EFEN

HH-2



HV Fuses

according to VDE 0670 T4/ IEC 60 282-1

from 3kV up to 36kV

高压熔断器符合VDE 0670 T4/IEC 60 282-1
从3kV 至 36kV

目录/*Contents*

	页码 /*Page*
产品概述 *General Information*	3
术语解释 / 定义 *Explanation of Terms/Definitions*	4–6
变压器保护 / 选择标准 *Protection of Transformers/Selection Criteria*	7
符合 VDE 0670 T4/IEC 60 282-1 标准的后备式熔断器: 选型表 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1: Selection table*	8
符合 VDE 0670 T4/IEC 60 282-1 标准的后备式熔断器: 技术参数 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1: Technical data*	9
符合 VDE 0670 T4/IEC 60 282-1 标准的后备式熔断器: 时间–电流特性曲线 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1: Time-current characteristics*	10
符合 VDE 0670 T4/IEC 60 282-1 标准, 带功率损耗控制的后备式熔断器: 概述 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1 with ÜLA (controlled power dissipation): general information*	11
符合 VDE 0670 T4/IEC 60 282-1 标准: 带功率损耗控制的后备式熔断器: 选型表 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1 with ÜLA: Selection table*	12
符合 VDE 0670 T4/IEC 60 282-1 标准, 带功率损耗控制的后备式熔断器: 技术参数 *Back-up Fuse-Links according to VDE 0670 T4/IEC 60 282-1 with ÜLA: Technical data*	13
符合IEC 62 271-105 标准的后备式熔断器在开关一熔断器组合中的使用 *Back-up Fuse-Links in conjunction with switch-fuse combinations according to IEC 62 271-105*	14
符合DIN 43 624 标准, 室内 使用的高压熔断器底座, 底座接触支架 *HV Fuse-Bases for indoor use according to DIN 43 624, fuse-base contacts*	15
符合 VDE 0670 T4/IEC 60 282-1 标准的电压互感器保护高压熔断器(HSW): 概述, 技术参数 *High-Voltage Fuse-Links for voltage transformers (HSW) according to VDE 0670 T4/IEC 60 282-1: General Information and Technical Data*	16

产品概述

几十年来，高压熔断器作为一种可靠的保护装置应用于中压电气开关及控制系统。它能可靠地保护电气设备与装置免受由于短路造成的热力和动力作用的影响。

埃芬（EFEN）高压熔断器的突出性能体现于:

– 切断能力强
– 限制电流能力强
– 操作电压低
– 断开时间极短
– 耐老化

埃芬（EFEN）高压熔断器符合下列标准:

– VDE 0670 T4/IEC 60 282-1: 高压熔断器“限流式熔断器”

– IEC 60 787: 变压器保护用高压熔断器的选择指南

– VDE 0671 T105/IEC 62 271-105: 高压交流开关–熔断器组合

– DIN 43 625: 高压熔断器，额定电压 3.6 kV ~ 36kV（熔断器尺寸）
– DIN 43 624: 高压熔断器，额定电压 3 / 3.6kV ~ 30 / 36 kV（单极熔断器底座）

埃芬（EFEN）有限公司的质量保证体系符合国际标准DIN ISO 9001（欧洲标准 29001），并取得认证证书.

埃芬（EFEN）的环境管理体系遵从 DIN ISO 14001 国际标准。

埃芬（EFEN）生产符合DIN 43 625 标准尺寸的高压熔断器，其户内型和户外型两种均带有撞针系统。撞针动作时启动机械脱扣装置，同时由于它的红颜色还可以作为显示熔断的装置。

除了本目录介绍的高压熔断器外，埃芬（EFEN）还生产多种特殊用途，特殊尺寸的熔断器。若您有特殊的要求，请联系我们。我们乐意为您提供服务！

General information

HV fuse-links have been used for reliable protection in medium-voltage switchgear and controlgear and systems for decades. They protect apparatus and equipment against the thermal and dynamic effects of short-circuits.

The outstanding features of EFEN HV fuse-links are:

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

EFEN HV fuse-links conform to the following standards:

– *VDE 0670 T4/IEC 60 282-1: High-voltage fuses “current limiting fuses”*
– *IEC 60 787: Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit applications*
– *VDE 0671 T105/IEC 62 271-105: High-voltage alternating current switch-fuse combinations*
– *DIN 43 625: High-voltage fuses, rated voltages 3,6 to 36kV (fuse-link dimensions)*
– *DIN 43 624: High-voltage fuses, rated voltages 3/3,6 to 30/36kV (single-pole fuse bases)*

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

EFEN operates a certified environment management system conforming to DIN ISO 14001.

EFEN manufactures HV fuse-links with dimensions conforming to DIN 43 625 with striker for indoor and outdoor use, where the striker serves for actuating a trip-free mechanism as well as an indicator due to its red colour.

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

术语及定义

后备熔断器

后备熔断器有一个“额定最小分断电流I_3”，在达到该电流时熔断器能够将电流切断。后备熔断器在低于“额定最小分断电流”（小于I_3）不会动作。后备熔断器动作范围是I_3至“最大额定分断电流”（I_1）。

后备熔断器在应用时要注意到该熔断器侧的最小短路电流要高于I_3（$I_{Kmin}>I_3$）。如果该短路电流比最小分断电流要小，那么必须采取附加的保护措施。

撞针

本目录中列出的高压熔断器的有效行程为30 mm，是一种中型熔断器。其分类的依据是撞针在点A和B（在动作范围内的一开始的20 mm）之间的能量的释放。最初的力大概为80 N，在自由运动的末端大概为15N。

撞针动作是用来启动开关的机械脱扣装置。

Terms and definitions

Back-up fuse-links

Back-up fuse-links have a “rated minimum breaking current I_3” from which the fuse-links are able to interrupt current. Back-up fuse-links are not supposed to operate below their “minimum breaking current” (below I_3). Their operating range is from I_3 to the "maximum rated breaking current” (I_1).

