Medium Voltage Distribution

Merlin Gerin fuses range

from 3.6 kV up to 36 kV

Fusarc CF
Soléfuse
Tépéfuse
MGK

Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric

Medium voltage fuses
from 3.6 up to 36 kV

Summary

Application field

Public distribution networks

Motor protection

Presentation

Our fuses Fusarc CF, Soléfuse, Tépéfuse and MGK make up a wide and comprehensive range of high breaking capacity, current limiting, high voltage fuses. They all are back-up type and their construction is such (depending on types) that they can be installed indoor as well as outdoor.
Their main purpose is to safely protect medium voltage switchgear (from 3 up to 36 kV) from the dynamic and short-circuit currents bigger than the minimum breaking current of the fuse.
Due to their low acquisition cost and null maintenance, the high voltage fuses are an excellent solution for the protection of different kinds of switchgear such as:

- high voltage equipment (transformers, motors, capacitors, etc).
- distribution networks of electrical utilities and industries.

They offer reliable protection against major faults which can occur either on the high voltage circuits or on the low voltage circuits.
This protection can be enhanced when the fuses are combined with low voltage protection systems or an overcurrent protection relay.

Range

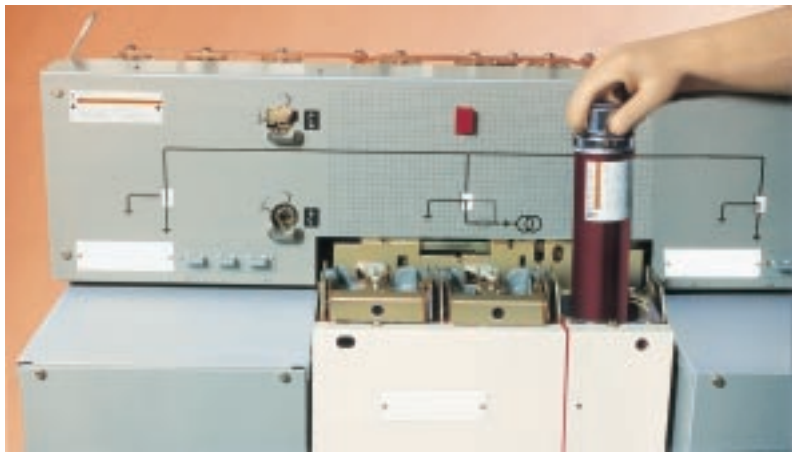
Depending on the equipment to be protected, the following table indicates the type of fuse required for its protection:

voltage (kV)	motors	power transformers	capacitors	voltage transformers
3.6	Fusarc CF MGK	Fusarc CF	Fusarc CF	Fusarc CF
7.2	Fusarc CF MGK	Fusarc CF Soléfuse	Fusarc CF Soléfuse	Fusarc CF
12	Fusarc CF	Fusarc CF Soléfuse	Fusarc CF Soléfuse	Tépéfuse Fusarc CF
17.5		Fusarc CF Soléfuse	Fusarc CF Soléfuse	Tépéfuse Fusarc CF
24		Fusarc CF	Fusarc CF Soléfuse	Tépéfuse Fusarc CF Soléfuse
36		Fusarc CF Soléfuse	Fusarc CF Soléfuse	Tépéfuse Fusarc CF

Application field

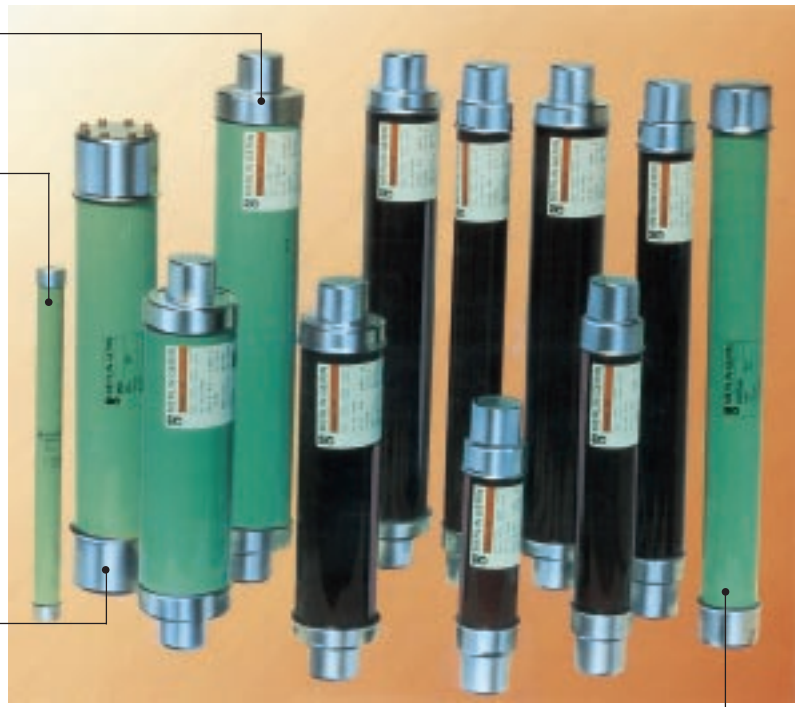
Fusarc CF fuses installed into a SM6 fuse switch.

Examples of installation



Fusarc CF fuse being installed into a ring main unit.

Range (continuation)



Fusarc CF
(DIN standard;
transformer, motor and
capacitor protection)

Tépéfuse
(UTE standard;
protection of voltage
transformers)

MGK
(UTE standard;
motor protection)

Soléfuse
(UTE standard;
transformer protection)

Main characteristics

Most important features

The most important features which define our range of fuses are the following:

- high breaking capacity
- high current limitation
- reliable interruption of critical currents
- low switching voltage
- low power dissipation
- free of aging / maintenance
- suitable for both indoor and outdoor (Fusarc CF type only)
- with indicating / tripping striker

Standards

Our fuses have been designed and manufactured according to the following standards:

- IEC-282-1, IEC-787 (Fusarc CF, Soléfuse, Tépéfuse, MGK)
- DIN 43625 (Fusarc CF)
- VDE 0670-402 (Fusarc CF)
- UTE C64200, C64210 (Soléfuse, Tépéfuse)

Quality assurance system

Besides testing our fuses at official and own laboratories, with their respective certificates, it is an additional guarantee for our client the fact that the fuses are manufactured following the quality guidelines imposed by the possession of the Quality System Certificate ISO-9001 and ISO-14001 issued by AENOR (EQ-NET).

Tests

We also perform regular tests on our fuses:

Watertightness test: in order to prove the watertightness of the Fusarc CF fuses, they are submerged into a hot water bath (80°C) during 5 minutes, according to IEC 282-1.
Electrical resistance: it is necessary to be sure that at the end of the manufacturing process the fuse gives the desired performances and therefore the fuse has not suffered any damage during the assembly.
To assure it, each individual fuse is submitted to cold resistance measure, to check whether it gives the correct values according to its rated voltage and current.

Basic definitions

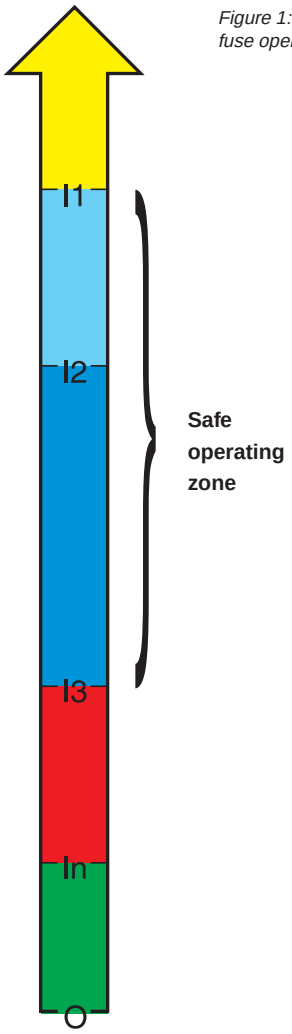


Figure 1: definition on the fuse operating zones.

Basic definitions

Un: rated voltage
It is the highest duty voltage (expressed in kV) between phases of the network on which the fuse may be installed.
In the high voltage range, some values have been fixed, namely:
3.6, 7.2, 12, 17.5, 24 and 36 kV.

In: rated current
It is the current that the fuse can withstand continuously without anormalous heating (generally this value is 65°C for the contacts).

I3: rated minimum breaking current
This is the minimum value of the current which causes melting and breaking of the fuse. For our fuses this value falls in the range of 3 to 5 times the value of In.
Remark: in order to break a current it is not enough that the fuse melts. For current values lower than I3, the fuse melts but may not necessarily break the current. The arc is maintained until a further external action interrupts the current.
Therefore it is essential to avoid using a fuse in the range between In and I3.

I2: critical currents (currents producing conditions approaching the maximum arcing energy)
Depending on the fuse element design, the value of I2 varies between 20 and 100 times the value of In. If the fuse can break this current, it can also safely interrupt any current in the range between I3 and I1.

I1: rated maximum breaking current
This is the assumed fault current that the fuse is able to break. This value is very high for our fuses, ranging from 20 to 63 kA.
Remark: it is necessary to make sure that the prospective short-circuit current of the network is equal or lower than the I1value of the fuse installed on it.

Construction (fusarc cf)

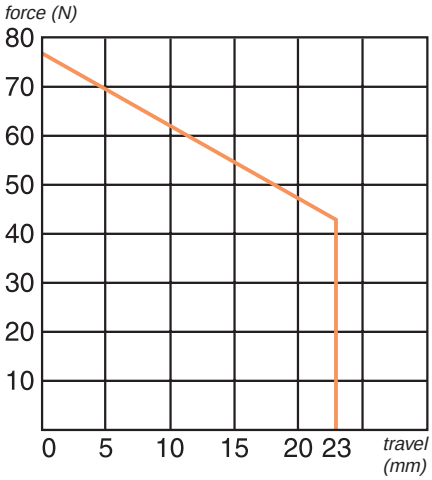


Figure 2: gives the value of the force generated by the striker depending on its stroke.

Contact caps (1)

Combined with the envelope tube, they form an assembly which must keep its integrity before, during and after breaking the current.
Therefore they must resist the mechanical and sealing stresses due to the high overpressures generated by the arc.
They must also assure the stability of the internal components throughout the time.

Envelope tube (2)

This piece of the fuse must withstand the following specific stresses (further to the already mentioned before):

- **thermal stresses:** the envelope must withstand the rapid temperature rises generated at the time the arc is extinguished.
- **dielectric stresses:** the envelope must withstand the recovery voltage after breaking.
- **mechanical stresses:** the envelope must withstand the pressure rise produced by the sand expansion when breaking.

Core (3)

This star shaped ceramic support is intended to carry on it the melting elements and house into it the striker control wire.
Ceramic materials have been chosen as the best for the manufacturing of this core.

Fuse element (4)

It is the main element of a fuse. Low resistivity and non ageing materials should be used. Together with the appropiate physicho-chemical characteristics and in combination with the quartz sand, it must be capable of extinguishing the arc.
Our Fusarc CF fuses elements configurations have been carefully chosen after many tests, so the desired results can be obtained.

