxidizing atmosphere ,on the surface of $MoSi_2$ element owing to the high temperature combustion a layer of compact quartz protective film is formed to prevent $MoSi_2$ from continuously oxidizing .In oxidizing atmosphere ,its Max temperature can reach 1800℃ and its applicable temperature is 500－1700℃.It can be widely used in such applications as sintering and heat treatment on ceramics, magnet, glass, metallurgy, refractory, etc.We can offer different types of products-----ED type, W type, U type and L type to customers according to their needs.

U type Moly disilicide



Hot zone length:Le,mm
Cold end length:Lu,mm
Shank Spacing:A,mm
Diameter:D_1/D_2 ,mm/mm(Le/Lu)
Specify as:
U D_1/D_2*Le*Lu*A

W type Moly disilicide



Hot zone length:Le,mm
Cold end length:Lu,mm
Shank Spacing:A,mm
Diameter:D_1/D_2 ,mm/mm(Le/Lu)
Specify as: W D_1/D_2*Le*Lu*3A

ED Moly disilicide

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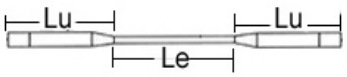
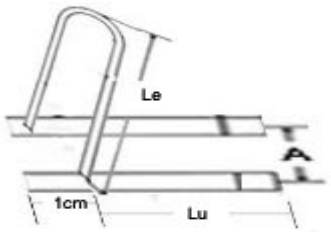


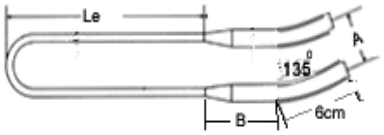
Hot zone length:Le,mm
Cold end length:Lu,mm
Diameter:D_1/D_2 ,mm/mm(Le/Lu)
Specify as:
ED D_1/D_2*Le*Lu

L type Moly disilicide



Hot zone length:Le,mm
Cold end length:Lu,mm
Shank Spacing:A,mm
Diameter:D_1/D_2 ,mm/mm(Le/Lu)
Specify as: L D_1/D_2*Le*Lu*A

ARC type Moly disilicide



Hot zone length:Le,mm
Cold end length:Lu=B+6,mm
Shank Spacing:A,mm
Diameter:D_1/D_2 ,mm/mm(Le/Lu)
Specify as: ARC D_1/D_2*Le*Lu*A

Having the same mechanical character as other ceramic products, $MoSi_2$ heating elements belong to the brittleness material so that they are easy to rupture at the normal temperature ,which brings some difficulty to transport and install ,but it may be avoided if they wrer installed and used correctly.

physical property

Volume density	Bend strength	Vickers-nadness	Porosity rate	Water absortion	Hot extensibility
5.5－5.6g/cm^3	15-25kg/cm^2	(HV)570kg/mm^2	7.4%	1.2%	4%

Chemical property

Oxygen-resistance under high temperature: in oxidizing atmosphere, on the surface of

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element owing to the high-temperature combustion a layer of compact quartz (SiO_2) protective film is formed to prevent $MoSi_2$ from continuously oxidizing. When the element temperature is higher than 1700℃,the SiO_2 protective film ,whose fusing point is 1710℃,is fused ,and the SiO_2 is fused into molten drops owing to the action of its surface extension, so that loses its protective ability .In the oxidizing atmosphere , when the element is continuously used ,again the protective film forms. It should be pointed out that element cannot be used for rather long time in 400-700℃,or it will be powdered owing to the strong oxidizing action in low temperature.

The Max temperature of elements in different atmospheres

Atmosphere	**Max element temperature**	
	1700 type	**1800 type**
Air	1700	1800
Nitrogen	1600	1700
Argon,Helium	1600	1700
Hydrogen	1100－1450	1100－1450
N_2/H_2 95/5%	1250－1600	1250－1600
General applications	Most types of industrial furnace for heat treatment, forgoing, sintering, glass melting and refining and for use in radiant tubes.	Laboratory furnaces, testing equipment and high temperature sintering production furnace.

Electric property of elements

Resistance property

The resistivity of element rapidly rises as the temperature rises ,under normal operating conditions, generally the element resistance doesn't change with the service time changing .So the old and new elements can be used mixed.

Surface load

The key factor to the optimum service life of the element is to select the surface load of the element correctly according to the furnace construction, atmosphere and temperature.