For the assignment of back-up fuse-links, it is important to note that the lowest short circuit current is higher at the site of the HV back-up fuse-link than I_3 ($I_{Kmin}>I_3$). If the short circuit current is lower than the minimum breaking current, additional protection must be provided.

Striker

The striker of HV fuse-links in this product list has an effective length of 30 mm and is a “medium” type. This classification results from the energy released by the striker between the points A and B (within the first 20 mm of the operating distance). The initial force is about 80N, the force at the end of free movement is about 15N.

The striker serves for actuation of the trip-free mechanism of the switch.

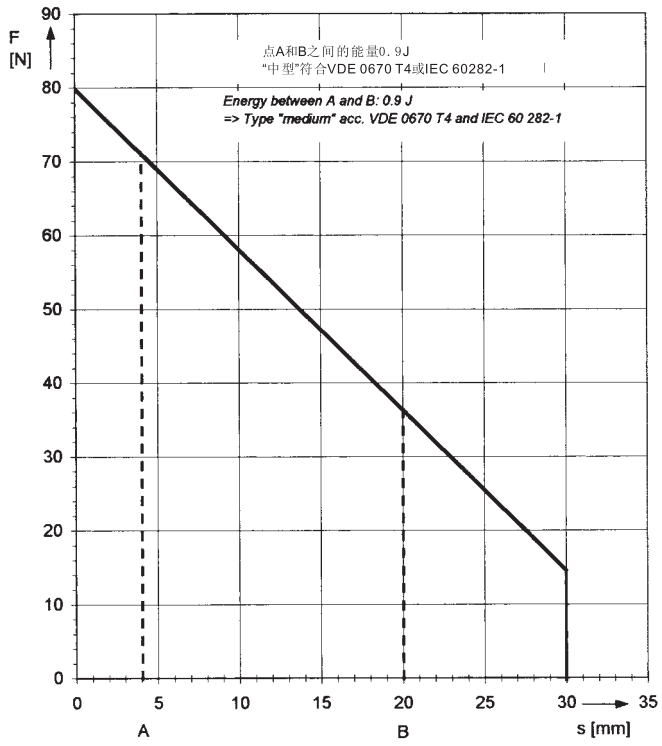


图1./*Fig.* 1

额定电流的范围

高压熔断器必须在额定的电压下工作，这一点十分重要。因此，工作电压要依照熔断器的最大额定电压，考虑到熔断器起弧时的开关电压，熔断器不能无限制的在低于额定电压下使用。低于额定电压可以考虑，但是这种情况下熄弧不应该超过系统绝缘等级。

Rated voltage range

It is important for HV fuse-links that they must be operated at the voltage for which it has been rated. Accordingly, the operating voltage corresponds to the maximum rated voltage of the fuse-link. Owing to the switching voltage occurring during arcing, the fuse-link cannot be used at lower voltages without limitation. A lower operating voltage at which the fuse-link can still be used without exceeding the system insulation level during extinction must therefore be taken into account.

从以上两个值我们可以得到熔断器允许的电压范围，该电压范围会印在我们的熔断器上或者写在技术数据里，如10/24kV。

From these two values results the permissible voltage range of the fuse-link, which is shown on the fuse-links or in the technical data, e.g. 10/24kV.

分断能力I_1

分断能力通常也被叫做“额定最大分断电流”。这种定义很清楚地显示了能被熔断器切断的最大电流。

I_1必须要比通过熔断器侧的最大短路电流大 ($I_1 > I_{Kmax}$)。

Breaking capacity I_1

The breaking capacity is also referred to as the “rated maximum breaking current”. This clearly indicates that this is the maximum current which can be interrupted by the fuse-link.

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

最小分断电流I_3

最小分断电流通常也被叫做“额定最小分断电流”。该值对于后备熔断器必须定义。从该电流开始，后备熔断器能够切断故障电流。熔断器必须被安装在该处故障电流不低于I_3的系统中（取决于系统参数或其他保护装置）。

Minimum breaking current I_3

The minimum breaking current is referred to as the “rated minimum breaking current”. This value must be specified for back-up fuse-links. From this current, back-up fuse-links are capable to breaking fault currents. The fuse-links must be assigned to the system so that no fault current below I_3 can occur at the site of the fuse-link (due to the system parameters or other protective devices).

熔断器的功率损耗P_{warm}

高压熔断器的功率损耗是根据其额定电流而定的。应该注意，使用高压熔断器保护时，工作电流一般只是额定电流的二分之一。根据物理学的原理，实际的功率损耗小于技术参数表中后备高压熔断器P_{warm}值的四分之一。

Power dissipation of a fuse-link P_{warm}

The power dissipation of a HV fuse-link is specified at the rated current of the fuse-link. For protection with HV fuse-links, it should be noted that the operating current is normally half the rated current. Because of the physical relationships, the actual power dissipation is less than a quarter of the value P_{warm} for HV fuse-links shown in the technical data table.

时间—电流（I/t）特性

时间电流特性曲线描述了电流与时间至熔断器熔芯熔断时的相互关系。有效时间（t_{vs}）用以表示100ms以下的熔断器的I/t特性的对应关系。在与其他保护装置，如：负荷分断开关或断路器配合使用时，熔断参数I^2t必须要参照100ms以下的熔断时间。

Time-current characteristic (I/t characteristic)

The time-current characteristic shows the correlation between time (t_{vs}) is specified to enable a comparison of the I/t current and time up to the melting of a fuse-element. The virtual characteristics of fuse-links below 100ms. For co-ordination with other protective devices, e.g. switches or circuit breakers, the melting integral I^2t must be referred to for melting times below 100ms.

