General Application Guide of the High-Speed Fuse

Used for Semiconductors

1. Overview

The fuse for protection of semiconductor devices produced by Zhejiang Galaxy Fuse Co., Ltd., rated voltage up to AC1250V/DC1000V, rated current up to 3000A, with a lower I^2t value, strong current limiting capacity and high breaking capacity, is suitable for applications in metallurgy, rail transit, electric vehicles, AC/DC substations and other industries. It has been used for power systems, energy storage systems, rectifier diodes, short-circuit protection for thyristors and their complete sets consisting of semiconductor devices, and overload and short-circuit protection. This series of fuses comply with GB/T13539.1/IEC60269-1; GB/ T13539.4/IEC60269-4 standards.

2. Basic Parameters

2.1 Rated voltage: AC(150V~1250V)/DC(24V~1000V). See the description of the specific model for details.

2.2 Rated current: 2A~3000A. See the description of the specific model for details.

2.3 Breaking capacity: 30kA~120kA. See the description of the specific model for details.

2.4 AC rated frequency: 45~62Hz.

2.5 DC time constant: 2ms~15ms. See the description of the specific model for details.

2.6 Usage category: "aR", "gR" and "gS". Performance and differences are detailed below.

2.6.1 "aR"

"aR" indicates a fuse with partial range breaking capacity for the protection of semiconductor equipment.

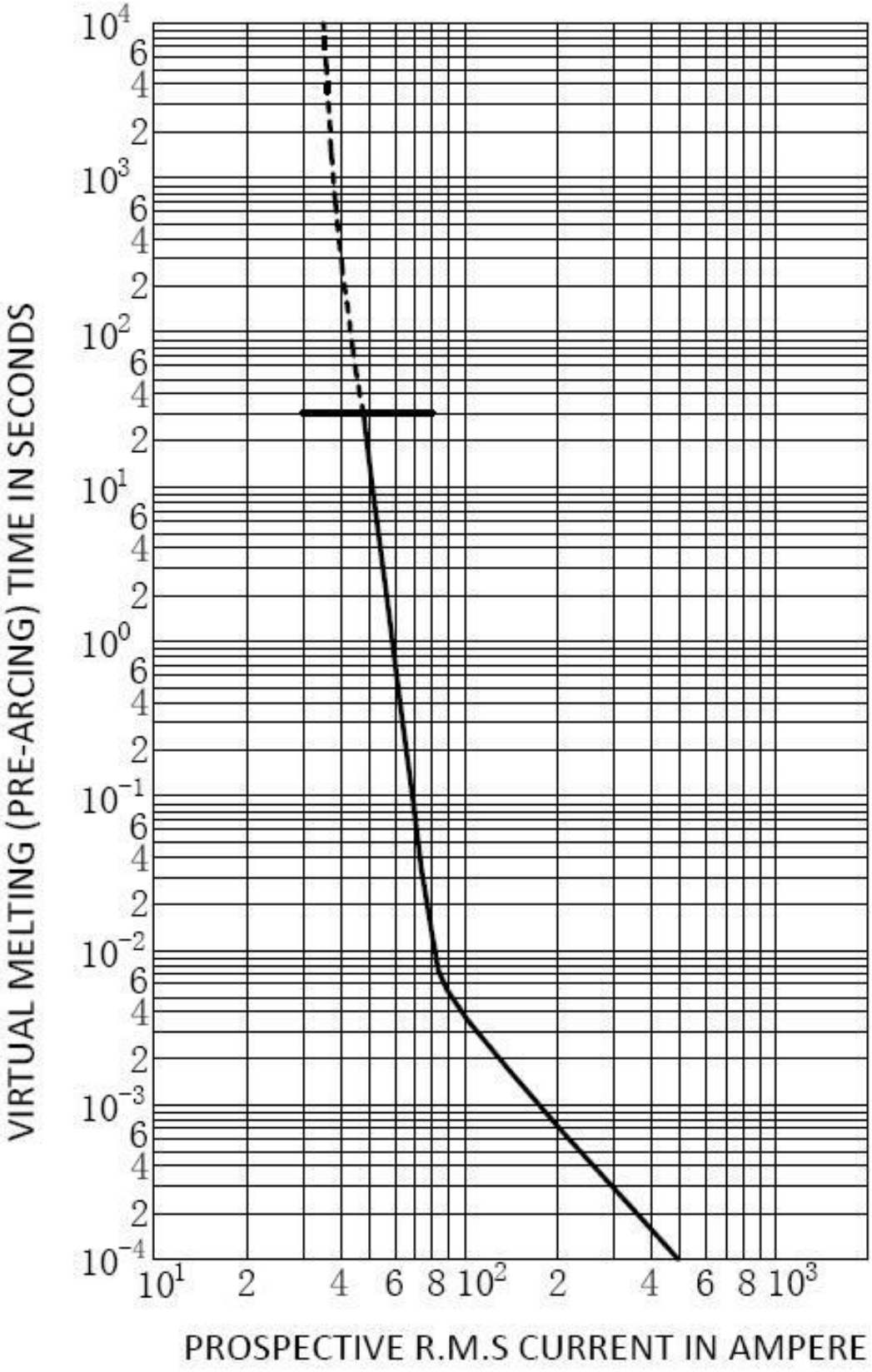
The element inside the fuse has no metallurgical effect and has no breaking capacity for small multiples of current, which can only be used for short-circuit protection.

