制动电阻 stopping resistor

制动电阻是用于将电机的再生能量以热能方式消耗的载体，它包括电阻值和功率两个重要的参数。通常在工程上选用较多的是波纹电阻和铝合金电阻两种：前者采用表面立式波纹有利于散热减低寄生电感量，并选用高阻燃无机涂层，有效保护电阻丝不被老化，延长使用寿命；后者电阻器耐气候性、耐震动性，优于传统瓷骨架电阻器，广泛应用于高要求恶劣工控环境使用，易紧密安装、易附加散热器，外型美观，抗氧化 Brake resistance is used to consume the regenerative energy of motor as heat energy. It includes two important parameters: resistance value and power.Usually choose more in the project is corrugated resistance and aluminum resistance two kinds: the former USES the surface vertical corrugated is conducive to reduce the amount of parasitic inductance, and choose high flame retardant inorganic coating, effective protection of resistance wire is not aging, extend the service life;The latter resistor is resistant to climate and shock, better than the traditional porcelain frame resistor, widely used in the harsh industrial control environment with high requirements, easy to install tightly, easy to attach radiator, beautiful appearance, oxidation resistance。

制动单元 brake unit

制动单元的功能是当直流回路的电压 Ud 超过规定的限值时（如 660V 或 710V），接通耗电路，使直流回路通过制动电阻后以热能方式释放能量。制动单元可分内置式和外置式二种，前者是适用于小功率的通用变频器，后者则是适用于大功率变频器或是对制动有特殊要求的工况中。从原理上讲，二者并无区别，都是作为接通制动电阻的“开关”，它包括功率管、电压采样电路和驱动电路 The function of the brake unit is when the voltage of the dc circuit Ud exceed the prescribed limits (such as 660 V or 710 V), switch on electricity road, take the dc circuit through the braking resistance after way release energy as heat. Brake unit can be divided into built-in and built-out type two kinds, is suitable for low power general inverter, the latter is suitable for high power inverter or have special request for braking condition. In principle, there is no difference between both, are as "switches" connect braking resistor, it includes power tube, voltage sampling circuit and driver circuit

制动能耗过程如下 Braking energy consumption process is as follows

A、当电机在外力作用下减速、反转时（包括被拖动），电机即以发电状态运行，能量反馈回直流回路，使母线电压升高； A. When the motor slows down and reverses under the action of external force (including being dragged), the motor runs in the state of power generation, and the energy is fed back to the dc circuit to increase the bus voltage;

B、当直流电压到达制动单元开的状态时，制动单元的功率管导通，电流流过制动电阻；

B. When the dc voltage reaches the state of braking unit opening, the power tube of the braking unit is on, and the current flows through the braking resistance

C、制动电阻消耗电能为热能，电机的转速降低，母线电压也降低；

C. The braking resistance consumes electrical energy as heat energy, the motor speed decreases, and the bus voltage also decreases;

D、母线电压降至制动单元要关断的值，制动单元的功率管截止，制动电阻无电流流过；

D. Bus voltage drops to the value to be turned off by the braking unit, the power tube of the braking unit is cut off, and no current flows through the braking resistance;

E、采样母线电压值，制动单元重复 ON/OFF 过程，平衡母线电压，使系统正常运行。

E. Sample bus voltage value, repeat ON/OFF process of braking unit, balance bus voltage and make the system run normally

■ 电阻器安装方式 Resistor mounting mode

内置电阻：电阻器体积小、产品厚度超薄型、电阻芯内部要求较高、导线分软质硅胶线、或铁氟龙线或高温硅胶线，功率 50W～200W 范围。Built-in resistance: small size of resistor, ultra-thin product thickness, high internal requirements of resistance core, flexible silicone wire, or teflon wire or high-temperature silicone wire, power range of 50W ~ 200W

外置电阻：电阻器体积大、温度高、温度超过 180℃以上增加冷却风扇降温温升、维修方便，导线硅胶高温线，功率 300W～3000W 范围 External resistance: large size of resistor, high temperature, temperature above 180℃ increase cooling fan temperature rise, easy maintenance, high temperature wire silicone wire, power range of 300W ~ 3000W。

■ 特性用途 Feature USES

- 金属铝外壳，散热性能好、适合散热板安装，可长期在恶劣环境下使用.

