

**Breaking tests**

test duty no.3 with 812 A at 12,1 kV

test circuit: see D043

power factor: 0.48

frequency: 50 Hz



prospective current	
rms value	oscillogram no.
A	
812	

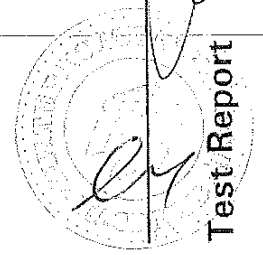
rated normal current of the fuse link: 160 A

condition of the apparatus before the tests: new

date: December 22, 2003

test no.	fuse link		oscillogram no.	breaking current A	power frequency recovery voltage kV	maximum overvoltage kV	pre-arc s	duration of		striker operation
	number	resistance mΩ						arc	maintained voltage	
7	19	4,55	32/2	812	12,1	20,2	6,355	ms	s	Yes
8	20	4,50	33/2	812	12,1	25,7	5,156	24,4	60	Yes
								41,0	60	Yes

conditions of the apparatus after the tests: no remarks.



*Handwritten signature*

Test Report

**CESIEST**  
Testing Services

GPS-A4/004268

# Type Test Certificate **CESI**

A4/513313

Approved

Page 1

Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

Designation VV - THERMO

Rated voltage 24 kV ; Rated normal current 100 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 December 23, 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. BECCARINI

Verified PeC - A. ELLI

Approved PeC - M. de NIGRIS

На основании чл.36а ал.3 от ЗОП

# Type Test Certificate

# CESI

A4/513313

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	24 kV
Current	100 A
Frequency	50 Hz
Maximum breaking current	50 kA
Minimum breaking current (at 24 kV)	550 A

### - Characteristics of the fuse link

Class	Back-up
Maximum cut-off current	15 kA
Resistance	15 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	A4/004269
2	Manufacturer's drawings	A4/512340

## 4 - Additional references

Not applicable.

Activity code 432950


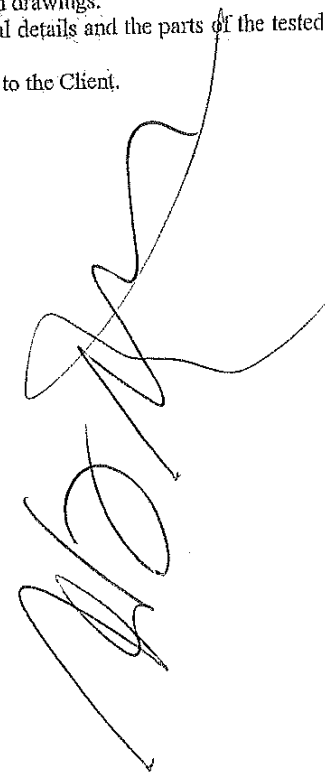
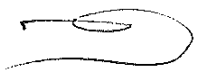
### 5 – Record of proving tests

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	A4/004269
IEC 60282-1 (2002) – Clause 6.6	Test duty No.2	A4/004269
IEC 60282-1 (2002) – Clause 6.6	Test duty No.3	A4/004269

### 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 A4/512340 No.1 and 2 have been returned to the Client.



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# Type Test Certificate

# CESI

A4/513314

Approved

Page 1

Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

Designation VV - THERMO

Rated voltage 24 kV ; Rated normal current (\*) A ; Rated frequency 50 Hz  
(\* ) 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 .

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. BECCARINI

Verified PeC - A. ELLI

Approved PeC - M. de NIGRIS

На основании чл.36а ал.3 от ЗОП

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# Type Test Certificate **CESI**

A4/513314

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	24 kV
Current	50 A - 63 A - 80 A
Frequency	50 Hz
Maximum breaking current	50 kA
Minimum breaking current (at 24 kV)	(50 A Fuse) 225 A
Minimum breaking current (at 24 kV)	(80 A Fuse) 400 A

#### - Characteristics of the fuse link

Class		Back-up
Resistance	(50 A Fuse) 25 mΩ	± 10 %
Resistance	(80 A Fuse) 16 mΩ	± 10 %

#### - Characteristics of the striker

Type	Medium
Operating mechanism	Spring

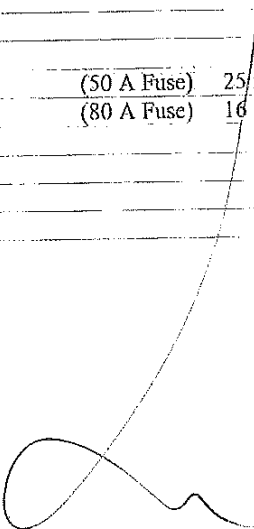

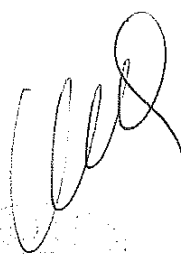
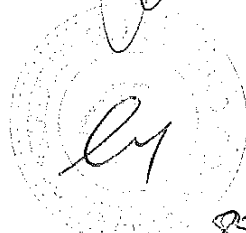
2 - This Certificate also verifies  
Not applicable.