电流限制

短路电流很高时，高压熔断器能在几毫秒之内切断电流。这意味着电流在未达到正弦曲线的峰值之前就被切断了，高压熔断器是一种电流限制装置。相比那些机械动作开关，这是一个显著的优势。那些机械开关需要更长的时间开启并切断电流。而正是在这段时间里，峰值短路电流不受限制而产生了强大的冲击作用。使用高压熔断器，则能在几毫秒内将该浪涌电流限制在相对较小的数值，所以其后的系统在耐冲击作用上的设计可以降低。

Current limitation

At high short circuit currents, HV fuse-links interrupt current within several milliseconds. That means, the sinusoidal current does not reach its peak value and that HV fuse-links are 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 time, 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 and the design of the subsequent system can be reduced in terms of dynamic forces.

操作电压

由于高压熔断器起限流作用，短路电流在上升时就应被限制并减弱。这就要求一个高于系统电压的操作电压来迫使电流归零。该操作电压须在允许的范围内，不超过最大额定电压峰值的2.2倍。埃芬（EFEN）的高压熔断器符合该规定。

Switching voltage

So that HV fuse-links perform a current-limiting action, the short circuit current must be limited and reduced as it increases. This requires a switching voltage that exceeds the driving system voltage and forces the current to zero. This switching voltage must not exceed the specified permissible value of 2.2 times the peak value of the maximum rated voltage. EFEN HV fuse-links are within this limit.

尺寸

本目录介绍的高压熔断器均符合 DIN 43 625 标准。

该标准的触点端盖尺寸如下图所示（图2）。其中尺寸“e”是因高压熔断器额定电压的不同而变化的，具体尺寸请查询熔断器技术数据表。直径“d”也是根据额定电流变化的，具体尺寸也请查询熔断器技术数据表。

Dimensions

HV fuse-links in this product list conform to DIN 43 625.

The contact cap dimensions defined in this standard are shown in Fig. 2. The dimension “e” varies depending on the rated voltage of HV fuse-links, which is shown as a dimension for fuses in the technical data tables. The diameter “d” also varies with the rated current, whereby this dimension is also shown in the tables.

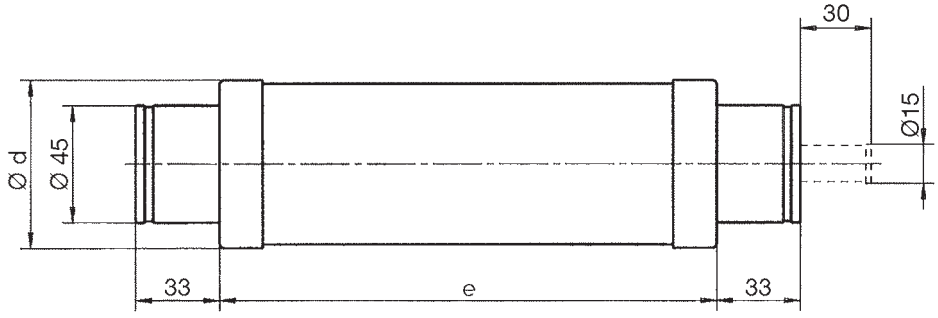


图2/*Fig. 2*

符合 DIN 43 625 的尺寸（mm）
Dimensions acc. to DIN 43 625 inz mm

变压器保护

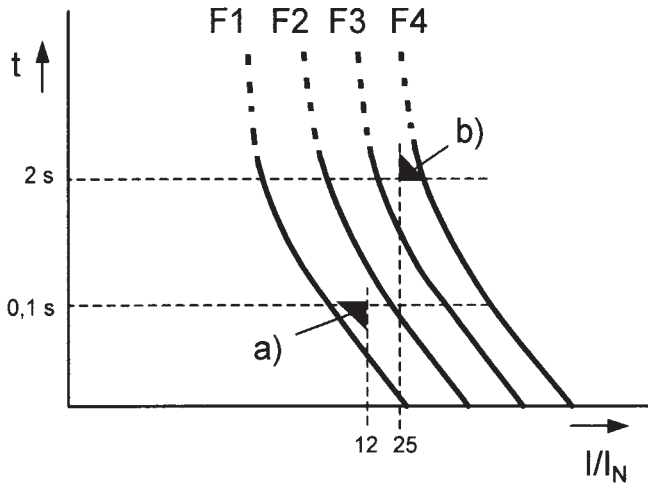
选择高压熔断器保护变压器须遵循以下几点：

a）变压器的额定值
- –工作电压（U）
- –额定输出（S）
- –短路阻抗（u_k%）
- –浪涌电流（系数8...12倍的I_N）

b）高压熔断器的时间–电流特性
c）二次侧的装置/选择

举例说明：

630KVA的变压器在工作电压为20KV的情况下额定电流为18.2A。其短路阻抗为4%，浪涌电流为12 x I_N。在二次侧短路时的短路电流取决于短路阻抗。变压器在设计上必须能够承受这样的电流2秒。如图3中b点所示。高压熔断器必须在2秒之内切断该电流。在图3中，不能使用熔断器F4来保护该变压器，因为该熔断器在该短路电流下熔断时间需要超过2秒。



浪涌电流允许持续0.1秒，图3中a）点所示。在此时间熔断器不能熔断，所以图3中的熔断器F1是不能被用来保护该变压器的。熔断器F2和F3可以保护该变压器，因为它们的时间–电流特性曲线在a）点和b）点之间。同一个变压器，可以选用几种不同额定电流的高压熔断器来保护。选择正确的熔断器取决于其时间–电流特性曲线而非其额定电流。

Protection of transformers

The following should be observed for HV fuse-link selection:

a) Transformer ratings
- *– Service voltage (U)*
- *– Rated output (S)*
- *– Relative short-circuit voltage (u_k %)*
- *– Inrush current (factor 8...12 I_N)*

b) Time-current characteristic of HV fuse-links
c) Secondary devices/selectivity

Procedure based on an example:

A 630kVA transformer has a transformer rated current of 18,2A at a service voltage of 20kV. The relative short-circuit voltage is 4% and the inrush current is 12 x I_N. The short-circuit current on secondary terminal short-circuit is given 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 interrupt this current within 2 seconds. In Fig. 3, the fuse link F4 must not be used for this transformer, as the fuse-link will require longer than 2 seconds to melt at this short-circuit current.