  Metal aluminum shell, good heat dissipation performance, suitable for heat dissipation plate installation, can be used in bad environment for a long time.
- 体积小、功率负荷大 Small volume, large power load
- 镍铬合金及高频瓷芯组成 Nickel chromium alloy and high frequency porcelain core composition。
- 耐绝缘电压最高可达 6KV、绝缘电阻≥5000MΩ、具有超强电气安全特性 Insulation resistance voltage up to 6 kv, 5000 m Ω insulation resistance or greater, with super electrical safety features
- 耐机械震动性能良好、符合 GB/T T5729-2003&JIS-C-5202 电气特性 Good mechanical vibration resistance, in line with GB/T t5729-2003 & jis-c-5202 electrical characteristics
- 广泛用于工业变频器&伺服器制动刹车系统 Widely used in industrial inverter & servo brake system

■ 产品类别编码规则 Product category coding rules

第一行 GRT RX□□ – □□W – □□Ω – .J

first line：

RXLG：瓷棒

额定功率
10W
100W

额定阻值
R1=0.1
2R2=2.2
100R=100

精度
F=1%
G=2%
J=5%
K=10%

第二行：2021 01 10 □□□1

The second line

制造序号 Manufacturing serial number。

制造日期 manufacturing date。

制造月份 In manufacturing。

制造年份 year of manufacture。

制动电阻计算方法 Brake resistance calculation method

- 刹车使用率 ED%定义，刹车使用率 ED%=制动时间/刹车周期 Brake usage ED% is defined, brake usage ED%= brake time/brake cycle

  制动使用率的概念：10%的制动频率可以这样理解，如果制动电阻在 10 秒钟能够消耗掉 100%的功率，那么制动电阻至少需要 90 秒才能把产生的热量散掉 The concept of brake utilization rate: 10% of the brake frequency can be interpreted in such a way that if the brake resistance consumes 100% of the power in 10 seconds, it will take at least 90 seconds for the brake resistance to dissipate the heat generated。

- 制动电阻的阻值的选择范围 A range of resistance values for brake resistors：

$$\frac{U_D}{I_{MN}} < R \leq \frac{2*U_D}{I_{MN}}$$

- 设计举例：根据以上的公式我们可以大致的推算出来我们需要的制动电阻的阻值和功率。以变频器驱动 7.5KW 的电机作为例来说明，7.5KW 电机额定电流是 18A,输入电压 AC400，则有：

Design example: according to the above formula, we can roughly calculate the resistance value and power of the brake resistance we need. Take the 7.5kw motor driven by the frequency converter as an example to illustrate, the rated current of 7.5kw motor is 18A, and the input voltage AC400, then

$$R_B = \frac{2*U_D}{I_{MN}} = \frac{2*800}{18} = 88.9\ \Omega \qquad R_{Bmin} = \frac{U_D}{I_{MN}} = \frac{800}{18} = 44.4\ \Omega$$

- 因此制动电阻的阻值取值范围 Therefore, the resistance value range of brake resistance：44.4≥Ω≤88.9Ω

产品执行标准 Product execution standard

标准文件号 Standard file number	文件名 document name	备注 remark
GB/T5729-2003	电子设备固定电阻器：第 1 部分总规范	
GB/T2423.17-1993	电工电子产品试验规程试验:盐雾试验方法	IEC60115-1-2001
C=0 MIL-STD-1916	C=0 MIL-STD-1916 抽样计划表 II	IATF16949
GB/T4798.1-2005	电工电子产品应用环境条件 第 1 部分 贮存	
GB/T4798.2-2008	电工电子产品应用环境条件 第 2 部分 运输	
GB/T191-2008	包装储运图标示	
GB/T17035-1997	带散热型固定电阻器 评定水平 F	IEC60115-4-3-1993
Test Methods of JIS-C-5202	JIS-C-5202	

