



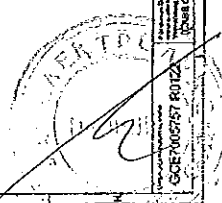
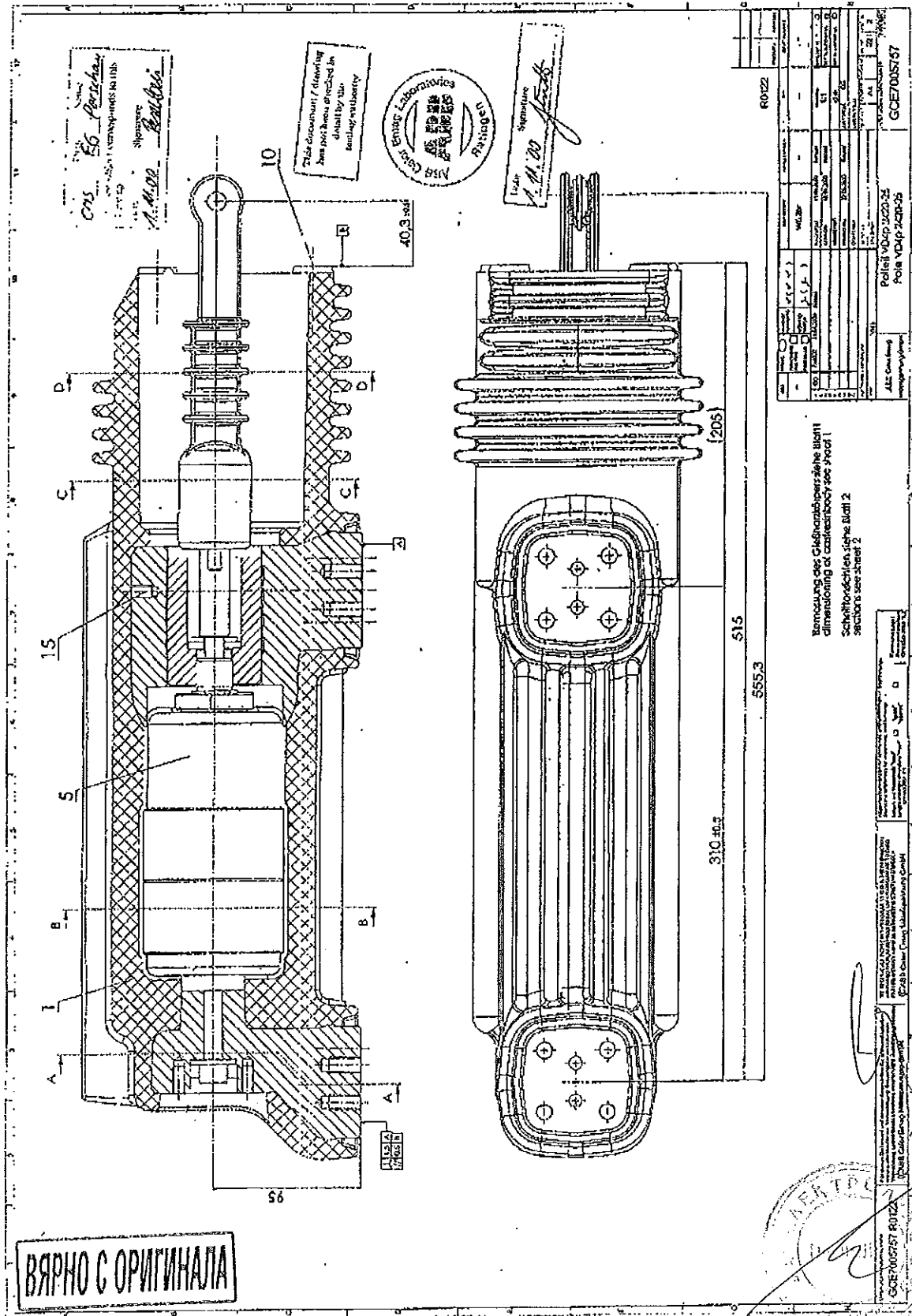
Reg.-Nr.
DAT-P-032/93

ABB Calor Emag Laboratories

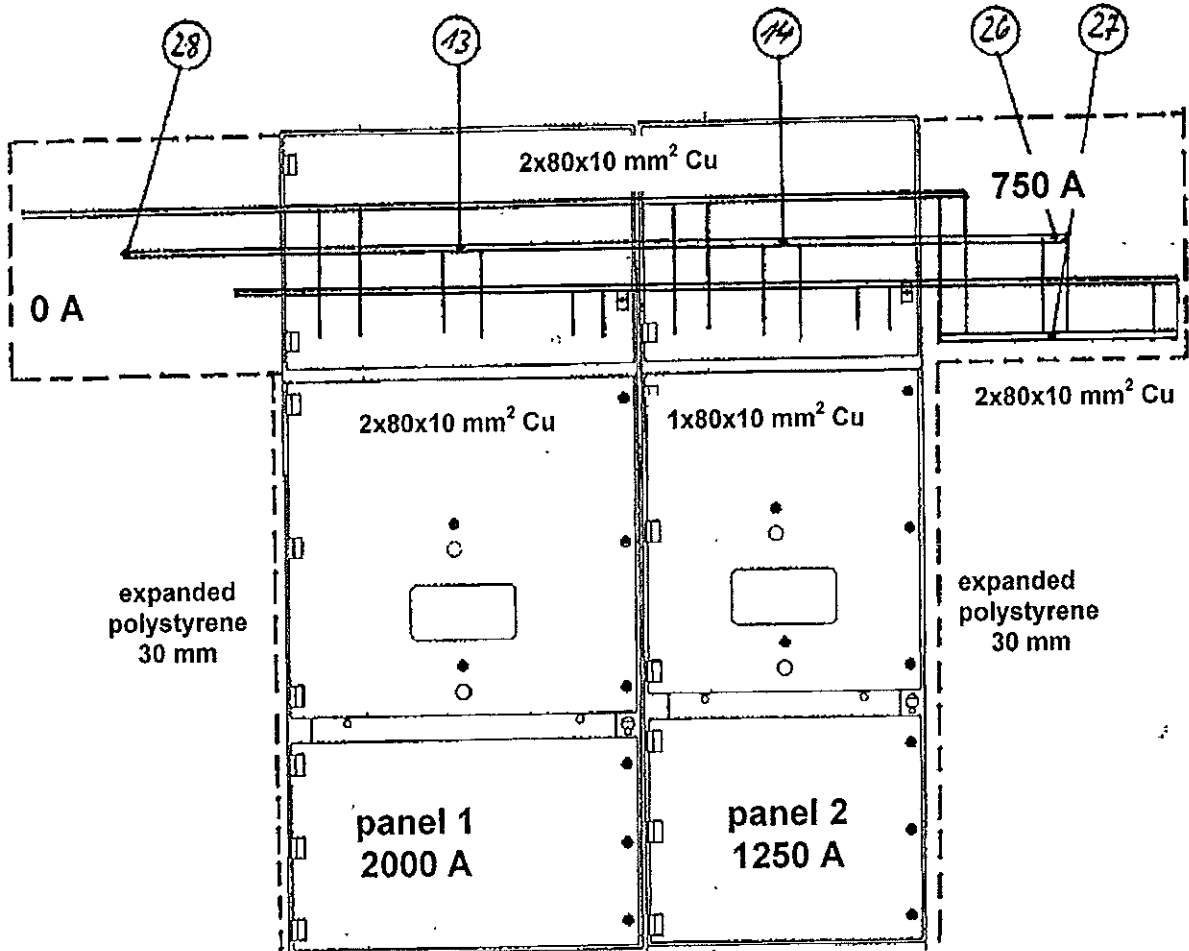
TEST REPORT No. HZ 236 E 06
Issued by an Accredited Laboratory
corresponding to EN 45001