Recommend surface load

℃ Furnace temp.	1400	1500	1600	1650	1700
Surface load of hotzone(W/cm^2)	＜18	＜15	＜12	＜10	＜8

Installation of $MoSi_2$ heating elements

Vertically hanging

Under normal temperature, MoSi2 element is very brittleness, while under high temperature it is very brittleness, while under high temperature it is plasticity .So the better way for installation is the U shape element is to hang it vertically, to the furnace top through the support clamping chuck H.The aim lf such way is to avoid putting the mechanical stress directly to the element heat-generation end, or the element will easily be broken.

Support clamp

Support clamp are applied to Φ9/18 and Φ6/12 two kind of elements respectively .The support

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clamp supports the whole weight of the element and the position of the element is also determined by it .Therefore ,it must be installed carefully to assure that the element is vertically hung .In order to prevent the element from being over heated locally ,the taper part of the element lower end must put into the furnace chamber.

Wire clip

The wire connection clamp connecting $MoSi_2$ element is made of aluminum woven wire or multilayer aluminum foil. The steel plate outside it only acts as a clamp and isn't used for electric conduction. For Φ6/12 element, single rowing wire is used ,and for Φ9/18 element ,double-rowing wire is used .The end of the lead wire should be a little larger than linear distance between the element and bus .

When the element is installed, the thread fixing the wire clip shouldn't be screwed too much at one time, it can be tightened when thee element rises to high temperature, as the element has some plastic and isn't easily broken. The temperature of the wire clip generally shouldn't be higher than 200℃. Therefore, the contact voltage between the clip wire and element should bee lowered to 0.1V. In order to avoid that the radiation heat is conducted to the clip, the distance between the lower end of the clip and upper surface of the through brick should not less then 500mm. Generally for Φ6/12 element ,170A should not bee used for a long time and for Φ9/18 element ,300A shouldn't be used.

Operation of $MoSi_2$ furnace

Drying of the furnace

The new built furnace or the furnace that haven't been used for a long time should be dried before use .The drying temperature will cause low-temperature oxidation .For the small-sized furnace ,as its drying is long ,it should be dried carefully .You'd better open the furnace gate to make it ventilated .The gate may be half-opened with the rising of temperature and fully closed when the temperature rises above 1000℃.

starting of the furnace

If the furnace has been dried or neednt to be dried ,then is may be started to raise temperature .In order to avoid that it is impacted by over current and the electric device is overload ,the following steps should bee adapted :

Small furnace(power<100KW)		**Large furnace**(power100-500KW)	
Furnace temp.℃	Voltage	Furnace temp. ℃	Voltage
20-150	1/3working voltage	20－300	1/3working voltage
150-500	2/3working voltage	300－700	2/3working voltage
500－Working temp.	Full working voltage	700－Working temp.	Full working voltage

Replacing of element

If it is found that one element is damaged during operating ,firstly ,you should determine where it is , at the same time prepare a made up one .Then loosen the thread which links the lead wire of the damaged element and the bus ,clear out the ceramic cotton and pull out the through-brick. Afterward, insert the new element from the furnace top ,link the lead wire ,block the gap with ceramic cotton and start raising temperature.

Reference data for MoSi2 heating elements

1,**1800Grade U shape 3/6mm elements**

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Lu\Le	150mm	180	200	250	300	350
150 mm	397W 0.196Ω 8.8V	466 0.230 10.4	510 0.252 11.3	626 0.309 13.9	741 0.366 15.5	855 0.422 19.0
200	409 0.202 9.1	478 0.236 10.6	522 0.258 11.6	638 0.315 14.2	753 0.372 16.7	867 0.428 19.3
250	421 0.208 9.4	490 0.242 10.9	535 0.264 11.9	650 0.321 14.5	765 0.378 17.0	879 0.434 19.5
280	427 0.211 9.5	496 0.246 11.0	543 0.268 12.1	658 0.325 14.6	772 0.381 17.1	887 0.438 19.7
300	433 0.214 9.6	502 0.248 11.2	547 0.270 12.2	662 0.327 14.7	778 0.384 17.3	891 0.440 19.8
Condition: Element temp. 1700℃ Furnace temp. 1600℃ Current :45A Surface load:11.4W/cm^2				Power:W Resistance: Ω Working Voltage:V		

