

HV Fuse-Links

General remarks

General information

HV fuse-links have been ensuring reliable protection in medium-voltage substations and grids for decades. They protect systems and equipment against the thermal and dynamic effects of short-circuits.

EFEN HV fuse-links provide the following significant features:

- High breaking capacity
- High current limitation
- Low switching voltage
- Quick breaking
- Non-ageing

EFEN HV fuse-links comply with the following standards:

- VDE 0670 T4 / IEC 60 282-1: High-voltage "current-limiting fuses"
- VDE 0670 T402: Selection of current-limiting fuses for transformer circuits
- IEC 60 787: Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit applications
- VDE 0671 T105 / IEC 62271-105: High-voltage switch-fuse combinations
- DIN 43 625: High-voltage fuses, rated voltages 3.6 to 36 kV (fuse-link dimensions)
- DIN 43 624: High-voltage fuses, rated voltages 3/3.6 to 30/36 kV (single-pole fuse bases)

The quality management system of EFEN GmbH is certified to the international standard DIN ISO 9001 (EN 29001).

EFEN applies a certified environment management system acc. to DIN ISO 14001 and the Eco Audit Order of the Council (EEC) 1836/93.

EFEN manufactures HV fuse-links dimensioned acc. to DIN 43 625 with strikers for indoor and outdoor use. Due to its red color, the striker can be used as a trip-free mechanism and also as an indicator.

In addition to the HV fuse-links shown in this catalogue, EFEN also manufactures a wide range of special-purpose fuse-links in other or custom dimensions. If you have a particular application that requires a special fuse protection solution, simply ask the EFEN team, we are there for you!

Terms and definitions

According to the applicable standards and physical properties, distinction is made between back-up fuse-links and general-purpose fuse-links:

Back-up Fuse-Links

Back-up fuse-links have a "rated minimum breaking current" from which the fuse-links are able to interrupt current. Back-up fuse-links cannot interrupt current when operated below their "rated minimum breaking current" (below I_3). They operate from I_3 to the "rated maximum breaking current" (I_1).

When assigning back-up fuse-links, it must be considered that the lowest short-circuit current at the point of installation of the HV back-up fuse-link is higher than I_3 ($I_{kmin} > I_3$). If the short-circuit current is possibly lower than the minimum breaking current, additional protection must be provided.

General-purpose Fuse-Links

EFEN's general-purpose fuse-links comply with the correspondingly defined standards. Their operating range is extended for lower currents. These fuse-links are capable of interrupting all currents from any current causing the fuse-link to melt within a period of at least 1 hour and up to the "maximum rated breaking current" (I_1). This allows these fuse-links to interrupt low fault currents reliably.

Striker

The strikers of the HV fuse-links of this product list have an effective length of 30 mm and are of type "medium". This classification results from the energy released by the striker between the points A and B (Fig.1). The initial force is approx. 80 N, the force at the end of the free motion is approx. 15 N. The striker is provided to serve as trip-free mechanism of the load-break switches.

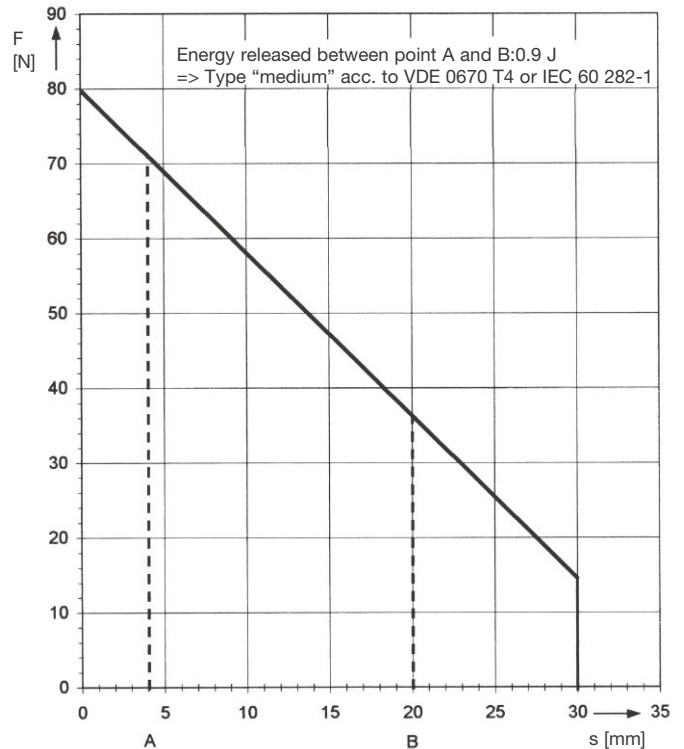


Fig.1

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Rated voltage range

When selecting HV fuse-links, it is important to ensure that these are operated at the voltage for which they are rated. Accordingly, the operating voltage must correspond to the maximum rated voltage of the fuse-link. Because of the switching voltage occurring during arcing, the fuse-link cannot be used at lower voltages without limitation. Accordingly, a lower operating voltage must also be observed at which the fuse-link can still be used without exceeding the system insulation level during arcing. These two values define the fuse-link's permissible voltage range indicated on the fuse-link or in the technical data, e.g. 10/24 kV.

Breaking capacity I_1

The breaking capacity is also referred to as "rated maximum breaking current". This clearly indicates that this is the maximum current that the fuse-link is able to interrupt.

I_1 of the fuse-link must be greater than the maximum short-circuit current at the fuse-link's point of installation ($I_1 > I_{Kmax}$).

Minimum breaking current I_3

According to the standard, the minimum breaking current is referred to as "rated minimum breaking current". This value must be specified on backup fuse-links. This is the minimum current from which on back-up fuse-links are capable of breaking fault currents.

Fuse-links must be assigned to systems in such a way that no fault current below I_3 can occur at the fuse-link's point of installation (because of the system parameters or other protective devices).

Power dissipation of a fuse-link P_{warm}

The power dissipation of an HV fuse-link is specified at the fuse-link's rated current. When protecting systems with HV fuse-links, it must be noted that the operating current is normally no more than half the rated current. Due to the physical correlations, the actual power dissipation is less than a quarter of the value P_{warm} shown in the technical data table for HV fuse-links.

Time-current characteristic (I/t characteristic)

The time-current characteristics show the correlation between the current and pre-arcing time required for the fuse-element to melt. This is indicated as the virtual time (t_{vs}) to allow comparing the I/t characteristics of fuse-links in the range below 100 ms. For coordination with other protective devices such as load-break switches or circuit breakers tripping at less than 100 ms the pre-arcing interval of I^2t must be applied.

Current limitation

At high short-circuit currents, HV fuse-links interrupt currents within few milliseconds. This means that the sinusoidal current does not reach its peak value and the HV fuse-links act as current-limiting devices. This is a significant advantage compared to mechanical switches whose contacts take longer to open and interrupt currents at natural zero. During this period, the peak short-circuit current is able to freely develop its dynamic force. By using HV fuse-links, this surge current is limited within several ms to a fraction of its peak value, allowing the design of the downstream system to be reduced in terms of dynamic forces.

Switching voltage

To allow HV fuse-links to perform as current-limiters, the short-circuit current must be limited and reduced already as it increases. This requires a switching voltage that counteracts the driving system voltage and forces the current to zero. According to the specifications stated above, this switching voltage must not exceed the permissible value of 2.2 times the peak value of the maximum rated voltage. EFEN HV fuse-links meet this requirement.

Dimensions

HV fuse-links in this product list comply with DIN 43 625. Fig. 2 shows the contact cap dimensions defined in this standard. Dimension "e" varies depending on the rated voltage of HV fuse-links and is shown as "dimension" of the fuse-links in the corresponding technical data tables. In addition, diameter "d" varies with the rated current. The corresponding values are also shown in the tables.

(Tables on page 90, 98, 101, 102 and 103)

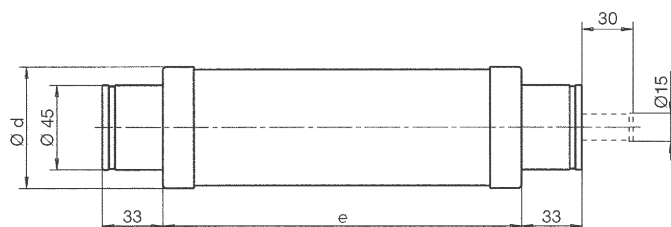


Fig. 2
Dimensions acc. to DIN 43 625 in mm

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Description of further applications of EFEN HV Fuse-Links

Protection of high-voltage motors

With EFEN HV back-up fuse-links, high-voltage squirrel-cage motors can be protected against the effects of high short-circuit currents. Overloads must be interrupted by accompanying protective devices.

Protection of high-voltage capacitors

EFEN HV back-up fuse-links can be used to protect individual capacitors in the event of a short-circuit. However, particular aspects must be taken into account with respect to the rated voltage and rated current of the HV fuse-links.

Protection against distance short-circuits

HV fuse-links are not always used on bus bars or directly at the feeder, but rather directly upstream of the transformer at the end of a stub line. In such cases, it should be noted that the short-circuit current at the installation point of the HV fuse-links can be considerably lower than the current on a transformer secondary terminal short-circuit. In addition to transformer impedance, line impedance must also be taken into account.

Special applications

In addition to the standard applications described above, EFEN HV fuse-links can also be used for a wide range of special-purpose applications:

- Protection of voltage transformers
- Protection of capacitive transformers
- Protection of railway installations (16 2/3 Hz or DC)

Oil-tight HV Fuse-Links

EFEN also manufactures oil-tight HV fuse-links.

These fuse-links can be directly integrated into the devices to be protected such as transformer as they are suitable for oil-submerged operation.

These HV fuse-links can be manufactured with and without striker. Their contact caps can be fitted with threaded studs or nuts for the connection of cable lugs.

EFEN has developed a wide range of HV fuse-links for special applications which would be too numerous to list here.

Whenever you are facing a non-standard protection task, we will be happy to assist you in finding an optimal solution!

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Protection of transformers

The following must be observed when selecting HV fuse-links:

- a) Transformer ratings
 - Rated operating voltage (U)
 - Rated output (S)
 - rel. short-circuit voltage (u_k %)
 - Inrush current ($8... 12 I_N$)
- b) Time-current characteristics of HV fuse-links
- c) Secondary protective devices/selectivity

Procedure explained using an example:

A 630 kVA transformer has a transformer rated current of 18.2 A at a rated operating voltage of 20 kV. The relative short-circuit voltage is 4%, and the inrush current is $12 \times I_N$. The short-circuit current on the secondary terminal short-circuit results from the relative short-circuit voltage. The transformer must be designed to withstand this current for 2 seconds. This condition results in point b) in Fig. 3. HV fuse-links must break this current within 2 seconds. In Fig. 3, fuse-link F4 must not be used for this transformer, as the fuse-link will require more than 2 seconds to melt at the given short-circuit current.

The inrush current is plotted for a duration of 0.1 seconds, resulting in point a). This inrush current must not melt the fuse-link. Accordingly, fuse-link F1 cannot be used for this transformer.

