Fuse Terminology

AMPERE (or CURRENT) RATING (In)

This is the nominal value upon which all performance characteristics of a fuse are based. Ambient Environment Derating, Life, Temperature Rise, and Overload Clearing tests are all conducted at percentages of the fuse *In*.

BREAKING CAPACITY

(also referred to as: INTERRUPTING RATING, IR ABILITY, or SHORT CIRCUIT RATING)

This is the maximum current flow that a fuse can safely interrupt at an open circuit voltage equal to, or less than, its voltage rating. Breaking capacity is tabulated for all fuses in this catalog; the values were established using tests conducted by the appropriate safety agencies.

DERATING

In general, it is recommended that fuses be operated continuously at no more than 75% of rated current when in a 25°C ambient. However, there are many extenuating factors which should be considered for each, specific application:

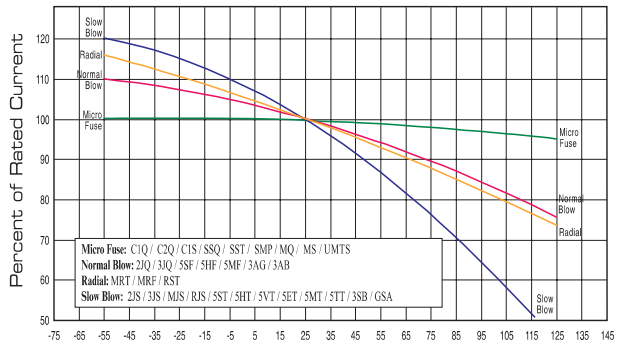
1. Higher or lower ambient - see general derating curves in Figure 1 below.
2. Slow blow/time lag fuse designs are more sensitive to heat and usually require a greater degree of derating.
3. Smaller, quick-acting fuses, such as the "MQ" micro, "SSQ" surface mount and "C1Q/C2Q" chip series can tolerate higher percentages of continuous current (up to 90-95% *In*) if inrush surges or transients are not likely.
4. Fuses designed to certain IEC127 standard sheets can be operated continuously at up to 90% of rated current. These include:

   IEC127-2, Standard Sheets 1 through 6.

   IEC127-3, Standard Sheets 3 and 4.

   In such cases, inrush surges and transients must be considered.

Figure 1 :Effect of Ambient Temperature on Current-Carrying Capacity



FUSE CHARACTERISTICS

(terms which define how quickly a fuse will operate at various overload currents)

Fuses designed and approved to the **IEC127** Fuse Standard have clearly defined performance gates, dictated by specific "Standard Sheets". All IEC fuses in this catalog are either Quick-Acting (Type F) or Time-Lag (Type T). Performance gates are tabulated on the individual pages for each IEC Style Fuse Series.

The **UL/CSA 248-14** Fuse Standard requirements are much broader in scope in terms of characteristics. There are only two fusing points (135% and 200%) for Miniature Fuses and just one (200%) for Micro Fuses. Only fuses designated "Time Delay" must meet a specified, minimum clearing time requirement. All others need only comply with the broad criteria of : 135% Rating - one hour maximum to clear; 200% rating - two minutes maximum to clear (one minute maximum for Micro Fuses).

This means that, for UL/CSA 248 Style fuses, the definitions of terms such as "Very Fast Acting", "Fast Acting", "Quick Acting", "Normal Blow", "Normal Acting", "Time-Lag", "Slow Blow", etc., are left to the individual fuse manufacturer. UL Listing and CSA Certification under 248 only verify

Fuse Terminology

performance that is in compliance with the broad 135% and 200% test points - there are no tests to distinguish amongst the various characteristics claimed by the fuse manufacturers.

I^2t (Ampere Squared Seconds) - a measure of heat energy associated with current flow. See subsequent pages for detailed explanation of I^2t.

VOLTAGE RATING

Fuses may be used in any application where the open circuit voltage does not exceed the fuse's voltage rating AND the maximum, anticipated short circuit current is below the fuse's Interrupting Rating. A fuse can be used at any voltage below the fuse voltage rating (i.e. a 250V fuse may be used in a 125V circuit.)

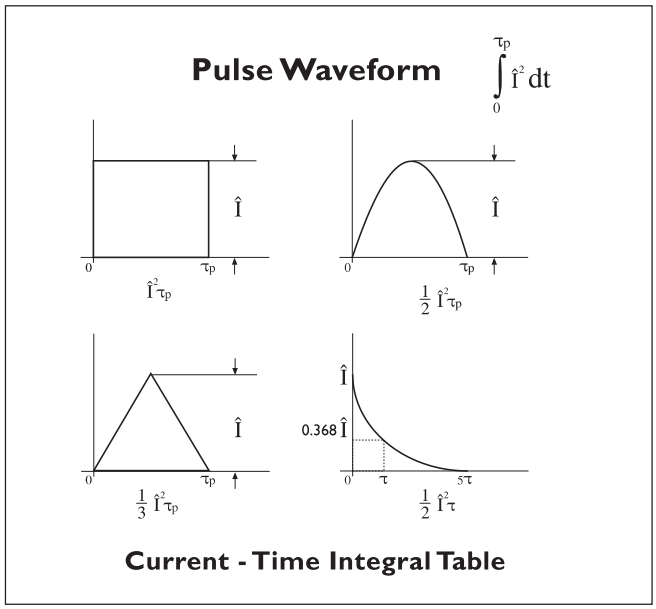
I^2t (AMPERE SQUARED SECONDS)

I^2t is a measure of heat energy. The use of I^2t values to determine proper fuse type/rating is only valid under adiabatic conditions, where there is no external heat transfer from the fuse element to its surroundings. This is generally accepted to be times of one-half an alternating current cycle (8 mSec for 60Hz or 10msec for 50Hz) or less. For inrush or transient current conditions lasting longer than 10 mSec, the standard Time-Current (I-T) curves should be used to select the proper fuse rating.

I^2t values of fuses are helpful in 3 general areas:

1. To determine that a specific fuse / rating will **not** operate (open) under known inrush or transient conditions.
2. To determine if a specific fuse / rating **WILL** operate quickly enough under short circuit or overload conditions to protect sensitive components (typically semiconductors.)
3. To compare fuses from different manufacturers for substitution purposes.

In the first case, the fuse should have a melting integral (melting I^2t) value that exceeds the I^2t value of the inrush or transient current pulse. In most cases, pulse I^2t value may be approximated using the formulas for the common waveforms shown in the following table.



Current - Time Integral Table

In the second case, the withstand I^2t rating (surge tolerance) of the device to be protected must be known. The selected fuse should have a TOTAL I^2t value that is less than the device's withstand rating. Total I^2t is defined as the sum of the melting I^2t (measure of energy to melt the fuse element) and the ARCING I^2t (measure of energy passed from the time the element opens to the time when any arcing within the fuse extinguishes). For the types of fuses covered in this catalog, arcing I^2t usually accounts for an insignificant portion of total I^2t. However, high voltage and/or low power factor (inductive) circuits require additional consideration.

The third case, any valid comparison of different manufacturers' fuses, is severely hampered by lack of standardized test methods and data presentation. The following section provides some insight into why this is so.