SAFEL

MEDIUM VOLTAGE FUSE CATALOGUE

SAFEL ELECTRIC is reputable and well established Company in TURKEY.

SAFEL ELECTRIC is one of the innovative , dynamic companies of the electromechanical industry of our company with its staff consisting of experienced and competent personnel and R&D and production departments consistently keeping pace with high technology.Safel Electrical medium voltage fuses in the system; Turkey, which is also established in Istanbul in order to fill the gaps quality products.

The entire process up to marketing to design Safel Electrical ISO 9001 is the quality management system is carried out under the guarantee, all products are manufactured according to TSE and international standards, after testing and quality checks are sent to the customer after-sales customer satisfaction with services in the foreground it is maintained.

Our Mission

Medium Voltage Fuses adapt quickly to technological developments in the sector in the field on, the exchange forwards, user and employee satisfaction at the highest level, domestic and preferred by foreign partners, is to become a leader in the industry.

Our Vision

Continuously improving the structure safe and quality products supported by technological investment, innovation and customer satisfaction with the aim to provide free product designs that meet global trends ; Domestic market leader in medium voltage fuses, and has become a preferred brand in the world market with products conforming to international standards among the leading companies are among the foundations of our vision.SAFEL ELECTRIC, with attributes as Pioneer, innovative , researcher in enhancement of elelectromechanical industry of ou country advances in firm steps towards being the leading company of the sector building on the quality awarded type tests products it is manufacturing , new products it is developing and the confidence attributed. SAFEL ELECTRIC is trying to extend their export other countries.

General

High voltage current limiting back-up fuses are system elements that are widely employed in HV systems to protect overhead lines, power cables, motors, transformers, capacitor banks, disconnectors and switches against circuit currents over rated values.
brand high voltage fuses are current limiting BACK-UP CLASS fuses as defined in the EN 60282-1 standard and they are manufactured in compliance with this standard.Back-up class fuses are
able to safely break currents in the range between the declared minimum breaking current (Imin) to the maximum breaking current (I1). Such fuses can be used in outdoor and indoor stations in a range of voltages between 7,2 kV. to 36 kV.

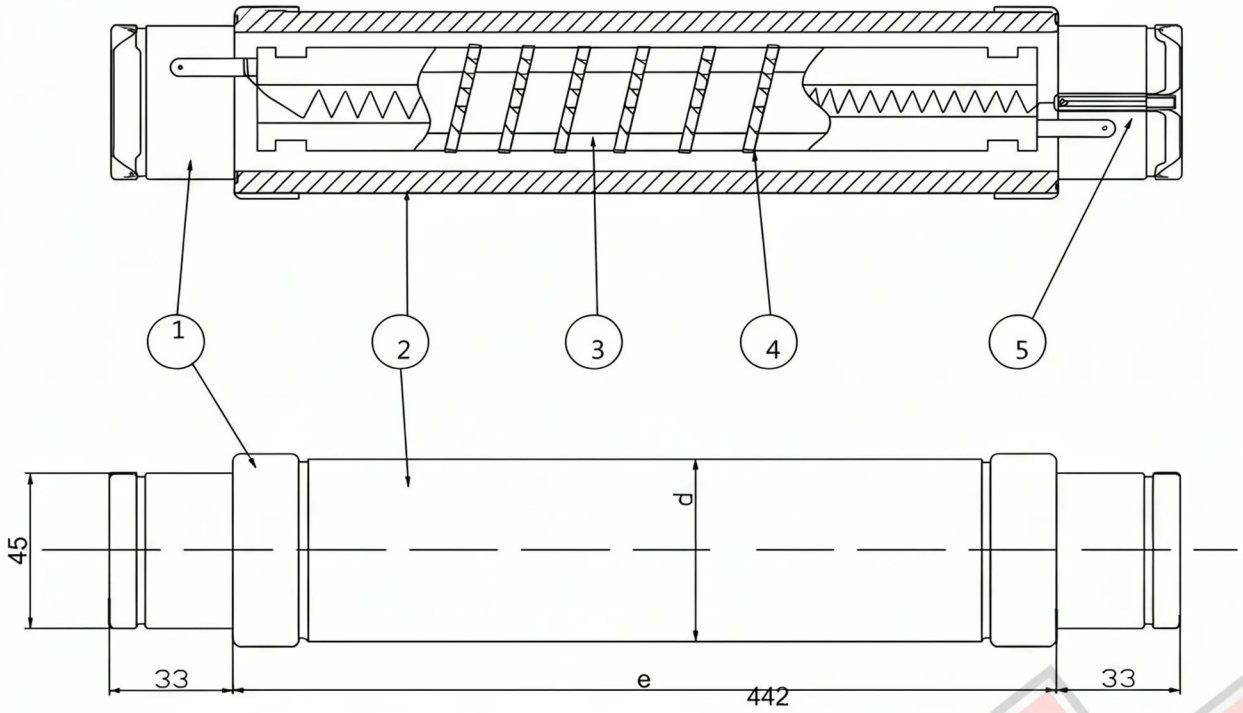
SAFEL SFP and SFN type back-up fuses are current limiting and high breaking capacity solutions for the mentioned purposes, at any rated system voltage between 7.2kV and 36kV and for indoor
or outdoor applications.