3 - Reference documents  
*The following reference documents are integral part of this Certificate*

No.	Description	CESI registration
1	Test Report	A4/014906
2	Manufacturer's drawings	A4/014229

4 - Additional references  
Not applicable.

Activity code 432950

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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	A4/014906
IEC 60282-1 (2002) - Clause 6.6	Test duty No.2	A4/014906
IEC 60282-1 (2002) - Clause 6.6	Test duty No.3	A4/014906

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 A4/014229 No.1 and 2 have been returned to the Client.

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Type Test Certificate of Breaking performance

Apparatus Back-up current limiting fuses

Designation VV - THERMO

Rated voltage 24 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. - Milanó - 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.

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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 основание чл.36а ал.3 от ЗОП



# Type Test Certificate

# CESI

A4/513320

Approved

Page 2

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

### Current limiting fuse

Manufacturer ETI ELEKTROBLEMENT d.d. - Izlake - SLOVENIA

### - Fuse link

Type	VV - THERMO
Voltage	24 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 24 kV)	(10 A Fuse) 50 A
Minimum breaking current (at 24 kV)	(40 A Fuse) 200 A

### - Characteristics of the fuse link

Class	Back-up
Resistance	(10 A Fuse) 160 mΩ ± 10 %
Resistance	(40 A Fuse) 41 mΩ ± 10 %

### - Characteristics of the striker

Type	Medium
Operating mechanism	Spring

## 2 - This Certificate also verifies

Not applicable.

## 3 - Reference documents

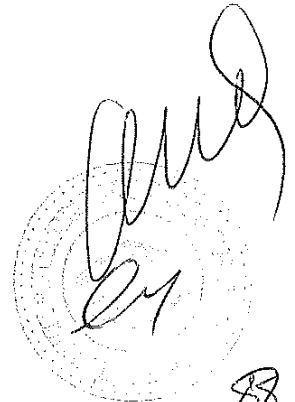
The following reference documents are integral part of this Certificate.

No.	Description	CESI registration
1	Test Report	A3/033272
2	Manufacturer's drawings	A4/014228

## 4 - Additional references

Not applicable.

Activity code 432950



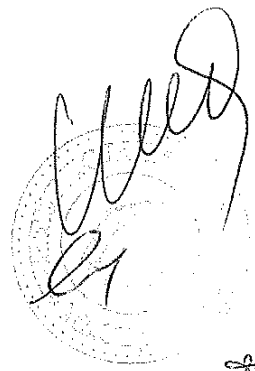
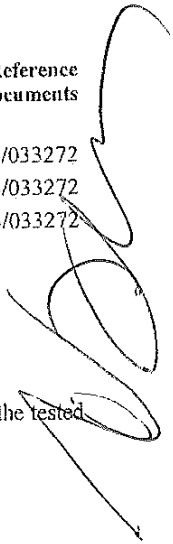
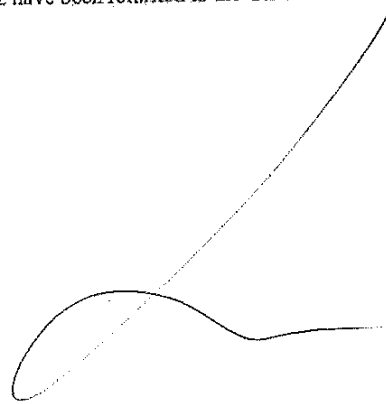
### 5 - Record of proving tests

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	A3/033272
IEC 60282-1 (2002) - Clause 6.6	Test duty No.2	A3/033272
IEC 60282-1 (2002) - Clause 6.6	Test duty No.3	A3/033272

### 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 A4/014228 No.1 and 2 have been returned to the Client.



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 23, 2003

no. of pages 10 no. of pages annexed 25

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

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

90

tests witnessed by:

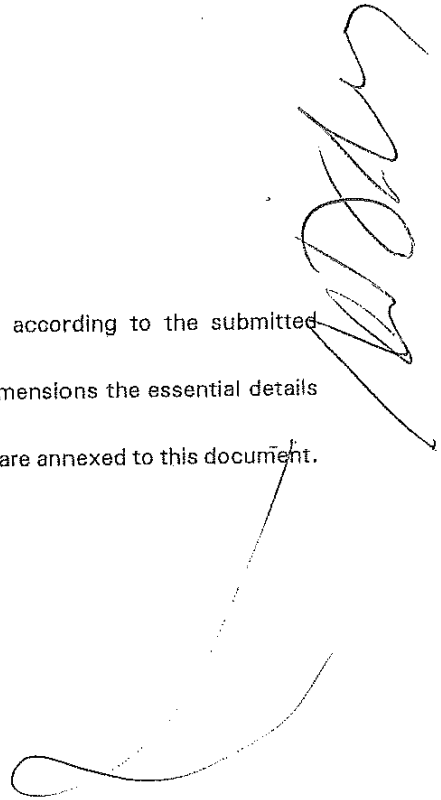
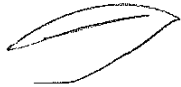
Mr. MARTINCIC - ETI  
Mr. KOVAC - ETI

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 A4/512340 no.1 and 2 are annexed to this document.