产品试验大纲 Product test outline

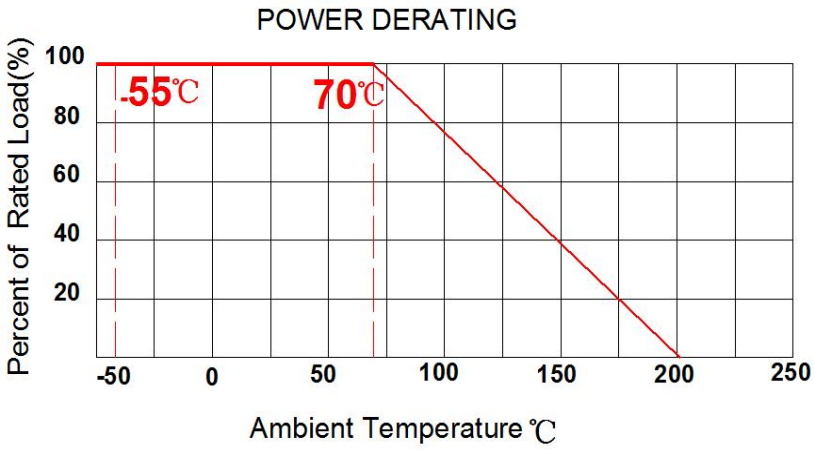
NO	试验项目 strength tests	试验设备 testing equipment	依据标准 according to the standard
1	电阻值Ω±J（5%）Resistance	电阻测试仪表 Resistance measuring instrument	GB/T5729-2003 4.5
2	耐电压测试 Voltage testAC3000V	绝缘电压测试仪 Insulation voltage tester	GB/T5729-2003 4.7
3	绝缘电阻测试 DC1000V	绝缘电阻测试仪 insulation testing set	GB/T5729-2003 4.6
4	过载测试 V=$\sqrt{10XPXR}$	大功率输出电源 High power output power supply	GB/T5729-2003 4.13
5	温度系数测试 PM/℃	恒温箱 incubator	GB/T5729-2003 4.8
6	70℃耐久性 The durability of 70 ℃	恒温恒湿箱 constant temperature humidity chamber	GB/T5729-2003 4.25.1
7	40℃稳态湿热 Steady moist heat at 40℃	恒温恒湿箱 constant temperature humidity chamber	GB/T5729-2003 4.24

8	温度快速变化测试-55℃～155℃Rapid temperature change test -55℃	高低温箱 high-low temperature chamber	GB/T5729-2003 4.19
9	温度热平衡±3℃Thermal equilibrium ±3℃	持续额定电压 1H Continuous rated voltage 1H	GB/T5729-2003 4.8.3
10	盐雾试验 salt spray tes	盐雾试验箱 salt spray test chamber	GB/T2423.18
11	端子拉力 N/mTerminal tension N/m	拉力测试仪 Tensile tester	GB/T5729-2003 4.16
12	ROHS	第三方 third party	QC/T941/942/943/944
13	震动测试 vibration test	第三方 third party	GB/T5729-2003 4.22
14	模拟刹车制动测试 Brake simulation test	制动测试平台连续测试 Max250 小时 Brake test platform continuous test Max250 hours	客户要求提供参数 he customer requested parameters

