Medium voltage products

Fuses

Power and productivity
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ABB

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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.

Additionally to professional support in fuse application range ABB is proud to introduce new production of CEF series fuses that is highly automatized with on line monitoring of running process. Therefore both quality and performance aspects are 100% controllable and final product is delivered with complete identification package containing all fuse data and routine test report.

Thus 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 tense 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. Therefore, these types are used rarely and are usually recognized as a separate element of protection, without any linkage to the opening function of load break switch.
ABB current limiting fuses have low minimum breaking currents, i.e. close to three times the rated current In.

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-selection 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 eting 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

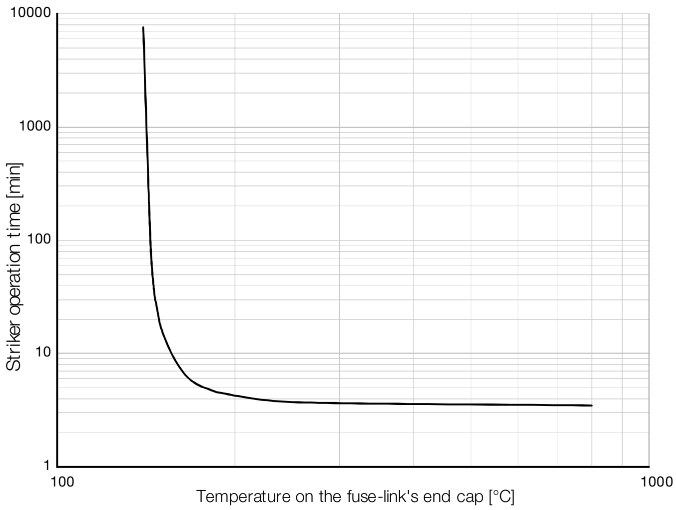
The Temperature Control Unit (TCU) is tripping device which is integrated with the striker of high-voltage (HV) fuses. It is activated when the allowable temperature in the switchgear is exceeded. When the temperature is to high the TCU activates the striker by releasing the switch disconnector, which 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.ferred to the temperature.
2. Withstanding temperatures up to 125°C on the fuse end-cap.
3. I ≤ 1.1xIn – no operation.

Notes:

1. Operation time tolerance is ±10% referred to the temperature.
2. Characteristic was recorded for cold fuse-link rapidly subjected to specific temperature.



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 fuse 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_6 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. The ABB CEF, CEF-S, CMF and CEF-VT (with striker) are equipped with a TCU as standard design. Moreover the 2015 production series of CEF, CEF-S and CEF-VT come with many beneficial features like combined operating voltages, welded current path, standard outdoor sealing and improved striker pin force (80N) for more customer satisfaction. The upgraded design simply extends application flexibility and reliability of CEF series fuses and is fully comparable as regards type test validity with previously produced CEF types (including CEF, CEF-S, CEF-VT, CMF and their TCU/BS/outdoor variants).

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

General principles for fuse links selection

Choice of rated voltage Un:

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 In

To obtain the best possible current limitation and thereby protection, the rated current, In, 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 In,
- 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, In, for the fuses should be least twice the rated current, Inc, of the capacitor bank. The rated voltage, Un, should also be at least twice Unc.
In≥2xInc
Un≥2xUnc

Example

315 kvar capacitor bank with 10 kV Unc.

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

Selected fuses: In = 40 A; Un = 24 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, In, of the fuses should be selected so that it is more than three times the Inc 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_6 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_6 switchgear and CEF fuses.

For detailed information regarding the correct choice of ABB fuses for transformer protection in SF_6 switchgear please refer to switchgear catalogue data.

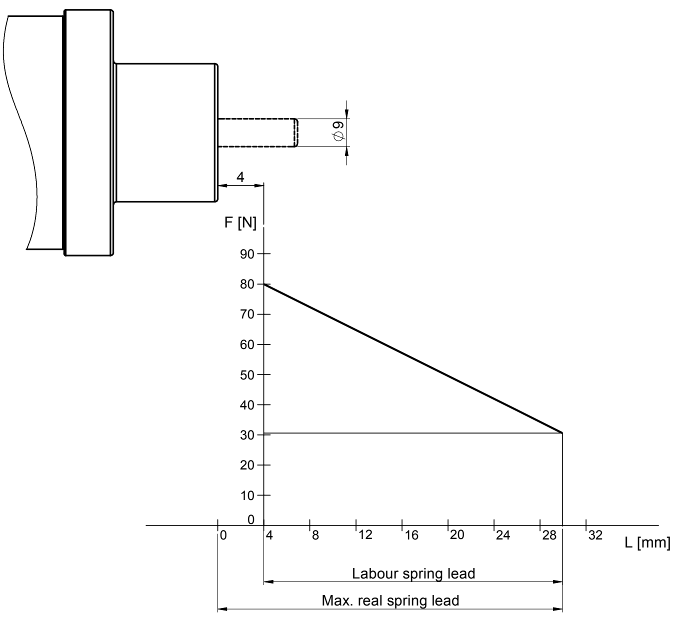
Replacement of melted fuse links

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 series 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 refer to the ordering tables. The force diagram is in accordance with the requirements of IEC 60282-1 (IEC 282-1) and DIN 43625.

The striker pin force diagram shown below refers to presently manufactured CEF/CMF fuses.



Nameplate

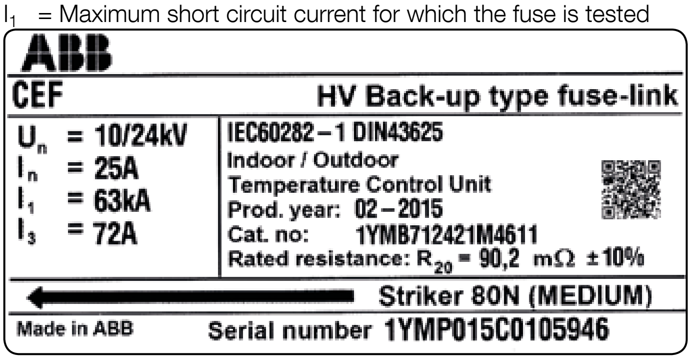
The symbols on the nameplate have the following meaning:

In = Rated current

Un = Rated voltage (The digits before the slash mean the lowest voltage at which the fuse can be safely used. Digits after the slash mean the rated voltage of the fuse).

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 variant has been included in standard CEF, CEF-S and CEF-VT fuse design and is no more marked separately.

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

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.

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. There are available CEF fuses marked as E-Rated. The detailed information are published in separate publication. ABB's high-voltage fuse links have the following properties:

– unified voltage ratings for more application flexibility,
– integrated striker pin with temperature control unit (TCU) to prevent overheating in installation place
– overload spots control internal arc initiation and determine outstanding temperature performance
– single fuse version for both indoor and outdoor operating conditions
– narrow tolerance of resistance for better fuse synchronizing in three phase networks
– graved fuse data for long term fuse recognition
– welded current path secures stable electrical contacts with active breaking elements,
– full range protection in application with switch-fuse combination,
– low power losses make fuses suitable for compact switchgear and ring main units,
– high current limitation significantly reduces prospective value of short circuit currents and therefore extends insulation live time,
– type tested acc. to IEC 60282-1,

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 be used within voltage range presented in fuse name (i.e. 10/24 kV means safe application between 10kV and 24 kV) please see rated voltage allowable ratings in fuse label area.

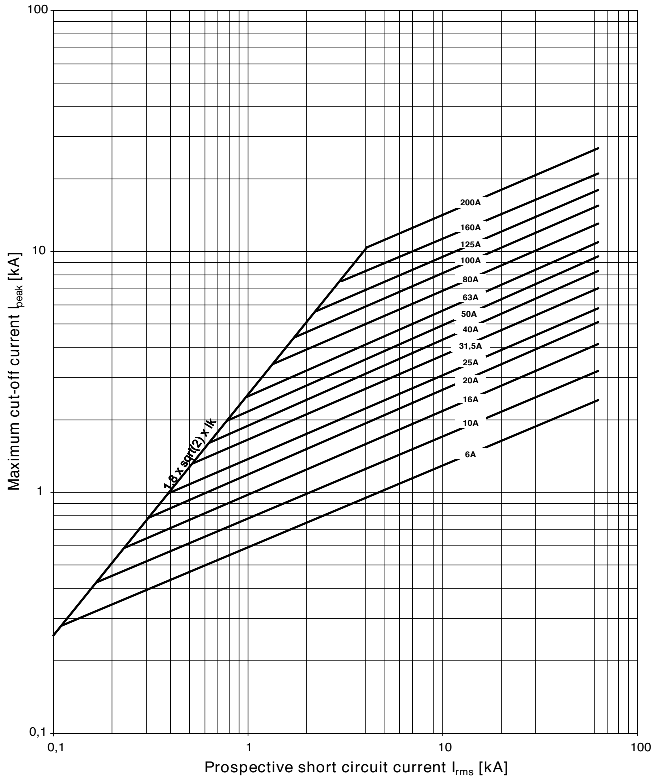
3. Pre-arcing times and cut-off characteristics

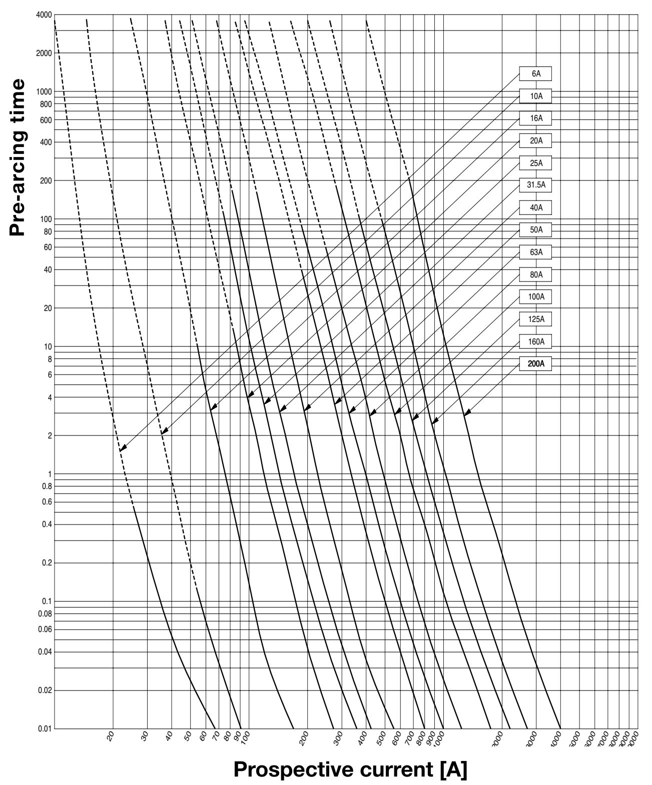
The characteristics are equal for all rated voltages and are recorded for cold fuse link. Dashed sections of the curves indicate an area of uncertain interruption. The tolerance is 10% and it refers to the current.

4. Choice of fuse links

Choice of rated current In

The selection of In for transformer protection for free air circulation is presented in Table 10. When fuses are placed in closed panels the selection should be taken from catalogues of these applications (SafeRing, SafePlus etc.)





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[1)]	315[1)]	2x250[1)]	2x315[1)]					3/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	160	200	250[1)]	315[1)]	2x250[1)]	2x315[1)]			
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160	200	250[1)]	315[1)]	2x250[1)]	2x315[1)]		
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	160	200	2x160	2x200	2x200	6/12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125	160	200	2x160	2x200	
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	125	2x100	2x125		10/17.5
20	6	6	6	10	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	2x100	2x100	10/24
24	6	6	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	125	2x100	
30	6	6	6	6	6	10	10	16	16	16	25	25	25	40	40	2x25	2x40				20/36
36	6	6	6	6	6	10	10	10	16	16	25	25	25	40	40	2x25	2x40	2x40			

1) 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

New smartcode CEF	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	Pre-arcing integral I^2t [A^2s]	Operating integral I^2t [A^2s]	R_0 [mΩ]	D [mm]	Weight [kg]	Old catalogue No. CEF	Old catalogue No. CEF-TCU
Rated voltage: 3/7.2 kV Length "e": 192 mm											
1YMB710713M1611	6	50	35	26	20	300	460.00	65	1.5	1YMB531001M0001	1YMB531851M0001
1YMB710716M1611	10	50	55	16	30	500	120.30	65	1.5	1YMB531001M0002	1YMB531851M0002
1YMB710718M1611	16	50	55	26	120	2000	60.20	65	1.5	1YMB531001M0003	1YMB531851M0003
1YMB710721M1611	25	50	72	24	500	7000	30.10	65	1.5	1YMB531001M0004	1YMB531851M0004
1YMB710725M1611	40	50	100	30	1000	20000	15.30	65	1.5	1YMB531001M0005	1YMB531851M0005
1YMB710727M1611	50	50	190	35	2500	31000	10.40	65	1.5	1YMB531001M0006	1YMB531851M0006
1YMB710729M1611	63	50	190	40	4500	90000	7.80	65	1.5	1YMB531001M0007	1YMB531851M0007
1YMB710731M1811	80	50	250	52	9200	78000	6.20	87	2.6	1YMB531001M0008	1YMB531851M0008
1YMB710733M1811	100	50	275	57	15000	300000	4.40	87	2.6	1YMB531001M0009	1YMB531851M0009
Rated voltage: 3/7.2 kV Length "e": 292 mm											
1YMB710713M2611	6	50	35	26	20	300	460.00	65	2.3	1YMB531034M0001	1YMB531884M0001
1YMB710716M2611	10	50	55	16	30	500	120.30	65	2.3	1YMB531034M0002	1YMB531884M0002
1YMB710718M2611	16	50	55	26	120	2000	60.20	65	2.3	1YMB531034M0003	1YMB531884M0003
1YMB710721M2611	25	50	72	24	500	7000	30.10	65	2.3	1YMB531034M0004	1YMB531884M0004
1YMB710725M2611	40	50	100	30	1000	20000	15.30	65	2.3	1YMB531034M0005	1YMB531884M0005
1YMB710727M2611	50	50	190	35	2500	31000	10.40	65	2.3	1YMB531034M0006	1YMB531884M0006
1YMB710729M2611	63	50	190	40	4500	90000	7.80	65	2.3	1YMB531034M0007	1YMB531884M0007
1YMB710731M2811	80	50	250	52	9200	78000	6.20	87	3.6	1YMB531034M0008	1YMB531884M0008
1YMB710733M2811	100	50	275	57	15000	300000	4.40	87	3.6	1YMB531034M0009	1YMB531884M0009
1YMB710735M2811	125	50	375	76	20000	400000	3.50	87	3.6	1YMB531001M0010	1YMB531851M0010
1YMB710738M2811	160	50	480	101	35000	600000	2.60	87	3.6	1YMB531001M0011	1YMB531851M0011
1YMB710739M2811	200	50	650	107	100000	900000	1.70	87	3.6	1YMB531001M0012	1YMB531851M0012
Rated voltage: 3/7.2 kV Length „e": 367 mm											
1YMB710735M3811	125	50	375	76	20000	400000	3.5	87	4.4	1YMB531034M1010	1YMB531884M1010
1YMB710738M3811	160	50	480	101	35000	600000	2.6	87	4.4	1YMB531034M0011	1YMB531884M0011
1YMB710739M3811	200	50	650	107	100000	900000	1.7	87	4.4	1YMB531034M0012	1YMB531884M0012
Rated voltage: 6/12 kV Length "e": 292 mm											
1YMB711213M2511	6	63	36	46	20	300	665.0	53	1.9	1YMB531042M0001	1YMB531892M0001
1YMB711213M2611	6	63	35	41	20	300	665.0	65	2.3	1YMB531002M0001	1YMB531852M0001
1YMB711216M2511	10	63	65	25	30	500	180.5	53	1.9	1YMB531042M0002	1YMB531892M0002
1YMB711216M2611	10	63	55	33	30	500	180.5	65	2.3	1YMB531002M0002	1YMB531852M0002
1YMB711218M2511	16	63	65	34	120	2000	105.2	53	1.9	1YMB531042M0003	1YMB531892M0003