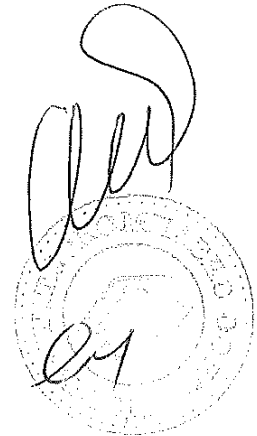
the data necessary to permit repetition of the tests are contained in the document marked:  
GPS-A3/043762

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

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

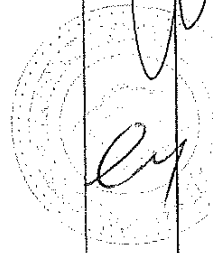
The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum values.

activity code: 38086V



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contents	page	test date
rated characteristics of the tested object assigned by the Client		
tests performed	4	
Breaking tests; test duty no.1 with 50,4 kA at 20,7 kV	5	December 19, 2003
Breaking tests; test duty no.2 with 6,42 kA at 20,7 kV	6	December 22, 2003
Breaking tests; test duty no.3 with 545 A at 24,0 kV	7	December 23, 2003
circuit-diagrams	8 - 9	
photo	10	
pages annexed		
Oscillograms (no.25)		
reference documents annexed		
Drawing of fuse-link		
Drawing of melting element		
Melting characteristic		
Cut-off characteristic		



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**CESI [EST]**  
Testing Services

GPS-A4/004269

**Test Report**

*92*

rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

fuse link

type

voltage

current

frequency

maximum breaking current

minimum breaking current (at 24 kV)

VV-THERMO

24 kV

100 A

50 Hz

50 kA

550 A

characteristics of the fuse link

class

maximum cut-off current

resistance

melting characteristic

cut-off characteristic

back-up

15 kA

15,0 mΩ ± 10 %

see annexed CESI ref.no.A4/512343-01

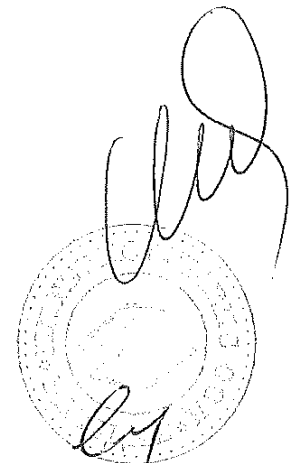
see annexed CESI ref.no.A4/512343-02

characteristics of the striker

type

operating mechanism

medium  
spring



**Breaking tests** test duty no.1 with 50,4 kA at 20,7 kV

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

prospective transient recovery voltage						
$U_c$ kV	$t_0$ $\mu$ s	$U_1$ kV	$t_1$ $\mu$ s	$U_c$ kV	$t_2$ $\mu$ s	$t_d$ $\mu$ s
42	88	-	-	-	-	-

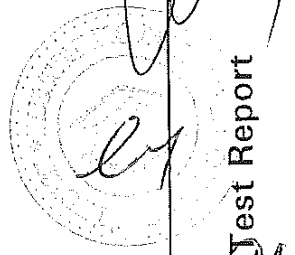
rated normal current of the fuse link: 100 A

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

date: December 19, 2003

test no.	fuse link		oscillogram no.	breaking current		$I^2t$		energy kJ	angle of		power frequency recovery voltage kV	maximum overvoltage kV	duration, of		striker operation yes/no
	number	resistance m $\Omega$		cut-off kA	at arc initiation kA	melting kA <sup>2</sup> s	total kA <sup>2</sup> s		making $^\circ$	initiation of the arc $^\circ$			pre-arc ms	arc ms	
1	1	12,7	2/3	13,0	31,5	131	551	59	-	10,6	49,3	5,8	15	yes	
2	2	12,7	3/3	13,7	31,5	143	559	76	-	10,6	50,1	5,1	15	yes	
3	3	12,6	4/3	13,6	31,3	123	491	75	-	10,6	52,5	5,2	15	yes	

conditions of the apparatus after the tests: no remarks.



Test Report



GPS-A4/004269

*[Handwritten Signature]*

**Breaking tests** test duty no.2 with 6,42 kA at 20,7 kV

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

prospective transient recovery voltage						
U <sub>c</sub> kV	t <sub>g</sub> μs	t <sub>d</sub> μs	U <sub>1</sub> kV	t <sub>1</sub> μs	U <sub>c</sub> kV	t <sub>d</sub> μs
45,4	277	-	-	-	-	-

rated normal current of the fuse link: 100 A

condition of the apparatus before the tests: new

date: December 22, 2003

test no.	fuse link		breaking current		i <sup>2</sup> t		energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	maximum overvoltage kV	duration of		striker operation yes/no
	number	resistance mΩ	cut-off kA	at arc initiation kA	melting KA <sup>2</sup> s	total KA <sup>2</sup> s		making °	recovery voltage °			pre-arc ms	arc ms	
4	12	13,2	7,15	6,63	40,2	135	735	8	-	20,7	55,8	6,6	15	yes
5	13	12,1	7,20	6,14	40,0	174	876	9	-	20,7	49,6	7,0	15	yes
6	14	12,2	7,32	6,16	39,4	204	872	11	-	20,7	45,5	7,4	15	yes

conditions of the apparatus after the tests: no remarks.