图.3/*Fig.* 3

F1–F4）高压熔断器的时间–电流特性曲线
Time-current characteristics of HV fuse-links
a）浪涌电流
Inrush current
b）变压器的最小短路电流
lowest short-circuit current of transformer

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, for which reason the fuse-link F1 cannot be used for this transformer. The fuse-links F2 and F3 can be used for this transformer, since their time-current characteristics are between the points a) and b). A transformer can thus be assigned several HV fuse-links for various rated currents. Decisive for selection of the correct fuse is the time-current characteristic and not the rated current of the HV fuse-link.

高压后备式熔断器选择表符合 VDE 0670 T4/IEC 60282-1
Selection table for HV back-up fuse-links acc. to VDE 0670 T4/IEC 60282-1

熔断器的额定电压[kV] *Rated voltage range of fuse-link [kV]*		3/7,2		6/12		10/24		20/36	
变压器额定电压[kV] ***Service voltage of transformer [kV]***		**6**		**10**		**20**		**30**	
短路阻抗 *rel. short-circuit voltage*	变压器的设计功率[KVA] ***Transformer output [kVA]***	变压器额定电流（A） *Transformer rated current [A]*	熔断器的额定电流（A） *Rated current of fuse-link [A]*	变压器额定电流（A） *Transformer rated current [A]*	熔断器的额定电流（A） *Rated current of fuse-link [A]*	变压器额定电流（A） *Transformer rated current [A]*	熔断器的额定电流（A） *Rated current of fuse-link [A]*	变压器额定电流（A） *Transformer rated current [A]*	熔断器的额定电流（A） *Rated current of fuse-link [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 %	**1600**	154	200	92,4	**125**–200	46,2	**80**–100	30,8	**50**–63

黑体标注的数值优先选用
Bold typed figures are prefered values

表/Table 1

高压后备式熔断器符合 VDE 0670 T4/IEC 60282-1
HV back-up fuse-links acc. to VDE 0670 T4/IEC 60 282-1

电气参数，尺寸和重量
Electrical data, dimensions, weights

订货号 *Order no.*	额定电压等级 *Rated voltage range* U_n kV	额定电流 *Rated current* I_n A	额定最大开断电流 *Rated maximum breaking current* I_1 kA	额定最小开断电流 *Rated minimum breaking current* I_3 A	尺寸 *Dimensions (图2./Fig. 2)* e mm	 d mm	电阻和功耗 *Resistances and power dissipation* R_{kalt} mΩ	 P_{warm} W	总I^2t *Total* I^2t A^2s	重量 *Weight* kg	包装 *Pack*
67210.0020		2		15			290	1,8	600		
67210.0040		4		20			270	5	800		
67110.0060		6,3		21			256	11	800		
67110.0100		10		38			144	19	3.000		
67110.0160		16		65		56	41	13	2.340	1,1	
67110.0200		20		92			32	14,5	3.900		
67110.0250		25		110			25	20	4.900		
67110.0320	3/7,2	31,5	63	123	192		19	23	7.000		1
67110.0400		40		140			12,3	30	14.000		
67110.0500		50		194			9,3	35	25.300		
67210.0630		63		220			8,75	60	41.200		
67210.0800		80		306		65	6,3	85	84.000	1,4	
67210.1000		100		363			5	96	93.600		
67110.1250		125		440			2,9	75	440.000		
67210.1600		160		509		88	2,5	120	500.000	2,4	
67210.2000		200		612			2,3	200	654.000		
67220.0010		1		14			1500	1,6	90		
67220.0020		2		16			510	2	280		
67220.0040		4		22			338	6	500		
67220.0060		6,3		30			190	8	600		
67220.0100		10		42			139	16	1.150		
67220.0160		16		54		56	107	38	1.290	1,6	
67220.0200		20		73			71	38	3.200		
67220.0250		25		93			52	46	5.200		
67220.0320	6/12	31,5	63	105	292		43	65	7.200		1
67220.0400		40		125			23	54	23.300		
67220.0500		50		160			18	70	34.900		
67220.0630		63		230			12	85	58.300		
67220.0800		80		350		65	10,6	114	90.000	2,1	
67220.1000		100		500			8,5	156	140.000		
67220.1250		125		480			4	117	440.000		
67220.1600		160		560		88	4,3	217	500.000	3,7	
67220.2000		200		610			3,8	333	654.000		
67240.0010		1		14			2100	2	90		
67240.0020		2		16			800	3	340		
67240.0040		4		23			550	10	450		
67240.0060		6,3		30			300	13	530		
67240.0100		10		43			220	26	940		
67240.0160		16		54		56	197	73	1.400	2,3	
67240.0200		20		73			134	76	3.100		
67240.0250		25		93			96	89	4.500		
67240.0320	10/24	31,5	63	105	442		79	127	5.900		1
67240.0400		40		125			45	114	18.800		
67240.0500		50		205			35	147	33.500		
67240.0630		63		280			24	170	59.600		
67240.0800		80		310		65	20,5	233	84.000	3,1	
67240.1000		100		430		78	18	400	93.600	4,1	
67240.1250		125	40	760			11	340	350.000		
67240.1600		160	31,5	900		88	9,6	515	500.000	5,9	
67240.2000		200		1050			7,4	740	730.000		
67250.0020		2		15			950	9	600		
67250.0040		4		20			900	32	800		
67150.0060		6,3		23			827	39	600		
67150.0100		10	31,5	34		56	520	65	2.000	2,7	
67150.0160		16		70			210	67	2.340		
67150.0200	20/36	20		100	537		165	84	3.900		1
67150.0250		25		110			125	100	6.500		
67150.0320		31,5		135		65	85	119	7.000	3,7	
67150.0400		40		205			65	176	14.200		
67150.0500		50	20	220		88	42	183	40.000	6,5	
67150.0630		63		360			35	271	61.700		