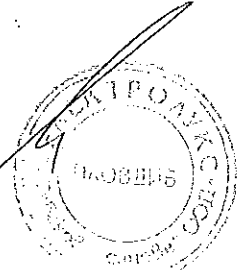
Sheet 12



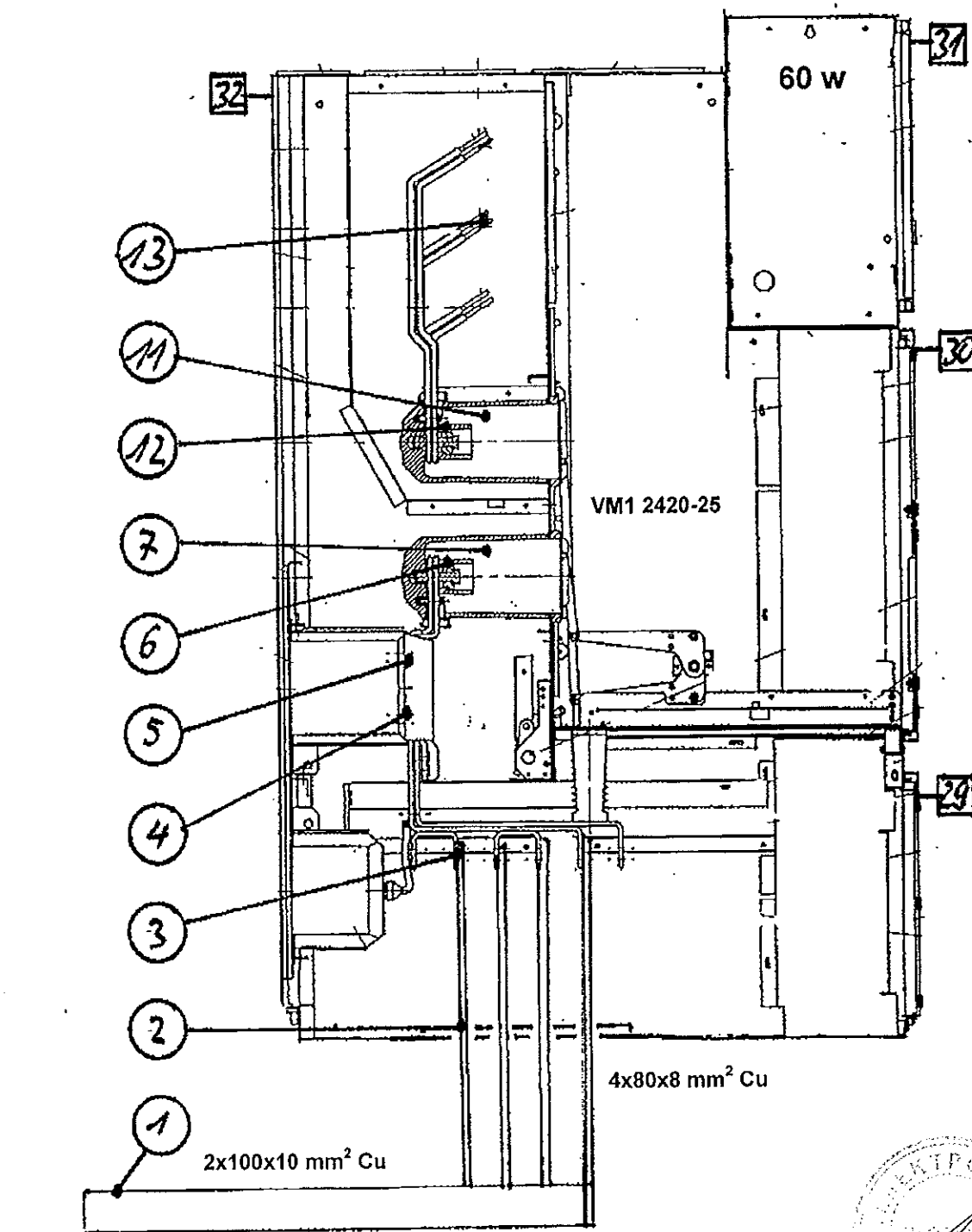
Test Arrangement and Measurement Points for Temperatures and Resistances on the Busbars



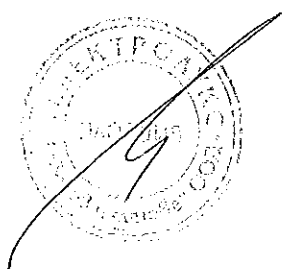
ВЯРНО С ОРИГИНАЛА



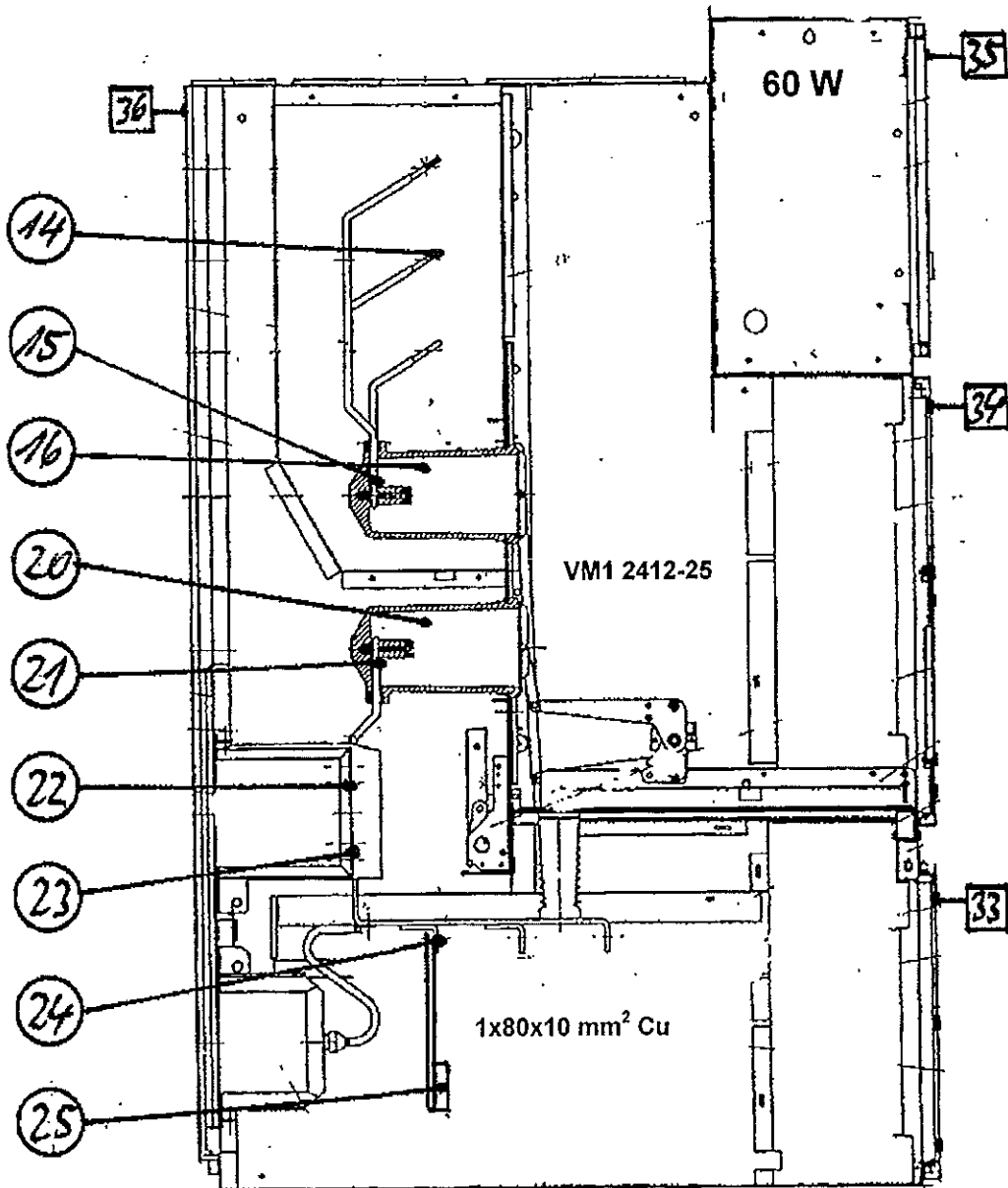
Measurement Points for Temperatures and Resistances of Panel 1



ВЯРНО С ОРИГИНАЛА



Measurement Points for Temperatures and Resistances of Panel 2



ВЯРНО С ОРИГИНАЛА





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DAT-P-032/93

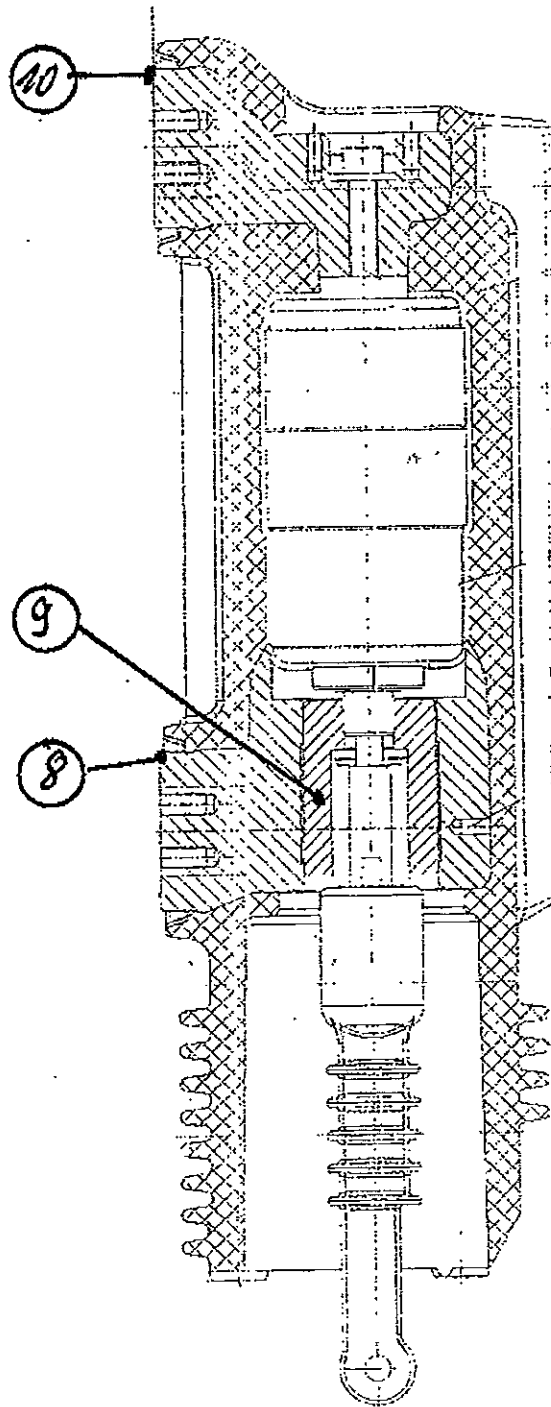
ABB Calor Emag Laboratories



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Sheet 17

Measurement Points for Temperatures of Circuit-Breaker Poles Panel 1



ВЯРНО С ОРИГИНАЛА





Deutscher
Akkreditierungs
Rat

Reg.-Nr.

