



Medium voltage products

# Fuses

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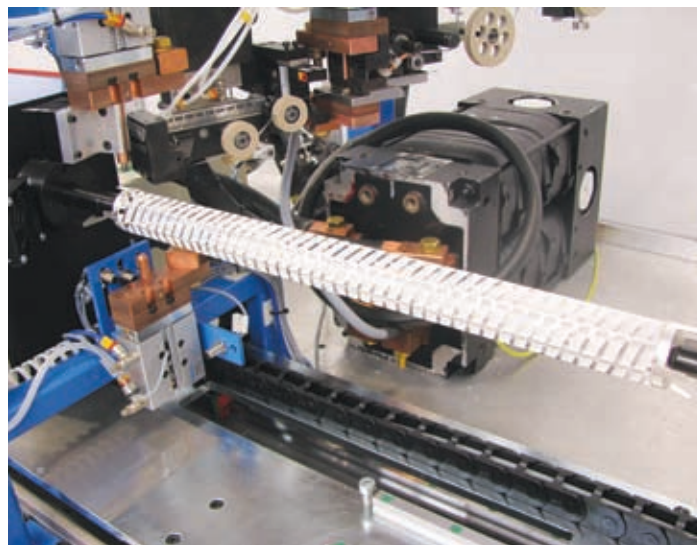
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# Introduction

The main function of current limiting fuses is to protect electrical apparatus, such as distribution transformers, motors and capacitor banks against overload currents. The fuses can operate as sole devices or can be combined with air/SF6 insulated switch disconnectors. The choice depends on each application requirements and specific network conditions. One of the most critical factors for optimum protection is proper fuse selection. This can be done based on theoretical calculations but in many cases practical knowledge obtained from actual test results could make it easier and even more reliable. ABB, with its extensive apparatus product portfolio, has years of experience in this field. Our current limiting fuses have been designed to ensure safe operation in open air and for limited heat dissipation in installations such as that found in gas insulated switchgears.

Fuse selection principles for the most common situations are presented in the following pages together with common definitions. Moreover we offer our support for each specific case where presented criteria are not sufficient.

Before using our products, we encourage you to read the technical definitions and application principles presented below.



# Main definitions

## Current limiting back-up fuses

The current limiting fuse family is generally composed of three different fuse groups: back-up fuses, general purpose fuses and full range fuses. All of them limit the value of prospective short-circuit currents during the interruption process, thereby extending the life time of nearby installed electrical equipment. The main difference is in the minimum breaking current that characterizes the lowest fault current that the fuses are capable of interrupting. This value is generally highest for back-up fuses, slightly smaller for general purpose fuses and smallest, with the value close to the minimum melting current, for full range fuses. But reaction time is critical for the protection function. That is why back-up fuses, with an interruption time for the minimum breaking current in the range of a few seconds down to a few tens of milliseconds, are the most commonly used. The total clearing time in cases of high short-circuit currents is even shorter i.e. only a few milliseconds. That is why back-up fuses can be used as typical overload protection elements. General purpose and full range fuses capable of interrupting even the smallest values of currents can only be considered as over current devices since the interruption time is greater than one hour. ABB current limiting fuses have low minimum breaking currents, i.e. close to three times the rated current,  $I_n$ .

## M-effect

One of the structural means used to form the time-current characteristics of medium-voltage fuse links for ABB's CEF and CMF series is an overload spot located on the fuse elements. The M-effect is used to create this overload spot which is made by coating the silver fuse elements with a short segment of a metal which is characterized by a low melting point. The M-effect was first described by Professor Metcalf in the 1930s. It takes advantage of the effect of the melting of metals characterized by a higher melting point (e.g. copper, silver) by some metals in a liquid state which are characterized by a low melting point (e.g. tin, lead). Silver fuse elements coated with a segment of a metal with a low melting point (e.g. solder) fuse for current values that would otherwise not cause fusing if the overload spot were not present. The reason for this is as follows: As the fuse element is heated, the metal used to make the overload spot starts melting and diffuses into the fuse element metal, thus reducing the active cross-section of the main silver fuse element. As a result, the silver fuse element is melted at the moment when the other parts of the fuse element are, by comparison, still relatively cool. With this design the overload spot reduces both the minimum melting current and the minimum breaking current. Consequently, the operating range of the fuse link is extended. It must also be emphasized that in case of short-circuit currents, when fuse elements quickly heat up and practically no heat is dissipated into the surrounding arc-quenching medium (adiabatic heating), the fuse elements melt before the metal used for making the overload spot reaches its melting temperature. Therefore, the overload spot does not affect the fuse's characteristic for short-circuit currents.

Additionally, a very important advantage of using the overload spot is the fact that an arc is always initiated at the same point on the fuse element, i.e. near the geometrical center of the fuse link. This solution therefore protects the end-caps from sustaining any damage. To sum up, the overload spot enables an increase in the useful operational range of the fuse link by extending the range of correct operation for small overload currents. Moreover, use of the overload spot prevents the arc from initializing near one of the fuse-link ends and, thus, makes the fuse link safer to use.

## Fuse-switch combination

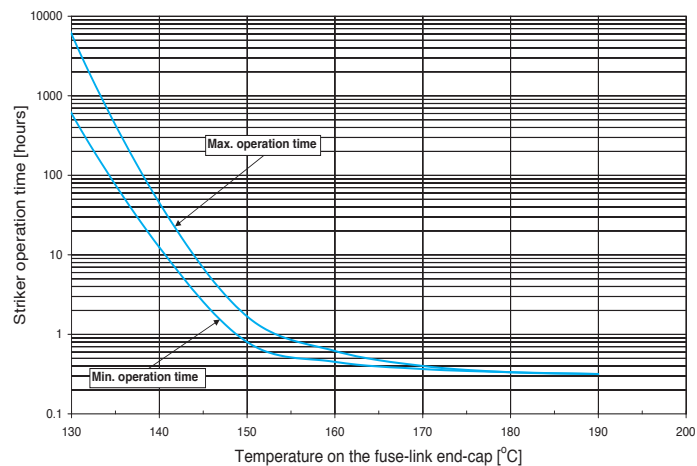
Back-up fuses are commonly used in fuse-switch combinations, both in open air and in gas insulated panels. When a fuse-switch combination operated as a protective device by tripping a system, the fuse assumes two different functions depending on the interrupted current value. When the fault current is greater than the transfer current, the fuse simply extends the breaking capability of the switch disconnecter by completing the interruption operation faster than the incorporated switch. This happens when the fuse clearing time is shorter than the total opening time of the Load Break Switch (LBS). By the time the striker pin pops up, the fuse has already cleared the fault current and the switch opens in almost no load conditions. If the fault currents are less than the nominal transfer current, the fuse then uses the striker pin to activate the switch, which in turn causes the system to trip. In other words, the interruption process is completed by the switch to prevent overloading of the fuses in situations where the fault current is low. Fuses used in fuse-switch combinations have to fulfill conditions specified in IEC 62271-105 (former IEC 60420 and IEC 420). Back-up fuses are specially designed for such an application. The fuse of general purpose or full range fuses in fuse-switch combinations is not reasonable due to coordination principles.

# ABB HV Fuses with Temperature Control Unit

The Temperature Control Unit (TCU) is tripping device which is integrated with the striker of high-voltage (HV) fuses. It is activated when the allowable temperature in the switchgear is exceeded. When the temperature is too high the TCU activates the striker by releasing the switch disconnector, which in turn opens the electric circuit and avoids further temperature increases.

## Temperature Control Unit parameters

1. Operation for approximately one hour at 150°C on the fuse end-cap.
2. Withstanding temperatures up to 125°C on the fuse end-cap.
3.  $I \leq 1.1 \times I_n$  – no operation.



With reference to the diagram above, the higher the temperature, the faster the striker operation.

The high temperatures inside the switchgear interior may be caused by external conditions or by a high current passing through the fuse-link. Other possible reasons include:



- reduced head transfer inside the switchgear,
- over-heating of degraded conducting contacts,
- long-term fuse overloads,
- improper selection of the fuse rating,
- local melting of fuse elements caused by transformer inrush currents, starting currents of motors etc.

Safety is significantly increased when fuses are equipped with a TCU. This is especially true in devices where fuses are located inside closed fuse holders, as is the case in SF<sub>6</sub> switchgear. However, in gas insulated switchgear fuse canisters or in the narrow panels of air switchgear the risk of overheating is high because cooling is limited. High temperatures in switchgears cause degradation and oxidation of the metal contacts, degradation of switchgear equipment or enclosures, and insulator ageing. Unfavorable effects, i.e. temperature rise inside the switchgear, leads to internal short-circuit and further temperature increases.

Fuse link equipped with a TCU are compatible with standard fuse links. Striker force and striker energy, as well as dimension and all fuse ratings, are in accordance with CEF, CEF-S, CEF-VT and CMF type fuses manufactured to date and with IEC standards. To differentiate fuses with a TCU from standard fuses, additional catalogue numbers have been generated and special markings on the fuse body are provided.

## Markings on the striker label and rating plate of fuse with TCU:



 STRIKER - SCHLAGSTIFT	<b>ABB</b>		
	Prod. year 08-2009		IEC 60282-1
	CEF		HV Back-up fuse link
	$I_N = 6A$	$I_3 = 35A$	
	$U_N = 24kV$	$I_1 = 63kA$	
	INDOOR - INNENRAUM		
TEMPERATURE CONTROL UNIT			
Striker 60N (medium)		Cat. number 1YMB531854M0001	
MADE by ABB		S/N 1YMP009C0146222	

# General principles for fuse links selection

## Choice of rated voltage $U_n$ :

The rated voltage of the fuse links must be equal to, or higher than the operating line voltage. By choosing the fuse link rated voltage considerably higher than the line voltage, the maximum arc voltage must not exceed the insulation level of the network.

## Choice of rated current $I_n$

To obtain the best possible current limitation and thereby protection, the rated current,  $I_n$ , must be as low as possible compared to the rated current of the object to be protected.

However, the following limitations must be taking into consideration:

- the largest load current must not exceed  $I_n$ ,
- cooling conditions (e.g. in compact switchgear),
- inrush current of off load transformers,
- starting currents of motor circuits. (See Chapter CMF, special motor fuses).

## Protection of capacitor banks

HRC fuses are normally connected in series with capacitor units or banks. They are activated when these units become faulty under normal operating voltages, including the transient voltage as the capacitor are being energized. That is why the chosen fuse-link rated voltage should not be less than 1.1 times that of the rated voltage of the capacitor unit. As recommended in IEC 60549, the rated current of the fuse should be at least 1.43 times that of the capacitor's rated current. In practice we can distinguish two general cases:

### a) Only one capacitor bank connected

Selected rated current,  $I_n$ , for the fuses should be least twice the rated current,  $I_{nc}$ , of the capacitor bank. The rated voltage,  $U_n$ , should also be at least twice  $U_{nc}$ .

$$I_n \geq 2 \times I_{nc}$$

$$U_n \geq 2 \times U_{nc}$$

### Example

315 kvar capacitor bank with 10 kV  $U_{nc}$ .

$$I_{nc} = \frac{315}{10 \times \sqrt{3}} = 18.2 \text{ A}$$

Selected fuses:  $I_n = 40 \text{ A}$ ;  $U_n = 24 \text{ kV}$

### b) More than one capacitor connected in parallel

While including the possibility of reloading i.e. transmitting from a load capacitor bank to an unloaded condition, very high transient currents may occur. The rated current,  $I_n$ , of the fuses should be selected so that it is more than three times the  $I_{nc}$  of the capacitor bank. Because a wide variation in transient currents may occur, ABB recommends that the calculation be discussed with the supplier of the capacitors.

## Application in SF<sub>6</sub> switchgears

CEF fuses were designed to be applied inside gas insulated switchgears. The interaction between fuses and switch disconnectors when limited heat dissipation conditions occur is not an easy task. This knowledge has been obtained mainly from practical tests performed under different loading conditions.

First the maximum allowable power losses should be defined for the fuses so as not to exceed temperature rise limits according to the referred standard. Therefore, the rated current of fuses with power losses above this limit are de-rated to a safe level that takes into consideration the fuse load factor. This procedure should be verified by temperature rise and breaking tests. ABB uses this standards approach for SF<sub>6</sub> switchgear and CEF fuses.

For detailed information regarding the correct choice of ABB fuses for transformer protection in SF<sub>6</sub> switchgear please refer to switchgear catalogue data.

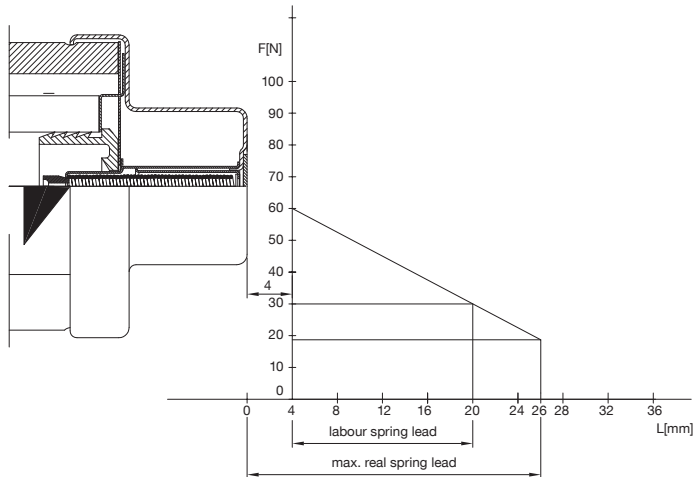
## Replacement of melted fuse links

HRC fuse links cannot be regenerated. According to IEC Publication 60282 1 (IEC 282-1), all three fuse links should be replaced even if only one of them in a three phase system melts. Exceptions are allowed when it can be verified that the fuse link (s) have not experienced any over current.

### Indicator and striker pin

CEF and CMF fuses are equipped with a combined indicator and striker system which is activated immediately when the fuse element melts. CEF-VT is available with and without a striker pin-please refers to the ordering tables. The force diagram in accordance with the requirements of IEC 60282-1 (IEC 282-1) and DIN 43625.

The striker pin force diagram shown below is valid for CEF/CMF fuses and has been available since May 2006. The former version of the striker pin was rated for an initial force of 50N.



All CEF and CMF fuses are marked with EAN 13 codes (on their carton boxes). These are specified in the ordering tables and are positioned to the right of the catalogue numbers. An example of this nameplate is presented below.



### Current limitation

All ABB fuse links presented are current limiting ones. A large short-circuit current will therefore not reach its full value. The cut-off characteristics show the relationship between the prospective short-circuit current and the peak value of the cut-off current. Substantial current limitation results in a considerable reduction in thermal and mechanical stress in a high-voltage installation.

### Nameplate

The symbols on the nameplate have the following meaning:

$I_N$  = Rated current

$U_N$  = Rated voltage

$I_3$  = Minimum breaking current

$I_1$  = Maximum short circuit current for which the fuse is tested

The arrowhead on the nameplate indicates at which end of the fuse link the indicator and striker pin appears. Additionally this end contact of the fuse link is specially marked.

**CEF-U** indicates an outdoor type.

 STRIKER - SCHLAGSTIFT	<b>ABB</b>		
	Prod. year 08-2009	IEC 60282-1	
	CEF	HV Back-up fuse link	
	$I_N = 16A$	$I_3 = 55A$	
	$U_N = 24kV$	$I_1 = 63kA$	
INDOOR - INNENRAUM			
Striker 60N (medium)		Cat. number 1YMB531004M0003	
MADE by ABB		S/N 1YMP009C0146223	

A typical ABB CEF fuse nameplate is shown above. The information presented varies for specific fuse types.

# High voltage current limiting Fuse links type CEF

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# Rated voltage: 3.6/7.2-36 kV

## High voltage current limiting Fuse links type CEF

### 1. General

The HRC generation of fuse links type CEF is designed and tested according to IEC Publication 60282-1 (IEC 282-1). Dimensionally the fuse links are in accordance with DIN 43625. ABB's high-voltage fuse links have the following properties:

- low minimum breaking current,
- low power losses,
- low arc voltage,
- high breaking capacity up to 63 kA,
- high current limitation.

Low power losses permit installations of these fuse links in compact switchgear.

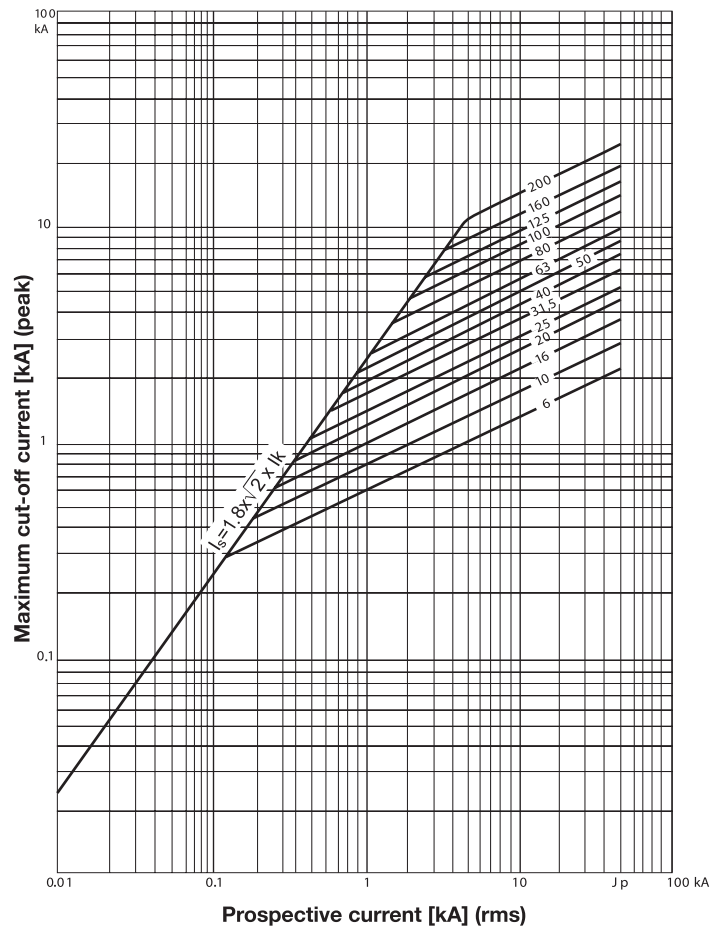
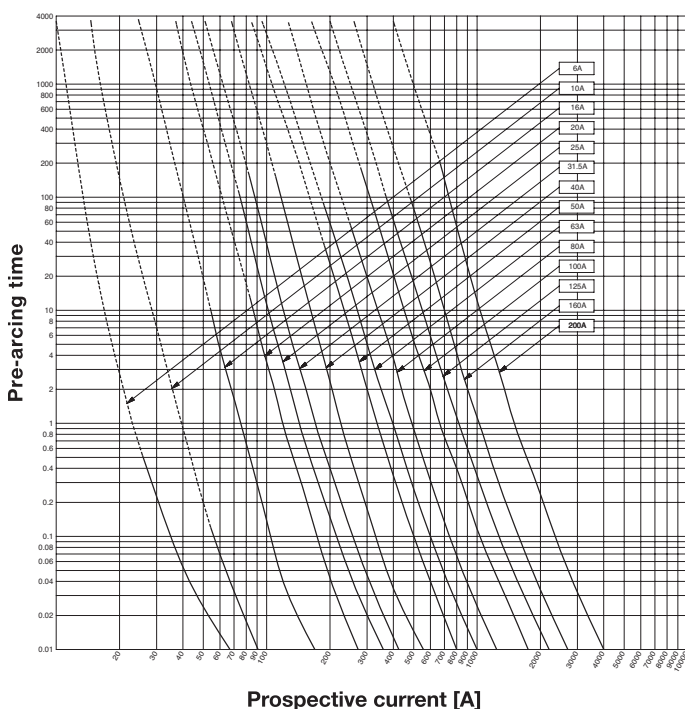
CEF fuses are of a back-up type. They have a zone between the minimum melting current and the minimum breaking current where the fuse links may fail to interrupt. For CEF fuse links this zone is very narrow. The minimum breaking current,  $I_3$ , for any type is specified in the table on pages 10 to 12.

### 2. Overvoltages

In order to be current limiting, the fuse link must generate an arc voltage that exceeds the instantaneous value of the operating voltage. The switching voltage generated by the CEF fuse link is below the maximum permissible value according to IEC 60282-1 (IEC 282-1). The CEF fuse link can safely be used if the system line voltage is 50-100% of the rated fuse-link voltage.

### 3. Pre-arcing times and cut-off characteristics

The characteristics are equal for all rated voltages and are recorded under cold conditions. Dashed sections of the curves indicate an area of uncertain interruption.



### 4. Choice of fuse links

#### Choice of rated current $I_n$

In order to choose the current fuse-link rated current for transformer protection, the relation between the power rating of the transformers, and the operating voltage and rated current of the fuse link is given in the table on page 10.

For the correct choice of fuse links for transformer protection in switchgear type SafeRing, SafePlus and SafeLink, see SF6 Insulation Compact Switchgear and Ring Main Unit catalogue.

#### Remarks:

1. Characteristics show the average melting time as a function of the prospective current.
2. The deviation of 10% refers to the current.
3. The characteristics are valid for all rated voltages and are recorded from fuse-link cold condition.
4. Broken line indicates the uncertain interrupting zone.

Choice of fuse links for transformer protection

Transformer rated voltage [kV]	Transformer rating [kVA]																			Fuse rated voltage [kV]			
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3000		3500		
	CEF Fuse-link In [A]																						
3	16	25	25	40	40	50	63	80	100	125	160	200	250 <sup>1)</sup>	315 <sup>1)</sup>	2x250 <sup>1)</sup>	2x315 <sup>1)</sup>							3.6/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	160	200	250 <sup>1)</sup>	315 <sup>1)</sup>	2x250 <sup>1)</sup>	2x315 <sup>1)</sup>					
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160	200	250 <sup>1)</sup>	315 <sup>1)</sup>	2x250 <sup>1)</sup>	2x315 <sup>1)</sup>				
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	160	200	2x160	2x200	2x200		12	
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125	160	200	2x160	2x200	2x200		
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	125	2x100	2x125			17.5	
20	6	6	6	10	10	16	16	16	16	20	20	25	31.5	40	50	63	80	100	125	2x100	2x100	2x100	
24	6	6	6	6	10	10	16	16	16	16	20	20	25	31.5	40	50	63	80	100	125	2x100	2x100	
30	6	6	6	6	6	10	10	16	16	16	16	25	25	25	40	40	2x25	2x40				36	
36	6	6	6	6	6	10	10	10	16	16	16	25	25	25	40	40	2x25	2x40	2x40				

<sup>1)</sup> CMF Fuse-link

The table was calculated according to standards IEC 60787 and IEC 62271-105. The following transformer work conditions were assumed:

- maximum long-lasting overload – 150%,
- magnetizing inrush current – 12xIn during 100 ms,
- transformer short-circuit voltage according to IEC 60076-5,
- standard ambient working conditions of fuses.

The table above details the rated current of a particular fuse link for a given line voltage and transformer rating. For different criteria, the fuse selection must be recalculated.