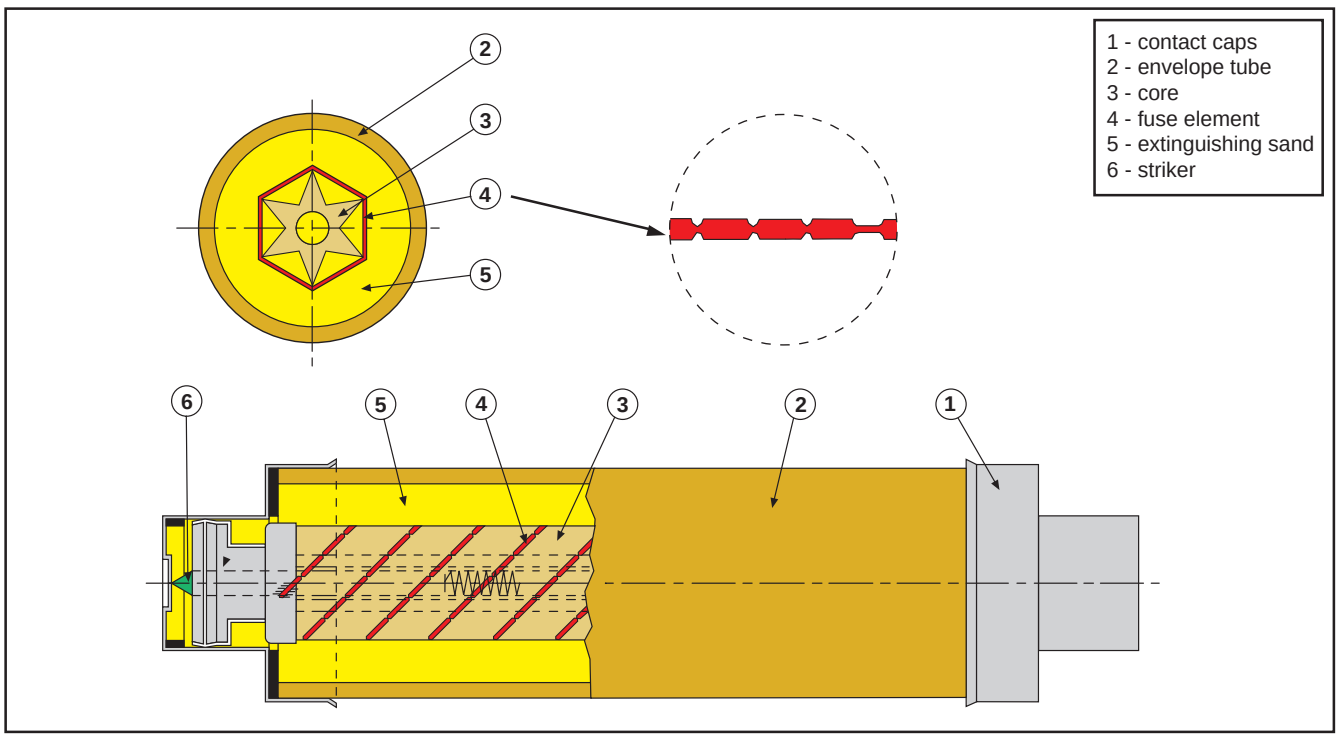
Extinguishing sand (5)

The extinguishing sand consists of high-purity quartz sand (higher than 99.7%) free of metal particles and humidity.
This sand vitrifies to absorb the energy developed by the arc forming together with the fuse element an insulating compound called *fulgurite.*

Striker (6)

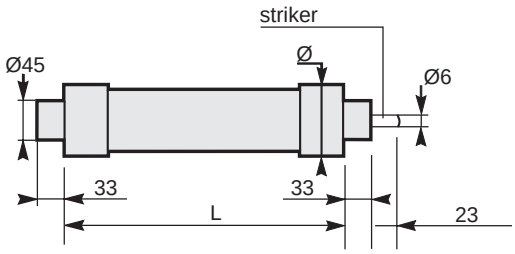
This is the mechanical device which indicates the correct actuation of the fuse. It also provides the necessary energy to trip an associated cut-out mechanism.
The striker is controlled by a high-resistance wire, which after melting releases the striker. It is very important that the control wire does not inadvertently trip the striker and also must not interfere the breaking process.
The strikers installed in our fuses are “medium type” and on the figure 2 are showed their force / travel characteristics.

Schematic cross-section of a fuse



Types of fuses

Dimensions



** Ø and L can be seen on next page, depending on the fuse rating.*

Fusarc CF (DIN)

This is the range of DIN standard fuses within Schneider Electric.
In the construction of this range has been payed special attention and care in obtaining the lowest possible power dissipation.
The use of RMUs which adopt the SF6 gas as insulating material becomes more and more common . Due to these operational conditions, where the fuse goes normally into an hermetically closed epoxy-resin receptacle with practically no ventilation, the use of those fuses avoids the premature ageing of the fuses themselves as well as the switchgear itself that would be caused by a non-optimized fuse.
The envelope tube of the Fusarc CF range up to one hundred amperes (rated current), is made of brown glazed porcelain, thus resistent to ultra-violet radiations. Higher rating envelope tubes are made of fiber glass for indoor protection. If we add that the connexion with the contact caps is perfectly watertight, the result is that these Fusarc CF fuses can be installed both indoor and outdoor.
Nevertheless there are some Fusarc CF fuses (the ones with rated currents of 125, 160, 200 and 250 amperes) which have fiberglass body.
The reason is that the lower thickness and weight of the fiberglass envelope permits to house a greater quantity of sand, which in fuses with so high rated currents, is very useful. Further, those fuses are always used at indoor installations.
We can see the complet range of Fusarc CF fuses on the table at the next page.
With rated voltages ranging from 3 up to 36 kV and rated currents reaching up to 250 amperes, customers can cover all their needs, as far as switchgear protection against short-circuits is concerned.

Time-current curves

These characteristics curves indicate that for each type of fuse, a rms current value has an associated melting or pre-arcing time.
A careful selection of the melting elements and its design, as well as the severe manufacturing controls guarantee that +/- 10% of dispersion is not exceeded, which is lower than what is recommended by the IEC standards.
At the time we designed our Fusarc CF fuses we favoured a relative high melting currents at 0.1 sec. in order to withstand the in-rush currents of the transformers, and at the same time a relative low melting current at 10 sec. to get a fast breaking in case a fault turns up. On the next pages are printed the time current characteristics of the Fusarc CF fuses.

Current limitation curves

The Fusarc CF range of fuses is specially adapted to protect transformers against short-circuits. Such short-circuits will not reach their peak value if a Fusarc CF fuse with a correct rated current is chosen.
As example, it can be seen on figure 5 that given a short-circuit in an unprotected installation whose prospective short-circuit current is 5 kA, the peak value of the current would be 7 kA in a symmetrical flow and 13 kA in an assymetrical case.
If we had used a Fusarc CF fuse with a rated current of 16 amperes, the peak value reached would have been 1.5 kA (page 12).

Types of fuses

Table of references and technical characteristics (Fusarc CF fuses).

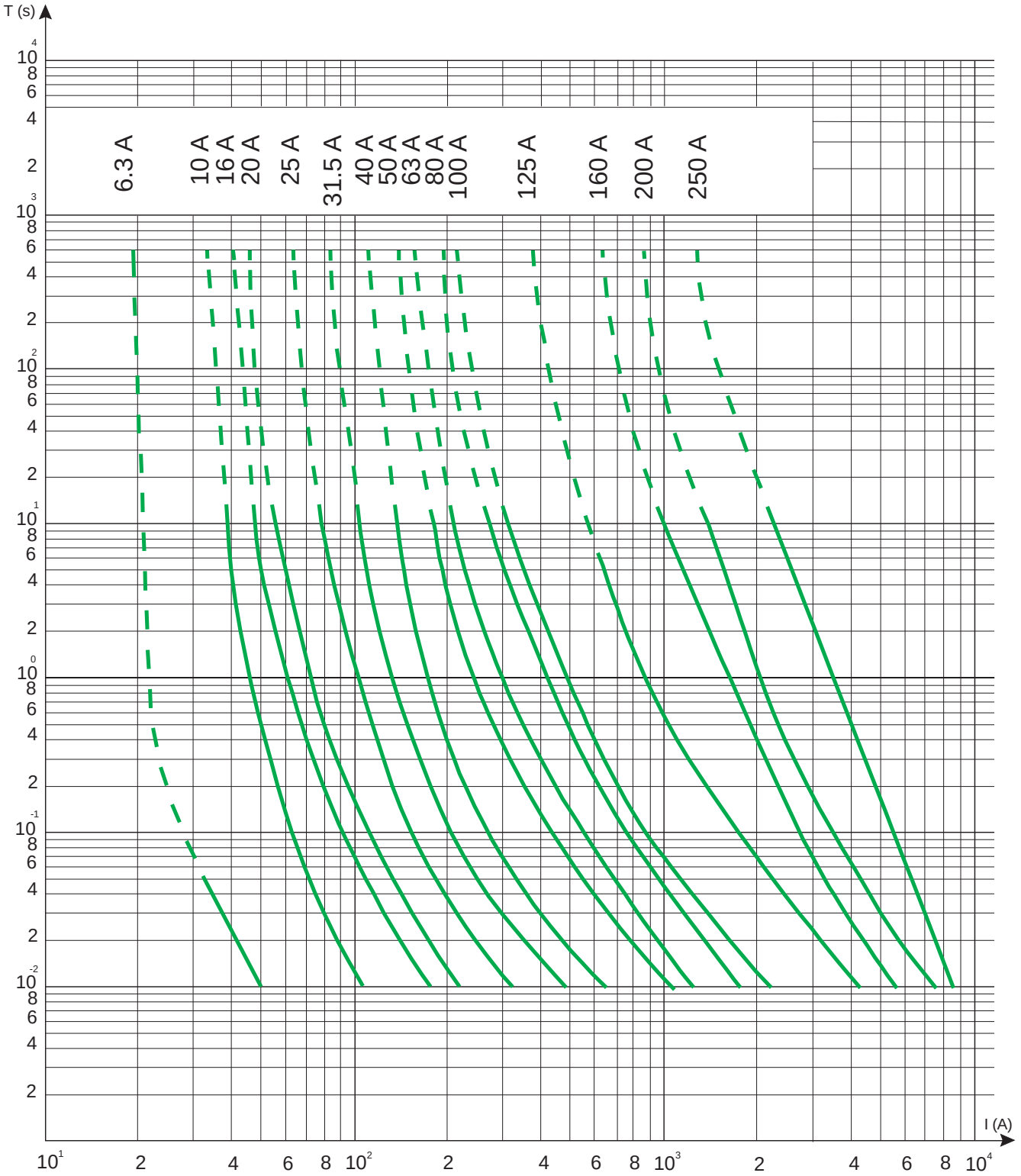
reference	rated voltage (kV)	service voltage (kV)	rated current (A)	maximum cut-off-current I1 (kA)	minimum cut-off-current I3 (A)	cold resistance (m Ω)	power dissipation (W)	length (mm.)	diameter (mm.)	weight (Kg.)
757372 AR	3.6	3 / 3.6	250	50	2,000	0.6	58	292	86	3.3
51006 500 M0			6.3		36	205	12			
51006 501 M0			10		34	102	14		50.5	0.9
51006 502 M0			16		46	68	26			
51006 503 M0			20		55	53	32			
51006 504 M0			25		79	36	35			
51006 505 M0			31.5	63	101	26	42	192	57	1.1
51006 506 MO			40		135	18	46			
51006 507 M0	7.2	3 / 7.2	50		180	11.7	44			
51006 508 M0			63		215	8	52		78.5	2
51006 509 M0			80		280	6.4	68			
51006 510 M0			100		380	5	85			
757352 BN			125		650	3.4	88			
757352 BP			160	50	1,000	2.2	87	292	86	3.3
757352 BQ			200		1,400	1.8	95			
757374 BR			250		2,200	0.9	95	442		4.6
51006 511 M0			6.3		36	319	16			
51006 512 M0			10		34	158	18		50.5	1.2
51006 513 M0			16		46	106	37			
51006 514 M0			20		55	82	42			
51006 515 M0			25		79	56	52			
51006 516 M0			31.5	63	101	40	59	292	57	1.5
51006 517 M0	12	6 / 12	40		135	28	74			
51006 518 M0			50		180	17.4	70			
51006 519 M0			63		215	13	82		78.5	2.8
51006 520 M0			80		280	10	102			
51006 521 M0			100		380	7.5	120			
757364 CN			125		650	5.3	143			
757354 CP			160	40	1,000	3.5	127	442	86	4.6
757354 CQ			200		1,400	2.7	172			
51006 522 M0			10		34	203	23		50.5	1.2
51006 523 M0			16		46	132	47			
51006 524 M0			25		79	71	72	292	57	1.5
51006 525 M0			31.5		101	51	78		78.5	2.8
51006 526 M0			40		135	35	90			
51006 527 M0			6.3	40	35	402	21			
51006 528 M0			10		34	203	25		50.5	1.4
51006 529 M0	17.5	10 / 17.5	16		46	132	46			
51006 530 M0			20		55	103	52			
51006 531 M0			25		79	71	66			
51006 532 M0			31.5		101	51	74	367	57	1.9
51006 533 M0			40		135	35	94			
51006 534 M0			50		180	22	93		78.5	3.5
51006 535 M0			63	32	215	18	121			
51006 536 M0			80		300	13.5	145		86	4.4
51006 537 M0			100		450	11	192			
51006 538 M0			6.3		36	485	25			
51006 539 M0			10		34	248	31		50.5	1.6
51006 540 M0			16		46	158	58			
51006 541 M0			20	40	55	123	67			
51006 542 M0			25		79	85	79			
51006 543 M0	24	10 / 24	31.5		101	61	96	442	57	2.2
51006 544 M0			40		135	42	119			
51006 545 M0			50		180	31.5	136			
51006 546 M0			63	32	215	22	144		78.5	4.1
51006 547 M0			80		300	18	200			
51006 548 M0			100		450	13.5	240		86	5.3
51006 549 M0			6.3		36	750	39			
51006 550 M0			10		34	380	50		50.5	1.8
51006 551 M0			16		46	252	98			
51006 552 M0			20		58	197	120			
51006 553 M0	36	20 / 36	25	20	79	133	133	537	57	2.6
51006 554 M0			31.5		101	103	171		78.5	4.7
51006 555 M0			40		135	70	207			
51006 556 M0			50		200	47	198		86	6.4
51006 557 M0			63		250	35	240			