SAFEL high voltage current limiting back-up fuses are available as two types in the market:

- SFP type, fuse link with integrated “Heavy” type (80N) striker mechanism,
- SFN type, fuse link without any striker mechanisms.

Design and Performance

The construction of the high voltage back-up fuses manufactured by SAFEL Elektrik (is shown below). The body of the fuses (2) are made of high-quality brown glazed porcelain pipe and it is type C120 as discripted in relevant standart.The nickel coated contact heads (1) are produced from 1 mm thick electrolytic copper and fixed to the groove at the end of the porcelain pipe by plastering method. The special seal used between the head ensures impermeability. Inside the porcelain pipe is a star-shaped ceramic rod (3) coiled made of special silver tape by a fusion element (4). In order to ensure proper operation of the fuse under overcurrents, a necessary number of extremely pure silver fusion elements are connected in parallel to provide minimum cross sections. The fusion elements are fixed to the copper tape on the tips of the star rod with welding. The copper tape is connected to both copper heads with special welding. If the fuse is exposed to short circuit current or overstrained, in order to kill the arc formed inside and discharge the heat, it is filled with special granule quartz sand. Another part of the fuse serves is the striker system (5). If the fusion element melts during overcurrent, the pin moves outwards with a certain force. This not only indicates that the fuse has blown bu ensures the operation of some switching devices as wel



	6A-40A	50A-63A	80A-100A-125A
d	53mm	74mm	85mm

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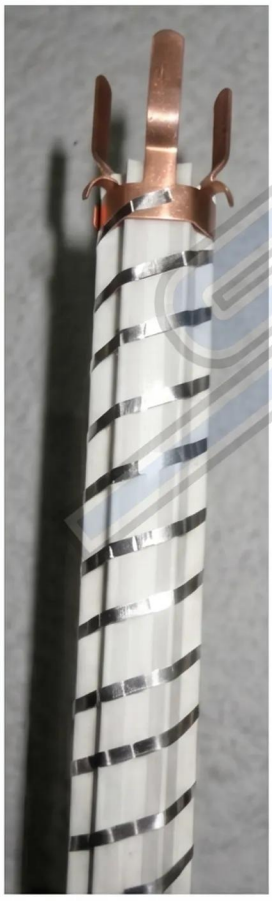
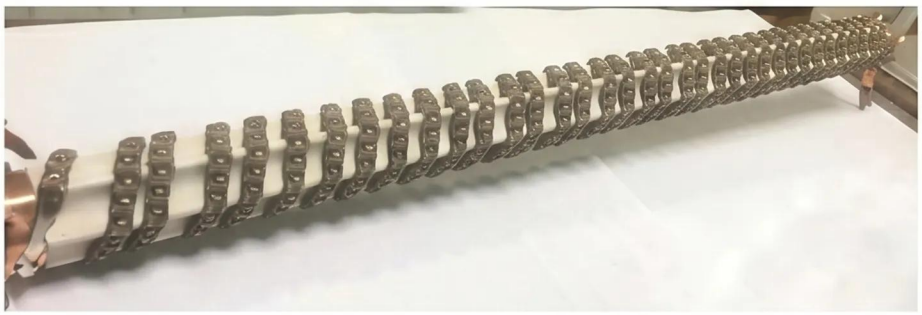