*[Handwritten signature]*

*[Handwritten signature]*

prospective current	
rms value kA	oscillogram no.
6,42	14/1





**Breaking tests** test duty no.3 with 545 A at 24,0 kV

test circuit: see D043 power factor: 0,48 frequency: 50 Hz

prospective current	
rms value A	oscillogram no.
545	25/1

rated normal current of the fuse link: 100 A

condition of the apparatus before the tests: new

date: December 23, 2003

test no.	fuse link		oscillogram no.	breaking current A	power frequency recovery voltage kV	maximum overvoltage kV	pre-arc s	duration of		striker operation yes/no
	number	resistance mΩ						arc ms	maintained voltage s	
7	15	12,8	26/2	545	24,0	-	6,85	17,7	60	yes
8	16	13,1	27/2	545	24,0	-	6,66	13,1	60	yes

conditions of the apparatus after the tests: no remarks.



*Handwritten signature*

96 Test Report



GPS-A4/004269

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 31, 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

first issue date **May 17, 2004**

prepared **PeC/TEST - P. BECCARINI**

verified **PeC/TEST - G. GHEZZI**

approved **PeC/TEST - M. de NIGRIS**

**CESI**  
CENTRO ELETTROTECNICO Sperimentale ITALIANO  
Business Unit  
Prove ai Componenti  
Il Responsabile del Laboratorio

CESI  
Centro Elettrotecnico  
Sperimentale Italiano  
Giulio Notta SpA

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20134 Milano - Italia  
Telefono +39 0221251  
Fax +39 0221255440  
www.cesi.it

Capitale sociale Lit 500.000 Euro  
Integramente versato  
Codice fiscale a numero  
Iscrizione C.C.I.A.A. 03793850150

Registro Imprese di Milano  
Sezione Ordinaria  
N. R.G.A. 429223  
P.I. IT00793850150

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tests witnessed by:

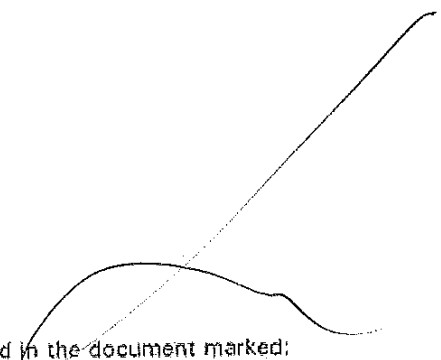
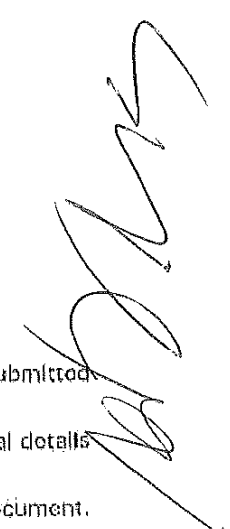
Mr. MARTINCIC - ETI  
Mr. KOVAC - ETI

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 A4/014229 no.1 and 2 are annexed to this document.



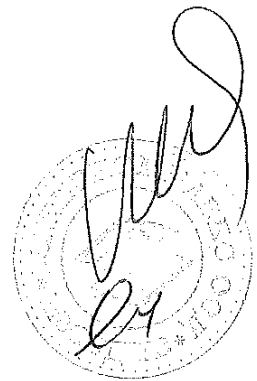
the data necessary to permit repetition of the tests are contained in the document marked:  
GPS-A3/036495

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

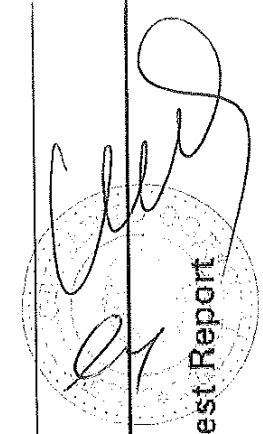


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contents	page	test date
rated characteristics of the tested object assigned by the Client		
tests performed	4	
Breaking tests; test duty no.1 with 50,1 kA at 20,8 kV on 50 A-fuse	5	October 29, 2003
Breaking tests; test duty no.1 with 50,1 kA at 20,8 kV on 80 A-fuse	6	October 29, 2003
Breaking tests; test duty no.2 with 2,83 kA at 20,9 kV on 50 A-fuse	7	October 29, 2003
Breaking tests; test duty no.3 with 225 A at 24,2 kV on 50 A-fuse	8	October 30, 2003
Breaking tests; test duty no.3 with 400 A at 24,0 kV on 80 A-fuse	9	October 31, 2003
Breaking tests; test duty no.2 with 4,52 kA at 20,9 kV on 80 A-fuse	10	October 31, 2003
circuit-diagrams	11 - 12	
photos	13 - 14	