**The cold resistances values (at 20°C) have a tolerance of a ± 10%.*

Types of fuses

Fusarc CF

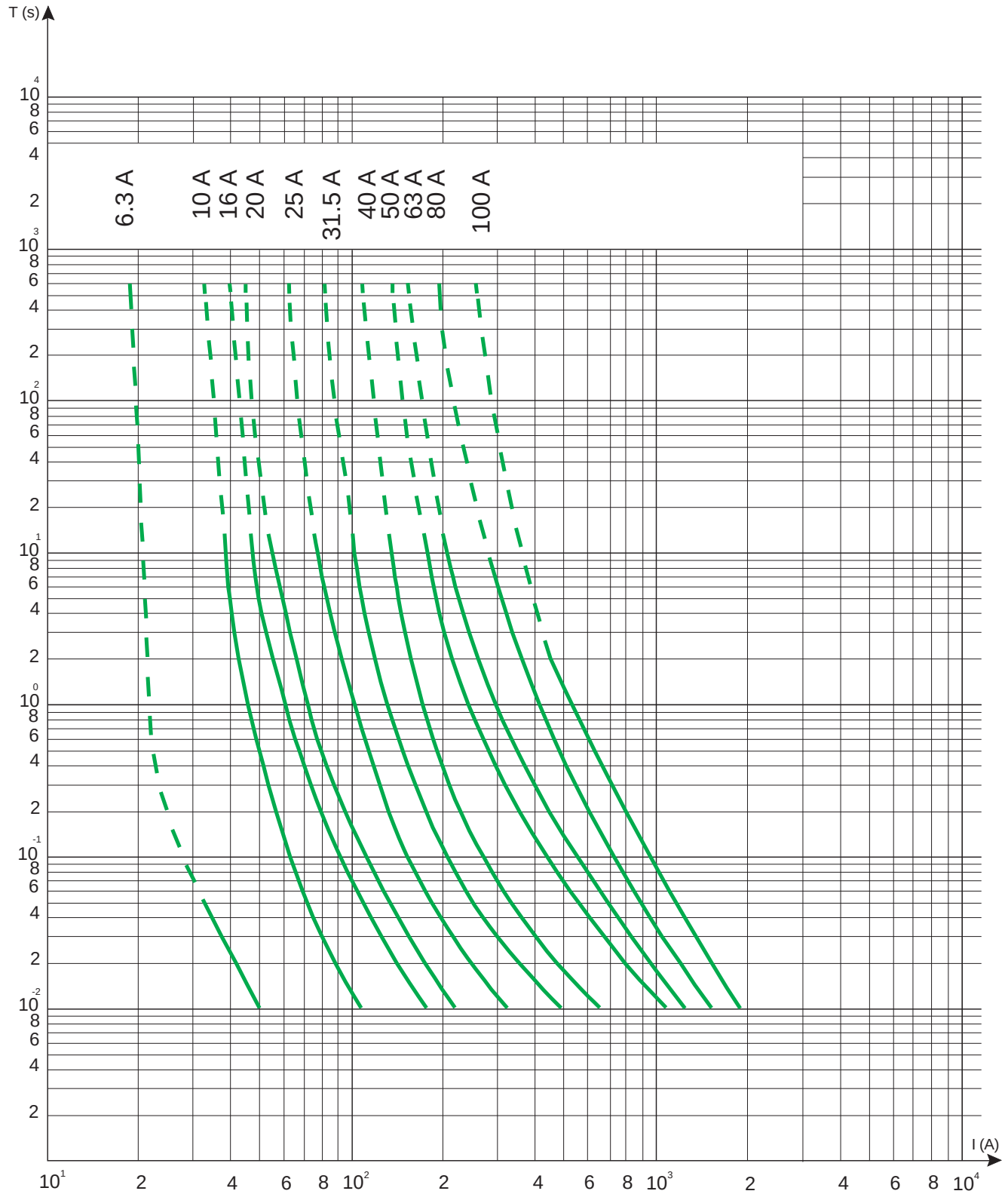
Time - current curves
3.6, 7.2 and 12 kV.



Types of fuses

Fusarc CF

Time - current curves
17.5 and 24 kV.

