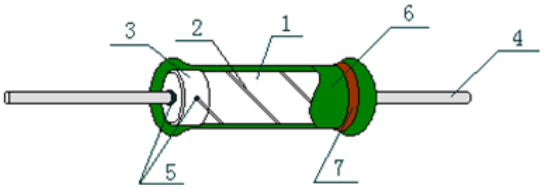
Technical Application of Wire-Wound Fusing Resistors

§0. Abstract

Wire-wound fusing resistor is a type of wire-wound resistor which is very comprehensive in design. It has a certain load capacity in circuit applications and can ensure that it is in an open circuit state at predetermined current and voltage values. It presents a resistance state under a certain current and voltage, playing the role of a resistor. However, when the current exceeds a certain value, it has the function of a fuse, a special component with the dual functions of a resistor and a fuse

This resistor, small in size, with low cost and little space occupation in circuit design, is cost-saving. And it is a wire-wound resistor with dual functions, which is also better than ordinary wire-wound resistors in terms of safety performance, and has important practical value.

§1. Structural Characteristics of Wire-Wound Fusing Resistors



NO.	Name	Raw materials
1	Basic body	Rod Type Ceramics
2	Resistor	Resistance Wire Alloy
3	End cap	Steel (Tin Plated iron Surface)
4	Lead wire	Annealed copper wire coated with tin
5	Joint	By welding
6	Coating	Insulated & Non-Flame paint (Color :Deep Green)
7	Color code	Non-Flame Epoxy Resin

§2. Classification of Wire-Wound Fusing Resistors

Fusing resistors can be divided into recoverable and disposable fusing resistors according to their working methods:

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(1) Recoverable fusing resistors are ordinary resistors (or resistance wires) that are welded to an elastic metal sheet with low melting point solder and then sealed in a cylindrical or square shell. When the load current is excessive and the temperature is too high, the solder joints of the low melting point solder melt, and the elastic metal sheet detaches from the resistor, causing the circuit to disconnect. After the problem of the circuit is fixed, the resistor is then welded in series with the metal sheet to restore normal operation.

(2) A disposable fusing resistor (non-recoverable fusing resistor) serves as a fixed resistor during normal circuit operation. When the working current exceeds the rated current, it will quickly fuse and protect the circuit. Fusing resistors are used in electrical appliances such as televisions, energy-saving lights, and mobile phone power supplies.

This wire-wound fusing resistor belongs to a disposable fusing resistor and cannot be restored after melting.

§3. The Principle of Wire-Wound Fusing Resistors

By utilizing the correlations between alloy resistance wire and temperature, as well as the correlations between electronic component current (voltage, % of rated power) and temperature, through changes in material and process, the product performance can reach the predetermined technical parameters. The current calculated based on the rated power is the rated current IR=√ PR/R. When the rated current is applied to the resistor, the power loaded on the resistor is the rated power, and the voltage drop on the resistor is the rated voltage. The rated current is related to the resistance value of the resistor. The lower the resistance value, the greater the rated current. For low resistance resistors, the rated current may reach a great value. After extensive experiments and reference to relevant materials, it has been concluded that the fusing current is related to the resistance value of the resistor: the greater the resistance