- pages annexed
- Oscillograms (no.45)
- reference documents annexed
  - Drawings ETI
  - Melting characteristic
  - Cut-off characteristic

- CESI ref.no.A4/014229 (no.2 pages)
- CESI ref.no.A4/014369-1
- CESI ref.no.A4/014239-2



Test Report



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rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

ETI

fuse link

type

voltage

current



frequency

maximum breaking current

minimum breaking current (at 24 kV)

VV Thermo

24 kV

50 A

80 A

50 Hz

60 kA

(50) 225 A

(80) 400 A



characteristics of the fuse link

class

resistance

back-up

(50) 25 mΩ ± 10 %

(80) 16 mΩ ± 10 %

melting characteristic

cut-off characteristic

see annexed CESI ref.no.A4/014369-1

see annexed CESI ref.no.A4/014369-2

characteristics of the striker

type

operating mechanism

medium

spring



Breaking tests test duty no.1 with 50.1 kA at 20.9 kV

test circuit: see D042 power factor: <0.5 frequency: 50 Hz

prospective transient recovery voltage						
$U_c$ kV	$t_1$ $\mu s$	$U_1$ kV	$t_2$ $\mu s$	$U_2$ kV	$t_3$ $\mu s$	$t$ $\mu s$
42	50	-	-	-	-	-

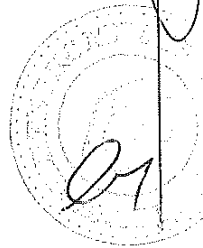
rated normal current of the high link: 50 A

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

date: October 29, 2003

test no	fuse link		opening time	breaking current		PI	energy	arcing		maximum overvoltage	duration of		arc time operation
	number	resistance		cut-off	at arc initiation			total	measuring		at arc initiation	at arc	
1	1	26.2	303	7.38	7.81	27.7	251	20.9	47.1	3.34	7.80	15	925
2	2	24.8	573	8.76	7.64	35.0	233	20.9	51.8	3.32	4.80	15	925
3	3	25.0	173	8.66	7.83	31.8	203	20.9	51.6	3.32	4.50	15	925

condition of the apparatus after the tests: no remarks.



Test Report

**CESTEST**  
ELECTRIC TEST SERVICES

GPS-A4/D1-4506

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prospective current	
rms value	oscillogram no.
50.1	2/1

Breaking tests test duty no.1 with 50,1 kA at 20.9 kV

test circuit see D042 power factor: <0.15 frequency: 50 Hz

prospective transient recovery voltage					
U <sub>1</sub> kV	I <sub>1</sub> kA	U <sub>2</sub> kV	I <sub>2</sub> kA	U <sub>3</sub> kV	I <sub>3</sub> kA
42	30				

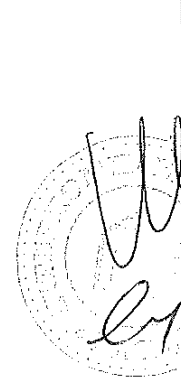
rated normal current of the test link: 50 A

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

date: October 20, 2003

test no.	test link number	resistance mΩ	oscillogram no.	breaking current at arc extinction kA	P1		energy kJ	number of arcs	amp. of the arc	wave frequency		recovery percentage	duration of arc ms	recovery voltage kV	striker operation
					max	min				max	min				
4	4	16,2	7/3	10,7	16,3	71,7	286	50	50,1	20,1	40,0	3,42	1,90	15	yes
5	5	16,6	8/3	11,3	17,7	85,9	306	72	70,5	52,4	52,4	3,45	1,80	15	yes
6	6	16,3	9/3	11,6	7,5	95,3	173	12	26,2	49,3	49,3	3,42	1,60	15	yes

conditions of the apparatus after the tests: no remarks.



Test Report

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CESIEST

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**Breaking tests** test duty no. 2 with 2,83 kA at 20,9 kV

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

prospective transient recovery voltage					
U <sub>1</sub> kV	t <sub>1</sub> μs	U <sub>1</sub> kV	t <sub>1</sub> μs	U <sub>2</sub> kV	t <sub>2</sub> μs
46	276	-	-	-	-

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prospective current	
rms value kA	oscillogram no.
2,83	1171

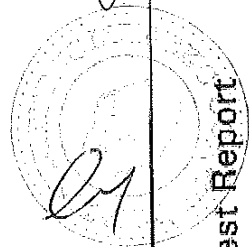
rated normal current of the fuse link: 50 A

condition of the apparatus before the tests: new

date: October 29, 2003

test no.	fuse link number	resistance mΩ	oscillogram no.	breaking current		i <sub>1</sub>		energy kJ	angle of making		recovery voltage kV	minimum overvoltage kV	duration of		striker operation pps/100	
				cut-off kA	at arcs initiation kA	making kA's	total kA's		initiation of the arc °	recovery voltage °			pre-arc ms	arc ms		recovery voltage V
1	1	24,7	12/3	3,22	2,97	8,20	35,1	277	11	-	20,3	49,7	3,60	6,80	60	yes
2	2	24,9	13/3	3,28	2,94	9,25	42,7	402	10	-	20,9	45,9	3,60	7,20	80	yes
3	3	24,9	14/3	3,24	2,94	8,10	35,7	375	11	-	20,3	50,6	3,60	6,80	60	yes

conditions of the apparatus after the tests: no remarks.



