

Типовое TC 5
всех тех. спецификаций

Type Test Certificate CESI

A4/513311

Approved

Page 1

Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

Designation VV - THERMO

Rated voltage 12 kV ; Rated normal current (*) A ; Rated frequency 50 Hz
(* Homogeneous series constituted by the following current ratings:
10 - 16 - 20 - 25 - 32 - 40 A

Manufacturer ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Tested for ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Date(s) of tests from July 9, 2003 to September 17, 2003

Tested by CESI S.p.A. - Milano - ITALY

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in the reference documents, identified in this certificate, has been subjected to the series of proving tests in accordance with

IEC 60282-1 (2002)
Clause 6.6

This Type Test Certificate has been issued by CESI following exclusively the STL Guides.

The results are shown in the record of Proving Tests and the oscillograms attached in the Test Reports. The values obtained and the general performance are considered to comply with the above Standards and to justify the ratings assigned by the Manufacturer as listed on page No.2 .

The Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

Only integral reproduction of this Certificate, or reproductions of this page accompanied by any pages on which are stated the endorsed ratings of the apparatus tested, are permitted without written permission from CESI.

No. of pages 3

Issue date September 24, 2004

Prepared PeC - P. На основании чл.36а ал.3 от ЗОП

Verified PeC - A.

Approved PeC - M.

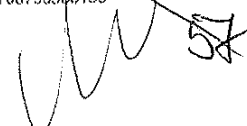
CESI
Centro Elettrotecnico
Sperimentale Italiano
Giacinto Motta spa

Via R. Ruballino 54
20134 Milano - Italia
Telefono +39 022125.1
Fax +39 022125440
http://www.cesi.it

Capitale sociale 9 650 000 Euro
interamente versato
Codice fiscale e numero
iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 428222
P.I. IT00793580150

ОПТИМАЛ



Type Test Certificate **CESI**

A4/513311

Approved

Page 2

1 - Ratings assigned by the Manufacturer as proved by the tests

Current limiting fuse

Manufacturer **ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA**

- Fuse link

Type	VV - THERMO
Voltage	12 kV
Current	10 A - 16 A - 20 A - 25 A - 32 A - 40 A
Frequency	50 Hz
Maximum breaking current	50 kA
Minimum breaking current (at 12 kV)	(10 A Fuse) 50 A
Minimum breaking current (at 12 kV)	(40 A Fuse) 200 A

- Characteristics of the fuse link

Class	Back-up
Resistance	(10 A Fuse) 87 mΩ ± 10 %
Resistance	(40 A Fuse) 23 mΩ ± 10 %

- Characteristics of the striker

Type	Medium
Operating mechanism	Spring

2 - This Certificate also verifies

Not applicable.

3 - Reference documents

The following reference documents are integral part of this Certificate

No.	Description	CESI registration
1	Test Report	A3/033271
2	Manufacturer's drawings	A4/014224

4 - Additional references

Not applicable.

Activity code 432950

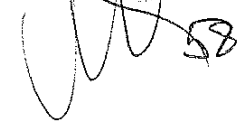
5 – Record of proving tests

The table below lists all the tests performed and the references to the relevant Test Reports containing the test values.

No. Standard and clause	Description of tests	Reference documents
IEC 60282-1 (2002) – Clause 6.6	Test duty No.1	A3/033271
IEC 60282-1 (2002) – Clause 6.6	Test duty No.2	A3/033271
IEC 60282-1 (2002) – Clause 6.6	Test duty No.3	A3/033271

6 – Identification of the sample

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings. CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object. These drawings identified by CESI and numbered A4/014224 No.1 and 2 have been returned to the Client.





Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

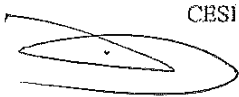
Designation VV - THERMO

Rated voltage 12 kV ; Rated normal current (*) A ; Rated frequency 50 Hz
(*^e) Homogeneous series constituted by the following current ratings:
50 - 63 - 80 A

Manufacturer ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Tested for ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Date(s) of tests from October 28, 2003 to October 30, 2003

Tested by  CESI S.p.A. - Milano - ITALY

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in the reference documents, identified in this certificate, has been subjected to the series of proving tests in accordance with

IEC 60282-1 (2002)
Clause 6.6

This Type Test Certificate has been issued by CESI following exclusively the STL Guides.

The results are shown in the record of Proving Tests and the oscillograms attached in the Test Reports. The values obtained and the general performance are considered to comply with the above Standards and to justify the ratings assigned by the Manufacturer as listed on page No.2 .

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No. of pages 3

Issue date September 27, 2004

Prepared PeC - P. BECCARINI

Verified PeC - A. ELLI

Approved PeC - M. de NIGRIS

На основании чл.36а ал.3 от ЗОП

Type Test Certificate **CESI**

A4/513317

Approved

Page 2

1 - Ratings assigned by the Manufacturer as proved by the tests

Current limiting fuse

Manufacturer **ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA**

- Fuse link

Type	VV - THERMO
Voltage	12 kV
Current	50 A - 63 A - 80 A
Frequency	50 Hz
Maximum breaking current	50 kA
Minimum breaking current (at 12 kV)	(50 A Fuse) 225 A
Minimum breaking current (at 12 kV)	(80 A Fuse) 365 A

- Characteristics of the fuse link

Class	Back-up
Resistance	(50 A Fuse) 15,0 mΩ ± 10 %
Resistance	(80 A Fuse) 9,00 mΩ ± 10 %

- Characteristics of the striker

Type	Medium
Operating mechanism	Spring

2 - This Certificate also verifies
Not applicable.

3 - Reference documents

The following reference documents are integral part of this Certificate

No.	Description	CESI registration
1	Test Report	A3/038548
2	Manufacturer's drawings	A4/014227

4 - Additional references
Not applicable.

