Fuses—
Medium Voltage

Contents

Specifications

See Eaton's *Product Specification Guide*, available on CD or on the Web.

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Current Limiting Fuses

General Description

Medium Voltage Fuses

Eaton's entry in the power fuse business began over 75 years ago under Westinghouse® Electric. In 1935, Westinghouse introduced the medium voltage boric acid expulsion fuse followed by the medium voltage current limiting fuse. Even today, medium voltage fuses continue to use the core Westinghouse technology. Eaton continues to build on the Westinghouse technology legacy by engineering higher performance, cost-effective power fuse products.

Eaton medium voltage fuses are manufactured and tested to the requirements of the ANSI C37.4X series of standards.

Eaton is the only North American manufacturer of both current limiting and expulsion medium voltage power fuses. A full range of general purpose, backup and boric acid fuses is available for distribution and power applications.

All Eaton medium voltage fuses are thoroughly tested and conform to ANSI specifications. Some motor starter fuses are UR® recognized, and both current limiting and expulsion fuses have been approved in UL® rated switchgear.

Current limiting and expulsion fuses can be used to meet any overcurrent protection need. At any point along the medium voltage electrical distribution system, Eaton has a fuse to satisfy your overcurrent protection needs.

The following fuse terminology will assist in understanding and selecting the correct fuse. The following is a brief overview of those terms.

Power vs. Distribution

The differentiation is intended to indicate the test conditions and where fuses are normally applied in a power system, based on specific requirements for generating sources, substations and distribution lines. Each class has its own unique set of voltage, current and construction requirements (see ANSI C37.42, .46 and .47).

Low vs. Medium vs. High Voltage

While fuses are defined in the ANSI standards as either low or high voltage, Eaton's Electrical Sector has elected to name their fuses to correspond with the equipment in which they are installed. Therefore, per ANSI C84, fuses are named as follows:

Low Voltage 1000V and below

Medium Voltage Greater than 1000–69,000V

High Voltage Greater than 69,000V

Expulsion vs. Current Limiting

Expulsion Fuse: An expulsion fuse is a vented fuse in which the expulsion effect of the gases produced by internal arcing, either alone or aided by other mechanisms, results in current interruption.

An expulsion fuse is not current limiting and as a result limits the duration of a fault on the electrical system, not the magnitude.

Current Limiting Fuse: A current limiting fuse is a fuse that, when its current responsive element is melted by a current within the fuse's specified current limiting range, abruptly introduces a high resistance to reduce current magnitude and duration, resulting in subsequent current interruption.

Table 9.0-1. General Fuse Comparison

Expulsion	Current Limiting
Vented	Sealed
Electromechanical	Static
Interrupts at current zero, limits fault current duration	Limits fault current magnitude and duration
Generally higher voltage ratings	Generally higher interrupting ratings
Different time/current characteristics	Different time/current characteristics

Table 9.0-2. Eaton Medium Voltage Fuse Family

Current Limiting	Expulsion
HLE: Helical configuration current limiting, E-rated CLE: Current limiting, E-rated CLS: Current limiting starter (motor starter) HCL: Current limiting, clip-mount, E-rated CX: Current limiting, C-rated CLPT: Current limiting, E-rated	RBA: Refillable, boric acid RDB: Refillable, dropout, boric acid DBU: Dropout, boric acid, indoor/outdoor S&C equivalent

