Bussmann DC fuses — CBMG series (1500 Vdc, 1250A-4000A)



Basic information

Voltage rating	1500Vdc
Current Ratings	1250A-4000A
Operation class	aR
Breaking capacity	Max: 300kA Min: 14.5In
Standard	UL248-13, GB/T 13539.4 IEC60269.4
Certification	UL, CCC, TUV, CE

Storage condition:

Fuses should be stored in their original boxes under typical warehouse conditions for electromechanical products (free from any dirt and dust).
Storage conditions should be no more then 70 percent relative humidity and in the -40 °C to +85 °C range.

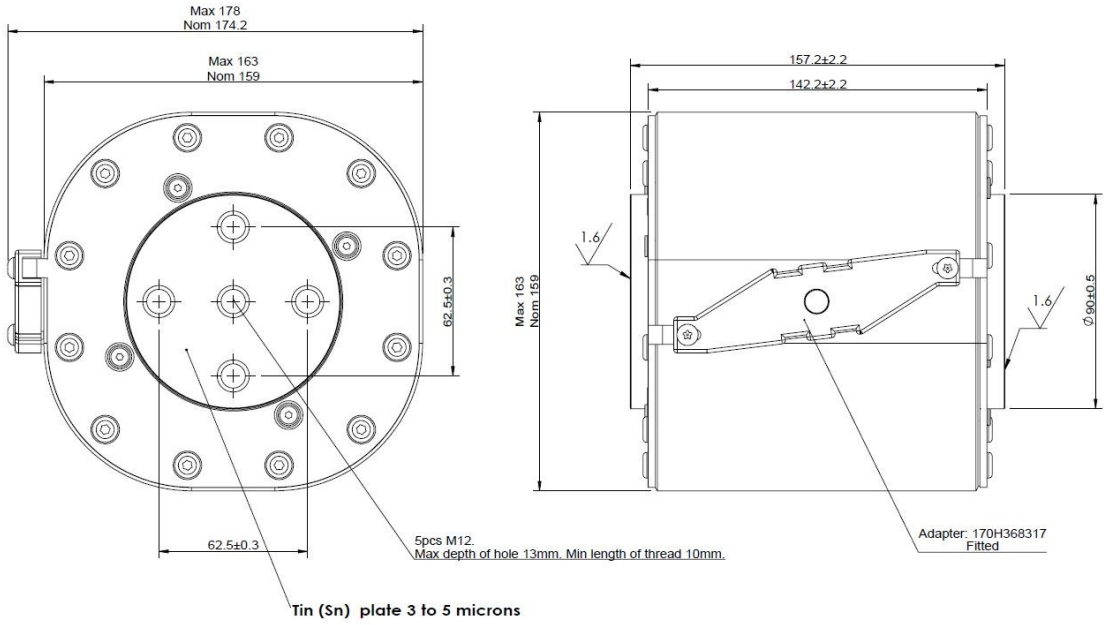
Work conditions:

Work within the temperature -40 °C to +100 °C range.

Installation conditions:

The fuse should be mounted to busbar with 5pcs M12 socket set screws at each side, the screws according to ISO4026/DN913 or ISO4029/DIN916 are recommended. The studs must be tightened carefully applying a torque of 5-8 N.m, recommended nut tightening torques is 35±4% N.m.