Fuse-links F2 and F3 may be used for this transformer since their time-current characteristics are between points a) and b). Several HV fuse-links for various rated currents can therefore be assigned to a transformer. The selection of the correct fuse must be based on the time-current characteristic and not the rated current of the HV fuse-link.

German standard VDE 0670 T402 defines time-current ranges for rated currents, taking into account points a) and b) as well as the selectivity to the NH fuse-links of utilization category gTr. If an HV fuse-link is assigned to a transformer according to part 402, all of the above factors must be taken into account to select the correct HV fuse-link.

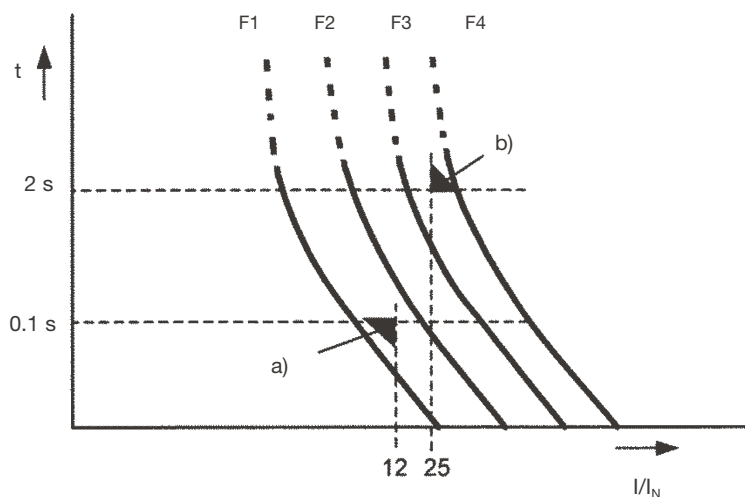


Fig. 3

- F1– F4) Time-current characteristics for HV fuse-links
 a) Inrush current
 b) Lowest short-circuit current of the transformer

HV Fuse-Links General remarks

HV back-up Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1 with controlled power dissipation (ÜLA)

Application

EFEN HV back-up fuses of type ÜLA meet the requirements of VDE 0670 and are specifically designed for installation in compact, enclosed SF6-insulated substations. In these substations, the fuse-links are installed in tight compartments. These significantly affect heat dissipation and only absorb a limited amount of heat. However, overheating of fuse compartments in such enclosures is not to be expected if EFEN HV fuse-links have been properly selected and are matched to the transformer to be protected according to table 3, and if the fuse-links are in faultless condition (Fig. 4).

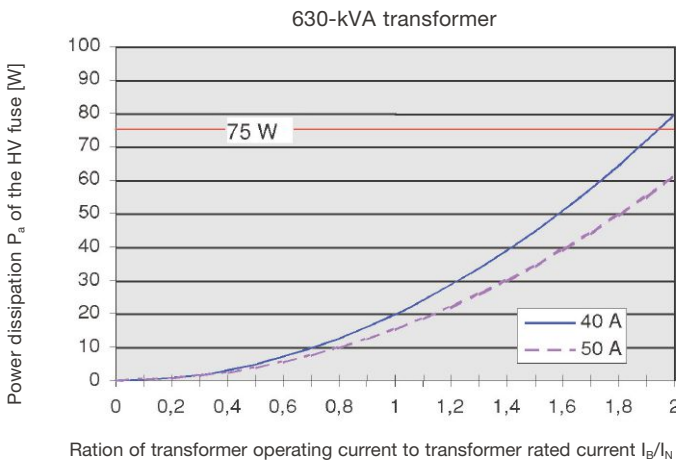


Fig. 4: Power dissipation of 40-A and 50-A HV fuse-links for a 20-kV 630-kVA transformer

One or more of the fuse elements connected in parallel may be interrupted by transient currents caused by transformer inrush or lightning current. As a result, fuses dissipate significantly more heat. There is a certain risk that the heat absorption limit for transformer rated current of the fuse compartments may be exceeded. EFEN HV back-up fuses of type ÜLA prevent such overheating when installed in conjunction with a transformer switch having a trip-free mechanism.

Operating mode

The average heat absorption of the fuse compartments is approximately 75 W. To prevent thermal overload, heat output P_a of the fuse must not exceed this limit:

$$P_a \leq 75 \text{ W}$$

The ÜLA striker system controls the power dissipation of the fuse as the tripping of the striker depends on the voltage, and power dissipation, accordingly:

$$U_a = R \cdot I_B$$

$$U_a \cdot I_B = P_a \leq 75 \text{ W}$$

The tripping voltage U_a of the ÜLA striker system has been selected so that, when multiplied by the operating current I_B , it will not exceed the limiting value, e.g. 75 W, if the resistance R of the fuse elements increases. In this case the ÜLA striker system controls the power dissipation of the fuse, triggering the transformer switch before the permissible power acceptance of the fuse compartment is exceeded (Fig. 5).

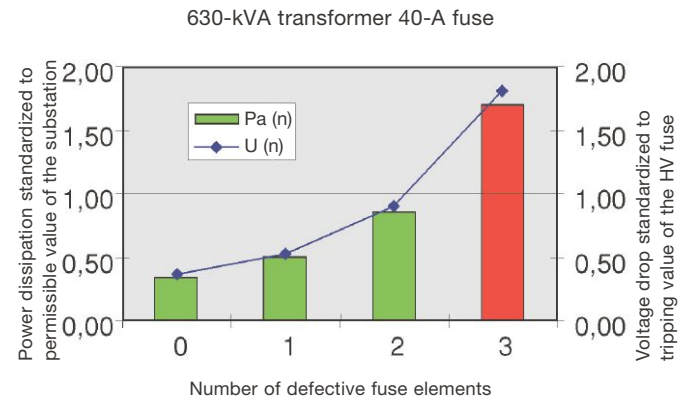


Fig. 5: Controlled power dissipation at 1.3 times the transformer rated current

Benefits of protection with controlled power dissipation (ÜLA)

- ÜLA controls the power dissipation of the fuse-links
- ÜLA is based on Ohm's law
- ÜLA works independently of the installation position of the fuse
- ÜLA trips the striker before the system overheats
- ÜLA is non-ageing

HV fuse-switch ÜLA Plus for switch-fuse combinations

The HV fuse-switch ÜLA Plus was specially designed for use in switch-fuse combinations. This product is characterized by low power dissipation and optimized breaking capacity, even at high rated currents.

- Fast-blowing: With regard to the requirements for switch-fuse combinations according to IEC 62271-105 / VDE 0671 T105, tripping speed in the range of 10 – 100ms was significantly increased. Letting the fuse perform the switching of the transformer short circuit current is a requirement. This is supported by the special characteristics of the fuse.
- Lower power dissipation: Reducing power dissipation by up to 30% allows protection with a switch-fuse combination even with large transformers and also reduces costs.
- Combined control system: The process of controlling temperature and power dissipation simultaneously allows excellent system protection.

The HV ÜLA Plus fuse-link is available from 6/12 kV to 20/36 kV. Thanks to the optimized characteristics, this line of fuse-links is especially suitable for use in gas-insulated SF6-substations.

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High-voltage switch-fuse combinations acc. to VDE 0671 T105 / IEC 62 271-105

Switches can be combined with current-limiting HV fuse-links to increase their utilization range. Such combinations offer short-circuit protection as well as load-switching capacity. HV fuse-links provide short-circuit protection while the switch interrupts the currents below the take-over current of the combination unit. Further to the inrush current, the short-circuit current on the secondary-terminal short-circuit and the low-voltage selectivity, the following switch characteristics must be taken into account:

- Rated transfer current ($I_{transfer}$)
- Switch response time (t_0)

Fig. 6 shows the rated transfer current ($I_{transfer}$) as a vertical line. The switch response time (t_0) must be multiplied by 0.9 (simplified procedure for characteristic gradient 4) and is shown as a horizontal line. This results in an intersection that is characteristic to load switches and must be established for each switch individually.

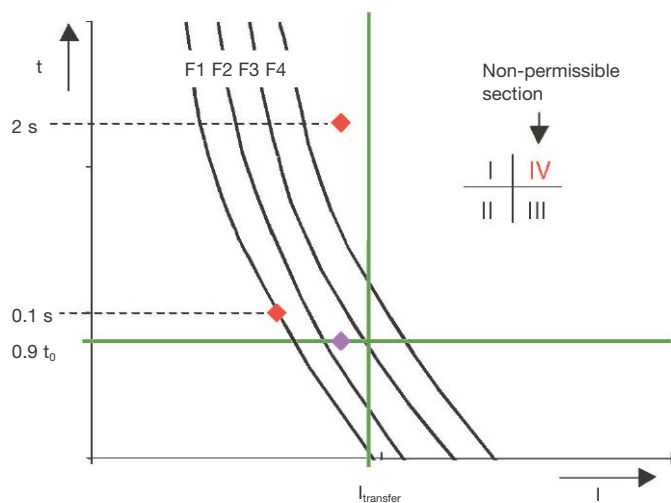


Fig. 6
Selecting an HV fuse-link acc. to VDE 0671 T105 / IEC 62 271.105

This switch intersection divides the diagram into four quadrants (see Fig. 6). Only HV fuse-links with time-current characteristic that do not pass through quadrant IV ("non-permissible section") are suitable for the switch-fuse combination described. This means that all HV fuse-links with striker that meet this requirement can be used in switch-fuse combinations according to IEC 62 271-105. EFEN has assigned HV fuse-links to suitable switches and transformers for switchgear of all major manufacturers. These documents are available on request.

EFEN HV general-purpose Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1

EFEN HV general-purpose fuse-links have an extended breaking range for low currents. Connecting two fuse elements in series in one body results in specific time-current characteristic.

This allows a specific selectivity to be established between HV general-purpose fuse-links and low-voltage circuit breakers.

While one system can reliably interrupt low pre-arcing currents with long pre-arcing times (up to one hour), the other system is ready to break high short-circuit currents. Therefore, the time-current characteristic consists of two sections. The handover (intersection) point between the two systems is at approx. 1 second (see I/t characteristic F1 in Fig. 7).

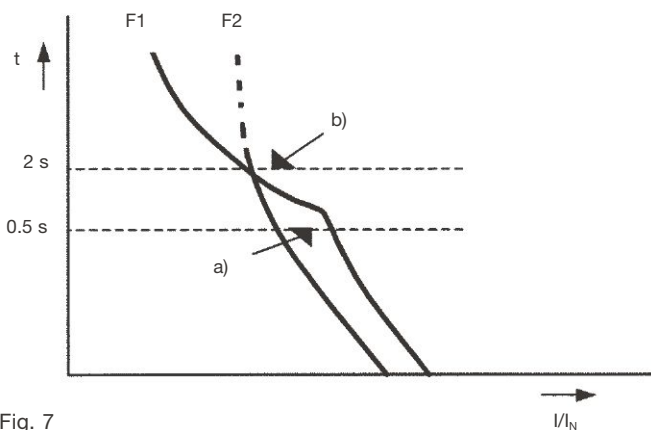


Fig. 7

- F1) Time-current characteristic of a general-purpose fuse-link
- F2) Time-current characteristic of a back-up fuse-link
- a) Selectivity to low-voltage circuit breaker
- b) Lowest short-circuit current of the transformer

In Fig. 7, point b) corresponds to the short-circuit current of a transformer. Point a) is the tripping current of a circuit breaker on the low-voltage side set e.g. to a tripping time of 0.5 seconds, transferred to the high-voltage side.