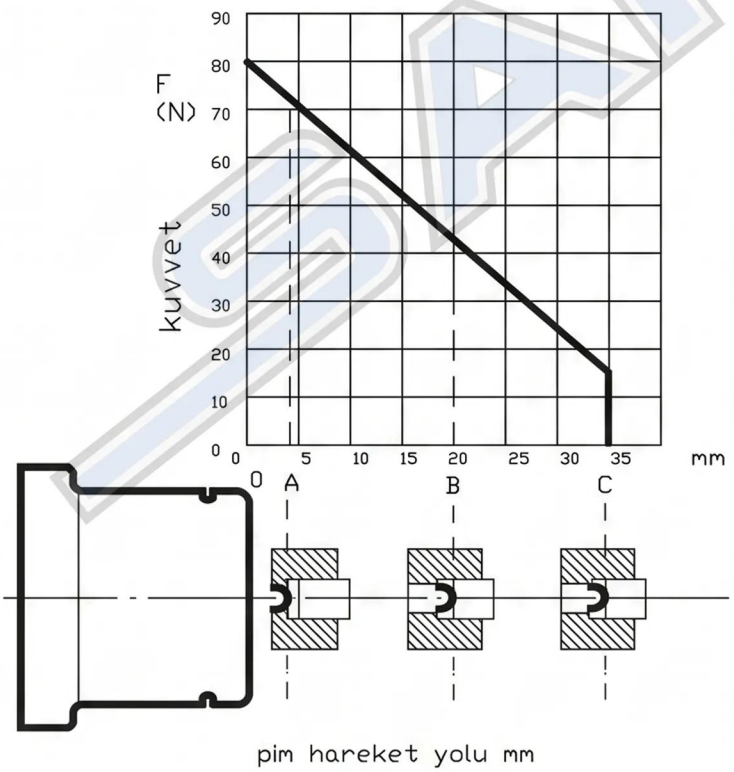


View before
The test

View after 31.5 kA current

* Single design for indoor and outdoor applications.
* Extreme breaking capacity.
* Safe breaking of the critical current.
* Safe breaking of the minimum breaking current.
* Perfect cut-off characteristic.
* Low power dissipation.
* Pure Ag melting elements.
* Robust and safe striker mechanism (available only for SFP tyıe).
* Low switching overvoltage.

Characteristics of striker pins



OA : Free motion (max.4mm)
AB : Section for energy intake (16 mm.) Energy value 1 ± 0,5 Joule
OC : Longest actual motion (35 mm.)

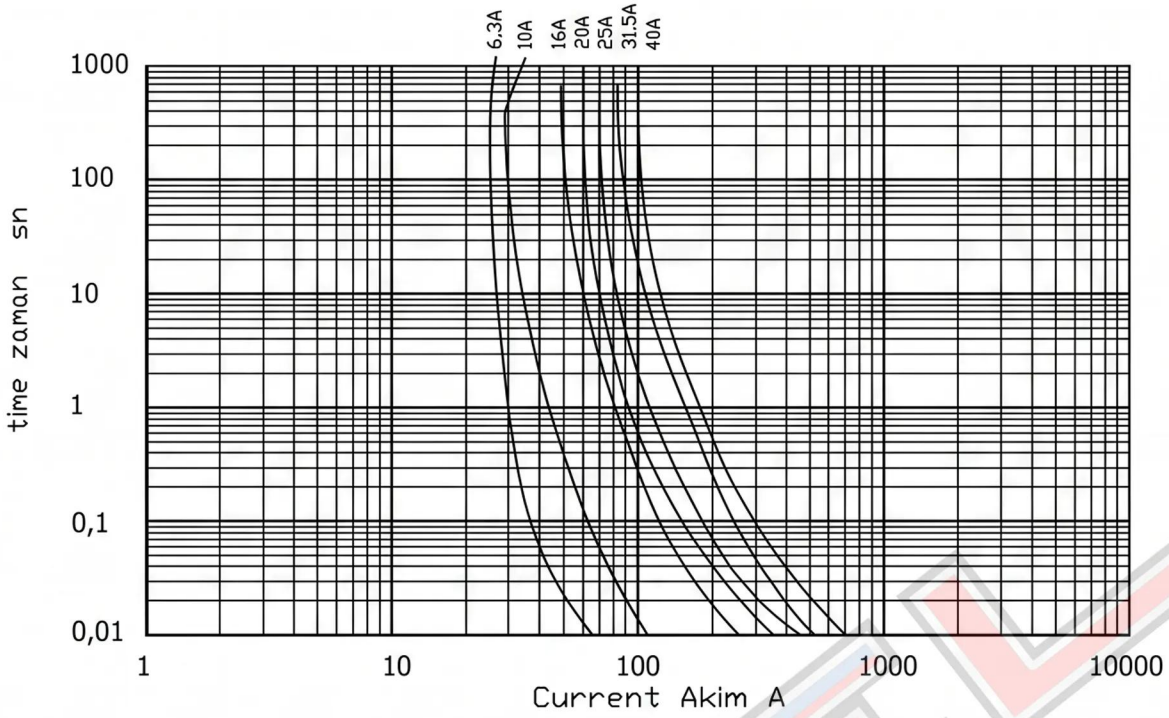
When the fuse has blown, the striker pin moves outwards with force. Its initial force is 80 N.This corresponds to an energy amount of 1 Joule and is of MED IUM TYPE according to the EN 60282 - 1 standard.The motion path - force correlation is as shown in the graph above. Striker pin moves 35 mm.Therefore it can be ensured that a breaker is opened or the warning system is activated, if necessary.