Activity code 432950

5 – Record of proving tests

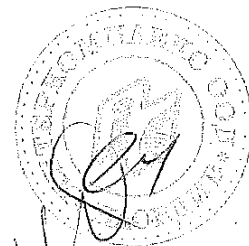
The table below lists all the tests performed and the references to the relevant Test Reports containing the test values.

No. Standard and clause	Description of tests	Reference documents
IEC 60282-1 (2002) – Clause 6.6	Test duty No.1	A3/038548
IEC 60282-1 (2002) – Clause 6.6	Test duty No.2	A3/038548
IEC 60282-1 (2002) – Clause 6.6	Test duty No.3	A3/038548

6 – Identification of the sample

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings. CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.

These drawings identified by CESI and numbered A4/014227 No.1 and 2 have been returned to the Client.



ВЕРНО С
ОРИГИНАЛА

60



Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

Designation VV - THERMO

Rated voltage 12 kV ; Rated normal current 100 - 160 A ; Rated frequency 50 Hz

Manufacturer ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Tested for ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

Date(s) of tests from December 19, 2003 to May 5, 2004

Tested by CESI S.p.A. - Milano - ITALY

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in the reference documents, identified in this certificate, has been subjected to the series of proving tests in accordance with

IEC 60282-1 (2002)
Clause 6.6

This Type Test Certificate has been issued by CESI following exclusively the STL Guides.

The results are shown in the record of Proving Tests and the oscillograms attached in the Test Reports. The values obtained and the general performance are considered to comply with the above Standards and to justify the ratings assigned by the Manufacturer as listed on page No.2.

The Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

Only integral reproduction of this Certificate, or reproductions of this page accompanied by any pages on which are stated the endorsed ratings of the apparatus tested, are permitted without written permission from CESI.

No. of pages 3

Issue date September 24, 2004

Prepared PeC - P. BECCARI

Verified PeC - A. ELLI

Approved PeC - M. de NIGRI

На основании чл.36а ал.3 от ЗОП

Type Test Certificate **CESI**

A4/513308

Approved

Page 2

1 - Ratings assigned by the Manufacturer as proved by the tests

Current limiting fuse

Manufacturer ETI ELEKTROELEMENT d.d. - Izlake - SLOVENIA

- Fuse link

Type VV - THERMO
Voltage 12 kV
Current 100 A - 160 A
Frequency 50 Hz
Maximum breaking current 50 kA
Minimum breaking current (at 12 kV) 550 A - 815 A

- Characteristics of the fuse link

Class Back-up
Maximum cut-off current 22 kA
Resistance 8,00 mΩ ± 10 % - 4,50 mΩ ± 10 %

- Characteristics of the striker

Type Medium
Operating mechanism Spring

2 - This Certificate also verifies

Not applicable.

3 - Reference documents

The following reference documents are integral part of this Certificate.

No.	Description	CESI registration
1	Test Report	A4/502480
2	Test Report	A4/004268
3	Manufacturer's drawings	A4/512345
4	Manufacturer's drawings	A4/512340

4 - Additional references

Not applicable.

Activity code 432950

5 - Record of proving tests

The table below lists all the tests performed and the references to the relevant Test Reports containing the test values.

No. Standard and clause	Description of tests	Reference documents
IEC 60282-1 (2002) - Clause 6.6	Test duty No.1 (100 A)	A4/502480
IEC 60282-1 (2002) - Clause 6.6	Test duty No.1 (160 A)	A4/004268
IEC 60282-1 (2002) - Clause 6.6	Test duty No.2 (100 A)	A4/502480
IEC 60282-1 (2002) - Clause 6.6	Test duty No.2 (160 A)	A4/004268
IEC 60282-1 (2002) - Clause 6.6	Test duty No.3 (100 A)	A4/502480
IEC 60282-1 (2002) - Clause 6.6	Test duty No.3 (160 A)	A4/004268

6 - Identification of the sample

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
 CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
 These drawings identified by CESI and numbered A4/512345 No.1-2 and A4/512340 No.1-2 have been returned to the Client.



027402
097703A4A



client ETI ELEKTROELEMENT d.o.o.
Ljubljana - SLOVENIJA

equipment under test Back up current limiting fuses

tests performed Breaking tests



normative documents IEC 60282-1 (1998)

receipt date of the sample July 7, 2003

test date: from July 9, 2003 to September 17, 2003

no. of pages 14 no. of pages annexed 49

The test results relate only to the sample tested
this document shall not be reproduced except in full without the written approval of CESI

n° 0030

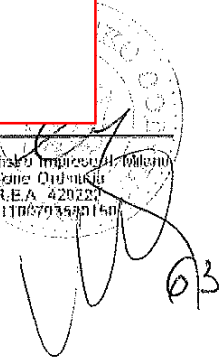
first issue date October 6, 2003

prepared PeC/TEST - P. BECCARINI

verified PeC/TEST - D. GIORDANI


approved PeC/TEST - V. SCARIONI

На основании чл.36а ал.3 от ЗОП



tests witnessed by:

Mr. MARTINCIC - ETI
Mr. KOVAC - ETI

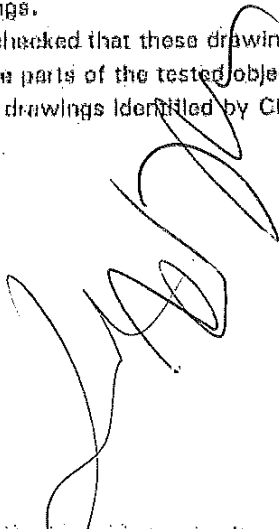


identification of the object: Effected.

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.

CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.