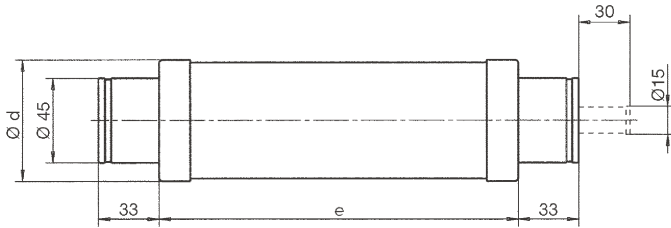
The transformer is protected by both fuse-links with I/t characteristic F1 and F2 as the short-circuit current is interrupted within 2 seconds. If a selectivity of the HV fuse-link to the circuit breaker (point a) is required, an EFEN HV general-purpose fuse-link must be used on the high-voltage side. Its time-current characteristic F1 is located to the right of point a) of the circuit-breaker, in contrast to I/t characteristic F2 of the HV back-up fuse-link which would already melt before the circuit breaker trips.

Thanks to a special manufacturing process, these HV general-purpose fuse-links can also be produced as an oil-tight variants which can be directly integrated into the transformer. Such fuse-links do not have a striker and are provided with a threaded connection on both ends. They are suitable for oil-submerged operation inside the transformer.

HV Fuse-Links

Electrical data, dimensions, weight

Fuse-Links


Technical data

HV back-up Fuse-Links acc. to VDE 0670 / IEC 60 282-1 with controlled power dissipation (ÜLA)

Order no.	Rated voltage range		Rated current	Rated value, Maximum breaking current	Rated value, Minimum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	
	Un kV	In A				I1 kA	I3 A	e mm	d mm			R initial mΩ
67523.0100	6/12	10	63	63	35	292	56	227	29	3.000	1,6	
67523.0160		16			64			66	21	3.700		
67523.0200		20			90			51	25	4.700		
67523.0250		25			95			40	29	4.920		
67523.0320		31,5			110			30	39	7.000		
67523.0400		40			134			20	46	14.000		
67523.0500		50	190	15	62		25.300					
67523.0630		63	80	80	250		65	11,9	58	52.200		2,1
67523.0800		80			280		9,5	82	78.000			
67523.1000		100			330		7,4	103	152.000			
67523.1250		125			430		5,2	109	266.800			
67524.1000		100			325		7,5	100	169.500			
67524.1250	125	430			5,3	109	291.000					
67524.1600	160	460	4,4	175	358.500	3,3						
67543.0060	10/24	6,3	63	63	23	442	56	640	31	800	2,3	
67543.0100		10			36			386	48	2.000		
67543.0160		16			73			127	42	2.340		
67543.0200		20			91			97	53	3.900		
67543.0250		25			116			73	60	6.500		
67543.0320		31,5			125			57	84	7.000		
67543.0400		40	161	41	96		14.200					
67543.0500		50	210	65	27		89	27.900	3,1			
67543.0630		63	235	78	21		102	67.000	3,3			
67543.0800		80	265	17	153		92.500					
67543.1000		100	345	88	13,6		200	152.000	5,9			
67543.1250		125	435	10,1	254		279.000					
67553.0060	20/36	6,3	31,5	31,5	20	537	56	889	39	600	2,7	
67553.0100		10			33			529	66	2.000		
67553.0160		16			66			190	67	2.340		
67553.0200		20			95			153	84	3.900		
67553.0250		25			110			118	100	6.500		
67553.0320		31,5			135			65	82	119		7.000
67553.0400		40	200	63	176		14.200	3,7				
67553.0500		50	220	40	130		34.000					
67553.0630		63	35	35	250		88	31	165	72.500	6,5	
67553.0800		80			340		24	229	119.000			

* This rated current requires a reduction factor. Reduction factors are available on request.

HV Fuse-Links

Selection table for HV back-up Fuse-Links

VDE 0670 T402 with ÜLA Plus / selection table acc. to IEC 62271-105

		Transformer rated output in kVA															
Rated voltage range of the fuse-link (kV)		U _K = 4 %									U _K = 6 %						
Rated operating voltage of the transformer		100	125	160	200	250	315	400	500	630	630	800	1000	1250	1600	2000	2500
6/12 10	Transformer rated current in A	5,8	7,2	9,2	11,5	14,4	18,2	23,1	28,9	36,4	36,4	46,2	57,7	72,2	92,4		
	Short-circuit current 2s in A	144	180	231	289	361	455	577	722	909	606	770	962	1203	1540		
	Transfer current I transfer in A T ₀ = 40 ms	143	143	184	258	321	433	567	512	660	512	660	837	1135	1320		
	Rated current of the fuse-link in A	16	16	20	25	31,5	40	50	63	80	63	80	100	125	160		
	Power dissipation of the fuse-link IN transf. in W	1,9	3,0	3,4	4,7	5,3	6,9	8,3	8,1	11,3	14,0	19,8	24,1	26,3	42,2		
10/24 20	Transformer rated current in A	2,9	3,6	4,6	5,8	7,2	9,1	11,5	14,4	18,2	18,2	23,1	28,9	36,1	46,2	57,7	72,2
	Short-circuit current 2s in A	72	90	115	144	180	227	289	361	455	303	385	481	601	770	962	1203
	Transfer current I transfer in A	72	72	72	136	173	239	239	310	436	307	436	450	562	701	860	1184
	Rated current of the fuse-link in A	10	10	10	16	20	25	25	31,5	40	31,5	40	50	63	80	100	125
	Power dissipation of the fuse-link IN transf. in W	2,6	4,0	6,7	4,0	4,8	5,8	9,7	11,8	13,2	20,2	23,1	23,6	24,1	36,9	48,2	61,2
20/36 30	Transformer rated current in A	1,9	2,4	3,1	3,8	4,8	6,1	7,7	9,6	12,1	12,1	15,4	19,2	24,1	30,8	38,5	48,1
	Short-circuit current 2s in A	48	60	77	96	120	152	192	241	303	202	257	321	401	513	642	802
	Transfer current I transfer in A T ₀ = 40 ms	39	39	71	71	71	139	181	181	228	181	228	315	400	450	577	731
	Rated current of the fuse-link in A	6,3	6,3	10	10	10	16	20	20	25	20	25	31,5	40	50	63	80
	Power dissipation of the fuse-link IN transf. in W	2,4	3,7	4,1	6,3	6,1	3,6	6,3	13,1	15,9	22,8	28,3	33,0	46,9	51,7	45,7	61,0

HV Fuse-Links General remarks

High-voltage Fuse-Links for voltage transformer “HSW” acc. to VDE 0670 T4 / IEC 60 282-1

HV fuse-links for voltage transformers (HSW) offer protection against short-circuits. They reliably isolate the defective transformer from the power supply.

Their compact design enables integration into the transformer housing. By sealing the transformer housing with a screw cap, the HSW can be replaced and is visible from outside if the screw cap has a window. For status indication purposes, the HSW can be provided with an indicator. The HSW can be used for transformers with an output limit of up to 3000 VA (6 to 12 kV) or 6000 VA (15 to 24 kV).

In the event of a short-circuit, the HSW significantly reduces the current in such a way that the maximum peak current of 1 kA flows only for a few microseconds. In this way, effects of the defect on the supplying system are largely prevented.



Fig. 8

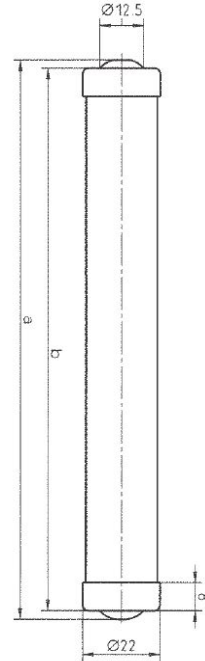


Fig. 9

HV Fuse-Links for voltage transformers

Electrical data, dimensions, weight

Variant	Rated voltage range U_N kV	Dimensions		Initial resistance	Weight kg	PU	Order no.
		a mm	b mm	$R_{initial}$ max. Ω			
with indicator	6/12	160	155	7	0,15	1	67036-0004
with indicator	15/24	280	275	12	0,27	1	67037-0004
without indicator	6/12	160	155	7	0,15	1	67036-0003
without indicator	15/24	280	275	12	0,27	1	67037-0003
without indicator	20/36	421	-	9	2,7	1	67088-0003

HV Fuse-Links

Selection table acc. to VDE 0670 T402 / IEC 60 282-1

Selection table for HV back-up Fuse-Links acc. to VDE 0670 T402 / IEC 60 282-1 with selectivity to the low-voltage fuse-link (gTr/gG)

Table 1

Rated voltage range of the fuse-link [kV]	Mode of protection, rated current of the fuse-link [A]	Transformer rated output [kVA]											
		Rel. short circuit voltage						u _K = 4 %				u _K = 5 %	
		50	100	125	160	200	250	315	400	500	630	800	1000
3/7,2	I _N Tr	4,8	9,6	12,0	15,4	19,2	24,1	30,3	38,5	48,1	60,6	77,1	96,3
	with NH gG	16	20-25	25-31,5	31,5-40	40-50	50-63	63-80	80-100	100-125	100-160	160	160
6	with NH gTr		20-25	25-31,5	31,5-40	40-50	50-63	63-80	80-100	100-125	100-160	160	160
	I _N Tr	2,9	5,8	7,2	9,2	11,5	14,4	18,2	23,1	28,9	36,4	46,2	57,7
6/12	with NH gG	10	16	16	20-25	25-31,5	31,5-40	40-50	50-63	63-80	80-100	100-125	100-125
	with NH gTr		16	16	20-25	25-31,5	31,5-40	40-50	50-63	63-80	80-100	100-125	100-160
10/24	I _N Tr	1,5	2,9	3,6	4,6	5,8	7,2	9,1	11,5	14,4	18,2	23,1	28,9
	with NH gG	6,3	10	10	16	16	16-25	25	25-31,5	31,5-40	40-50	63	63
20	with NH gTr		10	10	16	16	16-25	25	25-31,5	31,5-40	40-50	63	63-80
	I _N Tr	1,0	1,9	2,4	3,1	3,8	4,8	6,1	7,7	9,6	12,1	15,4	19,2
20/36	with NH gG		6,3	10	10	16	16-20	20-25	25	25-31,5	31,5-40	40-50	40-50
	with NH gTr		6,3	10	10	16	16-20	20-25	25	25-31,5	31,5-40	40-50	40-50
0,4	I _N Tr	72	144	180	231	289	361	455	577	722	909	1155	1443
	with NH gG	80	125/160	160/200	200/250	250/315	315/400	400/500	500/630	630/800	800/1000	1000/1250	1250/1600
	with NH gTr		100	125	160	200	250	315	400	500	630	800	1000