DAT-P-032/93

**ABB Calor Emag
Laboratories**

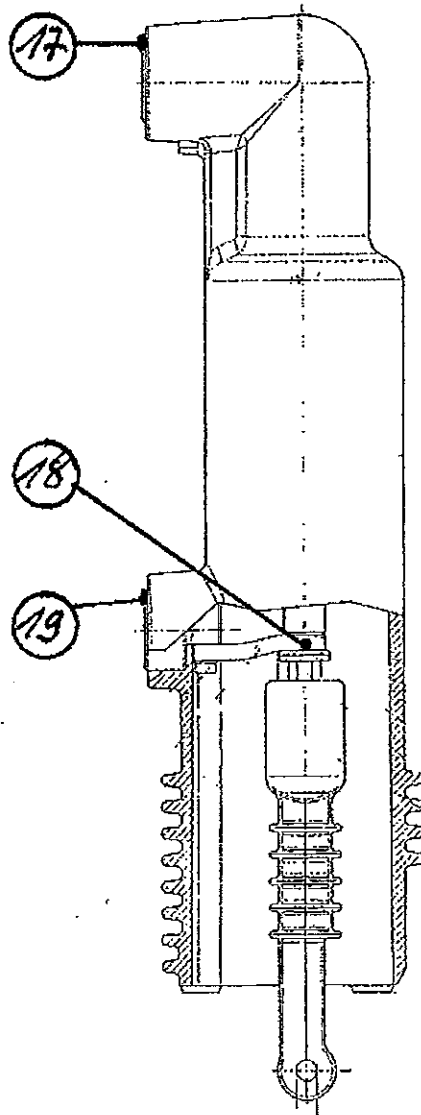


TEST REPORT No. HZ 236 E 06

Sheet 18

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corresponding to EN 45001

Measurement Points for Temperatures of Circuit-Breaker Poles Panel 2



ВЯРНО С ОРИГИНАЛА





Reg.-Nr.
DAT-P-032/93

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TEST REPORT No. HZ 236 E 06
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corresponding to EN 45001

Sheet 19

Measurement of the Resistance of the Main Circuit

Date of test: 11th November 2000 - before temperature rise test
12th November 2000 - after temperature rise test

Condition of test object before test: factory new panels

Ambient air temperature: before temperature rise test 22 °C
after temperature rise test 24 °C

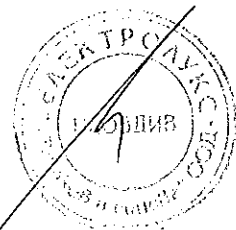
Measurement between points (see sheet 14 - 16)	Resistance of the main circuit $\mu\Omega$		
	L1 before/after ¹⁾	L2 before/after ¹⁾	L3 before/after ¹⁾
2 - 14 (panel 1)	56.3 / 56.4	53.5 / 53.6	51.6 / 51.5
13 - 25 (panel 2)	95.0 / 94.4	90.4 / 89.1	83.3 / 81.9

Remarks: ¹⁾ Before: before temperature rise test
After: after temperature rise test

Resistance measurement at direct current of: 50 A

The measurement of the resistances are carried out by using the thermocouples at the named measurement points.

ВЯРНО С ОРИГИНАЛА





Reg.-Nr.
DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. HZ 236 E 06

Sheet 20

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Temperature Rise Test

Date of test: 11th and 12th November 2000

Condition of test object before test: factory new panels

Connections to test object: feeder:
two bars 100x10 mm² Cu, length about 2 m outside the panel and four bars 80x8 mm² Cu, length about 0.8 m outside and inside the panel

neutral points:

- busbar outside feeder panel 2 with two bars 80x10 mm² Cu
- extended cable connection bars of panel 2 with one bar 80x10 mm² Cu

Duration of test: 9 h

Ambient air temperature: 26.1 °C

Test current: see sheet 14

Test frequency: 50 Hz

Distribution of the currents of the panels:

panel or busbar	current in A			
	phase L1	phase L2	phase L3	average value
panel 1, incoming 2000 A	2002	2004	2013	2006
busbar panel 1 - 2	2002	2004	2013	2006
panel 2, outgoing 1250 A	1251	1250	1252	1251

Remarks:

- The distribution of the currents at the busbar connections of the feeder panel 2 was done by using of iron cores over the extended busbars.
- The side walls of the panels and the extended busbars were covered by expanded polystyrene sheets of 30 mm thickness.
- The temperatures were measured by thermocouples type T. For the measurement points of the main circuit the thermocouples were inserted into holes and fixed. The measurement system determines the average value of the ambient temperatures, calculates the differences to the temperatures of all measuring points and records the temperature rises directly.

ВЯРНО С ОРИГИНАЛА





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DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. HZ 236 E 06
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Sheet 21

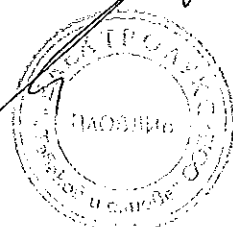
Permitted Temperature Rise of the Main Circuit according IEC 60694 table 3

Kind of measuring point	Maximum value temperature rise at ambient air temperature not exceeding 40 °C	Measuring point (see sheet 14 to 18)
cable terminal	50	3, 24
Connection, bolted, Cu silver coated in air	75	13, 14, 18, 26, 27, 28
Connection, bolted, Cu silver coated in air in contact with insulation material class A	65	8, 10, 17, 19
Connection, bolted, Cu silver coated in air in contact with insulation material class E	75	4, 5, 22, 23
Contact, Cu silver-coated in air	65	6, 7, 9, 11, 12, 15, 16, 20, 21

Continuation from sheet 20

Measuring point (see sheets 15 and 16)	Panel	Description of measuring point	Kind of measuring point	Final temperature rise K	Permitted temperature rise K
29	1	Front door top cable compartment	Access. part expected to be touched in normal operation	4.7	30
30	1	Front door top c.b. compartment	Access. part expected to be touched in normal operation	5.0	30
31	1	Front door top low voltage compartment	Access. part expected to be touched in normal operation	7.6	30
32	1	Rear wall top	Accessible part which need not to be touched in normal op.	14.4	40
33	2	Front door top cable compartment	Access. part expected to be touched in normal operation	3.8	30
34	2	Front door top c.b. compartment	Access. part expected to be touched in normal operation	6.3	30
35	2	Front door top low voltage compartment	Access. part expected to be touched in normal operation	8.1	30
36	2	Rear wall top	Accessible part which need not to be touched in normal op.	11.0	40

ВЕРНО С ОРИГИНАЛА





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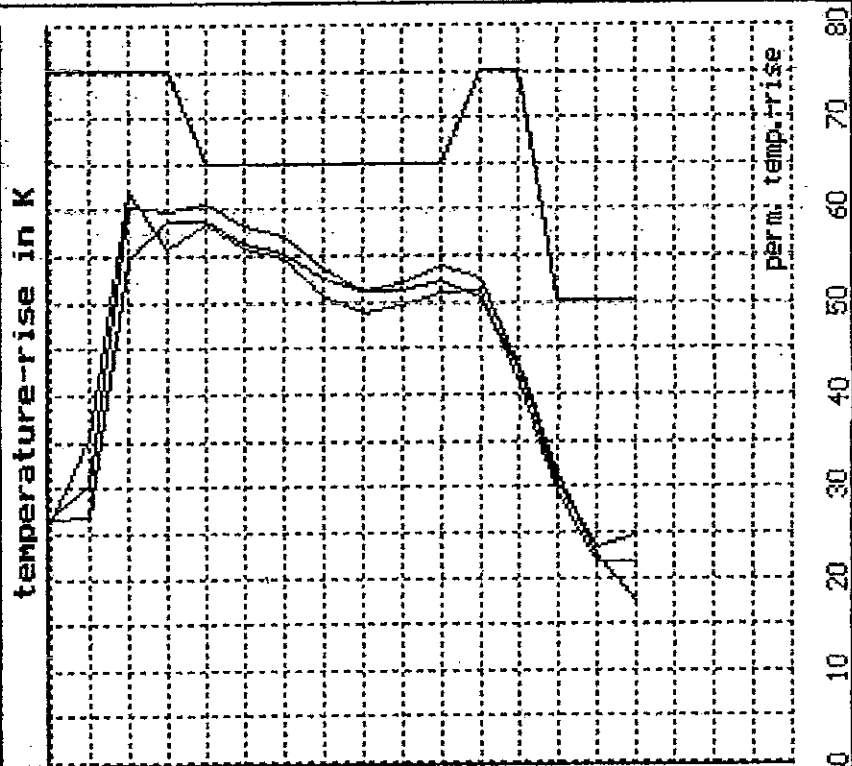
Sheet 22

Temperature rises and Permitted Temperature rises of the Incoming Panel 1 and the Busbar – right side

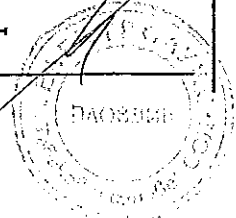
ABB Calor Emag Laboratory Test report HZ236E06 12.11.2000
Temperature-rise of switchgear ZS1.2 - 24 kV with UM1 2420-25 with UG4-S