Test Report

**CESI TEST**

GPS-A4/014906



Breaking tests test duty no.3 with 225 A at 24.2 kV

test circuit: see 0043 power factor: 0.50 frequency: 50 Hz

prospective current	
rms value A	oscillogram no.
225	22/1

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		maximum overvoltage KV	PRG-arc %	duration of arc ms	maintained voltage %	striker operation yes
	number	resistance mΩ			recovery voltage KV	arc					
10	15	25.2	23/1	225	24.2	32.0	2	1.05	67.7	60	yes
11	16	25.1	24/1	225	24.2	44.0	2	0.80	77.5	60	yes

conditions of the apparatus after the tests: no remarks.

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Test Report

GPS-A4/0149D6

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**Breaking tests** test duty no.3 with 400 A at 24.0 kV

test circuit: see D0003 power factor: 0.54 frequency: 50 Hz

prospective current	
rms value A	oscillogram no.
400	29/1

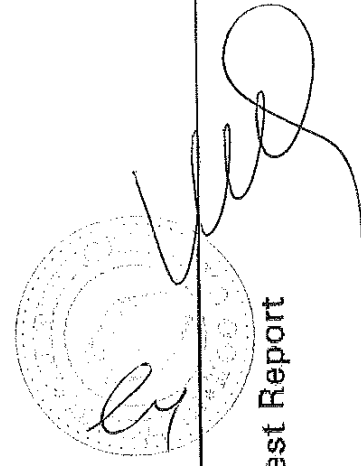
rated normal current of the fuse link: 50 A

condition of the apparatus before the tests: new

date: October 31, 2003

test no.	fuse link		resistance mΩ	oscillogram no.	breaking current A	power recovery		maximum overvoltage kV	duration of arc ms	indicated voltage kV	striker operation yes
	number	no.				recovery voltage kV	%				
12	19	19	17.3	30/1	400	24.0	0.24	33.5	65.3	60	yes
13	20	20	16.8	31/1	400	24.0	0.21	33.5	50.1	60	yes

conditions of the apparatus after the tests: no remarks.



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**Breaking tests**

test duty no. 2 with 4,52 kA at 20,9 kV

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

prospective transient recovery voltage:					
U <sub>1</sub>	t <sub>1</sub>	U <sub>2</sub>	t <sub>2</sub>	U <sub>3</sub>	t <sub>3</sub>
kV	μs	kV	μs	kV	μs
45	255	-	-	-	-

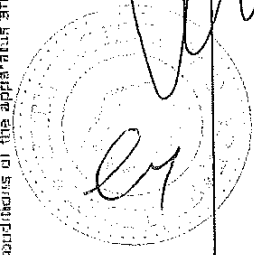
rated normal current of the fuse link: 80 A

condition of the apparatus before the tests: new

date: October 31, 2003

test no.	fuse link		breakup current at arc extinction	P <sub>t</sub>		angle of separation of the arc		power frequency recovery voltage	maximum overvoltage	duration of		striker operation
	number	resistance mΩ		melting	total	making	separation of the arc			pre-arc	arc	
	no.		kA	kA <sup>2</sup> s	kJ	°	°	kV	kV	ms	ms	yes/no
14	21	17,4	4,96	88,3	585	9	-	23,9	48,4	3,50	7,10	yes
15	22	17,0	4,85	74,6	534	9	-	20,9	31,0	3,50	6,60	yes
16	23	17,1	4,91	81,4	558	9	-	20,9	49,7	3,80	6,90	yes

conditions of the apparatus after the tests: no remarks.



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Test Report

GPS-A4/014906

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client ETI ELEKTROELEMENT d.d.  
Izlake - SLOVENIJA

equipment under test Back-up current limiting fuses

tests performed Breaking tests

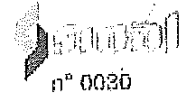
normative documents IEC 60282-1 (1998)

receipt date of the sample July 7, 2003

test date: from July 10, 2003 to September 16, 2003

no. of pages 14 no. of pages annexed 47

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



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:

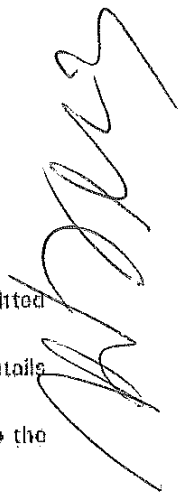
Mr. MARTINCIC - ETI  
Mr. KOVAC - ETI

identification of the object: Effected.

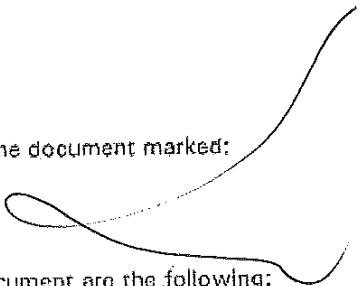
The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.