Preferred values shown in bold print

I_N Tr = Transformer rated current [A]

Selection table for HV back-up Fuse-Links acc. to VDE 0670 T402 with selectivity to NH gTr with controlled power dissipation (ÜLA)

Table 2

Rated voltage range of the fuse-link [kV]	Mode of protection, rated current of the fuse-link [A]	Transformer rated output [kVA]											
		Rel. short circuit voltage						u _K = 4 %				u _K = 5 %	
		100	125	160	200	250	315	400	500	630	800	1000	
6/12	I _N Tr	5,8	7,2	9,2	11,5	14,4	18,2	23,1	28,9	36,4	46,2	57,7	
	I _N	16	16	20	25	31,5	40	50	63	80	100	125	
10	P _{warm}	2,4	3,6	4,5	5,3	6,3	8,6	10,7	10,4	13,1	28,5	18,3	
	I _N Tr	2,9	3,6	4,6	5,8	7,2	9,1	11,6	14,4	18,2	23,1	28,9	
10/24	I _N	10	10	16	16	16/25	25	25/31,5	31,5	40	63	63	
	P _{warm}	3,3	5,0	2,9	4,6	7,2/3,8	6,2	10,2/8,3	13,0	15,2	14,0	22,7	
20/36	I _N Tr	1,9	2,4	3,1	3,8	4,8	6,1	7,7	9,6	12,1	15,4	19,2	
	I _N	6,3	10	10	16	16	20	25	25	31,5	40	40/50	
30	P _{warm}	2,8	3,0	4,7	3,0	4,5	5,6	6,5	10,0	12,3	16,9	27,6/17,3	

I_N Tr = Transformer rated current [A]

I_N = Fuse-link rated current [A]

P_{warm} = Power dissipation of the HV fuse-links for rated current of the transformer [W]

HV Fuse-Links

Selection table acc. to VDE 0670 T4 / IEC 60 282-1

Selection table for EFEN HV general-purpose fuses
VDE 0670 T4 / IEC 60282-1

Table 3

Rated voltage range of the fuse-link [kV]	Mode of protection, fuse-link rated current [A]	Transformer rated output [kVA]											
		Rel. short circuit voltage $u_k = 4\%$										$u_k = 5\%$	
		50	100	125	160	200	250	315	400	500	630	800	1000
3/7,2	$I_{N Tr}$	4,8	9,6	12	15,4	19,2	24,1	30,3	38,5	48,1	60,6	77,1	96,3
	I_N	6,3	16	16	16-25	25	25-40	40	40-50	50	50	-	-
6/12	$I_{N Tr}$	2,9	5,8	7,2	9,2	11,5	14,4	18,2	23,1	28,9	36,4	46,2	57,7
	I_N	6,3	6,3-10	10	16	16	16-25	25	25-40	40	40-50	50	50
10/24	$I_{N Tr}$	1,5	2,9	3,6	4,6	5,8	7,2	9,1	11,5	14,4	18,2	23,1	28,9
	I_N	-	4	4-6,3	6,3	6,3-10	10	16	16	16	25	25	25

$I_{N Tr}$ = Transformer rated current [A]

I_N = Fuse-link rated current [A]

Benefits of using EFEN HV general-purpose Fuse-Links:

- Reliable breaking of all currents: from the current tripping the fuse element within a time of ≥ 1 hour to the maximum rated breaking current I_1
- No lightning current and low inrush current sensitivity
- Very low power dissipation/low thermal load
- Selectivity to low-voltage circuit breaker possible
- EFEN HV general-purpose fuse-links are available as oil-tight variants for integration into transformers

HV Fuse-Links

Selection table acc. to VDE 0670 T4 and T 402 / IEC 60 282-1

HV Fuse-Links for protection of HV motors

EFEN HV fuse-links are suitable for HV motor protections.

EFEN has the expertise and the right products to protect your motor circuits effectively.

Selection table acc. to T402

Table 4

High-voltage motors	Number of starts per h	Maximum motor starting current (A)							
		Start-up times							
≤ 6 s	≤ 2	130	180	220	290	360	500	680	1100
	4	120	150	190	240	310	450	550	900
	10	110	140	170	220	270	400	490	770
	15	100	130	160	200	250	340	430	670
	30	90	120	140	190	230	320	400	630
6 – 15 s	2	120	160	190	240	310	430	580	670
	4	100	140	170	220	280	400	500	610
	10	90	120	150	200	240	340	430	540
	15	80	110	130	180	220	320	400	480
	30	70	100	120	160	200	290	350	430
15 – 60 s	2	100	130	160	220	270	380	470	590
	4	90	120	150	200	250	340	440	540
	6	80	110	140	190	230	320	400	500
	10	70	100	130	180	220	300	380	470

recommended fuse-link (acc. to IEC 60282-1 and VDE 0670 T4 & 402)

Rated current:	63 A	80 A	100 A	125 A	160 A	2 x 100 A	2 x 125 A	2 x 160 A	
Order number									
Motor rated voltage	3 – 7,2 kV	67110-0630	67110-0800	67110-1000	67110-1250	67110-1600	67110-1000	67110-1250	67110-1600
	6 – 12 kV	67120-0630	67120-0800	67120-1000	67120-1250	67120-1600	67120-1000	67120-1250	67120-1600
	10 – 24 kV	67140-0630	67140-0800	67140-1000					
	20 – 36 kV	67150-0630							

Selection table acc. to T4

Table 5

High-voltage motors	Number of starts per h	Maximum motor starting current (A)							
		Start-up times							
≤ 6 s	≤ 2	120	165	210	320	370	430	900	1050
	4	110	140	180	275	320	380	730	870
	10	100	130	160	240	280	330	620	750
	15	90	120	150	220	260	300	560	650
	30	80	110	135	205	240	280	510	600
6 – 15 s	2	115	145	180	270	320	370	590	640
	4	95	125	160	240	280	340	530	570
	10	85	110	140	210	250	300	480	510
	15	75	100	120	190	230	280	430	450
	30	65	90	110	170	210	250	380	400
15 – 60 s	2	90	120	150	240	280	320	520	550
	4	80	110	140	220	260	290	470	510
	6	75	100	130	205	240	270	430	470
	10	65	90	120	195	230	250	400	440

recommended fuse-link (acc. to IEC 60282-1 and VDE 0670 T4 & 402)

Rated current:	63 A	80 A	100 A	160 A	200 A	2 x 100 A	2 x 160 A	2 x 200 A	
Order number									
Motor rated voltage	3 – 7,2 kV	67210-0630	67210-0800	67210-1000	67210-1600	67210-2000	67210-1000	67210-1600	67210-2000
	6 – 12 kV		67220-0800	67220-1000	67220-1600	67220-2000	67220-1000	67220-1600	67220-2000
	10 – 24 kV		67240-0800	67240-1000					

HV Fuse-Links

Selection table acc. to VDE 0670 T4 / IEC 60 282-1

Selection table for capacitors

Table 6

Rated voltage range of the fuse-link [kV]	3/7,2		6/12		10/24		20/36	
Rated operating voltage of the capacitor [kV]	3		6		10		20	
Capacitor Rated output [kVAr]	I_{cr} [A]	I_r [A] Fuse-link	I_{cr} [A]	I_r [A] Fuse-link	I_{cr} [A]	I_r [A] Fuse-link	I_{cr} [A]	I_r [A] Fuse-link
		Order no.:		Order no.:		Order no.:		Order no.:
50	9,6	20 67110-0200	4,8	10 67220-0100	2,9	6,3 67240-060	1,44	4 67250-0040
100	19,2	40 67110-0400	9,6	20 67220-0200	5,8	10 67240-0100	2,9	6,3 67150-0060
125	24,1	50 67110-0500	12,0	25 67220-0250	7,2	16 67240-0160	3,6	6,3 67150-0060
160	30,8	80 67210-0800	15,4	31,5 67220-0320	9,2	20 67240-0200	4,6	10 67150-0100
200	38,5	100 67210-1000	19,2	50 67220-0500	11,5	25 67240-0250	5,8	16 67150-0160
250	48,1	125 67110-1250	24,1	63 67220-0630	14,4	31,5 67240-0320	7,2	16 67150-0160
315	60,6	160 67210-1600	30,3	80 67220-0800	18,2	50 67240-0500	9,1	20 67150-0200
400	77,0	200 67210-2000	38,5	100 67220-1000	23,1	63 67240-0630	11,5	25 67150-0250
500	96,2	2 x 125 2 x 67110-1250	48,1	125 67220-1250	28,9	80 67240-0800	14,4	31,5 67150-0320
630	121,2	2 x 160 2 x 67210-1600	60,6	160 67220-1600	36,4	100 67240-1000	18,2	40 67150-0400
800	154,0	2 x 200 2 x 67210-2000	77,0	200 67220-2000	46,2	125 67240-1250	23,1	50 67150-0500
1000	192,5	3 x 160 3 x 67210-1600	96,2	2 x 125 2 x 67220-2000	57,7	160 67240-1600	28,9	63 67150-0630

Selection table for capacitor protection with HV back-up fuse-links according to VDE 0670 T4 / IEC 60282-1

When switching on and adjusting capacitors, transient currents similar to a short-circuit are generated. The intensity and duration of these currents depends on the switching angle, natural frequency and inductivity of the grid and on the size of the capacitors. Therefore, HV fuse-links with the next higher voltage level should be selected to protect individual capacitors.

The following table complies with the requirements of IEC 549 "High-voltage fuses for the external protection of shunt power capacitors".