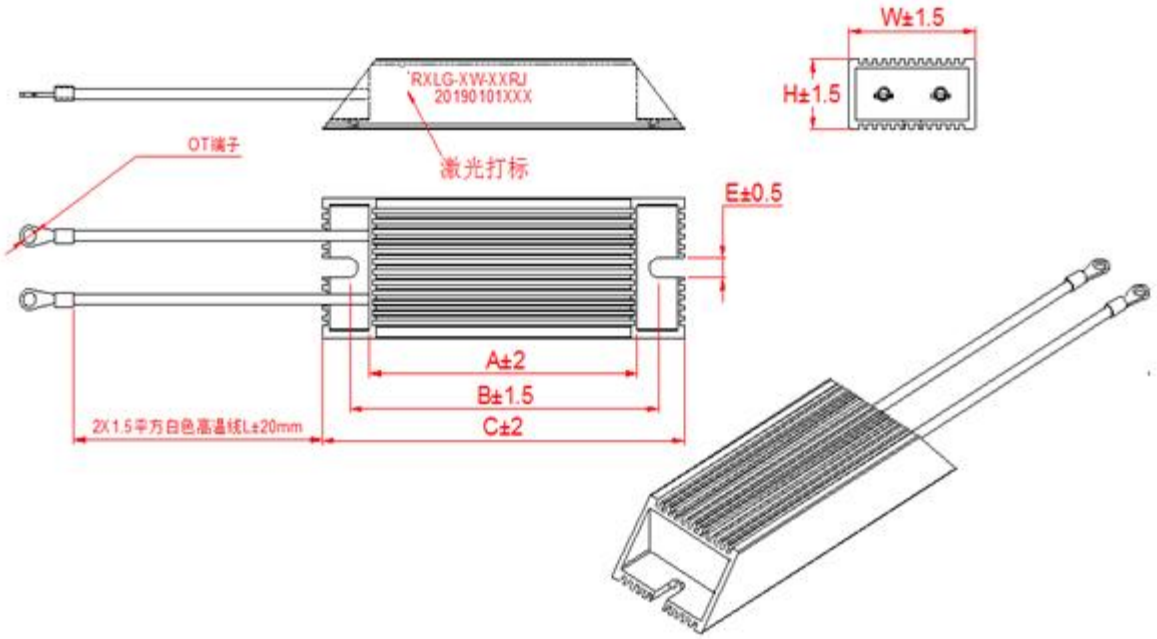
■ 额定值 Ratings

项目 project	内容 content
产品名称 The product name	RX 系列
额定功率 Rated power	W KW
额定电压 Rated Voltage	V=$\sqrt{WX100\Omega}$
耐绝缘电压 Insulation r	AC3000V/1min 漏电流≤3mA
绝缘电阻 Insulation resistance	DC1000V/1mim 绝缘电阻≥100MΩ
最高使用电压 Maximum service voltage	V=$\sqrt{P（功率）X\Omega（欧姆值）}$
使用环境温度范围 Use the ambient temperature range	-55℃～70℃（当环境温度在-55℃～70℃范围电阻连续负载承受最高使用电压）
额定环境温度 Rated ambient temperature	-55℃～70℃
电阻精度 Precision of resistance	F=±1%，G=±2%，J=±5%

■功率衰减曲线 Power Derationg curve

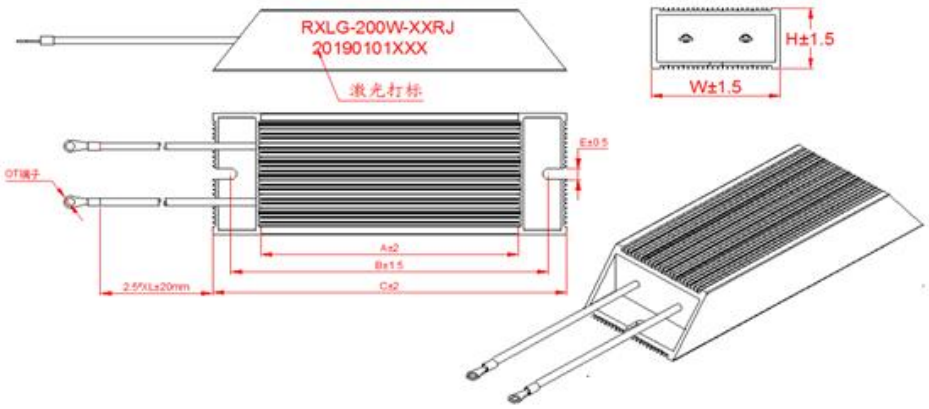


一般品 RXLG -40X20 型系列产品尺寸图片对照表 General product rxlg-40x20 series product size picture comparison table