Test current : 2006 A
Ambient temperature : 26.1 °C

Measuring points No. Name	Temperature-rise Δt / K		
	P1	P2	P3
27 neutral point busbar	26.3	26.9	26.6
26 end of busbar panel 2	35.5	30.2	26.8
14 busbar/jumper bar panel 2	61.8	60.4	54.6
13 jumper bar/busbar panel 1	55.7	59.7	58.7
12 upper disconn. contact pan	58.4	60.6	58.8
11 upper disconn. cont. c.b.	55.7	58.3	56.3
10 upper pole terminal	54.8	57.2	55.1
9 sliding contact stem side	50.7	53.5	52.6
8 lower pole terminal	48.9	51.2	51.3
7 lower disconn. cont. c.b.	49.7	52.0	51.2
6 lower disconn. contact pan	51.0	53.9	52.2
5 upper c.t. terminal	51.2	52.6	50.3
4 lower c.t. terminal	40.9	43.0	42.5
3 cable terminal	29.6	31.4	30.2
2 cable bar inside panel 1	21.8	22.6	23.3
1 feeder bar 1 m before 2	21.6	17.3	24.7



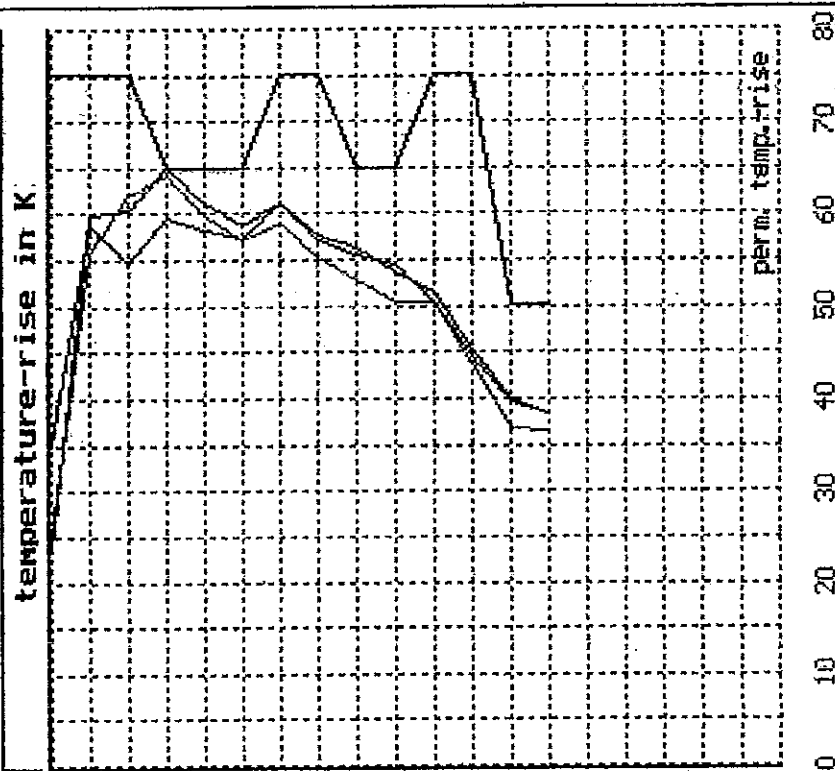
ВРАНО С ОПИТНАТА



**Temperature rises and Permitted Temperature rises of the Feeder Panel 2
and the Busbar – left side**

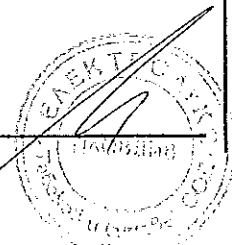
ABB Calor Emag Laboratory Test report HZ236E06 **12.11.2000**
Temperature-rise of switchgear ZS1.2 - 24 kV with UM1 2406-25 with UG4-S.

Test current : 1251 A
Ambient temperature : 26.1 °C



Measuring points No. Name	Temperature rise 48 / K		
	P1	P2	P3
28 end of busbar panel 1	24.9	23.3	34.9
13 busbar/jumper bar panel 1	55.7	59.7	58.7
14 busbar/jumper bar panel 2	61.9	60.4	54.6
15 upper disconn. contact pan	64.1	64.9	59.6
16 upper disconn. cont. c.b.	59.8	61.2	58.1
17 upper pole terminal	57.0	58.7	57.3
18 current lead interr. stem	59.0	61.1	61.2
19 lower pole terminal	55.2	57.7	57.1
20 lower disconn. cont. c.b.	52.9	56.3	55.5
21 lower disconn. contact pan	50.4	53.5	54.4
22 upper c.t. terminal	50.3	51.6	50.4
23 lower c.t. terminal	43.7	45.4	44.5
24 cable terminal	36.7	40.0	39.7
25 neutral point cable term.	36.5	38.3	38.3

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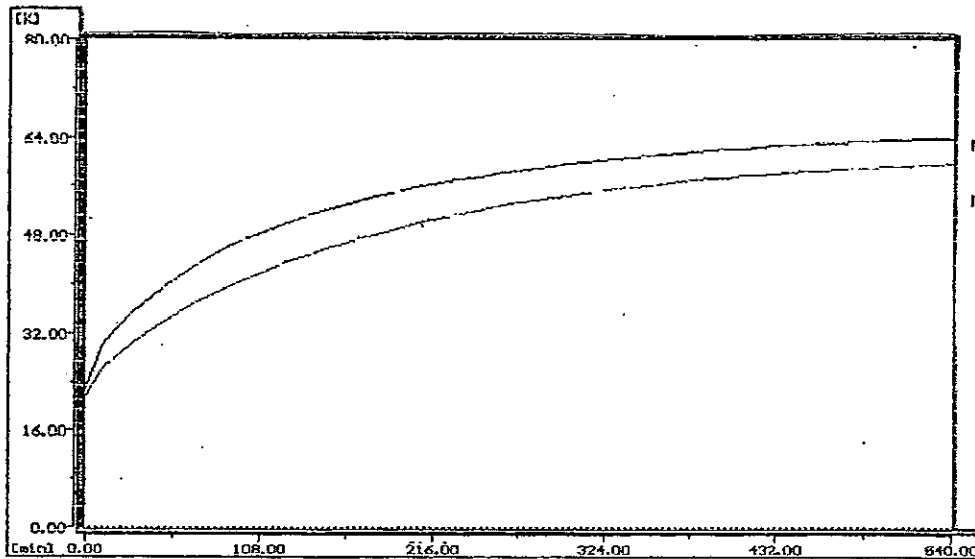


TEST REPORT No. HZ 236 E 06

Sheet 24

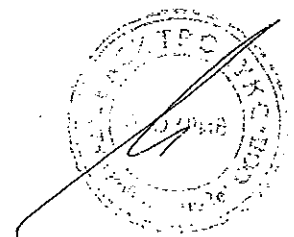
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Temperature rise of upper Disconnecting Contacts Panel Side - Phase L2



panel 2
measurement point 15
panel 1
measurement point 12

ВЯРНО С ОРИГИНАЛА



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 0511Ra

Copy No.: 1

Contents: 72 Sheets

Test object: Vacuum circuit-breaker type VD4/P 24.06.20 p275 in metal-enclosed air-insulated switchgear type UniGear ZS1, 1000 mm width

Designation: VD4/P 24.06.20 p275 in UniGear ZS1 (1000 mm width)

Rated voltage: 24 kV Rated normal current: 630 A Rated frequency: 50 / 60 Hz
Rated short-circuit breaking current: 20 kA

Manufacturer: ABB P.T. S.p.A.

Client: ABB P.T. S.p.A.

Testing station: PEHLA-Testing Laboratory Ratingen

Date of test: 10th February, 09th and 10th March 2005

Applied test specifications:

The tests have been carried out in full compliance with the below mentioned standards.

Test procedure and test parameters were strictly according to:

IEC 62271-200 / 1st Ed. / 2003-11, Clauses 6.6 and 6.101

IEC 60694 / Ed. 2.2 / 2002-01, Clause 6.6

IEC 62271-100 / Ed. 1.1 / 2003-05, Clause 6.106

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

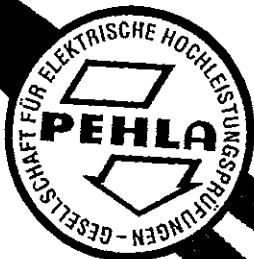
Three-phase short-time withstand current and peak withstand current test of the main circuit.

Three-phase making and breaking capacity test based on 20.0 kA at 24 kV comprising the basic test duties T10, T30, T60, T100s and T100a (dc-component of 35 %).

No-load operations and measurement of the resistance of the main circuit before and after the tests.
Power frequency withstand voltage test at 50.0 kV – 1 min before and after the tests as a condition check.

Test results:

The above mentioned vacuum circuit-breaker in metal-enclosed air-insulated switchgear passed the short-time withstand current and peak withstand current test and the three-phase making and breaking capacity test successfully.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

[Signature]
Management Committee

[Signature]
Technical Committee

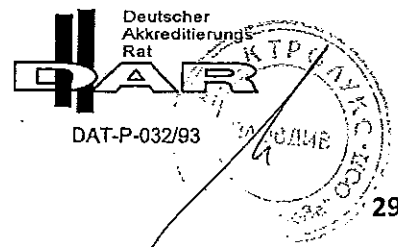
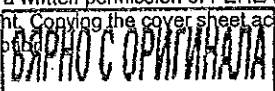
Mannheim, 20th July 2005

The test results relate only to the items tested.

The authenticity of this document is guaranteed by the integrity of the seal label and seal ribbon.