New smartcode CEF	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	Pre-arcing integral I^2t [A^2s]	Operating integral I^2t [A^2s]	R_0 [mΩ]	D [mm]	Weight [kg]	Old catalogue No. CEF	Old catalogue No. CEF-TCU
Rated voltage: 6/12 kV Length „e": 292 mm											
1YMB711218M2611	16	63	55	32	120	2000	105.2	65	2.3	1YMB531002M0003	1YMB531852M0003
1YMB711219M2511	20	63	83	38	365	5600	70.1	53	1.9	1YMB531042M0004	1YMB531892M0004
1YMB711221M2611	25	63	77	47	500	7000	52.6	65	2.3	1YMB531002M0004	1YMB531852M0004
1YMB711225M2611	40	63	105	52	1000	20000	23.0	65	2.3	1YMB531002M0005	1YMB531852M0005
1YMB711227M2611	50	63	190	70	2500	31000	17.9	65	2.3	1YMB531002M0006	1YMB531852M0006
1YMB711229M2611	63	63	190	78	4500	90000	13.4	65	2.3	1YMB531002M0007	1YMB531852M0007
1YMB711231M2811	80	63	250	82	9200	78000	9.2	87	3.6	1YMB531002M0008	1YMB531852M0008
1YMB711233M2811	100	63	275	84	15000	300000	6.6	87	3.6	1YMB531002M0009	1YMB531852M0009
1YMB711224M2611	31.5	63	100	41	610	12100	30.7	65	2.3	1YMB531002M0014	1YMB531852M0014
1YMB711231M2611	80	63	250	82	9200	78000	9.2	65	2.3	1YMB531002M0021	1YMB531852M0021
1YMB711233M2611	100	63	375	101	15000	300000	6.4	65	2.3	1YMB531002M0022	1YMB531852M0022
1YMB711235M2811	125	63	375	125	20000	400000	5.3	87	3.6	1YMB531043M0010	1YMB531893M0010
Rated voltage: 6/12 kV Length „e": 442 mm											
1YMB711213M4511	6	63	36	46	20	300	665.0	53	2.5	1YMB531047M0001	1YMB531897M0001
1YMB711213M4611	6	63	35	41	20	300	665.0	65	3	1YMB531035M0001	1YMB531885M0001
1YMB711216M4511	10	63	65	25	30	500	180.5	53	2.5	1YMB531047M0002	1YMB531897M0002
1YMB711216M4611	10	63	55	33	30	500	180.5	65	3	1YMB531035M0002	1YMB531885M0002
1YMB711218M4511	16	63	65	34	120	2000	105.2	53	2.5	1YMB531047M0003	1YMB531897M0003
1YMB711218M4611	16	63	55	32	120	2000	105.2	65	3	1YMB531035M0003	1YMB531885M0003
1YMB711219M4511	20	63	83	38	365	5600	70.1	53	2.5	1YMB531047M0004	1YMB531897M0004
1YMB711221M4611	25	63	77	47	500	7000	52.6	65	3	1YMB531035M0004	1YMB531885M0004
1YMB711224M4611	31.5	63	100	41	610	12100	30.7	65	3	1YMB531035M0014	1YMB531885M0014
1YMB711225M4611	40	63	105	52	1000	20000	23.0	65	3	1YMB531035M0005	1YMB531885M0005
1YMB711227M4611	50	63	190	70	2500	31000	17.9	65	3	1YMB531035M0006	1YMB531885M0006
1YMB711229M4611	63	63	190	78	4500	90000	13.4	65	3	1YMB531035M0007	1YMB531885M0007
1YMB711231M4611	80	63	250	82	9200	78000	9.2	65	3	1YMB531035M0021	1YMB531885M0021
1YMB711231M4811	80	63	250	82	9200	78000	9.2	87	5.3	1YMB531035M0008	1YMB531885M0008
1YMB711233M4611	100	63	375	103	15000	300000	6.4	65	3	1YMB531035M0022	1YMB531885M0022
1YMB711233M4811	100	63	275	84	15000	300000	6.6	87	5.3	1YMB531035M0009	1YMB531885M0009
1YMB711235M4611	125	63	375	125	20000	400000	5.3	65	3	1YMB531002M0023	1YMB531852M0023
1YMB711235M4811	125	63	375	125	20000	400000	5.3	87	5.3	1YMB531002M0010	1YMB531852M0010
1YMB711238M4811	160	63	480	170	35000	600000	3.9	87	5.3	1YMB531002M0011	1YMB531852M0011
1YMB711239M4811	200	50	650	174	100000	900000	2.7	87	5.3	1YMB531002M0012	1YMB531852M0012
Rated voltage: 6/12 kV Length „e": 537 mm											
1YMB711235M5611	125	50	375	125	20000	400000	5.3	65	4	1YMB531035M0023	1YMB531885M0023
1YMB711235M5811	125	50	375	125	20000	400000	5.3	87	5.3	1YMB531035M0010	1YMB531885M0010
1YMB711238M5811	160	50	480	170	35000	600000	3.9	87	5.3	1YMB531035M0011	1YMB531885M0011
1YMB711239M5811	200	50	650	174	100000	900000	2.7	87	5.3	1YMB531035M0012	1YMB531885M0012
Rated voltage: 10/17.5 kV Length "e": 292 mm											
1YMB711713M2611	6	20	35	54	20	300	807.0	65	2.3	1YMB531003M0001	1YMB531853M0001
1YMB711716M2611	10	20	55	41	30	500	270.7	65	2.3	1YMB531003M0002	1YMB531853M0002
1YMB711718M2611	16	20	55	67	120	2000	135.4	65	2.3	1YMB531003M0003	1YMB531853M0003
1YMB711719M2611	20	25	83	52.6	365	5600	90.3	65	2.3	1YMB531003M0013	1YMB531853M0013
1YMB711721M2611	25	25	72	64	500	7000	67.7	65	2.3	1YMB531003M0004	1YMB531853M0004
1YMB711724M2611	31.5	25	100	56.7	610	12100	46.0	65	2.3	1YMB531003M0014	1YMB531853M0014
1YMB711725M2611	40	25	210	80	1000	20000	34.7	65	2.3	1YMB531003M0021	1YMB531853M0021
1YMB711725M2811	40	25	100	80	1000	20000	34.5	87	3.6	1YMB531003M0005	1YMB531853M0005
1YMB711727M2611	50	25	210	90	2500	31000	23.1	65	2.3	1YMB531003M0022	1YMB531853M0022
1YMB711727M2811	50	25	210	90	2500	31000	23.1	87	3.6	1YMB531003M0006	1YMB531853M0006
1YMB711729M2811	63	25	210	100	4500	90000	17.3	87	3.6	1YMB531003M0007	1YMB531853M0007
Rated voltage: 10/17.5 kV Length "e": 367 mm											
1YMB711713M3611	6	20	35	54	20	300	807.0	65	2.7	1YMB531036M0001	1YMB531886M0001
1YMB711716M3611	10	20	55	41	30	500	270.7	65	2.7	1YMB531036M0002	1YMB531886M0002
1YMB711718M3611	16	20	55	67	120	2000	135.4	65	2.7	1YMB531036M0003	1YMB531886M0003
1YMB711719M3611	20	25	83	52.6	365	5600	90.3	65	2.7	1YMB531036M0013	1YMB531886M0013
1YMB711721M3611	25	25	72	64	500	7000	67.7	65	2.7	1YMB531036M0004	1YMB531886M0004
1YMB711724M3611	31.5	25	100	56.7	610	12100	46.0	65	2.7	1YMB531036M0014	1YMB531886M0014
1YMB711725M3611	40	25	210	80	1000	20000	34.7	65	2.7	1YMB531036M0021	1YMB531886M0021
1YMB711725M3811	40	25	100	80	1000	20000	34.5	87	4.4	1YMB531036M0005	1YMB531886M0005
1YMB711727M3611	50	25	210	90	2500	31000	23.1	65	2.7	1YMB531036M0022	1YMB531886M0022
1YMB711727M3811	50	25	210	90	2500	31000	23.1	87	4.4	1YMB531036M0006	1YMB531886M0006
1YMB711729M3811	63	25	210	100	4500	90000	17.3	87	4.4	1YMB531036M0007	1YMB531886M0007
1YMB711733M3811	100	25	375	136	15000	300000	9.5	87	4.4	1YMB531038M0001	1YMB531888M0001

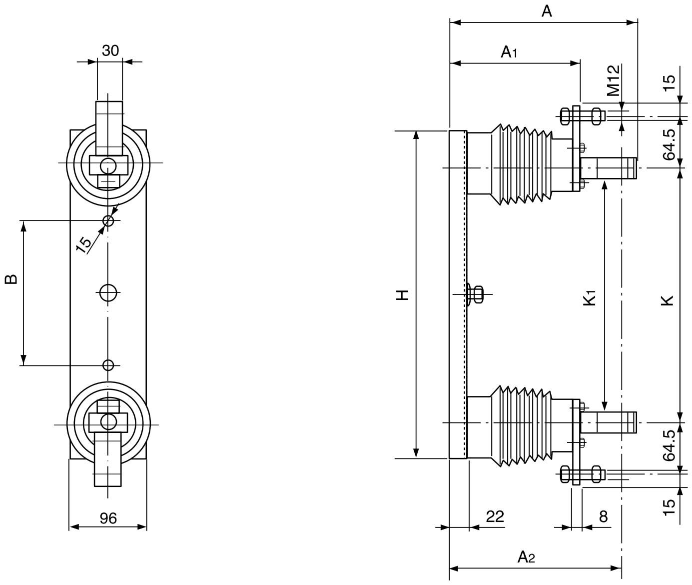
New smartcode CEF	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	Pre-arcing integral I^2t [A^2s]	Operating integral I^2t [A^2s]	R_0 [mΩ]	D [mm]	Weight [kg]	Old catalogue No. CEF	Old catalogue No. CEF-TCU
Rated voltage: 10/17.5 kV Length „e": 442 mm											
1YMB711713M4611	6	20	35	54	20	300	807.0	65	3	1YMB531037M0001	1YMB531887M0001
1YMB711716M4611	10	20	55	41	30	500	270.7	65	3	1YMB531037M0002	1YMB531887M0002
1YMB711718M4611	16	20	55	67	120	2000	135.4	65	3	1YMB531037M0003	1YMB531887M0003
1YMB711719M4611	20	25	83	52.6	365	5600	90.3	65	3	1YMB531037M0013	1YMB531887M0013
1YMB711721M4611	25	25	72	64	500	7000	67.7	65	3	1YMB531037M0004	1YMB531887M0004
1YMB711724M4611	31.5	25	100	56.7	610	12100	46.0	65	3	1YMB531037M0014	1YMB531887M0014
1YMB711725M4611	40	25	210	80	1000	20000	34.7	65	3	1YMB531037M0021	1YMB531887M0021
1YMB711725M4811	40	25	100	80	1000	20000	34.5	87	5.3	1YMB531037M0005	1YMB531887M0005
1YMB711727M4611	50	25	210	90	2500	31000	23.1	65	3	1YMB531037M0022	1YMB531887M0022
1YMB711727M4811	50	25	210	90	2500	31000	23.1	87	5.3	1YMB531037M0006	1YMB531887M0006
1YMB711729M4811	63	25	210	100	4500	90000	17.3	87	5.3	1YMB531037M0007	1YMB531887M0007
1YMB711731M4811	80	25	250	124	9200	78000	13.8	87	5.3	1YMB531003M0008	1YMB531853M0008
1YMB711733M4811	100	25	275	136	15000	300000	9.9	87	5.3	1YMB531003M0009	1YMB531853M0009
Rated voltage: 10/17.5 kV Length "e": 537 mm											
1YMB711731M5811	80	25	250	124	9200	78000	13.8	87	5.3	1YMB531037M0008	1YMB531887M0008
1YMB711733M5811	100	25	275	136	15000	300000	9.9	87	5.3	1YMB531037M0009	1YMB531887M0009
1YMB711735M5811	125	25	375	175	20000	400000	7.9	87	5.3	1YMB531037M0010	1YMB531887M0010
Rated voltage: 10/24 kV Length „e": 442 mm											
1YMB712413M4511	6	63	25	82	20	300	1229.0	53	2.5	1YMB531044M0001	1YMB531894M0001
1YMB712413M4611	6	63	35	91	20	300	1229.0	65	3	1YMB531004M0001	1YMB531854M0001
1YMB712416M4511	10	63	65	48	30	500	360.9	53	2.5	1YMB531044M0002	1YMB531894M0002
1YMB712416M4611	10	63	55	62	30	500	360.9	65	3	1YMB531004M0002	1YMB531854M0002
1YMB712418M4511	16	63	65	63	120	2000	180.5	53	2.5	1YMB531044M0003	1YMB531894M0003
1YMB712418M4611	16	63	55	72	120	2000	180.5	65	3	1YMB531004M0003	1YMB531854M0003
1YMB712419M4511	20	63	83	64	365	5600	120.3	53	2.5	1YMB531044M0004	1YMB531894M0004
1YMB712419M4611	20	63	82	61	365	5600	120.3	65	3	1YMB531004M0011	1YMB531854M0011
1YMB712421M4611	25	63	72	79	500	7000	90.2	65	3	1YMB531004M0004	1YMB531854M0004
1YMB712424M4611	31.5	63	82	98	610	12100	72.2	65	3	1YMB531004M0012	1YMB531854M0012
1YMB712425M4611	40	63	110	106	1000	20000	46.0	65	3	1YMB531004M0005	1YMB531854M0005
1YMB712427M4611	50	63	210	130	2500	31000	30.7	65	3	1YMB531004M0021	1YMB531854M0021
1YMB712427M4811	50	63	210	130	2500	31000	30.7	87	5.3	1YMB531004M0006	1YMB531854M0006
1YMB712429M4611	63	63	250	147	4500	90000	23.0	65	3	1YMB531004M0022	1YMB531854M0022
1YMB712429M4811	63	63	210	147	4500	90000	23.0	87	5.3	1YMB531004M0007	1YMB531854M0007
1YMB712431M4811	80	63	250	165	9200	78000	18.4	87	5.3	1YMB531022M0001	1YMB531872M0001
Rated voltage: 10/24 kV Length „e": 537 mm											
1YMB712431M5611	80	63	250	165	9200	78000	18.4	65	4	1YMB531004M0023	1YMB531854M0023
1YMB712431M5811	80	63	250	165	9200	78000	18.4	87	6.2	1YMB531004M0008	1YMB531854M0008
1YMB712433M5811	100	63	300	186	15000	300000	13.2	87	6.2	1YMB531004M0009	1YMB531854M0009
1YMB712435M5811	125	63	375	234	20000	400000	10.5	87	6.2	1YMB531004M0010	1YMB531854M0010
Rated voltage: 27 kV Length „e": 442 mm											
1YMB712713M4611	6	20	35	91	20	300	1295.0	65	3	1YMB531005M0001	1YMB531855M0001
1YMB712716M4611	10	20	55	80	30	500	451.2	65	3	1YMB531005M0002	1YMB531855M0002
1YMB712718M4611	16	20	55	90	120	2000	225.6	65	3	1YMB531005M0003	1YMB531855M0003
1YMB712721M4811	25	20	72	100	500	7000	112.8	87	3	1YMB531005M0004	1YMB531855M0004
1YMB712725M4811	40	20	110	130	1000	20000	55.6	87	3	1YMB531005M0005	1YMB531855M0005
1YMB712727M4811	50	20	210	130	2500	20000	30.7	87	5.3	1YMB531005M0006	1YMB531855M0006
1YMB712729M4811	63	20	210	147	4500	20000	23.0	87	5.3	1YMB531005M0007	1YMB531855M0007
Rated voltage: 27 kV Length "e": 537 mm											
1YMB712731M5811	80	20	250	210	9200	20000	18.4	87	5.3	1YMB531005M0008	1YMB531855M0008
Rated voltage: 20/36 kV Length "e": 537 mm											
1YMB713613M5611	6	20	35	137	20	300	1860.0	65	4	1YMB531006M0001	1YMB531856M0001
1YMB713616M5611	10	20	55	93	30	500	571.5	65	4	1YMB531006M0002	1YMB531856M0002
1YMB713618M5611	16	20	55	109	120	2000	285.8	65	4	1YMB531006M0003	1YMB531856M0003
1YMB713621M5811	25	20	72	144	500	7000	142.9	87	6.2	1YMB531006M0004	1YMB531856M0004
1YMB713625M5811	40	20	100	176	1000	20000	69.1	87	6.2	1YMB531006M0005	1YMB531856M0005

Legend:

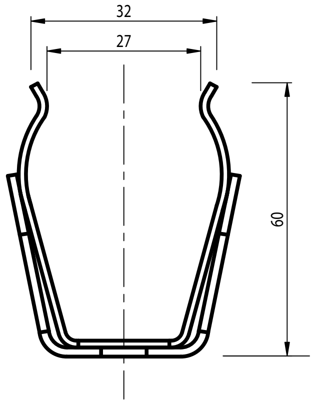
In – rated current
I_1 – rated maximum breaking current
I_3 – rated minimum breaking current
Pw – rated power
Ro – resistance
D – diameter

Remark:
Above table is for reference purpose and is not commercial offer. The present technical data and product availability information should be obtained from our sales representatives.