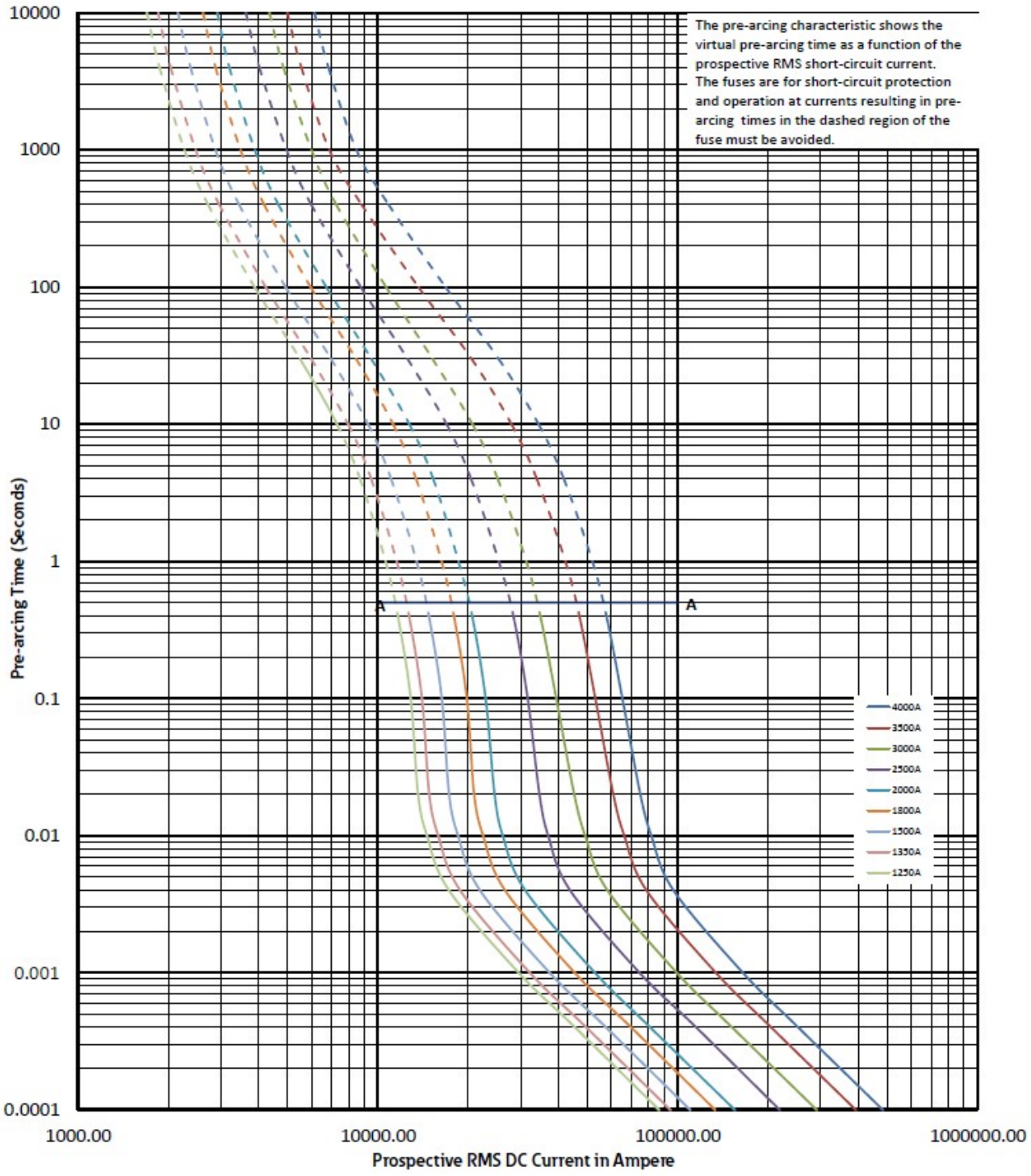
Drawing: (mm)



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T-C curve



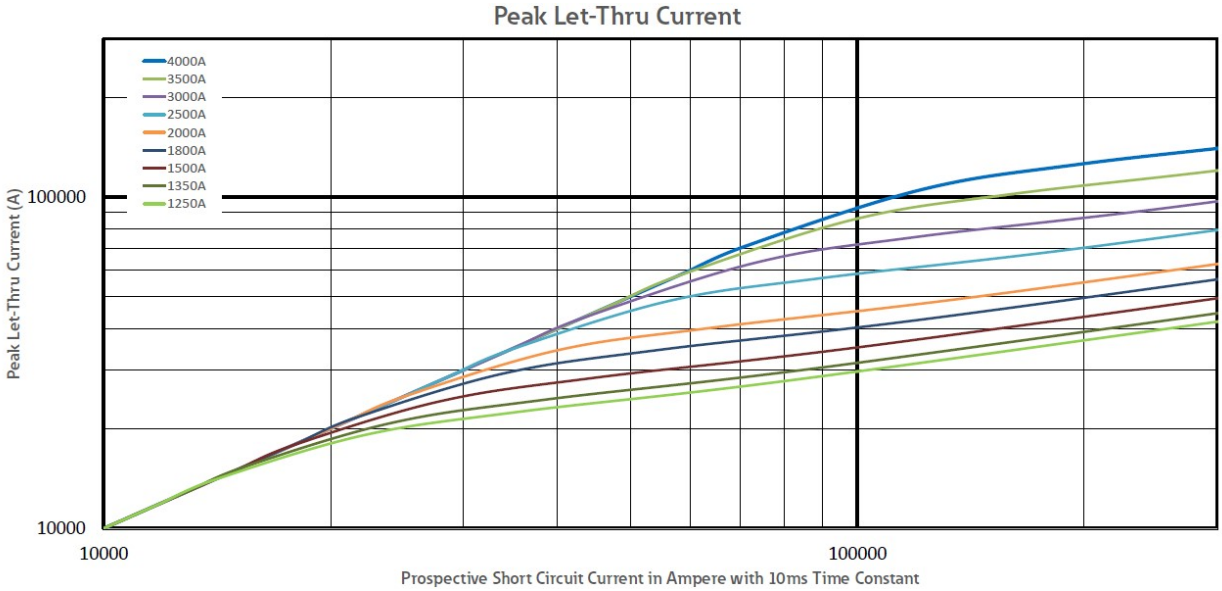
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Technical parameter