2,**1800Grade U shape 4/9mm elements**

Lu\ Le	150mm	180	200	250	300	350
150 mm	459 0.111 7.2	549 0.130 8.5	604 0.143 9.3	739 0.175 11.4	875 0.207 13.5	1006 0.238 15.5
200	486 0.115 7.5	566 0.134 8.7	617 0.145 9.5	752 0.178 11.6	887 0.210 13.6	1022 0.242 15.7
250	503 0.119 707	579 0.137 8.9	634 0.150 9.8	769 0.182 11.8	900 0.213 13.8	1035 0.245 15.9
280	507 0.120 7.8	587 0.139 9.0	642 0.152 9.9	777 0.184 11.9	908 0.215 14.0	1044 0.247 16.1
300	511 0.121 7.9	592 0.140 9.1	645 0.153 10.0	782 0.185 12.0	921 0.2184 14.2	1052 0.249 15.2
Condition: Element temp. 1700℃ Furnace temp. 1600℃ Current :65A Surface load:11.4W/cm^2				Power:W Resistance: Ω Working Voltage:V		

3, **1700Grade U shape φ6/12mm MoSi2 Elements**

Lu\Le	150	180	200	250	300	350	400	450	500	550	600
150	975 0.043 6.5	1155 0.051 7.7	1260 0.056 8.4	1560 0.069 10.4	1875 0.083 12.5	2160 0.096 14.4		Power:w Resistance: Ω Voltage:V			
200	1202	1200	1305	1605	1920	2205	2505				

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	0.045 6.8	0.053 8.0	0.058 8.7	0.071 10.7	0.085 12.8	0.098 14.7	0.111 16.7				
250	1065 0.047 6.9	1245 0.055 8.3	1350 0.060 9.0	1650 0.073 11.0	1965 0.087 13.1	2250 0.100 15.0	2550 0.113 17.0	2853 0.126 18.9	3150 0.140 21.0		
270	1080 0.048 7.1	1260 0.056 8.4	1380 0.061 9.1	1665 0.074 11.1	1980 0.088 13.2	2265 0.101 15.1	2565 0.114 17.1	2850 0.127 19.0	3165 0.141 21.1		
300	1110 0.049 7.4	1290 0.057 8.6	1395 0.062 9.3	1695 0.075 11.3	2010 0.089 13.4	2295 0.102 15.3	2595 0.115 17.3	2880 0.128 19.2	3195 0.142 21.3	3495 0.155 23.3	3780 0.168 25.2
350	1155 0.051 7.7	1335 0.059 8.9	1440 0.064 9.6	1740 0.077 11.6	2055 0.091 13.7	2340 0.104 15.6	2640 0.117 17.6	2925 0.130 19.5	3240 0.144 21.6	3540 0.157 23.6	3825 0.170 25.5
400	1200 0.053 8.0	1380 0.061 9.2	1485 0.066 9.9	1785 0.079 11.9	2100 0.093 14.0	2385 0.106 15.9	2685 0.119 17.9	2970 0.132 19.8	3285 0.146 21.9	3585 0.159 23.9	3870 0.172 25.8
450		1425 0.063 9.5	1530 0.068 10.2	1830 0.081 12.2	2145 0.095 14.3	2430 0.108 16.2	2730 0.121 18.2	3015 0.134 20.1	3330 0.148 22.2	3630 0.161 24.2	3915 0.174 26.1
500				1875 0.083 12.5	2190 0.097 14.6	2475 0.110 16.5	2775 0.123 18.5	3060 0.136 20.4	3375 0.150 22.5	3675 0.163 24.5	3960 0.176 26.4
550	Condition: Element temp. 1500℃ Furnace temp. 1300℃ Amperage 150A Surface load 15w/cm^2				2235 0.099 14.9	2520 0.112 16.8	2820 0.125 18.8	3105 0.138 20.7	3420 0.152 22.8	3720 0.165 24.8	4005 0.178 26.7
600					2280 0.101 15.2	2565 0.114 17.1	2865 0.127 19.1	3150 0.140 21.0	3465 0.154 23.1	3765 0.167 25.1	4050 0.180 27.0
650							2910 0.129 19.4	3195 0.142 21.3	3510 0.156 23.4	3810 0.169 25.4	4095 0.182 27.3
700								3240 0.144 21.6	3555 0.158 23.7	3855 0.171 25.7	4140 0.184 27.6