表/Table 2

后备式高压熔断器符合 VDE 0670 T4 和 T4ÜLA
HV back-up fuse-links acc. to VDE 0670 T4 and T4 ÜLA

时间电流曲线
Time-current characteristics

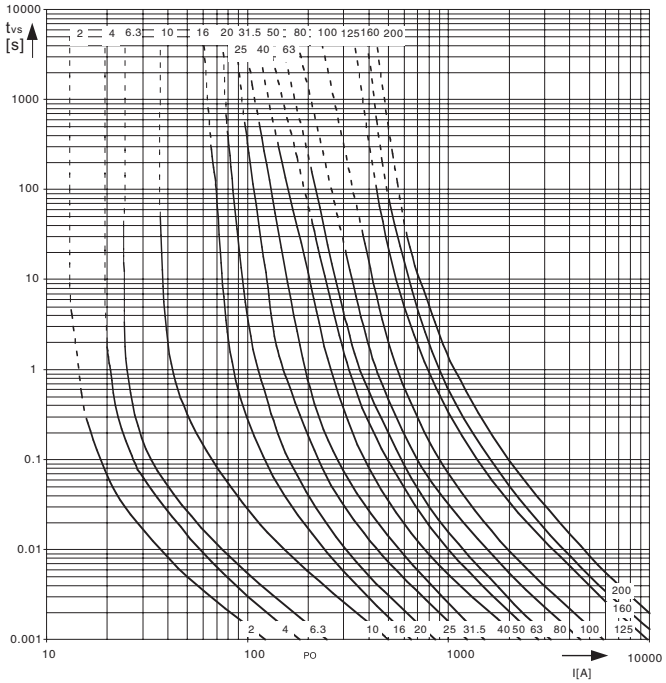


图4./*Fig.* 4
3/7,2 kV

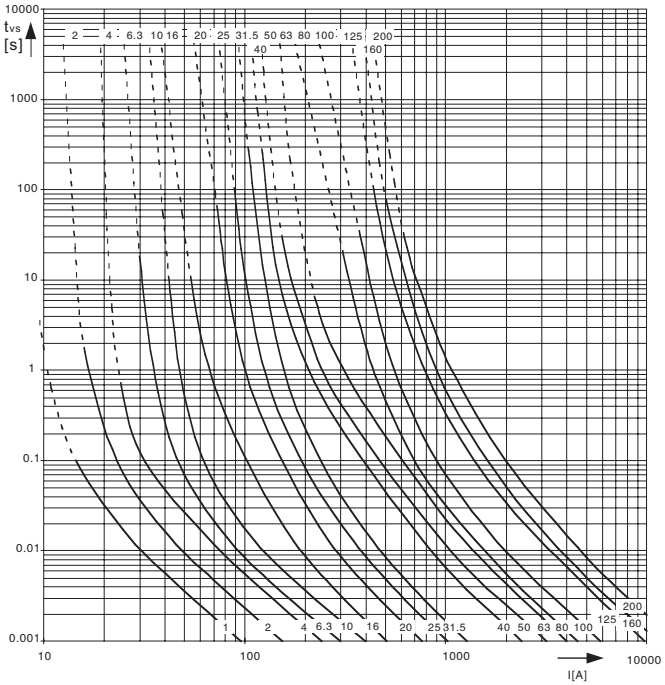


图5./*Fig.* 5
6/12 kV

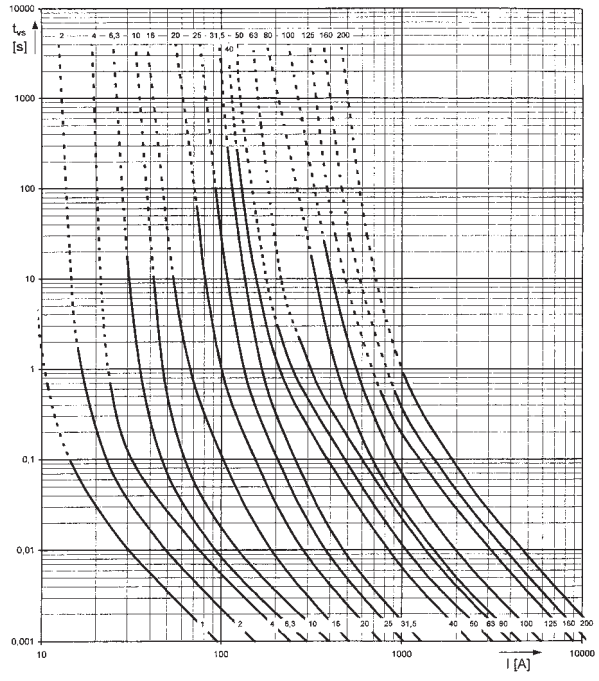


图6./*Fig.* 6
10/24 kV

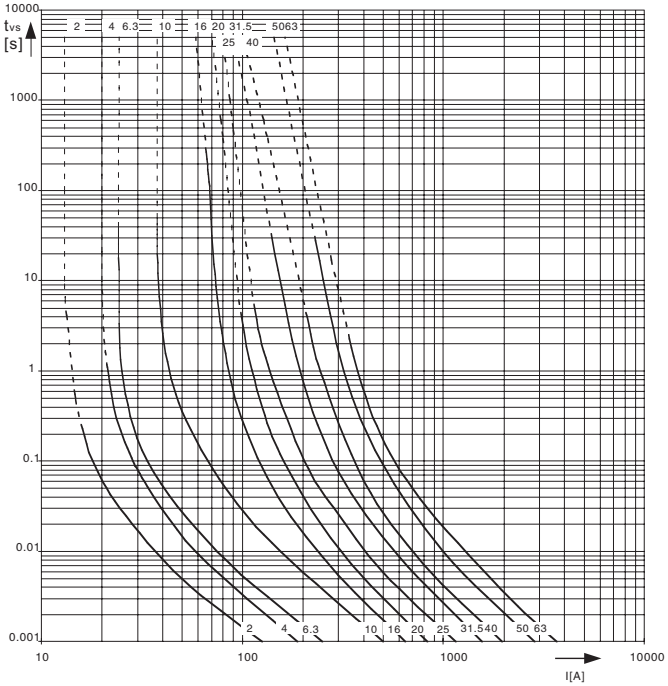


图7./*Fig.* 7
20/36 kV

高压熔断器符合 VDE 0670 T4/IEC 60 282-1
HV back-up fuse-links acc. to VDE 0670 T4/IEC 60 282-1