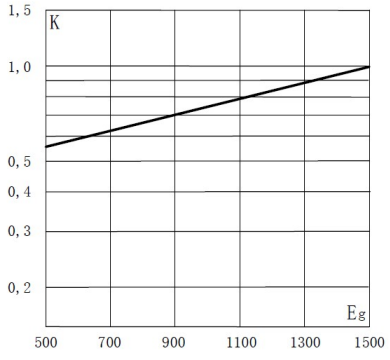
Part Number	Rated Voltage (Vdc)	Current Rating (A)	Pre-arcing I2t (A2s)	Max. operating I2t (A2s)	Power Loss at In (W)
CBMG-4000	1500	4000	20,000,000	93,600,000	690
CBMG-3500		3500	13,200,000	53,000,000	640
CBMG-3000		3000	8,100,000	24,300,000	585
CBMG-2500		2500	4,650,000	14,000,000	530
CBMG-2000		2000	2,300,000	7,000,000	480
CBMG-1800		1800	1,650,000	5,000,000	460
CBMG-1500		1500	1,100,000	3,650,000	390
CBMG-1350		1350	825,000	2,800,000	365
CBMG-1250		1250	695,000	2,400,000	340

Cut-off curve



Correction factor for max operating I^2t

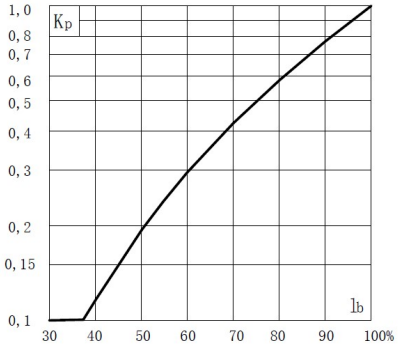
K : Correction factor for max. operating It^2



E_g: RMS value of working voltage in V

Correction factor for watt loss

Kp : Correction factor for watt loss



RMS value of load current in % of rated current

Appendix 1: Rated current dimensioning factors

The fuse's rated current is the RMS current it can continuously carry without degrading or exceeding the applicable temperature rise limits under well defined and steady-state conditions. This is in contrast to semiconductors, whose rated current is given as a mean or average value. Many conditions can effect the current carrying capability a fuse and to prevent premature ageing, following will allow the rated current selection to be on the safe side.

Basic selection

This part covers the basic selection criteria for only the fuse's rated current and not the influence from overload and cyclic loading. The actual RMS steady-state load current passing through the fuse should be lower or equal to the calculated maximum permissible load current called I_b.

$I_b = I_n \times K_t \times K_e \times K_v \times K_f \times K_a \times K_b$

I_b	The max permissible continuous RMS load current*
I_n	Rated current of a given fuse
K_t	Ambient temp. correction factor per Fig. 1
K_e	Thermal connection factor per Fig. 2
K_v	Cooling air correction factor per Fig. 3
K_f	Frequency correction factor per Fig. 4
K_a	Correction for high altitude
K_b	Fuse load constant. For fuses with porcelain body it is normally 1.0 (see data sheet) For fiber body fuses the factor is normally 0.8

In case of water cooled fuse terminals, please consult Eaton's application engineering bulehighspeedtechnical@eaton.com

*NB: For any periods of 10 minutes duration or more the RMS-value of the load current should not exceed this.