5. Ordering table, data and dimensions CEF/CEF-TCU

Rated current [A]	Maximum breaking current I <sub>1</sub> [kA]	Minimum breaking current I <sub>3</sub> [A]	Rated power Pn [W]	Resistance Ro [mΩ]	Diameter D [mm]	Length e [mm]	Weight [kg]	Catalogue number CEF	Catalogue number CEF-TCU
<b>Rated voltage 3.6/7.2 kV</b>									
6	50	35	26	460.0	65	192	1.5	1YMB531001M0001	1YMB531851M0001
10	50	55	16	120.3	65	192	1.5	1YMB531001M0002	1YMB531851M0002
16	50	55	26	60.2	65	192	1.5	1YMB531001M0003	1YMB531851M0003
25	50	72	24	30.1	65	192	1.5	1YMB531001M0004	1YMB531851M0004
40	50	100	30	15.3	65	192	1.5	1YMB531001M0005	1YMB531851M0005
50	50	190	35	10.4	65	192	1.5	1YMB531001M0006	1YMB531851M0006
63	50	190	40	7.8	65	192	1.5	1YMB531001M0007	1YMB531851M0007
80	50	250	52	6.2	87	192	2.6	1YMB531001M0008	1YMB531851M0008
100	50	275	57	4.4	87	192	2.6	1YMB531001M0009	1YMB531851M0009
125	50	375	76	3.5	87	292	3.6	1YMB531001M0010	1YMB531851M0010
160	50	480	101	2.6	87	292	3.6	1YMB531001M0011	1YMB531851M0011
200	50	650	107	1.7	87	292	3.6	1YMB531001M0012	1YMB531851M0012
6	50	35	26	460.0	65	292	2.3	1YMB531034M0001	1YMB531884M0001
10	50	55	16	120.3	65	292	2.3	1YMB531034M0002	1YMB531884M0002
16	50	55	26	60.2	65	292	2.3	1YMB531034M0003	1YMB531884M0003
25	50	72	24	30.1	65	292	2.3	1YMB531034M0004	1YMB531884M0004
40	50	100	30	15.3	65	292	2.3	1YMB531034M0005	1YMB531884M0005
50	50	190	35	10.4	65	292	2.3	1YMB531034M0006	1YMB531884M0006
63	50	190	40	7.8	65	292	2.3	1YMB531034M0007	1YMB531884M0007
80	50	250	52	6.2	87	292	3.6	1YMB531034M0008	1YMB531884M0008
100	50	275	57	4.4	87	292	3.6	1YMB531034M0009	1YMB531884M0009
160	50	480	101	2.6	87	367	4.4	1YMB531034M0011	1YMB531884M0011
200	50	650	107	1.7	87	367	4.4	1YMB531034M0012	1YMB531884M0012
125	50	375	76	3.5	87	367	4.4	1YMB531034M1010	1YMB531884M1010
<b>Rated voltage 12 kV</b>									
6	63	36	46	665.0	53	292	1.9	1YMB531042M0001	1YMB531892M0001
6	63	35	41	665.0	65	292	2.3	1YMB531002M0001	1YMB531852M0001
10	63	65	25	180.5	53	292	1.9	1YMB531042M0002	1YMB531892M0002
10	63	55	33	180.5	65	292	2.3	1YMB531002M0002	1YMB531852M0002
16	63	65	34	105.2	53	292	1.9	1YMB531042M0003	1YMB531892M0003
16	63	55	32	105.2	65	292	2.3	1YMB531002M0003	1YMB531852M0003
20	63	83	38	70.1	53	292	1.9	1YMB531042M0004	1YMB531892M0004

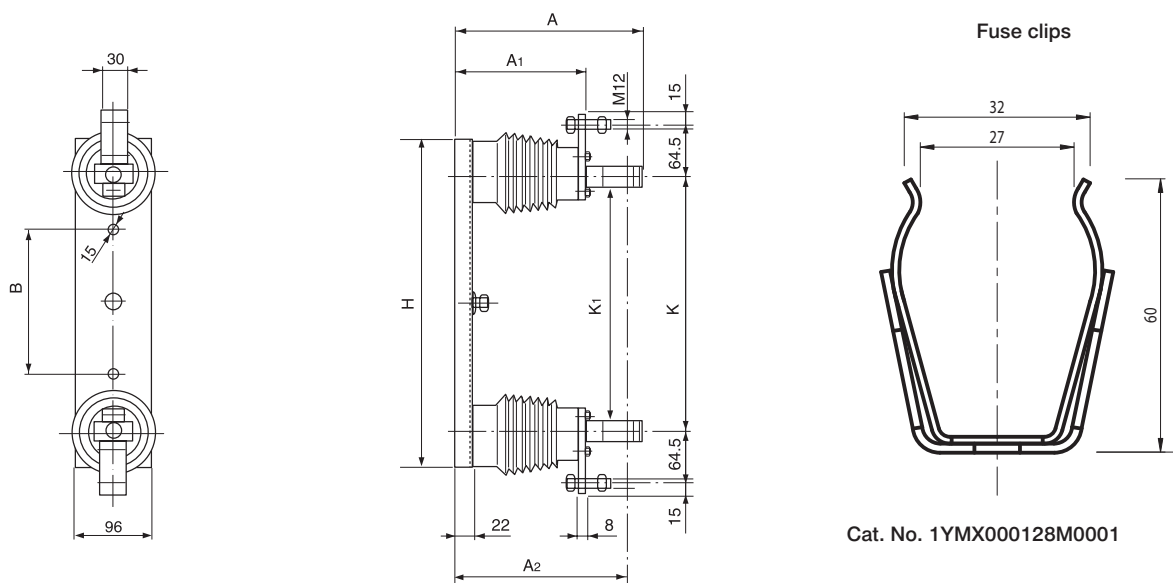
Rated current [A]	Maximum breaking current I <sub>1</sub> [kA]	Minimum breaking current I <sub>3</sub> [A]	Rated power P <sub>n</sub> [W]	Resistance R <sub>o</sub> [mΩ]	Diameter D [mm]	Length e [mm]	Weight [kg]	Catalogue number CEF	Catalogue number CEF-TCU
25	63	77	47	52.6	65	292	2.3	1YMB531002M0004	1YMB531852M0004
31.5	63	100	41	30.7	65	292	2.3	1YMB531002M0014	1YMB531852M0014
40	63	105	52	23.0	65	292	2.3	1YMB531002M0005	1YMB531852M0005
50	63	190	70	17.9	65	292	2.3	1YMB531002M0006	1YMB531852M0006
63	63	190	78	13.4	65	292	2.3	1YMB531002M0007	1YMB531852M0007
80	63	250	82	9.2	65	292	2.3	1YMB531002M0021	1YMB531852M0021
80	63	250	82	9.2	87	292	3.6	1YMB531002M0008	1YMB531852M0008
100	63	375	101	6.4	65	292	2.3	1YMB531002M0022	1YMB531852M0022
100	63	275	84	6.6	87	292	3.6	1YMB531002M0009	1YMB531852M0009
125	63	375	125	5.3	87	292	3.6	1YMB531043M0010	1YMB531893M0010
6	63	36	46	665.0	53	442	2.5	1YMB531047M0001	1YMB531897M0001
6	63	35	41	665.0	65	442	3	1YMB531035M0001	1YMB531885M0001
10	63	65	25	180.5	53	442	2.5	1YMB531047M0002	1YMB531897M0002
10	63	55	33	180.5	65	442	3	1YMB531035M0002	1YMB531885M0002
16	63	65	34	105.2	53	442	2.5	1YMB531047M0003	1YMB531897M0003
16	63	55	32	105.2	65	442	3	1YMB531035M0003	1YMB531885M0003
20	63	83	38	70.1	53	442	2.5	1YMB531047M0004	1YMB531897M0004
25	63	77	47	52.6	65	442	3	1YMB531035M0004	1YMB531885M0004
31.5	63	100	41	30.7	65	442	3	1YMB531035M0014	1YMB531885M0014
40	63	105	52	23.0	65	442	3	1YMB531035M0005	1YMB531885M0005
50	63	190	70	17.9	65	442	3	1YMB531035M0006	1YMB531885M0006
63	63	190	78	13.4	65	442	3	1YMB531035M0007	1YMB531885M0007
80	63	250	82	9.2	65	442	3	1YMB531035M0021	1YMB531885M0021
80	63	250	82	9.2	87	442	5.3	1YMB531035M0008	1YMB531885M0008
100	63	375	103	6.4	65	442	3	1YMB531035M0022	1YMB531885M0022
100	63	275	84	6.6	87	442	5.3	1YMB531035M0009	1YMB531885M0009
125	63	375	125	5.3	65	442	3	1YMB531002M0023	1YMB531852M0023
125	63	375	125	5.3	87	442	5.3	1YMB531002M0010	1YMB531852M0010
160	63	480	170	3.9	87	442	5.2	1YMB531002M0011	1YMB531852M0011
200	50	650	174	2.7	87	442	5.2	1YMB531002M0012	1YMB531852M0012
125	50	375	125	5.3	65	537	5.2	1YMB531035M0023	1YMB531885M0023
125	50	375	125	5.3	87	537	5.3	1YMB531035M0010	1YMB531885M0010
160	50	480	170	3.9	87	537	5.3	1YMB531035M0011	1YMB531885M0011
200	50	650	174	2.7	87	537	5.3	1YMB531035M0012	1YMB531885M0012
<b>Rated voltage 17.5 kV</b>									
6	20	35	54	807.0	65	292	2.3	1YMB531003M0001	1YMB531853M0001
10	20	55	41	270.7	65	292	2.3	1YMB531003M0002	1YMB531853M0002
16	20	55	67	135.4	65	292	2.3	1YMB531003M0003	1YMB531853M0003
20	25	83	52.6	90.3	65	292	2.3	1YMB531003M0013	1YMB531853M0013
25	25	72	64	67.7	65	292	2.3	1YMB531003M0004	1YMB531853M0004
31.5	25	100	56.7	46.0	65	292	2.3	1YMB531003M0014	1YMB531853M0014
40	25	210	80	34.7	65	292	2.3	1YMB531003M0021	1YMB531853M0021
40	25	100	80	34.5	87	292	3.6	1YMB531003M0005	1YMB531853M0005
50	25	210	90	23.1	65	292	2.3	1YMB531003M0022	1YMB531853M0022
50	25	210	90	23.1	87	292	3.6	1YMB531003M0006	1YMB531853M0006
63	25	210	100	17.3	87	292	3.8	1YMB531003M0007	1YMB531853M0007
6	20	35	54	807.0	65	367	2.7	1YMB531036M0001	1YMB531886M0001
10	20	55	41	270.7	65	367	2.7	1YMB531036M0002	1YMB531886M0002
16	20	55	67	135.4	65	367	2.7	1YMB531036M0003	1YMB531886M0003
20	25	83	52.6	90.3	65	367	2.7	1YMB531036M0013	1YMB531886M0013
25	25	72	64	67.7	65	367	2.7	1YMB531036M0004	1YMB531886M0004
31.5	25	100	56.7	46.0	65	367	2.7	1YMB531036M0014	1YMB531886M0014
40	25	210	80	34.7	65	367	2.7	1YMB531036M0021	1YMB531886M0021
40	25	100	80	34.5	87	367	4.4	1YMB531036M0005	1YMB531886M0005
50	25	210	90	23.1	65	367	2.7	1YMB531036M0022	1YMB531886M0022
50	25	210	90	23.1	87	367	4.4	1YMB531036M0006	1YMB531886M0006
63	25	210	100	17.3	87	367	4.4	1YMB531036M0007	1YMB531886M0007
100	25	375	136	9.5	87	367	4.4	1YMB531038M0001	1YMB531888M0001
6	20	35	54	807.0	65	442	3	1YMB531037M0001	1YMB531887M0001
10	20	55	41	270.7	65	442	3	1YMB531037M0002	1YMB531887M0002
16	20	55	67	135.4	65	442	3	1YMB531037M0003	1YMB531887M0003
20	25	83	52.6	90.3	65	442	3	1YMB531037M0013	1YMB531887M0013
25	25	72	64	67.7	65	442	3	1YMB531037M0004	1YMB531887M0004

Rated current [A]	Maximum breaking current I <sub>1</sub> [kA]	Minimum breaking current I <sub>3</sub> [A]	Rated power P <sub>n</sub> [W]	Resistance Ro [mΩ]	Diameter D [mm]	Length e [mm]	Weight [kg]	Catalogue number CEF	Catalogue number CEF-TCU
31.5	25	100	56.7	46.0	65	442	3	1YMB531037M0014	1YMB531887M0014
40	25	210	80	34.7	65	442	3	1YMB531037M0021	1YMB531887M0021
40	25	100	80	34.5	87	442	5.3	1YMB531037M0005	1YMB531887M0005
50	25	210	90	23.1	65	442	3	1YMB531037M0022	1YMB531887M0022
50	25	210	90	23.1	87	442	5.3	1YMB531037M0006	1YMB531887M0006
63	25	210	100	17.3	87	442	5.3	1YMB531037M0007	1YMB531887M0007
80	25	250	124	13.8	87	442	5.3	1YMB531003M0008	1YMB531853M0008
100	25	275	136	9.9	87	442	5.3	1YMB531003M0009	1YMB531853M0009
125	25	375	175	7.9	87	442	5.3	1YMB531003M0010	1YMB531853M0010
80	25	250	124	13.8	87	537	5.3	1YMB531037M0008	1YMB531887M0008
100	25	275	136	9.9	87	537	5.3	1YMB531037M0009	1YMB531887M0009
125	25	375	175	7.9	87	537	5.3	1YMB531037M0010	1YMB531887M0010
<b>Rated voltage 24 kV</b>									
6	63	25	82	1229.0	53	442	2.5	1YMB531044M0001	1YMB531894M0001
6	63	35	91	1229.0	65	442	3	1YMB531004M0001	1YMB531854M0001
10	63	65	48	360.9	53	442	2.5	1YMB531044M0002	1YMB531894M0002
10	63	55	62	360.9	65	442	3	1YMB531004M0002	1YMB531854M0002
16	63	65	63	180.5	53	442	2.5	1YMB531044M0003	1YMB531894M0003
16	63	55	72	180.5	65	442	3	1YMB531004M0003	1YMB531854M0003
20	63	83	46	120.3	53	442	2.5	1YMB531044M0004	1YMB531894M0004
20	63	82	61	120.3	65	442	3	1YMB531004M0011	1YMB531854M0011
25	63	72	79	90.2	65	442	3	1YMB531004M0004	1YMB531854M0004
40	63	110	106	46.0	65	442	3	1YMB531004M0005	1YMB531854M0005
50	63	210	130	30.7	65	442	3	1YMB531004M0021	1YMB531854M0021
50	63	210	130	30.7	87	442	5.3	1YMB531004M0006	1YMB531854M0006
63	63	250	147	23.0	65	442	3	1YMB531004M0022	1YMB531854M0022
63	63	210	147	23.0	87	442	5.3	1YMB531004M0007	1YMB531854M0007
80	63	250	165	18.4	87	442	5.3	1YMB531022M0001	1YMB531872M0001
100	63	300	186	15.4	87	442	5.3	1YMB531022M0002	1YMB531872M0002
125	63	375	234	10.5	87	442	5.3	1YMB531022M0003	1YMB531872M0003
31.5	63	82	98	72.2	65	442	3	1YMB531004M0012	1YMB531854M0012
80	63	250	165	18.4	65	537	5.3	1YMB531004M0023	1YMB531854M0023
80	63	250	165	18.4	87	537	6.2	1YMB531004M0008	1YMB531854M0008
100	63	300	186	13.2	87	537	6.2	1YMB531004M0009	1YMB531854M0009
125	63	375	234	10.5	87	537	6.2	1YMB531004M0010	1YMB531854M0010
<b>Rated voltage 27 kV</b>									
6	20	35	91	1295.0	65	442	3	1YMB531005M0001	1YMB531855M0001
10	20	55	80	451.2	65	442	3	1YMB531005M0002	1YMB531855M0002
16	20	55	90	225.6	65	442	3	1YMB531005M0003	1YMB531855M0003
25	20	72	100	112.8	87	442	3	1YMB531005M0004	1YMB531855M0004
40	20	110	130	55.6	87	442	3	1YMB531005M0005	1YMB531855M0005
50	20	210	130	30.7	87	442	5.3	1YMB531005M0006	1YMB531855M0006
63	20	210	147	23.0	87	442	5.3	1YMB531005M0007	1YMB531855M0007
80	20	250	210	18.4	87	537	6.2	1YMB531005M0008	1YMB531855M0008
100	20	300	300	15.8	87	537	6.2	1YMB531005M0009	1YMB531855M0009
<b>Rated voltage 36 kV</b>									
6	20	35	137	1860.0	65	537	3.1	1YMB531006M0001	1YMB531856M0001
10	20	55	93	571.5	65	537	3.1	1YMB531006M0002	1YMB531856M0002
16	20	55	109	285.8	65	537	3.1	1YMB531006M0003	1YMB531856M0003
25	20	72	144	142.9	87	537	6.2	1YMB531006M0004	1YMB531856M0004
40	20	100	176	69.1	87	537	6.2	1YMB531006M0005	1YMB531856M0005

**Legend:**  
I<sub>1</sub> – maximum short-circuit current tested  
I<sub>3</sub> – minimum breaking current  
P<sub>n</sub> – power loss at rated current  
Ro – resistance at room temp.

## 6. Accessories

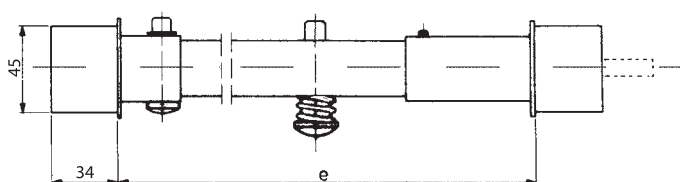
### Fuse base type UCE



Type	Rated voltage	Current ratings	Fuse length	Dimensions in mm							Weight	Catalogue No.
	[kV]	[A]	[mm]	A	A1	A2	H	K	K1	B	[kg]	
UCE 7.2	3.6/7.2	6-100	192	242	160	221	310	218	193	55	3.4	1YMX052501M0001
UCE12	3.6/12	6-200	292	242	160	221	410	318	293	180	3.7	1YMX052503M0001
UCE 12L	12	125-200	442	242	160	221	570	468	443	300	4.2	1YMX052505M0001
UCE 17.5	17.5	6-63	292	327	245	306	410	318	293	180	3.7	1YMX052507M0001
UCE 24	24	6-125	292	327	245	306	410	318	293	180	3.7	1YMX052508M0001
UCE 24	17.5/24	6-125	442	327	245	306	570	468	443	300	6.9	1YMX052509M0001
UCE 24L	24	80-125	537	327	245	306	675	563	538	380	7.4	1YMX052511M0001
UCE 36	36	6-40	537	422	340	401	675	563	538	380	7.6	1YMX052513M0001

### CEF test fuse-link 3.6/7.2-36 kV for test of striker system

Catalogue No.	Weight [kg]	Dimension in mm	
		e*)	Total length
1YMX300062M0001	1.4	192	605
		292	
		442	
		537	

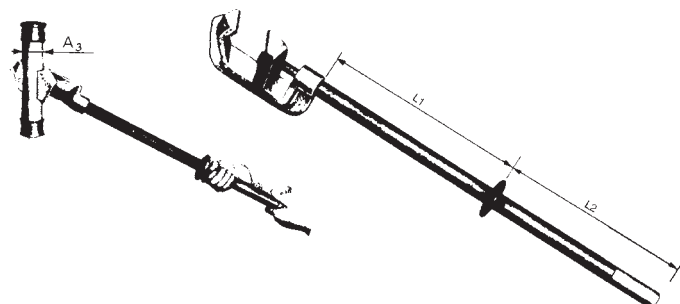


\*) Adjustable

The striker has a force-travel characteristic as shown in the figure on page 7.