These drawings identified by CESI and numbered A4/014224 no.1 and 2 have been returned to the Client.




the data necessary to permit repetition of the tests are contained in the document marked:
GPS-A3/024750

The measurement uncertainties of the test results reported in this document are the following:

voltage: $\pm 5\%$; current: $\pm 5\%$; time: $\pm 5\%$

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.



activity code: 22921B

contents	page	test date
rated characteristics of the tested object assigned by the Client		
tests performed		
Breaking tests; test duty no.1 with 52,0 kA at 10,6 kV on 10 A-fuse	4	July 9, 2003
Breaking tests; test duty no.1 with 52,0 kA at 10,6 kV on 40 A-fuse	5	July 9, 2003
Breaking tests; test duty no.2 with 2,10 kA at 10,6 kV on 40 A-fuse	6	July 9, 2003
Breaking tests; test duty no.2 with 0,51 kA at 10,6 kV on 10 A-fuse	7	July 9, 2003
Breaking tests; test duty no.3 with 199 A at 12,2 kV on 40 A-fuse	8	September 17, 2003
Breaking tests; test duty no.3 with 49,5 A at 12,2 kV on 10 A-fuse	9	September 17, 2003
circuit-diagrams	10	
photo	11 to 13	
pages annexed	14	
Oscillograms (no.49)		
reference documents annexed		
Drawings ETI		- CESI ref.no.A4/014224 (no.2 pages)
Matching characteristic		- CESI ref.no.A4/014269-1
Cut-off characteristic		- CESI ref.no.A4/014269-2



Test Report

CESTEST
Centre de Services

GP5-A31033271

rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

fuse link

type	VV thermo
voltage	12 kV
current	10-40 A
frequency	50 Hz
maximum breaking current	50 kA
minimum breaking current (at 12 kV)	(10) 50 A (40) 200 A

characteristics of the fuse link

class	back-up
resistance	(10) 87 mΩ ± 10 % (40) 23 mΩ ± 10 %
melting characteristic	see annexed CESI ref.no.A4/014269-1
cut-off characteristic	see annexed CESI ref.no.A4/014269-2

characteristics of the striker

type	medium
operating mechanism	spring


MORPHING

Breaking tests test duty no.1 with 52,0 kA at 10.6 kV

test circuit: see D142 power factor: <0,15 frequency: 50-Hz

prospective transient recovery voltage					
U _c kV	t _{cr} μs	U ₁ kV	t ₁ μs	U _c kV	t _c μs
52,0	60	-	-	-	-

rated normal current of the fuse link: 10 A

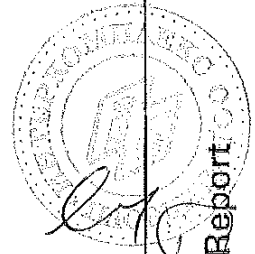
conditions of the apparatus before the tests: new, see photo no.1

date: July 9, 2003

prospective current	
rms value kA	oscillogram no.
52,0	2/1

test no.	fuse link		number	resistance mΩ	breaking current		IT total kA ² s	energy kJ	angle of arcing °	power frequency recovery voltage kV	maximum overvoltage kV	duration of		arcing operation yes/no	
	number	resistance			cut-off kA	arcing initiation kA						arcing	recovery voltage		
1	1	57,5	4,3	2,40	195	1,40	22,5	22,5	47	10,6	17,9	0,12	0,05	5	yes
2	2	57,3	5,3	2,94	197	1,81	22,5	22,5	72	10,6	22,0	0,10	0,10	5	yes
3	3	58,0	6,3	3,02	179	2,02	22,5	22,5	79	10,6	17,2	0,10	0,10	15	yes

conditions of the apparatus after the tests: no remarks.



CESI TEST

Test Report

GPS-A31033271

Breaking tests

test duty no. 1 with 52,0 kA at 10,6 kV

test circuit/see D042 power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage					
U _{ca} kV	t ₁ ms	U ₁ kV	t ₂ ms	U ₂ kV	t _r ms
22,7	50	-	-	-	-

rated normal current of the fuse link: 40 A

condition of the apparatus before the tests: new

date: July 9, 2003

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prospective current	
rms value kA	oscillogram no.
52,0	2/1

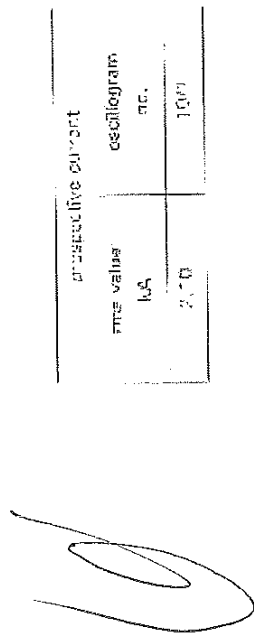
test no.	fuse link		oscillogram	breaking current		energy kJ	angle of meltback		power frequency recovery voltage kV	maximum symmetrical current rms	duration of		striker operation yes/no
	number	resistance mΩ		cut-off kA	at 100% indication kA		melting kA ² s	total kA ² s			arc ms	recovery voltage kV	
4	4	22,7	7/3	5,51	2,32	77,5	-	55	10,5	0,24	6,00	15	yes
5	5	22,9	5/3	5,94	2,25	65,0	-	77	10,5	0,23	4,70	15	yes
6	6	23,4	5/3	5,99	2,15	56,6	-	91	10,5	0,10	4,40	15	yes

conclusion of the apparatus after the tests: no remarks.