Technical data and dimensions for SAFEL Fuse-Links types SFP and SFN

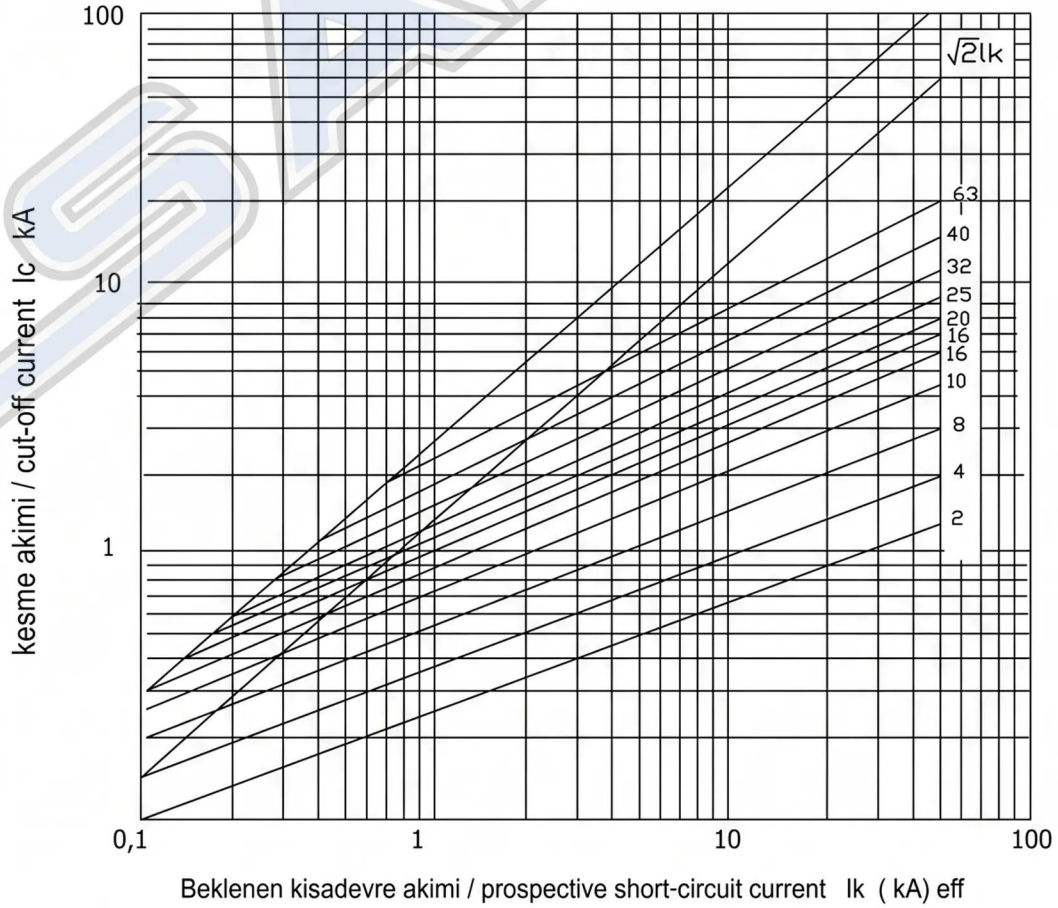
Rated voltage	Rated current	Dimensions		Rated breaking c apacity	Minimum breaking current	Resistance	Power dissipation	Weight
U_r (kV)	I_r (A)	a (mm)	Ød (mm)	I_1 (kA)	I_3 = min A)	R_{cold} mΩ)	P (W)	W (kg)
7,2	2	292	53	31,5	8	414	3,5	1,6
	4				16	370	8,9	
	6				24	144	6,6	
	10				50	94	10,5	
	16				64	54	16,5	
	20				92	34	19	
	25				110	27	23,6	
	30				145	22,4	28,2	
	40				145	16	45,2	
	50		75	20	250	15	53,2	3
	63				360	10,2	60	
	80				380	7	67,2	
	100		84,5		400	4,6	69,6	4
	125				500	3,5	85,5	
12	2	292	53	31,5	8	822	5,9	1,6
	4				16	630	15,1	
	6				24	240	9,7	
	10				40	155	17,7	
	16				68	90	27,6	
	20				68	60	31,7	
	25				110	30	39,3	
	31,5				132	37	47	
	40				170	27	75	
	50		75		200	25	88,9	3
	50				240	17	110	
	80				320	11,6	112	
	100		84,5		400	5	116	4
	125				500	6,1	142	
24	2	442	53	31,5	6	1570	11,8	2,3
	4				16	1260	30	
	6,3				31	530	33	
	10				42	330	39,6	
	16				42	133	68	
	20				86	113	69	
	25				109	90	79	
	31,5				134	69	162	
	40				167	60	179	
	60		75	20	200	34	202	4,5
	63				240	34	202	
	80				360	23,3	234	
	100		84,5		400	15,4	232	6
	125				500	12,3	285	
36	2	537	53	20	6	2300	17,4	2,8
	4				16	1120	44,9	
	6				24	740	29,2	
	10				50	380	53,1	
	31,5				80	340	95,2	
	20				92	170	95,2	
	25				110	140	118,1	
	30				145	103	141,1	
	40				105	90	226	
	50		75	16	160	47	268	5,1
	60				260	36	304	
	80				360	37	304	
	100		84,5		400	23,2	310	7
	125				500	18,4	428	