### Operating tong for fuse links CEF 3.6/7.2 – 36 kV

Catalogue No.	Test voltage [kV]	Weight [kg]
1YMX053006M001	100	2.2



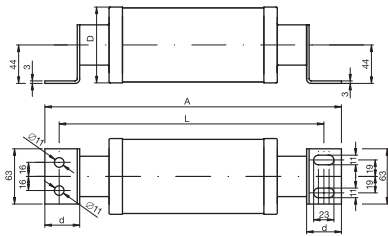
#### Dimensions in mm

L1	L2	A3(Ø)
700	600	30-90

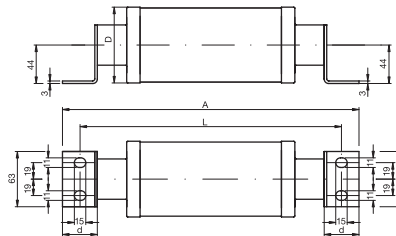
## 7. Data and dimension CEF-BS

Type	Rated voltage Un [kV]	Rated current In [A]	L/D [mm]	A [mm]	Catalogue No.	EAN13 Codes
CEF-BS	3.6/7.2	6	305/65	340	1YMB531007M0001	5901436020721
CEF-BS	3.6/7.2	10	305/65	340	1YMB531007M0002	5901436020738
CEF-BS	3.6/7.2	16	305/65	340	1YMB531007M0003	5901436020745
CEF-BS	3.6/7.2	25	305/65	340	1YMB531007M0004	5901436020752
CEF-BS	3.6/7.2	40	305/65	340	1YMB531007M0005	5901436020769
CEF-BS	3.6/7.2	50	305/65	340	1YMB531007M0006	5901436020776
CEF-BS	3.6/7.2	63	305/65	340	1YMB531007M0007	5901436020783
CEF-BS	3.6/7.2	80	305/87	340	1YMB531007M0008	5901436020790
CEF-BS	3.6/7.2	100	305/87	340	1YMB531007M0009	5901436020806
CEF-BS	3.6/7.2	125	405/87	440	1YMB531007M0010	5901436020813
CEF-BS	3.6/7.2	160	405/87	440	1YMB531007M0011	5901436020820
CEF-BS	3.6/7.2	200	405/87	440	1YMB531007M0012	5901436020837
CEF-BS	12	6	405/65	440	1YMB531008M0001	5901436021179
CEF-BS	12	10	405/65	440	1YMB531008M0002	5901436021186
CEF-BS	12	16	405/65	440	1YMB531008M0003	5901436021193
CEF-BS	12	25	405/65	440	1YMB531008M0004	5901436021209
CEF-BS	12	40	405/65	440	1YMB531008M0005	5901436021216
CEF-BS	12	50	405/65	440	1YMB531008M0006	5901436021223
CEF-BS	12	63	405/65	440	1YMB531008M0007	5901436021230
CEF-BS	12	80	405/87	440	1YMB531008M0008	5901436021247
CEF-BS	12	100	405/87	440	1YMB531008M0009	5901436021254
CEF-BS	12	125	555/87	590	1YMB531008M0010	5901436021261
CEF-BS	12	160	555/87	590	1YMB531008M0011	5901436021278
CEF-BS	12	200	555/87	590	1YMB531008M0012	5901436021285
CEF-BS	17.5	6	405/65	440	1YMB531009M0001	5901436021506
CEF-BS	17.5	10	405/65	440	1YMB531009M0002	5901436021513
CEF-BS	17.5	16	405/65	440	1YMB531009M0003	5901436021520
CEF-BS	17.5	25	405/65	440	1YMB531009M0004	5901436021537
CEF-BS	17.5	40	405/87	440	1YMB531009M0005	5901436021544
CEF-BS	17.5	50	405/87	440	1YMB531009M0006	5901436021551
CEF-BS	17.5	63	405/87	440	1YMB531009M0007	5901436021568
CEF-BS	17.5	80	555/87	590	1YMB531009M0008	5901436021575
CEF-BS	17.5	100	555/87	590	1YMB531009M0009	5901436021582
CEF-BS	17.5	125	555/87	590	1YMB531009M0010	5901436021599
CEF-BS	24	6	555/65	590	1YMB531010M0001	5901436021773
CEF-BS	24	10	555/65	590	1YMB531010M0002	5901436021780
CEF-BS	24	16	555/65	590	1YMB531010M0003	5901436021797
CEF-BS	24	25	555/65	590	1YMB531010M0004	5901436021803
CEF-BS	24	40	555/65	590	1YMB531010M0005	5901436021810
CEF-BS	24	50	555/87	590	1YMB531010M0006	5901436021827
CEF-BS	24	63	555/87	590	1YMB531010M0007	5901436021834
CEF-BS	24	80	650/87	685	1YMB531010M0008	5908270801745
CEF-BS	24	100	650/87	685	1YMB531010M0009	5908270801752
CEF-BS	24	125	650/87	685	1YMB531010M0010	5908270801769

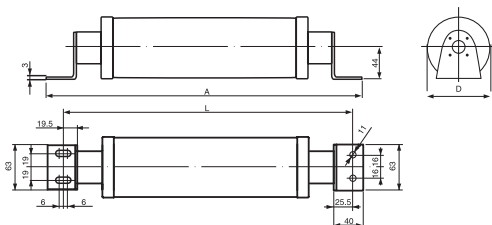
### Dimension CEF-BS-B



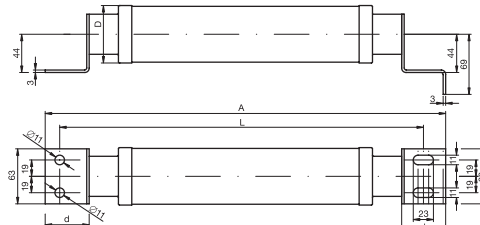
### Dimension CEF-BS-C



### Dimension CEF-BS



### Dimension CEF-BS-D



8. Data and dimension CEF-BS acc. To IEC 60282-1:1996

Type	Rated voltage Un [kV]	Rated current In [A]	L/D [mm]	A/d [mm]	Catalogue No.	EAN13 Codes
CEF-BS-B	3,6/7,2	6	305/65	340/40	1YMB531007M0021	5901436020844
CEF-BS-B	3,6/7,2	10	305/65	340/40	1YMB531007M0022	5901436020851
CEF-BS-B	3,6/7,2	16	305/65	340/40	1YMB531007M0023	5901436020868
CEF-BS-B	3,6/7,2	25	305/65	340/40	1YMB531007M0024	5901436020875
CEF-BS-B	3,6/7,2	40	305/65	340/40	1YMB531007M0025	5901436020882
CEF-BS-B	3,6/7,2	50	305/65	340/40	1YMB531007M0026	5901436020899
CEF-BS-B	3,6/7,2	63	305/65	340/40	1YMB531007M0027	5901436020905
CEF-BS-B	3,6/7,2	80	305/87	340/40	1YMB531007M0028	5901436020912
CEF-BS-B	3,6/7,2	100	305/87	340/40	1YMB531007M0029	5901436020929
CEF-BS-D	3,6/7,2	125	419/87	461/50,5	1YMB531007M0030	5901436020936
CEF-BS-D	3,6/7,2	160	419/87	461/50,5	1YMB531007M0031	5901436020943
CEF-BS-D	3,6/7,2	200	419/87	461/50,5	1YMB531007M0032	5901436020950
CEF-BS-D	12	6	419/65	461/50,5	1YMB531008M0021	5901436021292
CEF-BS-D	12	10	419/65	461/50,5	1YMB531008M0022	5901436021308
CEF-BS-D	12	16	419/65	461/50,5	1YMB531008M0023	5901436021315
CEF-BS-D	12	25	419/65	461/50,5	1YMB531008M0024	5901436021322
CEF-BS-D	12	40	419/65	461/50,5	1YMB531008M0025	5901436021339
CEF-BS-D	12	50	419/65	461/50,5	1YMB531008M0026	5901436021346
CEF-BS-D	12	63	419/65	461/50,5	1YMB531008M0027	5901436021353
CEF-BS-D	12	80	419/87	461/50,5	1YMB531008M0028	5901436021360
CEF-BS-D	12	100	419/87	461/50,5	1YMB531008M0029	5901436021377
CEF-BS-B	12	125	553/87	590/40	1YMB531008M0030	5901436021384
CEF-BS-B	12	160	553/87	590/40	1YMB531008M0031	5901436021391
CEF-BS-B	12	200	553/87	590/40	1YMB531008M0032	5901436021407
CEF-BS-D	17,5	6	419/65	461/50,5	1YMB531009M0021	5901436021605
CEF-BS-D	17,5	10	419/65	461/50,5	1YMB531009M0022	5901436021612
CEF-BS-D	17,5	16	419/65	461/50,5	1YMB531009M0023	5901436021629
CEF-BS-D	17,5	25	419/65	461/50,5	1YMB531009M0024	5901436021636
CEF-BS-D	17,5	40	419/87	461/50,5	1YMB531009M0025	5901436021643
CEF-BS-D	17,5	50	419/87	461/50,5	1YMB531009M0026	5901436021650
CEF-BS-D	17,5	63	419/87	461/50,5	1YMB531009M0027	5901436021667
CEF-BS-B	17,5	80	553/87	590/40	1YMB531009M0028	5901436021674
CEF-BS-B	17,5	100	553/87	590/40	1YMB531009M0029	5901436021681
CEF-BS-B	17,5	125	553/87	590/40	1YMB531009M0030	5901436021698
CEF-BS-B	24	6	553/65	590/40	1YMB531010M0021	5901436021841
CEF-BS-B	24	10	553/65	590/40	1YMB531010M0022	5901436021858
CEF-BS-B	24	16	553/65	590/40	1YMB531010M0023	5901436021865
CEF-BS-B	24	25	553/65	590/40	1YMB531010M0024	5901436021872
CEF-BS-B	24	40	553/65	590/40	1YMB531010M0025	5901436021889
CEF-BS-B	24	50	553/87	590/40	1YMB531010M0026	5901436021896
CEF-BS-B	24	63	553/87	590/40	1YMB531010M0027	5901436021902
CEF-BS-C	3,6/7,2	6	305/65	340/40	1YMB531007M0041	5901436020967
CEF-BS-C	3,6/7,2	10	305/65	340/40	1YMB531007M0042	5901436020974
CEF-BS-C	3,6/7,2	16	305/65	340/40	1YMB531007M0043	5901436020981
CEF-BS-C	3,6/7,2	25	305/65	340/40	1YMB531007M0044	5901436020998
CEF-BS-C	3,6/7,2	40	305/65	340/40	1YMB531007M0045	5901436021001
CEF-BS-C	3,6/7,2	50	305/65	340/40	1YMB531007M0046	5901436021018
CEF-BS-C	3,6/7,2	63	305/65	340/40	1YMB531007M0047	5901436021025
CEF-BS-C	3,6/7,2	80	305/87	340/40	1YMB531007M0048	5901436021032
CEF-BS-C	3,6/7,2	100	305/87	340/40	1YMB531007M0049	5901436021049
CEF-BS-C	3,6/7,2	6	320/65	361/50,5	1YMB531007M0061	5901436021087
CEF-BS-C	3,6/7,2	10	320/65	361/50,5	1YMB531007M0062	5901436021094
CEF-BS-C	3,6/7,2	16	320/65	361/50,5	1YMB531007M0063	5901436021100
CEF-BS-C	3,6/7,2	25	320/65	361/50,5	1YMB531007M0064	5901436021117
CEF-BS-C	3,6/7,2	40	320/65	361/50,5	1YMB531007M0065	5901436021124
CEF-BS-C	3,6/7,2	50	320/65	361/50,5	1YMB531007M0066	5901436021131
CEF-BS-C	3,6/7,2	63	320/65	361/50,5	1YMB531007M0067	5901436021148
CEF-BS-C	3,6/7,2	80	320/87	361/50,5	1YMB531007M0068	5901436021155
CEF-BS-C	3,6/7,2	100	320/87	361/50,5	1YMB531007M0069	5901436021162
CEF-BS-C	3,6/7,2	125	400/87	440/40	1YMB531007M0050	5901436021056
CEF-BS-C	3,6/7,2	160	400/87	440/40	1YMB531007M0051	5901436021063
CEF-BS-C	3,6/7,2	200	400/87	440/40	1YMB531007M0052	5901436021070
CEF-BS-C	12	6	400/65	440/40	1YMB531008M0041	5901436021414
CEF-BS-C	12	10	400/65	440/40	1YMB531008M0042	5901436021421
CEF-BS-C	12	16	400/65	440/40	1YMB531008M0043	5901436021438
CEF-BS-C	12	25	400/65	440/40	1YMB531008M0044	5901436021445
CEF-BS-C	12	40	400/65	440/40	1YMB531008M0045	5901436021452
CEF-BS-C	12	50	400/65	440/40	1YMB531008M0046	5901436021469
CEF-BS-C	12	63	400/65	440/40	1YMB531008M0047	5901436021476
CEF-BS-C	12	80	400/87	440/40	1YMB531008M0048	5901436021483
CEF-BS-C	12	100	400/87	440/40	1YMB531008M0049	5901436021490
CEF-BS-C	17,5	6	400/65	440/40	1YMB531009M0041	5901436021704
CEF-BS-C	17,5	10	400/65	440/40	1YMB531009M0042	5901436021711
CEF-BS-C	17,5	16	400/65	440/40	1YMB531009M0043	5901436021728
CEF-BS-C	17,5	25	400/65	440/40	1YMB531009M0044	5901436021735
CEF-BS-C	17,5	40	400/87	440/40	1YMB531009M0045	5901436021742
CEF-BS-C	17,5	50	400/87	440/40	1YMB531009M0046	5901436021759
CEF-BS-C	17,5	63	400/87	440/40	1YMB531009M0047	5901436021766

# High voltage current limiting Fuse links type CEF-S

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## 1. General

As seen in the data table, high-voltage current limiting fuse links type CEF-S has a minimum current value ( $I_{0.1sec}$ ) which allows the fuse link to interrupt the fault current within 100ms. This ensures very good protection and prevents faults in low-voltage switch-gears. The current value for the different fuse-link types is shown for the total maximum breaking time of 100ms. For bigger fault currents the maximum total breaking time will be shorter. CEF-S

fuses are specially designed to achieve the lowest possible breaking current value at 100ms. However, this results in a reduced margin, which for standard CEF fuses, prevents fuse-link operation due to inrush currents developed when an unloaded power transformer is energized.

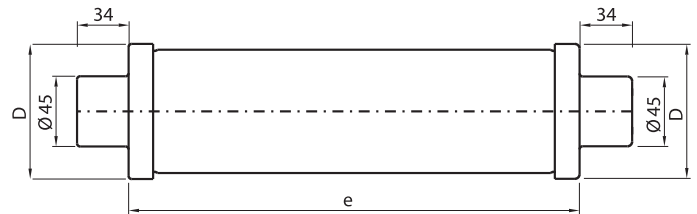
At any given value of  $I_{0.1sec}$ , the total breaking time is a maximum of 100ms – this value includes maximum pre-arcing time, arcing time and production tolerance.

## 2. Dimensions and electrical data

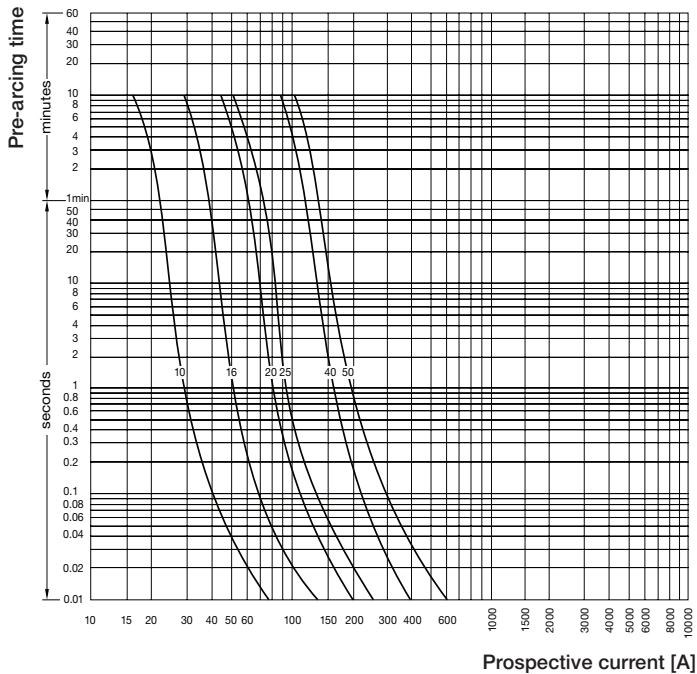
Un [kV]	In [A]	e [mm]	D [mm]	I <sub>1</sub> [kA]	I <sub>g</sub> [A]	I <sub>0.1sec</sub> [A]	Pn [W]	V [kg]	Ro [mΩ]
12	10	292	65	50	55	48	27	2.3	187.0
	16	292	65	50	55	80	38	2.3	108.5
	20	292	65	50	72	120	39	2.3	72.3
	25	292	65	50	72	160	45	2.3	46.5
	40	292	65	50	100	240	54	2.3	24.5
24	50	292	65	50	190	330	70	2.3	18.8
	10	442	65	25	55	48	54	3	373.2
	16	442	65	25	55	80	67	3	186.6
	20	442	65	25	72	120	69	3	124.4
	25	442	65	25	72	160	70	3	93.3
	40	442	65	25	110	240	122	3	48.8

### Legend:

e	see figure
D	see figure
I <sub>1</sub>	maximum rated breaking current
I <sub>0.1sec</sub>	lowest current which gives maximum breaking time smaller than or equal to 100ms
Pn	power losses at rated current V weight
R <sub>c</sub>	resistance at room temperature

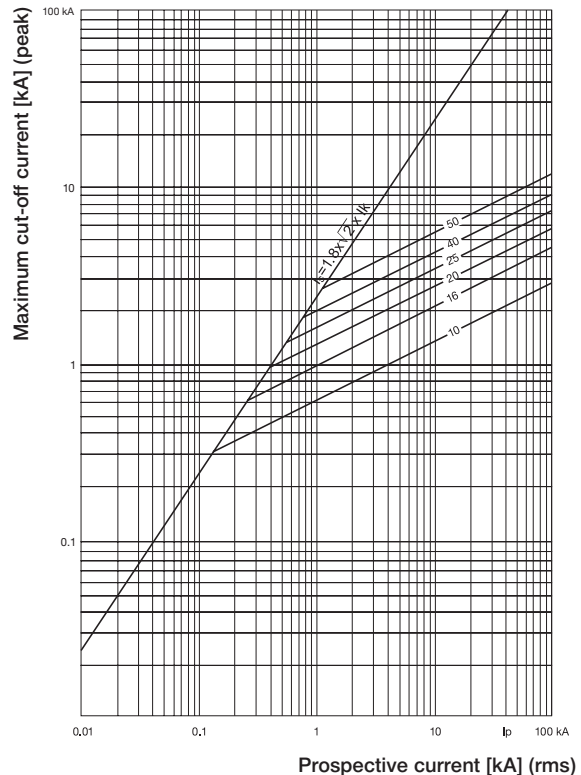


## 3. Time-current characteristics



### Melting times

The characteristic curves are the same for rated voltages of 12 and 24 kV taken under cold conditions.



#### 4. Fuse selection table for transformer protection

Transformer rated voltage [kV]	Transformer rating [kVA]												Fuse rated voltage [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	
	CEF-S Fuse-link In [A]												
3	16	25	40	50									12
5	10	20	25	40	40	50							
6	10	16	20	25	40	40	50						
10	10	10	16	20	20	25	40	40	50				
11	10	10	16	20	20	25	40	40	40	50			
12	10	10	16	16	20	20	25	40	40	50			
15	10	10	10	16	16	20	20	25	40	40			24
20	10	10	10	10	16	16	20	20	25	40	40		
22	10	10	10	10	16	16	20	20	20	40	40	40	
24	10	10	10	10	16	16	16	20	20	25	40	40	

The table was calculated according to standards IEC 60787 and IEC 62271-105. The following transformer work conditions were assumed:

- maximum long-lasting overload – 150%,
- magnetizing inrush current –  $12 \times I_n$  during 100 ms,
- transformer short-circuit voltage according to IEC 60076-5,
- standard ambient working conditions of fuses.

For different criteria fuse selection must be recalculated. The table indicates the correct fuse-link rated current for a given line voltage and transformer rating.

#### 5. Fuse power losses at transformer rated current

For different transformer ratings, power losses are shown in the table below. The table is valid for fuses selected according to the fuse selection table. The measurements were done at the rated transformer power and air cooling according to IEC 60282-1:2002.

The losses mentioned are per single fuse. If the fuse link is to be used in compact switchgears where cooling is limited, the supplier must be contacted regarding maximum permitted power losses and required fuse derating.

Transformer rated voltage [kV]	Transformer rating [kVA]											
	25	50	75	100	125	160	200	250	315	400	500	630
	Power loss per single CEF-S fuse link at the transformer's rated current [W]											
3	3.4	6.7	7.0	10.4								
5	2.3	3.3	5.4	4.5	7.0	9.6						
6	1.6	3.4	5.1	6.7	4.9	8.0	10.4					
10	0.6	2.3	2.8	3.3	5.1	6.1	4.5	7.0	9.3			
11	0.5	1.9	2.3	2.7	4.2	5.1	3.7	5.8	9.2	12.3		
12	0.4	1.6	1.9	3.4	3.5	5.8	6.7	4.9	7.8	10.4		
15	0.5	2.0	4.5	3.9	6.1	6.5	10.2	10.4	11.2	18.1		
20	0.3	1.1	2.5	4.5	3.4	5.6	5.8	9.0	9.3	10.2	15.9	
22	0.2	0.9	2.1	3.7	2.8	4.6	4.8	7.4	11.8	8.4	13.1	20.8
24	0.2	0.8	1.8	3.1	2.4	3.9	6.1	6.2	9.9	10.4	11.0	17.5

## 6. Ordering table CEF-S & CEF-S-TCU

Type	Rated voltage	Rated current	e/D	Catalogue No	EAN13 Codes	Weight
	Un [kV]	In [A]	[mm]			
CEF-S	12	10	292/65	1YMB531011M0001	5901436021919	2.3
CEF-S	12	16	292/65	1YMB531011M0002	5901436021926	2.3
CEF-S	12	20	292/65	1YMB531011M0003	5901436021933	2.3
CEF-S	12	25	292/65	1YMB531011M0004	5901436021940	2.3
CEF-S	12	40	292/65	1YMB531011M0005	5901436021957	2.3
CEF-S	12	50	292/65	1YMB531011M0006	5901436021964	2.3
CEF-S	24	10	442/65	1YMB531012M0001	5901436021988	3
CEF-S	24	16	442/65	1YMB531012M0002	5901436021995	3
CEF-S	24	20	442/65	1YMB531012M0003	5901436022008	3
CEF-S	24	25	442/65	1YMB531012M0004	5901436022015	3
CEF-S	24	40	442/65	1YMB531012M0005	5901436022022	3
CEF-S-TCU	12	10	292/65	1YMB531861M0001	5908270800724	2.3
CEF-S-TCU	12	16	292/65	1YMB531861M0002	5908270800731	2.3
CEF-S-TCU	12	20	292/65	1YMB531861M0003	5908270800748	2.3
CEF-S-TCU	12	25	292/65	1YMB531861M0004	5908270800755	2.3
CEF-S-TCU	12	40	292/65	1YMB531861M0005	5908270800762	2.3
CEF-S-TCU	12	50	292/65	1YMB531861M0006	5908270800779	2.3
CEF-S-TCU	24	10	442/65	1YMB531862M0001	5908270800786	3
CEF-S-TCU	24	16	442/66	1YMB531862M0002	5908270800793	3
CEF-S-TCU	24	20	442/67	1YMB531862M0003	5908270800809	3
CEF-S-TCU	24	25	442/68	1YMB531862M0004	5908270800816	3
CEF-S-TCU	24	40	442/69	1YMB531862M0005	5908270800823	3

# High voltage current limiting Fuse links type CEF-VT

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# Rated voltage: 7.2/24 kV

# Rated current: 2-6.3 A

## 1. General

The new generation of fuse links type CEF-VT is designed and tested according to IEC 60282-1:2002. Dimensionally the fuse links are in accordance with DIN 43625. CEF-VT fuses are applicable as voltage transformer fuses and in cases where current limiting back-up fuses are required. ABB's high-voltage fuse links have the following properties:

- low minimum breaking current,
- low power losses,
- low arc voltage,
- high breaking capacity,
- high current limitation.

CEF-VT fuses are typically a back-up fuse type. They have a zone between the minimum melting current and the minimum breaking current where the fuse links may fail to interrupt.

For CEF-VT fuse links this zone is very narrow. The minimum breaking current  $I_3$  for any type is specified in the table on page 29.

## 2. Overvoltages

In order to be current limiting, the fuses link must generate an arc voltage which exceeds the instantaneous value of the operating voltage. The switching voltage generated by the CEF-VT fuse link is below the maximum permissible value according to IEC 60282-1:2002. The CEF-VT fuse link can be safely used for the system line voltage of 7.2/12 and 17/24 kV.

## 3. Choice of fuse links

ABB recommends using voltage transformer fuses type WBP and CEF-VT in the energy supply system of medium-voltage single/double insulated poles voltage transformers. Voltage transformer fuse provide:

- 1) electrical shock protection in case of main insulation damage to the voltage transformer and high-voltage penetration into the low-voltage side of the voltage transformer,
- 2) protection of the switchgear apparatus from internal short circuits.

The main selection rules concerning voltage transformer fuses are similar to those specified for current limiting fuses (type CEF) used in the protection of distribution transformers.

### Choice of rated voltage

The rated current of the fuse links should be equal to or higher than the maximum operating system voltage of where it is installed.

### Choice of rated current

The rated voltage of the fuse links should be higher than the maximum continuous current of the voltage transformer (depends on voltage transformer load level).

### Moreover the following points should be observed:

- a) Starting conditions
  - Initial starting current of voltage transformer should not cause fuse tripping under normal working conditions.
- b) Short circuit conditions
  - Rated breaking current of the fuse links should be higher than the prospective value of the short-circuit in its place of installation.
- c) Overvoltages
  - The ability of the electrical system (switchgear) to withstand impulses should exceed the switching overvoltages generated by the fuse links.

