

Fuse Facts and Fuse Selection Guide

DERIVATION OF NOMINAL MELTING I²t: Laboratory tests are conducted on each fuse design to determine the amount of energy required to melt the fusing element. This energy is described as nominal melting I²t and is expressed as "Ampere Squared Seconds" (A² Sec.). A pulse of current is applied to the fuse, and a time measurement is taken for melting to occur. If melting does not occur within a short duration of about 8 milliseconds (0.008 seconds) or less, the level of pulse current is increased. This test procedure is repeated until melting of the fuse element is confined to within about 8 milliseconds. The purpose of this

procedure is to assure that the heat created has insufficient time to thermally conduct away from the fuse element. That is, all of the heat energy (I²t) is used, to cause melting. Once the measurements of current (I) and time (t) are determined, it is a simple matter to calculate melting I²t. When the melting phase reaches completion, an electrical arc occurs immediately prior to the "opening" of the fuse element. Clearing I²t = Melting I²t + arcing I²t. The nominal I²t values given in this publication pertain to the melting phase portion of the "clearing" or "opening".

FUSE SELECTION GUIDE

The application guidelines and product data in this guide are intended to provide technical information that will help with application design. Since these are only a few of the contributing parameters, application testing is strongly recommended and should be used to verify performance in the circuit/application.

Many of the factors involved with fuse selection are listed below:

Selection Factors

1. Normal operating current
2. Application voltage (AC or DC)
3. Ambient temperature
4. Overload current and length of time in which the fuse must open.
5. Maximum available fault current
6. Pulses, Surge Currents, Inrush Currents, Start-up Currents, and Circuit Transients
7. Physical size limitations, such as length, diameter, or height
8. Agency Approvals required, such as UL, CSA, VDE, METI, MITI or Military
9. Considerations: mounting type/form factor, ease of removal, axial leads, visual indication, etc.
10. Fuseholder features: clips, mounting block, panel mount, p.c. board mount, R.F.I. shielded, etc.

NORMAL OPERATING CURRENT: The current rating of a fuse is typically derated 25% for operation at 25°C to avoid nuisance blowing. For example, a fuse with a current rating of 10A is not usually recommended for operation at more than 7.5A in a 25°C ambient. For additional details, see RERATING in the previous section and AMBIENT TEMPERATURE below.

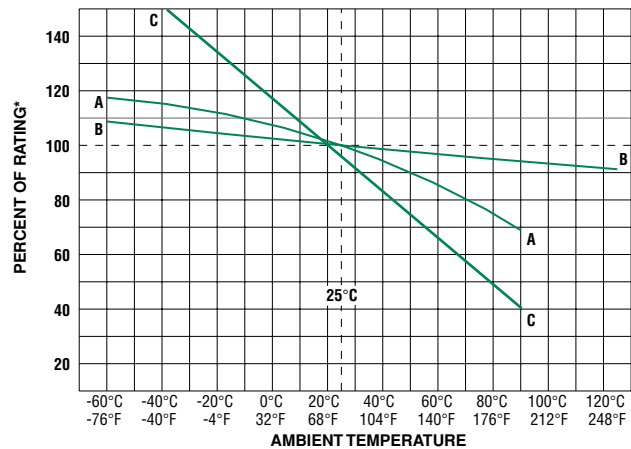
VOLTAGE: The voltage rating of the fuse must be equal to, or greater than, the available circuit voltage. For exceptions, see VOLTAGE RATING.

AMBIENT TEMPERATURE: The current carrying capacity tests of fuses are performed at 25°C and will be affected by changes in ambient temperature. The higher the ambient temperature, the hotter the fuse will operate, and the shorter its life will be. Conversely, operating at a lower temperature will prolong fuse life. A fuse also runs hotter as the normal operating current approaches or exceeds the rating of the selected fuse. Practical experience indicates fuses at **room temperature** should last indefinitely, if operated at no more than 75% of catalog fuse rating.

CHART SHOWING EFFECT OF AMBIENT TEMPERATURE ON CURRENT-CARRYING CAPACITY (TYPICAL)

KEY TO CHART:

- Curve A: Thin-Film Fuses and 313 Series (.010 to .150A)
- Curve B: Very Fast-Acting, Fast-Acting, and Spiral Wound Slo-Blo® Fuses
- Curve C: Resettable PTC's



*Ambient temperature effects are in addition to the normal rerating, see example.

Example: Given a normal operating current of 2.25 amperes in an application using a Very Fast Acting fuse at room temperature, then:

$$\text{Catalog Fuse Rating} = \frac{\text{Normal Operating Current}}{0.75}$$

or

$$\frac{2.25 \text{ Amperes}}{0.75} = 3 \text{ Amp Fuse (at } 25^{\circ}\text{C)}$$