6. Accessories
Fuse bases type UCE (suitable for CEF, CEF-S, CEF-VT fuses)



Fuse clips

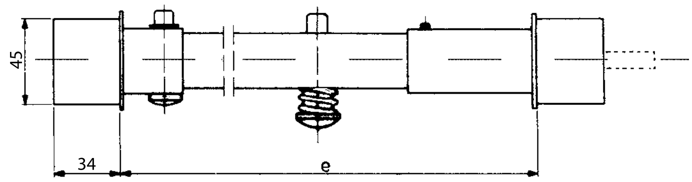


Cat. No. 1YMX000128M0001

Type	Rated voltage	Rated current	Fuse length	Dimensions in mm							Weight	Catalogue No.
	Un [kV]	In [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 3.6/7.2-40.5 kV for test of striker system

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



*) 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]
1YMX053006M0001	75	2.59

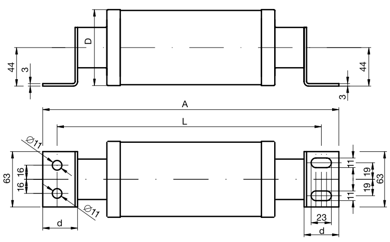
Dimensions in mm	
Clamping range	50 ... 90 mm
Total length (lG)	1500 mm
Insulating clearance (lI)	525 mm
Length (handle) (lH)	780 mm
Insertion depth (lO)	195 mm

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

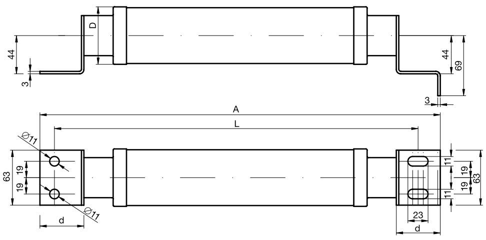
Type	Rated voltage Un [kV]	Rated current In [A]	L/D [mm]	A/d [mm]	Catalogue No.	EAN13 Codes
CEF-BS-B	3,6/7,2	6	305/65	340/40	1YMB531007M0021	5901436020844
CEF-BS-B	3,6/7,2	10	305/65	340/40	1YMB531007M0022	5901436020851
CEF-BS-B	3,6/7,2	16	305/65	340/40	1YMB531007M0023	5901436020868
CEF-BS-B	3,6/7,2	25	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	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

Remark:
BS styles are available on request only.

Dimension CEF-BS-B



Dimension CEF-BS-D



High voltage current limiting
Fuse links type CEF-S

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1. General

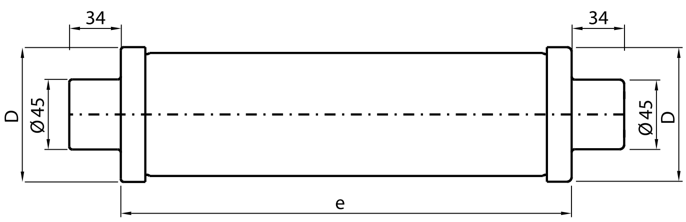
As seen in the data table, high-voltage current limiting fuse links type CEF-S has a minimum current value ($I_{0.1sec}$) which allows the fuse link to interrupt the fault current within 100ms. This ensures very good protection and prevents faults in low-voltage switchgears. The current value for the 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. Ordering table, dimensions and electrical data of CEF-S

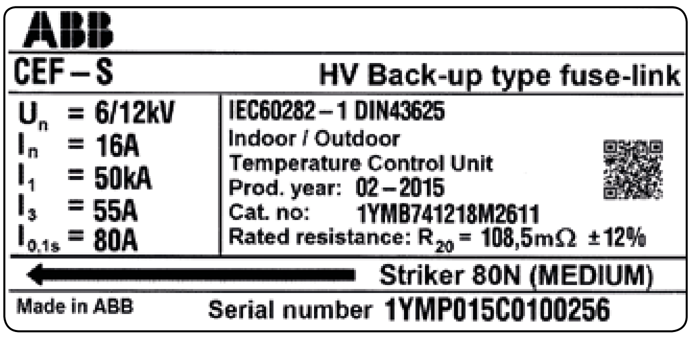
New smartcode CEF	In [A]	I_1 [kA]	I_3 [A]	$I_{0,1s}$ [A]	Pn [W]	Pre-arcing integral I^2t [A^2s]	Operating integral I^2t [A^2s]	R_0 [mΩ]	D [mm]	Weigth [kg]	Catalogue No. CEF-S	Catalogue No. CEF-S-TCU
Rated voltage: 6/12 kV Length „e": 292 mm												
1YMB741216M2611	10	50	55	48	27	20	2520	187.00	65	2.3	1YMB531011M0001	1YMB531861M0001
1YMB741218M2611	16	50	55	80	38	80	2930	108.5	65	2.3	1YMB531011M0002	1YMB531861M0002
1YMB741219M2611	20	50	72	120	39	200	3200	72.3	65	2.3	1YMB531011M0003	1YMB531861M0003
1YMB741221M2611	25	50	72	160	45	390	7400	46.5	65	2.3	1YMB531011M0004	1YMB531861M0004
1YMB741225M2611	40	50	100	240	54	940	17600	24.5	65	2.3	1YMB531011M0005	1YMB531861M0005
1YMB741227M2611	50	50	190	330	70	2030	27000	18.8	65	2.3	1YMB531011M0006	1YMB531861M0006
Rated voltage: 10/24 kV Length "e": 442 mm												
1YMB742416M4611	10	25	55	48	54	20	1450	373.3	65	3	1YMB531012M0001	1YMB531862M0001
1YMB742418M4611	16	25	55	80	67	90	2910	186.6	65	3	1YMB531012M0002	1YMB531862M0002
1YMB742419M4611	20	25	72	120	69	240	3960	124.4	65	3	1YMB531012M0003	1YMB531862M0003
1YMB742421M4611	25	25	72	160	70	340	6140	93.3	65	3	1YMB531012M0004	1YMB531862M0004
1YMB742425M4611	40	25	110	240	122	930	13300	48.8	65	3	1YMB531012M0005	1YMB531862M0005
Rated voltage: 30/40,5 kV Length "e": 537 mm												
1YMB744014M5611	6.3	20	50	43	47	20	2350	927	65	3.1	1YMB531112M0001	1YMB531962M0001
1YMB744016M5611	10	20	66	54	100	30	3000	615	65	3.1	1YMB531112M0002	1YMB531962M0002
1YMB744018M5611	16	20	52	87	121	200	3400	313	65	3.1	1YMB531112M0003	1YMB531962M0003
1YMB744019M5611	20	20	77	122	134	270	4620	207	65	3.1	1YMB531112M0004	1YMB531962M0004
1YMB744021M5611	25	20	134	118	162	300	3880	175	65	3.1	1YMB531112M0005	1YMB531962M0005
1YMB744024M5611	31.5	20	265	202	132	1050	11900	89.56	65	3.1	1YMB531112M0006	1YMB531962M0006
1YMB744025M5811	40	20	172	324	126	2480	36100	60.3	87	6.2	1YMB531112M0007	1YMB531962M0007
1YMB744027M5811	50	20	251	500	132	6600	76800	39.76	87	6.2	1YMB531112M0008	1YMB531962M0008
1YMB744029M5811	63	20	334	655	164	9460	110000	29.7	87	6.2	1YMB531112M0009	1YMB531962M0009

Legend:

In	rated current
I_1	rated maximum breaking current
I_3	rated minimum breaking current
$I_{0,1s}$	minimal breaking current within 100 ms
Pw	rated power
R_0	resistance
D	diameter

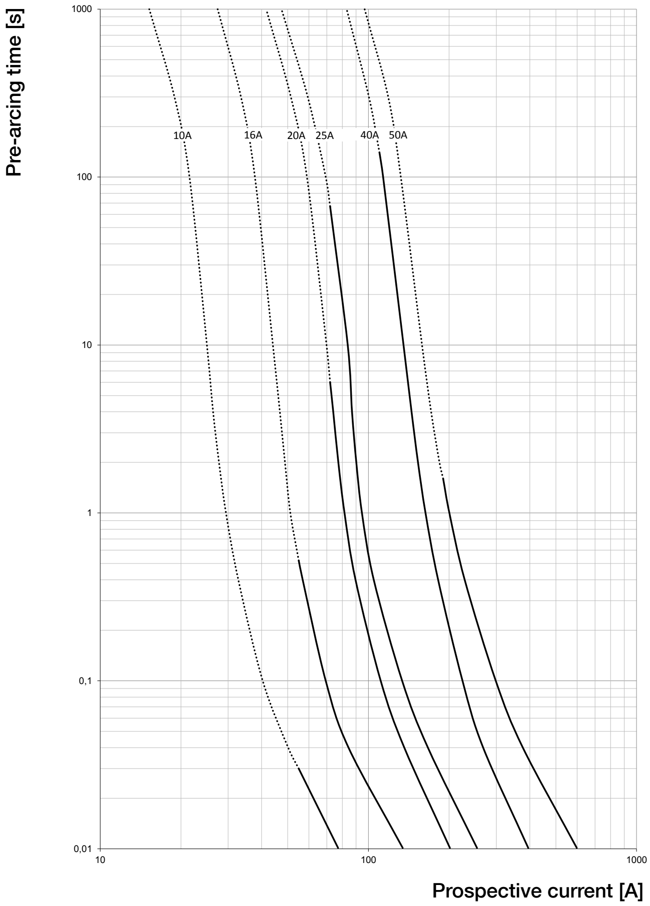


Nameplate

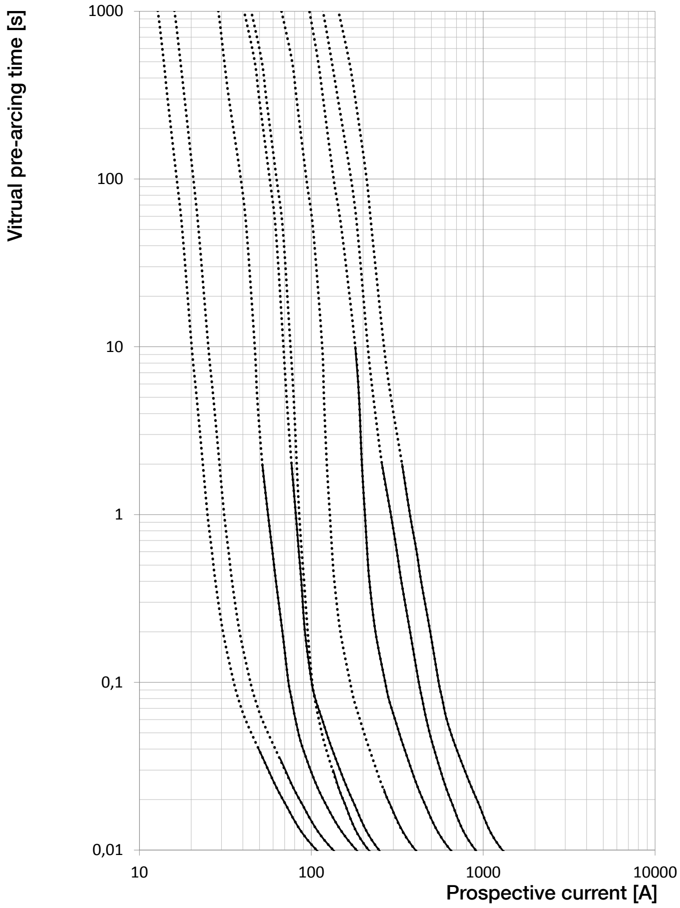


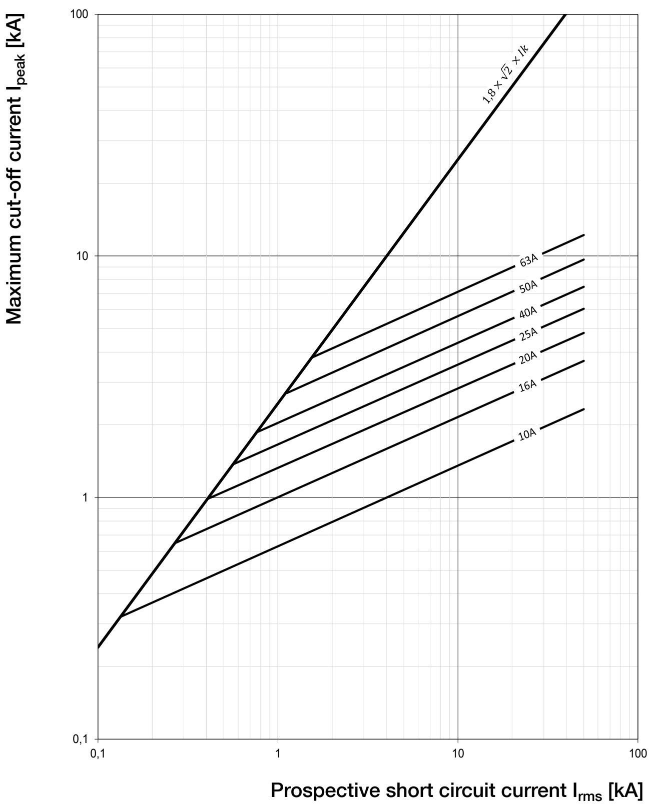
3. Time-current characteristics

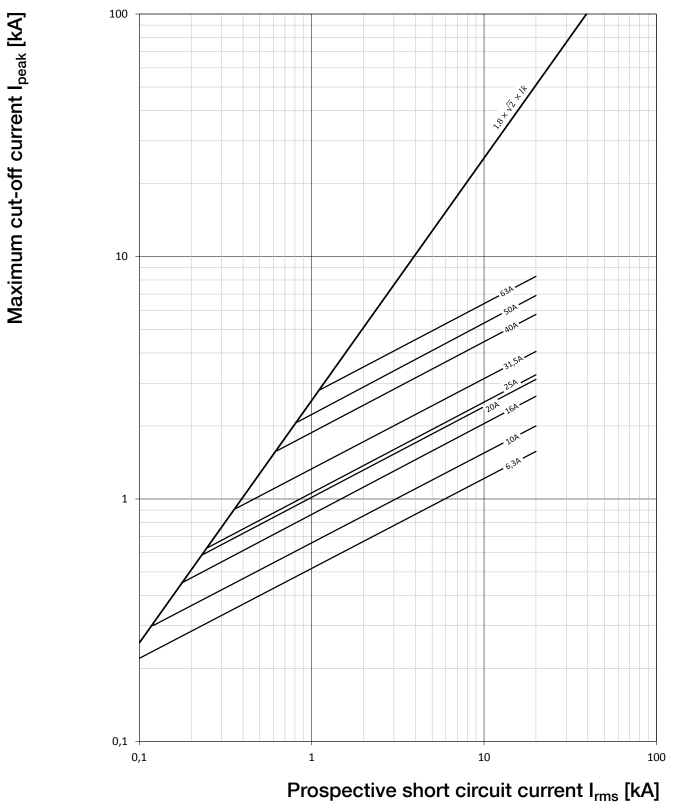
Characteristics for 12&24 kV fuses



Characteristics for 30/40.5 kV fuses







Melting times

The presented curves refer to indicated ranges of voltages, i.e. 12/24 and 30/40.5 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	800	1000	1250	1600	2000	2500	3000	
	Fuse link rating I_n [A]																			
3	16	25	40	50																6/12
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										10/24
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								
30	6.3*	6.3*	6.3*	6.3*	6.3	10	16	16	20	40	40	40	40	40	40	50	63	63		30/40.5
36	6.3*	6.3*	6.3*	6.3*	6.3	6.3	10	16	16	20	40	40	40	40	40	50	50	63	63	
38.5	6.3*	6.3*	6.3*	6.3*	6.3*	6.3	10	16	16	20	20	40	40	40	40	40	50	50	63	
40.5	6.3*	6.3*	6.3*	6.3*	6.3*	6.3	10	16	16	20	20	40	40	40	40	40	50	50	63	
Max. gG fuse link at LV side [A]	40	80	125	160	160	200	250	250	300	400	400	800	1000	1000	1000	1000	1250	1250	1250	