带功率损耗控制的高压熔断器 ÜLA
with controlled power dissipation

应用

埃芬(EFEN)公司的ÜLA型后备高压熔断器符合VDE 0670 T4 标准，并且特别适合安装在紧凑密封SF6绝缘柜内。在这些柜中，高压熔断器被安装在结构紧凑的熔断器室内，这样一方面阻止了熔管的有效冷却，另一方面也限制了其自身的热量吸收能力。

不过，只要按照被保护的变压器的要求正确选择出相对应的额定电流的高压熔断器（参见表3），而且熔断器完好，那么在这些密封室内就不会出现熔断器过热的情况(见图8)。

由于变压器涌流或雷击所产生的瞬时电流可能使熔断器内并联的熔丝中的一根或多根发生熔断，这时功率损耗会显著增加。导致在变压器额定电流下，甚至低于额定电流的情况下，熔断器室会出现过热的风险。埃芬（EFEN）公司的ÜLA型后备保护高压熔断器和一个带脱扣装置的变压器开关连接，就能阻止熔断器室中可能产生的过热的现象。

功能模式

ÜLA撞针系统根据欧姆定律来控制熔芯的功率损耗（ÜLA即功率损耗控制）。撞针的释放取决于通过熔断器的电压降，也就是取决于功率损耗。

ÜLA撞针系统的释放电压是选定的，因此，在通过熔断器工作电流 I_B 时的电压降不会超过其限制值。

ÜLA撞针系统控制熔断器的功率损耗，并在熔断器室过热之前断开变压器开关（见图8）。

Application

EFEN HV back-up fuse-links type ÜLA meet the requirements of VDE 0670 T4 and were specifically developed to be installed in compact sized enclosed SF_6 insulated substations. In these substations HV fuse-links are enclosed in narrow fuse compartments which on the one hand prevent efficient cooling of the fuse-links and on the other hand have a limited thermal power acceptance themselves.

Overheating of fuse compartments in such enclosures is, however, not to be expected, if the fuse-links have been properly selected by their rated current according to the transformer to be protected (see table 3) and if the melting elements of the fuse-lins are in faultless condition (Fig. 8).

One or more of the melting elements connected in parallel may, however, be interrupted by transient currents caused by transformer inrush or lightning strikes. Fuse-links having one or more of the paralleled melting elements interrupted, dissipate significantly more heat than faultless fuse-links. There is a certain risk that the limited power acceptance of fuse compartments may be exceeded at or even below rated transformer current. EFEN HV back-up fuse-links type ÜLA prevent such potential overheating when installed in conjunction with a transformer switch having trip-free mechanism.

Function mode

The ÜLA striker system controls the power dissipation of the fuse according to Ohms law (ÜLA means controlled power dissipation). The striker pin is released depending on the voltage drop across the fuse and, therefore depending on the power dissipation.

The release voltage of the ÜLA striker system has been selected so that the fuse carrying the operating current I_B does not exceed the limiting value.

The ÜLA striker system controls the power dissipation of the fuse and releases the transformer switch before the permissible power acceptance of the fuse compartment will be exceeded (Fig. 8).

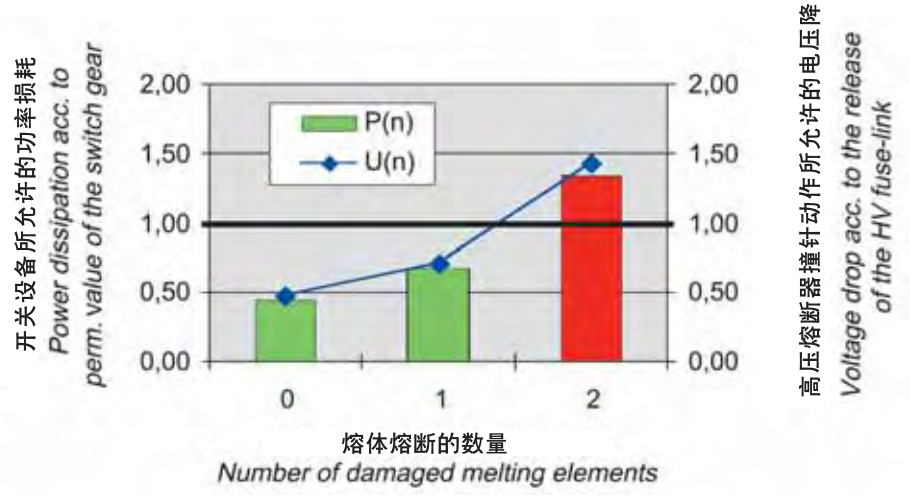


图8./*Fig.* 8: 功率损耗控制/*Controlled power dissipation*

带功率损耗控制ÜLA高压熔断器符合 VDE 0670 T4/IEC 60282-1
Selection table HV back-up fuse-links acc. to VDE 0670 T4/IEC 60282-1 with controlled power dissipation ÜLA

熔断器的额定电压[KV] *Rated voltage range of fuse-link [kV]*		6/12		10/24	
变压器的额定电压[kV] ***Service voltage of transformer [kV]***		**10**		**20**	
短路阻抗 *rel. short-circuit voltage*	变压器设计功率[KVA] ***Transformer output [kVA]***	变压器额定电流 [A] *Transformer rated current [A]*	熔断器额定电流 [A] *Rated current of fuse-link [A]*	变压器额定电流 [A] *Transformer rated current [A]*	熔断器额定电流 [A] *Rated current of fuse-link [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
	630	36,4	**63**–100	18,2	**40**–63
u_K = 5 %	**800**	46,2	**80**–125	23,1	**40**–63
	1000	57,7	**100**–160	28,9	**50**–80
	1250	72,2	**125**–200	36,1	**63**–100
u_K = 6,25 %	**1600**	92,4	**125**–200	46,2	**80**–100