4,**1700Grade U Shape 9/18mm MoSi2 Elements**

Le	150	180	200	250	300	350	400	450	500	550	600	650	700	750	800
250	1440 0.019	1740 0.023	1890 0.025	2340 0.031	2800 0.037	3250 0.043	3700 0.049	4160 0.061	4610 0.061	5070 0.067	5520 0.073	5970 0.079	6430 0.085	6880 0.091	7340 0.097

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	5.2	6.3	6.9	8.5	10.2	11.8	13.5	16.8	16.8	18.4	20.1	21.7	23.4	25.0	26.7
	1510	1810	1960	2420	2870	3330	3780	4240	4690	5140	5600	6050	6500	6960	7410
300	0.020	0.024	0.026	0.032	0.038	0.044	0.050	0.056	0.062	0.068	0.074	0.080	0.086	0.092	0.098
	5.5	6.6	7.2	8.8	10.5	12.1	13.8	15.4	17.1	18.7	20.4	22.0	23.7	25.3	27.0
	1590	1890	2040	2500	2950	3400	3850	4310	4760	5220	5670	6130	6580	7030	7490
350	0.021	0.025	0.027	0.033	0.039	0.045	0.051	0.057	0.063	0.069	0.075	0.081	0.087	0.093	0.099
	5.8	6.9	7.5	9.1	10.7	12.4	14.1	15.7	17.3	19.0	20.6	22.3	23.9	25.6	27.2
	1670	1970	2120	2570	3030	3480	3930	4390	4840	5290	5750	6200	6660	7110	7560
400	0.022	0.026	0.028	0.034	0.040	0.046	0.052	0.058	0.064	0.070	0.076	0.082	0.088	0.094	0.100
	6.1	7.2	7.8	9.4	11.0	12.7	14.3	16.0	17.6	19.3	20.9	22.6	24.2	25.9	27.5
		2040	2190	2650	3100	3550	4010	4460	4920	5370	5820	6280	6730	7180	7640
450		0.027	0.029	0.035	0.041	0.047	0.053	0.059	0.065	0.071	0.077	0.083	0.089	0.095	0.101
		7.4	8.0	9.6	11.3	12.9	14.6	16.2	17.9	19.5	21.2	22.8	24.5	26.1	27.8
			2270	2720	3180	3630	4080	4540	4990	5450	5900	6350	6800	7260	7710
500			0.030	0.036	0.042	0.048	0.054	0.060	0.066	0.072	0.078	0.084	0.090	0.096	0.102
			8.3	9.9	11.6	13.2	14.9	16.5	18.2	19.8	21.5	23.1	24.8	26.4	28.1
				2800	3250	3700	4160	4610	5070	5520	5970	6430	6880	7340	7790
550				0.037	0.043	0.049	0.055	0.061	0.067	0.073	0.079	0.085	0.091	0.097	0.103
				10.2	11.8	13.5	15.1	16.8	18.4	20.0	21.7	23.4	25.0	26.7	28.3
				2870	3250	3700	4160	4610	5070	5520	5970	6430	6880	7340	7790
600				0.037	0.043	0.049	0.055	0.061	0.067	0.073	0.079	0.085	0.091	0.097	0.103
				10.2	11.8	13.5	15.1	16.8	18.4	20.0	21.7	23.4	25.0	26.7	28.3
650	Power:W Resistance: Ω Voltage:V				3400	3860	4310	4760	5220	5670	6050	6500	6960	7410	7870
					0.045	0.051	0.057	0.063	0.069	0.074	0.080	0.086	0.092	0.098	0.104
					12.4	14.0	15.7	17.3	19.0	20.3	22.0	23.7	25.3	27.0	28.6
					3480	3860	4310	4760	5220	5670	6130	6580	7030	7490	7940
700	Condition:				0.045	0.051	0.057	0.063	0.069	0.075	0.081	0.087	0.093	0.099	0.105
	Element temp. 1500				12.4	14.0	15.7	17.3	19.0	20.6	22.3	23.9	25.6	27.2	28.9
	℃					4010	4460	4920	5370	5820	6280	6730	7180	7640	8090
750	Furnace temp. 1300					0.053	0.059	0.065	0.071	0.077	0.083	0.089	0.095	0.101	0.107
	℃					14.6	16.2	16.2	19.5	21.2	22.8	24.5	26.1	27.8	29.4
	Amperage:275A					4080	4540	4990	5450	5900	6350	6800	7260	7710	8170
800	Surface					0.054	0.060	0.066	0.072	0.078	0.084	0.090	0.096	0.102	0.108
	load:15W/cm^2					14.9	16.5	18.2	19.8	21.5	23.1	24.8	26.4	28.1	29.7

