

GLOSSARY

Ampere rating

That current that the fuse will carry continuously without deterioration and without exceeding temperature rise limits specified for that fuse.

Arcing time

The arcing time of a fuse is the time elapsing from the melting of the current-responsive element (such as the link) to the final interruption of the circuit.

Class H fuses

Cartridge fuses were formerly known as "NEC dimensioned fuses." Class H fuses are tested and listed by Underwriters Laboratories, Inc., under their standard ANSI/UL 198B-1982 in 250 and 600 V ratings with interrupting capabilities of 10,000 A. Class H fuses are not marked as current limiting. UL standards for Class H fuses have a time-delay requirement of at least 10 s opening time at five times rating in order to have the words "time delay" on the label.

Class J fuses

These fuses are rated to interrupt 200,000 A ac and meet the standards of Underwriters Laboratories, Inc., for Class J fuses. They are UL-labeled as "current limiting," are rated only for 600 V (or less) ac, and are of dimensions not interchangeable with other classes. Class J fuses that have a time delay of at least 10 s opening time at five times rated current may have the words "time delay" on the label.

Class K fuses

These fuses meet ANSI/UL 198D-1982 of Underwriters Laboratories, Inc., for Class K as either K-1, K-S, or K-9. These standards have prescribed values for maximum peak let-through currents and I^2t for each subclass, with K-1 having the lowest (most restrictive) values and Class K-9 having the highest (least restrictive) values. Dimensionally the same as Class H fuses, these fuses have no UL-recognized "rejection feature." Their ac interrupting rating appears on their labels as 50,000, 100,000, or 200,000 A. They are not labeled as "current

limiting." The words "time delay," "dual element," letter "D," or phrase of similar significance on the label will indicate the manufacturer has met UL's optional testing for this feature. The use of Class K fuses permits equipment and circuits to be applied on systems having potential fault currents in excess of 10,000 A. Some hazards may exist in that they can be replaced with Class H fuses by uninformed personnel under present standards.

Class L fuses

These fuses meet ANSI/UL 198C-1981 of Underwriters Laboratories, Inc., for Class L fuses, have ratings in the range of 601-6000 A, are rated to interrupt 200,000 A ac, are rated only for 600 V or less ac, and are of specified dimensions larger than those of other fuses rated 600 V (or less). They are intended to be bolted to bus bars and are not used in clips. UP has no definition of time delay for Class L fuses; however, many Class L fuses have substantial overload time-current carrying capability. Class L fuse standards do not include 250 V ratings, dc testing, or dc ratings.

Class R fuses

These fused meet ANSI/UL 198E-1982 of Underwriters Laboratories, Inc., for Class R as either RK1 or RK5. Their interrupting ratings are 200,000 A ac. The standard has prescribed values for maximum peak let-through currents, I^2t and threshold current, with subclass RK1 having the lowest (most restrictive) values as compared to subclass RK5. These fuses have dimensions that provide a one-way physical rejection feature, that is, no other class of fuse will fit into equipment designed to employ Class R fuses; however, Class R fuses can be installed in older Class H or Class K equipment as replacement to upgrade these systems to the maximum allowed by other devices in the system. Class R fuses are available with or without time delay. If marked "time delay" or similar phrase, they are required to have a minimum opening time of 10 s when subjected to a load of five times rated current.

Continuous current

Standard molded-case circuit breakers are calibrated to carry 100% of their current rating in open air at a given ambient temperature (usually 25 or 40 degrees C). In accordance with the NEC, these breakers, as installed in their enclosures, should not be continuously loaded over 80% of their current

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TM 5-811-14

rating. Low-voltage power circuit breakers and certain molded-case circuit breakers are specifically approved for 100% continuously duty. These breakers can be continuously loaded to 100% of their current rating in a 40 degree C ambient when installed in their proper enclosures.

Control voltage

This is the ac or dc voltage designated to be applied to control devices intended to open or close a circuit breaker. These devices can normally be supplied with a voltage rating needed to meet a particular control system.

Current limiter

A device intended to function only on fault currents of high magnitude and that may not successfully open on lesser overcurrents regardless of time. Such a device should always be used in series with a fuse, contactor, or circuit breaker to protect against overloads and low-level short circuits. Current limiters are typically added to molded-case circuit breakers, power circuit breakers, or instantaneous circuit protectors.

Current-limiting breaker

A circuit breaker that does not employ a fusible element and that when operating within its current range, limits the let-through I^2t to a value less than the I^2t of a $\frac{1}{2}$ cycle wave of the symmetrical prospective current.