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03PE0402



Notes

Accreditation

The PEHLA-Testing Laboratory Ratingen has been approved by the DATech (German accreditation body for technology) according to EN ISO/IEC 17025 for tests in the field of high-voltage switchgear and controlgear and power engineering equipment (Registration-No. DAT-P032/93).

STL-Member

PEHLA is founder member of the SHORT-CIRCUIT TESTING LIAISON (STL) which has been established in March 1969. STL is a forum for the international cooperation of the testing organisations with the further full members ASTA (UK), CESI (IT), ESEF (FR), KEMA (NL), SATS (NO; SE, FI), STLNA (US, CA) and JSTC (JP). In the framework of EC, STL (EU) has been recognised in 1992 by EOTC as agreement group.

PEHLA-Documents

A Type Test Certificate

is issued for type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

A Test Document

is issued for parts of type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

A Test Report

is issued for all other tests which have been carried out according to specifications, standards or "PEHLA-Richtlinien" (PEHLA Guides) and/or clients' instructions. Similarly, this test report contains all test results, details of the conditions under which the tests were carried out, also details relating to the behaviour of the test object, and its condition after the tests.

A Test Confirmation

is issued immediately after the tests. It confirms that the tests have been conducted and is valid only until publishing the detailed results in an entire document.

Uncertainty of the measurement systems

The PEHLA - Testing Laboratories apply the PEHLA Guide No. 12 for determining the uncertainties of measurement, based on ENV 13005 (Guide to the expression of uncertainty in measurement). As long as no explicit statements are made, the uncertainties required by the relevant standards have been complied with.

Addresses

Office: PEHLA-Geschäftsstelle
Hallenweg 40
68219 Mannheim
Germany
Internet: www.pehla.com

Testing Station: PEHLA-Testing Laboratory Ratingen
Oberhausener Str. 33
40472 Ratingen
Germany

Manufacturer: ABB P.T. S.p.A.
Via Friuli, 4
24044 Dalmine (BG)
Italy

Client: ABB P.T. S.p.A.
Via Friuli, 4
24044 Dalmine (BG)
Italy

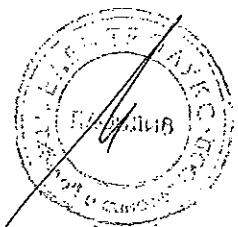
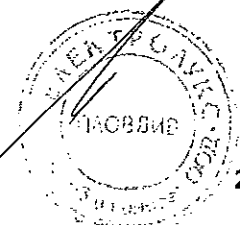


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ВЯРНО С ОРИГИНАЛА



List of Test Participants

Representatives of Technical Committee:

Mr. Klaus Niemeyer	PEHLA-Testing Laboratory Berlin-Siemensstadt, Germany
Mr. Joachim Oemisch	PEHLA-Testing Laboratory Berlin-Siemensstadt, Germany
Dr. Thomas Ebke	PEHLA-Testing Laboratory Ratingen, Germany

Test Engineer / Test Operator:

Mr. Joachim Köhler	PEHLA-Testing Laboratory Ratingen, Germany
Dr. Thomas Ebke	PEHLA-Testing Laboratory Ratingen, Germany

Representatives of Client:

Mr. Stefano Magoni	ABB P.T. S.p.A., Dalmine, Italy
--------------------	---------------------------------

Further Participants:

Mr. Frank Idaszek	PEHLA-Testing Laboratory Ratingen, Germany
-------------------	--

ВЯРНО С ОРИГИНАЛА



**Technical Data of Test Object
Switchgear**

Test object: Metal-enclosed air-insulated switchgear.
Designation: UniGear ZS1
Manufacturer: ABB P.T. S.p.A., Via Friuli, 4, 24044 Dalmine (BG), Italy
Serial No.: -
Year of manufacture: 2004
Drawing No.: See sheet 7

Ratings assigned by the manufacturer:

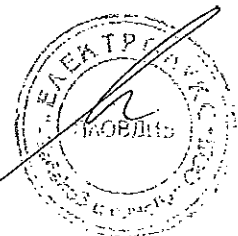
Rated voltage	24 kV
Rated normal current	630 A
Rated frequency	50/60 Hz
Rated lightning impulse withstand voltage	125 kV
Rated switching impulse withstand voltage	- kV
Rated power-frequency withstand voltage	50 kV
Rated peak withstand current	63/65 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Insulating medium	-
Rated filling pressure for insulation	- MPa abs. at 20 °C
Minimum functional pressure for insulation	- MPa abs. at 20 °C

Permissible values for internal arc faults:

Peak current	63/65 kA
Short-circuit current	25 kA
Duration of short-circuit	1 s

Further data: -**Essential characteristics and installed devices: -**

ВЯРНО С ОРИГИНАЛА



**Technical Data of Test Object
Circuit-Breaker**

Test object: Vacuum circuit-breaker
Designation: VD4/P 24.06.20
Manufacturer: ABB P.T. S.p.A., Via Friuli, 4, 24044 Dalmine (BG), Italy
Serial No.: 1VC1AE00038562
Year of manufacture: 2004
Serial No. of drive: -
Drawing No.: See sheet 7

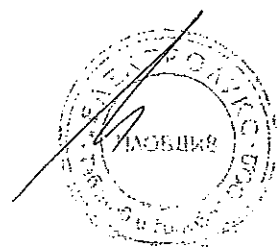
Ratings assigned by the manufacturer:

Rated voltage	24 kV
Rated normal current	630 A
Rated frequency	50/60 Hz
Rated lightning impulse withstand voltage	125 kV
Rated switching impulse withstand voltage	- kV
Rated power-frequency withstand voltage	50 kV
Rated peak withstand current	50/52 kA
Rated short-time withstand current	20 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	20 kA
DC component of the rated short-circuit breaking current	35 %
Rated short-circuit making current	50/52 kA
Rated transient recovery voltage	41 kV
Rate of rise of transient recovery voltage	0.47 kV/μs
First-pole-to-clear factor	1.5
Rated operating sequence	O - 0.3 s - CO - 15 s - CO
Arc extinguishing medium	vacuum
Rated filling pressure for operation	- MPa abs. at 20 °C
Minimum functional pressure for operation	- MPa abs. at 20 °C
Insulating medium	-
Rated filling pressure for insulation	- MPa abs. at 20 °C
Minimum functional pressure for insulation	- MPa abs. at 20 °C
Driving mechanism (type)	spring charged by motor
Number of poles	3
Number of units per pole	1
Rated opening time	30 - 60 ms
Rated closing time	50 - 80 ms
Rated supply voltage of opening device	110 V d.c.
Rated supply voltage of closing device	110 V d.c.
Rated supply voltage of auxiliary circuits	110 V d.c.
Rated frequency of supply voltage	- Hz

Further data:

Type and Serial No. of Poles: P4 with VG4, L1: EP00013111, L2: EP00013094, L3: EP00013073

Essential characteristics: -



List of Identified Drawings

The manufacturer has submitted to the testing laboratory drawings and other data containing sufficient information to unambiguously identify by type the essential details and parts of the test object presented for test.

The drawings have been stamped and signed by the manufacturer in order to guarantee that the drawings or data schedules truly represent the test object to be tested.

Further these drawings have been stamped and signed by PEHLA representatives and are kept

at the client.

with the test documents at the test laboratory.

The testing laboratory has checked that drawings and data schedules adequately represent the essential details and parts of the test object to be tested, but is not responsible for the accuracy of the detailed information.

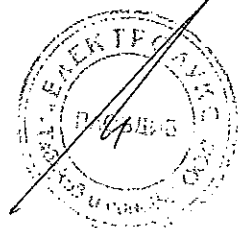
The drawing(s) contained in this document are identical with the checked, stamped and signed drawings.

Drawing No.	Rev.	P/D *)	Title	Additional remarks
GCE8010459 R0103	01	D	Abzweigfeld 24kV, TLG.1000 Feeder panel 24kV, PW.1000	Included in the Test Report
TN 7414	--	D	Interruttore in Vuoto Tipo Vacuum Circuit Breaker Type VD4/P 24kV 630-1250A	Included in the Test Report
GCE8012502 R0103	01	D	MONTAGEPLATTE H=310, KONTAKT 35 Mounting plate H=310, contact 35	-
GCE8685778 P0121	03	D	Kontaktstift	-
N 510509 Gr. 810	--	P	Tabella Materiali N 510509	-
510509 Gr. 810	--	D	Completamento Interruttore C.B. Completion	-
N 1VCR003288 G0015	--	P	Tabella Materiali N 1VCR003288G	-
1VCR003288 G0015	--	D	Struttura con poli Frame with Poles	-
N 1VCR003324 G0015	--	P	Tabella Materiali N 1VCR003324G	-
1VCR003324 G0015	--	D	Interruttore Base Base Breaker	-
N 1VCR003321 G0003	--	P	Tabella Materiali N 1VCR003321G	-
1VCR003321 G0003	--	D	Commando con Albero Operating Mechanism with Shaft	-
N 510508 Gr. 802	--	P	Tabella Materiali N 510508	-
510508 Gr. 802	--	D	Montaggio Passanti e Tulipani Bushing and Tulip Mounting	-
GCE7004730 R0104	11	D	Pol, vst. 24kV 1250A Pole complet 24kV 1250A	-