Voltage transformer fuses do not protect a voltage transformer against overloading.

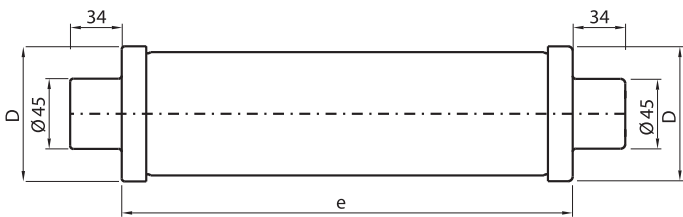
#### 4. Ordering table

High-voltage HRC fuse links

Type	Rated voltage Un [kV]	Rated current In [A]	Striker	Length e [mm]	Diameter D [mm]	Catalogue No.	EAN13 Codes	Weight [kg]
CEF-VT	7.2/12	2	no	192	53	1YMB531048M0001	5901436024378	1.50
CEF-VT	7.2/12	2	no	292	53	1YMB531049M0001	5901436024408	1.60
CEF-VT	7.2/12	2	yes	192	53	1YMB531048M0002	5901436024385	1.50
CEF-VT	7.2/12	2	yes	292	53	1YMB531049M0002	5901436024415	1.60
CEF-VT	7.2/12	6.3	yes	192	53	1YMB531048M0003	5901436024392	1.30
CEF-VT	7.2/12	6.3	yes	292	53	1YMB531049M0003	5901436024422	1.90
CEF-VT	17.5/24	2	no	292	53	1YMB531050M0001	5901436024439	1.60
CEF-VT	17.5/24	2	no	442	53	1YMB531046M0001	5901436024316	2.40
CEF-VT	17.5/24	6.3	yes	292	53	1YMB531050M0003	5901436024446	1.90
CEF-VT	17.5/24	6.3	yes	442	53	1YMB531046M0003	5901436024323	2.50
CEF-VT-TCU	7.2/12	2	yes	192	53	1YMB531898M0002	5908270801691	1.5
CEF-VT-TCU	7.2/12	2	yes	292	53	1YMB531899M0002	5908270801714	1.6
CEF-VT-TCU	7.2/12	6.3	yes	192	53	1YMB531898M0003	5908270801707	1.3
CEF-VT-TCU	7.2/12	6.3	yes	292	53	1YMB531899M0003	5908270801721	1.9
CEF-VT-TCU	17.5/24	6.3	yes	292	53	1YMB531900M0003	5908270801738	1.9
CEF-VT-TCU	17.5/24	6.3	yes	442	53	1YMB531896M0003	5908270801646	2.5

#### 5. Data and dimensions CEF-VT & CEF-VT-TCU

Type	Striker	Rated voltage Un [kV]	Rated current In [kV]	Length e [mm]	Diameter D [mm]	Short circuit current I <sub>1</sub> [kA]	Minimum breaking current I <sub>3</sub> [A]	Rated power losses Pn [W]	Resistance R <sub>O</sub> [mΩ]
CEF-VT	no	7.2/12	2	192	53	63	27	7.4	1.50
CEF-VT	no	7.2/12	2	292	53	63	27	7.4	1.50
CEF-VT/CEF-VT-TCU	yes	7.2/12	2	192	53	63	27	7.4	1.34
CEF-VT/CEF-VT-TCU	yes	7.2/12	2	292	53	63	27	7.4	1.34
CEF-VT/CEF-VT-TCU	yes	7.2/12	6.3	192	53	63	41	18	0.33
CEF-VT/CEF-VT-TCU	yes	7.2/12	6.3	292	53	63	41	18	0.33
CEF-VT	no	17.5/24	2	292	53	31.5	32	17	3.10
CEF-VT	no	17.5/24	2	442	53	31.5	32	17	3.10
CEF-VT/CEF-VT-TCU	yes	17.5/24	6.3	292	53	31.5	46	35	0.60
CEF-VT/CEF-VT-TCU	yes	17.5/24	6.3	442	53	31.5	46	35	0.60





# High voltage current limiting Fuse links for MOTOR circuit applications type CMF

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## 1. General

The fuse links type CMF are specially designed for motor circuit applications. They are tested according to the IEC Publication 60282-1 (IEC 282-1) and Publication 644. The IEC 644 applies to fuse links used with motors that are started direct-on-line in alternating current system. High-voltage fuses used in motor circuits must be able to withstand, without deterioration, the repeated surges associated with motor starting.

The dimensions are in accordance with DIN 43625, i.e. the 3.6 kV rating is realized in the normal 12 kV length (e = 292 mm). The 7.2 kV and 12 kV rating in the 24 kV length (e = 442 mm).

Special connection elements can be delivered in cases where fuses have to be configured in parallel.

ABB's motor fuses have the following properties:

- higher current rating within single body dimensions,
- tested according to IEC 644 which guarantees excellent ability to withstand repeated motor starting conditions,
- low power losses,
- low minimum breaking current,
- high breaking capacity and excellent short circuit current limitation.

Although a motor fuse is normally run at a stationary current which is much lower than the fuse rated current, the low-loss characteristics of the CMF fuses make them especially suitable in compact contactor compartments.

## 2. Ordering table type CMF

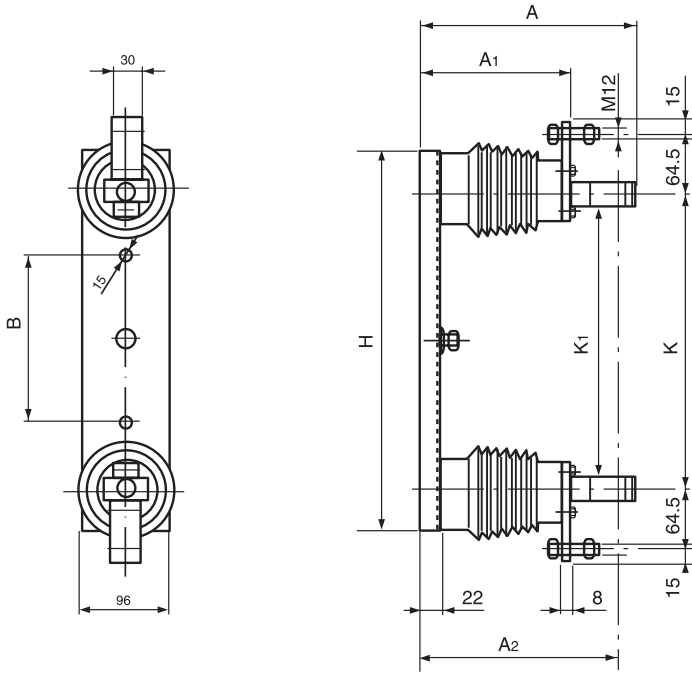
High – voltage fuse links

Type	Rated voltage Un [kV]	Rated current In [A]	e [mm]	D [mm]	Catalogue No.	EAN13 Codes	Weight [kg]
CMF	3.6	100	292	65	1YMB531028M0001	5901436023197	2.3
CMF	3.6	160	292	65	1YMB531028M0002	5901436023203	2.3
CMF	3.6	200	292	87	1YMB531028M0003	5901436023210	2.6
CMF	3.6	250	292	87	1YMB531028M0004	5901436023227	3.8
CMF	3.6	315	292	87	1YMB531028M0005	5901436023234	3.8
CMF	7.2	63	442	65	1YMB531029M0001	5901436023241	3.0
CMF	7.2	100	442	65	1YMB531029M0002	5901436023258	3.0
CMF	7.2	160	442	65	1YMB531029M0003	5901436023265	3.0
CMF	7.2	200	442	87	1YMB531029M0004	5901436023272	5.3
CMF	7.2	250	442	87	1YMB531029M0005	5901436023289	5.3
CMF	7.2	315	442	87	1YMB531029M0006	5901436023296	5.3
CMF	12	63	442	65	1YMB531030M0001	5901436023302	3.0
CMF	12	100	442	87	1YMB531030M0002	5901436023319	5.3
CMF	12	160	442	87	1YMB531030M0003	5901436023326	5.3
CMF	12	200	442	87	1YMB531030M0004	5901436023333	5.3

## 3. Ordering table UCM

Type	Rated voltage [kV]	Dimensions in mm							Weight [kg]	Catalogue No.
		A	A1	A2	H	K	K1	B		
UCM	3.6	232	160	220	410	318	293	180	3.7	1YMX139037M0001
UCM	7.2/12	232	160	220	570	468	443	300	4.2	1YMX139037M0002

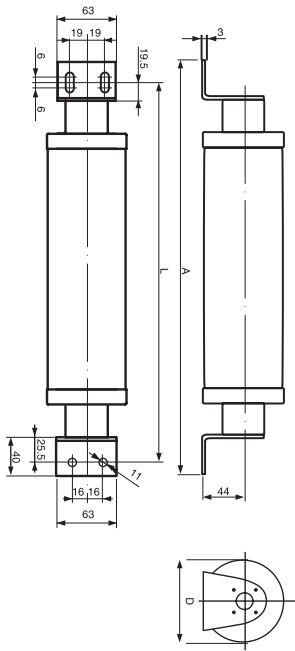
## Fuse base type UCM



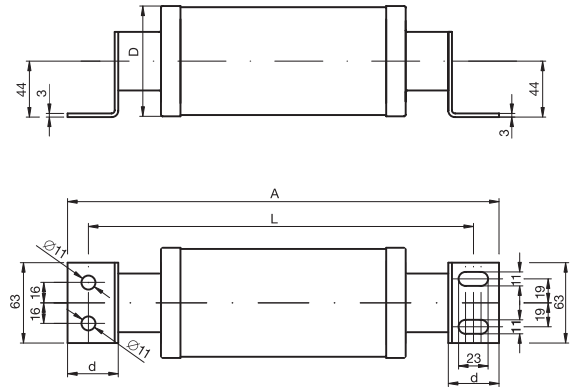
## 4. Ordering table type CMF-BS

Type	Rated voltage Un [kV]	Rated current In [A]	L/D [mm]	A/d [mm]	Catalogue No.	EAN13 Codes	Weight [kg]
CMF-BS-C	3.6	100	400/65	440/40	1YMB531031M0021	5901436023449	2.6
CMF-BS-C	3.6	160	400/65	440/40	1YMB531031M0022	5901436023456	2.6
CMF-BS-C	3.6	200	400/87	440/40	1YMB531031M0023	5901436023463	3.9
CMF-BS-C	3.6	250	400/87	440/40	1YMB531031M0024	5901436023470	4.1
CMF-BS-C	3.6	315	400/87	440/40	1YMB531031M0025	5901436023487	4.1
CMF-BS-D	3.6	100	419/65	461/50.5	1YMB531031M0011	5901436023395	2.6
CMF-BS-D	3.6	160	419/65	461/50.5	1YMB531031M0012	5901436023401	2.6
CMF-BS-D	3.6	200	419/87	461/50.5	1YMB531031M0013	5901436023418	4.1
CMF-BS-D	3.6	250	419/87	461/50.5	1YMB531031M0014	5901436023425	4.1
CMF-BS-D	3.6	315	419/87	461/50.5	1YMB531031M0015	5901436023432	4.1
CMF-BS-B	7.2	63	553/65	590/40	1YMB531032M0021	5901436023555	3.3
CMF-BS-B	7.2	100	553/65	590/40	1YMB531032M0022	5901436023562	3.3
CMF-BS-B	7.2	160	553/65	590/40	1YMB531032M0023	5901436023579	3.3
CMF-BS-B	7.2	200	553/87	590/40	1YMB531032M0024	5901436023586	5.6
CMF-BS-B	7.2	250	553/87	590/40	1YMB531032M0025	5901436023593	5.6
CMF-BS-B	7.2	315	553/87	590/40	1YMB531032M0026	5901436023609	5.6
CMF-BS-B	12	63	553/65	590/40	1YMB531033M0021	5901436023654	3.3
CMF-BS-B	12	100	553/87	590/40	1YMB531033M0022	5901436023661	5.6
CMF-BS-B	12	160	553/87	590/40	1YMB531033M0023	5901436023678	5.6
CMF-BS-B	12	200	553/87	590/40	1YMB531033M0024	5901436023685	5.6
CMF-BS	3.6	100	405/65	440/40	1YMB531031M0001	5901436023340	2.6
CMF-BS	3.6	160	405/65	440/40	1YMB531031M0002	5901436023357	2.6
CMF-BS	3.6	200	405/87	440/40	1YMB531031M0003	5901436023364	4.1
CMF-BS	3.6	250	405/87	440/40	1YMB531031M0004	5901436023371	4.1
CMF-BS	3.6	315	405/87	440/40	1YMB531031M0005	5901436023388	4.1
CMF-BS	7.2	63	555/65	590/40	1YMB531032M0001	5901436023494	3.3
CMF-BS	7.2	100	555/65	590/40	1YMB531032M0002	5901436023500	3.3
CMF-BS	7.2	160	555/65	590/40	1YMB531032M0003	5901436023517	3.3
CMF-BS	7.2	200	555/87	590/40	1YMB531032M0004	5901436023524	5.6
CMF-BS	7.2	250	555/87	590/40	1YMB531032M0005	5901436023531	5.6
CMF-BS	7.2	315	555/87	590/40	1YMB531032M0006	5901436023548	5.6
CMF-BS	12	63	555/65	590/40	1YMB531033M0001	5901436023616	3.3
CMF-BS	12	100	555/87	590/40	1YMB531033M0002	5901436023623	5.6
CMF-BS	12	160	555/87	590/40	1YMB531033M0003	5901436023630	5.6
CMF-BS	12	200	555/87	590/40	1YMB531033M0004	5901436023647	5.6

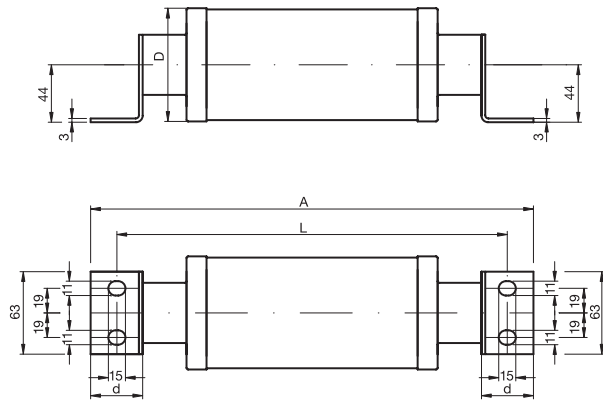
### Dimension CMF-BS



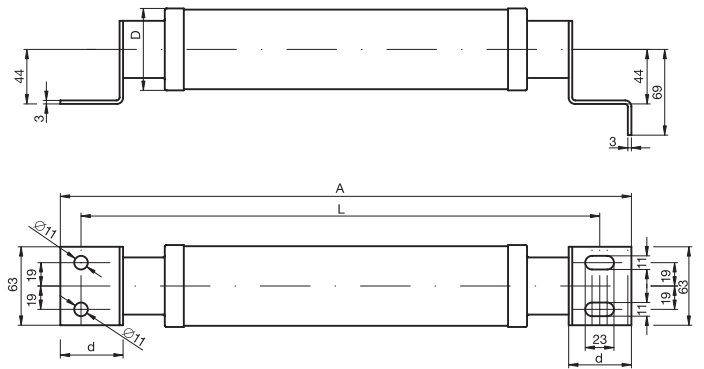
### Dimension CMF-BS-B



### Dimension CMF-BS-C



### Dimension CMF-BS-D

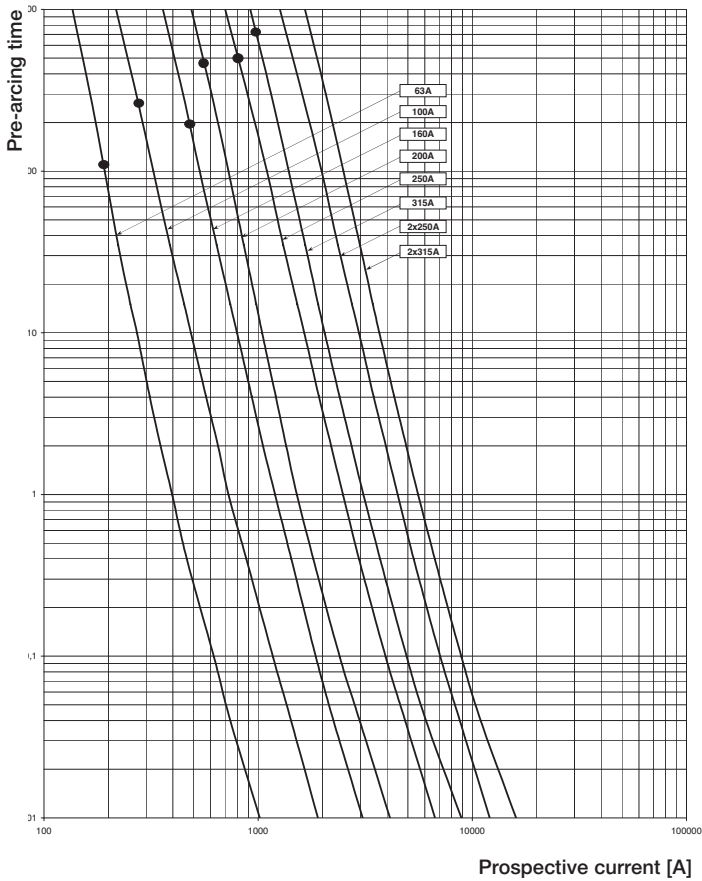


### 5. Ordering table CMF – TCU

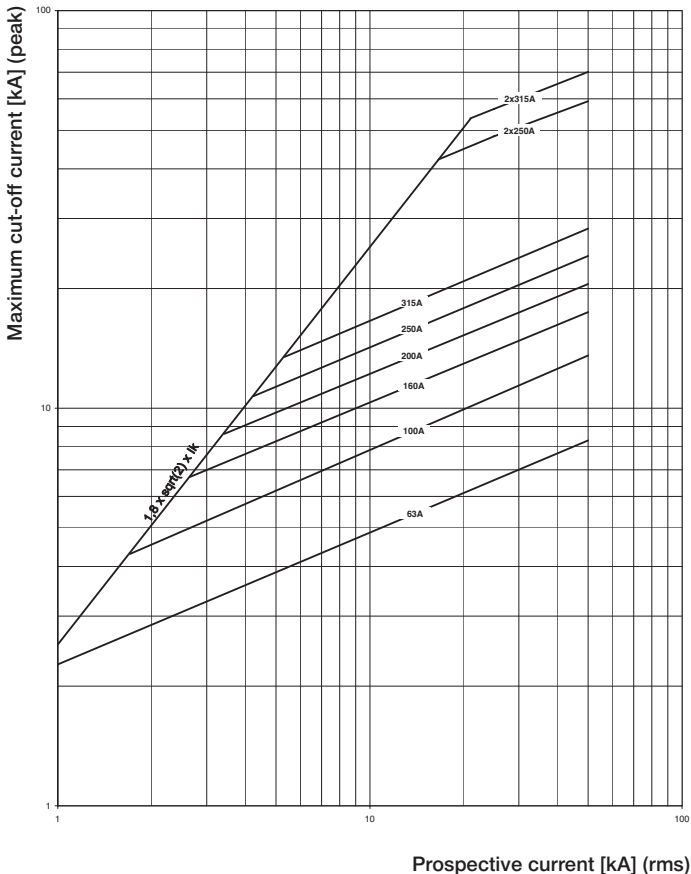
Type	Rated voltage: Un [kV]	Rated current: In [A]	e [mm]	D [mm]	Catalogue No.	EAN 13 Code	Weight [kg]
CMF-TCU	3.6	100	292	65	1YMB531878M0001	5908270800861	2.3
CMF-TCU	3.6	160	292	65	1YMB531878M0002	5908270800878	2.3
CMF-TCU	3.6	200	292	87	1YMB531878M0003	5908270800885	2.6
CMF-TCU	3.6	250	292	87	1YMB531878M0004	5908270800892	3.8
CMF-TCU	3.6	315	292	87	1YMB531878M0005	5908270800908	3.8
CMF-TCU	7.2	63	442	65	1YMB531879M0001	5908270800915	3
CMF-TCU	7.2	100	442	65	1YMB531879M0002	5908270800922	3
CMF-TCU	7.2	160	442	65	1YMB531879M0003	5908270800939	3
CMF-TCU	7.2	200	442	87	1YMB531879M0004	5908270800946	5.3
CMF-TCU	7.2	250	442	87	1YMB531879M0005	5908270800953	5.3
CMF-TCU	7.2	315	442	87	1YMB531879M0006	5908270800960	5.3
CMF-TCU	12	63	442	65	1YMB531880M0001	5908270800977	3
CMF-TCU	12	100	442	87	1YMB531880M0002	5908270800984	5.3
CMF-TCU	12	160	442	87	1YMB531880M0003	5908270800991	5.3
CMF-TCU	12	200	442	87	1YMB531880M0004	5908270801004	5.3

## 6. Pre-arcing times

The characteristics are equal for all rated voltages and are recorded from cold condition.



## 7. Current limitation



## 8. Choice of fuse links

### Choice of rated current $I_n$

The minimum permissible current rating of the fuse links for motor protection may be determined from the selection charts I, II and III on pages 34 and 35. These three charts are for run-up times of 6, 15 and 60 seconds respectively.

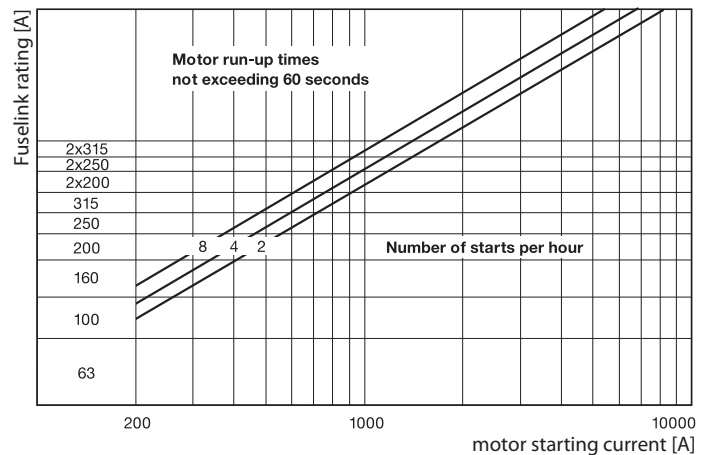
Each chart contains different characteristics, depending on the number of starts per hour. With reference to the number of starts per hour, the first two are in immediate succession while the rest are evenly spaced at intervals of one hour. The number of starts per hour indicates the time interval between separated starts. For example, four starts in 15 minutes are represented by 16 starts per hour. The horizontal axis of the selection chart indicates the motor starting current, while the current rating of the fuse link is found along the vertical axis.