Definitions:

I_{cr} = Capacitor rated current [A]
 I_r = Fuse-link rated current [A]

HV Fuse-Links

Selection table acc. to VDE 0670 T4 / IEC 60 282-1

Selection table

HV back-up Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1 with controlled power dissipation (ÜLA)

Table 7

Rated voltage range of the fuse-link [kV]		6/12		10/24	
Rated operating voltage of the transformer [kV]		10		20	
Rel. short-circuit voltage	Transformer rated output [kVA]	Transformer rated current [A]	Fuse-link rated current [A]	Transformer rated current [A]	Fuse-link rated current [A]
U _k = 4 %	50	2,9	10	1,5	4
	100	5,8	16 – 20	2,9	10
	125	7,2	20 – 25	3,6	10 – 16
	160	9,2	20 – 31,5	4,6	16 – 20
	200	11,5	25 – 40	5,8	16 – 20
	250	14,4	31,5 – 50	7,2	20 – 25
	315	18,2	40 – 63	9,1	20 – 31,5
	400	23,1	40 – 80	11,5	25 – 40
	500	28,9	50 – 100	14,4	31,5 – 50
U _k = 5 %	630	36,4	63 – 100	18,2	40 – 63
	800	46,2	80 – 125	23,1	40 – 63
	1000	57,7	100 – 160	28,9	50 – 80
U _k = 6,25 %	1250	72,2	125 – 200	36,1	63 – 100
	1600	92,4	125 – 200	46,2	80 – 100

Preferred values shown in bold print

Selection table

HV back-up Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1

Table 8

Rated voltage range of the fuse-link [kV]		3/7,2		6/12		10/24		20/36	
Rated operating voltage of the transformer [kV]		6		10		20		30	
Rel. short circuit voltage	Transformer rated output [kVA]	Transformer rated current [A]	Fuse-link rated current [A]	Transformer rated current [A]	Fuse-link rated current [A]	Transformer rated current [A]	Fuse-link rated current [A]	Transformer rated current [A]	Fuse-link rated current [A]
U _k = 4 %	50	4,8	16 - 20	2,9	10	1,5	4	0,96	2 - 6,3
	100	9,6	20 - 31,5	5,8	16 - 20	2,9	10	1,9	6,3 - 10
	125	12	25 - 40	7,2	20 - 25	3,6	10 - 16	2,4	10
	160	15,4	31,5 - 50	9,2	20 - 31,5	4,6	16 - 20	3,1	10
	200	19,2	40 - 63	11,5	25 - 40	5,8	16 - 20	3,8	10 - 16
	250	24,1	40 - 80	14,4	31,5 - 50	7,2	20 - 25	4,8	16 - 20
	315	30,3	50 - 100	18,2	40 - 63	9,1	20 - 31,5	6,1	16 - 25
	400	38,5	63 - 125	23,1	40 - 80	11,5	25 - 40	7,7	20 - 25
	500	48,1	80 - 160	28,9	50 - 100	14,4	31,5 - 50	9,6	20 - 31,5
	630	60,6	100 - 200	36,4	63 - 100	18,2	40 - 63	12,1	25 - 40
U _k = 5 %	800	77,1	125 - 200	46,2	80 - 125	23,1	40 - 63	15,4	31,5 - 40
	1000	96,3	125 - 160	57,7	100 - 160	28,9	50 - 80	19,2	40 - 50
	1250	120,3	160 - 200	72,2	125 - 200	36,1	63 - 100	24,1	40 - 50
U _k = 6,25 %	1600	154	200	92,4	125 - 200	46,2	80 - 100	30,8	50 - 63

Preferred values shown in bold print

HV Fuse-Links

 HV back-up Fuse-Links acc. to VDE 0670 T402 / IEC 60 282-1
 Electrical data, dimensions, weight

Table 9

Rated voltage range	Rated current	Rated value Maximum breaking current	Rated value Minimum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
				e mm	d mm	R _{initial} mΩ	P _{warm} W				
U _N kV	I _N A	I ₁ kA	I ₃ A					A ² s	kg		
3/7,2	6,3	63	21	192	56	256	11	800	1,2	1	67110-0060
3/7,2	10	63	38	192	56	144	19	3.000	1,2	1	67110-0100
3/7,2	16	63	65	192	56	41	13	2.340	1,2	1	67110-0160
3/7,2	20	63	92	192	56	32	14,5	3.900	1,1	1	67110-0200
3/7,2	25	63	110	192	56	25	20	4.900	1,2	1	67110-0250
3/7,2	31,5	63	123	192	56	19	23	7.000	1,2	1	67110-0320
3/7,2	40	63	140	192	56	12,3	30	14.000	1,2	1	67110-0400
3/7,2	50	63	194	192	56	9,3	35	25.300	1,2	1	67110-0500
3/7,2	63	63	220	192	65	7,0	60	61.700	1,4	1	67110-0630
3/7,2	80	63	300	192	65	5,2	85	87.400	1,6	1	67110-0800
3/7,2	100	63	440	192	78	4,0	96	180.000	2,0	1	67110-1000
3/7,2	125	63	440	192	88	2,9	75	440.000	2,4	1	67110-1250
3/7,2	160	63	610	192	88	2,3	120	654.000	2,7	1	67110-1600
6/12	6,3	63	23	292	56	409	19	800	1,7	1	67120-0060
6/12	10	63	35	292	56	231	29	3.000	1,7	1	67120-0100
6/12	16	63	64	292	56	69	21	3.700	1,7	1	67120-0160
6/12	20	63	90	292	56	53	25	4.700	1,6	1	67120-0200
6/12	25	63	95	292	56	41	31	4.920	1,7	1	67120-0250
6/12	31,5	63	110	292	56	31	39	7.000	1,7	1	67120-0320
6/12	40	63	134	292	56	20	46	14.000	1,7	1	67120-0400
6/12	50	63	190	292	56	16,7	62	25.300	1,7	1	67120-0500
6/12	63	63	220	292	65	11,7	60	63.000	2,1	1	67120-0630
6/12	80	63	345	292	65	8,7	82	87.000	2,3	1	67120-0800
6/12	100	63	400	292	78	6,7	96	180.000	3,1	1	67120-1000
6/12	125	63	480	292	88	4,9	117	440.000	3,7	1	67120-1250
6/12	160	63	610	292	88	3,8	175	654.000	1,9	1	67120-1600
10/17,5	6,3	63	20	367	56	530	24	800	1,9	1	67130-0060
10/17,5	10	63	33	367	56	312	34	3.000	1,9	1	67130-0100
10/17,5	16	63	64	367	56	100	34	2.340	1,9	1	67130-0160
10/17,5	20	63	80	367	56	75	42	3.900	1,9	1	67130-0200
10/17,5	25	63	100	367	56	56	50	6.500	1,9	1	67130-0250
10/17,5	31,5	63	110	367	56	46	61	7.000	1,9	1	67130-0320
10/17,5	40	63	134	367	56	32	83	14.200	1,9	1	67130-0400
10/17,5	50	63	180	367	56	22	84	40.000	3,5	1	67130-0500
10/17,5	63	63	240	367	56	16	110	61.700	3,5	1	67130-0630
10/17,5	80	63	320	367	78	13	130	87.400	3,5	1	67130-0800
10/17,5	100	63	420	367	78	9,5	180	170.000	4,4	1	67130-1000
10/24	6,3	63	23	442	56	640	32	800	2,4	1	67140-0060
10/24	10	63	36	442	56	386	48	2.000	2,4	1	67140-0100
10/24	16	63	73	442	56	127	43	2.340	2,4	1	67140-0160
10/24	20	63	91	442	56	97	53	3.900	2,3	1	67140-0200
10/24	25	63	116	442	56	74	64	6.500	2,4	1	67140-0250
10/24	31,5	63	125	442	56	61	85	7.000	2,4	1	67140-0320
10/24	40	63	161	442	56	43	103	14.200	2,3	1	67140-0400
10/24	50	63	230	442	56	35	146	24.200	4,5	1	67140-0500
10/24	63	63	350	442	65	25	163	46.400	3,1	1	67140-0630
10/24	80	63	460	442	65	19	196	104.000	4,5	1	67140-0800
10/24	100	63	420	442	88	14	279	140.000	4,1	1	67140-1000
20/36	6,3	31,5	23	537	56	827	39	600	2,8	1	67150-0060
20/36	10	31,5	34	537	56	463	65	2.000	2,8	1	67150-0100
20/36	16	31,5	70	537	56	210	67	2.340	2,7	1	67150-0160
20/36	20	31,5	100	537	56	165	84	3.900	2,8	1	67150-0200
20/36	25	31,5	110	537	56	125	100	6.500	2,8	1	67150-0250
20/36	31,5	31,5	135	537	56	85	119	7.000	3,7	1	67150-0320
20/36	40	20	205	537	56	65	176	14.200	3,8	1	67150-0400
20/36	50	20	220	537	56	42	183	40.000	6,5	1	67150-0500
20/36	63	20	360	537	65	35	271	61.700	6,8	1	67150-0630