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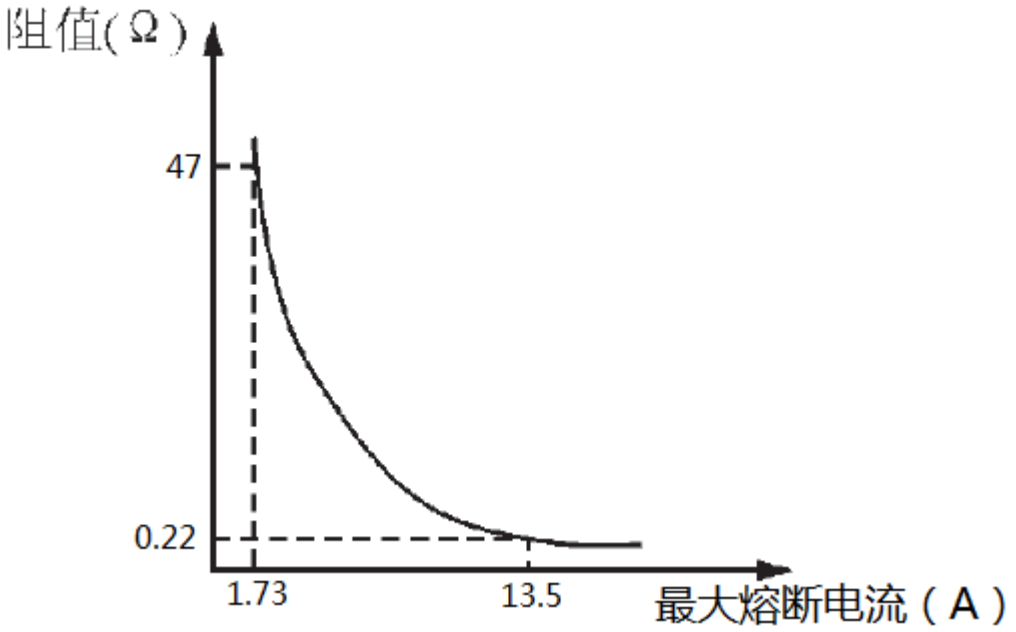
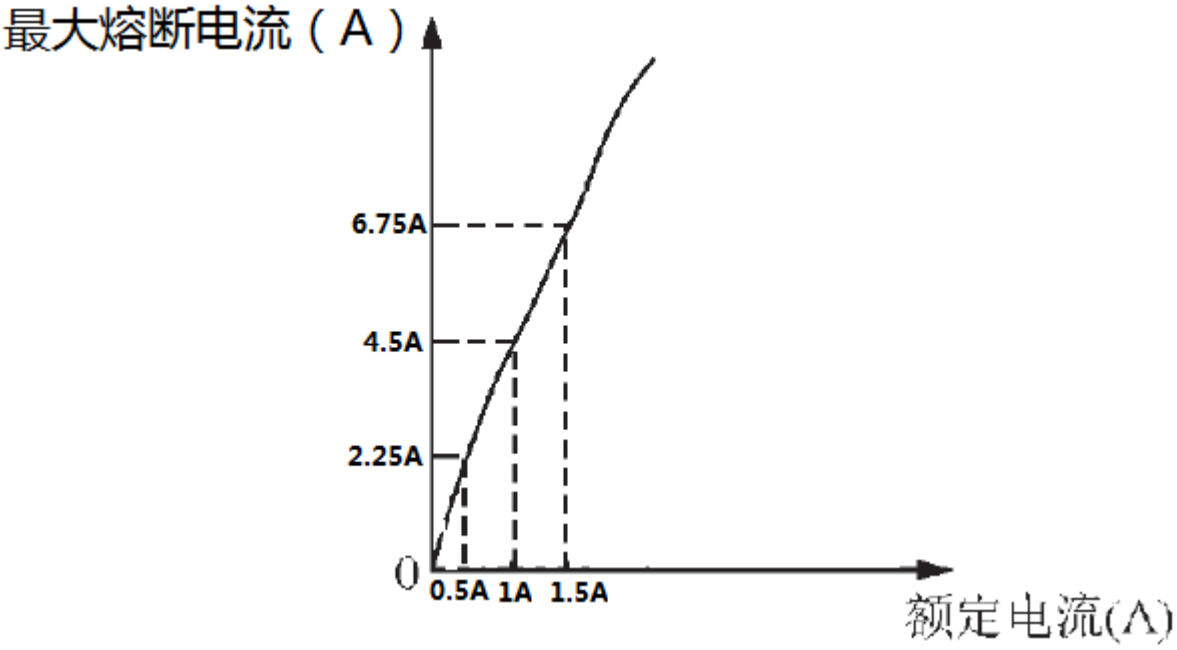
value, the lower the fusing current; the lower the resistance value, the greater the fusing current. The correlation between the fusing current and the resistance value is shown in Figure 1. The fusing current is directly proportional to the rated current, as shown in Figure 2.