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

– Maximum long-lasting transformer overload – 120%,
– Magnetizing inrush current for transformers up and including 630kVA – 12 x I_n during 100ms,
– Magnetizing inrush current for transformers above 630kVA – 10 x I_n during 100ms,
– Standard ambient working conditions of fuses,
– For ratings marked with "*" transformer maximum short-circuit current at LV side, transferred to HV side, is below fuse link minimum breaking current I_3.

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. The CEF-S fuse links fulfill Swedish requirements (§17; fuse with cut off time within 0.1 seconds "Sverigesäkring") and offer very good protection against faults in the low voltage side of distribution transformers, without necessity of using LV fuses.

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 se-lected 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	800	1000	1250	1600	2000	2500	3000
	Fuse link power dissipation at transformer rated current [W]																		
3	3.4	6.7	7	10.4															
5	2.3	3.3	5.4	4.5	7	9.6													
6	1.6	3.4	5.1	6.7	4.9	8	10.4												
10	0.6	2.3	2.8	3.3	5.1	6.1	4.5	7	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	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	9.3	10.2	15.9								
22	0.2	0.9	2.1	3.7	2.8	4.6	4.8	7.4	11.6	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							
30	0.7	2.0	3.9	6.3	9.2	13.6	10.8	15.8	17.8	7.7	11.3	16.7	25.0	36.3	52.6	57.3	70.3	102.5	
36	0.5	1.5	2.8	4.6	6.8	10.2	14.6	11.6	17.2	19.5	8.3	12.3	18.4	26.8	38.8	42.3	61.4	75.3	102.5
38.5	0.5	1.3	2.5	4.1	6.0	9.2	13.0	10.4	15.3	17.4	25.4	10.9	16.4	23.9	34.7	52.4	54.9	79.9	91.4
40.5	0.5	1.2	2.3	3.8	5.5	8.4	11.9	9.5	14.1	16.0	23.3	10.0	15.1	22.0	31.9	48.1	50.4	73.3	83.9

High voltage current limiting
Fuse links type CEF-VT

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2. Overvoltages 21
3. Choice of fuse links 21
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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. 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:

- unified voltage ratings for more application flexibility,
- integrated striker pin with temperature control unit (TCU) to prevent overheating in installation place
- overload spots control internal arc initiation and determine outstanding temperature performance
- single fuse version for both indoor and outdoor operating conditions
- narrow tolerance of resistance for better fuse synchronizing in three phase networks
- graved fuse data for long term fuse recognition
- welded current path secures stable electrical contacts with active breaking elements,
- full range protection in application with switch-fuse combination,
- low power losses make fuses suitable for compact switchgear and ring main units,
- high current limitation significantly reduces prospective value of short circuit currents and therefore extends insulation live time,
- type tested acc. to IEC 60282-1,

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. The CEF-VT fuse link can be safely used for the system line voltage of 7.2/12, 10/17.5 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.

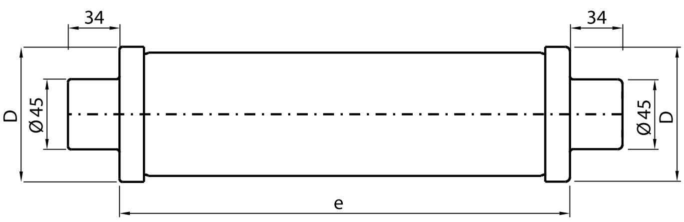
Voltage transformer fuses do not protect a voltage transformer against overloading.

4. Ordering table, technical data and dimensions of CEF-VT

New smartcode CEF-VT	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	Striker pin force [N]	R_0 [mΩ]	D [mm]	Weight [kg]	Catalogue number CEF-VT	Catalogue number CEF-VT-TCU
Rated voltage: 6/12 kV Length „e": 192 mm										
1YMB751209M1501	2	63	27	7.4	-	3142.0	53	1.5	1YMB531048M0001	
1YMB751209M1511	2	63	27	7.4	80N	1340.0	53	1.5	1YMB531048M0002	1YMB531898M0002
1YMB751214M1511	6.3	63	41	18	80N	325.0	53	1.3	1YMB531048M0003	1YMB531898M0003
Rated voltage: 6/12 kV Length „e": 292 mm										
1YMB751209M2501	2	63	27	7.4	-	1500.0	53	1.6	1YMB531049M0001	
1YMB751209M2511	2	63	27	7.4	80N	1340.0	53	1.6	1YMB531049M0002	1YMB531899M0002
1YMB751214M2511	6.3	63	41	18	80N	325.0	53	1.9	1YMB531049M0003	1YMB531899M0003
Rated voltage: 10/17.5 kV Length "e": 192 mm										
1YMB751714M1501	6.3	63	43	23	-	428.0	53	1.5	1YMB531045M0003	
1YMB751714M1511	6.3	63	43	23	80N	428.0	53	1.5	1YMB531045M0004	
Rated voltage: 15/24 kV Length "e": 292 mm										
1YMB752409M2501	2	31.5	32	17	-	3142.0	53	1.6	1YMB531050M0001	
1YMB752414M2511	6.3	31.5	46	18	80N	600.0	53	1.9	1YMB531050M0003	1YMB531900M0003
Rated voltage: 15/24 kV Length "e": 442 mm										
1YMB752409M4501	2	31.5	32	17	-	3142.0	53	2.4	1YMB531046M0001	
1YMB752414M4511	6.3	31.5	46	35	80N	600.0	53	2.5	1YMB531046M0003	1YMB531896M0003

Legend:

In rated current
I_1 rated maximum breaking current
I_3 rated minimum breaking current
Pw rated power
R_0 resistance
D diameter



High voltage current limiting
Fuse links for MOTOR circuit applications type CMF/CMF-TCU

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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 guaranties excellent ability to withstand repeated motor starting conditions,
- low overvoltages,
- 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, technical data and dimensions of CMF/CMF-TCU type BS

Type	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	R_0 [mΩ]	D [mm]	Weight [kg]	Catalogue No. CMF	Catalogue No. CMF-TCU
Rated Voltage 3.6 kV Length „e": 292 mm									
CMF	100	50	275	49	3.2	65	2.3	1YMB531028M0001	1YMB531878M0001
CMF	160	50	400	75	1.9	65	2.3	1YMB531028M0002	1YMB531878M0002
CMF	200	50	500	75	1.4	87	2.6	1YMB531028M0003	1YMB531878M0003
CMF	250	50	760	90	1.0	87	3.8	1YMB531028M0004	1YMB531878M0004
CMF	315RC280*	50	900	122	0.8	87	3.8	1YMB531028M0005	1YMB531878M0005
Rated Voltage 7.2 kV Length „e": 442 mm									
CMF	63	50	175	45	8.5	65	3.0	1YMB531029M0001	1YMB531879M0001
CMF	100	50	275	67	4.9	65	3.0	1YMB531029M0002	1YMB531879M0002
CMF	160	50	400	119	2.9	65	3.0	1YMB531029M0003	1YMB531879M0003
CMF	200	50	500	118	2.1	87	5.3	1YMB531029M0004	1YMB531879M0004
CMF	250	50	800	142	1.5	87	5.3	1YMB531029M0005	1YMB531879M0005
CMF	315RC280*	50	950	193	1.2	87	5.3	1YMB531029M0006	1YMB531879M0006
Rated Voltage 12 kV Length „e": 442 mm									
CMF	63	50	190	77	13.5	65	3.0	1YMB531030M0001	1YMB531880M0001
CMF	100	50	275	103	6.6	87	5.3	1YMB531030M0002	1YMB531880M0002
CMF	160	50	480	155	3.9	87	5.3	1YMB531030M0003	1YMB531880M0003
CMF	200	50	560	173	2.7	87	5.3	1YMB531030M0004	1YMB531880M0004

Legend:

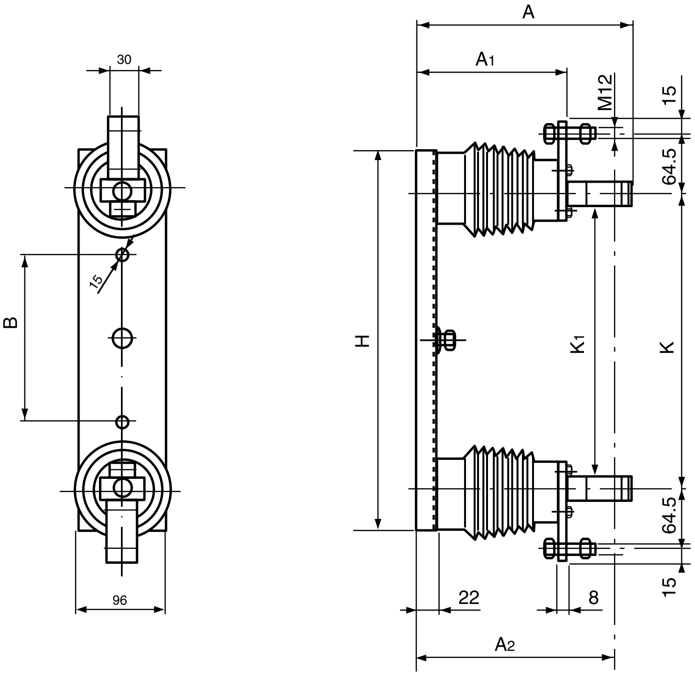
In	rated current
I_1	rated maximum breaking current
I_3	rated minimum breaking current
Pw	rated power
R_0	resistance
D	diameter

* fuse-link with time-current characteristic typical for 315A fuses, but with maximum rated current 280A

3. Ordering table of UCM

Type	Rated voltage Un [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, technical data and dimensions of CMF/CMF-TCU type BS

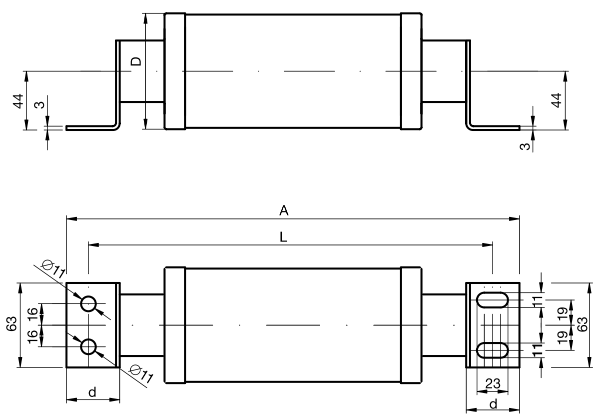
Type	In [A]	I_1 [kA]	I_3 [A]	Pn [W]	R_0 [mΩ]	D [mm]	A/d [mm]	Weight [kg]	Catalogue No.
Rated voltage: 3.6 kV Length „L": 400 mm									
CMF-BS-C	100	50	275	49	3.2	65	440/40	2.3	1YMB531031M0021
CMF-BS-C	160	50	400	75	1.9	65	440/40	2.3	1YMB531031M0022
CMF-BS-C	200	50	500	75	1.4	87	440/40	2.6	1YMB531031M0023
CMF-BS-C	250	50	760	90	1.0	87	440/40	3.8	1YMB531031M0024
CMF-BS-C	315RC280*	50	900	122	0.8	87	440/40	3.8	1YMB531031M0025
Rated voltage: 7,2 kV Length „L": 553 mm									
CMF-BS-B	63	50	175	45	8.5	65	590/40	3.0	1YMB531032M0021
CMF-BS-B	100	50	275	67	4.9	65	590/40	3.0	1YMB531032M0022
CMF-BS-B	160	50	400	119	2.9	65	590/40	3.0	1YMB531032M0023
CMF-BS-B	200	50	500	118	2.1	87	590/40	5.3	1YMB531032M0024
CMF-BS-B	250	50	800	142	1.5	87	590/40	5.3	1YMB531032M0025
CMF-BS-B	315RC280*	50	950	193	1.2	87	590/40	5.3	1YMB531032M0026
Rated voltage: 12 kV Length „L": 553 mm									
CMF-BS-B	63	50	190	77	13.5	65	590/40	3.0	1YMB531033M0021
CMF-BS-B	100	50	275	103	6.6	87	590/40	5.3	1YMB531033M0022
CMF-BS-B	160	50	480	155	3.9	87	590/40	5.3	1YMB531033M0023
CMF-BS-B	200	50	560	173	2.7	87	590/40	5.3	1YMB531033M0024

Legend:

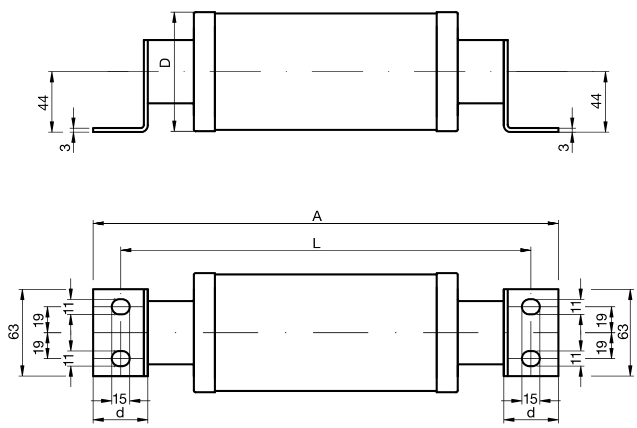
In rated current
I_1 rated maximum breaking current
I_3 rated minimum breaking current
Pw rated power
R_0 resistance
D diameter

* fuse-link with time-current characteristic typical for 315A fuses, but with maximum rated current 280A