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 A4/014228 no.1 and 2 have been returned to the Client.



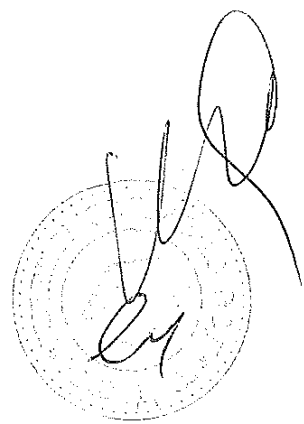
the data necessary to permit repetition of the tests are contained in the document marked:  
GPS-A3/024943



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	4	
tests performed		
Breaking tests: test duty no.1 with 52,0 kA at 21,0 kV on 10 A-fuse	5	July 10, 2003
Breaking tests: test duty no.1 with 52,0 kA at 21,0 kV on 40 A-fuse	5	July 10, 2003
Breaking tests: test duty no.2 with 2,10 kA at 21,0 kV on 40 A-fuse	7	July 10, 2003
Breaking tests: test duty no.2 with 0,50 kA at 21,0 kV on 10 A-fuse	8	July 10, 2003
Breaking tests: test duty no.3 with 46,0 A at 24,0 kV on 10 A-fuse	9	September 16, 2003
Breaking tests: test duty no.3 with 178 A at 24,0 kV on 40 A-fuse	10	September 16, 2003
circuit-diagrams	11 to 13	
photo	14	
pages annexed		
Oscillograms (no.47)		
reference documents annexed		
Drawings ETI		
Melting characteristic		
Cut-off characteristic		



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ESTABLISHED 1968

Test Report

GPS-A31033272

p.3

rated characteristics of the tested object assigned by the Client

current limiting fuse

manufacturer

fuse link

type

voltage

current

frequency

maximum breaking current

minimum breaking current (at 24 kV)

VV thermo

24 kV

10 40 A

50 Hz

50 kA

(10) 50 A

(40) 200 A

characteristics of the fuse link

class

resistance

back-up

(10) 160 mΩ ± 10 %

(40) 37,5 mΩ ± 10 %

melting characteristic

cut-off characteristic

see annexed CEST ref.no.A4/O14270/1

see annexed CEST ref.no.A4/O14270-2

characteristics of the striker

type

operating mechanism

medium  
spring



110

Breaking tests test duty no. 1 with 52,0 kA at 21,0 kV

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

prospective transient recovery voltage						
U <sub>r</sub> kV	t <sub>1</sub> μs	U <sub>1</sub> kV	t <sub>2</sub> μs	U <sub>2</sub> kV	t <sub>3</sub> μs	t <sub>4</sub> μs
41,5	83	-	-	-	-	-

rated normal current of the fuse link: 10 A

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

date: July 10, 2003

test no.	fuse link		oscillogram	breaking current		I <sub>2</sub> total	energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	duration of		arc ms	recovery voltage kV	arc ms	station operation yes/no
	number	resistance mΩ		cut-off kA	of arc initiation kA			making	ms		ms	ms				
1	1	160,6	3/3	2,52	188	2,55	80,7	-	25	21,0	30,1	0,10	3,5	15	5	yes
2	2	100,1	4/3	2,07	169	1,78	45,5	-	74	21,0	47,9	0,10	4,1	15	5	yes
3	3	159,5	5/3	3,02	182	2,72	62,9	-	74	21,0	46,1	0,09	4,7	15	5	yes

conditions of the apparatus after the tests: no remarks.



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Test Report



GPS-A31033272

AAA



**Breaking tests** test duty no.1 with 52,0 kA at 21,0 kV

test circuit: see 00042 power factor: <0.15 frequency: 50 Hz

prospective transient recovery voltage					
U <sub>c</sub> kV	t <sub>1</sub> μs	U <sub>1</sub> kV	t <sub>2</sub> μs	U <sub>2</sub> kV	t <sub>3</sub> μs
41.5	53	-	6	-	-

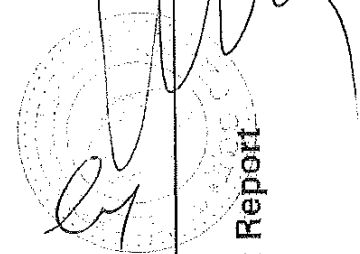
rated normal current of the test block: 40 A

condition of the apparatus before the tests: new

date: July 10, 2003

test no.	fuse link number	resistance mΩ	oscillogram no.	breaking current		I <sup>2</sup> t		energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	maximum average voltage kV	duration of		arlier operation
				out-off kA	at arc extinction kA	melting kA <sup>2</sup> s	total kA <sup>2</sup> s		pre-arc ms	arc ms			recovery voltage s		
4	40,0	6/3	6/3	5,14	12,1	2,09	157,3	47	47	21,0	4,5	0,26	6,4	15	yes
5	40,7	7/3	7/3	5,90	12,3	2,16	130,3	77	77	21,0	5,2	0,20	4,7	15	yes
6	40,7	8/3	8/3	6,34	12,3	2,12	140,3	76	76	21,0	50,9	0,21	4,8	15	yes

conditions of the apparatus after the tests: no remarks.