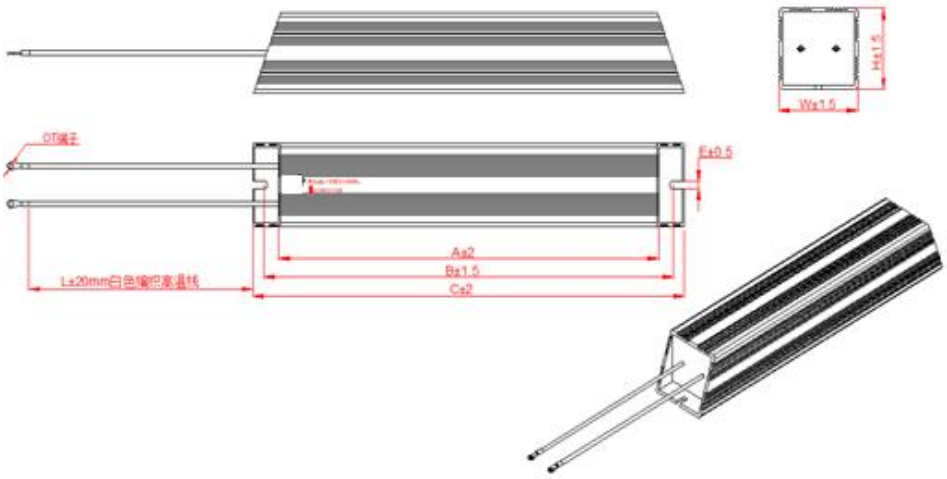
功率 powe	尺寸 size：mm								阻值范围 resistance range
	A±2	B±2	C±2	E±2	H±2	W±2	L±20	端子	
60W	85	98	115	5.5	20	40	1.5 ㎡=450	2-4	0.1Ω～10K
80W	110	123	140	5.5	20	40	1.5 ㎡=450	2-4	1Ω～10K
100W	135	148	165	5.5	20	40	1.5 ㎡=450	2-4	1Ω～10K
120W	160	173	190	5.5	20	40	1.5 ㎡=450	2-4	1Ω～15K
150W	185	198	215	5.5	20	40	1.5 ㎡=450	2-4	1Ω～20K

一般品 RXLG -60X30 型系列产品尺寸图片对照表 General product rxlg-60x30 series product size picture comparison table



功率 powe	尺寸 size：mm								阻值范围 resistance range
	A±2	B±2	C±2	E±2	H±2	W±2	L±20	端子	
200W	147	126	165	5.5	30	60	2.5 ㎡=450	2-4	1Ω～10K
300W	197	176	215	5.5	30	60	2.5 ㎡=450	2-4	1Ω～20K
400W	247	226	265	5.5	30	60	2.5 ㎡=450	2-4	1Ω～20K
500W	317	296	335	5.5	30	60	2.5 ㎡=450	2-4	1Ω～20K
800W	382	361	400	5.5	30	60	2.5 ㎡=450	2-4	1Ω～20K

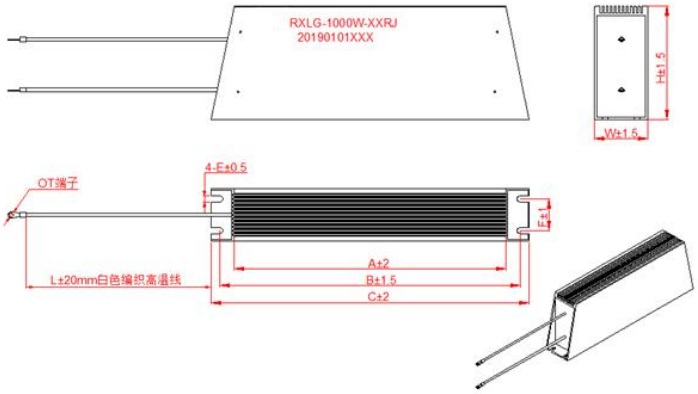
■ 一般品 RXLG -61X59 型系列产品尺寸图片对照表 General product rxlg-61x59 series product size picture comparison table



功率 powe	尺寸 size：mm								阻值范围 resistance range
	A±2	B±2	C±2	E±2	H±2	W±2	L±20	端子	

1000W	295	317	335	5.5	59	61	2.5 ㎡=500	2-4	1Ω～1K
1200W	345	367	385	5.5	59	61	2.5 ㎡=500	2-4	1Ω～1K
备注 remark	电阻器 1200W 垂直时建议使用双安装孔会更加牢固 1200 w resistor when vertical recommend using double mounting holes will be more solid								