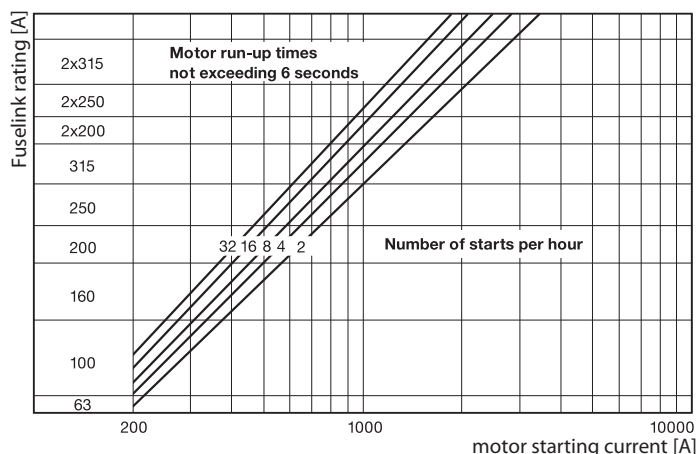
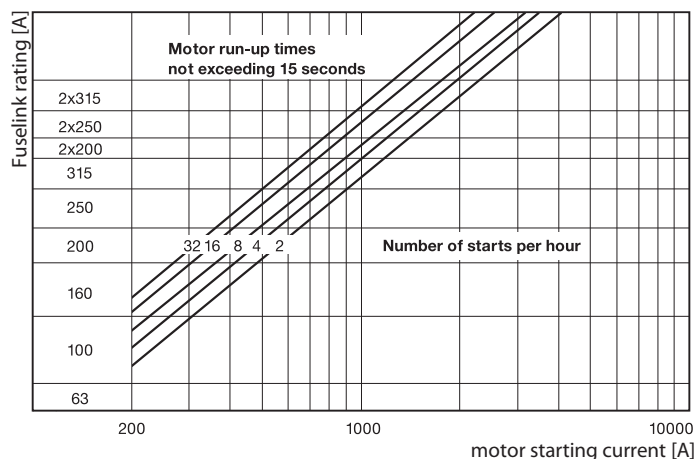
### Selection procedure:

- select the charts which are appropriate for the run-up time of the motor,
- select the starting current along the horizontal axis,
- depending on the number of starts per hour, select the correct characteristic (2, 4, 8, 16, 32),
- read the correct fuse-link rating on the vertical axis.

Because the main function of motor fuses is to protect against short circuits, fuses are selected to withstand start-up currents only. The minimum breaking current has only limited importance in such an application.

Example:	A	B
Starting current of the motor	850 A	250 A
Run-up time	6 sec.	15 sec.
Number of starts per hour	2	16
Chart number	3	2
Rated current of fuse link	250 A	160 A





### 9. The K-factor

According to the IEC 60644, the K-factor is a factor (less than unity) defining an overload characteristic to which the fuse link may be repeatedly subjected under specified motor starting conditions without deterioration. The overload characteristic is obtained by multiplying the current on the pre-arcing characteristic (melting time characteristics) by K. The value of K given in the data table is

chosen at 10 seconds melting time, and is valid for melting times between 5 and 60 seconds, for a frequency of starts up to six per hour, and for not more than two consecutive starts. The K factor for higher number of starts has been already included in above presented selection charts.

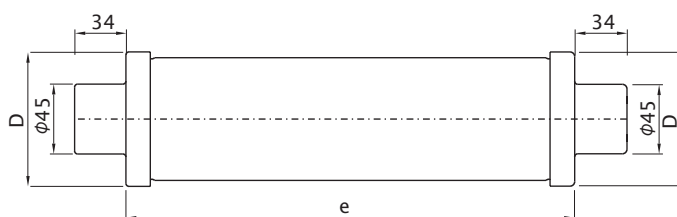
### 10. Data and dimensions CMF

Un	In	e	D	K <sup>*)</sup>	I <sub>1</sub>	I <sub>3</sub>	Ro	Pn	Min. Joule Integral	Max. Joule Integral
[kV]	[A]	[mm]	[mm]	-	[kA]	[A]	[mΩ]	[W]	[A <sup>2</sup> xs]	[A <sup>2</sup> xs]
3.6	100	292	65	0.75	50	275	3.20	49	1.4 × 10 <sup>4</sup>	17 × 10 <sup>4</sup>
	160	292	65	0.7	50	400	1.92	75	3.8 × 10 <sup>4</sup>	50 × 10 <sup>4</sup>
	200	292	87	0.7	50	500	1.40	75	7.6 × 10 <sup>4</sup>	71 × 10 <sup>4</sup>
	250	292	87	0.6	50	760	0.97	90	14 × 10 <sup>4</sup>	115 × 10 <sup>4</sup>
	315	292	87	0.6	50	900	0.81	122	21 × 10 <sup>4</sup>	180 × 10 <sup>4</sup>
7.2	63	442	65	0.75	50	175	8.50	45	0.48 × 10 <sup>4</sup>	6.5 × 10 <sup>4</sup>
	100	442	65	0.75	50	275	4.86	67	1.40 × 10 <sup>4</sup>	18 × 10 <sup>4</sup>
	160	442	65	0.7	50	400	2.92	119	3.8 × 10 <sup>4</sup>	54 × 10 <sup>4</sup>
	200	442	87	0.7	50	500	2.12	118	7.6 × 10 <sup>4</sup>	75 × 10 <sup>4</sup>
	250	442	87	0.6	50	800	1.48	142	14 × 10 <sup>4</sup>	120 × 10 <sup>4</sup>
12	315	442	87	0.6	50	950	1.23	193	21 × 10 <sup>4</sup>	220 × 10 <sup>4</sup>
	63	442	65	0.75	50	190	13.52	77	0.48 × 10 <sup>4</sup>	11 × 10 <sup>4</sup>
	100	442	87	0.75	50	275	6.62	103	1.4 × 10 <sup>4</sup>	20 × 10 <sup>4</sup>
	160	442	87	0.7	50	480	3.98	155	3.8 × 10 <sup>4</sup>	70 × 10 <sup>4</sup>
	200	442	87	0.7	50	560	2.73	173	9.3 × 10 <sup>4</sup>	91 × 10 <sup>4</sup>

<sup>\*)</sup> The K-factor is referred to the average value of current.

#### Legend:

- e = see figure
- D = see figure
- K = K-factor acc. to IEC 60644
- I<sub>1</sub> = max. short circuit current tested
- I<sub>3</sub> = minimum breaking current
- Ro = resistance at room temperature
- Pn = power loss at rated current



# Voltage Transformer Fuses

## Indoor – WBP Outdoor – BRT

### Index

- 1. Features . . . . . 31
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## 1. Features

- high breaking capacity,
- short-circuit current limiting,
- small dimensions.

## 2. Applications

The WBP fuse links are used to protect switchgear equipment against short circuits in voltage transformers. Protection of switchgear equipment is very effective thanks to the unlimited breaking capacity and short-circuit current limitation of this type of fuse link. In addition, their very small dimensions mean the WBP type fuse links can be used in various types of switchgear, including those that are flame-proof.

## 3. Environmental operating conditions

Type WBP and BRT... fuse links can be operated under the following environmental conditions.

Temperature	Type of fuse-links			
	WBP		BRT	
	N3	T3	N1	T1
	From -5 °C to +40 °C	From -5 °C to +50 °C	From -25 °C to +40 °C	From -10 °C to +50 °C
Relative humidity of ambient air at a temperature: N - +20 °C T - +30 °C	to 80%	to 95%	to 100%	to 100%
Height of installation above the sea level	Up to 1 000 m			

Designations:

N – Normal climate 1 – Outdoor installation T – Tropical wet and dry climate 3 – Indoor installation

## 4. Designations and versions

### 4.1 WBP indoor instrument transformer fuse-links numbering system

The numbering system for the WBP fuse-links has two alphanumerical sections as shown in the following diagram.

<b>WBP</b>	–	<b>6</b>
<b>Indoor Fuse-link type</b>		<b>Rated Voltage</b> 6 – 7.2 kV 10 – 12 kV 20 – 24 kV 30 – 36 kV

### 4.2 BRT outdoor instrument transformer fuse-links numbering system.

The numbering system for the BRT fuse-links has two alphanumerical sections as shown in the following diagram.

<b>BRT</b>	–	<b>6</b>
<b>Outdoor Fuse-link type</b>		<b>Rated Voltage</b> 6 – 7.2 and 12 kV 15 – 17.5 and 24 kV 30 – 36 kV

### 4.3 Indoor fuse-bases numbering system

The numbering system for indoor fuse-bases has two alphanumerical sections as shown in the following diagram.

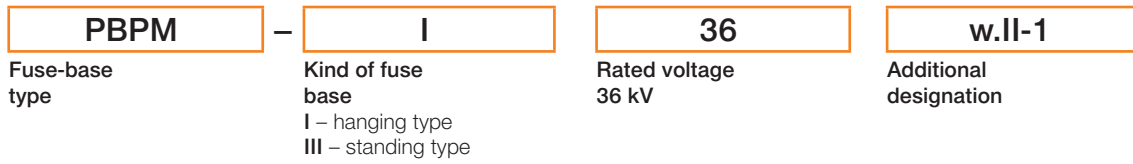
<b>PBPM</b>	–	<b>6</b>
<b>Fuse-base type</b>		<b>Rated Voltage</b> 6 – 7.2 kV 10 – 12 kV 20 – 24 kV 30 – 36 kV

#### 4.4 Outdoor fuse bases numbering system

The numbering system for outdoor fuse bases have four double alphanumerical sections as shown in the following diagram.

A fuse-link when mounted on a fuse base makes a complete fuse.

Refer to Table 7.2 for the available fuse bases.



#### 5. Compliance with standards

##### 5.1 The fuse links meet the requirements of the following standards:

- Polish Standard PN-77/E-06110,
- British Standard BS:2692:1956,
- Russian Standard GOST 2213:1959.

##### 5.2 The fuse bases meet the requirements of the following standards:

- Polish Standard PN-77/E-06110,
- German Standard VDE 0670 Teil 4/3 1967,
- International Standard IEC 282-1 of 1985.

#### 6. How to order

##### 6.1 Ordering table WBP/BRT

Type	Rated voltage [kV]	Rated current [A]	Length [mm]	Diameter B [mm]	Catalogue No.	Weight [kg]
WBP-6	7.2	0.7	210	23	1YMB412101M0001	0.12
WBP-10	12	0.6	250	23	1YMB412101M0002	0.16
WBP-20	24	0.5	310	23	1YMB412101M0003	0.2
WBP-30	36	0.4	385	23	1YMB412101M0004	0.25
Fuse clips for BP	-	-	-	-	1YMB411002M0001	-
BRT-6	7.2/12	0.8	311	62	1YMB315101M0001	1.8
BRT-15	17.5/24	0.8	393	62	1YMB315101M0002	2.2
BRT-30	36	0.8	469	62	1YMB315101M0003	2.6

##### 6.2 Ordering table fuse bases

Type	Rated voltage [kV]	Post insulators	Application	Fuse length [mm]	Catalogue No.
PBPM-6	7.2	porcelain	indoor	210	1YMB311101M0001
PBPM-10	12	porcelain	indoor	250	1YMB311101M0002
PBPM-20	24	epoxy	indoor	310	1YMB311101M0007
PBPM-30	36	epoxy	indoor	385	1YMB311101M0004
PBPN-24-1	24	porcelain	outdoor	393	1YMB303114M0001
PBWMNI 36 w.II-1	36	porcelain	outdoor	469	1YMB303111M0002
PBWMN III 36 W.II-1	36	porcelain	outdoor	469	1YMB303112M0002

Order by specifying the product name, type symbol, rated value, rated current and quantity.

All additional demands which are not listed in this catalogue should be agreed with the manufacturer by means of an inquiry where the sources of requirements (regulations, standards, etc.) should to be specified.

##### 6.3 Order example

1. Type WBP-6 fuse-link for a rated voltage of 7.2 kV and rated current of 0.7A – 10 pcs.
2. Type PBPM-6 Indoor fuse-base for a rated voltage of 7.2 kV – 20 pcs.



## 7. Specifications

### 7.1 Technical data of fuse links

Fuse-link type <sup>1)</sup>	Rated voltage	Frequency	Rated current	Rated breaking current	Rated breaking capacity	Overvoltages	Weight	Resistance		Fuse-base type
	Un	f	In	I <sub>1</sub>	S <sub>1</sub>	U <sub>TRV</sub>		Min.	Max.	
	[kV]	[Hz]	[A]	[kA]	[MVA]	[kV]	[kg]	[Ω]	[Ω]	
WBP-6	7.2	50 or 60	0.7	120	>1500	<23	0.12	42	52	PBPM-6
WBP-10	12		0.6	72		<38	0.16	62	72	PBPM-10
WBP-20	24		0.5	36		<75	0.20	135	165	PBPM-20
WBP-30	36		0.4	24		<112	0.25	225	275	PBPM-30
BRT-6	7.2/12	50 or 60		80 <sup>2)</sup> /48	>1000	<23	1.8	57	63	-
BRT-15	17.5/24		33 <sup>3)</sup> /24	<55		2.2	144	156	PBPN-24-1	
BRT-30	36		16	<112		2.6	290	310	PBWMNI36 w.II-1 PBWMNIII 36 w.II-1	

<sup>1)</sup> Insulating tube is made from glass (WBP) or porcelain (BRT)

<sup>2)</sup> for Un = 12 kV, I<sub>1</sub> = 48 kA <sup>3)</sup> for Un = 24 kV, I<sub>1</sub> = 24 kA

The resistance is to be measured using the electrical bridge method or technical method using a measuring instrument with an accuracy class not worse than 0.5% at an ambient temperature of t = 20°C ± 2°C.

Note: In cases where WBP fuses are installed within an enclosed housing and/or similar equipment characterized by heat exchange (stabilized ambient air temperature exceeds +40 °C), the value of the nominal current, In, should be reduced by 0.1 A.

### 7.2 Technical data of fuse bases

Fuse-base type	Rated voltage	Frequency	Impulse withstand voltage of insulation		50 Hz withstand voltage of insulation		Fuse-link type
	Un	f	to earth	in pole	to earth	in pole	
	[kV]	[Hz]	[kV]	[kV]	[kV]	[kV]	
PBPM-6	7.2	50 or 60	60	70	27	35	WBP-6
PBPM-10	12		75	85	35	45	WBP-10
PBPM-20	24		125	145	55	75	WBP-20
PBPM-30	36		170	200	75	100	WBP-30
PBPN-24-1	24		125	145	55	75	BRT-15
PBWMNI 36 w.II-1	36		170	195	70	85	BRT-30
PBWMNIII 36 w.II-1	36	170	195	70	80		

PBPM – an indoor fuse-base with resin insulators

PBPN – an outdoor suspended fuse-base on 24 kV

PBWMNI 36 w.II-1 – an outdoor suspended fuse-base on 36 kV

PBWMNIII 36 w.II-1 – an outdoor fuse-base on 36 kV

### Recommendation of fuse links selection for MV voltage transformer protection

ABB Sp. z o. o. recommends using instrument transformer fuse element type WBT from our production portfolio as protection for ABB's voltage transformers types UMZ and UDZ equipped with a fuse holder. The use of instrument transformer fuses has two main functions: to protect distribution equipment when internal voltage transformer short-circuits occur and to reduce the possibility of an explosion if the internal isolation of the voltage transformer has been damaged.

The selection of a fuse element for voltage transformer protection primarily depends on the rated primary voltage of the voltage transformer\*. The rated voltage of the fuse element should be

equal to or higher than (phase to phase) the rated voltage transformer's primary winding. For example, for a VT type UMZ 15-1 with a primary winding voltage of  $\sqrt{3}$  kV, fuse-link type WBP-10, with a rated voltage is 10 kV should be selected.

From the beginning of January 2001, the rated current of fuse-link type WBT was reduced from 0.8A to 0.4-0.7A (depending on Un). The reason for this change was to improve cooperation between the fuse link and voltage transformers. Therefore, ABB Sp. z o. o. now recommends the use of these new fuse links for the protection of voltage transformer types UMZ and UDZ.

A comparison of the old voltage transformer fuse-link type WBP with the new one is presented in the table below:

Fuse-link type	Rated voltage	Rated continuous (till 12.2000)	Current continuous current (from 01.2001)
	Un	In	In
	[kV]	[A]	[A]
WBP-6	7.2	0.8	0.7
WBP-10	12		0.6
WBP-20	24		0.5
WBP-30	36		0.4

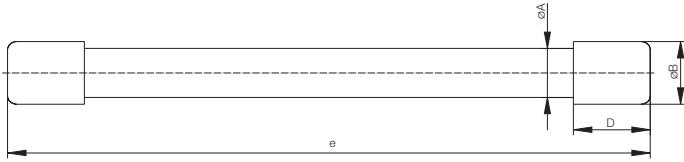
\* In rarely cases when the following criteria have been fulfilled:

1) Instrument transformer is used with rated primary voltage below 3000 V.

2) Power taken from instrument transformer is much higher than rated power output and it is close to the limit of thermal power output; the user should contact the producer (ABB Sp. z o. o.) for advice regarding the proper selection of voltage transformer protection.

## 8. Dimensional drawings

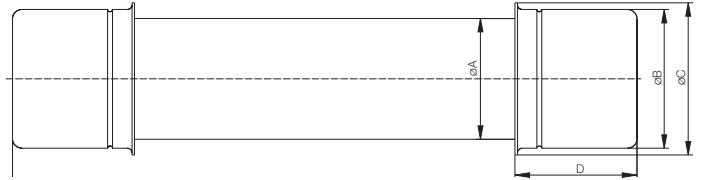
### Dimensional drawing of WBP type fuse links



Notes:  
Connections: silver-plated cooper.  
Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-link type	Dimensions [mm]			
	e	D	ØA	ØB
WBP-30	385±3	25	18	23
WBP-20	310±3	25	18	23
WBP-10	250±3	25	18	23
WBP-6	210±3	25	18	23

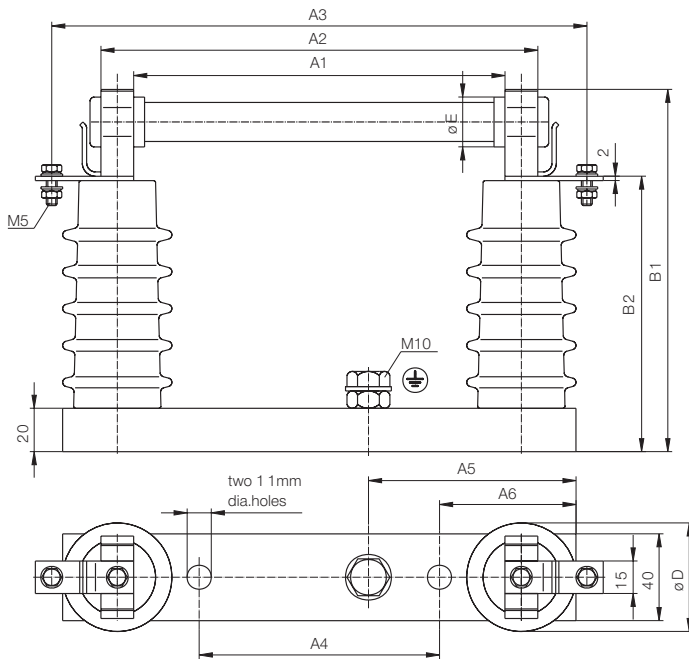
### Dimensional drawing of BRT type fuse links



Notes:  
Connections: silver-plated cooper.  
Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-link type	Dimensions [mm]				
	e	D	ØA	ØB	ØC
BRT-30	469±1.5	50	54	62	68
BRT-15	393±1.5	50	54	62	68
BRT-6	311±1.5	50	54	62	68

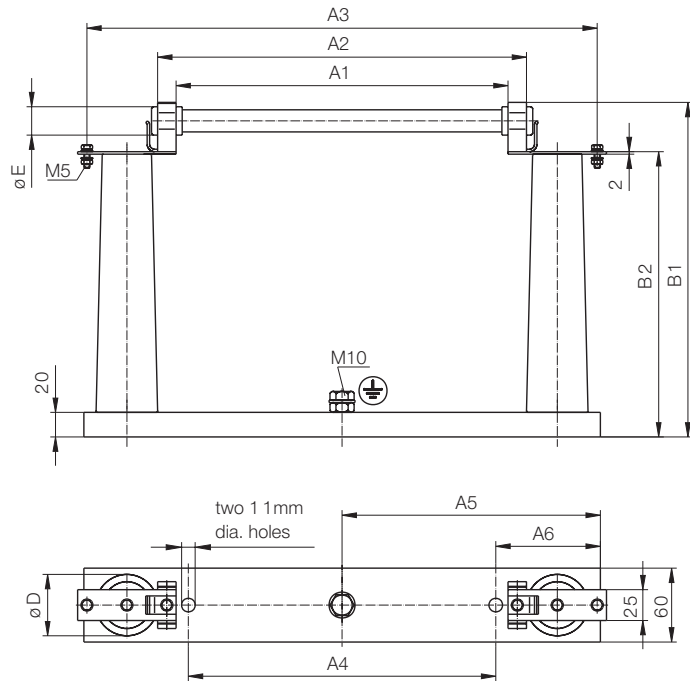
### Dimensional drawing of PBPM-6 and PBPM-10 type fuse bases



Notes:  
Earthing Terminal: tinned steel.  
Connections: silver-plated brass.  
Contact Springs: silver-plated brass.  
Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-base type	Dimensions [mm]									
	A1	A2	A3	A4	A5	A6	B1	B2	ØD	E
PBPM-6	170±2	200±2	245	110	95	62.5	165	128	50	23
PBPM-10	210±2	240±2	285	150	95	62.5	190	153	50	23

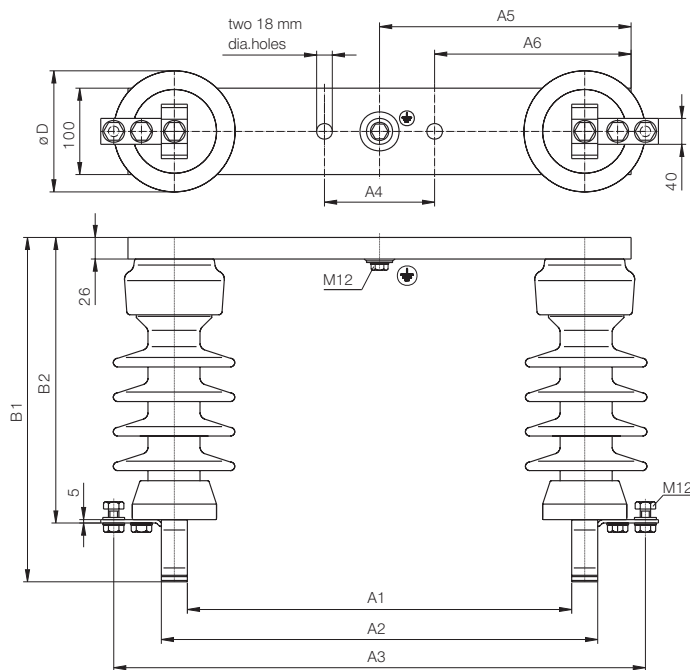
### Dimensional drawing of PBPM-20 and PBPM-20 type fuse bases



Notes:  
 Earthing Terminal; tinned steel.  
 Connections: silver-plated brass.  
 Contact Springs: silver-plated brass.  
 Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-base type	Dimensions [mm]									
	A1	A2	A3	A4	A5	A6	B1	B2	ØD	E
PBPM-20	270 $\pm 2$	300 $\pm 2$	415	250	210	85	272	232	50	23
PBPM-30	345 $\pm 2$	375 $\pm 2$	490	325	247.5	85	362	322	70	23

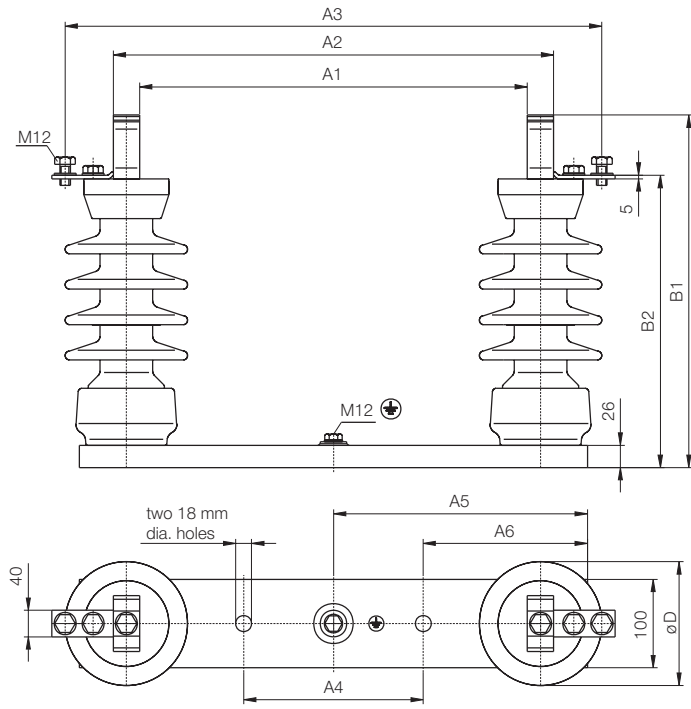
### Dimensional drawing of PBPN-24-1 and PBWMNI 36 w.II-1 type fuse bases



Notes:  
 Earthing Terminal; tinned steel.  
 Connections: silver-plated brass.  
 Contact Springs: silver-plated brass.  
 Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-base type	Dimensions [mm]									
	A1	A2	A3	A4	A5	A6	B1	B2	ØD	E
PBPN-24-1	297 $\pm 2$	357 $\pm 2$	467	127	223	159.5	417	336	145	62
PBWMNI 36 w.II-1	375 $\pm 2$	435 $\pm 2$	545	205	263	159.5	559	476	175	62

## Dimensional drawing of PBWMNIII 36 w.II-1 type fuse bases



Notes:  
 Earthing Terminal; tinned steel.  
 Connections: silver-plated brass.  
 Contact Springs: silver-plated brass.  
 Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-base type	Dimensions [mm]									
	A1	A2	A3	A4	A5	A6	B1	B2	ØD	E
PBWMNIII 36 w.II-1	375±2	435±2	545	205	263	159.5	559	476	175	62



# Indoor Railway DC Fuses type WBT

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## 1. Features

- high rupturing capacity,
- short circuit current limiting,
- low switching voltages,
- R1, P1 fire-protection grade for the materials used – in accordance with PN-84/K-02500.