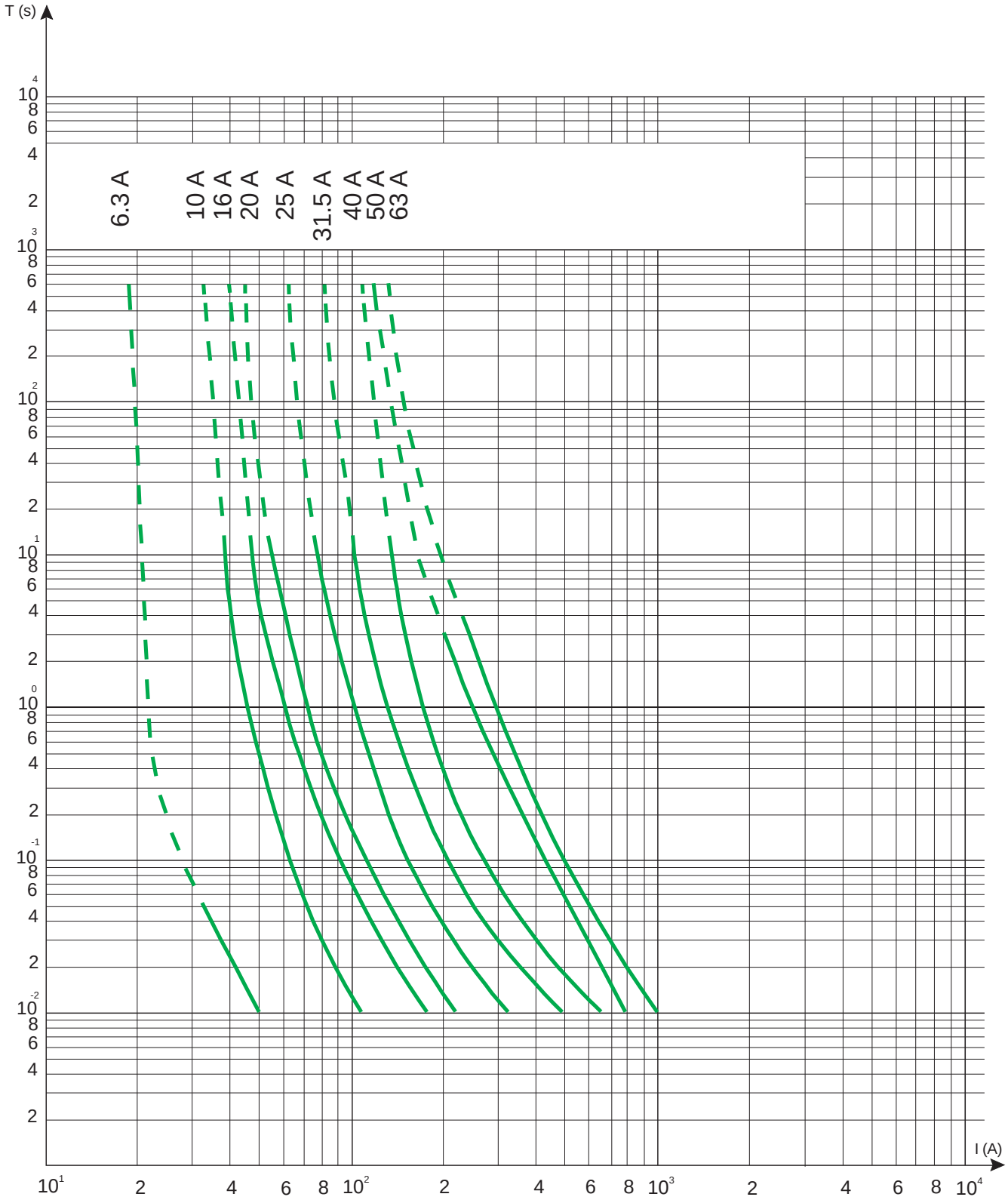


Types of fuses

Fusarc CF

Time - current curves

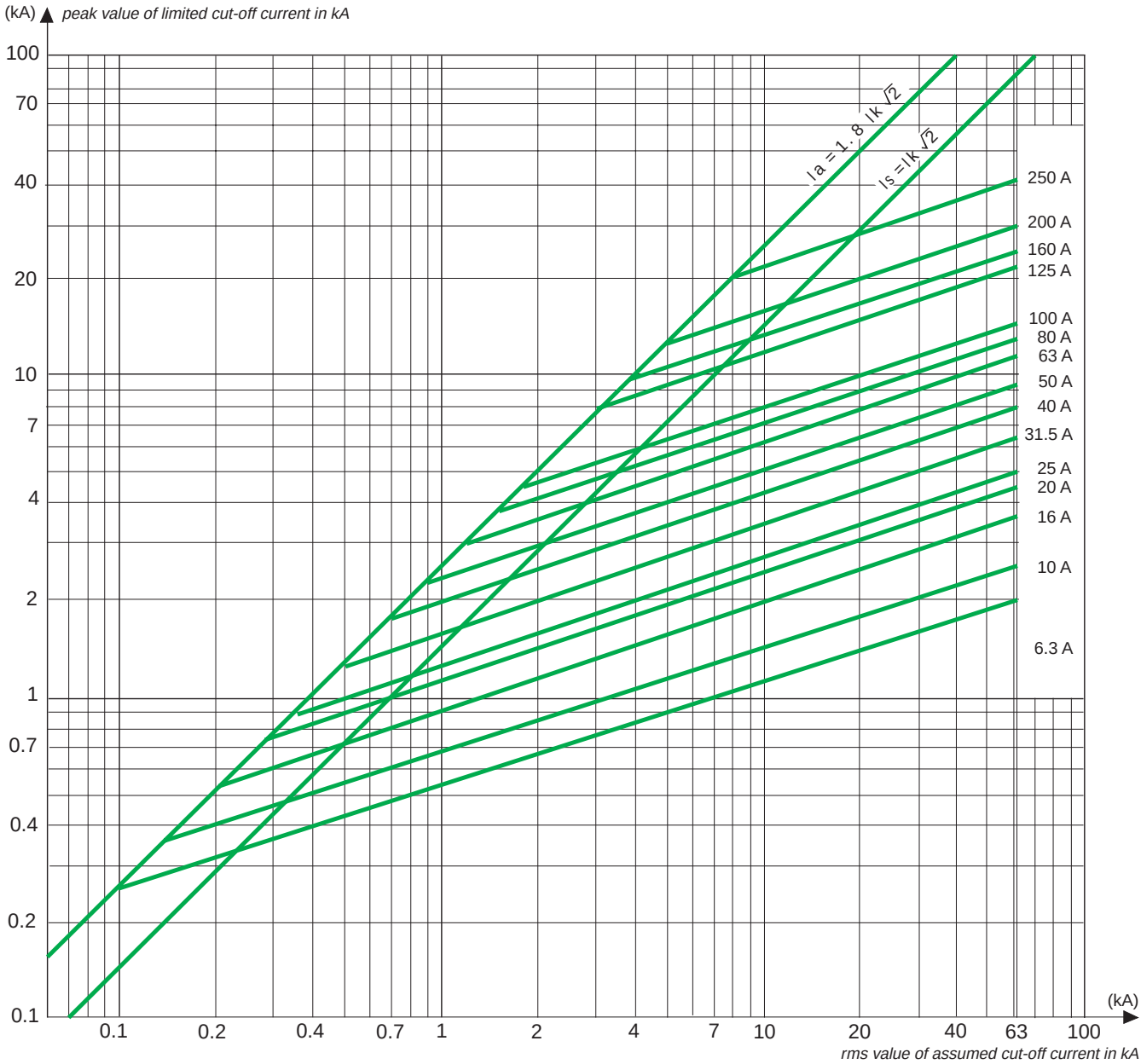
36 kV.



Types of fuses

Fusarc CF

Current limitation curves

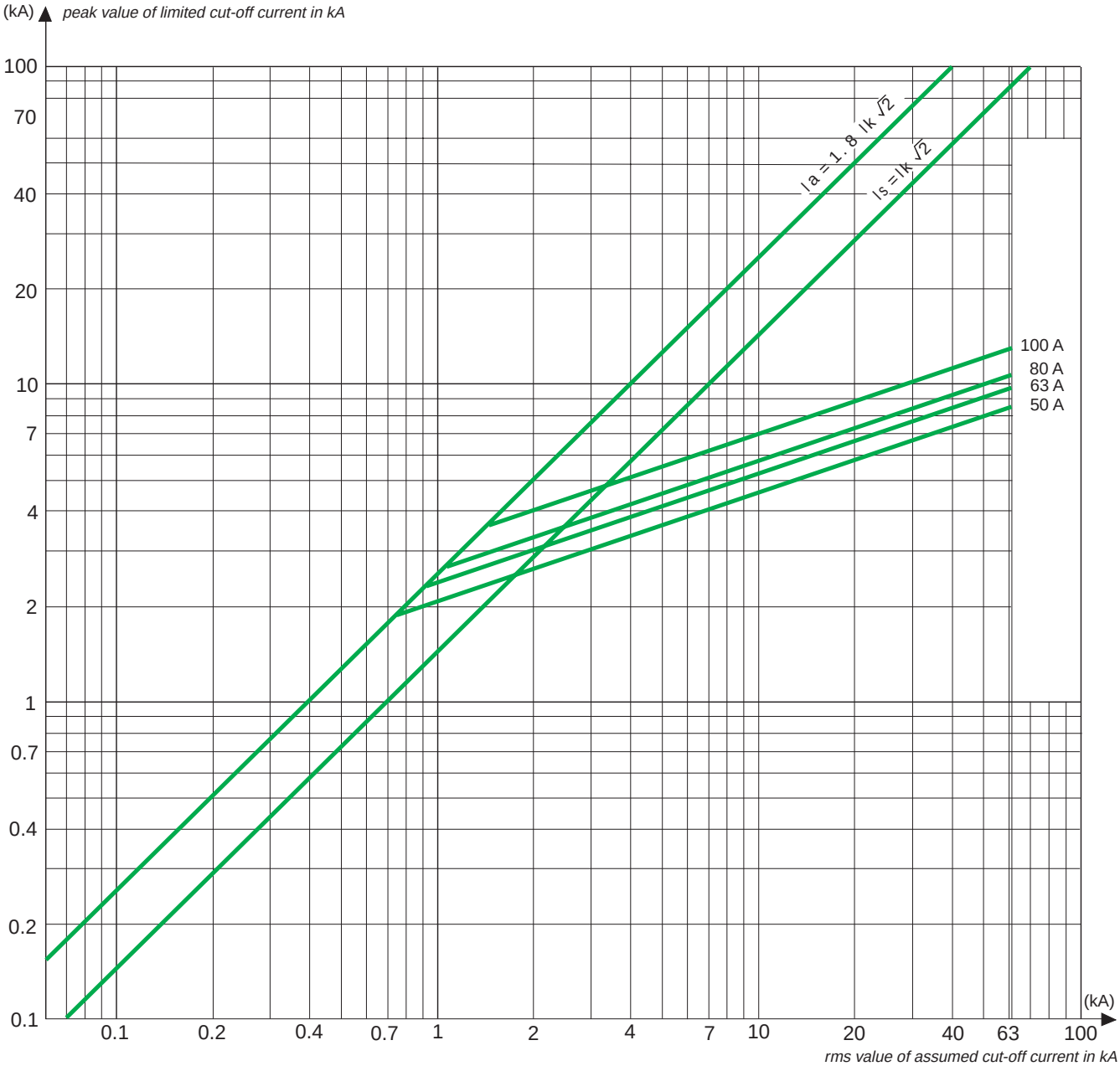


The diagrams indicate the maximum value of limited cut-off current as a function of the rms value which could have occurred in the absence of a fuse.

Types of fuses

Fusarc CF

Current limitation curves
(17.5 & 24 kV / 80 & 100 Amp.) (36 kV / 50 & 63 Amp.)



The diagrams indicate the maximum value of limited cut-off current as a function of the rms value which could have occurred in the absence of a fuse.

Types of fuses

Soléfuse (UTE C 64.210)

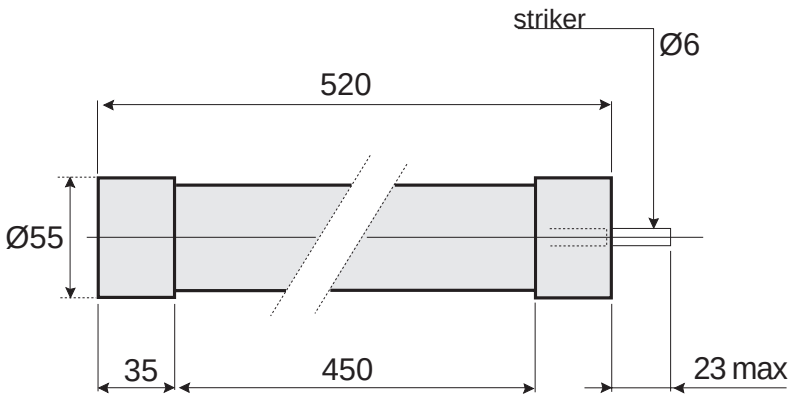
The Soléfuse range of fuses is manufactured according to the UTE C64200 standard. Their rated voltages go from 7.2 up to 36 kV.
Can be supplied either with striker or without it and they weight approx. 2 Kg.
They are mainly intended for the protection of transformers and distribution networks, but always for indoor installations (fiberglass envelope).