Breaking tests test duty no.2 with 2,10 kA at 10,6 kV

test circuit: see D042 power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage							
U _c kV	t ₁ μs	t ₂ μs	U ₁ kV	t ₁ μs	U ₂ kV	t ₂ μs	I _c kA
10	220	-	-	-	-	-	-



prospective current	
rms value	oscillogram
kA	sec.
2,10	1000

rated normal current of the fuse link: 40 A

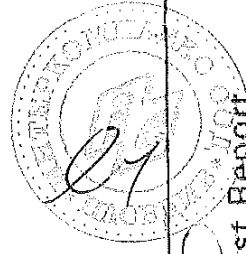
condition of the apparatus before the tests: none

date: July 2, 2002

test no	fuse link		oscillogram	breaking current		I ₁	energy	number of		prospective	recovery	voltage	status	
	number	resistance		at arc	at arc			of	of					
		μΩ	mV	kA	kA	kA	kJ	μs	μs	kV	μs	kV	μs	
7	7	24,1	1173	2,00	1,93	14,0	122	10,0	3,20	24,6	60	7,20	60	yes
8	8	23,3	1233	2,00	1,90	14,2	123	12,5	3,20	24,1	60	7,20	60	yes
9	9	24,0	1333	2,00	1,87	14,8	125	12,6	3,20	24,3	60	7,10	60	yes

condition of the apparatus after the tests: no remarks.

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Test Report

GPS-A3033271

MEASURED

[Signature]
Breaking tests

test duty no. 2 with 0,51 kA at 10,6 kV

test circuit: see D042 power factor: <0,18 frequency: 50 Hz

prospective transient recovery voltage:					
U_c kV	t_c μs	U_t kV	t_s μs	U_s kV	t_r μs
22,5	220	-	-	-	-

prospective current	
rms value kA	oscillogram no.
0,51	14/1

[Large handwritten signature]

rated normal current of the fuse link: 10 A

condition of the apparatus before the tests: new

date: July 9, 2003

test no.	fuse link		oscillogram		breaking current		I ² t		energy kJ	duration of making		maximum overvoltage kV	duration of recovery		striker operation
	number	resistance mΩ	no.	ms	at initiation kA	at initiation kA	total kA ² s	multilg kA ² s		ms	ms		ms	ms	
10	10	93,2	16/3	16/3	0,533	0,533	1,14	0,196	34,2	12	12	27,5	6,90	60	yes
11	11	94,7	16/3	16/3	0,532	0,532	1,37	0,171	36,4	11	11	21,1	7,20	60	yes
12	12	91,4	17/2	17/2	0,532	0,532	1,43	0,181	37,4	12	12	20,1	7,10	60	yes

conditions of the apparatus after the tests: no remarks

Test Report



GPS-A3/033271

Breaking tests test duty no. 3 with 199 A at 12.2 kV

test circuit: see EQM3 power factor: 0.50 frequency: 50 Hz

prospective current	
rms value A	oscillogram no.
-	-

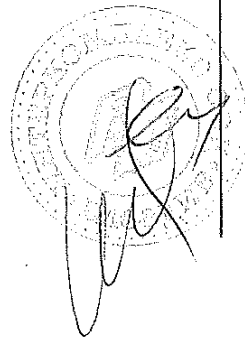
rated normal current of the free link: 40 A

condition of the apparatus before the tests: new

date: September 17, 2003

test no.	link number	resistance mΩ	oscillogram no.	breaking current A	power frequency recovery voltage kV	maximum over-voltage kV	pre-arc rms	duration of		oscilloscope operation yes/no
								arc	minimum voltage	
13	14	24.8	1972	159	12.2	29.6	109	78	60	yes
14	15	24.9	2072	150	12.2	-	115	81	60	yes

condition of the apparatus after the tests: no remarks.



CESTEST
TESTING SERVICES

Test Report

GPS-A3/033271

W

Breaking tests test duty no.3 with 49.5 A at 12.2 kV

power factor: 0.50 frequency: 50 Hz

[Signature]
 test circuit: see D01a

prospective current	oscillation no.
49.5 A	

rated normal current of the test link: 10 A

[Signature]

condition of the apparatus before the tests: new

date: September 17, 2003

test no.	type link number	impedance (mΩ)	switching	medium	breaking current (A)	power frequency recovery voltage (kV)	maximum overvoltage (kV)	duration of		strikes operation
								arc	travelling voltage	
15	16	88.9	21/3	10	49.5	12.2	970	100	60	yes
16	17	89.2	22/3	10	49.5	12.2	1288	100	60	yes

conditions of the apparatus after the tests: no remarks.

client  ETI ELEKTROELEMENT d.d.
Izlake - SLOVENIJA

equipment under test Back-up current limiting fuses

tests performed Breaking tests

normative documents IEC 60282-1 (2002)

receipt date of the sample October 20, 2003

test date: from October 28, 2003 to October 30, 2003

no. of pages 14 no. of pages annexed 45

the test results relate only to the sample tested
this document shall not be reproduced except in full without the written approval of CESI


n° 0030

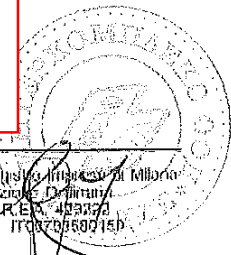
first issue date November 13, 2003

prepared PeC/TEST - P. BECCARINI

verified PeC/TEST - G. GHEZZI

approved PeC/TEST - V. SCARIONI

На основании чл.36а ал.3 от ЗОП



03793580150

68

tests witnessed by:

Mr. MARTINCIC - ETI
Mr. KOVAC - ETI



identification of the object: Not requested.

the data necessary to permit repetition of the tests are contained in the document marked:
GPS-A3/036400

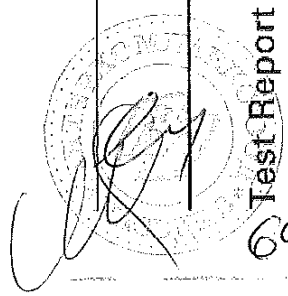
The measurement uncertainties of the test results reported in this document are the following:
voltage: $\pm 5\%$; current: $\pm 5\%$; time: $\pm 5\%$