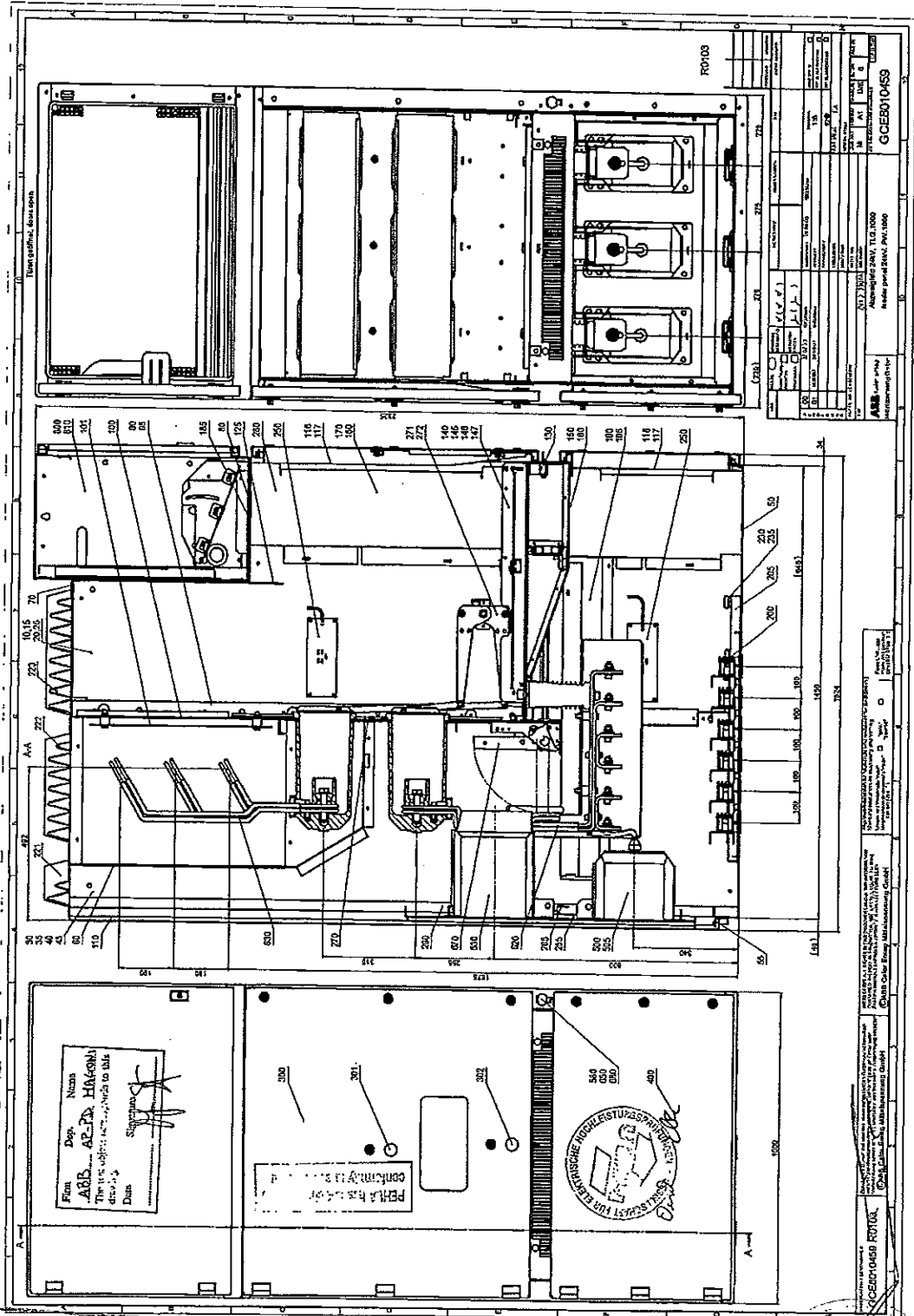
*) P: Parts list, D: Drawing

Remarks: -

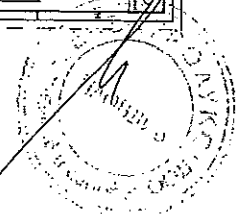
ВЕРНО С ОРИГИНАЛА



**Drawing
GCE8010459R0103**



ВЯРНО С ОРГИНАЛА

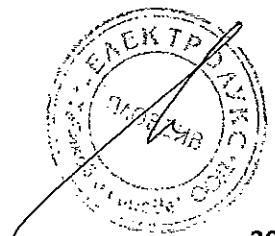


Technical Data of Test Circuits
Short-Time Withstand Current and Peak Withstand Current Tests

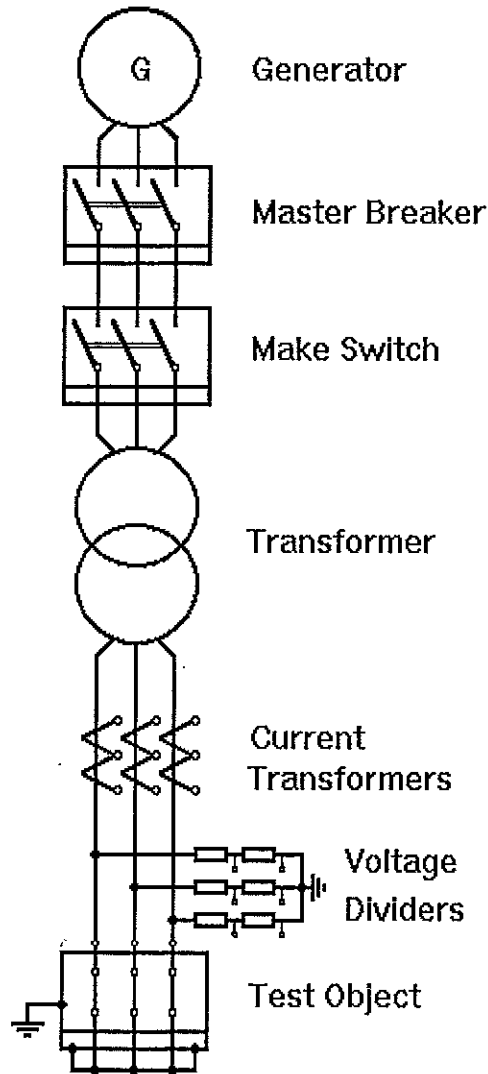
Test performed	STC	-	-	-
Test No. PEHLA 0511Ra	03 - 04	-	-	-
Circuit diagram	Sheet No. 11	-	-	-
Current circuit	-	-	-	-
Number of phases	3	-	-	-
Power frequency	Hz 50	-	-	-
Power factor	< 0.15	-	-	-
Earthing conditions	-	-	-	-
Generator / System	earthed via 5 kΩ	-	-	-
Transformer	not earthed	-	-	-
Short-circuit point	earthed	-	-	-
Test object	earthed	-	-	-
Test object (test values)	-	-	-	-
Number of phases	3	-	-	-
Measurement	-	-	-	-
Voltage measurement	Dividers 80 kΩ / 1.1 kΩ	-	-	-
Current measurement	Transf. 50 kA / 5 A	-	-	-

Remarks: -

ВЯРНО С ОРИГИНАЛА



Circuit Diagram
Test Circuit for Three-Phase Tests
Peak Withstand Current and Short-Time Withstand Current Tests



ВЯРНО С ОРИГИНАЛА
PE0402



**Technical Data of Test Circuit
Short-Circuit Direct Test**

Test performed		T30	T60	T100	T10				
Test No. PEHLA 0511Ra		07-08	09-12	13-28	29-30				
Circuit diagram (test circuit) see sheet		13	13	13	13				
Test object									
Rated voltage	kV	24	24	24	24				
Rated frequency	Hz	50	50	50	50				
Short-circuit breaking current	kA	6.00	12.0	20.0	2.00				
Units under test		-	-	-	-				
Voltage distribution	%	-	-	-	-				
Number of phases (test circuit)		3	3	3	3				
Power factor (test circuit)		≤ 0.15	≤ 0.15	≤ 0.15	≤ 0.15				
Frequency (test circuit)	Hz	50	50	50	50				
Earthing conditions									
Generator		earthed via 5 kΩ	earthed via 5 kΩ	earthed via 5 kΩ	earthed via 5 kΩ				
Transformer		not earthed	not earthed	not earthed	not earthed				
Short-circuit point		earthed	earthed	earthed	earthed				
Prospective transient recovery voltage		Required values	Tested values	Required values	Tested values	Required values	Tested values	Required values	Tested values
Evaluation of oscillogram	No.	-	prosp.	-	prosp.	-	prosp.	-	prosp.
Crest value u_c	kV	44.0	44.5	44.0	44.0	41.0	41.0	44.0	47.0
Time t_3	μs	19	38 ¹⁾	38	38	87	80	19	66 ¹⁾
Time delay t_d	μs	-	-	-	-	-	-	-	-
Rate of rise u_1/t_1 or u_c/t_3	kV/μs	2.32	1.17	1.16	1.16	0.47	0.51	2.32	0.71
u_1	kV	-	-	-	-	-	-	-	-
t_1	μs	-	-	-	-	-	-	-	-

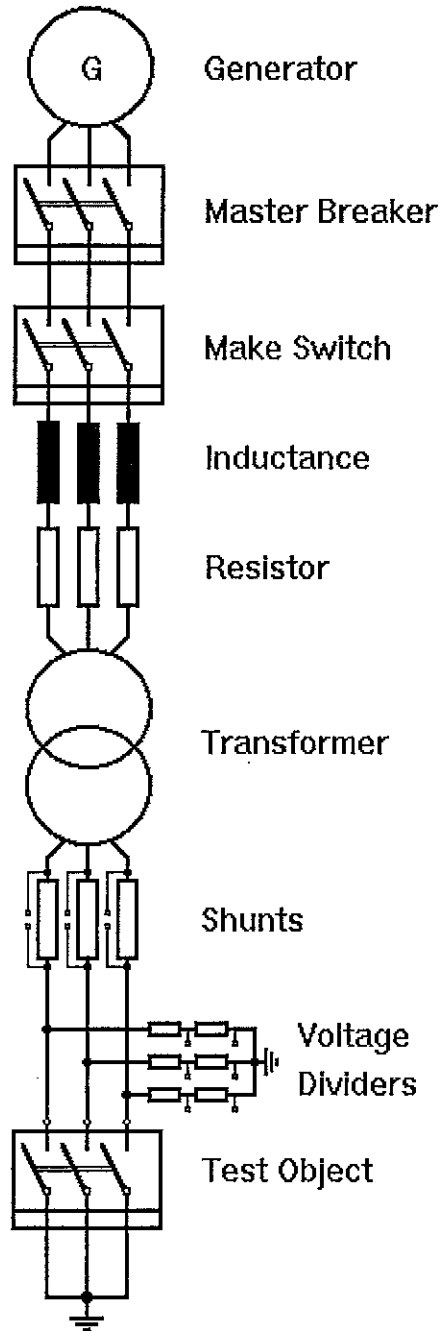
Remarks: ¹⁾ Due to limitations of the test plant the time coordinate t_3 is higher than the required values.