## 2. Applications

The fuse links for traction applications are used to protect traction substation and electric traction rolling stock equipment against the effects of overloads greater than  $2 \times I$  and of short-circuits at voltages of 1.9 kV DC and 4 kV DC. Please refer to Table 1 for application details for particular product types.

## 3. Climatic working conditions

Fuse-base type PBWMI can be operated indoors at ambient temperatures ranging from  $-5^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . Other parameters are presented below. The fuse links and fuse boards can be operated indoors or in sealed boxes secured under the railway car under the following environmental conditions:

- at ambient temperatures ranging from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ ,
- in ambient air with relative humidity of 95% at a temperature of  $+20^{\circ}\text{C}$ ,
- at an altitude of 1 200 m.

All other operating conditions first require approval from the manufacturer.

## 4. Designations, versions

### 4.1 Marking system

The marking system for particular fuse link, fuse base or fuse board has three alphanumerical sections as shown in the following diagram.



Fuse-link type                      Rated voltage                      Rated current



Fuse-board  
base type current                      Rated voltage                      Rated current

## 5. Technical data

The general technical data of the fuse links are presented in Table 3. The general technical data of the fuse boards are presented in Table 4.

## 6. Compliance with standards

Fuse links for traction applications meet the requirements specified in Table 2.

## 7. How to order

Order by specifying the following:

- product name,
- type symbol,
- rated voltage,
- rated current,
- quantity.

All additional requirements not listed in this catalogue should be agreed with the manufacturer.

## 8. Order example

1. Type WBTI-3/30 fuse link for traction applications with a rated voltage of 4kV, rated current of 20 A – 20 pcs.
2. Type TBT2-3/20 fuse board for traction applications with a rated voltage of 4 kV, rated current of 20 A – 20 pcs.

Table 1.

Fuse-link type	Fuse-base/board <sup>1</sup> type	Applications
WBTI-3/3 to 20	PBWMI-6/20	Protection against the effects of short-circuits and overloads in the electric circuits of railway traction substation equipment.
WBTI-3/25 to 50	PBWMI-6/50	
WBTI-3/80	PBWMI-10/100-1	
WBTI-3/3 to 20	TBT2-3/20 TBT2-3/20 & 50 TBTS2-3/20 TBTS2-3/20 & 50	Protection against the effects of short circuits and overload in the electric circuits of traction vehicles, railcoach space-heating equipment and electric locomotive.
WBTI-3/25 to 50	TBT2-3/50	Protection against the effects of short circuits and overloads in electric single and multi-voltage circuits of rail coach space-heating equipment.
WBTG-3/3; 4; 6	TBTG1-3/6	
WBTG-3/3-I	TBG-3/3-I	
WBTGI-3/10; 16; 20	PBPM-6	Protection against the effect of short-circuits and overloads in the electric single- and multi- voltage circuits of rail-coach space-heating equipment as well as other d.c. circuits at traction vehicles. The dimension of these fuse links meet the requirements of German Standards DIN 43625.
WBTS-3/0,6; 1	TBTS1-3/1	Protection against the effects of short-circuits and overloads in the voltage measurement circuits and special electric equipment in traction vehicles, if the nominal loads are lower than 1 A.
WBT-1,5/3; 15; 40	PBT-1,5/40	Protection against the effects of short circuits and overloads in electric circuits of traction substation equipment and vehicles operating at a rated voltage not greater than 1 900 V DC.
WBTS-3 WBTG-3 WBTGI-3	TBTG3-3/1; 6; 15 TBTG4-3/1; 3; 6; 15	A device for carrying replaceable parts in the form of types WBTS, WBTG, and WBTGI mounted outside electric circuits in electric locomotive.

<sup>1)</sup> The specified fuse boards and fuse bases will operate with fuse links selected according to Table 1. Other configurations should be agreed with the manufacturer.

Table 2.

Product type	Compliance with Standards
WBTI-3/3 to 80	PN-69/E-06120 in scope of environmental requirements and vibration and shock resistance. General Requirements according to PN-E-06172:1999, IEC Publ. 77 of 1968 as well as UIC 552VSheets, VII edition.
WBTG-3/3 to 6 WBTG-3/3-I	PN-69/E-06120 in scope of environmental requirements and vibration and shock resistance. General Requirements according to PN-E-06172:1999, IEC Publ. 77 of 1968 as well as UIC 552VSheets of 1993.
WBTGI-3/10 to 20	VII edition PN-69/E-06120 in scope of environmental requirements and vibration and shock resistance. DIN 43625 in scope of dimensional requirements General Requirements according to PN-E-06172:1999-14, IEC Publ. 77 of 1968 as well as UIC 552VSheets.
WBTS-3/0,6; 1	PN-69/E-06120 in scope of environmental requirements and vibration and shock resistance. General Requirements acc. PN-E-06172:1999-14 IEC Publ. 77 of 1968.
WBT-1,5/3; 15; 40 PBT-1,5/40	WTO-67/ZPM Technical Requirements and AE/A10-15004.

The fuse boards for traction applications meet the requirements of the following Standards:  
PN-69/E-06120 and PN-E-06172:1999-14  
and IEC Publ. 77 of 1968 in the scope specified above.



## General technical data of fuse links for traction applications

Table 3.

Fuse-link type	Rated voltage Un [kV] DC	Rated current		Switching overvolt. U <sub>TRV</sub> [kV]	Rated breaking current I <sub>1</sub> [kA]	Weight [kg]	Resistance		Fuse-base type
		ace. PN-E-06172:1999-14	ace. UIC-552				Min.	Max.	
		In [A] DC	In [A] DC				[mΩ]	[mΩ]	
WBTI-3/3	3.750 <sup>1)</sup>		3	3.5	<12	31.5	516.6	631.4	PBWMI-6/20
WBTI-3/6			6	7			189	231	TBT2-3/20
WBTI-3/10			10	10			130.5	159.5	TBT2-3/20 & 50
WBTI-3/16			16	16			64.8	79.2	TBTS2-3/20
WBTI-3/20			20	20			41.4	50.6	TBTS2-3/20 & 50
WBTI-3/25			25	25			33.3	40.7	PBWMI-6/50
WBTI-3/32			32	32			28.8	35.2	TBT2-3/50
WBTI-3/40			40	36			20.7	25.3	TBT2-3/20 & 50
WBTI-3/50			50	48			15.8	19.25	TBTS2-3/20 & 50
WBTI-3/80			80	-			8.73	10.67	PBWMI-10/100-1

<sup>1)</sup> While testing the breaking capacity, satisfactory results were found for the short-circuit range at recovery voltage of 4 000 V DC. For the overload currents at a recovery voltage of between 3 800-4 000 V DC, various values for particular fuse were obtained. The resistances are measured using either an electrical bridge method or a measuring instrument with an accuracy class not worse than 0.5% at an ambient temperature of t = 20°C ± 2°C.

Fuse-link type	Rated voltage Un [kV] DC	Rated current		Switching overvolt. U <sub>TRV</sub> [kV]	Rated breaking current I <sub>1</sub> [kA]	Weight [kg]	Resistance		Fuse-base type	
		ace. PN-E-06172:1999	ace. UIC-552				Min.	Max.		
		In [A] DC	In [A] DC				[mΩ]	[mΩ]		
WBTGI-3/10	3.750		10	10	<12	31.5	137.7	168.3	TBTG1A-3/15	
WBTGI-3/16			16	16			69.3	84.7		
WBTGI-3/20			20	20			45.1	55.3		
WBTG-3/3-I	4		3	3	<12	40	0.13	569.7	696.3	PBPM-6
WBTG-3/3	4		3	3	<12	40	569.7	696.3	TBTG1-3/6	
WBTG-3/4			3.5	4			459	561		
WBTG-3/6			6	6			300.6	367.4		
WBTS-3/0.6	4		0.6	-	<12	40	42(Ω)	51.3(Ω)	TBTS1-3/1	
WBTS-3/1			1	-			1710	2090		
WBT-1.5/3			3	-			234	316		
WBT-1.5/15	1.9		15	-	<6	50	28.2	38.2	PBT-1.5/40	
WBT-1.5/40			40	-			1.25	11.3		15.3

## General technical data of fuse boards

Table 4.

Fuse-board type	Rated voltage Un [kV] DC	Rated current In [A] DC	Rated test voltage at 50 Hz Ut [kV]	Number of poles [pcs]	Weight [kg]	Fuse-link type							
							PBWMI-6/20	7.2	20	35 <sup>1)</sup>	1	4.9	WBTI-3/3÷20
							PBWMI-6/50		40			5	WBTI-3/25÷50
TBT2-3/20	4	20	10	2	5.5	WBTI-3/3÷20 (2 pcs)							
TBT2-3/20 & 50 <sup>2)</sup>		20&50			5.65	WBTI-3/3÷20 (1 pcs) WBTI-3/25÷50 (1 pcs)							
TBT2-3/50		50			5.8	WBTI-3/25÷50 (2 pcs)							
TBTS2-3/20		20			7.0	WBTI-3/3÷20 (2 pcs)							
TBTS2-3/20 & 50		20&50			7.3	WBTI-3/3÷20 (1 pcs) WBTI-3/25÷50 (1 pcs)							
TBTG1A-3/15		20		1	1.15	WBTGI-3/10; 16; 20							
TBTG1-3/6		6		1	0.85	WBTG-3/3;4;6							
TBTG3-3/1;6;15		-		3	1.8	WBTS-3/1 WBTG-3/3;4;6 WBTGI-3/10; 16;20							
TBTG4-3/1;3;6;15		-		4	2.6	WBTS-3/1 WBTG-3/3;4;6 WBTGI-3/10; 16;20							
TBTS1-3/1	4	1	10	1	0.35	WBTS-3/0.6;1							
PBT-1.5/40	1.9	40	27 <sup>1)</sup> 35 <sup>3)</sup>	1	3.6	WBT-1.5/3 WBT-1.5/15 WBT-1.5/40							
PBWMI-10/100-1	12	100			5.6	WBTI-3/80							

Note: Due to the introduction of improvements, we reserve the right to modify the products.

<sup>1)</sup> AC contact-to-contact insulation test voltage.

<sup>2)</sup> One pole is designed for fixing the type WBTI-3/3 to 20 fuse-link and the second one for WBTI-3/25 to 50 fuse-link.

<sup>3)</sup> AC earth insulation test voltage.

## 9. Appendices

Fig.1 Cut-off current characteristics for fuse-link types WBTI-3...

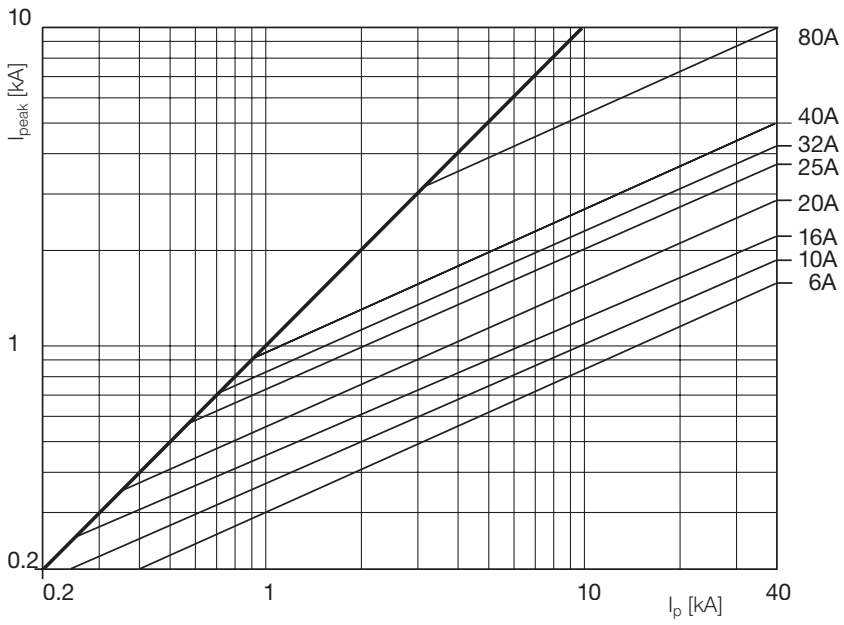


Fig. 2 Time-current characteristics for fuse-link types WBTI-3 ...  
Current value deviations for any average pre-arcing period value as read from the diagram are presented within  $\pm 20\%$

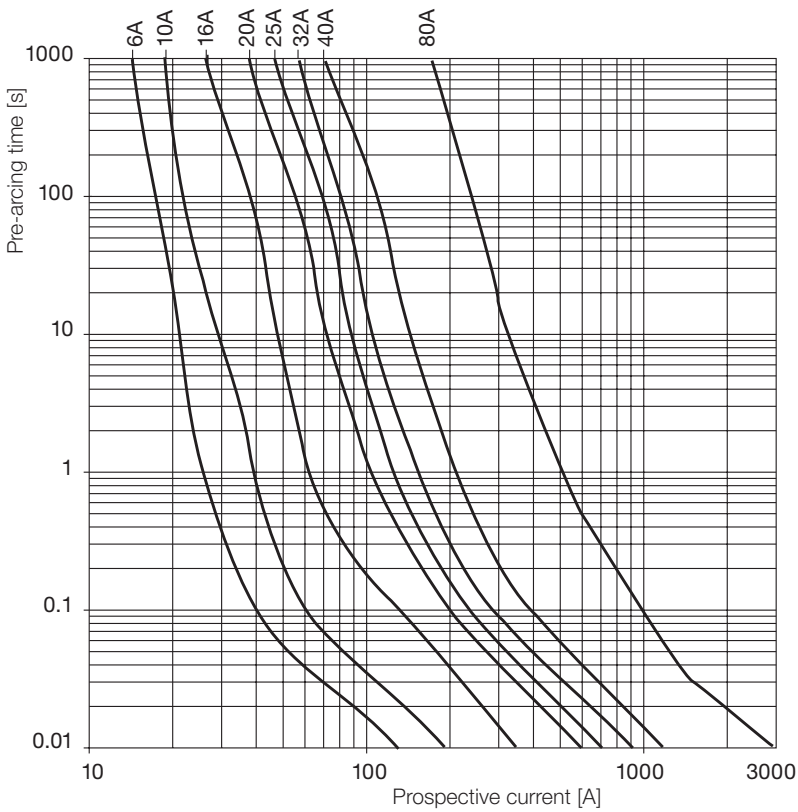


Fig. 3 Cut-off current characteristics fuse-link types WBTGI-3 ...

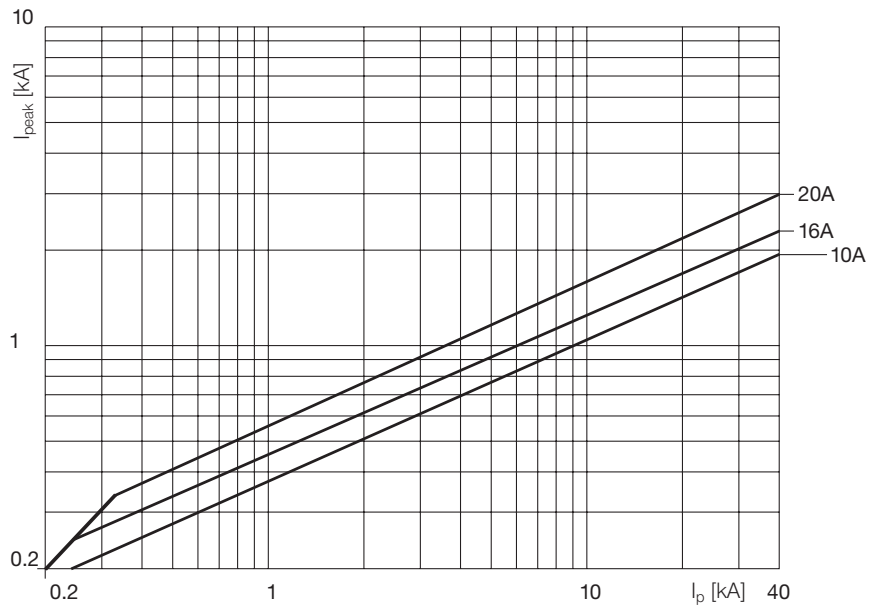


Fig. 4 Time-current characteristics for fuse-link types WBTGI-3 ...  
Current value deviations for any average pre-arcing period value as read from the diagram are presented within  $\pm 20\%$

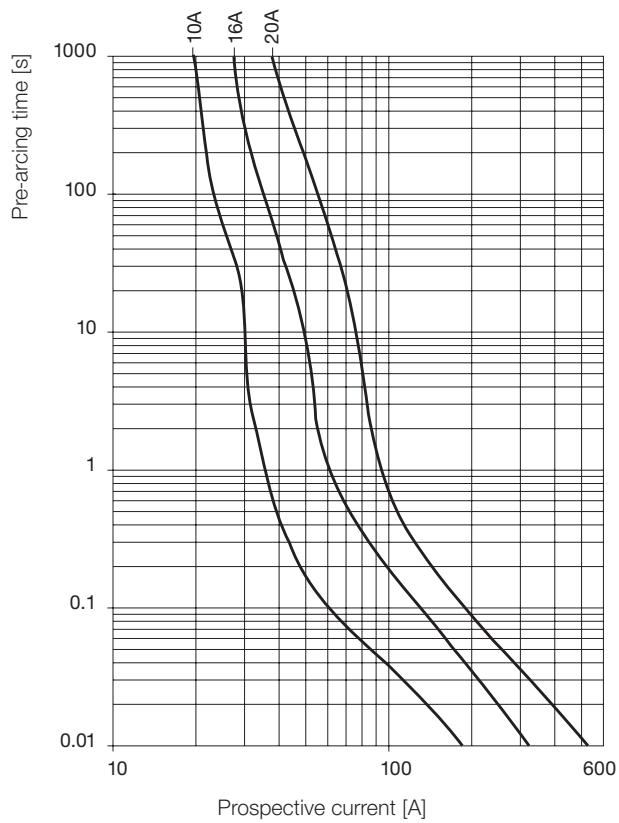


Fig. 5 Cut-off current characteristics for fuse-link types WBTG-3/3; 4; 6... and WBTG-3/3-I

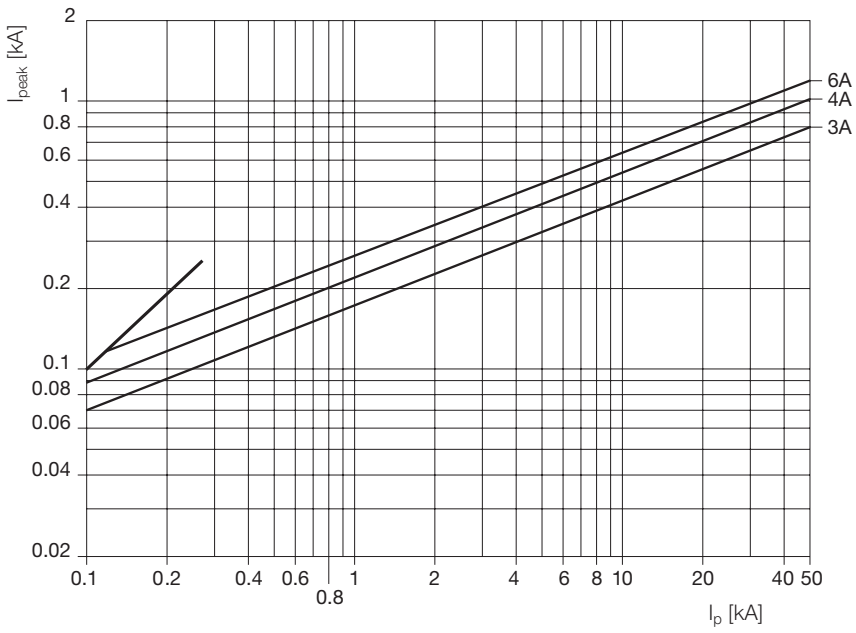


Fig. 6 Time-current characteristics for fuse-link types WBTG-3/3; 4; 6... and WBTG-3/3-I. Current value deviations for any average pre-arcing period value as read from the diagram are presented within  $\pm 20\%$ .