Table 9.0-3. Application Guide

Type	Fuse Voltage Range (kV)	Fuse Ampere Rating	Fuse Maximum Interrupting Rating (kA Sym.)	Class Use Indoor/Outdoor	Applied in:
Current Limiting					
CLE	2.4–15.5	10E–1350A	65	General purpose indoor/outdoor	Fused switches, feeder circuit sectionalizing, power transformers, dip poles, substation capacitor banks.
CLPT	2.4–38	0.25E–10E	80	General purpose indoor	Potential transformers. BAL-1 mountings and clips are no longer available.
CLS	2.4–8.3	2R–44R	50	Backup distribution indoor	AMPGARD® and non-AMPGARD motor starters. HCLS version is the same as the CLS except hermetically sealed for hazardous locations.
CX/CXI CXN	4.3–15.5	3.5C–300C	50	General purpose distribution indoor	Pad mounted distribution transformers, Substation service transformers, and fused switches. Direct substitution for McGraw's NX fuse.
HCL	2.4–15.5	10A–900A	63	General purpose distribution indoor	Fused switches, feeder circuit sectionalizing, power transformers, dip poles, substation capacitor banks.
HLE	2.4–15.5	10E–450E	65	General purpose indoor/outdoor	Fused switches, feeder circuit sectionalizing, power transformers, dip poles, substation capacitor banks.
Expulsion Fuses					
RBA	2.4–38	0.5E–720E	37.5	Boric acid power indoor	Fused switches, feeder circuit sectionalizing, and power transformers.
RDB	2.4–38	0.5E–720E	37.5	Boric acid power outdoor	Feeder circuit sectionalizing, power transformers, substation service transformers, dip poles, potential transformers, and substation capacitor banks. Outdoor version of the RBA.
DBU	4.4–38	5E–200E, 3K–200K	50	Boric acid power indoor/outdoor	Feeder circuit sectionalizing, fused switches, power transformers, substation service transformers, dip poles, and potential transformers. Direct equivalent for S&C's SMU-20 fuse units.

Table 9.0-4. Power Fuse Ampere Characteristic Ratings

Rating	Definition
E	Fuses rated 100E or below will melt in 300 seconds at some current value between 2.0 and 2.4 times the E number.
	Fuses rated above 100E will melt in 600 seconds at some current value between 2.2 and 2.64 times the E number.
R	The fuse will melt in 15 to 35 seconds when the current equals 100 times the R number.
C	The fuse will melt in 1000 seconds at some current value between 1.7 and 2.4 times the C number.
A	Class A fuses have parameters that do not fall within the 'C', 'E', or 'R' definitions above.
X	Meet C37.40 temperature requirements, but not the E rating.

Current Limiting Fuses

Current Limiting Fuse Types

There are three current limiting fuse types: backup, general purpose and full range. It is important that the user have an understanding of these definitions to ensure proper application of the fuse (**Figure 9.0-1**).

Backup Fuse: A fuse capable of interrupting all currents from the rated maximum interrupting current down to the rated minimum interrupting current.

Backup fuses are normally used for protection of motor starters and are always used in series with another interrupting device capable of interrupting currents below the fuse's rated minimum interrupting current.

General Purpose Fuse: A fuse capable of interrupting all currents from the rated maximum interrupting current down to the current that causes melting of the fusible element in no less than one hour.

General purpose fuses are typically used to protect feeders and components such as transformers.

Full Range Fuse: A fuse capable of interrupting all currents from the rated maximum interrupting rating down to the minimum continuous current that causes melting of the fusible element, with the fuse applied at the maximum ambient temperature specified by the manufacturer.

Current limiting fuses are constructed with pure silver fuse elements, high purity silica sand filler, and a glass resin outer casing.

A high fault current melts the silver element almost instantly and loses energy to the surrounding sand. The sand melts and forms fulgurite, a glass-like substance. The arc voltage rapidly increases to nearly three times the fuse voltage rating and forces the current to zero.

Low fault current melts a solder drop on the silver fuse element that, in turn, melts the silver. The element burns back until there is a sufficient internal gap to interrupt the current. This is known as the M-effect.

Eaton offers current limiting fuses in two basic types: backup and general purpose. Backup fuses are applied in series with another circuit protective device, such as a contactor or an expulsion fuse, to interrupt high fault currents beyond the other device's range. General purpose fuses are designed to interrupt low fault currents that cause them to melt in one hour or less.

Multi-Range Fuses

CLE and HLE fuses are also available in user-selectable multi-range versions 10–40A, 50–125A and 150–200A.