ВЯРНО С ОРИГИНАЛА

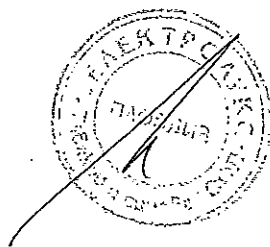
12PE0402



Circuit Diagram
Test Circuit for Three-Phase Tests
Basic Short-Circuit Making and Breaking Tests



ВЯРНО С ОРИГИНАЛА



Test Results

Three-phase short-time withstand current and peak withstand current tests

Test performed: Three-Phase Peak and Short-Time Withstand Current Tests, 52 kA / 20 kA – 3s
Date of test: 10th February 2005
Condition of test object before test: Factory new.
Test arrangement: Direct test circuit, circuit-breaker in air-insulated switchgear
Connections to test object: Infeed via copper bars to the busbar connection of the switchgear, short-circuited via copper bar at the cable terminals, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			03	04	-	-	-	-	
Short-circuit current - peak	L1	kA	52.3	36.6	-	-	-	-	
	L2	kA	40.6	29.8	-	-	-	-	
	L3	kA	46.1	37.1	-	-	-	-	
Short-circuit current - rms	First cycle	L1	kA	22.0	20.4	-	-	-	-
		L2	kA	22.7	19.9	-	-	-	-
		L3	kA	22.5	21.4	-	-	-	-
	Last cycle	L1	kA	21.0	21.1	-	-	-	-
		L2	kA	22.0	22.2	-	-	-	-
		L3	kA	21.4	21.5	-	-	-	-
	Equivalent current	L1	kA	21.0	20.6	-	-	-	-
		L2	kA	22.1	21.6	-	-	-	-
		L3	kA	21.4	21.0	-	-	-	-
Average value	kA	21.5	21.0	-	-	-	-		
Duration of short circuit	s	0.317	3.02	-	-	-	-		
Short-time current	L1	kA	-	20.6	-	-	-	-	
	L2	kA	-	21.7	-	-	-	-	
	L3	kA	-	21.0	-	-	-	-	
	Average value	kA	-	21.1	-	-	-	-	
	Duration	s	-	3.00	-	-	-	-	
Emission of flame/gas/oil		no	no	-	-	-	-		
Test result (P/N)		P	P	-	-	-	-		

Resistance of the main circuit

Before test	L1	μΩ	26.5	-	-	-	-	-
	L2	μΩ	28.4	-	-	-	-	-
	L3	μΩ	26.9	-	-	-	-	-
After test	L1	μΩ	-	26.2	-	-	-	-
	L2	μΩ	-	27.1	-	-	-	-
	L3	μΩ	-	26.2	-	-	-	-

Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

Remarks: PEHLA 0511Ra / 01: Current calibration

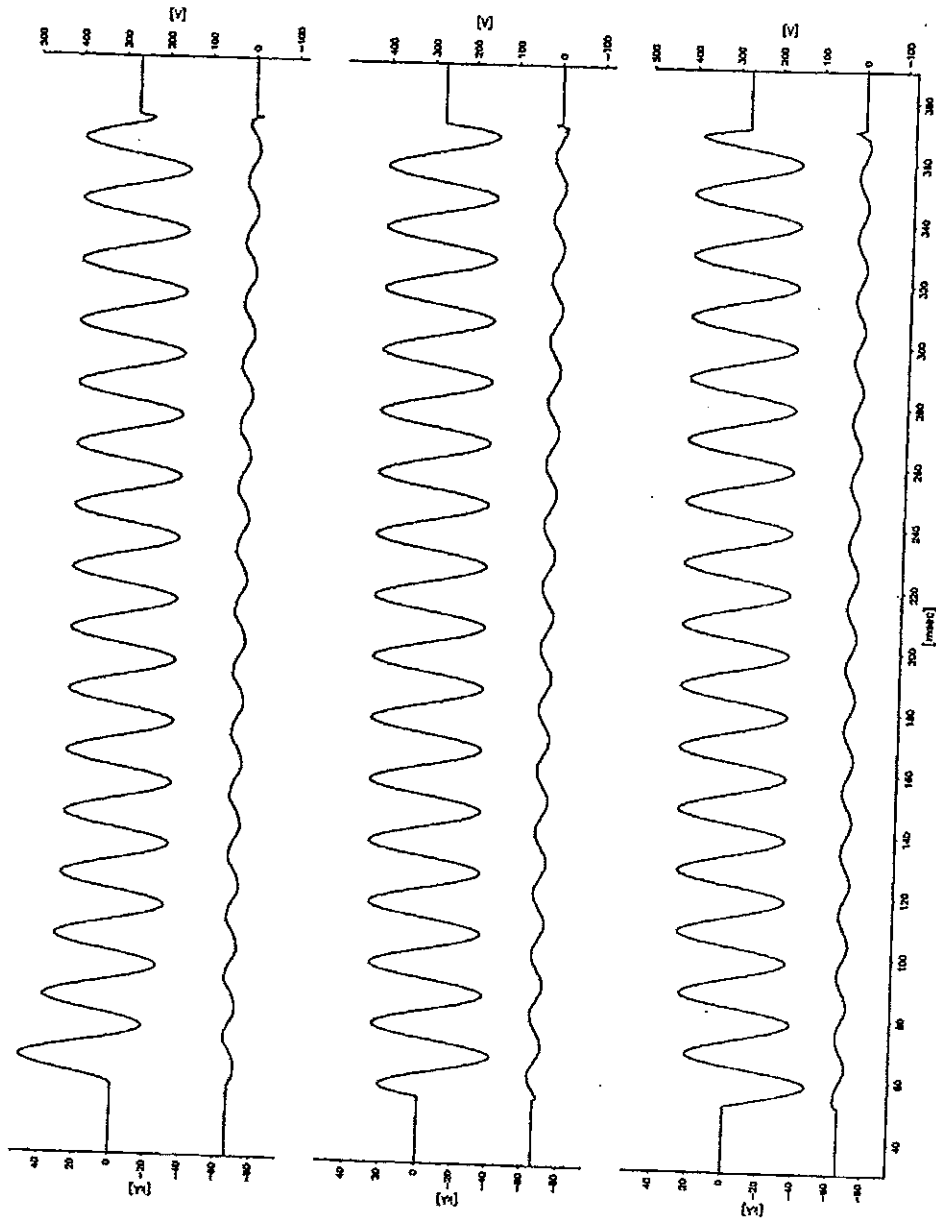
PEHLA 0511Ra / 02: No-load operation

Condition of test object after test: Vacuum circuit-breaker type VD4/P 24.06.20 p275 in metal-enclosed air-insulated switchgear type UniGear ZS1, 1000 mm width without visible or functional change or damage. It opened by its own mechanism energized at rated auxiliary voltage at the first attempt.