HV Fuse-Links

HV back-up Fuse-Links acc. to VDE 0670 T402 and T402 ÜLA

Time-current characteristics

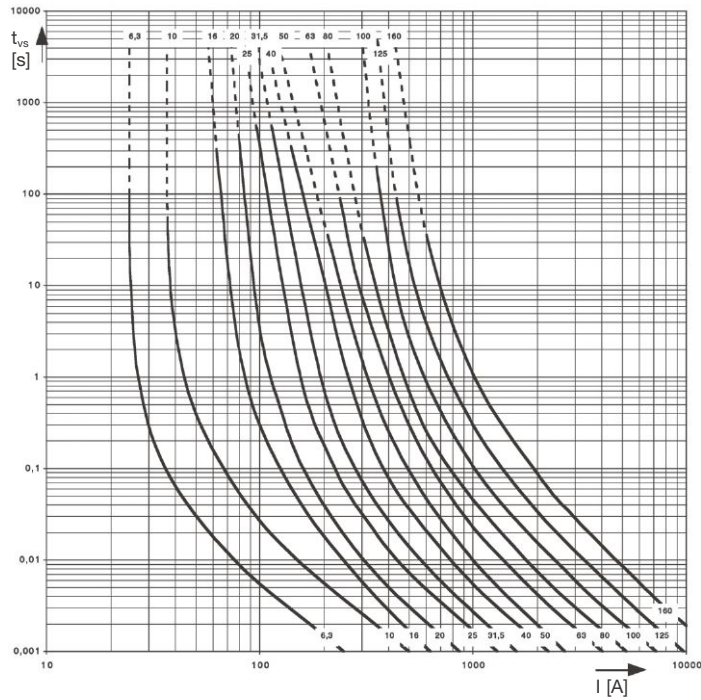


Fig.10
3/7.2 kV

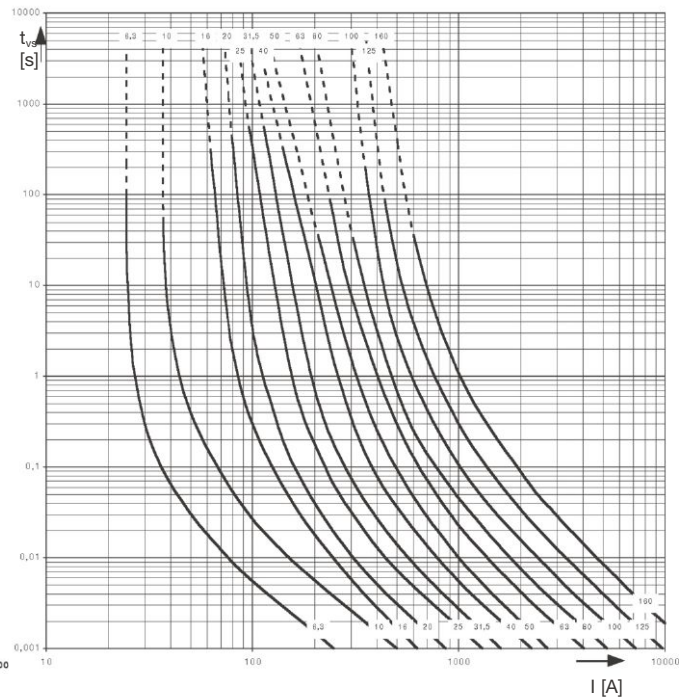


Fig. 11
6/12 kV

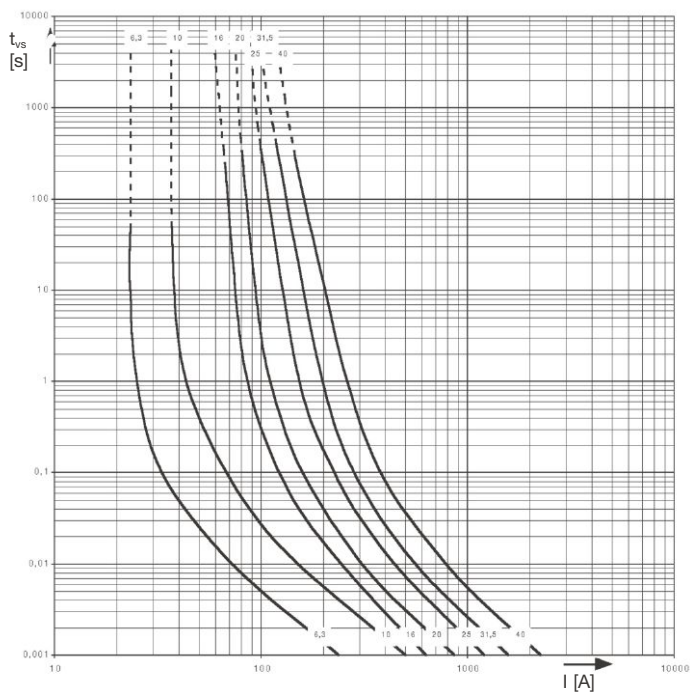


Fig. 12
10/24 kV 6.3 A – 40 A

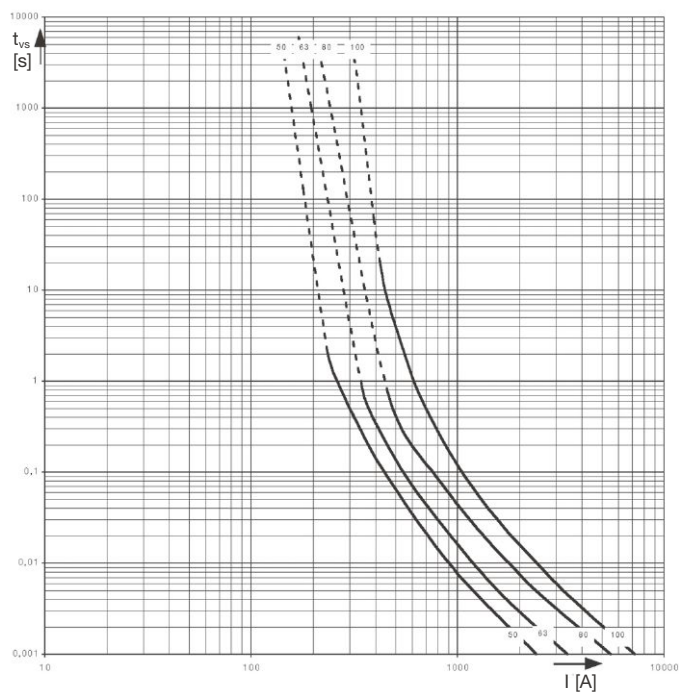


Fig. 13
10/24 kV 50 A – 100 A

HV Fuse-Links

Fuse-Links

HV back-up Fuse-Links acc. to VDE 0670 T402 and T402 ÜLA

Time-current characteristics

Dimensions acc. to DIN 43 625 in mm

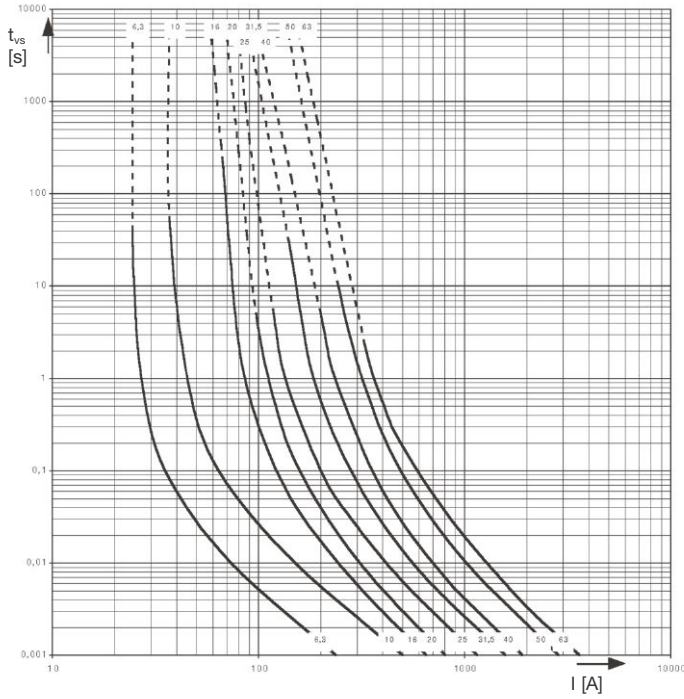
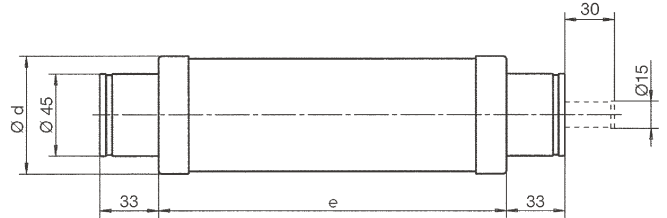


Fig. 14
20/36 kV



HV Fuse-Links

HV back-up Fuse-Links acc. to VDE 0670 T402 / IEC 60 282-1 with controlled power dissipation $\dot{U}LA$

Electrical data, dimensions, weight

Table 10

Rated voltage range	Rated current	Rated value Maximum breaking current	Rated value Minimum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
				e mm	d mm	R _{initial} mΩ	P _{warm} * W				
U _N kV	I _N A	I ₁ kA	I ₃ A					A ² s	kg		
6/12	10	63	35	292	56	227	29	3.000	1,6	1	67520-0100
6/12	16	63	64	292	56	66	21	3.700	1,6	1	67520-0160
6/12	20	63	90	292	56	51	25	4.700	1,6	1	67520-0200
6/12	25	63	95	292	56	40	29	4.920	1,6	1	67520-0250
6/12	31,5	63	110	292	56	30	39	7.000	1,6	1	67520-0320
6/12	40	63	134	292	56	20	46	14.000	1,6	1	67520-0400
6/12	50	63	190	292	56	15	62	25.300	1,6	1	67520-0500
6/12	63	63	220	292	65	12	62	63.000	2,1	1	67520-0630
6/12	80	63	345	292	65	8,7	85	87.000	2,1	1	67520-0800
6/12	100	63	500	292	65	8,1	152	140.000	2,1	1	67520-1000
6/12	125	63	480	292	88	4,5	117	430.000	3,7	1	67520-1250
6/12	160	63	610	292	88	4,0	175	670.000	3,7	1	67520-1600
10/24	6,3	63	23	442	56	640	31	800	2,3	1	67541-0060
10/24	10	63	36	442	56	386	48	2.000	2,3	1	67541-0100
10/24	16	63	73	442	56	127	42	2.340	2,3	1	67541-0160
10/24	20	63	91	442	56	97	53	3.900	2,3	1	67541-0200
10/24	25	63	116	442	56	73	60	6.500	2,3	1	67541-0250
10/24	31,5	63	125	442	56	57	84	7.000	2,3	1	67541-0320
10/24	40	63	161	442	56	41	96	14.200	2,3	1	67541-0400
10/24	50	63	230	442	65	35	146	24.200	3,1	1	67541-0500
10/24	63	63	350	442	65	24	163	46.400	3,1	1	67541-0630
10/24	80	63	460	442	65	19	196	104.000	3,1	1	67541-0800
10/24	100	63	420	442	88	14	279	140.000	4,1	1	67541-1000
20/36	6,3	31,5	23	537	56	889	39	600	2,7	1	67550-0060
20/36	10	31,5	34	537	56	529	66	2.000	2,7	1	67550-0100
20/36	16	31,5	70	537	56	190	67	2.340	2,7	1	67550-0160
20/36	20	31,5	100	537	56	153	84	3.900	2,7	1	67550-0200
20/36	25	31,5	110	537	56	118	100	6.500	2,7	1	67550-0250
20/36	31,5	31,5	135	537	65	82	119	7.000	3,7	1	67550-0320
20/36	40	20	205	537	65	63	176	14.200	3,7	1	67550-0400
20/36	50	20	220	537	88	41	183	40.000	6,5	1	67550-0500

* Power dissipation P_{warm} at HV fuse-link rated current; for power dissipation at transformer rated current see table 2