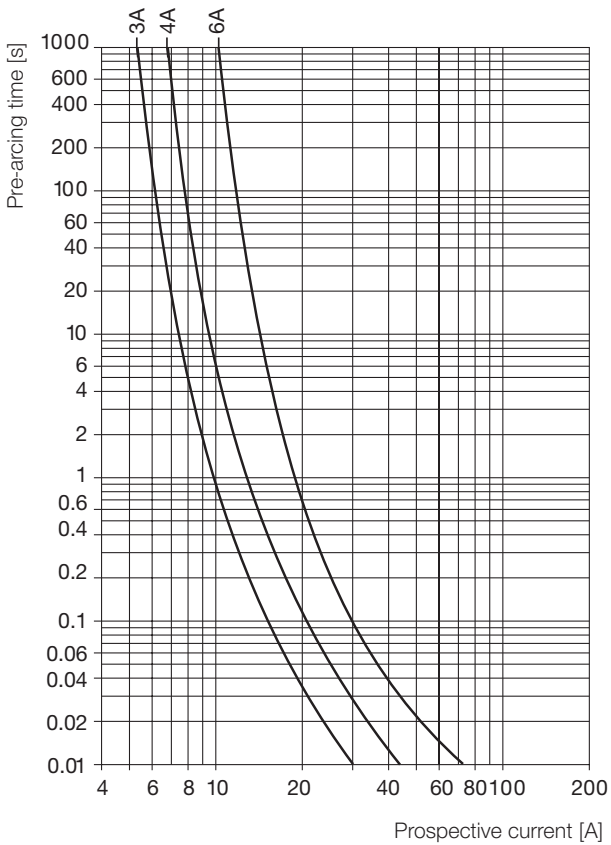


Fig. 7 Cut-off current characteristics for fuse-link types WBTS-3/0.6; 1

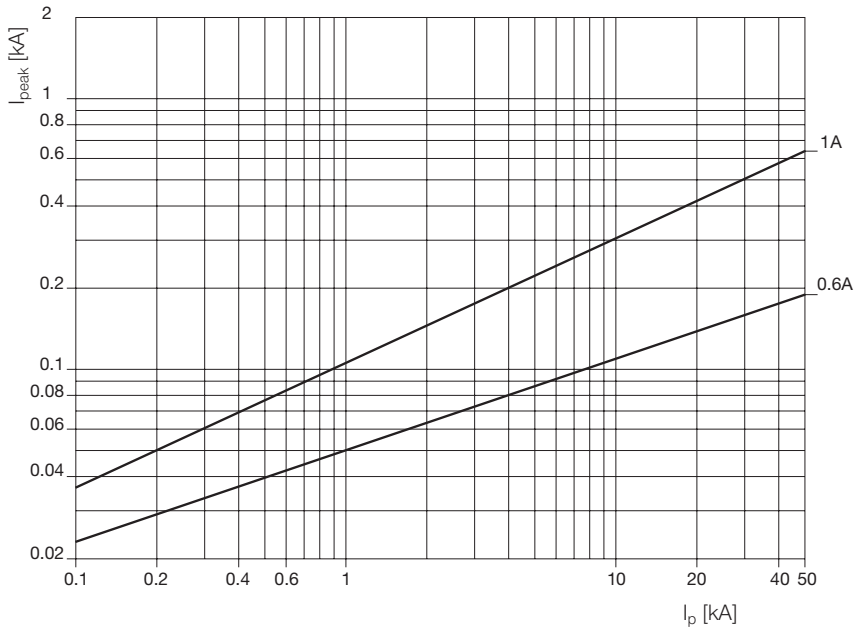


Fig. 8 Time-current characteristics for fuse-link types WBTS-3/0.6; 1  
Current value deviations for any average pre-arcing period value as read from the diagram are presented within  $\pm 20\%$ .

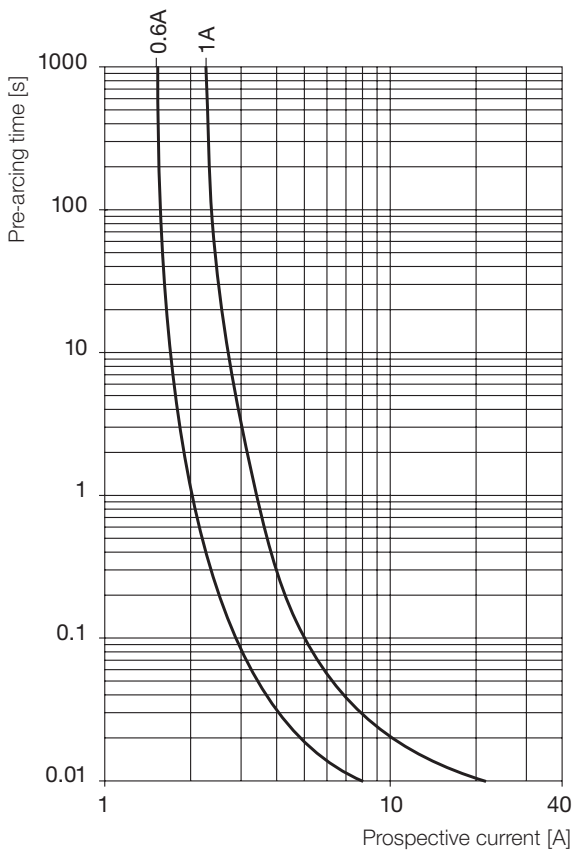


Fig. 9 Cut-off current characteristics for fuse-link types WBT-1.5/3; 15; 40

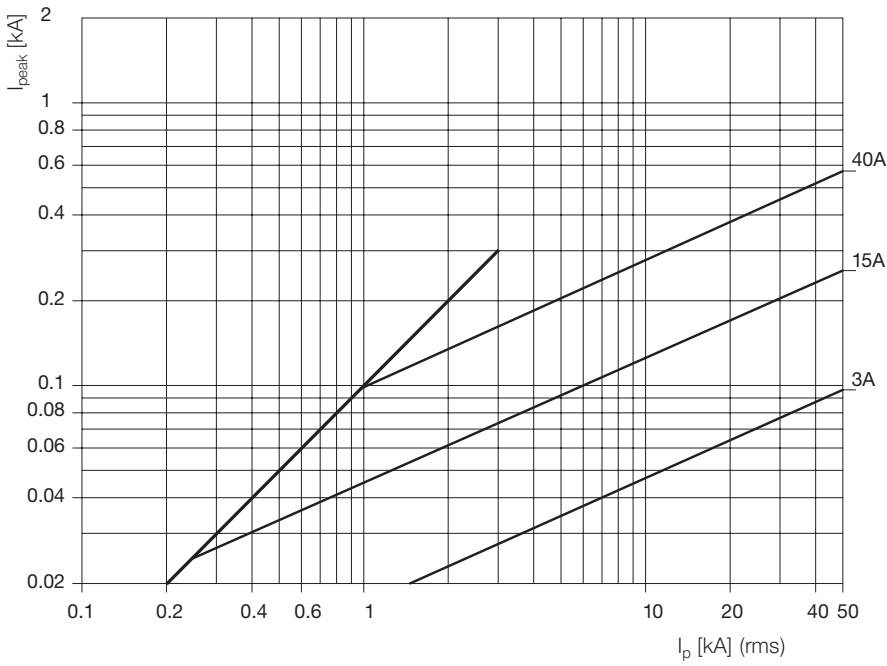
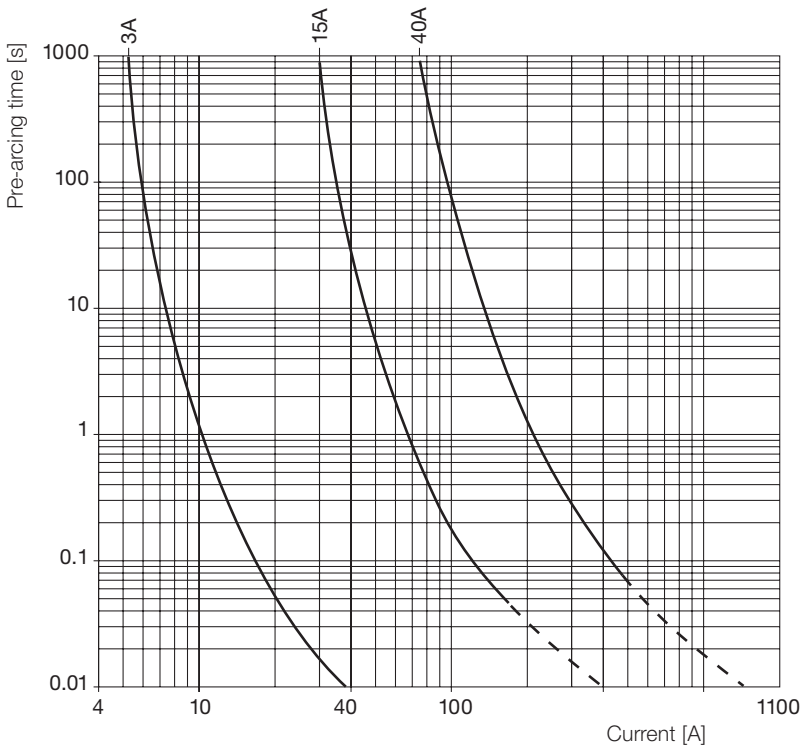


Fig. 10 Time-current characteristics for fuse-link types WBT-1.5/3; 15; 40. Current value deviations for any average pre-arcing period value as read from the diagram are presented within  $\pm 20\%$ .



**WBTI-3, WBTG-3, WBTGI-3,  
WBTG-3/3-I, WBTS-3 and WBT-1.5**  
fuse links for traction applications

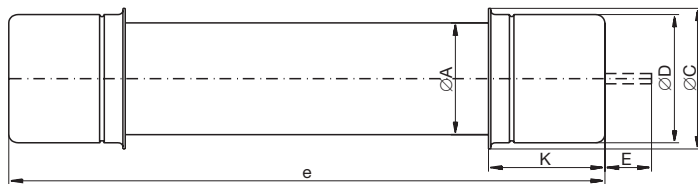
Fuse-link type	Dimensions [mm]					
	$\varnothing A$	$\varnothing D$	$\varnothing C$	K	E	e
WBTI-3/3 to 20	55	62	66			256±2
WBTI-3/25 to 50	70	78	84	50	20	
WBTGI-3/10 to 20	38	45	50	33		256±2
WBTG-3/3-I	18	23	-	25	-	209±2
WBTG-3/3 to 6	24	28	-	20	12	200±2
WBTI-3/0.6; 1	18	23	-	25	-	145±2
WBT-1.5/3;15	38	45	50	33	-	109±2
WBT-1.5/40	65	72	-	-	-	109±2

**BWT fuse links for traction applications**

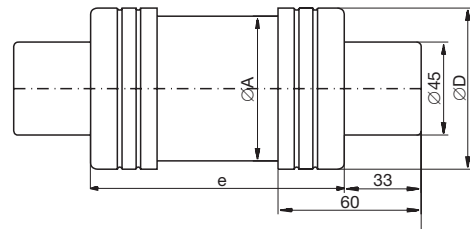
DC fuse links for railway applications are characterized by their small dimensions, high rupturing capacity, current-limitation and low switching voltage. Type tested according to 'Specifica Generale per la Fornitura di Valvole Fusibili A.T. per Circuiti C.C.' at Trenitalia (Italian Railways) testing station in Empoli/Italy.

**Technical parameters:**

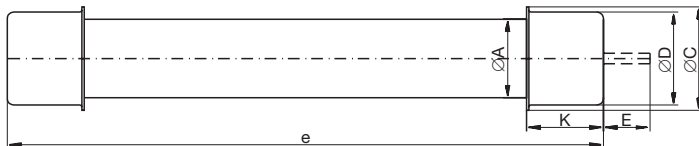
Rated voltage	$U_n$	3 kV DC
Rated current	$I_n$	3.15; 16; 20 A
Switching voltage (max)	$U_{TRV}$	12 kV
Minimum breaking current	$I_g$	5 x $I_n$
Rated breaking current	$I_1$	60 kA



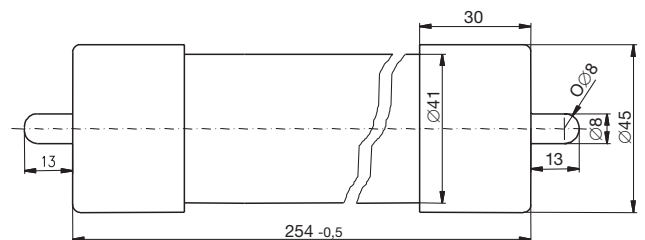
Type WBTI-3-3/... fuse links



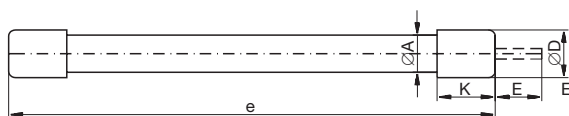
Type WBT-1,5/40 fuse links



Type WBTGI-3/...; WBT-1,5/3 ... fuse links



Type BWT fuse links



Type WBTG-3/3-6,  
WBTG-3/3-I; WBTS-3/... fuse links

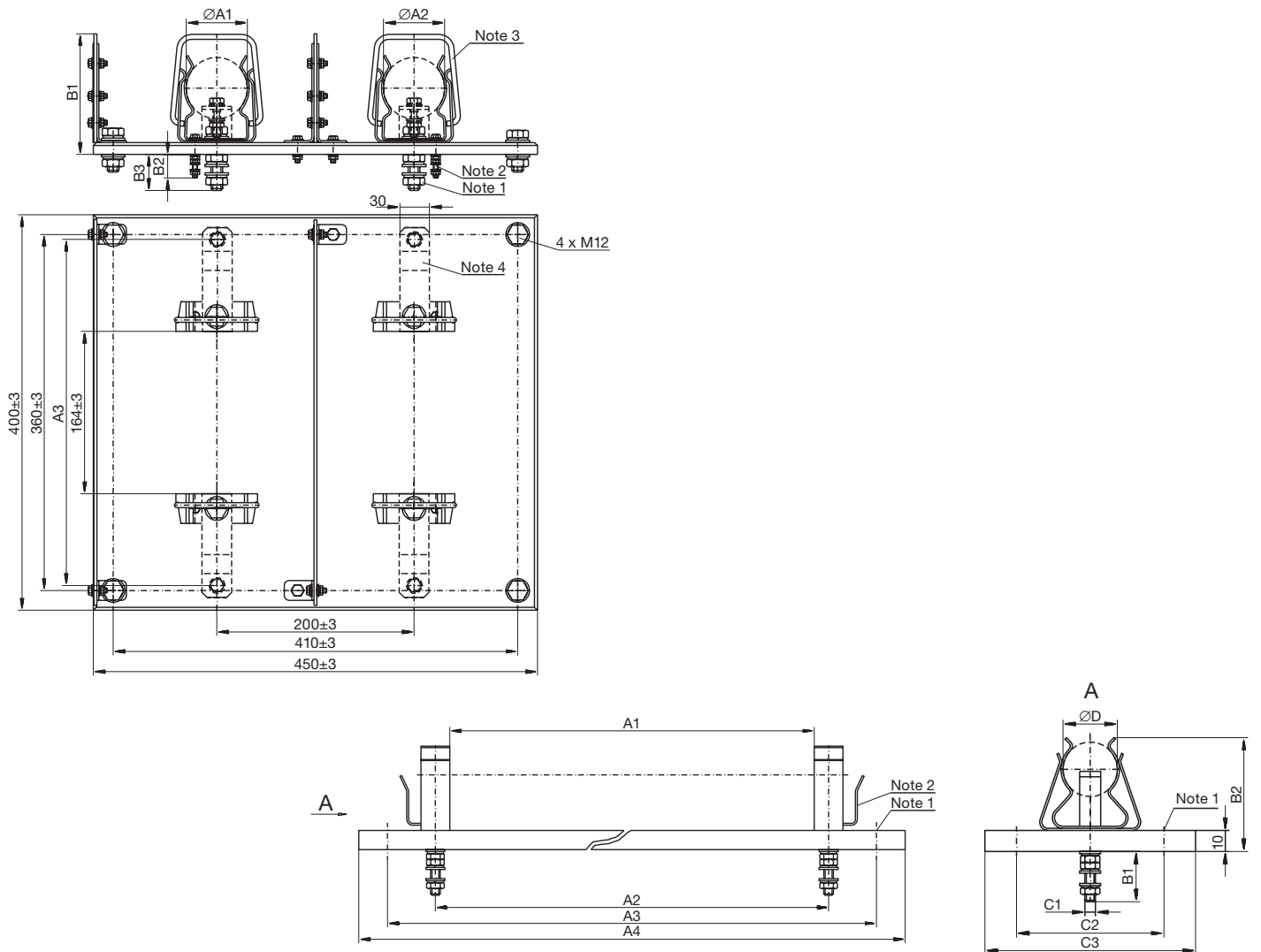
**TBT2-3/...; TBT2-3/20&50; TBTS2-3/20 and TBTS2-3/20&50 fuse boards for traction applications**

1. Connection screw, M12, for the board type TBT2-3/50 only.
2. Connection screw – M8 for the ØD1 pole or M5 for the ØD2 pole – for the board type TBT2-3/20 & 50 only.
3. Poles designed for the fuse-links type WBT-3/20-50 fitted with extrathimble terminals.
4. Flat connections employing a screw, M8 are fitted in the TBTS2-3/... only. Connections: silver-plated brass.

Contact Springs: silver-plated brass.

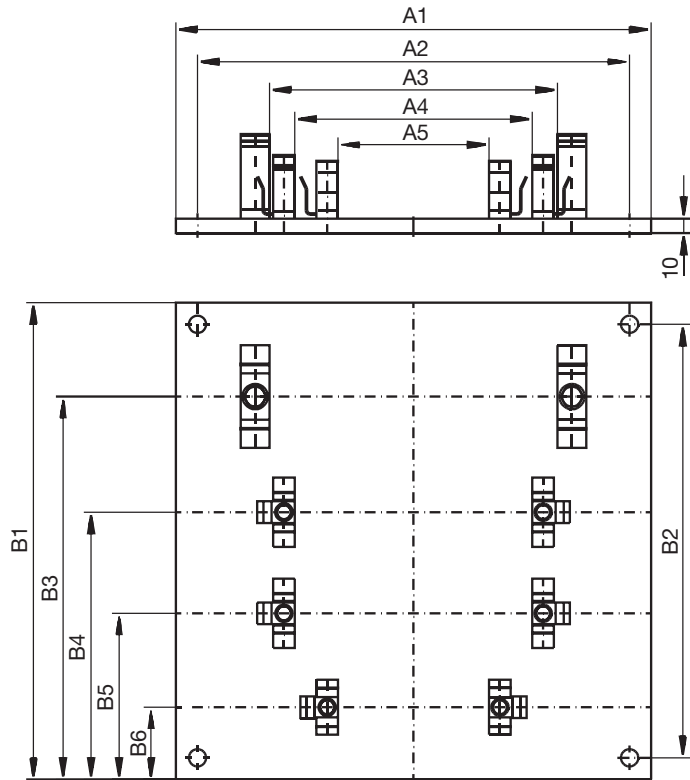
Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-board type	Dimensions [mm]					
	Ø A1	Ø A2	A3	B1	B2	B3
TBT2-3/20	62	62	-	136	30	-
TBT2-3/50	78	78	-	136	-	40
TBT2-3/20 & 50	78	62	-	138	40	40
TBTS2-3/20	62	62	295	138	-	-
TBTS2-3/20 & 50	62	78	295	138	-	-





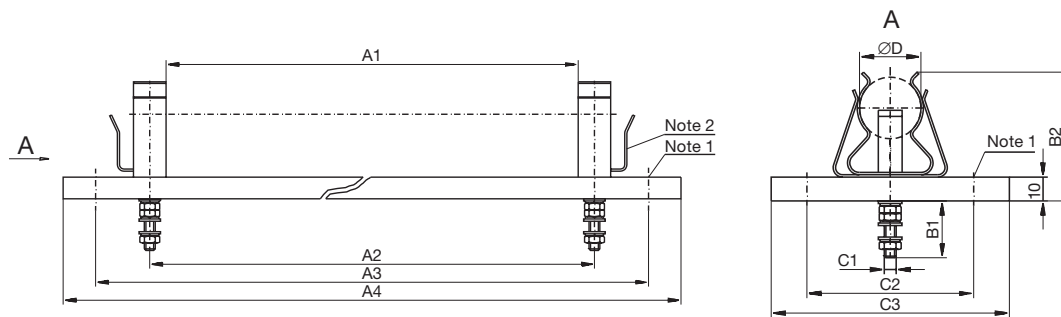
TBTG3-3/1; 6; 15 and TBTG4-3/1; 3; 6; 15 fuse boards for traction applications



- Notes:
1. Connections: silver-plated brass.
  2. Contact Springs: silver-plated brass.
  3. Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-board type	Dimensions [mm]										
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6
TBTG3-/1,6,15	330	300	220 $\pm$ 1	180 $\pm$ 1	120	250	220	190	110	-	40
TBT4-3/1,3,6,15	330	300	220 $\pm$ 1	180 $\pm$ 1	120	330	300	265	185	115	50

TBTG1-3/6; TBTG1A-3/15; TBTS1-3/1 Fuse boards for traction applications

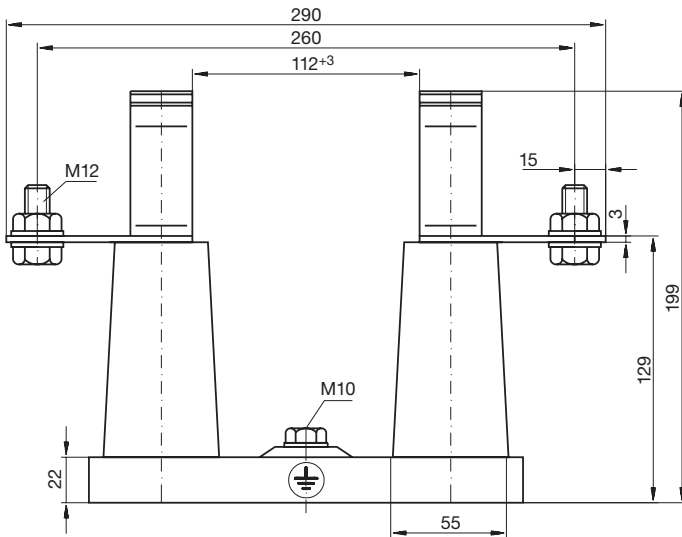


1. The  $\text{Ø}10$  holes are to be used for installation.
2. Fuse-link stops for the Type TBTG1-3/6 and TBTS1-3/1 Fuse-board are to be installed in the panels.
- Connections: silver-plated brass.
- Contact Springs: silver-plated brass.
- Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Fuse-board type	Dimensions [mm]										
	A1	A2	A3	A4	B1	B2	C1	C2	C3	C4	
TBTG1-3/6	165 $\pm$ 1.5	180 $\pm$ 3	395 $\pm$ 3	425	18	58 $\pm$ 2	M5	70 $\pm$ 2	100	28	
TBTG1A-3/15	205 $\pm$ 1.5	225 $\pm$ 3	440 $\pm$ 3	470	25	71 $\pm$ 2	M8	70 $\pm$ 2	100	45	
TBTS1-3/1	105 $\pm$ 1	120 $\pm$ 3	394 $\pm$ 3	425	20	60	M5	-	50	23	

## Type PBT-1.5/40

Fuse base for traction application



### Notes:

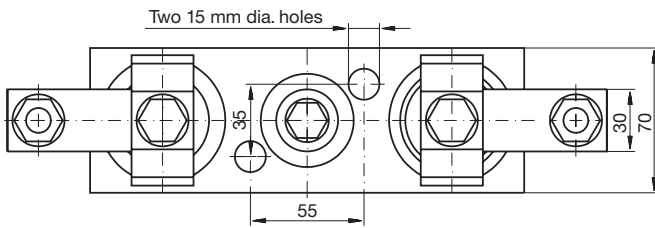
Earthing Terminal; tinned steel.