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**Test Report**



GFS-A3/033272

**Breaking tests** test duty no.2 with 2,10 kA at 21,0 kV

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

prospective transient recovery voltage					
U <sub>c</sub> kV	t <sub>2</sub> μs	U <sub>1</sub> kV	t <sub>1</sub> μs	U <sub>2</sub> kV	t <sub>2</sub> μs
4,5	275				

rated normal current of the fuse link: 40 A

condition of the apparatus before the tests: new

date: July 10, 2003

test no.	fuse link		oscillogram no.	breaking current		F <sub>1</sub>	energy	marking	range of indication at the APC	power frequency recovery voltage kV	maximum overvoltage kV	duration of		softener operation
	number	resistance mΩ		cut-off kA	at arc initiation kA							pre-arc μs	recovery voltage μs	
7	7	40,7	1073	2,03	1,87	16,7	250,5	1	-	21,0	47,0	3,70	7,40	Yes
8	3	40,3	1173	2,01	1,89	15,1	241,0	7	-	21,0	48,5	3,40	7,20	Yes
9	5	40,7	1273	2,03	1,89	16,9	251,5	5	-	21,0	45,6	3,40	7,40	Yes

condition of the apparatus after the tests: no remarks.



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Test Report

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**Breaking tests** test duty no.2 with 0,50 kA at 21,0 kV

test circuit: see D04Z power factor: <0,15 frequency: 50 Hz

prospective transient recovery voltage						
U <sub>2</sub> kV	I <sub>2</sub> pA	t <sub>1</sub> μs	U <sub>1</sub> kV	t <sub>1</sub> μs	U <sub>2</sub> kV	t <sub>2</sub> μs
44	310	-	-	-	-	-

rated normal current of the fuse links: 10 A

condition of the apparatus before the tests: new

date: July 10, 2003

test no.	fuse link		oscillation no.	breaking current		energy kJ	angle of initiation of the arc		power frequency recovery voltage kV	maximum overvoltage kV	duration of		striker operation
	number	resistance mΩ		out-off kA	all arc initiation kA		making	μ			μs	ms	
10	10	160,6	1473	0,608	0,500	76,6	-	5	21,0	38,7	3,50	7,60	yes
11	11	160,7	1673	0,608	0,500	77,7	-	6	21,0	36,8	3,70	7,70	yes
12	12	160,7	1673	0,636	0,500	81,9	-	5	21,0	33,1	3,70	7,30	yes

conditions of the apparatus after the tests: no remarks.

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**Test Report**



GPS-A31033272

114

Breaking tests

[redacted] 46.0 A and [redacted]

test circuit: see 2043 power factor 0.50 frequency: 50 Hz

PROSPECTIVE CURRENT	
rms value	oscillogram no.
4	

rated normal current of the fuse in [redacted]

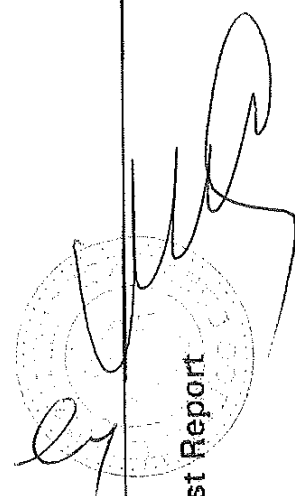
condition of the apparatus before the test: new

date: September 15, 2003

test no.	fuse link number	resistance mΩ	oscillogram	breaking current A	power frequency necessary voltage		maximum overvoltage	duration of		sticker operations
					kV	ms		dec	microseconds	
13	15	159.5	2172	46.0	25.0	[redacted]	170	50	YES	
14	16	159	2172	46.0	25.0	[redacted]	120	50	YES	

condition of the apparatus after the tests: no remarks.

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Test Report

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Special Testing Services Inc.

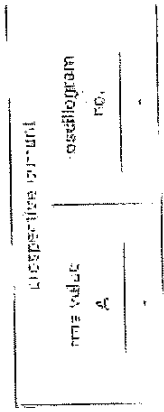
GPS-A3/033272

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Breaking tests test duty no. 3: with 181 A at 24,0 kV

test circuit: see D043 cover factor: 0,50 frequency: 50 Hz



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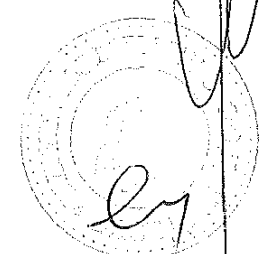
rated normal current of the bus link: 40 A

condition of the apparatus before the tests: new

date: September 16, 2003

test no.	test number	bus link		oscillogram no.	breaking current	power frequency voltage at bus	induced over-voltage	pre-arc time	duration of arc	indicated voltage	actual insulation
		resistance	inductance								
15	17	40,0	40,0	2785	181	24,0	42,0	0,8	1,0	50	208
16	18	39,9	39,9	2872	181	24,0	42,0	0,8	0,8	50	208

condition of the apparatus after the tests: no remarks.



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