The maximum current density of the busbars on which the fuses are mounted should be 1.3A/mm² (IEC 60269 part 4 defines 1.0 to 1.6/mm²). If the busbars carry a current density more than this then the fuse should be derated.

For example, a 200A square body fuse is mounted onto a busbar with a cross sectional area of 120mm². For a 200A fuse the minimum cross sectional area of the busbar to meet the 1.3A/mm² requirement should be 154mm² (200A/1.3A/mm²). As the actual busbar size is only 78 percent (120mm²/154mm²) of the recommended size, the fuse must be derated.

If two connections are not equal, the respective K_e factor can be found using the following formula: $(K_1 + K_2)/2$.

Fuse mounting inside the box etc., will reduce the convection cooling compared with the IEC conditions.

An additional K_e factor should be chosen here based on judgement. Often, box mounted fuses are given an additional K_e factor of 0.8.

Fuses under high frequency load (like in voltage commutated inverters) call for special attention. At these frequencies, the current carrying capability can be reduced due to the imposed skin and proximity effect on the current-carrying elements inside the fuse. Using the curve given in Fig. 4 normally ensures a sufficient margin.

When fuses are used at high altitudes there is reduced cooling effect on the fuse as the density of the atmosphere reduces.

Correction K_a should be applied to the fuse's continuous rating when the application is above 2000m:

$$I = In \times \left(1 - \left(\frac{h - 2000}{100} \times \frac{0.5}{100}\right)\right)$$

Where:

I = Current rating at high altitude

I_n = Rated current of a given fuse

h = Altitude in meters.

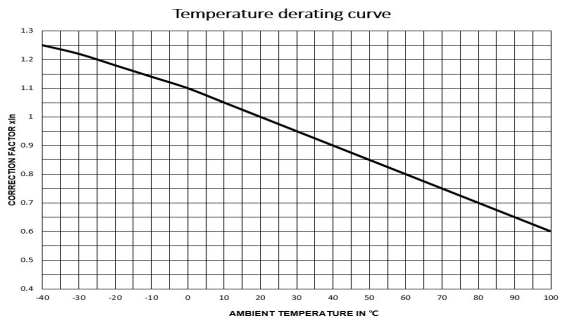


Figure 1 This curve shows the influence of the ambient temperature on the

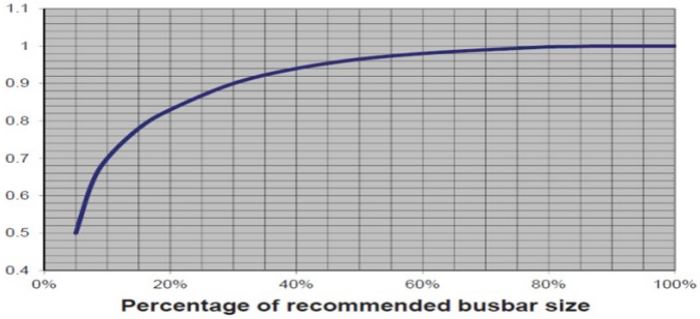


Figure 2

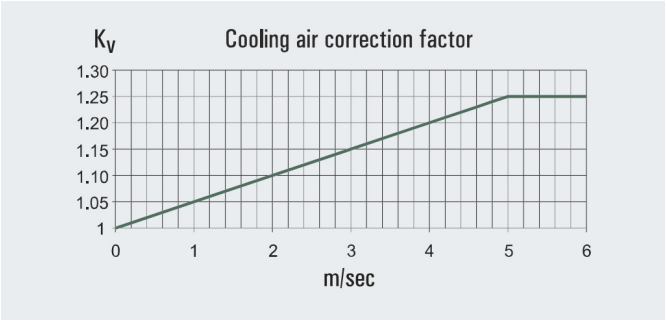


Figure 3 The curve shows the influence of forced air cooling on the fuse.