Current-limiting fuse

A fuse that will interrupt all available currents above its threshold current and below its maximum interrupting rating, limit the clearing time at rated voltage to an interval equal to or less than the first major or symmetrical loop duration, and limit peak let-through current to a value less than the peak current that would be possible with the fuse replaced by a solid conductor of the same impedance. Note that current-limiting action only becomes effective at a specific value of current. (See threshold current.) UL only recognizes and permits labeling of Classes G, J, L, R, CC, and T as current limiting, although Class K fuses are, in fact, current limiting.

Delay

This term is usually applied to the opening time of a fuse when in excess of one cycle, where the time may vary considerably between types and makes and still be within established standards. This word, in itself, has no specific meaning other than in manufacturers' claims (see time delay) unless published standards specify delay characteristics.

Dual-element fuse

A cartridge fuse having two or more current-responsive elements of different fusing characteristics in series in a single cartridge. This is a construction/design technique frequently used to obtain a time-delay response characteristic. Labeling a fuse as dual element means this fuse meets UL time-delay requirements (can carry five times rated current for a minimum of 10 s for Class H, K, J, and R fuses) and in this case defines a time-current response characteristic and not necessarily a dual-element construction technique.

Dual magnetic

(Dashpot)(Hydraulic) On overload, the device operates on an inverse time principle by utilizing a magnetic coil surrounding a plunger which is restrained by air or liquid. As the magnetic field increases due to increased currents, the plunger increases its speed to unlatch the mechanism and open or trip the breaker in a shorter time. Short-circuit and high-level ground fault protection by dual magnetic breakers is the same as that provided by a thermal-magnetic breaker.

Ferrule

The cylindrical-shaped fuse terminal that also encloses the end of the fuse. In low-voltage fuses, the design is only used in fuses rated up to and including 60 A. The ferrule may be made of brass or copper, and may be plated with various materials.

Fuse-link

In British terminology only, a complete enclosed cartridge fuse; in such cases the addition of the carrier, or holder, completes the fuse. (See link.) In the US, a renewable fusible element for fuse cut-outs.

Heating, air conditioning and refrigeration breaker (HACR)

The NEC permits the use of inverse-time circuit breakers to protect multimotor and combination-load installations involved in heating, air conditioning, and refrigerating (HACR) equipment provided the breakers have been approved for group installation. Circuit breakers complying with UP requirements for this type of application will be marked "Listed HACR Type."

High capacity breaker

The principle of operation is the same as the standard thermal-magnetic or solid-state breaker, but its current interrupting capability is much higher.

HRC

In British and Canadian terminology, high rupturing capacity, equivalent to US high interrupting capacity and generally indicating capability of interruption of at least 100,000 rms A for low-voltage fuses.

 I^2t

The measure of heat energy developed within a circuit during the fuse's melting or clearing. Generally stated as melting I^2t or clearing I^2t .

Instantaneous only breaker (motor circuit protector or circuit interrupter)

Provides short-circuit protection only, with no overload protection. Since external overload protection must be used with these breakers, they cannot be used for branch circuit protection. These breakers are used primarily as components in motor circuits in combination with motor starters in motor control centers and individual combination motor starters. They are also used in welding equipment for short-circuit protection only.

Integrally-fused circuit breaker

A combination of a thermal-magnetic breaker with current-limiting fuses contained within the same molded housing. The fuse prevents the development of the maximum prospective short-circuit current in the circuit. With this combination, much higher interrupting ratings are possible than those for standard thermal-magnetic and high capacity breakers.

Interrupting rating-circuit breaker

The interrupting rating (or short-circuit current rating, as it is referred to for a low-voltage power circuit breaker) is commonly expressed in rms symmetrical amperes. It may vary with the applied voltage and is established by testing per UL or ANSI standards.

Interrupting rating—fuse

A rating based upon the highest rms alternating current that the fuse is required to interrupt under the conditions specified. The interrupting ratings, in itself, has no direct bearing on any current-limiting effect of the fuse.

Link

The current-responsive element in a fuse that is designed to melt under overcurrent conditions and so interrupt the circuit. A renewal link is one intended for use in Class H low-voltage renewable fuses.

Melting time

The time required to melt the current-responsive element on a specified overcurrent. Where the fuse is current limiting in less than half-cycle, the melting time may be approximately half or less of the clearing time. (Sometimes referred to as pre-arcing.)

Molded case circuit breaker

A device, assembled as an integral unit in a supporting and enclosing housing of insulating material, designed to open and close a circuit by nonautomatic means, and to open the circuit automatically on a predetermined overcurrent, without injury to itself when properly applied within its rating.

Molded case switch

A device assembled as an integral unit in a supporting and enclosing housing of insulating material designed to open and close circuit by nonautomatic means.

NEC dimensions

Dimensions once stated in the National Electrical Code, but now found in ANSI/UL 198B-1982 and in ANSI/UL 198D-1982. These dimensions are common to Class H and K fuses and provide interchangeability between manufacturers for fuses and fusible equipment of a given ampere and voltage range.