Fusing characteristics: The fusing characteristic curve illustrates the function between the prospective current (A) and the adequate breaking time (S) (see diagram below).

The "aR" fuse is used for short-circuit protection against large fault currents. The fuse can't be operated in the dotted line section of the time-current characteristic curve, where the fuse is not guaranteed to work correctly. The minimum breaking current is the prospective current corresponding to the connection (30s) between the solid line and the dotted line on the characteristic curve.

The "aR" fuse has good current cut-off characteristics due to its thin structure, which can eliminate major faults within milliseconds. However, it dissipates higher power during regular operation.

The recommended long-term current value for "aR" fuses is not more than 80% of the rated current.



2.6.2 "gR"

"gR" indicates a fuse for general usage and semiconductor protection with a full range of breaking capacity and has a lower I^2t value.

The "gR" fuse has overload and short-circuits protection, and the fusing characteristics of the fuse are shown in (Table 1).

2.6.3 "gS"

"gS" indicates a fuse for general usage and semiconductor protection with a full range of breaking capacity and has a lower power dissipation value.

The "gS" fuse has overload and short-circuits protection and the fusing characteristics of the fuse are shown in (Table 1).

(Table 1) "gR"、"gS" Conventional Time and Conventional Current

Rated Current A	Conventional Time h	Conventional Current			
		"gR"		"gS"	
		Inf	If	Inf	If
In≤63 63<In≤160 160<In≤400 400<In	1 2 3 4	1.13In	1.6In	1.25In	1.6In

Note: In is the rated current of the fuse; Inf is the conventional non-fusing current; If is the conventional fusing current.

3. Operating Conditions

3.1 Ambient air temperature

Normal operating conditions: -5℃~40℃

Permissible use conditions: -40℃~85℃

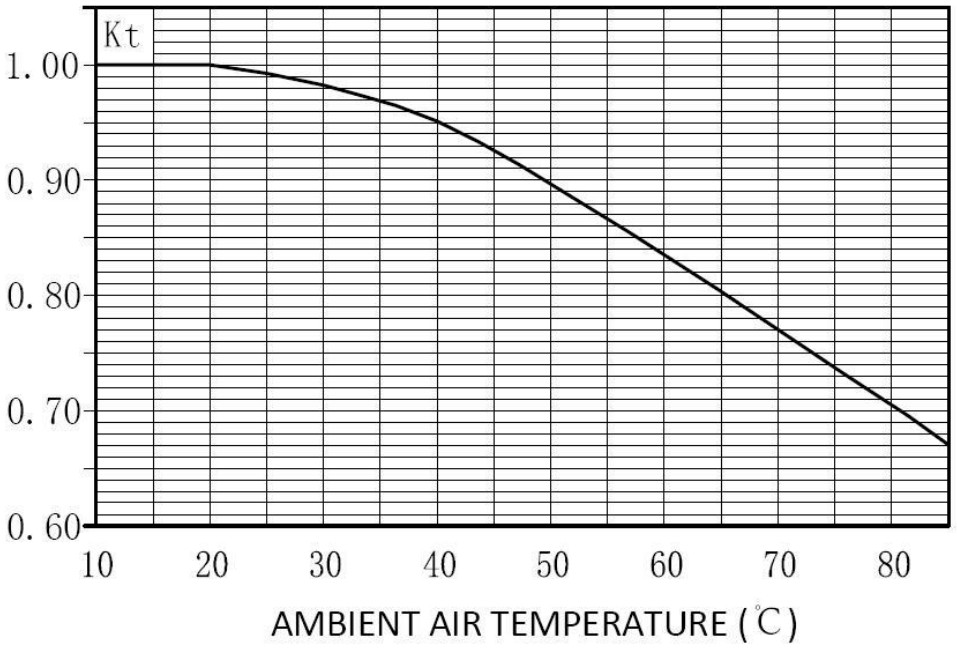
Parameter correction for changes in ambient air temperature: operating below:

When working under -5°C, the pre-arc time for low times overload overcurrent of the fuse is slightly extended and the rated current is slightly increased. However, unless -5°C or above is not the operating range, the increase in the rated current of the fuse is generally not considered.

For fuse operation above 40°C, the rated current requires an additional correction with a correction factor of Kt.

Note 1: The value of Kt already considers the influence of the rated current safety allowance of the fuse under normal operating conditions.

Note 2: The ambient air temperature needs to last for more than 1 to 2 hours to have a significant effect.



3.2 Altitude

Normal conditions of use

Altitude not exceeding 2000m.

Permissible conditions of use: 2000~4500m.

Parameter corrections for altitude changes: higher altitudes mainly bring about insulation deterioration, deterioration of thermal conditions and changes in gas pressure.

3.2.1 The temperature rise of the fuse body rises by 0.1-0.5k for every 100m of altitude gain.

3.2.2 For every 100m increase in altitude, the ambient temperature decreases by about 0.5k.

3.2.3 In general, fuses used in open environments can ignore the effect of altitude on rated current and are still selected according to standard conditions.

3.2.4 For fuses used in enclosed environments, if the case's ambient air temperature or the patient's internal temperature does not drop significantly with the rise in altitude and can still reach above 40°C, the rated current needs to be reduced in capacity. The rated current is reduced by 2%-5% for every 1000m rise in altitude.

Note: A higher reduction ratio is used for the highest-rated current in the same size series, and a lower reduction ratio is used for smaller rated currents.

3.3 Effect of altitude on air insulation strength (breakdown strength):

3.3.1 At higher altitudes, the strength of the air insulation decreases. Within 2000-4500m, the power of the insulation reduces by 12-15% for every 1000m increase in altitude. See GB/T16935.1 for the corresponding correction to the insulation gap.

3.3.2 The insulation distance between the fuse terminals is generally more significant than the insulation gap required by GB/T16935.1, Table A1, A2 standard. Except for individual more miniature fuses, no need to check the insulation gap.

3.3.3 The insulation gap between the fuse and other live structures and ground needs to be considered by the user as well as concerning the effect of altitude.

3.4 Atmospheric conditions

3.4.1 Normal working conditions:

The air is clean, and its relative humidity does not exceed 50% at a maximum temperature of 40°C. Higher relative humidities are possible at lower temperatures, for example, up to 90% at 20°C. Under these conditions, moderate condensation may occasionally occur due to temperature variations.

3.4.2 Permissible operating conditions:

Relative humidity up to 95% without significant condensation.

3.5 Vibration environment and ability to withstand disasters such as earthquakes

This series of fuse bodies have good resistance to vibration and shock and can withstand an acceleration of 10g or more.

This series of fuse bodies can withstand vibration and shock, in line with the rail transit class II application environment.

This series of fuse bodies can withstand vibration and shock per GB/T 28046.3 Vibration requirements for passenger cars' flexible bodies (bodywork).

Applications where vibration is more intense are generally tested and verified.

3.6 Fouling class

The fouling class meets class III.