Characteristic Curves

time-current characteristics



cut - off current diagram



Fuse Selection

Following criteria are important in the selection of fuses:

* The rated voltage of the fuse must be equal or higher than the rated system voltage.
If;
The operating voltage is higher than the rated voltage of the fuse:
- Inflammation during melting increases
- Thermal stresses on the fuse increases
- Value of the minimum breaking current of the fuse decreases If;
The operating voltage is lower than the rated voltage of the fuse:
- Value of the minimum breaking current of the fuse increases
- Stresses during melting increases

* The rated maximum breaking current of the fuse must be equal or higher than the maximum three phase short-circuit current of the system.

* The rated current of the fuse should be higher than the permitted maximum load current of the circuit or equipment protected by the fuse but lower than the continuous current allowed by the thermal criteria for the protected circuit.

* Phase to earth fault current possible in the medium voltage network should be higher than the rated minimum breaking current of the fuse.

Transformer Protection

Following conditions must be fulfilled for protec tion of transformers:

* The fuse must be able to withstand the inrush magnetizing current of the transformer. It is calculated that the melting current of the fuse at 0.1 second must be higher than 10 -12 times the rated current of the transformer.If
If (0.1 sec.) > (10 -12) x In Transformer

* The fuse must be capable of breaking the fault current at the secondary terminals of the transformer.The fuse protecting the transformer must break before the foresighted short circuit current damages the transformer.

* The fuse must be able to withstand the continuous service current as well as the eventual overloads.In order to get this, the rated current of the fuse must be higher than at least 1.3 times the rated current of the transformer.1.3 In trf < In Fuse An addi additonal criteria for selection of fuses for the protection of distribution transformers

is as follows:

When a short circuit occurs at the low voltage side of the transformer the associated short circuit current should be interrupted by protection equipment at the low voltage side of the transformer, if this is not possible the high voltage fuse at the primary side should melt. To fulfill this condition, the system should be designed such that in case of a short circuit at the low voltage side the short circuit current at the primary side of the transformer should be able to melt the fuse. In this case the current-time characteristics of the high voltage fuse should be considered. The current-time characteristics of the high voltage fuse should be higher than the current-time characteristics of the protection equipment at the low voltage side and the two protection systems should be coordinated.

Data Required for the Design of a Protection System for a Transformer of a Certain Rating :

1- Transformer characteristics

- Power kVA
- Short circuit voltage (Uk %) • Rated Current

2- Fuse Characteristics

- Time-Current Characteristics
- Rated minimum breaking current I3

3- System and Operating Conditions

- Open air or air insulated cubicles or SF6 gas insulated cubicles etc...
- Continuous or not continuous overloads

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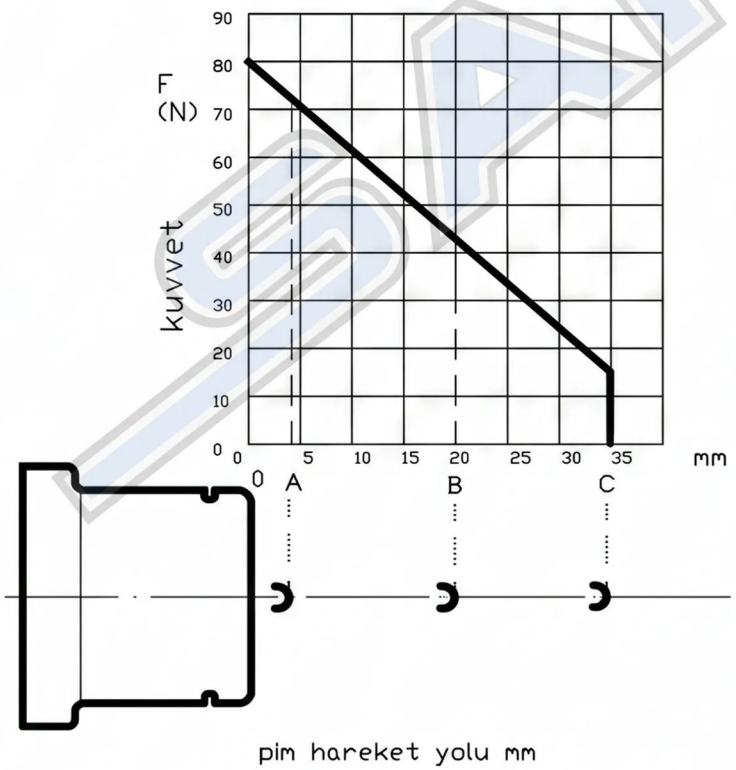
FUSE SELECTION TABLE FOR DISTRIBUTION TRANSFORMERS