5, 1800Grade U shape φ6/12mm MoSi2 Elements

Lu\Le	150	180	200	250	300	350	400	450	500	550	600
150	750 0.048 6.0	890 0.057 7.1	990 0.063 7.9	1240 0.079 9.9	1490 0.095 11.9	1730 0.110 13.8	Power:W Resistance: Ω Working voltage:V				
200	790 0.050	930 0.059	1010 0.065	1260 0.081	1510 0.097	1750 0.112	1980 0.126				

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	6.3	7.4	8.1	10.1	12.1	14.0	15.8				
250	810 0.052 6.5	950 0.061 7.6	1050 0.067 8.4	1300 0.083 10.4	1550 0.099 12.4	1790 0.114 14.3	2000 0.128 16.0	2200 0.141 17.6	2440 0.156 19.5		
270	850 0.054 6.8	990 0.063 7.9	1080 0.069 8.6	1330 0.085 10.6	1580 0.101 12.6	1810 0.116 14.5	2040 0.130 16.3	2240 0.143 17.9	2480 0.158 19.8		
300	880 0.056 7.0	1010 0.065 8.1	1110 0.071 8.9	1360 0.087 10.9	1610 0.103 12.9	1850 0.118 14.8	2060 0.132 16.5	2260 0.145 18.1	2500 0.160 20.0	2690 0.172 21.5	2930 0.187 23.4
350	910 0.058 7.3	1050 0.067 8.4	1140 0.073 9.1	1390 0.089 11.1	1640 0.105 13.1	1880 0.120 15.0	2100 0.134 16.8	2300 0.147 18.4	2540 0.162 20.3	2730 0.174 21.8	2950 0.189 23.6
400	940 0.060 7.5	1080 0.069 8.6	1180 0.075 9.4	1430 0.091 11.4	1680 0.107 13.4	1910 0.122 15.3	2130 0.136 17.0	2330 0.149 18.6	2560 0.164 20.5	2750 0.176 22.0	2990 0.191 23.9
450		1110 0.071 8.9	1200 0.077 9.6	1450 0.093 11.6	1700 0.109 13.6	1940 0.124 15.5	2170 0.138 17.3	2360 0.151 18.9	2600 0.166 20.8	2790 0.178 22.3	3010 0.193 24.1
500				1490 0.095 11.9	1740 0.111 13.9	1980 0.126 15.8	2190 0.140 17.5	2390 0.153 19.1	2630 0.168 21.0	2810 0.180 21.0	3050 0.195 24.6
550	Condition: Element temp. 1700℃ Furnace temp. 1600℃				1760 0.113 14.1	2000 0.128 16.0	2230 0.142 17.8	2430 0.155 19.4	2660 0.170 21.3	2850 0.182 22.8	3080 0.197 24.6
600	Current:125A Surface load:11.4w/cm^2				1800 0.115 14.4	2040 0.130 16.3	2250 0.144 18.0	2450 0.157 19.6	2690 0.172 21.5	2880 0.184 23.0	3110 0.199 24.9
650							2290 0146 18.3	2490 0.159 19.9	2730 0.174 21.8	2910 0.186 23.3	3140 0.201 25.1
700								2510 0.161 20.1	2750 0.176 22.0	2940 0.188 23.5	3180 0.203 25.4

6, 1800 U shape φ9/18mm MoSi2 Elements

Lu\Le	150	180	200	250	300	350	400	450	500	550	600	650	700	750	800
250	1110 0.022 5.0	1320 0.026 5.9	1470 0.029 6.5	1820 0.036 8.1	2180 0.043 9.7	2480 0.049 11.0	2840 0.056 12.6	3190 0.063 14.2	3540 0.070 15.8	3900 0.077 17.3	4200 0.083 18.7	4560 0.090 20.3	4910 0.097 21.8	5270 0.104 23.4	5620 0.111 25.0
300	1160 0.023	1370 0.027	1520 0.030	1870 0.037	2230 0.044	2530 0.050	2890 0.057	3240 0.064	3590 0.071	2950 0.078	4250 0.084	4610 0.091	4960 0.098	5320 0.105	5670 0.112.