Dimension CMF-BS-B

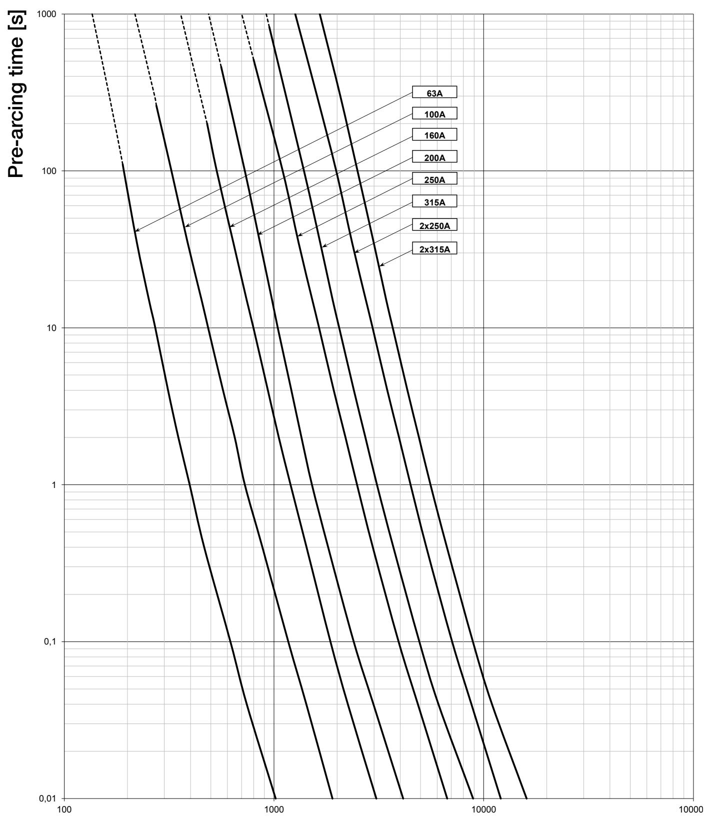


Dimension CMF-BS-C

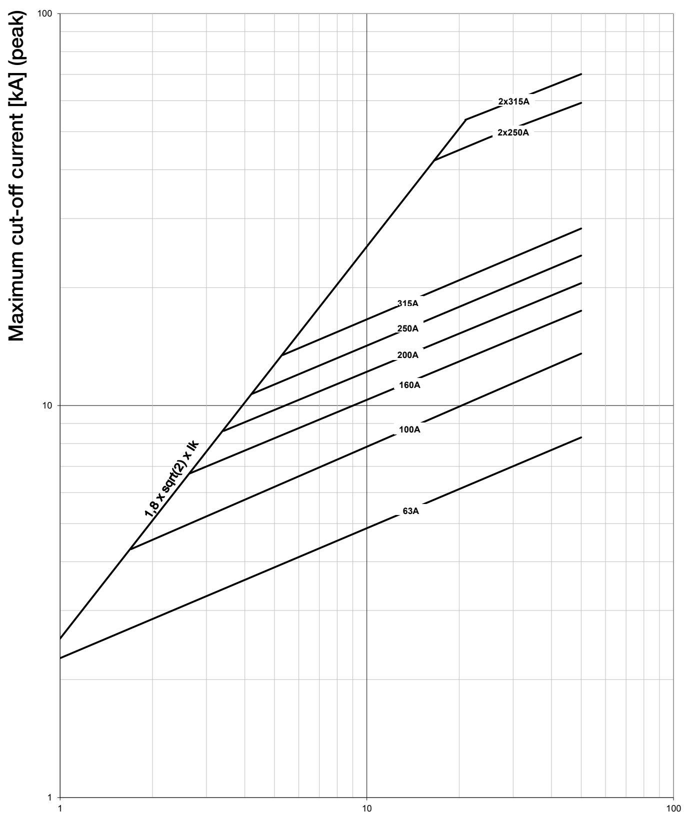


5. Pre-arcing times

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



6. Current limitation



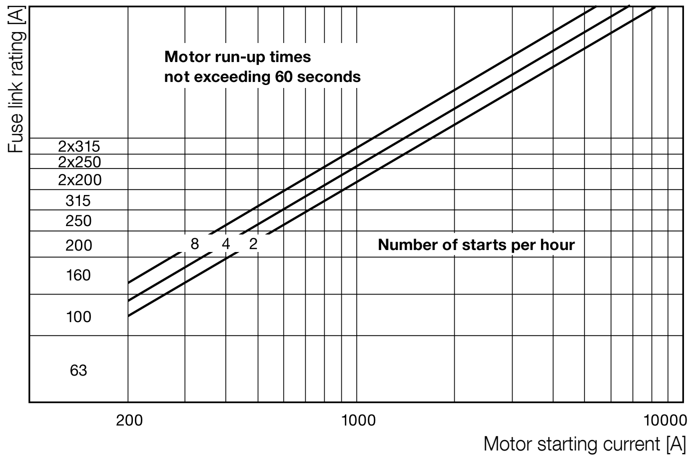
Remarks:
1. Characteristics show the average melting time as a function of the prospective current and are recorded from fuse link cold conditions.
2. The deviation of +/-10% refers to the current for single fuse links per phase and deviation of +/-20% refers to double fuse links per phase.
3. The characteristics are valid for rated voltages 3.6 kV, 7.2 kV and 12 kV.
4. Broken line indicates the uncertain interrupting zone.

7. Choice of fuse links

Choice of rated current In

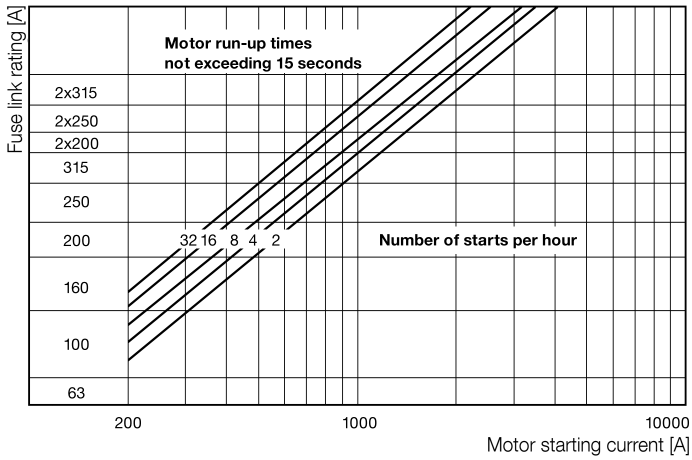
The minimum permissible current rating of the fuse links for motor protection may be determined from the selection charts I, II and III (see charts to the right). These three charts are for run-up times of 6, 15 and 60 seconds respectively.

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.



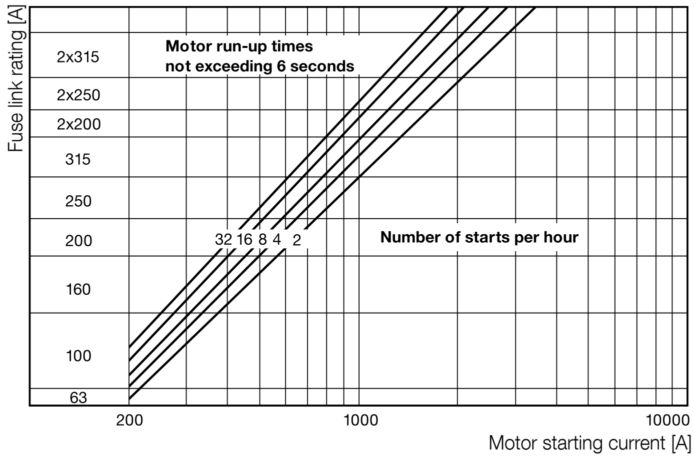
Selection procedure:

- 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



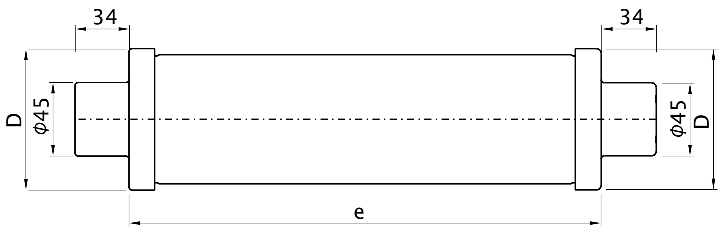
8. The K-factor

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.

9. Data and dimensions CMF

Un	In	K*)	Minimum I² x t	MaximalI² x t
[kV]	[A]	–	[A²xs]	[A²xs]
3.6	100	0.75	1.4×10^4	17×10^4
	160	0.7	3.8×10^4	50×10^4
	200	0.7	7.6×10^4	71×10^4
	250	0.6	14×10^4	115×10^4
	315RC280	0.6	21×10^4	180×10^4
7.2	63	0.75	0.48×10^4	6.5×10^4
	100	0.75	1.40×10^4	18×10^4
	160	0.	3.8×10^4	54×10^4
	200	0.7	7.6×10^4	75×10^4
	250	0.6	14×10^4	120×10^4
	315RC280	0.6	21×10^4	220×10^4
12	63	0.75	0.48×10^4	11×10^4
	100	0.75	1.4×10^4	20×10^4
	160	0.7	3.8×10^4	70×10^4
	200	0.7	9.3×10^4	91×10^4

*) The K-factor is referred to the average value of current.



Voltage Transformer Fuses
Indoor fuse links WBP

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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 fuse links can be operated under the following environmental conditions.

	Type of fuse links WBP
Ambient air temperature	from -5 °C up to +40 °C
Relative humidity	up to 95%

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.

WBP	–	6
Indoor Fuse link type		**Rated Voltage** **6** – 7.2 kV **10** – 12 kV **20** – 24 kV **30** – 36 kV

4.2 Indoor fuse bases numbering system

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

PBPM	–	6
Fuse base type		**Rated Voltage** **6 –** 7.2 kV **10 –** 12 kV **20 –** 24 kV **30 –** 36 kV

5. Compliance with standards

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

– European Standard PN-EN 60282-1.

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

– European Standard PN-EN 60282-1.

6. How to order

6.1 Ordering table WBP

Type	Rated voltage [kV]	Rated current [A]	Length e [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 WBP	-	-	-		1YMB411002M0001	-

6.2 Ordering table fuse bases

Type	Rated voltage [kV]	Post insulators	Application	Fuse length e [mm]	Catalogue No.
PBPM-6	7.2	epoxy	indoor	210	1YMB311101M0001
PBPM-10	12	epoxy	indoor	250	1YMB311101M0002
PBPM-20	24	epoxy	indoor	310	1YMB311101M0007
PBPM-30	36	epoxy	indoor	385	1YMB311101M0004

Order by specyfying 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 [1]	Rated voltage	Frequency	Rated current	Rated breaking current	Rated breaking capacity	Overvoltages	Weight	Resistance		Fuse base type
	Un	f	In	I_1	S_1	U_{TRV}		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

[1] Insulating tube is made from glass (WBP)

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 in an enclosed housing and/or similar equipment characterized by limited heat dissipation (stabilized ambient air temperature exceeds +40 °C), the value of the nominal current should be reduced.

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	20	23	WBP-6
PBPM-10	12		75	85	28	32	WBP-10
PBPM-20	24		125	145	50	60	WBP-20
PBPM-30	36		170	195	70	80	WBP-30

PBPM – an indoor fuse base with resin insulators

Recommendation of fuse links selection for MV voltage transformer protection

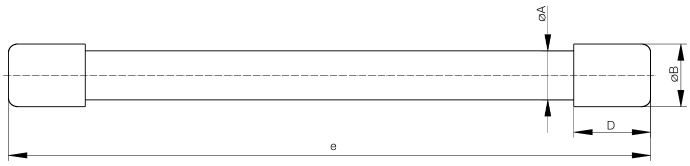
ABB Sp. z o. o. recommends using instrument transformer fuse element type WBP from our production portfolio as protection for ABB's voltage transformers types UMZ and UDZ equipped with a fuse holder. The use of instrument transformer fuses has two main functions: to protect distribution equipment when 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 √3 kV, fuse link type WBP-10, with a rated voltage is 12 kV should be selected.

* 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 then 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

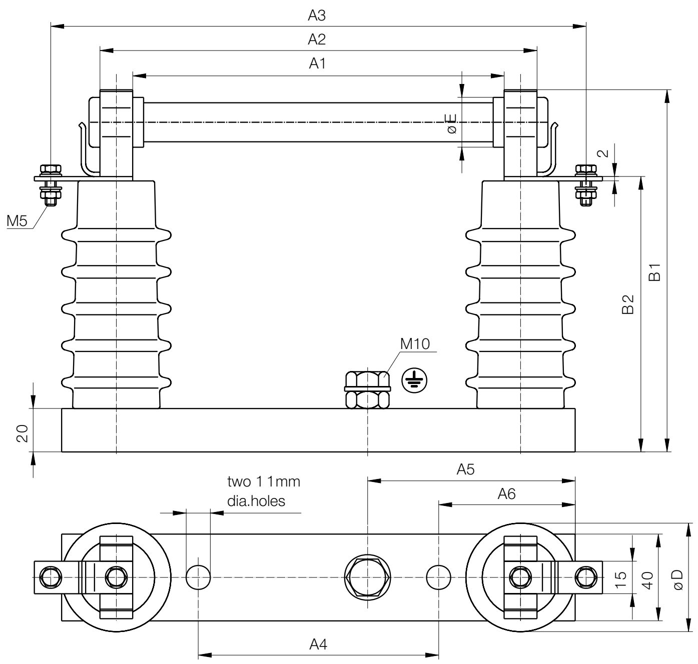
Dimensional drawing of WBP type fuse links



Notes:
Deviations of dimensions with no tolerance specified shall be within ±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

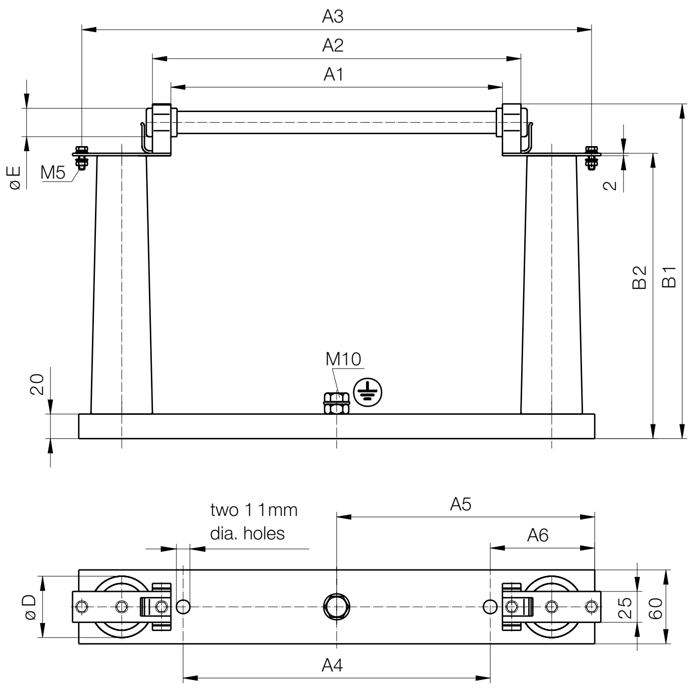
Dimensional drawing of PBPM-6....



Notes:
Deviations of dimensions with no tolerance specified shall be within ±3%.

Fuse base type	Dimensions [mm]									
	A1	A2	A3	A4	A5	A6	B1	B2	ØD	ØE
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...



Notes:
Deviations of dimensions with no tolerance specified shall be within ±3%.

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

Indoor Railway DC Fuses
type WBT

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1. Features

- simple design,
- 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 x 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°C to +50°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°C to +50°C,
- in ambient air with are relative humidity of 95% at a temperature of +20°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.