Electrical characteristics (as per UTE C 64200)

rated voltage (kV)	service voltage (kV)	rated current (A)	minimum cut-off-current I3 (A)	maximum cut-off-current I1 (kA)	cold resistance* (m. Ω) with striker	reference	cold resistance* (m. Ω) without striker	reference
7.2	3.6 / 7.2	6.3	28	50	140.5	757328 BC		
		16	72	50	51.7	757328 BE		
		31.5	142	50	24.5	757328 BH		
		63	283	50	11.3	757328 BK		
		125	562	50	4.8	757328 BN		
12	10 / 12	100	450	50	8.2	757328 CM		
17.5	13.8 / 15	80	360	40	15.1	757328 DL		
24	13.8 / 24	6.3	28	30	370	757328 EC	410	757331 EC
		16	72	30	141.4	757328 EE	147.4	757331 EE
		31.5	142	30	66.6	757328 EH	67.9	757331 EH
		43	193	30	38.5	757328 EJ	39	757331 EJ
		63	283	30	19.9	757328 EK	19.3	757331 EK
36	30 / 33	6.3	28	20	564	757328 FC		
		16	72	20	207.8	757328 FE		
		31.5	142	20	93	757328 FH		

**The cold resistances values (at 20 °C) have a tolerance of a ± 10%.*

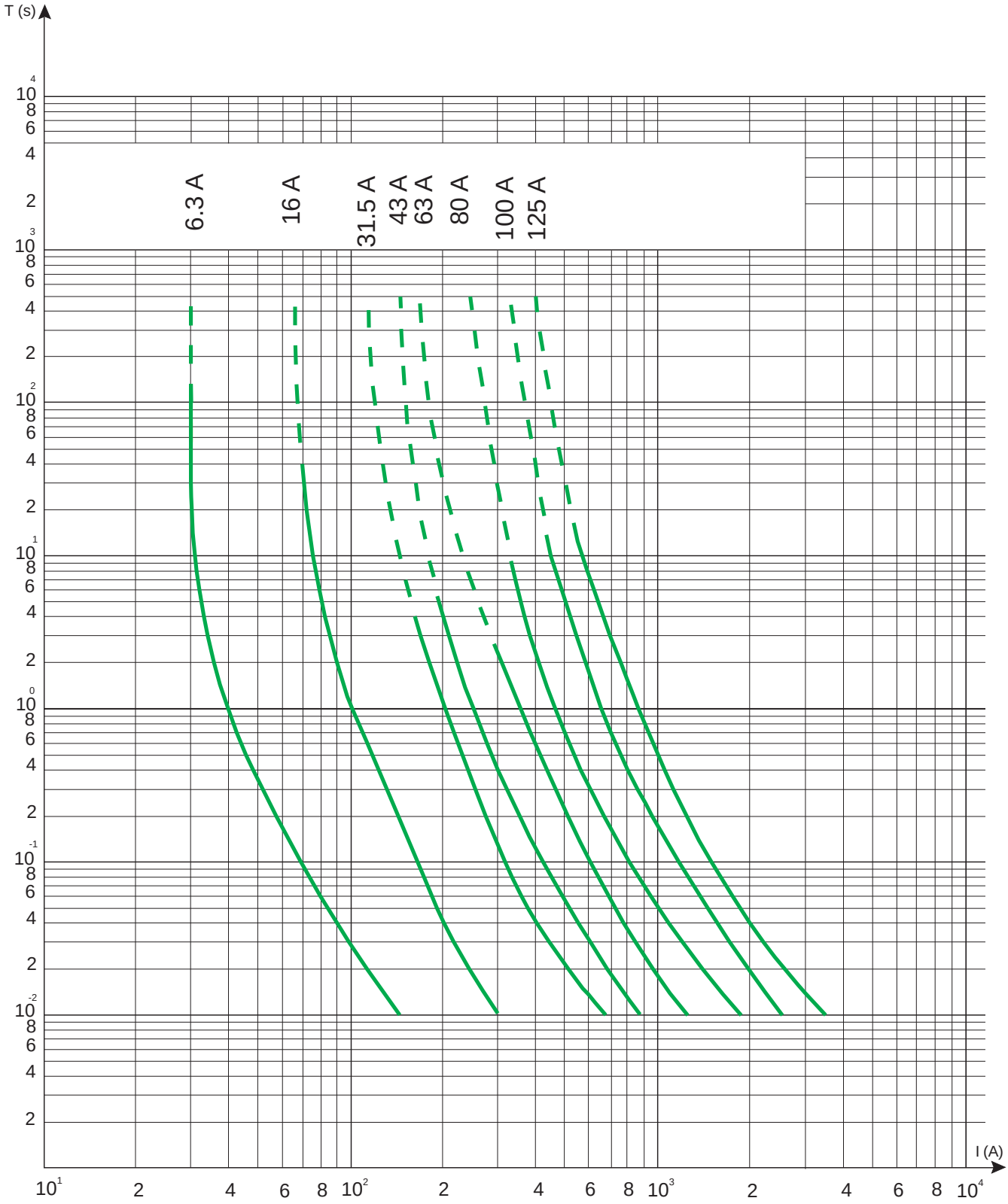
dimensions



Types of fuses

Soléfuse

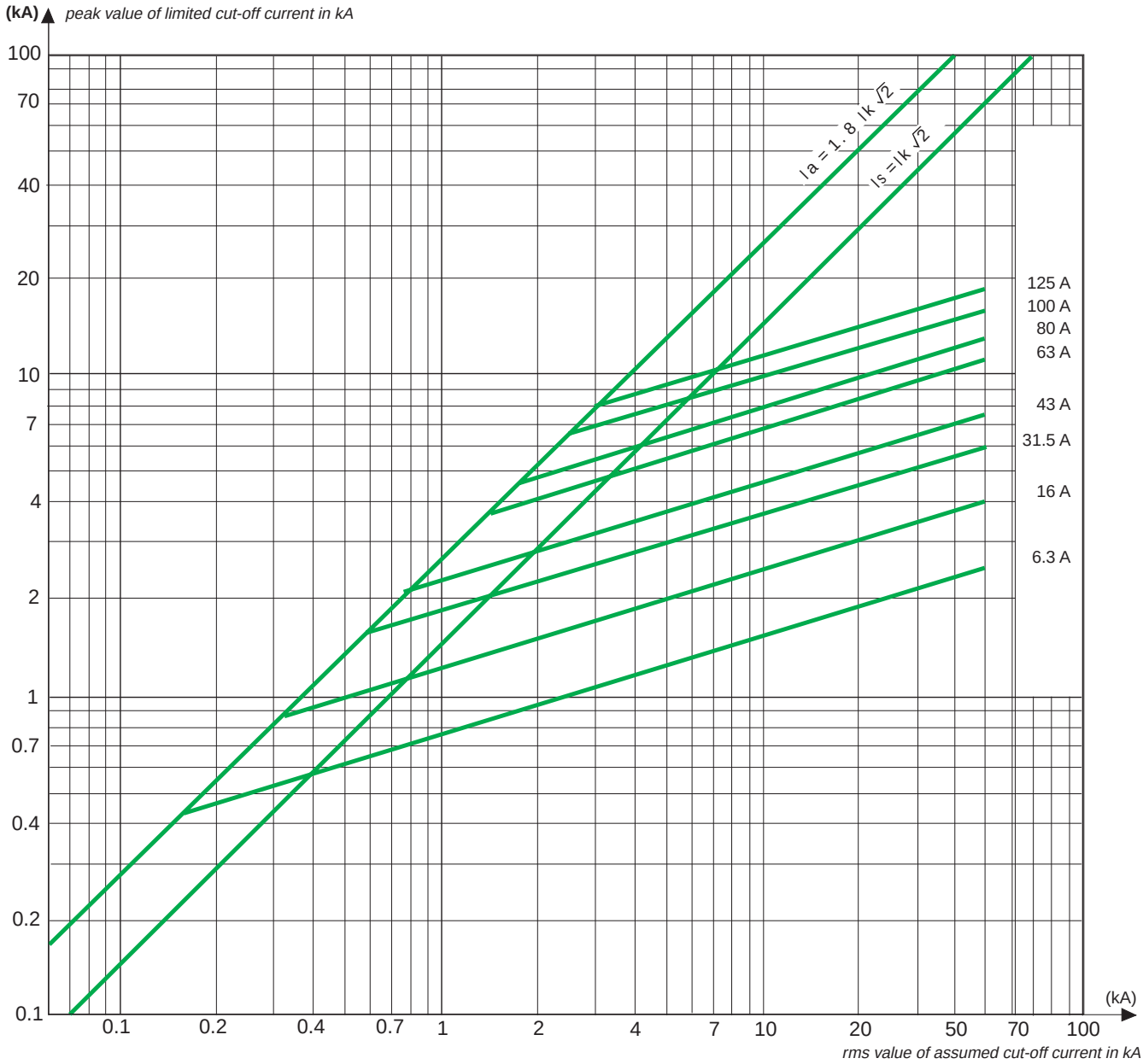
Time - current curves



Types of fuses

Soléfuse

Current limitation curves



The diagrams indicate the maximum value of limited cut-off current as a function of the rms value which could have occurred in the absence of a fuse.

Types of fuses

Tépéfuse (UTE C 64.210)

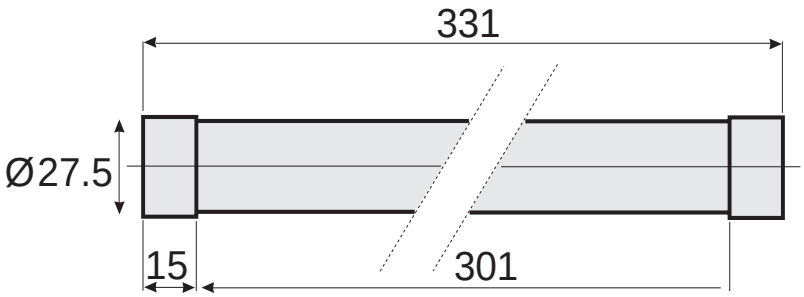
The Tépéfuse fuses are intended for voltage transformers protection in rated voltages between 7.2 and 24 kV for indoor applications.
They have not an actuating indicator.