Connectors: silver-plated brass.

Contact Springs: silver-plated brass.

Deviations of dimensions with no tolerance specified shall be within  $\pm 3\%$ .

Note: Due to the introduction of improvement, ABB reserve the right to modify the products.



### Note:

Design and specifications are subject to change without notice.

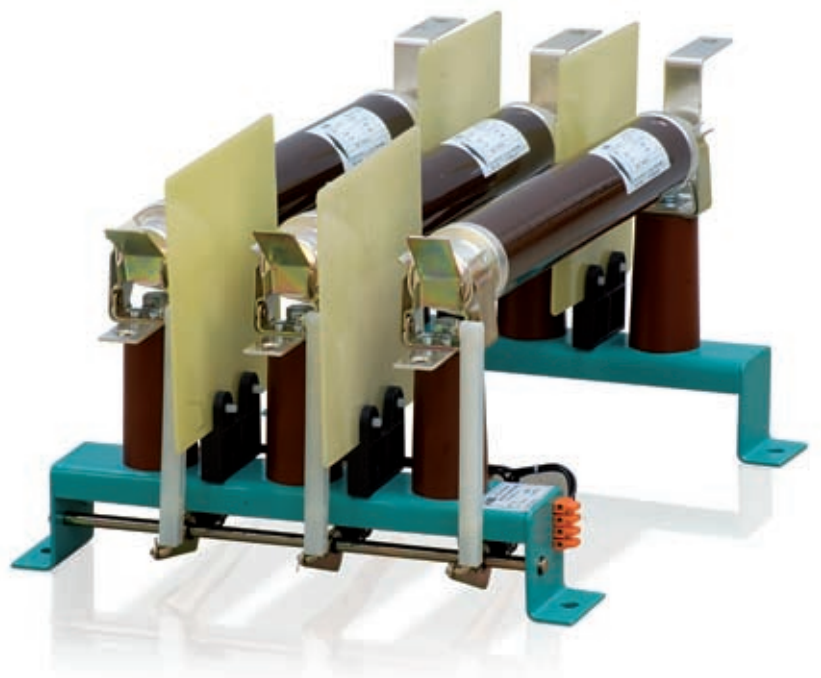


# Indoor Fuse Bases

## Fuse bases type BPS

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## 1. Features

- suitable for all types of high power fuse links fitted with Ø45mm contact,
- may co-operate with switching station auxiliary and control circuits,
- small overall dimensions.

## 2. Application

The fuse-bases BPS-type are intended for fixing medium-voltage fuse links fitted with a striker. The base can be applied in cases where fuse links are used to protect transformer circuits as well as motor circuits. By using these bases, the signaling circuits in the switching station can see that a particular fuse has blown.

## 3. Operating conditions

The fuse-bases BPS-type are designed for indoor applications where temperate climate conditions exist. The fuse-bases BPS-type can be mounted vertically or horizontally, and this enables easy replacement of the fuse link.

## 4. Versions and marking

The marking denoting a three-pole fuse base with a rated voltage of 7.2 kV is composed of two letter-digit segments: BPS-01.

The two-piece base is powder painted and fitted with a resin insulator. The base pole pitch is 112 mm. The catalogue number of this base is: 1YMB207101M0001.

The table below presents the different versions of single pole BPS-type fuse bases.

Fuse-base type	Rated voltage [kV]	Version	Coating	Post-insulators	Fuse link dimension e [mm]	Catalogue No.
BPS	7.2	1(*)	zinc	resin	192	1YMB507102M0001
BPS	7.2	1(*)	zinc	resin	292	1YMB507102M0003
BPS	12	1(*)	zinc	resin	292	1YMB507102M0005
BPS	12	1(*)	zinc	porcelain	292	1YMB507102M0006
BPS	12	1(*)	zinc	resin	442	1YMB507102M0007
BPS	12	1(*)	zinc	porcelain	442	1YMB507102M0008
BPS	17.5	1(*)	zinc	resin	292	1YMB507102M0009
BPS	17.5	1(*)	zinc	porcelain	292	1YMB507102M0010
BPS	24	1(*)	zinc	resin	442	1YMB507102M0013
BPS	24	1(*)	zinc	porcelain	442	1YMB507102M0014
BPS	24	1(*)	zinc	resin	537	1YMB507102M0015
BPS	24	1(*)	zinc	porcelain	537	1YMB507102M0016
BPS	27	1(*)	zinc	resin	442	1YMB507102M0017
BPS	27	1(*)	zinc	porcelain	442	1YMB507102M0018
BPS	36	1(*)	zinc	resin	537	1YMB507102M0021
BPS	36	1(*)	zinc	porcelain	537	1YMB507102M0022
BPS	7.2	1(*)	powder paint	resin	192	1YMB507102M0031
BPS	7.2	1(*)	powder paint	resin	292	1YMB507102M0033
BPS	12	1(*)	powder paint	resin	292	1YMB507102M0035
BPS	12	1(*)	powder paint	porcelain	292	1YMB507102M0036
BPS	12	1(*)	powder paint	resin	442	1YMB507102M0037
BPS	12	1(*)	powder paint	porcelain	442	1YMB507102M0038
BPS	17.5	1(*)	powder paint	resin	292	1YMB507102M0039
BPS	17.5	1(*)	powder paint	porcelain	292	1YMB507102M0040
BPS	24	1(*)	powder paint	resin	442	1YMB507102M0043
BPS	24	1(*)	powder paint	porcelain	442	1YMB507102M0044
BPS	24	1(*)	powder paint	resin	537	1YMB507102M0045
BPS	24	1(*)	powder paint	porcelain	537	1YMB507102M0046
BPS	27	1(*)	powder paint	resin	442	1YMB507102M0047
BPS	27	1(*)	powder paint	porcelain	442	1YMB507102M0048
BPS	36	1(*)	powder paint	resin	537	1YMB507102M0051
BPS	36	1(*)	powder paint	porcelain	537	1YMB507102M0052
BPS	7.2	2(**)	zinc	resin	any	1YMB507103M0001
BPS	12	2(**)	zinc	resin	any	1YMB507103M0003
BPS	12	2(**)	zinc	porcelain	any	1YMB507103M0004
BPS	24	2(**)	zinc	resin	any	1YMB507103M0007
BPS	24	2(**)	zinc	porcelain	any	1YMB507103M0008
BPS	36	2(**)	zinc	resin	any	1YMB507103M0009
BPS	36	2(**)	zinc	porcelain	any	1YMB507103M0010
BPS	7.2	2(**)	powder paint	resin	any	1YMB507103M0013
BPS	12	2(**)	powder paint	resin	any	1YMB507103M0015
BPS	12	2(**)	powder paint	porcelain	any	1YMB507103M0016
BPS	24	2(**)	powder paint	resin	any	1YMB507103M0019
BPS	24	2(**)	powder paint	porcelain	any	1YMB507103M0020
BPS	36	2(**)	powder paint	resin	any	1YMB507103M0021
BPS	36	2(**)	powder paint	porcelain	any	1YMB507103M0022

Remarks:

(\*)- single pole one-piece fuse base

(\*\*)- single pole two-piece fuse base

The single pole two-piece fuse base makes it possible to use fuse links with any „e” overall dimension.

## 5. Design and principle of operation

### 5.1 The three-pole fuse base

The three-pole fuse base, BPS-type, is composed of two separated steel bars fitted with M10 earthing terminals, and three fixed indoor resin post-insulators. Spring contacts and a terminal strip (fitted with M12 screw terminals for easy connection to an electrical circuit) are mounted on these insulators. The insulators are separated by insulating barriers, which ensure appropriate insulation between poles. In addition, these barriers help to reduce the overall dimensions of the fuse base. A tripping mechanism is fixed to one of the bars and consists of a lever system and a separate microswitch for each pole. The NC contact of each microswitch are connected in series, while the circuit ends are connected to terminals 1 and 2 of the terminal strip. If three operating fuse links are mounted onto the base, the microswitch NC contact are closed and the circuit between terminals 1 and 2 of the terminal strip has continuity.

The NC contacts of each microswitch are connected in parallel, while the circuit ends are connected to terminal 3 and 4 of the terminal strip. If three operational fuse links are mounted onto the fuse base, the microswitch NO contacts are opened and the circuit between terminals 3 and 4 of the terminal strip has no continuity. If any of the fuse links is missing or if the striker of one of the three fuse links is triggered, the circuit between terminals 1 and 2 will open and the circuit between terminals 3 and 4 will simultaneously close.

### 5.2 The single pole fuse base

Single pole fuse bases, BPS-type, are manufactured in two basic version i.e. as one and two-piece devices. Two-piece bases consist of two steel bars fitted with M10 earthing terminals. Indoor resin post-insulators are fixed to these bars. Spring contacts and a terminal strip (with M12 screw terminals for easy connection to an electrical circuit) are mounted onto these insulators. In the one-piece version, the bars with the insulators are joined to a steel bar to make a single assembly. A tripping mechanism consisting of a lever system and a microswitch is fixed to one of the bars. The NC contacts of the microswitch are connected to terminals 1 and 2, whereas the NO contacts are connected to terminals 3 and 4 of the terminal strip. If an operating fuse link is mounted onto the base, the micro switch NC contacts are closed and the NO contacts are opened. If, however, the fuse link is missing or the fuse link is triggered, the NC contacts will open while the NO contacts will close.

## 6. Characteristics

Fuse-base type	Fuse-base voltage	Rated	Frequency	Rated current	Types of suitable fuse-links
		Un [kV]	f [Hz]	In [A]	
BPS-01	Three-pole	7.2	50 or 60	315	BWMW-7.2/ 3.15÷100 CEF-7.2/ 6÷200 CMF - 7.2/63÷315
BPS7.2	Single pole	7.2		315	BWMW-7.2/3.15-100 CEF-7.2/6-200 CMF-7.2/63-315
BPS12	Single pole	12		200	BWMW-12/3.15-100 CEF-12/6-200 CMF-12/63-200
BPS17.5	Single pole	17.5		125	CEF-17.5/6-63
BPS 24	Single pole	24		125	BWMW-24/3.15-63 CEF-24/6-125
BPS27	Single pole	27		100	CEF-27/6-63
BPS36	Single pole	36		40	BWMW-36/3.15-40 CEF-36/6-40

## 7. Conformity with standards

The BPS fuse bases meet the requirements of the following standards:

- Polish Standard PN-77/E-06110,
- International Standard IEC 60 282-1.

## 8. Ordering method

The order must contain the following information: product name, type symbol, rated voltage, catalogue number and quantity of fuse bases.

All additional requirements not stated in this catalogue sheet must be agreed with the manufacturer. All inquiries must be made in writing and must state the source of the requirements (Regulations, Standards, etc).

## 9. Order example

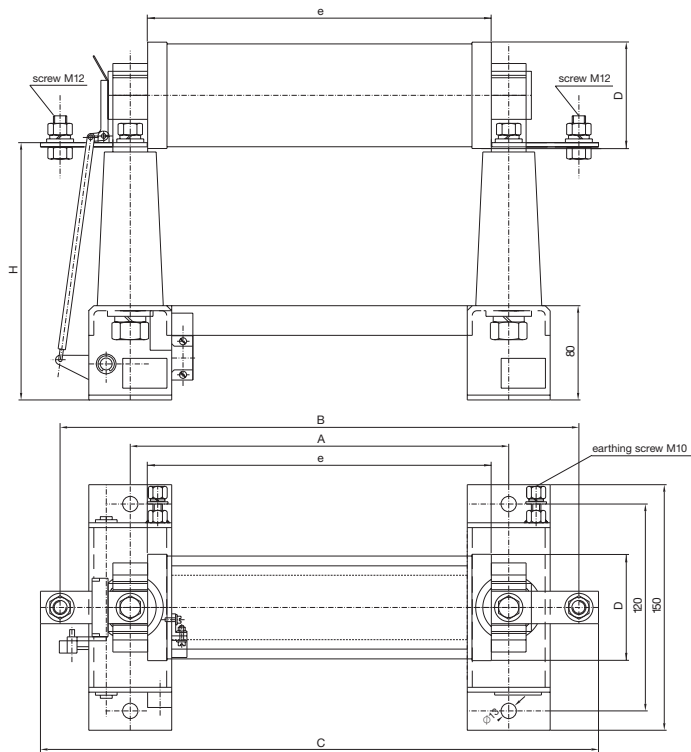
Three pole fuse-base BPS-01 type, rated voltage 7.2 kV, catalogue number 1YMB507101M0001 - 20 pcs.

Single pole one-piece fuse base with resin insulators, type BPS 12, rated voltage 12 kV, zinc plated, for fuse links with dimension e=292 mm, catalogue number 1YMB507102M0005, 10 pcs.

## 10. Enclosures

### 1. Dimensional drawings

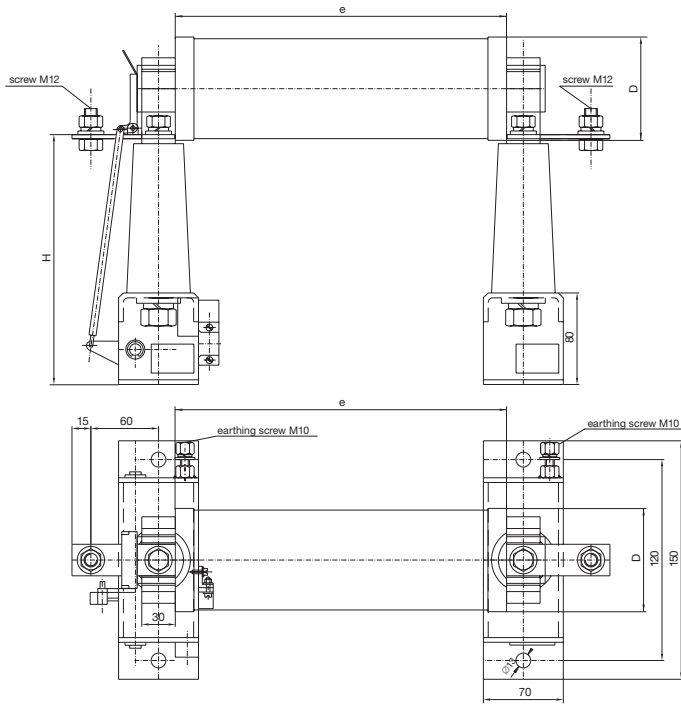
Single pole one-piece fuse base



Un kV	Fuse-link dimension e/D	Dimensions			H [mm]
		A [mm]	B [mm]	C [mm]	
7.2	192/Ø53, 192/Ø65, 192/Ø87	226+2	346+2	376+2	192±1 (resin post-insulators)
	292/Ø53, 292/Ø65, 292/Ø87	326+2	446+2	476+2	
12	292/Ø53, 292/Ø65, 292/Ø87	326+2	446+2	476+2	217±1 (resin post-insulators)
	442/Ø53, 442/Ø65, 442/Ø87	476+2	596+2	626+2	218±1 (porcelain post-insulators)
17.5	292/Ø53, 292/Ø65, 292/Ø87	326+2	446+2	476+2	297±1 (resin post-insulators)
	442/Ø53, 442/Ø65, 442/Ø87	476+2	596+2	626+2	312±1 (porcelain post-insulators)
24	442/Ø53, 442/Ø65, 442/Ø87	476+2	596+2	626+2	297±1 (resin post-insulators)
	537/Ø65, 537/Ø87	571+2	691+2	721+2	312±1 (porcelain post-insulators)
27	442/Ø65, 442/Ø87	476+2	596+2	626+2	388±1 (resin post-insulators)
	537/Ø65, 537/Ø87	571+2	691+2	721+2	389±1 (p)
36	442/Ø65, 442/Ø87	476+2	596+2	626+2	388±1 (resin post-insulators)
	537/Ø65, 537/Ø87	571+2	691+2	721+2	389±1 (porcelain post-insulators)



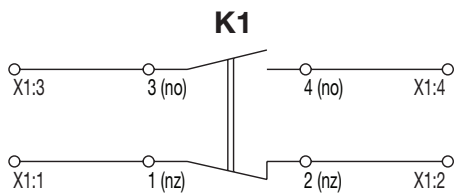
Single pole two-piece fuse base



**Dimensions**

<b>Un</b> <b>[kV]</b>	<b>Fuse-link dimension</b>		<b>H</b> <b>[mm]</b>
	<b>e/D</b>		
7.2	192/Ø53, 192/Ø65, 192/Ø87		192±1 (resin post-insulator)
	292/Ø53, 292/Ø65, 292/Ø87, 367/Ø87		
12	192/Ø53, 292/Ø53, 292/Ø65, 292/Ø87		217±1 (resin post-insulator)
	442/Ø53, 442/Ø65, 442/Ø87, 537/Ø65, 537/Ø87		218±1 (porcelain post-insulators)
24	442/Ø53, 442/Ø65, 442/Ø87, 292/Ø53		297±1 (resin post-insulator)
	537/Ø53, 537/Ø87		312±1 (porcelain post-insulators)
36	537/Ø53, 537/Ø87		388±1 (resin post-insulator)
			389±1 (porcelain post-insulators)

## 2. Wiring diagrams of fuse-base auxiliary circuits.



NOTES for single pole BPS

1. Contacts 1 and 2 of one of the auxiliary switches, K1, are open, and contacts 3 and 4 are closed:
  - a) after the fuse-link striker has been triggered,
  - b) if the fuse-link is missing from the fuse holder.

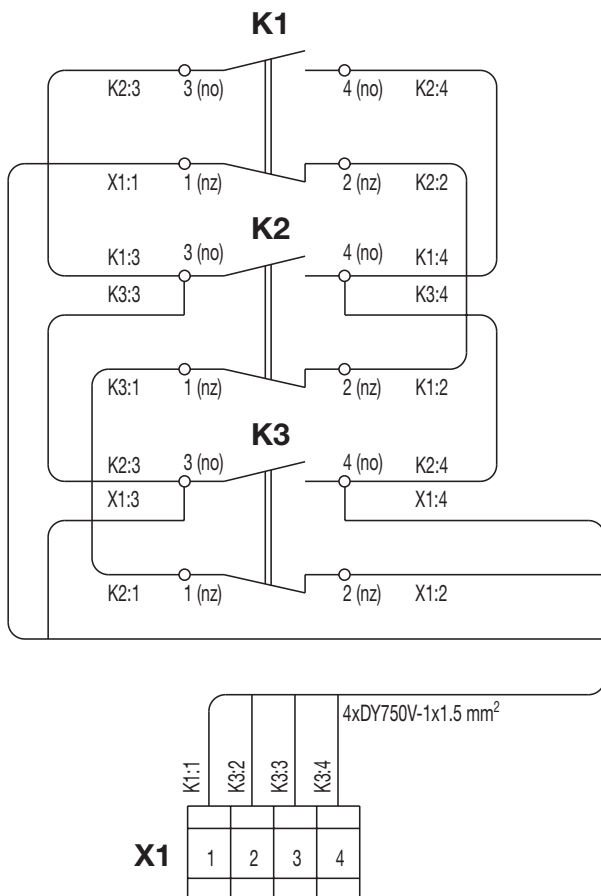
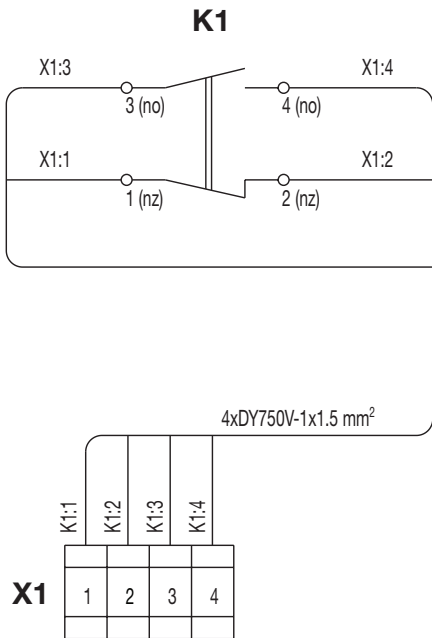
2. Contacts 1 and 2 of one of the auxiliary switches, K1, are closed, and contacts 3 and 4 are opened when fuse links in the fuse holder are operational.

3. Use fuse links with striker only.

4. Install fuse links with striker in the fuse holder in a manner that will allow the striker to be directed to the insulator with pull insulator.

5. K 1: type 83135,  $U_i = 380\text{ V}$ ;  $U_e = 380\text{ V}$ ,  $I_e = 6\text{ A}$ , AC15;  $U_e = 220\text{ V}$ ,  $I_e = 0.25\text{ A}$ , DC13.

6. X1: type LZ-B4/6,  $U_i = 500\text{ V}$ ;  $4\text{ mm}^2\text{ Cu}$ , IEC 947-7-1.



NOTES for three poles BPS

1. Contact 1 and 2 of one of the auxiliary switches K1, K2, K3 are open and contacts 3 and 4 are closed:
  - a) after the fuse-link striker has been triggered,
  - b) if the fuse-link is missing from the fuse holder.

2. Contact 1 and 2 of the auxiliary switches K1, K2, K3 are closed and contacts 3 and 4 are opened when all three fuse links in the fuse holder are operational.

3. Use fuse links with striker only.

4. Install fuse links with striker in the fuse holder in a manner that will allow the striker to be directed to the insulator with pull insulator.

5. K1: type 83135,  $U_i = 380\text{ V}$ ;  $U_e = 380\text{ V}$ ,  $I_e = 6\text{ A}$ , AC15;  $U_e = 220\text{ V}$ ,  $I_e = 0.25\text{ A}$ , DC13.

6. X1: type LZ-B4/6,  $U_i = 500\text{ V}$ ;  $4\text{ mm}^2\text{ Cu}$ , IEC 947-7-1.



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