3.7 Installation conditions

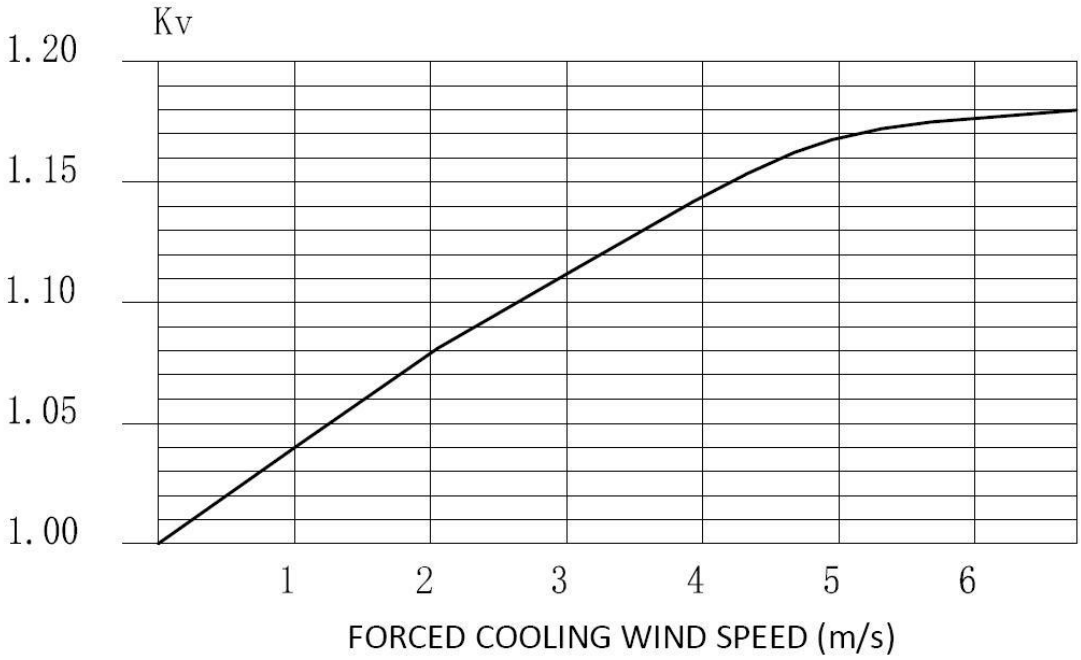
3.7.1 The fuse body is installed in natural air without ventilation, with no other heat-generating or dissipating parts within 1m except for the connecting wires.

3.7.2 The fuse connection terminals should ensure a stable and reliable electrical contact. The contact resistance should not significantly affect the work of the fuse.

3.7.3 The fuse body can be installed vertically, horizontally, or at an angle. Suppose the electrical connection of the fuse is ensured by spring pressure. It is advisable to choose a suitable position when installing the fuse to avoid the adverse effects of gravity and vibration on the electrical connection.

3.8 Forced air cooling:

The use of forced air cooling increases the heat dissipation of the fuse and can increase the rated current of the fuse. Correction factor of Kv for airspeed and rated current



4. Transport and Storage

4.1 Transport

Avoiding rain, snow and mechanical damage during the transport of the boxes.

4.2 Storage

Product and packaging storage temperature: -40℃ ～ 70℃. The relative humidity should be no more than 70% at 40℃, no more than 80% at 30℃, no more than 70% at 20℃, and no condensation.

The number of stacking layers of outer packaging cartons should not exceed 6 layers, the total stacking height should not be greater than 2m, and measures should be taken to prevent collapse.

The height of the falling body is not more than 0.6m when loading and unloading, and the impact energy should be borne by the plane, avoiding the corners of the box to maintain the impact energy.

Fireproof, waterproof, avoid contact with corrosive substances and gases.

5. Installation and Maintenance

5.1 When installed, the minimum gap between two adjacent fused parts with electricity meets the insulation requirements. If necessary, an insulating partition is installed between the fused parts to prevent an inter-phase short circuit when replacing the fused parts with electricity.

5.2 In conjunction with regular maintenance of electrical equipment, inspections and care to remove dust, oxide layers in contact with conductive parts, etc., should be carried out.

5.3 Fuses with mechanical damage must be replaced timely.

5.4 Do not replace fuses with load unless the use requirements allow it, e.g., fuse type load switches.

5.5 Metal parts can be recycled at the end of the product's life, and non-metal parts can be disposed of as general industrial waste after crushing, causing no pollution to the environment.