WBTI	-	3	/	3
Fuse link type		Rated voltage		Rated current

TBT2	-	3	/	20
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	Applications
WBTI-3/3 to 20 WBTI-3/25 to 50 WBTI-3/80	Protection against the effects of short-circuits and overloads in the electric circuits of railway traction substation equipment.
WBTI-3/3 to 20 WBTI-3/25 to 50	Protection against the effects of short circuits and overload in the electric circuits of traction vehicles, railcoach space--heating equipment and electric locomotive.
WBTG-3/3; 4; 6 WBTG-3/3-I	Protection against the effects of short circuits and overloads in electric single and multi-voltage circuits of rail coach space--heating equipment.
WBTGI-3/10; 16; 20	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	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	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.

Table 2.

Product type	Compilance 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-E-06172 in the scope specifi ed above.

Fuse type	Fuse base type suitable for selected fuse types
WBTI-3/3; WBTI-3/6; WBTI-3/10; WBTI-3/16; WBTI-3/20	PBWMI-6/20, TBT2-3/20 i 50,TBTS2-3/20 i 50, TBTS 2-3/20,TBT2-3/20
WBTI-3/25; WBTI-3/32; WBTI-3/40	PBWMI-6/40,TBT2-3/20 i 50,TBTS2-3/20 i 50,TBT2-3/50
WBTI-3/50	TBT2-3/20 i 50,TBTS2-3/20 i 50,TBT2-3/53
WBTI-3/80	PBWMI-10/100-1
WBTGI-3/10; WBTGI-3/16; WBTGI-3/20	TBTG1A-3/15
WBTG-3/3-I	PBPM-6
WBTG-3/3; WBTG-3/4; WBTG-3/6	TBTG1-3/6
WBTS-3/0,6; WBTS-3/1	TBTS1-3/1
WBT-1,5/3; WBT-1,5/15; WBT-1,5/40	PBT-1,5/40

Other configurations should be agreed with manufacturer.

General technical data of fuse links for traction applications

Table 3.

Fuse link type	Highest operating voltage Un [kV] DC	Rated current acc PN-E-06172:1999-14 In [A] DC	Rated current acc UIC-552 In [A] DC	Switching overvolt. U_{TRV} [kV]	Rated breaking current I_1 [kA]	Weight [kg]	Resistance Min. [mΩ]	Resistance Max [mΩ]
WBTI-3/3		3	3.5				516.6	631.4
WBTI-3/6		6	7				189	231
WBTI-3/10		10	10			1.5	130.5	159.5
WBTI-3/16		16	16				64.8	79.2
WBTI-3/20	3.750[1]	20	20	<12	31.5		41.4	50.6
WBTI-3/25		25	25				33.3	40.7
WBTI-3/32		32	32			2.3	28.8	35.2
WBTI-3/40		40	36				20.7	25.3
WBTI-3/50		50	48				15.8	19.25
WBTI-3/80		80	-			4.6	8.73	10.67

[1] 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 that 0.5% at an ambient temperature of t = 20°C ± 2°C.

Fuse link type	Highest operating voltage Un [kV] DC	Rated current acc PN-E-06172:1999 In [A] DC	Rated current acc UIC-552 In [A] DC	Switching overvolt. U_{TRV} [kV]	Rated breaking current I_1 [kA]	Weight [kg]	Resistance Min. [mΩ]	Resistance Max. [mΩ]
WBTGI-3/10		10	10				137.7	168.3
WBTGI-3/16	3.750	16	16	<12	31.5	0.65	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
WBTG-3/3		3	3				569.7	696.3
WBTG-3/4	4	3.5	4	<12	40	0.22	459	561
WBTG-3/6		6	6				300.6	367.4
WBTS-3/0.6	4	0.6	-	<12	40	0.08	42(Ω)	51.3(Ω)
WBTS-3/1		1	-				1710	2090
WBT-1.5/3		3	-			0.5	234	316
WBT-1.5/15	1950	15	-	<6	50		28.2	38.2
WBT-1.5/40		40	-			1.25	11.3	15.3

General technical data of fuse boards

Table 4.

Fuse board type; Fuse base 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]
PBWMI-6/20	7.2	20	35[1]	1	4.9
PBWMI-6/50		40			5
TBT2-3/20		20			5.5
TBT2-3/20 & 50[2]		20&50		2	5.65
TBT2-3/50		50			5.8
TBTS2-3/20	4	20	10		7.0
TBTS2-3/20 & 50		20&50		2	7.3
TBTG1A-3/15		20		1	1.15
TBTG1-3/6		6			0.85
TBTS1-3/1	4	1	10	1	0.35
PBT-1.5/40	1.9	40	27[1] 35[3]	1	3.6
PBWMI-10/100-1	12	100	-	1	5.6

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

[1] AC contact-to-contact insulation test voltage.

[2] 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.

[3] AC earth insulation test voltage.

9. Appendices

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

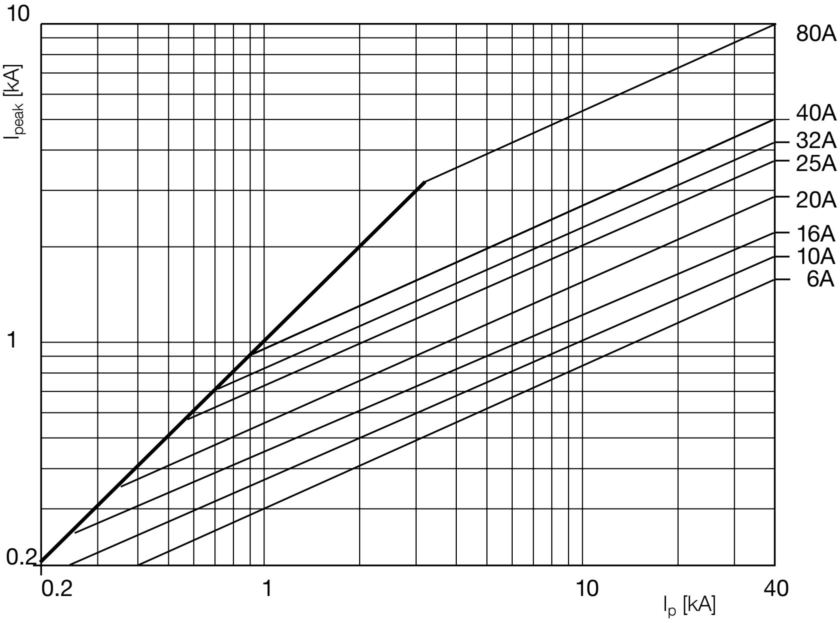


Fig. 2 Time-current characteristics for fuse link types WBTI-3 ...
Current value deviations for any average pre-arcing period value as read from the diagram are presented within ±20%

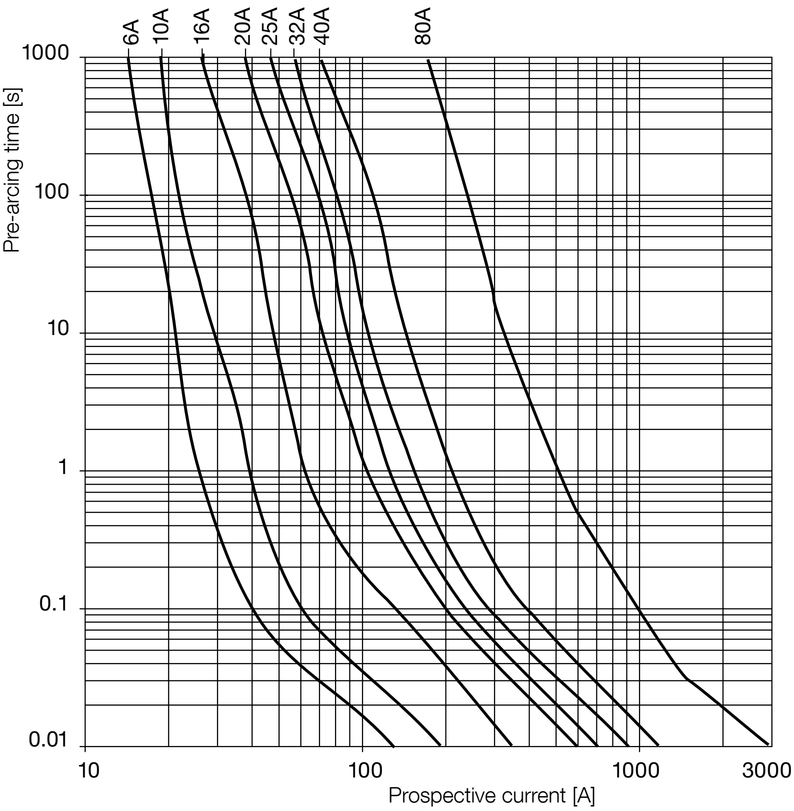


Fig. 3 Cut-off current characteristics fuse link types WBTGI-3 ...

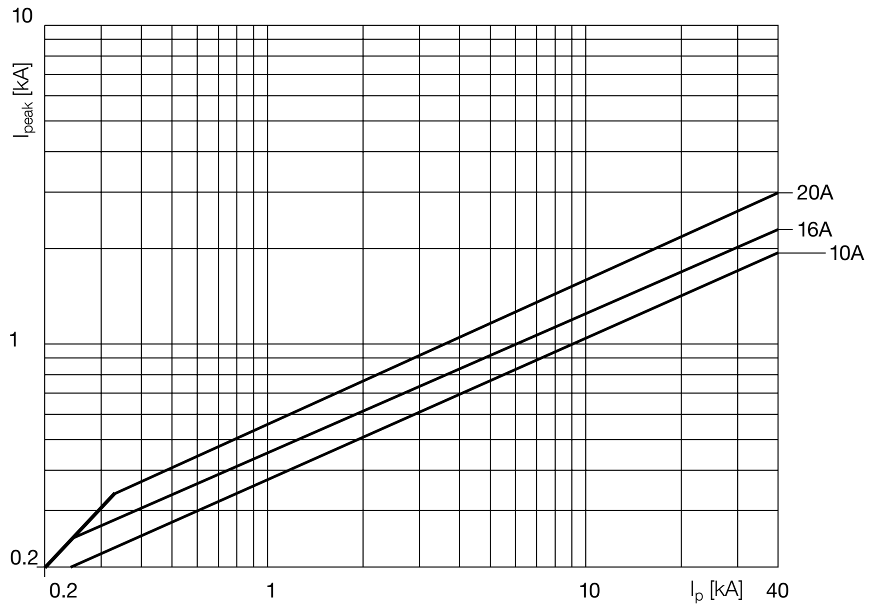


Fig. 4 Time-current characteristics for fuse link types WBTGI-3 ...
Current value deviations for any average pre-arcing period value as read from the diagram are presented within ±20%

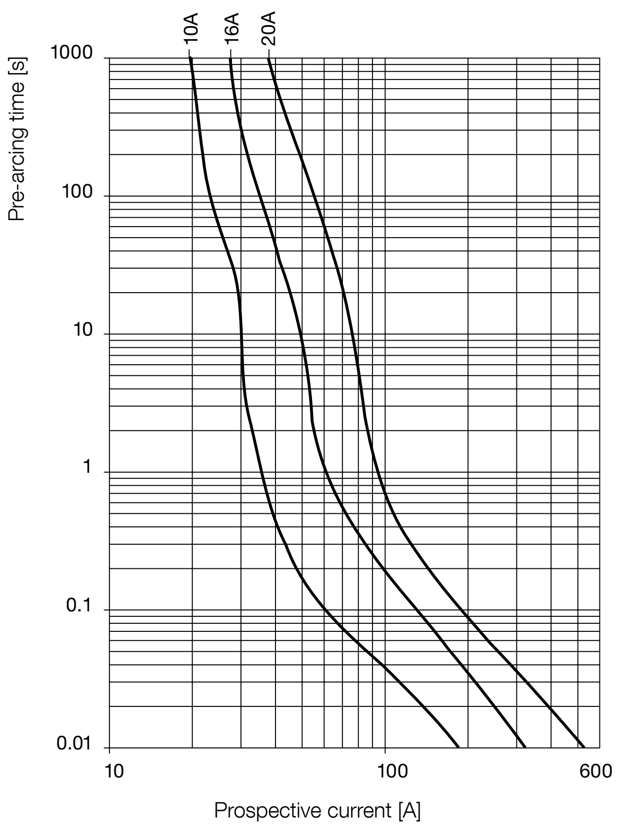


Fig. 5 Cut-off current characteristics for fuse link types
WBTG-3/3; 4; 6... and WBTG-3/3-I

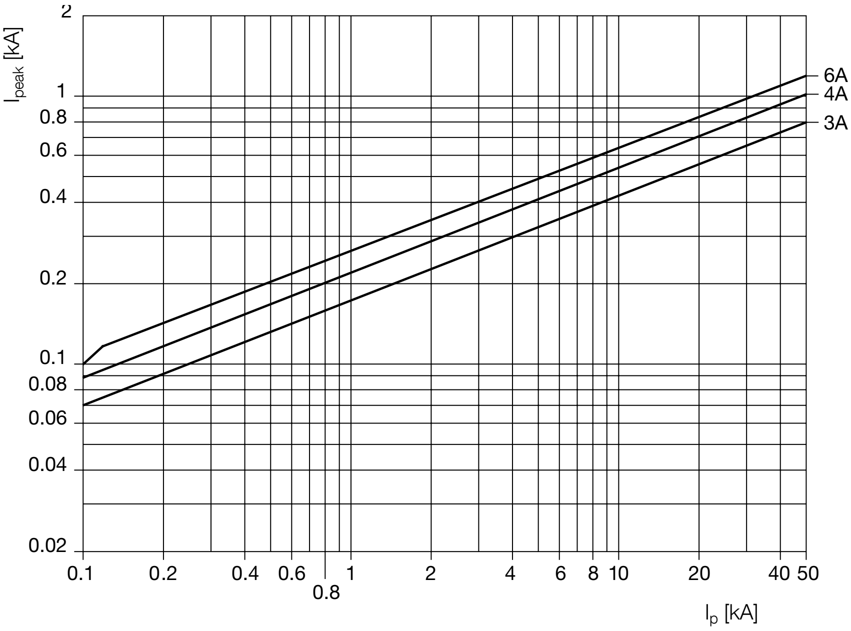


Fig. 6 Time-current characteristics for fuse link types
WBTG-3/3; 4; 6... and WBTG-3/3-I.
Current value deviations for any average pre-arcing period value as read from the diagram are presented within ±20%.