Electrical characteristics

reference	rated voltage (kV)	service voltage (kV)	rated current (A)	minimum cut-off-current I3 (A)	maximum cut.off-current I1 (kA)	cold* resistance (Ω)
781825 A	12	< 12	0.3	40	40	6.1
781825 B	24	13.8 / 24	0.3	40	30	11.6

**The cold resistances values (at 20 °C) have a tolerance of a ± 10%.*

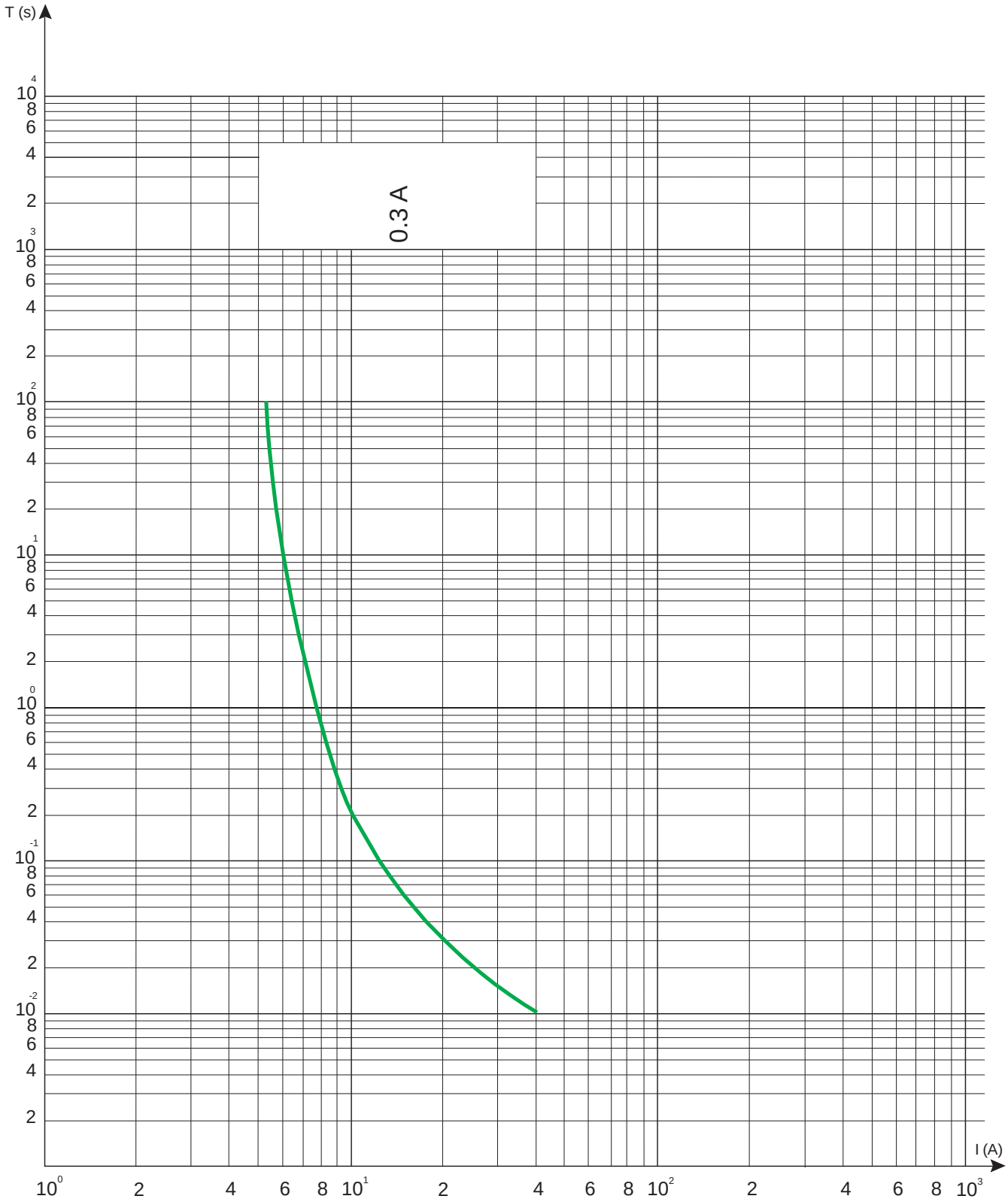
Dimensions



Types of fuses

Tépéfuse

Time - current curves



Types of fuses

MGK

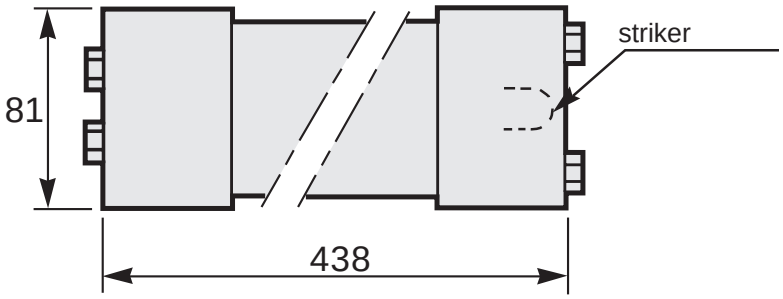
The MGK fuses are intended for medium voltage motors protection in 7.2 kV (indoor application).

Electrical characteristics

reference	rated voltage (kV)	service voltage (kV)	rated current (A)	minimum cut-off-current I3 (A)	maximum cut.off-current I1 (kA)	cold* resistance (Ω)
757314	7.2	⩽ 7.2	100	360	50	6.4
757315			125	570	50	4.6
757316			160	900	50	2.4
757317			200	1,400	50	1.53
757318			250	2,200	50	0.95