HV Fuse-Links

HV back-up Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1

Table 11

Electrical data, dimensions, weight

Rated voltage range	Rated current	Rated value Maximum breaking current	Rated value Minimum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
				e mm	d mm	R _{initial} mΩ	P _{warm} * W				
U _N kV	I _N A	I ₁ kA	I ₃ A					A2s	kg		
3/7,2	2	63	15	192	56	290	1,8	600	1,1	1	67210-0020
3/7,2	4	63	20	192	56	270	5	800	1,1	1	67210-0040
3/7,2	6,3	63	21	192	56	256	11	800	1,1	1	67110-0060
3/7,2	10	63	38	192	56	144	19	3.000	1,1	1	67110-0100
3/7,2	16	63	65	192	56	41	13	2.340	1,1	1	67110-0160
3/7,2	20	63	92	192	56	32	14,5	3.900	1,1	1	67110-0200
3/7,2	25	63	110	192	56	25	20	4.900	1,1	1	67110-0250
3/7,2	31,5	63	123	192	56	19	23	7.000	1,1	1	67110-0320
3/7,2	40	63	140	192	56	12,3	30	14.000	1,1	1	67110-0400
3/7,2	50	63	194	192	56	9,3	35	25.300	1,1	1	67110-0500
3/7,2	63	63	220	192	65	8,75	60	41.200	1,4	1	67210-0630
3/7,2	80	63	306	192	65	6,3	85	84.000	1,4	1	67210-0800
3/7,2	100	63	363	192	65	5	96	93.600	1,4	1	67210-1000
3/7,2	125	63	440	192	88	2,9	75	440.000	2,4	1	67110-1250
3/7,2	160	63	509	192	88	2,5	120	500.000	2,4	1	67210-1600
3/7,2	200	63	612	192	88	2,3	200	654.000	2,4	1	67210-2000
6/12	1	63	14	292	56	1500	1,6	90	1,6	1	67220-0010
6/12	2	63	16	292	56	510	2	280	1,6	1	67220-0020
6/12	4	63	22	292	56	338	6	500	1,6	1	67220-0040
6/12	6,3	63	30	292	56	190	8	600	1,6	1	67220-0060
6/12	10	63	42	292	56	139	16	1.150	1,6	1	67220-0100
6/12	16	63	54	292	56	107	38	1.290	1,6	1	67220-0160
6/12	20	63	73	292	56	71	38	3.200	1,6	1	67220-0200
6/12	25	63	93	292	56	52	46	5.200	1,6	1	67220-0250
6/12	31,5	63	105	292	56	43	65	7.200	1,6	1	67220-0320
6/12	40	63	125	292	56	23	54	23.300	1,6	1	67220-0400
6/12	50	63	160	292	56	18	70	34.900	1,6	1	67220-0500
6/12	63	63	230	292	56	12	85	58.300	1,6	1	67220-0630
6/12	80	63	350	292	65	10,6	114	90.000	2,1	1	67220-0800
6/12	100	63	500	292	65	8,5	156	140.000	2,1	1	67220-1000
6/12	125	63	480	292	88	4	117	440.000	3,7	1	67220-1250
6/12	160	63	560	292	88	4,3	217	500.000	3,7	1	67220-1600
6/12	200	63	610	292	88	3,8	333	654.000	3,7	1	67220-2000
6/12	250	63	740	292	88	-	-	-	-	1	67220-2500
10/17,5	2	63	15	367	56	610	4	600	1,9	1	67230-0020
10/17,5	4	63	20	367	56	580	15	800	1,9	1	67230-0040
10/17,5	50	63	165	367	65	28	117	20.600	2,6	1	67230-0500
10/17,5	63	63	220	367	65	21	150	41.200	2,6	1	67230-0630
10/17,5	80	63	300	367	65	15	183	84.000	2,6	1	67230-0800
10/17,5	100	63	350	367	65	13	260	93.600	2,6	1	67230-1000
10/24	1	63	14	442	56	2100	2	90	2,3	1	67240-0010
10/24	2	63	16	442	56	800	3	340	2,3	1	67240-0020
10/24	4	63	23	442	56	550	10	450	2,3	1	67240-0040
10/24	6,3	63	30	442	56	300	13	530	2,3	1	67240-0060
10/24	10	63	43	442	56	220	26	940	2,3	1	67240-0100
10/24	16	63	54	442	56	197	73	1.400	2,3	1	67240-0160
10/24	20	63	73	442	56	134	76	3.100	2,3	1	67240-0200
10/24	25	63	93	442	56	96	89	4.500	2,3	1	67240-0250
10/24	31,5	63	105	442	56	79	127	5.900	2,3	1	67240-0320
10/24	40	63	125	442	56	45	114	18.800	2,3	1	67240-0400
10/24	50	63	205	442	56	35	147	33.500	2,3	1	67240-0500
10/24	63	63	350	442	65	29	163	46.400	3,1	1	67240-0630
10/24	80	63	310	442	65	20,5	233	84.000	3,1	1	67240-0800
10/24	100	63	430	442	78	18	400	93.600	4,1	1	67240-1000
10/24	125	40	760	442	88	11	340	350.000	5,9	1	67240-1250
10/24	160	31,5	900	442	88	9,6	515	500.000	5,9	1	67240-1600
10/24	200	31,5	1050	442	88	7,4	740	730.000	5,9	1	67240-2000

HV Fuse-Links

Rated voltage range	Rated current	Rated value Maximum breaking current	Rated value Minimum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
				e mm	d mm	R _{initial} mΩ	P _{warm} * W				
U _N kV	I _N A	I ₁ kA	I ₃ A					A2s	kg		
20/36	2	31,5	15	537	56	950	9	600	2,7	1	67250-0020
20/36	4	31,5	20	537	56	900	32	800	2,7	1	67250-0040
20/36	6,3	31,5	23	537	56	827	39	600	2,7	1	67150-0060
20/36	10	31,5	34	537	56	520	65	2.000	2,7	1	67150-0100
20/36	16	31,5	70	537	56	210	67	2.340	2,7	1	67150-0160
20/36	20	31,5	100	537	56	165	84	3.900	2,7	1	67150-0200
20/36	25	31,5	110	537	56	125	100	6.500	2,7	1	67150-0250
20/36	31,5	31,5	135	537	65	85	119	7.000	3,7	1	67150-0320
20/36	40	20	205	537	65	65	176	14.200	3,7	1	67150-0400
20/36	50	20	220	537	88	45	183	40.000	6,5	1	67150-0500
20/36	63	20	360	537	88	35	271	61.700	6,5	1	67150-0630

HV back-up Fuse-Links acc. to VDE 0670 T4 and T4 ÜLA Time-current characteristics

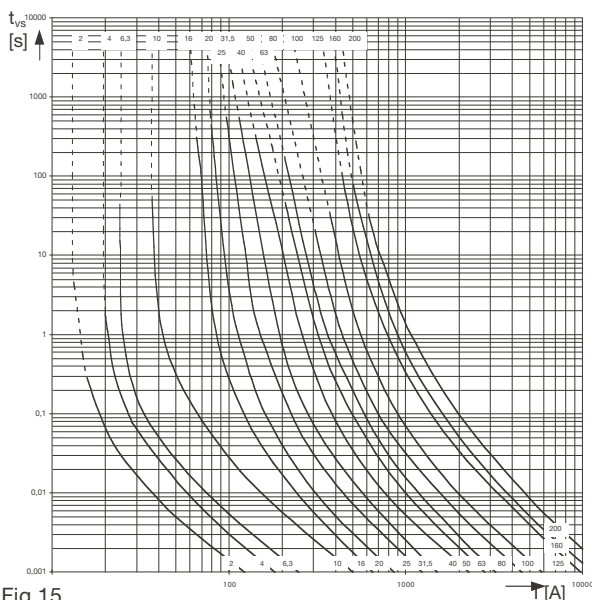


Fig.15
3/7.2 kV

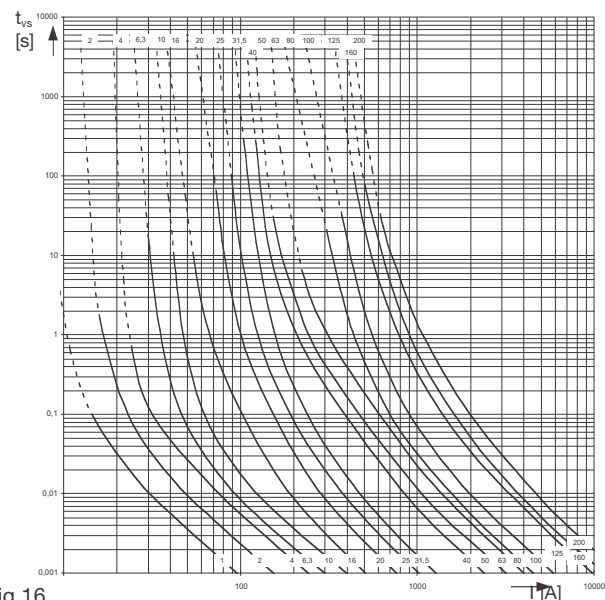


Fig.16
6/12 kV

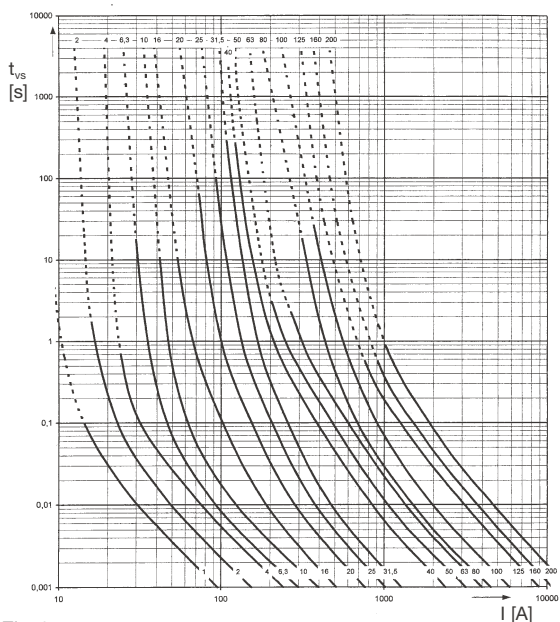


Fig.17
10/24 kV

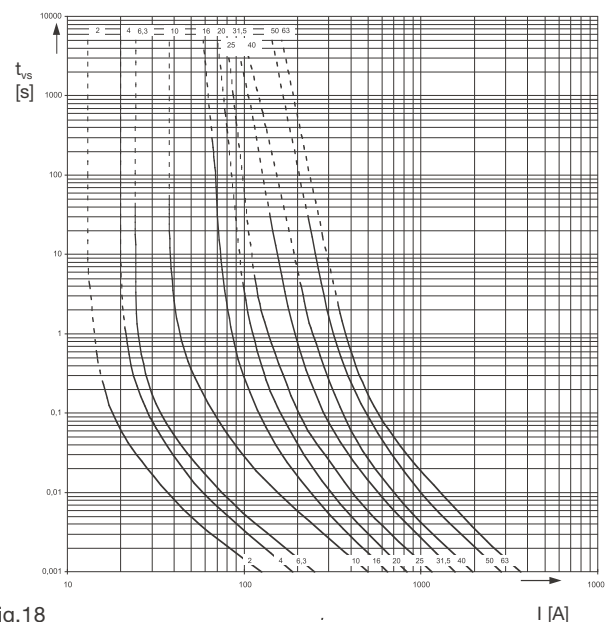


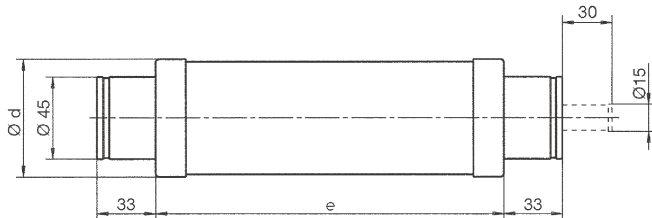
Fig.18
20/36 kV

HV Fuse-Links

EFEN HV back-up Fuse-Links acc. to VDE 0670 T4 / IEC 60 282-1
Electrical data, dimensions, weight

Rated voltage range	Rated current	Rated value Maximum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
			e mm	d mm	R _{initial} mΩ	P _{warm} * W				
U _N kV	I _N A	I ₁ kA					A2s	kg		
6/12	1	63	442	56	1500	1,5	90	2,3	1	67004-0010
6/12	2	63	442	56	510	2	280	2,3	1	67004-0020
6/12	4	63	442	56	338	6	500	2,3	1	67004-0040
6/12	6,3	63	442	56	190	7	600	2,3	1	67004-060
6/12	10	63	442	56	139	16	1.150	2,3	1	67004-0100
6/12	16	63	442	56	107	36	1.290	2,3	1	67004-0160
6/12	20	63	442	56	71	37	3.200	2,3	1	67004-0200
6/12	25	63	442	56	52	44	5.200	2,3	1	67004-0250
6/12	31,5	63	442	56	43	63	7.200	2,3	1	67004-0320
6/12	40	63	442	56	23	50	23.300	2,3	1	67004-0400
6/12	50	63	442	56	18	60	34.900	2,3	1	67004-0500
6/12	63	63	442	56	12	77	58.300	2,3	1	67004-0630
6/12	80	63	442	65	10,6	101	90.000	3,1	1	67004-0800
6/12	100	63	442	65	8,5	140	140.000	3,1	1	67004-1000
6/12	125	63	442	88	4	100	440.000	5,9	1	67004-1250
6/12	160	63	442	88	4	160	500.000	5,9	1	67004-1600
6/12	200*	63	442	88	3,5	248	654.000	5,9	1	67004-2000