ZHENGZHOU CHIDA FURNACE MATERIAL CO.,LTD
B1506,NO.7 DONGQING STREET,
ZHENGZHOU HI-TECH INDUSTRIAL DEVELOPMENT AREA HENAN,CHINA 450001
TEL: 86-371-67991791 FAX: 86-371-67980707
EMAIL:INFO@SIC-MOSI2.CN

	5.2	6.1	6.8	8.3	9.9	11.3	12.8	14.4	16.0	17.6	18.9	20.5	22.1	23.6	25.2
350	1220	1420	1570	1920	2280	2580	2940	3290	3650	4000	4300	1660	5010	570	5720
	0.0247	0.028	0.031	0.038	0.045	0.051	0.058	0.065	0.072	0.079	0.085	0.092	0.099	0.106	0.113
	5.4	6.3	7.0	8.6	10.1	11.5	13.1	14.6	16.2	17.8	19.1	20.7	22.3	23.9	25.4
400	1270	1470	1620	1970	2330	2630	2990	3340	3700	4050	4350	4710	5060	5420	5770
	0.025	0.029	0.032	0.039	0.046	0.052	0.059	0.066	0.073	0.080	0.086	0.093	0.100	0.107	0.114
	5.6	6.5	7.2	8.8	10.4	11.7	13.3	14.9	16.4	18.0	19.4	20.9	22.5	24.1	25.7
450	1320	1520	1670	2030	2380	2680	3040	3390	3750	4100	4400	4760	5110	5470	5820
	0.026	0.030	0.033	0.040	0.047	0.053	0.060	0.067	0.074	0.081	0.087	0.094	0.101	0.108	0.115
	5.9	6.8	7.4	9.0	10.6	11.9	13.5	15.1	16.7	18.2	19.6	21.2	22.7	24.3	25.9
500			1720	2080	2430	2730	3090	3440	3800	4150	4460	4810	5160	5520	5870
			0.034	0.041	0.048	0.054	0.061	0.068	0.075	0.082	0.088	0.095	0.102	0.109	0.116
			7.7	9.2	10.8	12.2	13.7	15.3	16.9	18.5	19.8	21.4	23.0	24.5	26.1
550				2130	2480	2780	3140	3490	3850	4200	4510	4860	5210	5570	5920
				0.042	0.049	0.055	0.062	0.069	0.076	0.083	0.089	0.096	0.103	0.110	0.117
				9.5	11.0	12.4	14.0	15.5	17.1	18.7	20.0	21.6	23.2	24.8	26.3
600				2180	2530	2830	3190	3540	3900	4250	4560	4910	5270	5620	5920
				0.043	0.050	0.056	0.063	0.070	0.077	0.084	0.090	0.097	0.104	0.111	0.118
				9.7	11.3	12.6	14.2	15.8	17.3	18.9	20.3	21.8	23.4	25.0	26.6
650					2580	2880	3240	3590	3950	5300	4610	4960	5320	5670	6020
					0.051	0.057	0.064	0.071	0.078	0.085	0.091	0.098	0.105	0.112	0.119
					11.5	12.8	14.4	16.0	17.6	19.1	2.05	22.1	23.6	25.2	26.8
700	Power:w				2630	2940	3290	3650	4000	4350	4660	5010	5370	5720	6080
	Resistance: Ω				0.052	0.058	0.065	0.072	0.079	0.086	0.092	0.099	0.106	0.113	0.120
	Working Voltage:V				11.7	13.1	14.6	16.2	17.8	19.4	20.7	22.3	23.9	25.4	27.0
750						2990	3340	3700	4050	4400	4710	5060	5420	5770	6130
	Condition:					0.059	0.066	0.073	0.080	0.087	0.093	0.100	0.107	0.114	0.121
	Element temp.1700℃					13.3	14.9	16.4	18.0	19.6	20.9	22.5	24.1	25.7	27.2
800	Furnace temp.1600℃					3040	3390	3750	4100	4460	4760	5110	5470	5820	6189
	Current:22.5A					0.060	0.067	0.074	0.081	0.088	0.094	0.101	0.108	0.115	0.122
	Surfaceload:11.4 w/cm²					13.5	15.1	16.7	18.2	19.8	21.2	22.7	24.3	25.9	27.5