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

activity code: 89086V
keywords: 12015R 23460W 31020W 53001D 62310N

contents	page	test date
rated characteristics of the tested object assigned by the Client	4	October 28, 2003
tests performed	5	October 28, 2003
Breaking tests: test duty no.1 with 50,2 kA at 10,6 kV on 50 A-fuse	6	October 28, 2003
Breaking tests: test duty no.1 with 50,2 kA at 10,6 kV on 80 A-fuse	7	October 28, 2003
Breaking tests: test duty no.2 with 2,81 kA at 10,6 kV on 50 A-fuse	8	October 28, 2003
Breaking tests: test duty no.2 with 4,63 kA at 10,6 kV on 80 A-fuse	9	October 30, 2003
Breaking tests: test duty no.3 with 225 A at 12,1 kV on 50 A-fuse	10	October 30, 2003
Breaking tests: test duty no.3 with 365 A at 12,1 kV on 80 A-fuse	11 - 12	
circuit-diagrams	13 - 14	
photos		
pages annexed		
Oscillograms (no.45)		

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GPS-A3/038548

rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

ETI

fuse link

type

VV-THLRMO

voltage

12 kV

current

50-80 A

frequency

50 Hz

maximum breaking current

50 kA

minimum breaking current at 12 kV (50 A)

225 A

minimum breaking current at 12 kV (80 A)

385 A

characteristics of the fuse link

class

back up

resistance (50 A)

14,0 mΩ ± 10 %

resistance (80 A)

9,30 mΩ ± 10 %

melting characteristic

see annexed CEST ref.no.A4/014368-01

cut off characteristic

see annexed CEST ref.no.A4/014368-02

characteristics of the striker

type

medium

operating mechanism

by spring

Breaking tests test duty no.1 with 50,2 kA at 10,6 kV

test circuit: see D02-2 power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage					
U _c kV	t ₁ μs	U ₁ kV	t ₂ μs	U _c kV	t ₂ μs
20,7	60	3	-	-	-

rated normal current of the bus link: 50 A

condition of the apparatus before the tests: new, see photo no.1

date: October 28, 2003

arrestive current	
rms value kA	oscillogram no.
50,2	2/1



test no.	bus link		oscillogram no.	breaking current		P ₁		energy making	angle of extinction of the arc		power frequency recovery voltage	duration of recovery		arrestor operation
	number	resistance mΩ		at arc initiation	at arc extinction	making	extinction		pre-arc	post-arc		ms	ms	
1	1	15,1	3/2	7,56	7,45	24,7	81,8	50	0,30	0,30	10,6	5,4	15	yes
2	2	14,8	4/3	8,47	7,35	27,5	88,5	72	0,33	0,33	10,6	4,4	15	yes
3	3	14,9	5/3	8,67	7,05	37,4	120	72	0,30	0,30	10,6	4,7	15	yes

conditions of the apparatus after the tests: no remark.

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CESTI [EST]
Central European Scientific Institute

Test Report

GPS-A3038548

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test duty no.1 with 50,2 kA at 10,6 kV

power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage					
U _c kV	t ₁ μs	U ₁ kV	t ₂ μs	U ₂ kV	t ₃ μs
20,7	30	-	-	-	-

rated normal current of the fuse link: 80 A

condition of the apparatus before the test: new, see photo no.2

date: October 28, 2003

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prospective current	
rms value kA	oscillogram no.
50,2	2/1

test no.	fuse link		oscillogram no.	breaking amount		P _t total kA ² s	energy kJ	angle of initiation of the arc		arcs frequency recovery voltage	maximum arrest voltage kV	pressure mbar	duration of		sticker operation yes/no
	number	resistance mΩ		at arc initiation kA	melting kA ² s			making	the arc				arc	recovery voltage	
4	4	3,65	6/3	-	18,2	58,6	171	54	54	10,6	21,0	0,49	5,70	15	yes
5	5	3,25	7/3	-	18,0	72,6	172	72	72	10,6	26,4	0,42	4,80	15	yes
5	6	3,80	8/3	-	17,8	71,3	168	72	72	10,6	26,2	0,42	4,70	15	yes

conditions of the apparatus after the test: no remark.

Breaking tests test duty no. 2 with 2,81 kA at 10,6 kV

test circuit: see D042 power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage					
U _c kV	t ₁ μs	U ₁ kV	t ₂ μs	U ₂ kV	t ₃ μs
22,5	215	-	-	-	-

rated normal current of the bus link: 50 A

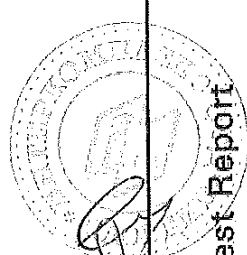
condition of the apparatus before the tests: new.

date: October 29, 2003

test no.	time links number	resistance mΩ	oscillogram no.	breaking current		P _t total kVA	energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	maximum over-voltage		duration of		striker operation
				calculated kA	of arc initiation kA			making °	extinguishing °		per-sec μs	ms	recovery voltage μ	arc ms	
1	7	14,6	10/3	3,18	2,80	7,93	174	-	8	10,5	24,8	3,50	6,80	80	yes
2	8	14,2	11/3	3,17	2,80	7,82	175	-	11	10,5	24,8	3,50	6,70	80	yes
3	9	14,1	12/3	3,16	2,80	7,92	189	-	10	10,5	25,1	3,50	6,50	80	yes

condition of the apparatus after the tests: no remark

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Test Report

CESIJET

GPS-A31038548

prospective current	
rms value kA	oscillogram no.
2,81	9/1

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Breaking tests

test duty no. 2 with 4,63 kA at 10,6 kV

test circuit: see D042

power factor: < 0,15

frequency: 50 Hz

prospective transient recovery voltage					
U ₁ kV	t ₁ µs	U ₂ kV	t ₂ µs	U ₃ kV	t ₃ µs
22,0	211	-	-	-	-