One-time fuse

Strictly speaking, any nonrenewable fuse, but generally accepted and used to describe any Class H nonrenewable cartridge fuse, with a single (as opposed to dual) fusing element and intended to interrupt not over 10,000 A.

Overload

Generally used in reference to an overcurrent that is not of sufficient magnitude to be termed a short circuit. An overload is normally that overcurrent value from 100% of fuse rating up to ten times fuse rating. (See short circuit.)

Plug fuses

Plug fuses are rated 125 V and are available with current ratings up to 30 A. Their use is limited to circuits rated 125 V or less. However, they may also be used in circuits supplied from a system having a grounded neutral, and in which no conductor operates at more than 150 V to ground. The NEC requires type S fuses in all new installations of plug fuses because they are tamper resistant and size limiting, thus making it difficult to overfuse.

TM 5-811-14

Peak let-through current

The maximum instantaneous current through a current-limiting fuse during the total clearing time. Since this is an instantaneous value, it may well exceed the rms available current, but will be less than the peak current available without a fuse in the circuit if the fault level is high enough for it to operate in its current-limiting mode.

Pre-arcing time

See melting time.

Renewable fuse

A fuse in which the element, usually a zinc link, may be replaced after the fuse has opened. Once a very popular item, this fuse is gradually losing popularity due to the possibility of using higher ampere-rated links or multiple links in the field, which can present a hazard.

Short-circuit current

An overcurrent usually defined as being in excess of ten times normal continuous rating. (See overload.)

Short-time rating

The short-time current rating specifies the maximum capability of a circuit breaker to withstand the effects of short-circuit current flow for a stated period, typically 30 cycles or less, without opening. This provides time for downstream protective devices closer to the fault to operate and isolate the circuit.

Solid-state (electronic)

On overload, the device operates on the inverse time principle. Current transformers or sensors are utilized in each pole of the breaker to sense the current. The solid-state circuitry measures and times the output from the current transformers. On overloads, short-circuits, or high-level ground faults, or both, the solid-state circuitry initiates an output to a delatching system. Also, this type of device can usually provide low-level ground fault protection.

Switching duty breaker (SWD)

Circuit breakers rated 15 or 20 amperes and intended to switch 277 volts or less fluorescent lighting loads on a regular basis. These breakers are marked "SWD".

Thermal-magnetic

The device provides overload, short-circuit and high-level ground fault protection. Overload sensing and tripping is obtained through the use of a bimetal, which is heated by the load current.

During an overload condition, the bimetal deflects sufficiently to cause the breaker to trip or open mechanically. The larger the overload, the faster the tripping of the breaker; the smaller the overload, the longer it takes the breaker to trip. This is commonly called an inverse time principle. Short-circuit or high-level ground fault protection, or both, is obtained through electromagnetic action. If the fault current reaches a predetermined value, the breaker trips instantaneously; that is without any intentional time delay.

Threshold current

The magnitude of current at which a fuse becomes current limiting, specifically, the symmetrical rms available current at the threshold of the current-limiting range, where the fuse total clearing time is less than half-cycle at rated voltage and rated frequency, for symmetrical closing, and a power factor of less than 20%. Refer to various peak let-through current curves for each type of fuse. The threshold ratio is the relationship of the threshold current to the fuse's continuous-current rating.

Time delay

Meaningless unless defined. This term is now used by NEMA, ANSI, and UL to mean, in Classes H, K, J, and R cartridge fuses, a minimum opening time of 10 s on an overload current five times the ampere rating of the fuse. Such a delay is particularly useful in allowing the fuse to pass the momentary starting overcurrent of a motor, yet not hindering the opening of the fuse should the overload persist. In Class G, CC, and plug fuses, the phrase "time delay" is required by UL to be a minimum opening time of 12 s on an overload of twice the fuse's ampere rating. The time-delay characteristic does not affect the fuse's short-circuit current clearing ability.

Total clearing time

The total time between the beginning of the specified overcurrent and the final interruption of the circuit, at rated voltage. It is the sum of the minimum melting time plus tolerance and the arcing time. For clearing times in excess of half-cycle, the clearing time is substantially the maximum melting time for low-voltage fuses.

Tube

The cylindrical enclosure of a fuse. Such a tube may be made of laminated paper, special fiber, melamine impregnated glass cloth, bakelite, ceramic, glass, plastic, or other materials.

Voltage rating

The rms alternating current (or the direct current) voltage at which the fuse is designed to operate. All low-voltage fuses will function on any lower voltage, but use on higher voltages than rated is

hazardous. For high short-circuit currents, the magnitude of applied voltage will affect the arcing and clearing times and increase the clearing I^2t values.