Disconnect End Fittings and Disconnect Live Parts

Accessories

A wide assortment of mountings, live parts and end fittings are available to facilitate power fuse installation.

Mountings

Mountings include a base, porcelain or glass polyester insulators, and live parts. They help enable the fuse to be safely attached to the gear. Mountings can be either disconnect or non-disconnect.

Live Parts

Live parts attach the fuse to the insulators and are considered part of the mounting. All parts above the insulators are live parts.

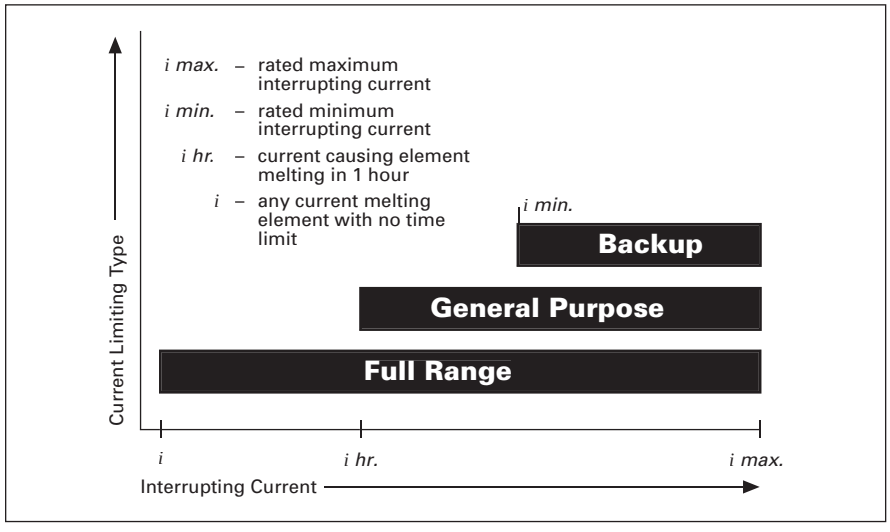

Figure 9.0-1. Current Limiting Types Protection Range

Current Limiting Fuses

Table 9.0-5. CLE, HLE, HCL and CLS Fuses

Description	Family			
	CLE	HLE	HCL	CLS
				
General				
Class	General purpose	General purpose	General purpose	Backup
Use	Power	Power	Power	Power
Maximum kV	2.75–15.5	5.5–15.5	5.5–15.5	2.4–15.5
Maximum kA	63	63	63	50
Rating	10E–1350A	10E–450A	10E–900E	2R–44R
Mounting	Clip	Clip, bolt-on, hookeye	Clip lock, bolt-on	Clip, bolt-on, hookeye
Indicator	Standard	Standard	Standard	Standard
Approvals	IEEE, ANSI	IEEE, ANSI	IEEE, ANSI	UL®, IEEE, ANSI
Applications				
Feeder circuits	■	■	■	
Motor starters				■
PTs and CTs				
LV breakers				
Substation service				
Transformers	■	■	■	
Capacitor banks	■	■	■	
Fused switches	■	■	■	

Table 9.0-6. CLPT, CX, CLT and DSL Fuses

Description	Family			
	CLPT	CX	CLT	DSL
				
General				
Class	General	General	General	Back-up
Use	Power/distribution	Distribution	Distribution	Power
Maximum kV	5.5–38	4.3–15.5	2.75–15	600V
Maximum kA	80	50	25	200
Rating	0.25E –10E	3.5C–300C	5–150	100–5000
Mounting	Clip	Clip	Stud bolt-on	Bolt-on
Indicator	Optional	None	None	None
Approvals	IEEE, ANSI	IEEE, ANSI	IEEE, ANSI	UL
Applications				
Feeder circuits				
Motor starters				
PTs and CTs	■			
LV breakers				■
Substation service		■		
Transformers		■	■	
Capacitor banks				
Fused switches				

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