**The cold resistances values (at 20 °C) have a tolerance of a ± 10%.*

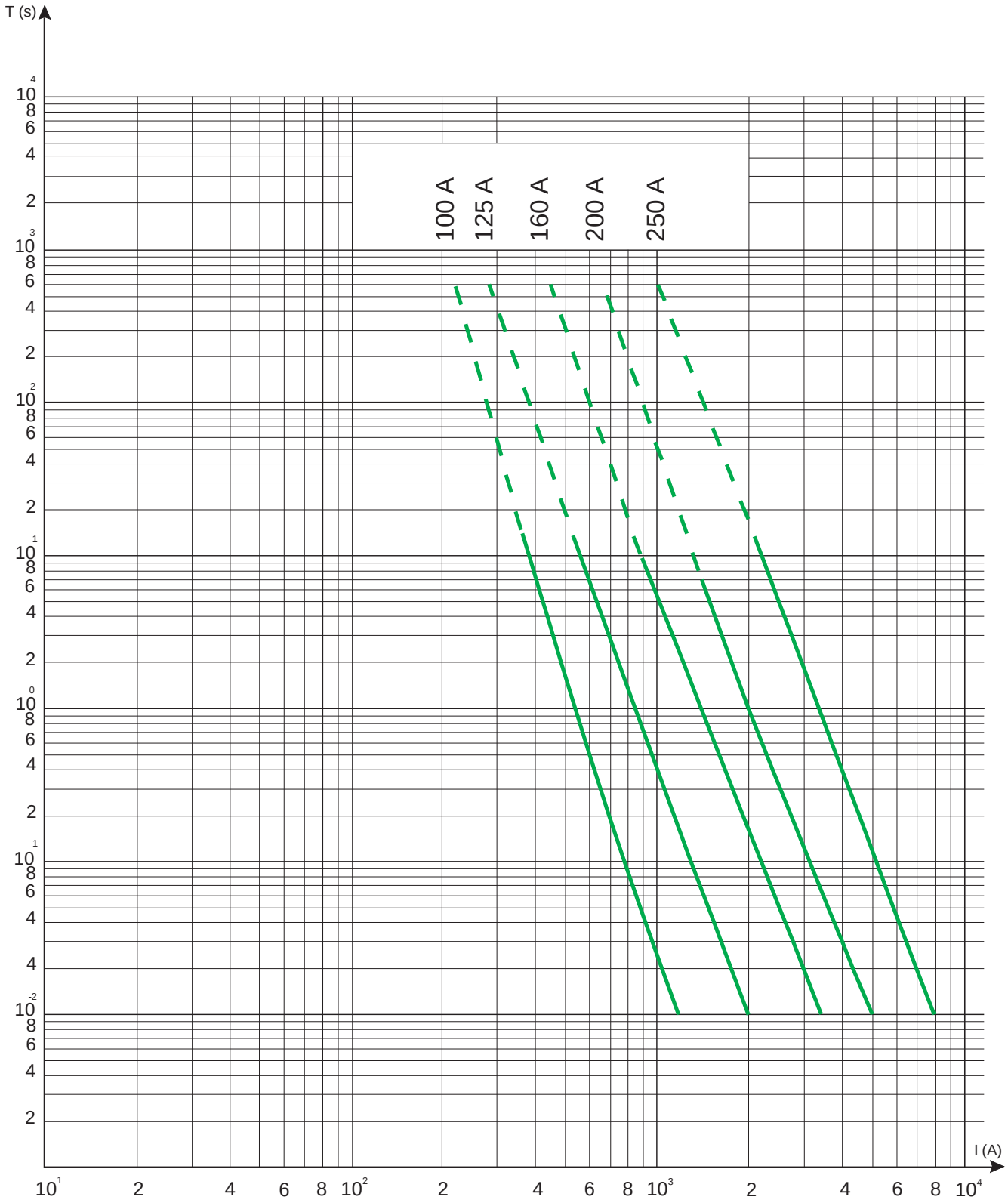
Dimensions



Types of fuses

MGK

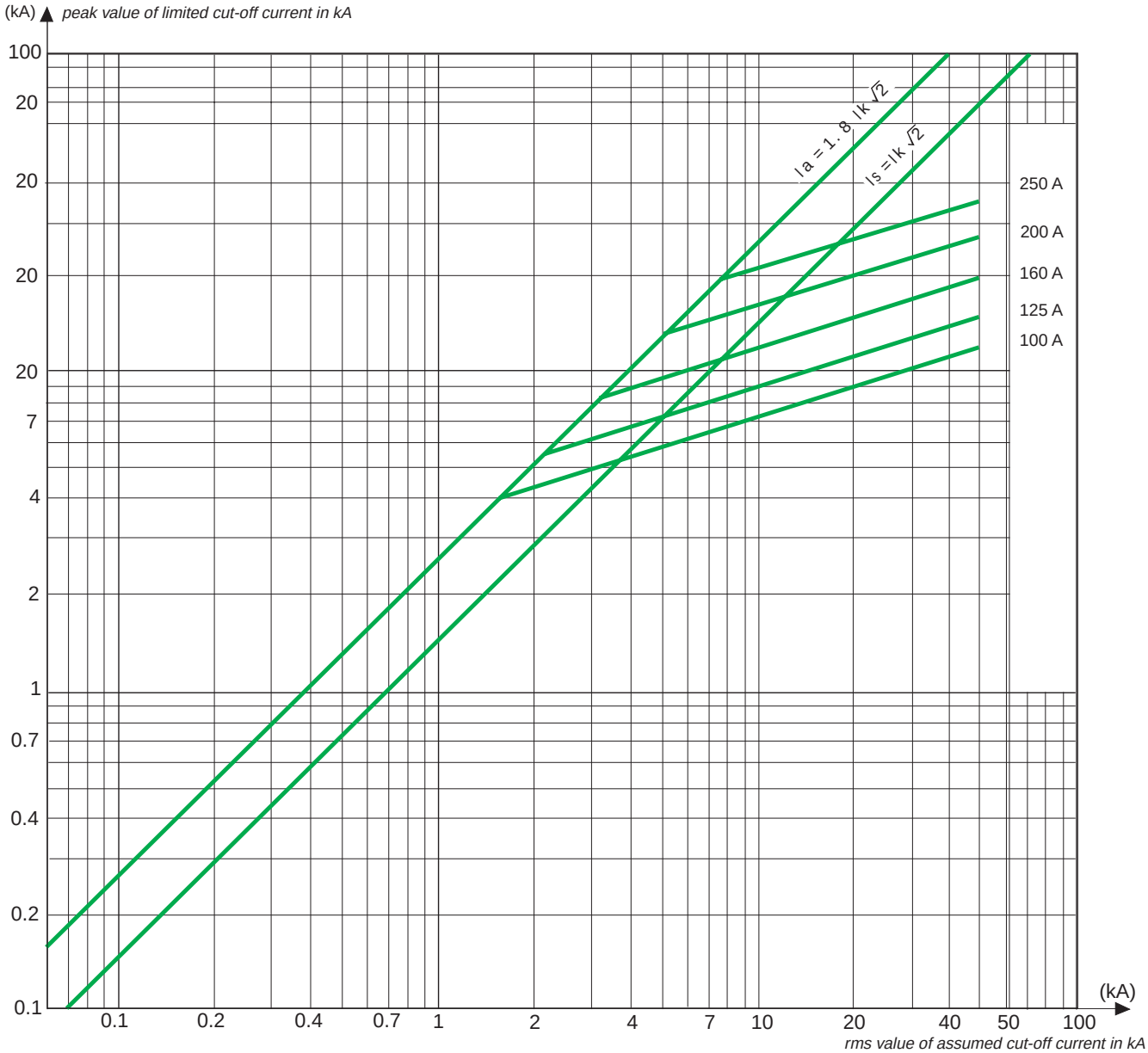
Time - current curves



Types of fuses

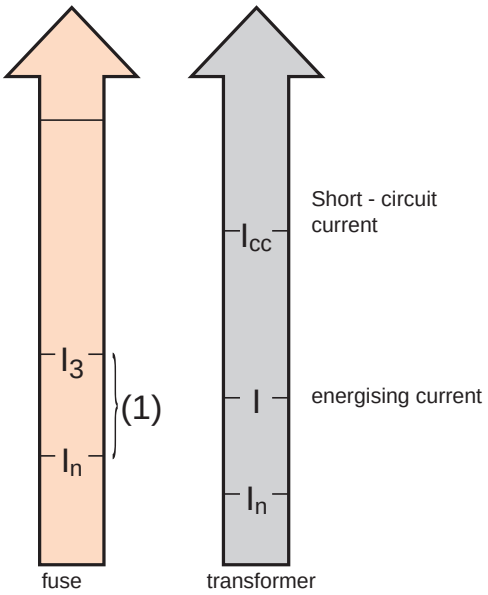
MGK

Current limitation curves



The diagrams indicate the maximum value of limited cut-off current as a function of the rms value which could have occurred in the absence of a fuse.

Selection and operation guide



(1) In this current zone, any overload must be eliminated by LV protection systems or by an MV switch equipped with an overcurrent protection relay.

Generalities

Depending on their individual characteristics, the various types of fuses (Fusarc CF, Soléfuse, Tépéfuse and MGK) guarantee a right protection to a wide variety of medium and high voltage equipment (transformers, motors and capacitors).
It is of the utmost importance to bear on mind the following:

- **Un** of the fuse must be equal or higher than the network voltage.
- **I1** of the fuse must be equal or higher than the short-circuit current of the network.
- Special consideration to the specific characteristics of the equipment to be protected.
- Even in the case that only one of three fuses has actuated, it is recommended to change all three fuses, because they may have been damaged.

Important: even in the case that only one of three fuses has actuated, it is recommended to change all three fuses, because they may have been damaged.

Transformer protection

A transformer imposes three main contraints on the fuse. Therefore the fuse must be able of ...

- **... withstand without blowing the in-rush current which accompanies the transformer´s connexion.**

It is calculated that the melting current of the fuse at 0.1 s. must be higher than 12 times the rated current of the transformer.

If(0.1 s.) > 12 x In transfo.

- **... cut fault currents at the terminals of the transformer´s secondary.**

A fuse assigned to transformer´s protection must avoid, cutting before, that the foresighted short-circuit current for this transformer (Icc) could damage it.

Icc > If(2 s.)

- **... withstand the continuous service current as well as the eventual overloads.**

In order to get this, the fuse rated current must be higher than 1.4 times the rated current of the transformer.

1.4 In transfo. < In fuse

Choice of rating

In order to correctly choose the fuse rated current for the protection of a transformer it should be known and considered:

- **the transformer characteristics:**
  - power (P in kVA)
  - short-circuit voltage (Ucc in %)
  - rated current
  - (In transfo./Ucc) > I3
- **the fuse characteristics:**
  - time / current characteristics (If 0.1 s. and If 2 s.)
  - rated minimum breaking current (I3)
- **the installation and working conditions:**
  - open air or air insulated cubicle or SF6 gas insulated cubicle, etc.
  - presence or not of continuous overloads.

Note: *in case of employment with SM6, RM6 from Schneider Electric or other manufacturer's switchgear, please always refer to the equipment's users guide and its recommendations.*

Selection and operation guide

Selection table of Fusarc CF fuses / DIN standard (rating in A) (1) (2) and (3)

service voltage (kV)	rated voltage (kV)	transformer power (kVA)																
		25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000
3	7.2	16 **20** 25	25 **31.5** 40	31.5 **40** 50	40 **50** 63	50 **63** 80	63 **80** 100	63 **80** 100	80 **100**	**100** 125	**125** 160	**125** 160	**160**	**200**	**250**			
5	7.2	**10** 16	16 **20** 25	25 **31.5** 40	31.5 **40** 50	31.5 **40** 50	40 **50** 63	50 **63** 80	63 **80** 100	63 **80** 100	80 **100**	**100** 125	**125** 160	**125** 160	**160**	**200**	**250**	
6	7.2	**10**	16 **20** 25	20 **25** 31.5	25 **31.5** 40	31.5 **40** 50	40 **50** 63	40 **50** 63	50 **63** 80	63 **80** 100	63 **80** 100	80 **100**	**100** 125	**125**	**125**	**160**	**200**	**250**
6.6	7.2	**10**	16 **20** 25	20 **25** 31.5	25 **31.5** 40	25 **31.5** 40	31.5 **40** 50	40 **50** 63	50 **63** 80	50 **63** 80	63 **80** 100	80 **100**	**100** 125	**125**	**125**	**160**	**200**	**250**
10	12	**6.3**	**10** 16	**16** 20	16 **20** 25	20 **25** 31.5	25 **31.5** 40	31.5 **40** 50	31.5 **40** 50	40 **50** 63	50 **63** 80	63 **80** 100	63 **80** 100	**80** 100	**100** 125	**125**	**125**	**160**
11	12	6.3	**10**	10 **16** 20	16 **20** 25	20 **25** 31.5	25 **31.5** 40	25 **31.5** 40	31.5 **40** 50	40 **50** 63	50 **63** 80	50 **63** 80	63 **80** 100	**80** 100	**100** 125	**125**	**125**	**160**
13.2	17.5 / 24			10 **10**	16 **16**	16 **20** 25	20 **20** 25	25 **25** 31.5	25 **31.5** 40	31.5 **31.5** 40	40 **40** 50	50 **50** 63	50 **63** 80	63 **63** 80	**80** 100	**80** 100	**100**	
13.8	17.5 / 24		6.3 **10**	10 **16**	10 **16** 20	16 **20** 25	20 **25** 31.5	25 **31.5** 40	25 **31.5** 40	31.5 **40** 50	40 **50** 63	50 **63** 80	50 **63** 80	63 **80** 100	**80** 100	**100**	**100**	
15	17.5 / 24		**6.3** 10	**10** 16	**16** 20	10 **20** 25	16 **20** 25	16 **25** 31.5	25 **31.5** 40	31.5 **40** 50	40 **50** 63	40 **50** 63	50 **63** 80	63 **80**	63 **80** 100	80 **100**	**100**	**100**
20	24		**6.3**	**10**	**10** 16	10 **16** 20	16 **20** 25	16 **20** 25	20 **25** 31.5	25 **31.5** 40	31.5 **40** 50	31.5 **40** 50	40 **50** 63	50 **63**	**63** 80	63 **80** 100	**80** 100	**100**
22	24		**6.3**	**6.3** 10	**10**	10 **16**	10 **16** 20	16 **20** 25	20 **25** 31.5	25 **31.5** 40	25 **31.5** 40	31.5 **40** 50	40 **50** 63	50 **63**	50 **63** 80	63 **80** 100	**80** 100	**100**
25	36			**6.3**	**10**	**10** 16	10 **16** 20	16 **20** 25	16 **20** 25	**25** 31.5	25 **31.5** 40	31.5 **40** 50	40 **50** 63	40 **50** 63	50 **63**	**63**	**63**	
30	36			**6.3**	**6.3** 10	**10**	**10** 16	10 **16** 20	16 **20** 25	16 **20** 25	**25** 31.5	25 **31.5** 40	31.5 **40** 50	40 **50**	40 **50** 63	50 **63**	**63**	**63**

(1) The fuse ratings are for an open-air installation with 30% transformer overload or for an in-cell installation with no transformer overload.
(2) If the fuse is incorporated into a MV switchboard, please refer to the own selection table of the switchboard manufacturer.
(3) Although the ratings in bold are the most suitable, the others give also right protection to the transformers.

Selection table of Soléfuse fuses / UTE standard (rating in A) (1) (2) and (3)

service voltage (kV)	rated voltage (kV)	transformer power (kVA)													
		25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600
3	7.2	**16**	**16**	**31.5**	**63**	**63**	**63**	**80**	**100**	**100**	**125**					
3.3	7.2	**16**	**16**	**31.5**	**31.5**	**63**	**63**	**80**	**80**	**100**	**125**					
4.16	7.2	**6.3**	**16**	**31.5**	**31.5**	**31.5**	**63**	**63**	**80**	**80**	**100**	**125**				
5.5	7.2	**6.3**	**16**	**16**	**31.5**	**31.5**	**31.5**	**63**	**63**	**63**	**80**	**100**	**125**			
6	7.2	**6.3**	**16**	**16**	**31.5**	**31.5**	**31.5**	**63**	**63**	**63**	**80**	**100**	**100**	**125**		
6.6	7.2	**6.3**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**63**	**63**	**80**	**80**	**100**	**125**		
10	12	**6.3**	**6.3**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**43**	**43**	**63**	**80**	**80**	**100**	
11	12	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**43**	**63**	**63**	**80**	**100**	
13.8	17.5 / 24	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**43**	**63**	**63**	**80**	
15	17.5 / 24	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**43**	**43**	**63**	**80**	**80**
20	24	**6.3**	**6.3**	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**43**	**43**	**63**	**63**	
22	24	**6.3**	**6.3**	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**	**43**	**43**	**63**
30	36			**6.3**	**6.3**	**6.3**	**16**	**16**	**16**	**16**	**16**	**31.5**	**31.5**	**31.5**		

(1) The fuse ratings are for an open-air installation with 30% transformer overload or for an in-cell installation with no transformer overload.
(2) If the fuse is incorporated into a MV switchboard, please refer to the own selection table of the switchboard manufacturer.
(3) Although the ratings in bold are the most suitable, the others give also right protection to the transformers.