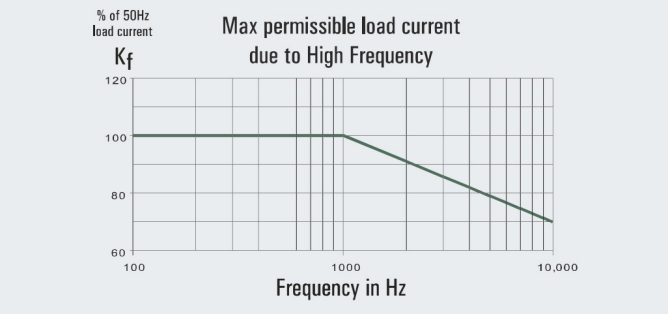


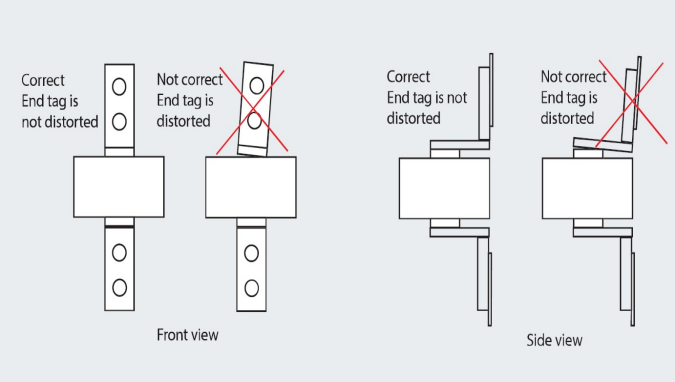
Figure 4

Appendix 2
Installation, service, maintenance, environmental and storage issues

Mounting alignment

Eaton's Bussmann series high speed fuses are generally supplied in a ready-to-install condition.

The fuses are not meant as mounting isolators. Excessive tension, compression and torque from misalignment between fuse and busbars (see example below) should be avoided. If possible, mounting should starting with the fuse followed by the necessary adjustment and tolerance utilization of busbar components.



Surface material

The electrical conducting metal parts of Eaton' s Bussmann series high speed fuses are usually plated to maintain an acceptable surface condition. Tin is the most common material for the fuse contacts today.

Tin-plated contacts

	Concentration - Duration PPM - h	According to standard
H_2O	12,5ppm-96h	IEC 68-2-43 Kd
SO_2	25ppm-504h	IEC 68-2-42 Kd

Most of Eaton' s Bussmann series high speed fuse contact surfaces are electro-plated with a 5µm layer of tin. This plating provides an excellent electrical and thermal interface with holders or cables/busbars of either pure copper or copper/aluminum plated with tin/ nickel or silver.

Many tests and more than 30 years of experience have shown that a tin, nickel or silver-plated surface is both mechanically and electrically stable in the entire temperature high speed fuse temperature range (typical maximum temperature rise of 130°C).

Temperature

Operating ambient temp –40°C to +100°C
When the fuse operates above 20°C, the rated current need additional correction.

Vibration and shock resistance

High speed fuses should not be submitted to excessive vibration. However, standard high speed fuses can withstand vibration with a maximum 5g magnitude for a long-time basis and 7g for short periods (shocks). Before using fuses in applications with stronger vibration, consult Eaton's application engineering: bulehighspeedtechnical@eaton.com.

Service and maintenance

The following points should be observed and checked during maintenance of electrical cabinets and switchgear.

1. Check tightening torques and examine ceramic fuse bodies for visible cracks. Tighten or replace as needed.

2. Check all fuse indicators. In case of any fuse opening, replace all opened AND unopened fuses that have been subjected to the same the fault current or a part of it. Even if the resistance (W) of the unopened fuses is unchanged, the fuses may be damaged by the fault current and must be changed to avoid nuisance openings.

Environmental issues

Generally, high speed fuses are made from the following basic materials:

- Ceramic
- Fiberglass
- Silver
- Copper
- Brass
- Steel
- Silica sand

Accessories like micro switches and fuse holders are partly made of various plastic materials. For further information on fuse materials, contact Eaton's application engineering: bulehighspeedtechnical@eaton.com.

Storage

Fuses should be stored in a dry warehouse or shelf, keep away from water. The storage temperature of the products is –40°C to +85°C, the relative humidity is less than 70%, and there is no condensation. In addition, they must be stored in a non corrosive environment. Any fuse submerged in water or sprayed can no longer be used, and any fuse exposed to fire of other forms of overheating can no longer be used.