Transformator Characteristics							Safel SFP / SFN Fuse Selection			
Rated Power	Rated Voltage	Rated Current	30% overload current	Magnetising Current	Rated Short-Circuit Current	Minimum breaking current	Selected Fuse			
kVA	kV	I_{rt} (A)	A	Ie (A/0.1sec)	I_{kt} (A)	I_3 (A)				
50	6,3 / 0,4	4,58	5,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
50	6,3 / 0,4	4,58	5,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
50	6,3 / 0,4	6,58	6,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
50	6,3 / 0,4	8,58	6,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
60	6,3 / 0,4	11,38	7,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
70	6,3 / 0,4	12,18	7,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
80	6,3 / 0,4	13,38	8,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
80	6,3 / 0,4	15,18	8,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
90	6,3 / 0,4	17,68	8,96	54,99	114,56	50	10A	7,2kV	36cm	31,5kA
100	6,3 / 0,4	19,28	9,96	54,99	114,56	50A	10A	7,2kV	36cm	31,5kA
100	6,3 / 0,4	10,69	11,66	54,99	114,56	50A	10A	7,2kV	36cm	31,5kA
100	6,3 / 0,4	12,09	11,66	54,99	114,56	50A	10A	7,2kV	36cm	31,5kA
125	6,3 / 0,4	14,78	12,86	54,99	134,56	50A	10A	7,2kV	36cm	31,5kA
125	6,3 / 0,4	15,38	15,96	54,99	133,56	50A	10A	7,2kV	36cm	31,5kA
125	6,3 / 0,4	16,78	17,06	54,99	135,56	50A	10A	7,2kV	36cm	31,5kA
160	6,3 / 0,4	18,89	19,96	54,99	133,56	50A	10A	7,2kV	36cm	31,5kA
160	6,3 / 0,4	19,89	29,36	54,99	235,56	50A	20A	7,2kV	36cm	31,5kA
160	6,3 / 0,4	20,18	23,66	54,99	235,56	50A	20A	7,2kV	36cm	31,5kA
160	6,3 / 0,4	22,48	23,56	54,99	245,56	50A	20A	7,2kV	36cm	31,5kA
200	6,3 / 0,4	24,03	25,66	54,99	245,56	50A	20A	7,2kV	36cm	31,5kA
200	6,3 / 0,4	25,39	26,76	54,99	245,56	50A	20A	7,2kV	36cm	31,5kA
200	6,3 / 0,4	26,09	30,68	54,99	254,56	50A	20A	7,2kV	36cm	31,5kA
250	6,3 / 0,4	26,78	33,56	54,99	265,56	50A	20A	7,2kV	36cm	31,5kA
250	6,3 / 0,4	27,19	34,36	54,99	264,56	50A	20A	7,2kV	36cm	31,5kA
315	6,3 / 0,4	31,38	16,36	54,99	305,56	50A	10A	7,2kV	36cm	31,5kA
315	6,3 / 0,3	8,98	10,28	54,99	321,56	50A	20A	7,2kV	36cm	31,5kA
315	6,3 / 0,3	3,38	9,18	54,99	314,56	50A	30A	7,2kV	36cm	31,5kA
400	6,3 / 0,3	3,58	3,48	54,99	377,56	50A	30A	7,2kV	40cm	31,5kA
400	6,3 / 0,3	4,58	3,56	54,99	377,56	50A	40A	7,2kV	40cm	31,5kA
400	6,3 / 0,3	4,58	5,96	54,99	377,56	50A	40A	7,2kV	40cm	31,5kA
400	6,3 / 0,3	5,38	4,96	54,99	403,56	40A	40A	7,2kV	40cm	31,5kA
500	6,3 / 0,4	6,38	5,96	54,99	403,56	40A	50A	7,2kV	46cm	41,5kA
500	6,3 / 0,4	6,58	6,86	54,99	403,56	40A	50A	7,2kV	46cm	41,5kA
500	6,3 / 0,4	6,58	6,96	54,99	403,56	40A	60A	7,2kV	46cm	41,5kA
630	6,3 / 0,4	7,98	6,36	54,99	403,56	40A	60A	7,2kV	46cm	41,5kA
630	6,3 / 0,4	7,68	7,78	64,99	503,56	50A	80A	7,2kV	46cm	42,5kA
630	6,3 / 0,4	9,78	8,78	64,99	203,56	50A	80A	7,2kV	46cm	42,5kA
800	6,3 / 0,6	10,02	9,96	114,56	256,56	50A	100A	7,2kV	46cm	43,5kA
1000	6,3 / 0,4	10,62	11,58	114,56	328,56	50A	100A	7,2kV	46cm	53,5kA
1000	6,3 / 0,5	12,22	12,88	114,56	384,56	50A	100A	7,2kV	46cm	53,5kA
1250	6,3 / 0,5	13,52	13,68	123,56	534,56	50A	125A	7,2kV	46cm	51,5kA