黑体标注的数值优先选用
Bold typed figures are prefered values

表*Table* 3

高压熔断器符合 VDE 0670 T4/IEC 60 282-1
HV back-up fuse-links acc. to VDE 0670 T4/IEC 60 282-1

带功率损耗控制 **ÜLA**
with controlled power dissipation

电气参数，尺寸，重量
Electrical data, dimensions, weights

订货号 *Order no.*	额定电压等级 *Rated voltage range* U_n kV	额定电流 *Rated current* I_n A	额定最大开断电流 *Rated maximum breaking current* I_1 kA	额定最小开断电流 *Rated minimum breaking current* I_3 A	尺寸 *Dimensions (图.2/Fig. 2)* e mm	 d mm	电阻和功耗 *Resistances and power dissipation* R_{kalt} mΩ	 P_{warm} W	总I^2t *Total I^2t* A^2s	重量 *Weight* kg	包装 *Pack*
67220.0019	6/12	1	63	14	292	56	1500	1,6	90	1,6	1
67220.0029		2		16			510	2	280		
67220.0049		4		22			338	6	500		
67220.0069		6,3		30			190	8	600		
67220.0109		10		42			139	16	1.150		
67220.0169		16		54			107	38	1.290		
67220.0209		20		73			71	38	3.200		
67220.0259		25		93			52	46	5.200		
67220.0329		31,5		105			43	65	7.200		
67220.0409		40		125			23	54	23.300		
67220.0509		50		160			18	70	34.900		
67220.0639		63		230			12	85	58.300		
67220.0809		80		350		65	10,6	114	90.000	2,1	
67220.1009		100		500			8,5	156	140.000		
67220.1259		125		480		88	4	117	440.000	3,7	
67220.1609		160		560			4,3	217	500.000		
67220.2009		200		610			3,8	333	654.000		
67240.0019	10/24	1	63	14	442	56	2100	2	90	2,3	1
67240.0029		2		16			800	3	340		
67240.0049		4		23			550	10	450		
67240.0069		6,3		30			300	13	530		
67240.0109		10		43			220	26	940		
67240.0169		16		54			197	73	1.400		
67240.0209		20		73			134	76	3.100		
67240.0259		25		93			96	89	4.500		
67240.0329		31,5		105			79	127	5.900		
67240.0409		40		125			45	114	18.800		
67240.0509		50		205			35	147	33.500		
67240.0639		63		280			24	170	59.600		
67240.0809		80		310		65	20,5	233	84.000	3,1	
67240.1009		100		430		78	18	400	93.600	4,1	

时间电流特性在第10页
Time-current characteristics on page 10

表/*Table* 4

选择ÜLA型熔断器作为熔断器室过热保护的优势

–ÜLA控制熔断器的功率损耗
–ÜLA依据欧姆定律
–无论熔断器的安装的位置，ÜLA均能有效地工作

–ÜLA在过热之前释放撞针
–ÜLA机构耐老化

Benefits of thermal protection of the fuse compartment by ÜLA

– *ÜLA controls the power dissipation of the fuse-links*
– *ÜLA is based on Ohm's law*
– *ÜLA works independent on the mounting position of the fuse*
– *ÜLA releases the striker, before an overheating is reached*
– *ÜLA mechanism is non-ageing*

符合 IEC 62 271-105 标准的高压交流开关-熔断器组合
High-voltage alternating current switch-fuse combinations acc. to IEC 62 271-105

为了扩大开关的使用范围，将其与限流高压熔断器组合起来。该组合除有负荷分断能力以外还提供短路保护，其中高压熔断器提供短路保护，而开关则负责开断低于交接电流的电流。

In order to increase the utilization range of a switch, it is combined with current limiting HV fuse-links. This combination unit offers short-circuit protection in addition to load switching capacity. HV fuse-links provide short-circuit protection, while the switch interrupts the currents below the transfer current of the combination unit.

除了浪涌电流，二次侧短路的短路电流以及低压元件的选择，开关的下列特性也需要考虑：

In addition to the inrush current, short-circuit current on secondary terminal short-circuits and low voltage selectivity, the following switch characteristics should be taken into account:

–额定转换电流 ($I_{transfer}$)
–熔断器动作后开关开启时间（t_0）

Rated transfer current ($I_{transfer}$)
Fuse-initiated opening time of the switch (t_0)

图9中，额定转换电流 ($I_{transfer}$) 用一条垂直线表示，熔断器动作后开关开启时间（t_0）须乘以系数0.9（据 IEC 62 271-105 标准规定）并用一条水平线画出。两条线的交点取决于开关的特性，所以对于不同的开关需要分别建立图示。

Fig. 9 shows the rated transfer current ($I_{transfer}$) as a vertical line. The fuse-initiated opening time (t_0) must be multiplied by 0,9 (procedure according to IEC 62 271-105) and a horizontal line be drawn. This results in an intersection that is characteristic to the switch and must be established for each switch individually.