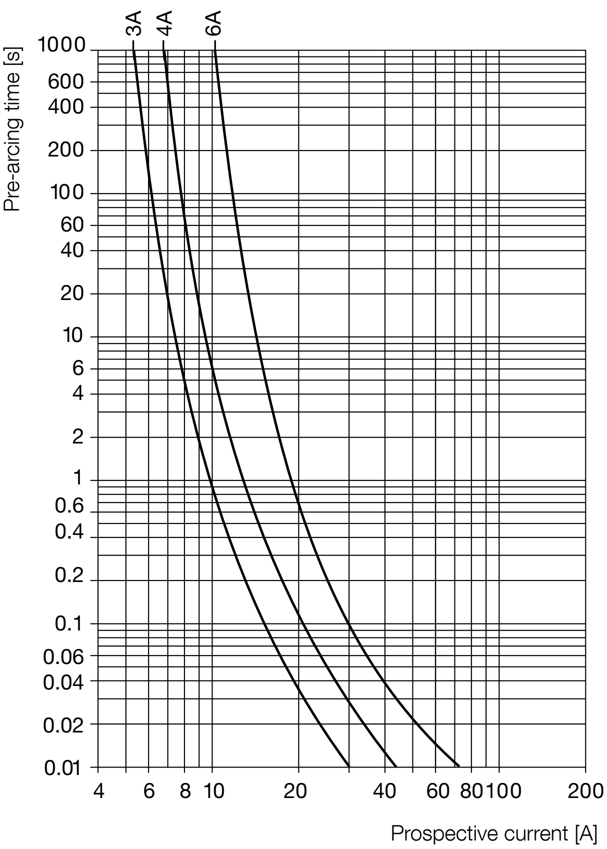


Fig. 7 Cut-off current characteristics for fuse link types WBTS-3/0.6; 1

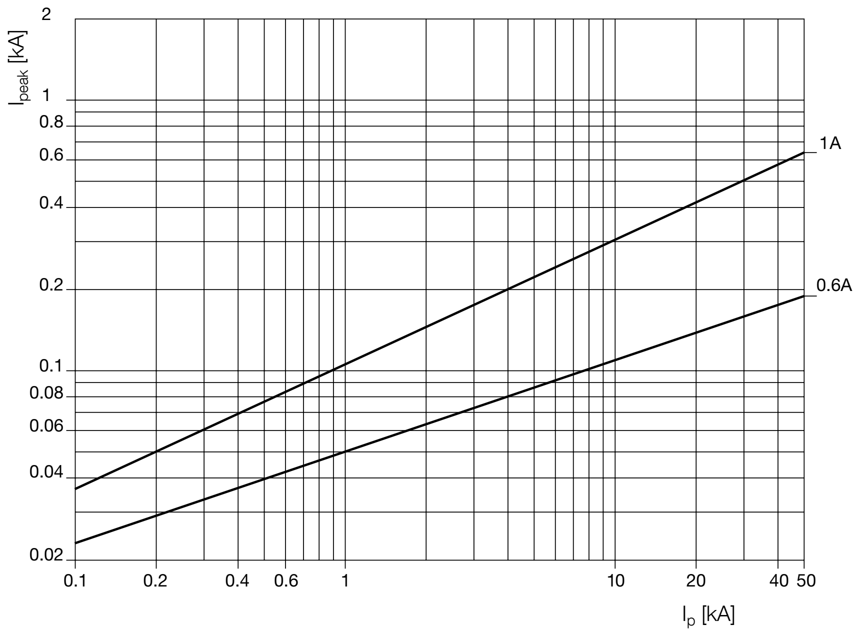


Fig. 8 Time-current characteristics for fuse link types WBTS-3/0.6; 1
Current value deviations for any average pre-arcing period value as read from the diagram are presented within ±20%.

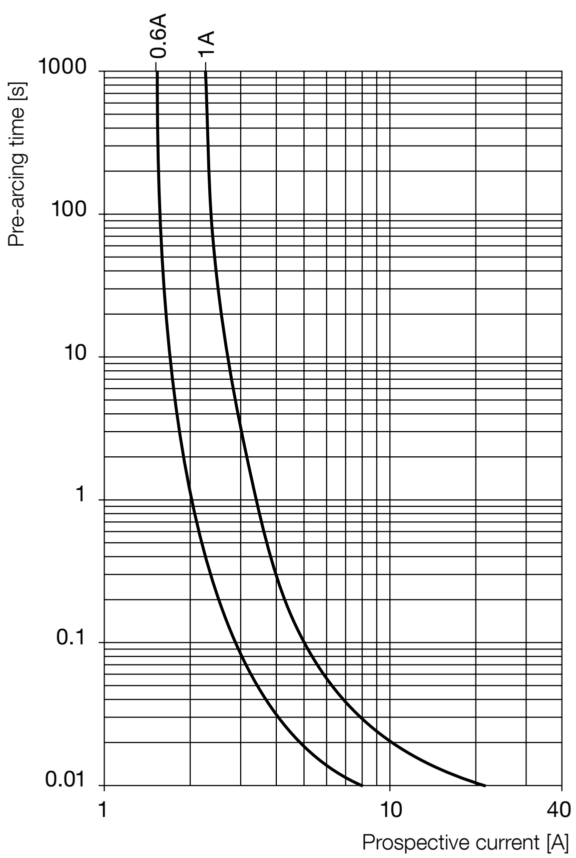


Fig. 9 Cut-off current characteristics for fuse link types WBT-1.5/3; 15; 40

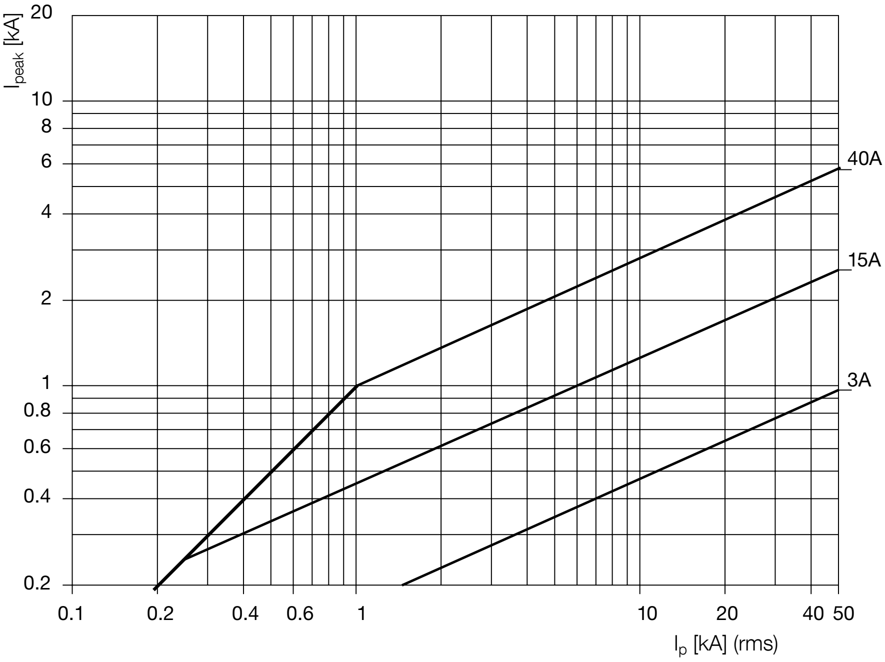
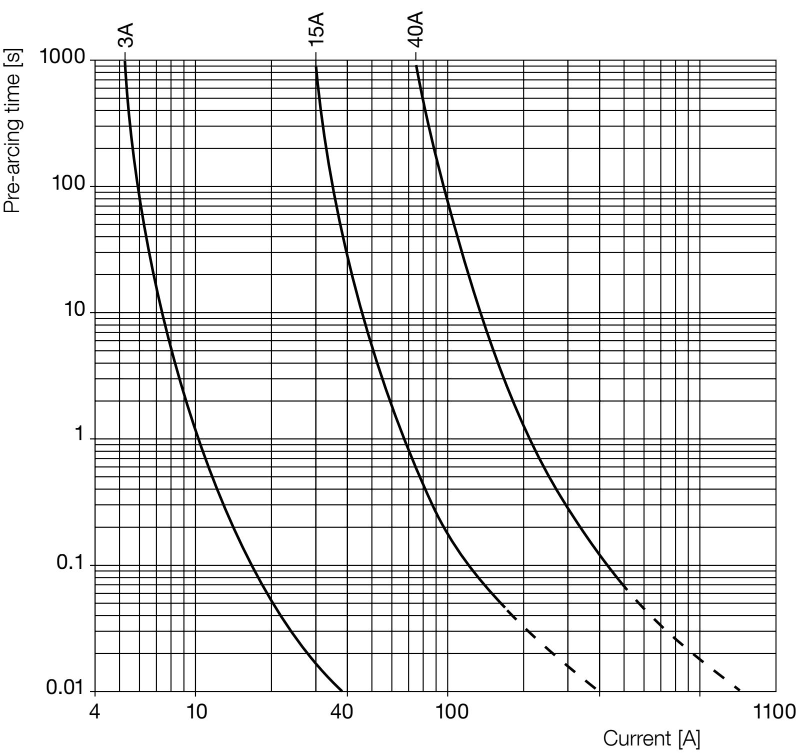
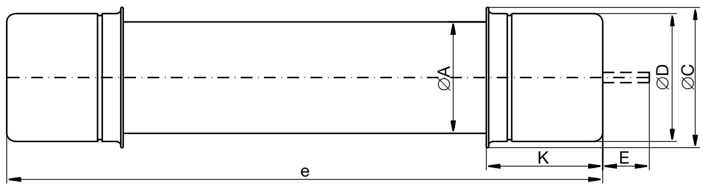


Fig. 10 Time-current characteristics for fuse link types WBT-1.5/3; 15; 40.
Current value deviations for any average pre-arcing period value as read from the diagram are presented within ±20%.

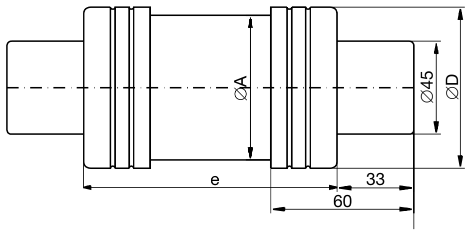


WBTI-3, WBTG-3, WBTGI-3, WBTG-3/3-I,WBTS-3 and WBT-1.5 fuse links for traction applications

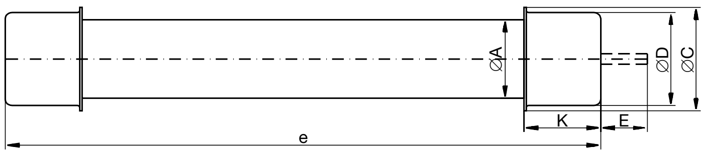
Fuse link type	Dimensions [mm]					
	ØA	ØD	ØC	K	E	e
WBTI-3/3 to 20	55	62	66	50		256±2
WBTI-3/25 to 50	70	78	84		20	
WBTGI-3/10 to 20	38	45	50	33		256±2
WBTG-3/3-I	18	23	-	25	-	209±2
WBTG-3/3 to 6	24	28	-	20	12	200±2
WBTS-3/0.6; 1	18	23	-	25	-	145±2
WBT-1.5/3;15	38	45	50	33	-	109±2
WBT-1.5/40	65	72	-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



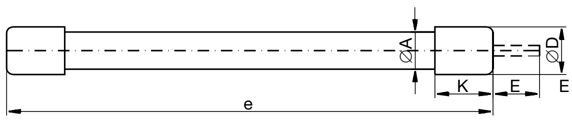
Type WBTI-3-3/... fuse links



Type WBT-1,5/40 fuse links



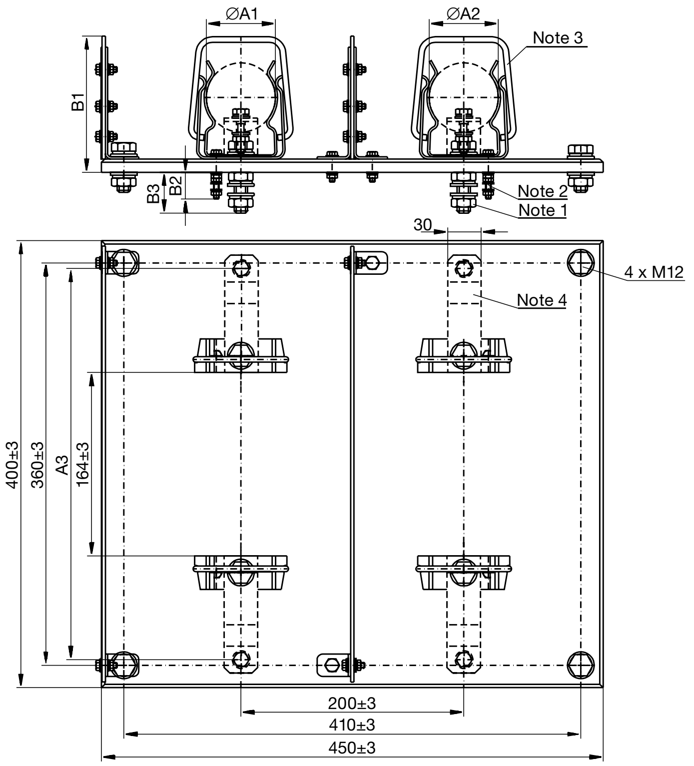
Type WBTGI-3/...; WBT-1,5/3 ... fuse links

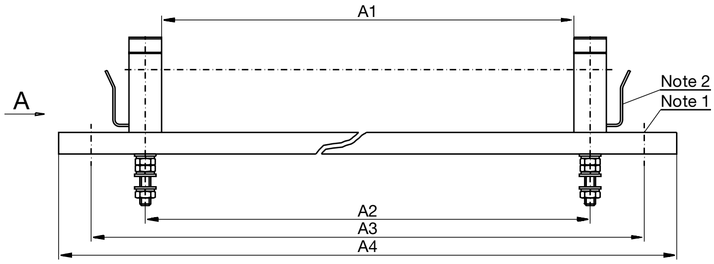


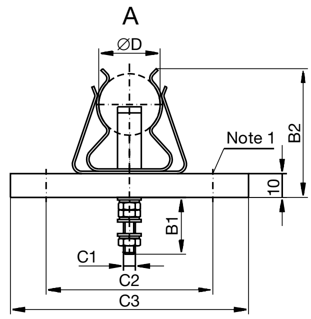
Type WBTG-3/3-6,
WBTG-3/3-I; WBTS-3/... fuse links

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

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	-	-



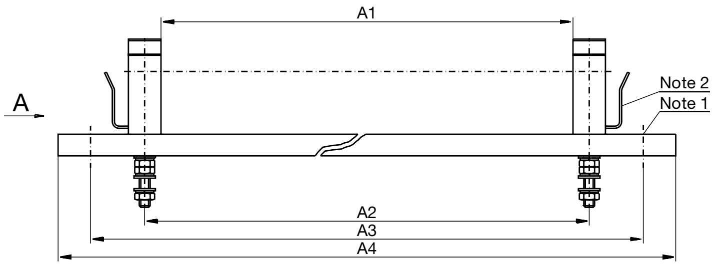


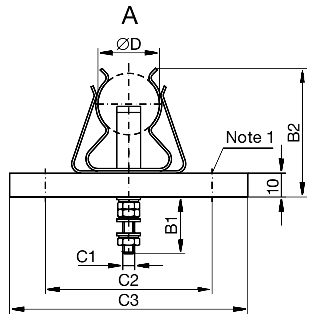


1. Connection screw, M12, for the board type TBT2-3/50 only.
2. Connection screw – M8 for the ØD1 pole or M5 for the ØD2 pole – for the board type TBT2-3/20 & 50 only.
3. Poles designed for the fuse links type WBT-3/20-50 fitted with extrathimble terminals.
4. Flat connections employing a screw, M8 are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

Deviations of dimensions with no tolerance specified shall be within ±3%.

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



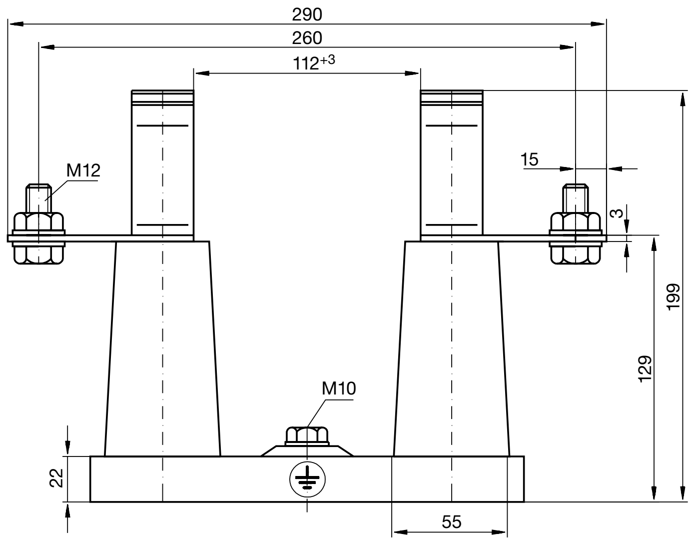


1. The Ø10 holes are to be used for instalation.
2. Fuse link stops for the Type TBTG1-3/6 and TBTS1-3/1 Fuse board are to be installed in the panels.
Deviations of dimensions with no tolerance specified shall be within ±3%.