rated normal current of the fuse link: 80 A

condition of the apparatus before the tests: new

date: October 28, 2003

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prospective current	
rms value kA	instilling no.
4,63	1441

test no.	fuse link		breaking current		β	energy kJ	angle of incidence		power frequency recovery voltage kV	max. arcing overvoltage kV	duration of		arcing yes/no
	number	resistance mΩ	cut-off kA	at arc initiation kA			marking	to arc			arcs	recovery voltage	
10	10	5,33	5,00	4,68	18,9	256	9	-	10,2	24,8	3,40	7,00	yes
11	11	9,62	4,93	4,67	19,8	253	10	-	10,6	24,4	3,40	7,00	yes
12	12	9,52	4,95	4,68	19,1	292	10	-	10,6	23,8	3,40	7,00	yes

conditions of the apparatus after the tests: no remark.

Breaking tests test duty no.3 with 225 A at 12,1 kV

test circuit: see D043 power factor: 0,44 frequency: 50 Hz

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prospective current	
rms value A	oscillogram no.
225	1011

rated normal current of the fuse link: 50 A

condition of the apparatus before the tests: new.

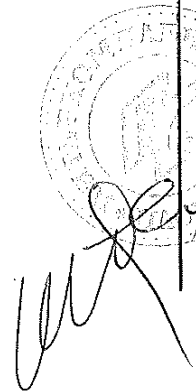
date: October 30, 2003

test no.	fuse link		oscillogram no.	breaking current A	power frequency recovery voltage kV	maximum overvoltage kV	parameters	duration of arc	multiscanned voltage	criticor application
	number	resistance mΩ								
13	13	14,1	20,1	225	12,1	20,4	0,86	38,1	60	yes
14	14	14,0	21,1	225	12,1	25,7	0,84	53,0	60	yes

condition of the apparatus after the tests: no remark.

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AT Test Report *[Handwritten signature]*

CESITEST

GPS-A3/03B548

Breaking tests

test duty no. 3 with 365 A at 12,1 kV

test circuits see Doc 3

power factor 0,41

frequency 50 Hz

W

rms value A	365
oscillogram no.	23/1

W

rated normal current of the fuse link: 60 A

condition of the apparatus before the test: new

date: October 30, 2009

test no.	fuse link number	resistance mΩ	oscillogram no.	breaking current A	power frequency recovery voltage kV	maximum overvoltage kV	pre-arc s	duration of		status operation
								arc	maintained voltage	
15	15	10,1	24/1	365	12,1	15,0	0,29	53,2	50	yes
16	15	10,0	25/1	365	12,1	15,0	0,37	54,0	50	yes

conditions of the apparatus after the tests: no remark

Test Report



GPS-A3/038548

Client: ÈTI ELEKTROELEMENT d.d. Izlake - SLOVENIA

Tested equipment: Back-up current limiting fuses

Tests carried out: Breaking tests

Standards/Specifications: IEC 60282-1 (2002)

Test date: from May 4, 2004 to May 5, 2004

The results reported in this document relate only to the tested equipment. Partial reproduction of this document is permitted only with the written permission from CESI

No. of pages: 10

No. of pages annexed: 25

Issue date: September 16, 2004

Prepared: PeC - P. BECCARINI

Verified: PeC - G. GHEZZI

Approved: PeC - M. de NIGRIS

На основании чл.36а ал.3 от ЗОП



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Tests witnessed by

Mr. MARTINCIC ETI
Mr. PESSAN BRANKO ETI

Identification of the object effected.

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings. CESI checked that these drawings adequately represent in shape and dimension the essential details and the parts of the tested object.

These drawings identified by CESI and numbered A4/512345 No.1 and 2 are annexed to this document.



Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: A4/013610

The measurement uncertainties of the test results reported in the document are the following:

voltage: $\pm 5\%$; current: $\pm 5\%$; time: $\pm 5\%$

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

Activity code 432950

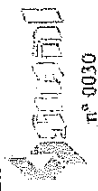


Contents	Page	Test date
<p>Rated characteristics of the tested object assigned by the Client</p>		
<p>Tests performed</p>	4	
<p>Breaking tests; test duty No.1 with 50,8 kA at 10,6 kV</p>	5	May 4, 2004
<p>Breaking tests; test duty No.2 with 6,43 kA at 10,6 kV</p>	6	May 4, 2004
<p>Breaking tests; test duty No.3 with 551 A at 12,1 kV</p>	7	May 5, 2004
<p>Test circuits</p>	8-9	
<p>Photo</p>	10	
<p>Pages annexed</p>		
<p>Oscillograms (No.25)</p>		
<p>Reference documents annexed</p>		
<p>Drawing of fuse-link - CESI Ref. No.A4/512345-01</p>		
<p>Drawing of melting element - CESI Ref. No.A4/512345-02</p>		
<p>Melting characteristic - CESI Ref. No.A4/512347-01</p>		
<p>Cut-off characteristic - CESI Ref. No.A4/512347-01</p>		

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AC Test Report



CESI

Approved

Test Report



A4/502480

n° 0030

Approved

Page 4

Rated characteristics of the tested object assigned by the Client

Current limiting fuse

Manufacturer ETI

- Fuse link

Type	VV - THERMO
Voltage	12 kV
Current	100 A
Frequency	50 Hz
Maximum breaking current	50 kA
Minimum breaking current (at 12 kV)	550 A

- Characteristics of the fuse link

Class	Back-up
Resistance	8,00 mΩ ± 10 %
Melting characteristic	See annexed CESI Ref. No. A4/512347-01
Cut-off characteristic	See annexed CESI Ref. No. A4/512347-02