* Single design for indoor and outdoor applications.
* Extreme breaking capacity.
* Safe breaking of the critical current.
* Safe breaking of the minimum breaking current.
* Perfect cut - off characteristic.
* Low power dissipation.
* Pure Ag melting elements.
* Robust and safe striker mechanism (available only for SFP type).
* Low switching overvoltage.

Characteristics of striker pins



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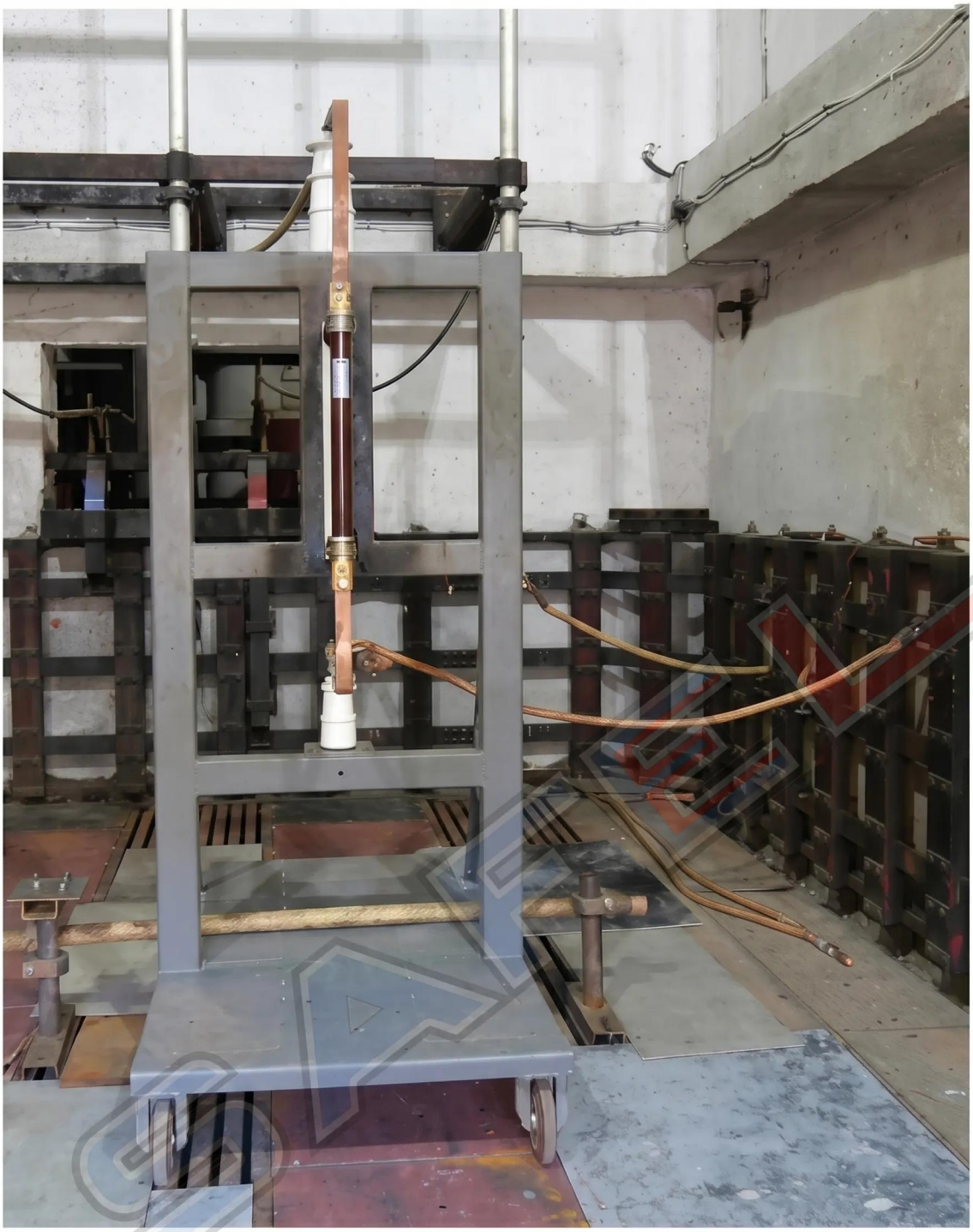
OC : Longest actual motion (35 mm.)