Selection and operation guide

Motor protection

Combined with a contactor, a fuse becomes a particularly effective device for medium voltage motor protection.
The specific stresses to which the fuses are subjected are induced by:

- the motor to be protected
- the network to which is connected

motor-induced stress factors
- the in-rush current (Id)
- the starting time (Td)
- the number of successive starts
- when the motor is switched on, and throughout the starting period, the impedance is such that the motor consumes a starting current Id significatively higher than the rated current In under load. Normally this current is of about 6 times the rated current (Id/In=6)
- the starting time Td depends on the type of load driven by the motor and it is generally of about 10 s.
- allowance must be also made for the possibility of several successive startings at the time of fuse choice

network-induced stress factors
- the rated voltage; the rated voltage of medium voltage motor does not exceed 11 kV.
- the short-circuit current of the network; networks including medium voltage motors are generally high capacity networks and, as such, the short-circuit current is very high.

choice of rating
The chosen rated current of the fuse will depend on three factors:
- the starting current
- the starting time
- the number of startings and their frequency.

starting current (A)	starting time (s)	5		10		20		maximum service voltage
	number of starts per hour	6	12	6	12	6	12	(kV)
1410		250						3.3
1290		250	250	250				
1140		250	250	250	250	250	250	
1030		250	250	250	250	250	250	
890		250	250	250	250	250	250	
790		200	250	250	250	250	250	
710		200	200	200	250	250	250	
640		200	200	200	200	200	250	
610		200	200	200	200	200	200	6.6
540		160	160	160	200	200	200	
480		160	160	160	200	200	200	
440		160	160	160	160	160	200	
310		160	160	160	160	160	160	
280		125	160	160	160	160	160	
250		125	125	125	160	160	160	
240		125	125	125	125	125	160	
230		125	125	125	125	125	125	
210		100	125	125	125	125	125	
180		100	100	100	100	100	125	
170		100	100	100	100	100	100	11
160		100	100	100	100	100	100	
148		80	100	100	100	100	100	
133		80	80	80	100	100	100	
120		80	80	80	80	80	100	
110		80	80	80	80	80	80	
98		63	80	80	80	80	80	
88		63	63	63	63	80	80	
83		63	63	63	63	63	80	
73		50	63	63	63	63	63	
67		50	50	50	63	63	63	
62		50	50	50	50	50	63	
57		50	50	50	50	50	50	

Selection and operation guide

Selection curves

The three sets of curves on this page (to be read from bottom left to right and then up) permit to determine the fuse rating, given the motor power (P in kW) and its rated voltage (Un in kV).

■ **set 1:** gives rated current In (A) from P and Un values.

■ **set 2:** indicates the starting current Id (A) from the value of In.

■ **set 3:** gives the suitable fuse rating as a function of Id (A) and the starting time Td (s).

Example

A 1650 kW motor powered by a 6.6 kV supply (point A, set 1) has a rated current of 167A (point B).
Being the starting current 6 times the rated current (set 2), this gives us 1000 A (point C).
For a starting time of 10 s., the set of curves nº 3 indicates a fuse rating of 250 A (point D).

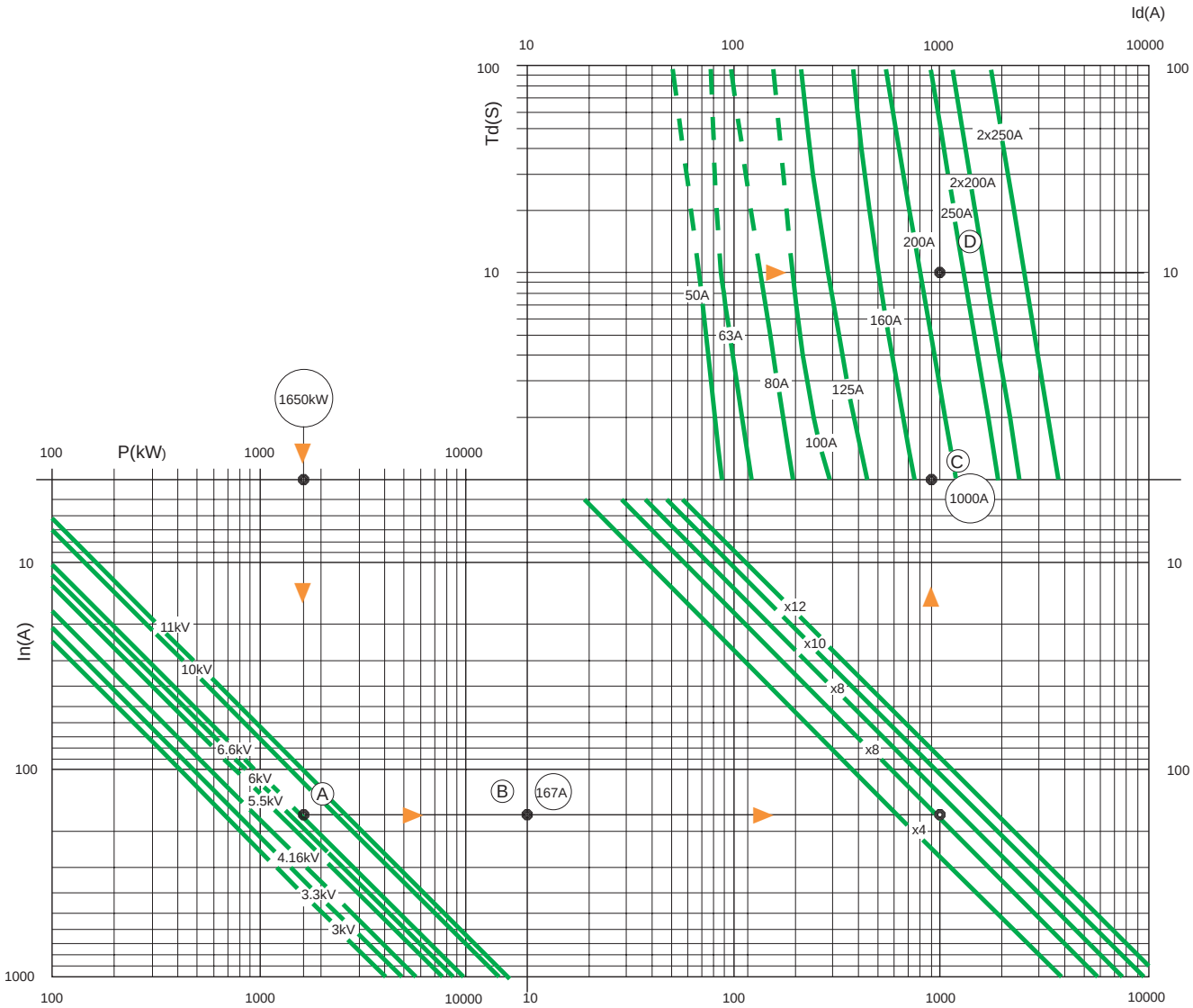
Remark

■ Network 1 is plotted for a power factor (cos φ) of 0.92 and an efficiency 0.94. For different values, use the following formula:

$$In = \frac{P}{h\sqrt{3}\,Ua\cos\varphi}$$

■ The network 3 graphs are plotted in the case of 6 start-ups spread over time or two successive start-ups.
For n distincts start-ups (n > 6), multiply td by $\frac{n}{6}$.
For p successive start-ups (p > 2), multiply by $\frac{p}{2}$ (see selection guide).
In the absence of information, take Td = 10 s.

■ If the start-up of the motor is not direct, the rating obtained using the charts below can be lower than the motor's full load current. A rating must therefore be chosen that is 20% higher than the value of this current to take account of the cubicle installation.



Protection of capacitor banks

The fuses intended for the protection of capacitor banks have to bear special stresses, mainly due to:
■ the high peaks appearing when the capacitor bank is energized, which can easily drive to premature ageing or melting of the fuse element.
■ once in operation, the presence of harmonics can lead to excessive temperature rises.

Choice of rating
A general rule applicable to all control gear is to displaced the rated current by 30 to 40% in the presence of capacitors in view of the harmonics which induce additional temperature rise.
It is recommended to apply a coefficient between 1.7 and 1.9 to the capacitive current in order to obtain the rating of the appropriate fuse, i.e., 1.7 or 1.9 times the rated current of the bank. As for the transformers, it is necessary to know the value and duration of the in-rush current.

Information to be provided on ordering

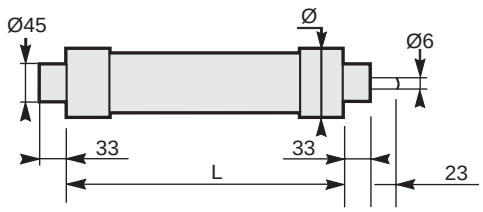
Information to be provided on ordering

There are some essential data which should be given by the customer at the time of ordering, so that unnecessary misunderstandings can be avoided. These are the following:

- rated voltage
- service voltage
- rated current
- transformer´s power, motor´s power respectively.
- working conditions
- Fuse length and diameter of the cap
- standard

For orders, please quote the reference of the fuse and its characteristics.

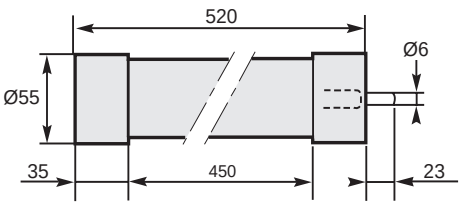
Dimensions



Fusarc CF

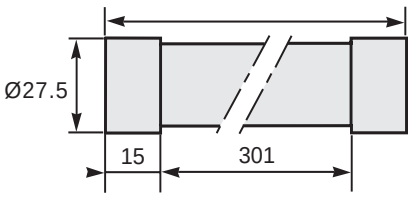
From 3.6 kV up to 36 kV.
Protection of transformers, motors and capacitors.
Dimensions according to DIN 43625.

rated voltage (kV)	rated current (A)	L length (mm.)	Ø diam. (mm.)	weight (kg.)
3.6	250	292	86	3.3
7.2	6.3 - 20	192	50.5	0.9
	25 - 40	192	57	1.1
	50 - 100	192	78.5	2
	125 - 200	292	86	3.3
	250	442	86	4.6
12	6.3 - 20	292	50.5	1.2
	25 - 40	292	57	1.5
	50 - 100	292	78.5	2.8
	125 - 200	442	86	4.6
17.5	10 - 16	292	57	1.5
	25 - 40	292	78.5	2.8
	6.3 - 20	367	50.5	1.4
	25 - 40	367	57	1.9
	50 - 80	367	86	4.4
	100	367	86	4.4
24	6.3 - 20	442	50.5	1.6
	25 - 40	442	57	2.2
	50 - 80	442	78.5	4.1
	100	442	86	5.3
36	6.3 - 20	537	50.5	1.8
	25	537	57	2.6
	31.5 - 40	537	78.5	4.7
	50 - 63	537	86	6.4



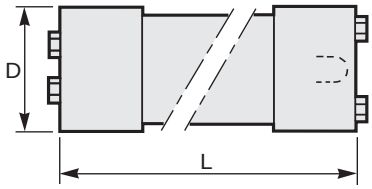
Soléfuse

From 7.2 kV up to 36 kV.
Protection of transformers and distribution networks.
Dimensions according to UTE 64200.
Weight = 2 kg.



Tépéfuse

12 kV and 24 kV.
Protection of voltage transformers.
Weight = 0.4 kg.



MGK

7.2 kV.
Protection of motors.

rated voltage (kV)	rated current (A)	L length (mm.)	D diam. (mm.)	weight (kg.)
7.2	100 - 250	438	81	4.1

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