Breaking tests; test duty No.1 with 50,8 kA at 10,6 kV

Test circuit : See D0042 Power factor : <0,15 Frequency : 50 Hz

Prospective transient recovery voltage					
U_c kV	t_d μ s	U_f kV	t_f μ s	U_c kV	t_d μ s
20,7	60	3	-	-	-

Prospective test current		
Oscillogram		Symmetrical rms value kA
No.	Sheets	
3	1	50,8

Rated normal current of the fuse link : 100 A

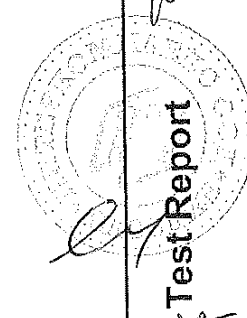
Condition of the apparatus before the tests: new, see photo No.1

Date: May 4, 2004

Test No.	Oscillogram No.	Fuse link Number	Resistance	Breaking current Cut-off	At arc initiation	Melting	i_{t}^2 Total	Energy	Angle of Making	Initiation of the arc	Power frequency recovery voltage	Maximum overvoltage	Pre-arcing time	Arcing time	Duration of recovery voltage	Striker operation
1	5	1A	8,34	12,1	11,8	29,3	83,6	160	-	40	10,6	25,4	0,6	5,9	15	Yes
2	6	2A	8,3	13,4	12,8	29	105	202	-	77	10,6	27,7	0,5	4,2	15	Yes
3	7	3A	8,7	13,4	12,8	29	108	210	-	77	10,6	27,5	0,5	4,4	15	Yes

Condition of the apparatus after the tests: no remarks.

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Test Report

CESI



n° 0030

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Page 5

A4/502480

D10181G

Breaking tests; test duty No.2 with 6,43 kA at 10,6 kV

Test circuit : See D0042 Power factor : <0,15 Frequency : 50 Hz

Prospective transient recovery voltage					
U_c kV	t_d μ s	U_1 kV	t_1 μ s	U_c kV	t_d μ s
22,3	212	-	-	-	-

Prospective test current		
Oscillogram		Symmetrical rms value kA
No.	Sheets	
11	1	6,43

Rated normal current of the fuse link : 100 A

Condition of the apparatus before the tests: new

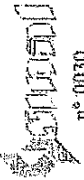
Date: May 4, 2004

Test No.	Oscillogram No.	Fuse link Number	Resistance m Ω	Breaking current Cut-off kA	At arc initiation kA	i^2t Melting kA ² s	Total i^2t kA ²	Energy kJ	Angle of Making $^\circ$	Angle of Initiation of the arc $^\circ$	Power frequency recovery voltage kV	Maximum overvoltage kV	Pre-arc time ms	Arcing time ms	Duration of recovery voltage s	Striker operation Yes / No
4	12	7A	8,3	6,64	6,29	32,7	156	389	0	-	10,6	23,5	3,6	6,9	60	Yes
5	13	8A	8,4	6,64	6,33	33	147	377	9	-	10,6	24,2	3,6	6,8	60	Yes
6	14	9A	8,5	6,75	6,52	34,5	164	393	12	-	10,6	23,2	3,6	7,0	60	Yes

Condition of the apparatus after the tests: no remarks.

Test Report

CESI



n° 0030

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A4/502480

Page 6

Breaking tests; test duty No.3 with 551 A at 12,1 kV

Test circuit : See D043 Power factor: <0,15 Frequency: 50 Hz

Prospective test current	
Oscillogram	Symmetrical rms value
No.	A
20	551
Sheets	
1	

The fuses were pre-heated in a low voltage circuit for the pre-arcing time and switched over the high voltage source in 150 ms.

Rated normal current of the fuse link : 100 A

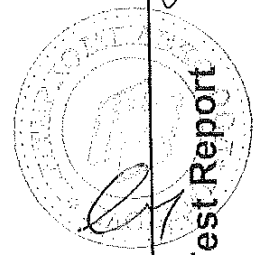
Condition of the apparatus before the tests: new

Date: May 5, 2004

Test	Oscillogram		Fuse link		Breaking current	Power frequency recovery voltage	Maximum overvoltage	Pre-arcing time	Arcing time	Duration of maintained voltage	Striker operation
	No.	Sheets	Number	Resistance							
7	23	2	10A	8,33 mΩ	551 A	12,1 kV	-	4,26 s	24,3 ms	60 s	Yes
8	24	2	11A	8,34 mΩ	551 A	12,1 kV	-	4,71 s	4,10 ms	60 s	Yes

Condition of the apparatus after the tests: no remarks.

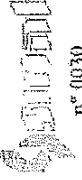
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Test Report

A6

CESI



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A4/502480

Page 7

client ETI ELEKTROELEMENT d.d.
Izlake - SLOVENIJA

equipment under test Back-up current limiting fuses

tests performed Breaking tests

normative documents IEC 60282-1 (2002)

receipt date of the sample December 18, 2003

test date: from December 19, 2003 to December 22, 2003

no. of pages 10 no. of pages annexed 24

the test results relate only to the sample tested
this document shall not be reproduced except in full without the written approval of CESI

n° 0030

first issue date September 16, 2004

prepared PeC/TEST - P. BECCARINI

verified PeC/TEST - G. GHEZZI

approved PeC/TEST - M. de NIGRIS

На основании чл.36а ал.3 от ЗОП

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tests witnessed by:

Mr. MARTINCIC - ETI
Mr. KOVAC - ETI

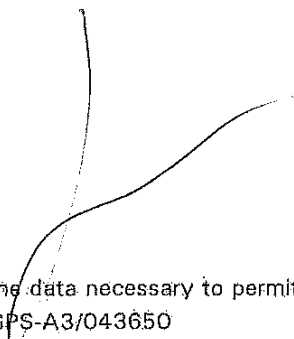


identification of the object: Effected.