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HIGH VOLTAGE UNIT

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TEST REPORTS

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Phone: (351) 402 427; Fax: (351) 404 890;
www.icmet.ro ; E-mail: lmp@icmet.ro, market@icmet.ro

TEST REPORT
No. 12438

CUSTOMER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

MANUFACTURER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

TESTED PRODUCT: 24 kV, 16-40 A, 31.5 kA medium voltage fuse-links in homogeneous series

REFERENCE STANDARD: IEC 60282-1

TEST PERFORMED: Breaking tests in test duties TD1, TD2, TD3

TEST DATE: 24-25.08.2016

TEST RESULT: **Passed the tests**

Test Report has 40 pages and it is edited in 4 original copies from which copy 1 for laboratory and copies 2, 3 and 4 for customer.

TECHNICAL MANAGER OF HIGH POWER LABORATORY: Phys. Daniel Truta

HEAD OF HIGH POWER LABORATORY: Eng. Catalin Dobrea

DATE OF ISSUE: 05.12.2016

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www.icmet.ro ; E-mail: lmp@icmet.ro, market@icmet.ro

TEST REPORT
No. 12439

CUSTOMER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

MANUFACTURER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

TESTED PRODUCT: 24 kV, 10 A, 31.5 kA medium voltage fuse-links

REFERENCE STANDARD: IEC 60282-1

TEST PERFORMED: Breaking tests in test duties TD1, TD2, TD3

TEST DATE: 24-25.08.2016

TEST RESULT: **Passed the tests**

Test Report has 28 pages and it is edited in 4 original copies from which copy 1 for laboratory and copies 2, 3 and 4 for customer.

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Matriculation certificate: J16/312/1999, VAT number RO387 1599
Phone: (351) 402 427; Fax: (351) 404 890;
www.icmet.ro ; E-mail: lmp@icmet.ro, market@icmet.ro

TEST REPORT
No. 12440

CUSTOMER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

MANUFACTURER: **SAFEL ELEKTRIK SANAYI VE TICARET LIMITED ŞIRKETI**
Karadeniz Mah. 1180/1/Sokak No. 8/7 Gaziosmanpaşa - Istanbul / TURKEY

TESTED PRODUCT: 24 kV, 6.3 A, 31.5 kA medium voltage fuse-links

REFERENCE STANDARD: IEC 60282-1

TEST PERFORMED: Breaking tests in test duties TD1, TD2, TD3

TEST DATE: 24-25.08.2016

TEST RESULT: **Passed the tests**

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Test Laboratuvarları

LVT Test Laboratuvarları Ltd. Şti.

AB-0341-T
KD-19-0279-R01-N01-02
04-19

DENEY RAPORU
Test Report

1/35

Müşteri / Client	:	SAFEL ELEKTRİK SAN. ve TİC. LTD. ŞTİ.
Adres / Address	:	KARADENİZ MAH. 1180/1 SK. NO:8/7 GAZİOSMANPAŞA/İSTANBUL
İmalatçı / Manufacturer	:	SAFEL ELEKTRİK SAN. ve TİC. LTD. ŞTİ.
Deney Numunesi / Test Sample	:	24 kV HIGH VOLTAGE CURRENT LIMITING BACK-UP FUSE (6.3 A – 10 A – 16 A – 20 A – 25 A – 31.5 A – 40A)
Marka / Trade Mark	:	SAFEL ELEKTRİK
Deney Metodu / Test Method	:	IEC 60282-1:2009+AMD1:2014 CSV
Deney Tarihi / Date of Test	:	04.03.2019 – 26.03.2019
Toplam Sayfa Sayısı / Total Number of Pages	:	35

2. Deney Sonuçları / *Test Results*

Numune / Sample	Uygulanan Deney / Applied Test	Sonuç / Result
24 kV HIGH VOLTAGE CURRENT LIMITING BACK-UP FUSE (6.3 A – 10 A – 16 A – 20 A – 25 A – 31.5 A – 40 A)	Temperature-Rise Tests and Power-Dissipation Measurement	PASSED
	Tests for Time-Current Characteristics	PASSED
	Tests of Strikers	PASSED

Mühür / Seal	Tarih / Date	Deney Sorumlusu / Person in Charge of Test	Laboratuvar Müdürü / Head of Laboratory
IEC 17025	04.04.2019	M. Ahmet EFE	Cahit GÖKSEL