■一般品 RXLG -50X107 型系列产品尺寸图片对照表 General product rxlg-50x107 series product size picture comparison table



功率 powe	尺寸 size：mm									阻值范围 Resistance range
	A±2	B±2	C±2	E±2	F±1	H±1.5	W±1.5	L±20	端子	
1000W	280	255	300	5.5	30	50	107	2.5 ㎡=500	2-4	1Ω～10K
1200W	345	305	350	5.5	30	50	107	2.5 ㎡=500	2-4	1Ω～10K
1500W	380	355	400	5.5	30	50	107	2.5 ㎡=500	2-4	1Ω～10K
2000W	430	405	450	5.5	30	50	107	6 ㎡=1000	3.5-8	1Ω～10K
2500W	410	440	485	5.5	30	50	107	6 ㎡=1000	3.5-8	1Ω～10K
3000W	530	505	550	5.5	30	50	107	6 ㎡=1000	3.5-8	1Ω～10K
备注 remark	功率超过 3KW 建议使用电阻箱或我司金属管电阻箱替代 If the power exceeds 3KW, it is suggested to use resistance box or our company's metal tube instead									

■使用注意事项 Precautions For Use

1、产品需在以下环境下保管：在温度-10℃ ～+40℃,湿度80% R.H.以内储存保管。

Products need to be in the following environment preservation: in the temperature - 30 ℃ ~ + 40 ℃, 4humidity less than 80% R.H. storage security。

2、因为在腐蚀性气体比较多之处（潮气、Cl2、H2S、NH3、SO2、NO2、等）或日光直射之处保管会造成性能恶化和影响焊接性的情况，须注意。 Because in the place where corrosive gas more (moisture, Cl2, H2S, NH3, SO2, NO2, etc.) or keep the place of direct sunlight can cause performance degradation and weldability, must pay attention to。

3、本品使用树脂填料，故请避免因碰撞、或用金属物体等击打本产品而导致损伤、在受到冲击或大力撞击并造成破损的可能性高，请注意使用。 This product use resin, filler, so please avoid because of the collision, or with metal objects such as hitting the products and cause damage, by the possibility of impact and cause damage or a strong high, please pay attention to use.

4、对端子或外壳进行清洗完成后，请避免用刷子等刷洗本品填充区，以免损伤填料脱落。

To cleaning after the completion of the terminal or shell, please avoid such as scrub with the brush populated area, so as not to damage the packing

5、在使用高压电回路时，考虑到邻接发热部品有导致温度上升等情况，请注意减少额定功率,设计电压&功率建议不超过70%,最大不超过90% 。When using high voltage loop, considering the adjacency hot zone has the rising temperature, etc., please pay attention to reduce the rated power, voltage design & power suggest no more than 70%, the biggest is not more than 90%.。

6、关于瞬间电压:针对在短时间内施加诸如脉冲等的高电压而产生的瞬间超载现象，在根据理论界功率或一般常态条件进行设计，使用的同时，还须在本品安装后，对整体产品进行测试评估确认。 About: transient voltages for applying such as pulse in a short period of time of instantaneous overload phenomenon, as a result of the high voltage power in the world of according to the theory or general normal conditions in the design, use at the same time, also must be in the product after installation, to the whole product was tested in assessment.。

7、特别在超出电阻器特殊环境下使用时，请对其性能和信赖性进行充分的确认。

Especially in beyond the resistor when used under special circumstances, please to fully confirm its performance and reliability

8、使用超出标示电压范围时会增加不良风险,请设计予以考量。

Use beyond the mark voltage range will increase the risk of not good, please design considerations

9、本产品金属外壳安装时涂抹散热硅脂与安装散热底板对产品至关重要。

This product installed metal case when daub heat dissipation silicon grease and heat dissipation plate is essential to the product

10、本产品符合ROHS、REACH指令涉及到的10大环境管理物质（铅、镉、六价铬、汞、多溴联苯及多溴二苯醚）。

This product conforms to the ROHS and REACH directive involves 10 environment management substance (lead, cadmium, hexavalent chromium, mercury, polybrominated biphenyls (PCBS) and polybrominated diphenyl ether)

END