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.

CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.

These drawings identified by CESI and numbered A4/512345 no.1 and 2 are annexed to this document.


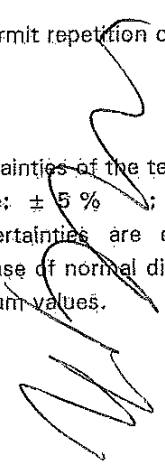


the data necessary to permit repetition of the tests are contained in the document marked:
GPS-A3/043650

The measurement uncertainties of the test results reported in this document are the following:

voltage: $\pm 5\%$; current: $\pm 5\%$; time: $\pm 5\%$

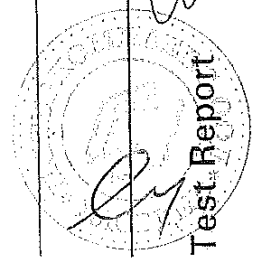
The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.



activity code: 38086V

contents	page	test date
rated characteristics of the tested object assigned by the Client	4	
tests performed	5	December 19, 2003
Breaking tests; test duty no.1 with 50,2 kA at 10,6 kV	6	December 22, 2003
Breaking tests; test duty no.2 with 11,3 kA at 10,6 kV	7	December 22, 2003
Breaking tests; test duty no.3 with 812 A at 12,1 kV	8 - 9	
circuit-diagrams	10	
photo		
pages annexed		
Oscillograms (no.24)		
reference documents annexed		
Drawing of fuse-link		- (CESI ref.no.A4/512345-01)
Drawing of melting element		- (CESI ref.no.A4/512345-02)
Melting characteristic		- (CESI ref.no.A4/512347-01)
Cut-off characteristic		- (CESI ref.no.A4/512347-02)

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Test Report



GPS-A4/004268

48

rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

ETI

fuse link

type

VV-THERMO

voltage

12 kV

current

160 A

frequency

50 Hz

maximum breaking current

50 kA

minimum breaking current (at 12 kV)

815 A

characteristics of the fuse link

class

back-up

maximum cut-off current

22 kA

resistance

4,50 mΩ ± 10 %

melting characteristic

see annexed CESI ref.no.A4/512347-01

cut-off characteristic

see annexed CESI ref.no.A4/512347-02

characteristics of the striker

type

medium

operating mechanism

spring

Breaking tests test duty no.1 with 50,2 kA at 10,6 kV

test circuit: see D042 power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage						
U _c kV	t _s μs	U ₁ kV	t ₁ μs	U _c kV	t ₂ μs	t ₄ μs
20,7	60	-	-	-	-	-

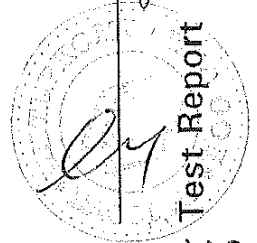
rated normal current of the fuse link: 160 A

condition of the apparatus before the tests: new, see photo no.1

date: December 19, 2003

test no.	fuse link		oscillogram no.	breaking current		i _{it} total	energy	angle of initiation of the arc		power frequency recovery voltage	maximum overvoltage	duration of		striker operation	
	number	resistance mΩ		cut-off	at arc initiation			making	°			°	pre-arc		arc
1	7	4,47	9/3	19,1	-	103	444	-	61	10,6	27,5	0,86	5,9	15	yes
2	8	4,45	10/3	20,0	-	101	514	-	81	10,6	27,2	0,80	5,0	15	yes
3	9	4,38	11/3	20,0	-	105	393	-	76	10,6	29,1	0,78	4,8	15	yes

conditions of the apparatus after the tests: no remarks.

Test Report

CESI TEST
Testing Solutions

GPS-A4/004268

prospective current	
rms value kA	oscillogram no.
50,2	2/1



Breaking tests

test duty no.2 with 11,3 kA at 10,6 kV

test circuit: see D042

power factor: <0,15

frequency: 50 Hz

prospective transient recovery voltage						
U _c kV	t _g μs	t _d μs	U ₁ kV	t _r μs	U _c kV	t _d μs
23	215	-	-	-	-	-

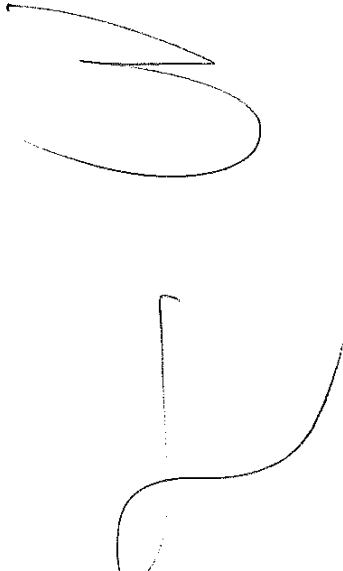
rated normal current of the fuse link: 160 A

condition of the apparatus before the tests: new

date: December 22, 2003

test no.	fuse link		oscillogram no.	breaking current		I ² t melting	I ² t total	energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	maximum overvoltage kV	duration of		striker operation	
	number	resistance mΩ		at arc initiation	at arc initiation				making	of the arc			pre-arc	arc		recovery voltage
4	10	4,54	14/3	12,2	11,3	129	465	675	8	-	10,6	26,5	3,7	6,7	15	yes
5	11	4,95	15/3	12,3	11,2	131	453	675	8	-	10,6	26,4	3,8	6,5	15	yes
6	12	4,56	16/3	12,3	11,2	128	498	696	13	-	10,6	25,4	3,6	6,9	15	yes

conditions of the apparatus after the tests: no remarks.



prospective current	
rms value kA	oscillogram no.
11,3	13/1