（Fig.1：correlation between fusing current and resistance value）



（Fig.2：correlation between fusing current and rated current）

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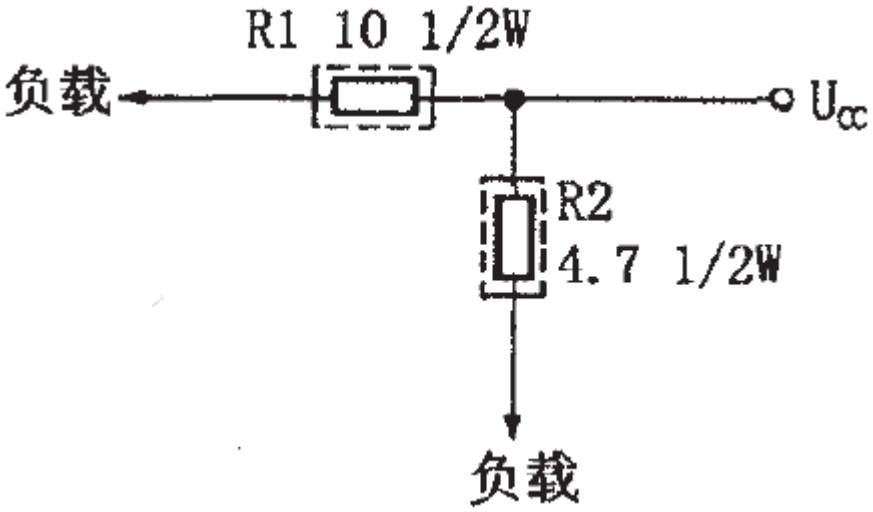
§4. Selection of Wire-Wound Fusing resistors

Fusing resistors, with protective functions, their dual performance should be considered when being selected. Select parameters such as resistance and power according to the specific requirements of the circuit to ensure that it can quickly fuse in case of overcurrent, and to ensure that it can work stably for a long time under normal conditions. When replacing this resistor, the new resistor should be absolutely the same with the original one in terms of resistance value and rated power (wattage). If the resistance value and power are too great or too low, they will not have a protective effect.



(Fig.3: Application circuit of fusing resistors)

The resistor in the circuit shown in Figure 2 is a fusing resistor, which serves as the connection resistor from the power to each part of the circuit as a short-circuit protection (fuse function) resistor.

When replacing a burnt out resistor, it is necessary to choose a resistor with the same resistance value and power as the original one, and cannot arbitrarily increase or decrease the resistance value and power. If the resistance value of the replaced resistor is equal to the original value but with a greater power, the resistor will not function as it should when a short circuit fault occurs in the circuit because the

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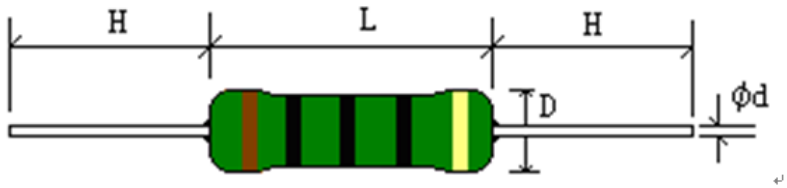
resistor cannot be blown out.

§5. Detection of Wire-Wound Fusing Resistors

In a circuit, if the surface of the fusing resistor is found to be blackened or burnt, it can be concluded that its load is too heavy, and the current passing through it exceeds the rated value many times. If there are no traces on the surface and there is an open circuit, it indicates that the current is just equal to or slightly greater than its rated fuse value. To judge the quality of a fusing resistor without any trace on the surface, a multi-meter at R ×10 Ω level can be used for measuring. To measure accurately, the fusing resistor should be soldered off the circuit. If the measured resistance value is infinite, it indicates that the fusing resistor is open. If the measured resistance value differs too far from the nominal value, it indicates that the resistance value has changed and cannot be used again. In daily experiments, attention should be paid as there are cases that a very small number of fusing resistors are broken down, causing short circuit.

§6. Model of Wire-Wound Fusing resistors



Type	Dimension(mm)				Tolerance	Resistance Range
	D±1	L±1	H±3	d±0.05		
KFR 1/2W	2.5	6.5	28	0.50	±5%	0.22Ω~160Ω
KFR 1W	3.5	9.5	28	0.55	±5%	0.22Ω~360Ω
KFR 2W	4.5	11.	28	0.65	±5%	0.22Ω~750Ω
KFR 3W	5.5	15.	28	0.75	±5%	4.7Ω~47Ω
KFR 5W	6.5	17.	28	0.75	±5%	4.7Ω~47Ω
KFR 7W	8.5	24.	38	0.75	±5%	4.7Ω~47Ω