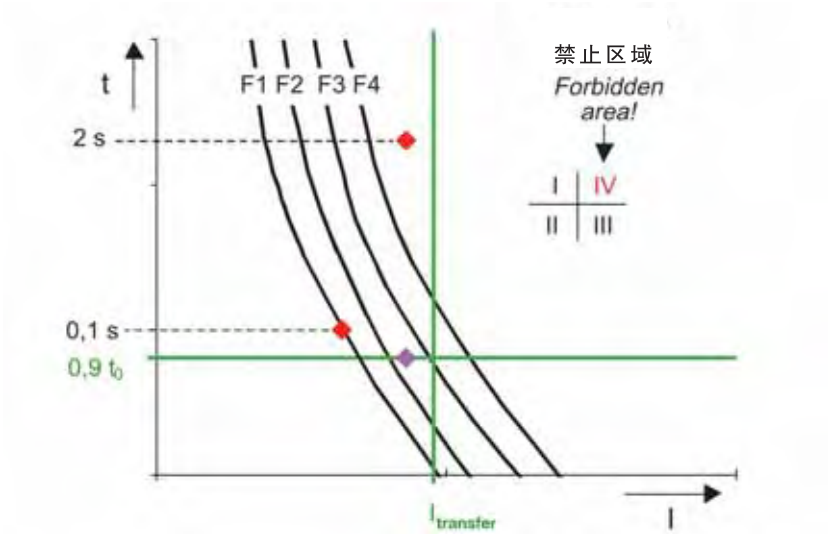


图9./*Fig.* 9: 高压熔断器的选配依据 IEC 62 271-105
Selection of HV fuse-links acc. to IEC 62 271-105

该交点将此坐标系分成了四个区域（见图9）

This switch intersection divides the sheet into four quadrants (see Fig. 9).

适合于该开关–熔断器组合的高压熔断器的时间–电流特性曲线须不经过第四区域（“禁区”）。

Suitable for the switch-fuse combination are HV fuse-links only with a time-current characteristic that does not pass through quadrant IV (“forbidden area”).

据 IEC 62 271-105 标准，所有带撞针且符合该标准的高压熔断器通常能够适合开关–熔断器组合使用。

Generally suitable for use in switch-fuse combinations according to IEC 62 271-105 are all HV fuse-links with striker which meet this criterion.

埃芬（EFEN）公司对主要的开关–熔断器组合和变压器生产商已经选配好熔断器。如有需要，尽请垂询。

EFEN has assigned HV fuse-links to the switch-fuse combination and the transformers of all major manufactures. These documents are available on request.

高压熔断器底座符合 DIN 43 624 室内用
HV fuse-bases acc. to DIN 43 624 for indoor

电气参数，尺寸，重量
Electrical data, dimensions, weights

额定 电压 *Rated voltage* U_N kV	应用 *Application*	订货号 *Order no.*	重量 *Weight* kg
12	室内 / *indoor*	68007.0010	3,8
24		68008.0010	4,8
36		68012.0010	9,4

表/*Table* 5

尺寸图可提供
Dimension drawings on demand



图10./*Fig.* 10
高压熔断器底座室内用36 kV/HV fuse–base indoor 36kV

熔断器底座 触头，额定电流200A
Fuse-base contacts, rated current 200 A



图12./*Fig.* 12

应用 *Application*	室内和室外 *indoor and outdoor*
触头弓形 *Contact-bow*	铜镀银 *E-Copper silver plated*
平面连接处 *Flat terminal*	铜镀镍 *E-Copper nickel plated*
重量 /*Weight*	0,42 kg
订货号 *Order no.*	68016.0010

表/*Table* 6

符合VDE 0670 T4/IEC 60 282-1 的电压互感器保护用高压熔断器（HSW）
HV fuse-links for voltage transformer "HSW" acc. to VDE 0670 T4/IEC 60 282-1

电压互感器保护用高压熔断器（HSW）用于互感器的短路保护，它能可靠地切断发生故障的互感器。

该熔断器结构紧凑，可以装入变压器室内。用螺帽封上变压器室，该熔断器可以更换并且如果螺帽有透明视窗的话，可以从室外直观地看到熔断器。如果需要知道熔断器的熔断情况，可以使用带熔断显示装置的互感器保护熔断器。该熔断器能保护最大值为 3000 VA（6 到 12 kV）或 6000 VA（15 至 24 kV）的变压器。

由于HSW的“双重动作”限流，其分断能力相当高，因此该熔断器的使用不受系统的短路电流的限制。由于HSW对短路有相当高的限流能力，使得最大只有1kA的峰值电流持续几微秒。这样就能够很大的抑制短路故障对系统的影响。

HV fuse-links for voltage transformers (HSW) serve for short-circuit protection. They reliably disconnect the faulted transformer from the 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 a limit rating up to 3000 VA (6 up to 12 kV) or 6000 VA (15 up to 24 kV).

The switching capacity of the HSW is so high due to the double-action current limitation that the fuse-link can be used independent of the short-circuit current of the system. The HSW operates highly current limiting on short-circuits, so that only a maximum peak current of 1 kA flows for several microseconds. In this way, reactions of the fault on the supplying system are largely suppressed.



图13./*Fig.* 13

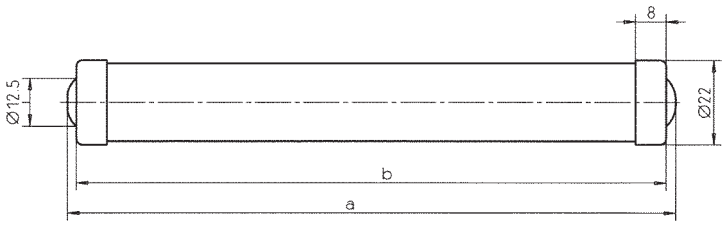


图14./*Fig.* 14

电气参数，尺寸和重量
Electrical data, dimensions, weights

订购号 *Order no.*	型号 *Version*	额定电压等级 *Rated voltage range*	尺寸 *Dimensions* (图14./*Fig.*14)		冷态电阻 *cold resistance*	重量 *Weight*	包装 *Pack*
		U_N kV	a mm	b mm	R_{kalt} Ω	kg	
67036.0004	带指示器 *with indicator*	6/12	160	155	7	0,15	1
67037.0004		15/24	280	275	14	0,27	
67036.0003	不带指示器 *without indicator*	6/12	160	155	7	0,15	1
67037.0003		15/24	280	275	14	0,27	

表/*Table* 7