* Reduction factor 0.95

Dimensions acc. to DIN 43 625 in mm


HV Fuse-Links

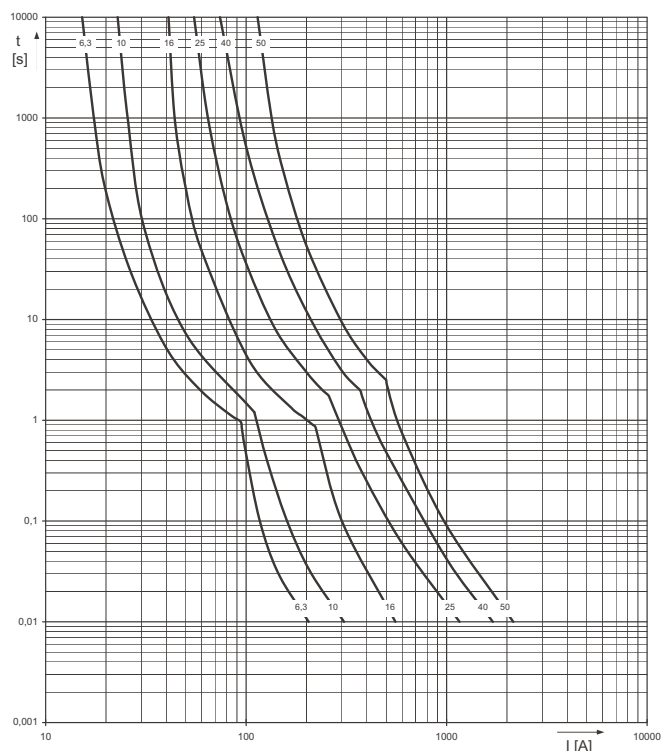
EFEN HV general-purpose Fuse-Links

Table 12

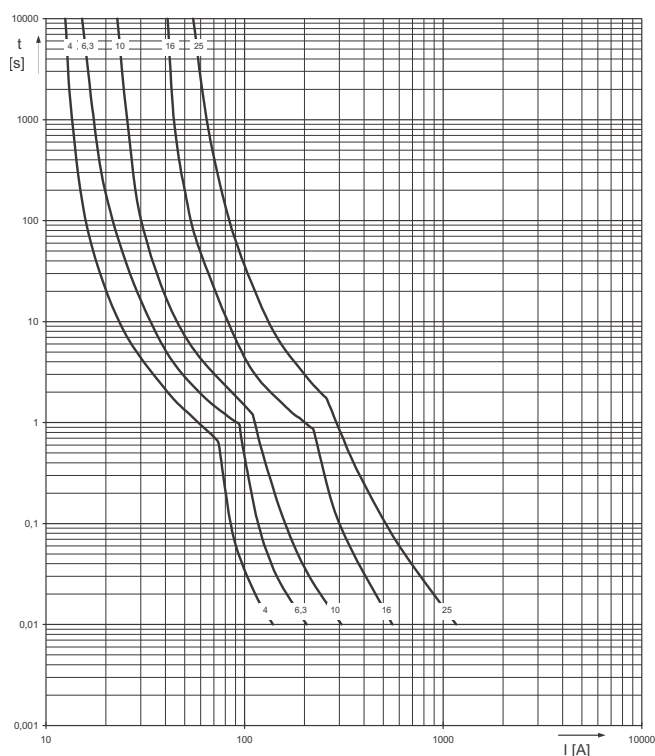
Electrical data, dimensions, weight

Rated voltage range	Rated current	Rated value Maximum breaking current	Dimensions		Resistance and power dissipation		Operating integral	Weight	PU	Order no.
			e mm	d mm	R _{initial} mΩ	P _{warm} * W				
U _N kV	I _N A	I ₁ kA					A2s	kg		
6/12	6,3	40	292	65	132	6	2.000	2,3	1	67420-0060
6/12	10	40	292	65	70	8	3.800	2,3	1	67420-0100
6/12	16	40	292	65	35	10	14.000	2,3	1	67420-0160
6/12	25	40	292	65	21	15	36.000	2,3	1	67420-0250
6/12	40	40	292	78	13	24	110.000	3,1	1	67420-0400
6/12	50	40	292	88	10	31	150.000	3,7	1	67420-0500
10/24	4	40	442	78	280	5	1.800	4,1	1	67440-0040
10/24	6,3	40	442	78	260	11	2.000	4,1	1	67440-0060
10/24	10	40	442	78	138	15	3.600	4,1	1	67440-0100
10/24	16	40	442	78	70	21	14.000	4,1	1	67440-0160
10/24	25	40	442	88	41	31	39.000	4,5	1	67440-0250

Time-current characteristics for HV general-purpose Fuse-Links 6/12 kV 6.3 A to 50 A acc. to IEC 60282-1 / VDE 0670 part 4



Time-current characteristics for HV general-purpose Fuse-Links 10/24 kV 4 A to 25 A acc. to VDE 0670 part 4



HV Accessories

Fuse-Links

HV fuse base acc. to DIN 43 624 for indoor use

Electrical data, dimensions, weight

Table 13

Order no.	U _N kV	I _n A	Dimensions in mm								Weight in kg	PU
			a	b	c	d	e	f	g	h		
68007-0010	12	200	293	255	195	323	425	55	453	55	3,8	1
68008-0010	24	200	443	335	275	473	575	300	603	66	4,8	1
68012-0010	36	200	538	495	435	568	700	380	698	108	9,4	1
68021-0010	7,2	200	193	254	194	223	325	55	353	55		

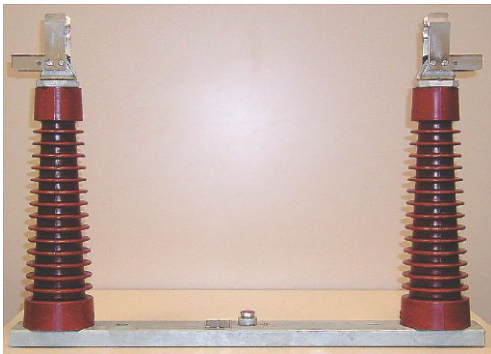
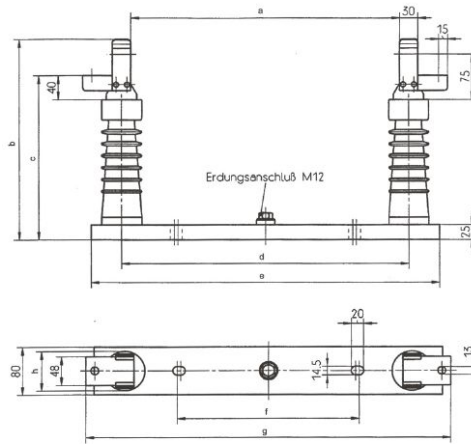


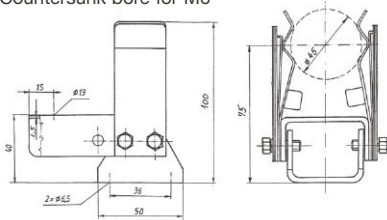
Fig. 19
HV fuse base for indoor use



Fuse-Base contacts, rated current 200 A

Table 14

Terminal bolt M10x35
Countersunk bore for M6



68016-0010

Application	Indoor and outdoor use
Contact spring	E-copper silver-plated
Terminal lug	E-copper tin-plated
Weight	0,42 kg
Order no.	68016-0010

Application	Indoor and outdoor use
Contact spring	E-copper silver-plated
Terminal lug	E-copper tin-plated
Weight	0,35 kg
Order no.	81931-0100

HV Accessories

Adapter for high-voltage Fuse-Links acc. to DIN 43 625
for extending the fuse-link from dimension "e"
292 mm (12 kV) to 442 mm (24 kV)

Adapter

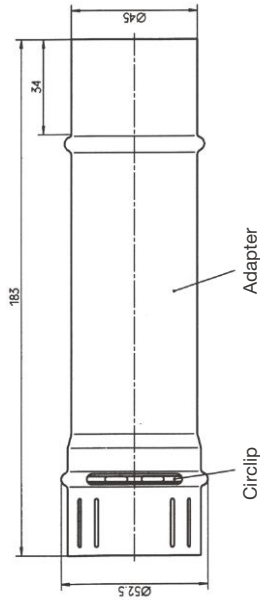


Fig. 20

Wall rack

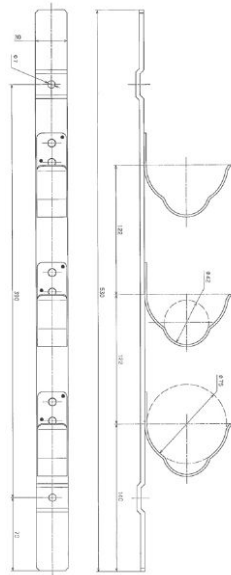


Fig. 21

Designation	Variant	Order no.
Adapter	Surface: silver	68003-0100
Adapter		68003-0200
Wall rack		68004-0010

Test device for tripping

Test device



Fig. 22

Extension
12 kV



Extension
24 kV



After activation of the timer, the striker is pushed in quickly and the fuse is inserted into the fuse box of the switch to be checked. After approx. 100 s, the switching mechanism trips, knocking out the striker. The dimensions of the test fuse-link correspond to those of HV fuse-links with a rated voltage of 7.2 kV. Extensions are available to adapt the test device to fuse-links of a different voltage.

1. Activate the timer using the yellow pin.
2. Push the striker in quickly.
3. If necessary, put on the adapter.
4. Insert the device into the fuse compartment of the switch and close it.
5. Wait for the device to trip.

Safety notice:
Risk of injury while the timer is running and the striker has not tripped.
Stay clear of the tripping area of the test fuse-link.
Do not use test fuse-link under voltage.

Mechanical test fuse-link of type HPS is used to check the tripping of load-break switches. Similar to an HV fuse-link, the test fuse-link consists of a cylindrical fuse body and contains a mechanical tripping mechanism with a timer and striker.

The test fuse-link has been designed for a nominal tripping force of 65 N that is less than the tripping characteristic of the EFEN HV fuse-link. This ensures the reliable tripping of the actual HV fuse-link.

Designation	Dimensions			PU	Order no.
	Diameter in mm	Length in mm	Resulting dimension "e" in mm		
Test device 65 N 192 mm (7.2 kV)	67	190	190	1	68013-0020
Extension to 292 mm (12 kV)	61	100	290	1	68014-0010
Extension to 442 mm (24 kV)	61	250	440	1	68015-0010