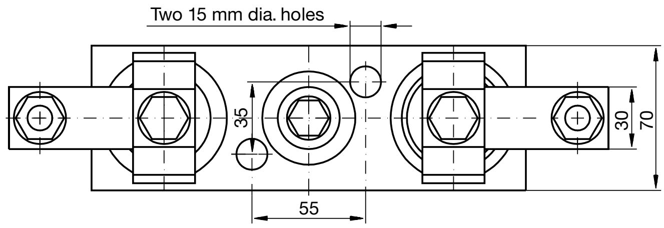
Fuse board type	Dimensions [mm]									
	A1	A2	A3	A4	B1	B2	C1	C2	C3	C4
TBTG1-3/6	165±1.5	180±3	395±3	425	18	58±2	M5	70±2	100	28
TBTG1A-3/15	205±1.5	225±3	440±3	470	25	71±2	M8	70±2	100	45
TBTS1-3/1	105±1	120±3	394±3	425	20	60	M5	-	50	23

Type PBT-1.5/40

Fuse base for traction application



Notes:
Deviations of dimensions with no tolerance specified shall be within ±3%.



Note:
Design and specifications are subject to change without notice.

Indoor Fuse bases
Fuse bases type BPS

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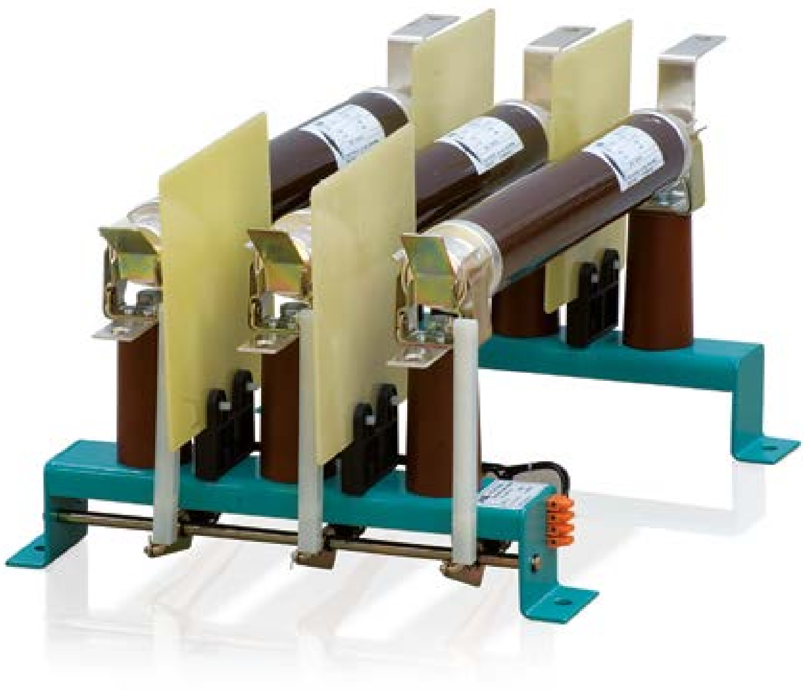


1. Features

– 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 Un [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	resin	442	1YMB507102M0007
BPS	17.5	1(*)	zinc	resin	292	1YMB507102M0009
BPS	24	1(*)	zinc	resin	442	1YMB507102M0013
BPS	24	1(*)	zinc	resin	537	1YMB507102M0015
BPS	27	1(*)	zinc	resin	442	1YMB507102M0017
BPS	36	1(*)	zinc	resin	537	1YMB507102M0021
BPS	7.2	2(**)	zinc	resin	any	1YMB507103M0001
BPS	12	2(**)	zinc	resin	any	1YMB507103M0003
BPS	24	2(**)	zinc	resin	any	1YMB507103M0007
BPS	36	2(**)	zinc	resin	any	1YMB507103M0009

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 ear thing 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 ear thing 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 Un [kV]	Frequency f [Hz]	Rated current In [A]	Types of suitable fuse links
BPS-01	Three-pole	7.2	50 or 60	315	CEF-7,2/ 6÷200 CMF-7,2/63÷315
BPS7.2	Single pole	7.2		315	CEF-7,2/6-200 CMF-7,2/63-315
BPS12	Single pole	12		200	CEF-12/6-200 CMF-12/63-200 CEF-S-12/10-50 CEF-VT-7,2-12/2-6,3
BPS17.5	Single pole	17.5		125	CEF-17,5/6-63 CEF-VT-10-17,5/2-6,3
BPS24	Single pole	24		125	CEF-24/6-125 CEF-S-24/10-40 CEF-VT-17,5-24/2-6,3
BPS27	Single pole	27		100	CEF-27/6-63
BPS36	Single pole	36		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 60282-1.

8. Ordering method

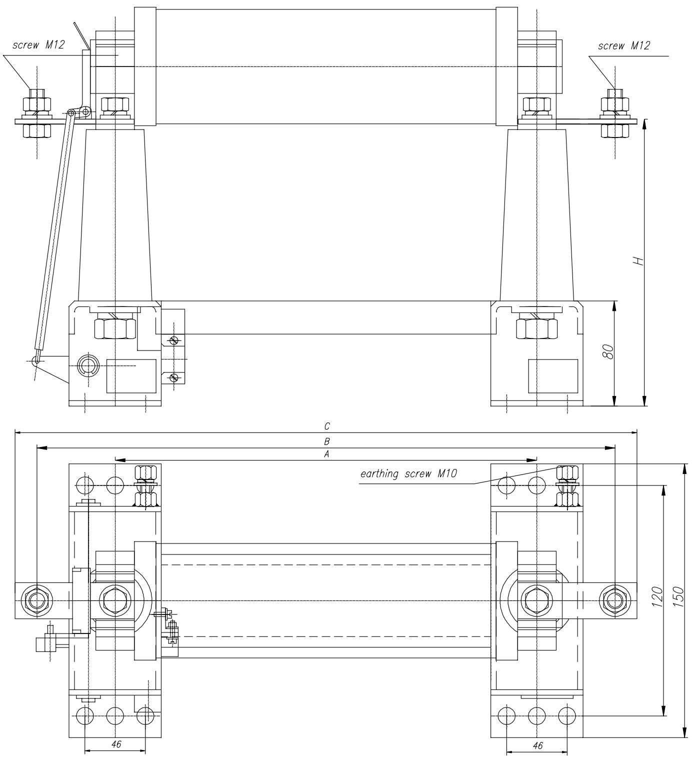
The order must contain the following information: product name, type symbol, rated voltage, catalogue number and quantity of fuse bases.
All additional requirements not stated in this catalogue sheet must be agree with the manufacturer. All inquires must be made in writing and must state the source of the requirements (Regulations, Standards, etc).

9. Order example

Three pole fuse base BPS-01 type, rated voltage 7.2 kV, catalogue number 1YMB207101M0001 - 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.

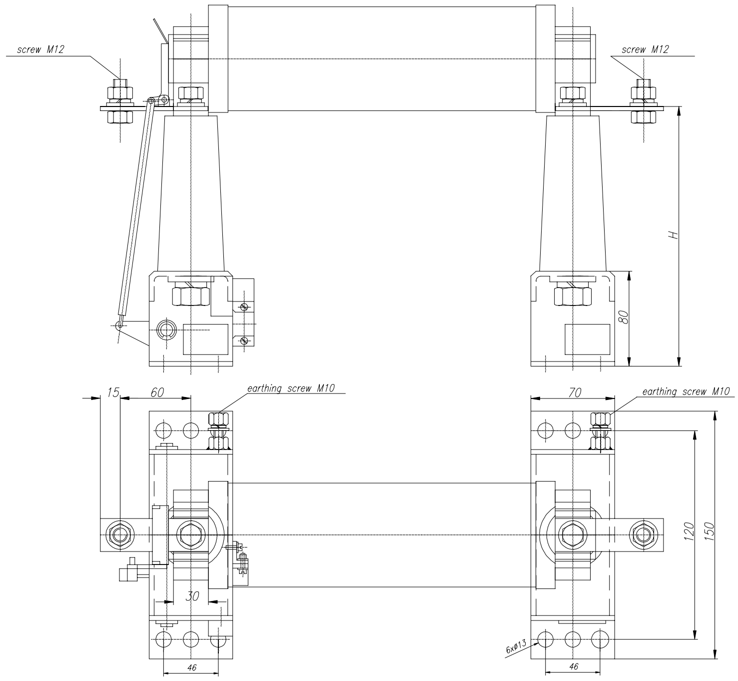
1. Dimensional drawings

Single pole one-piece fuse base



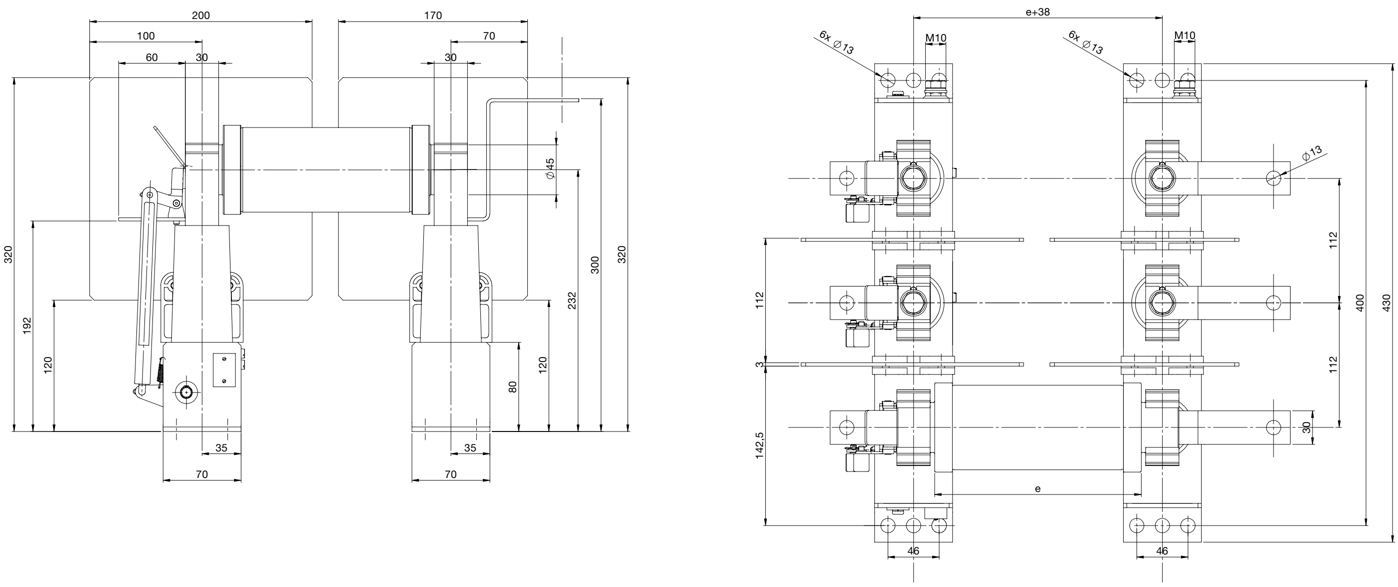
Dimensions					
Un	Fuse link dimension	A	B	C	H
kV	e/D	[mm]	[mm]	[mm]	[mm]
7.2	192/Ø53, 192/Ø65, 192/Ø87	226+2	346+2	376+2	
	292/Ø53, 292/Ø65, 292/Ø87	326+2	446+2	476+2	192±1(resin post-insulators)
12	292/Ø53, 292/Ø65, 292/Ø87	326+2	446+2	476+2	
	442/Ø53, 442/Ø65, 442/Ø87	476+2	596+2	626+2	217±1(resin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

Single pole two-piece fuse base

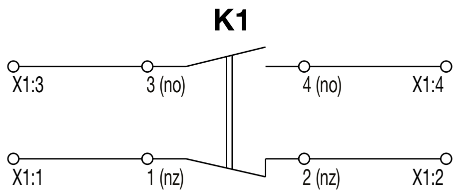


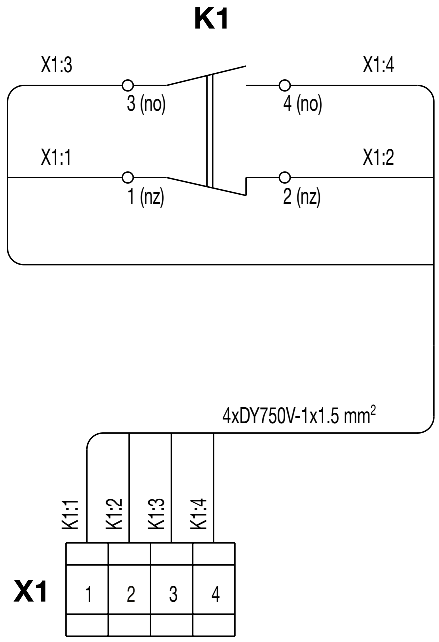
Dimensions		
Un	Fuse link dimension	H
[kV]	e/D	[mm]
7.2	192/Ø53, 192/Ø65, 192/Ø87	
	292/Ø53, 292/Ø65, 292/Ø87, 367/Ø87	192±1(resin post-insulators)
12	192/Ø53, 292/Ø53, 292/Ø65, 292/Ø87	
	442/Ø53, 442/Ø65, 442/Ø87, 537/Ø65, 537/Ø87	217±1(resin post-insulators)
24	442/Ø53, 442/Ø65, 442/Ø87, 292/Ø53	
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

Three phases fuse base type BPS-01



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.

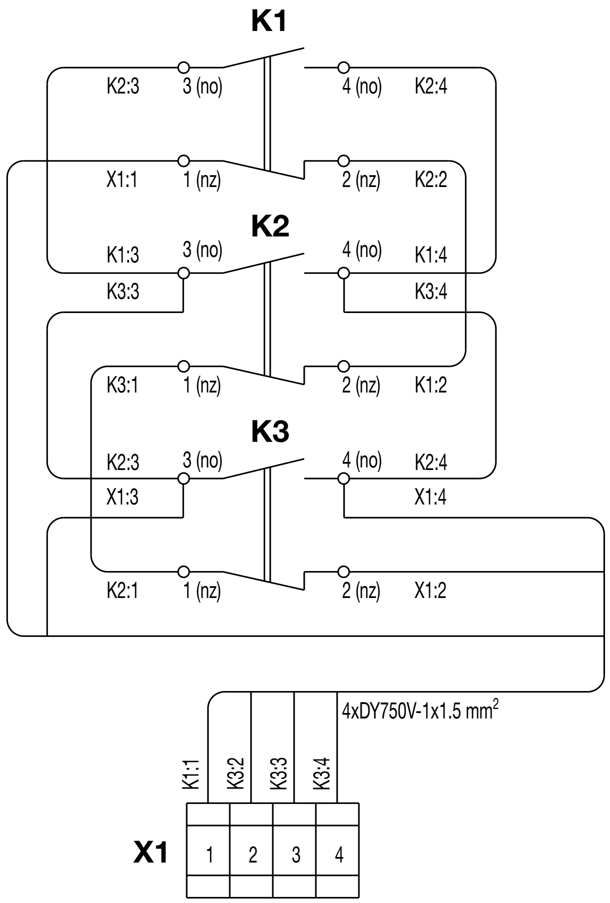
2. Contacts 1 and 2 of one of the auxiliary switches, K1, are closed, and contacts 3 and 4 are opened when fuse links in the fuse holder are operational.

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, Ui = 380 V; Ue = 380 V, Ie = 6A, AC15; Ue = 220 V, Ie = 0.25A, DC13.

6. X1: type LZ-B4/6, Ui = 500 V; 4mm2 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, Ui = 380 V; Ue = 380 V, Ie = 6A, AC15; Ue = 220 V, Ie = 0.25A, DC13.

6. X1: type LZ-B4/6, Ui = 500 V; 4mm2 Cu, IEC 947-7-1.

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