ВЯРНО С ОПРИГНАЛА

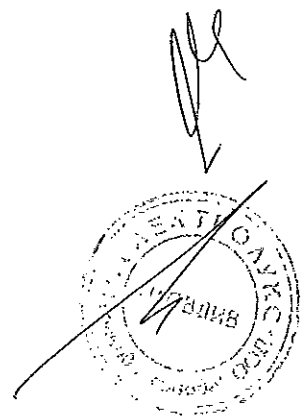


Oscillogram
PEHLA 0511Ra / 03

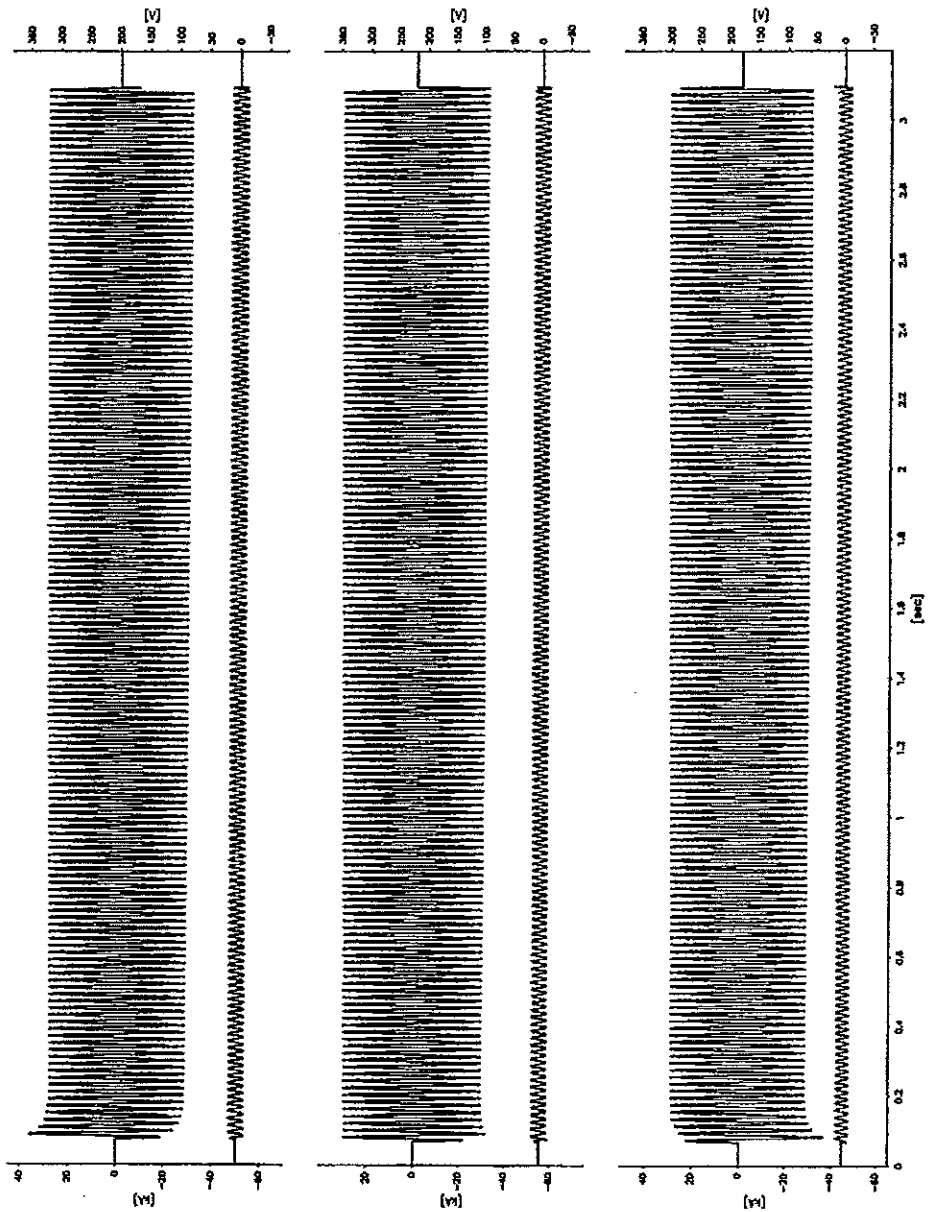


ВЯРНО С ОРИГИНАЛА

18PE0402

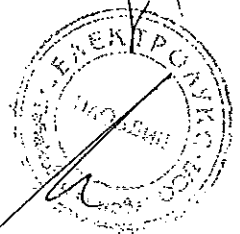


Oscillogram
PEHLA 0511Ra / 04



ВЯРНО С ОРИГИНАЛА

18PE0402



Test Results
Basic Short-Circuit Making and Breaking Tests

Test performed: Basic short-circuit making and breaking tests (T30)
Date of test: 09th March 2005
Condition of test object before test: As after PEHLA 0511Ra / 04.
Test arrangement: Direct test circuit, circuit-breaker in gas insulated switchgear
Connections to test object: Infeed via copper bars to the busbar connection of the switchgear, short-circuited via copper bar at the cable terminals, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			07	08	-	-	-		
Operating sequence and time intervals			O-0.3s-CO-15s-CO			-	-	-	
Applied voltage	kV		-	24.5	24.2	-	-	-	
Making current (peak)	L1	kA	-	10.4	11.2	-	-	-	
	L2	kA	-	15.1	15.5	-	-	-	
	L3	kA	-	14.9	13.2	-	-	-	
Breaking current (r.m.s.)	L1	kA	6.58	6.67	6.58	-	-	-	
	L2	kA	6.68	6.77	6.81	-	-	-	
	L3	kA	6.54	6.73	6.66	-	-	-	
	Average value	kA	6.60	6.72	6.69	-	-	-	
Recovery voltage (r.m.s)	L1	kV	13.8	14.2	14.0	-	-	-	
	L2	kV	14.1	14.2	14.0	-	-	-	
	L3	kV	14.1	14.4	14.3	-	-	-	
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-	
	Time t_1	μ s	-	-	-	-	-	-	
	TRV peak value u_c	kV	44.5	43.0	44.5	-	-	-	
	Time t_3	μ s	-	-	-	-	-	-	
	Time delay t_d	μ s	-	-	-	-	-	-	
	Rate of rise u_o/t_3	kV/ μ s	-	-	-	-	-	-	
C-Operation	Voltage of closing device	V	-	94	94	-	-	-	
	Closing time	ms	-	63.4	62.6	-	-	-	
	Pre-arcing time	ms	-	-	-	-	-	-	
	Make time	ms	-	63.4	62.6	-	-	-	
O-Operation	Voltage of opening device	V	77	77	77	-	-	-	
	Opening time	ms	59.8	60.7	59.0	-	-	-	
	Arcing time	L1	ms	4.6	8.2	8.2	-	-	-
		L2	ms	9.6	7.8	3.0	-	-	-
		L3	ms	9.4	2.8	8.2	-	-	-
	Break time	ms	69.4	68.9	67.2	-	-	-	
Emission of flame/gas/oil, occurrence of NSDD			no	no	no	-	-	-	
Number of valid test			-	-	-	-	-	-	
Test result			P	P	P	-	-	-	

Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

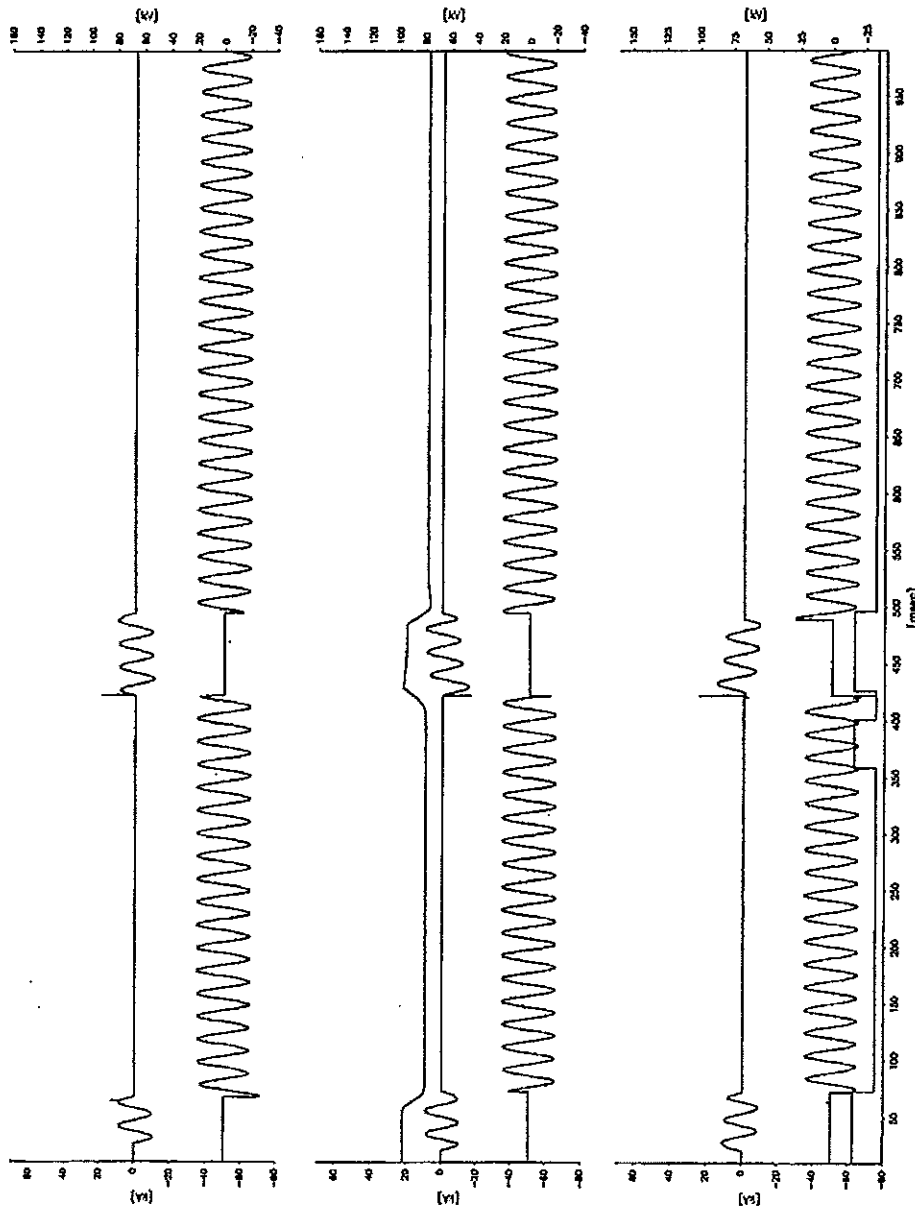
Remarks: PEHLA 0511Ra / 05 and 06: No-load operations

Condition of test object after test: Switchgear and circuit-breaker were not inspected.

ВЯРНО С ОПРИГИНАЛА

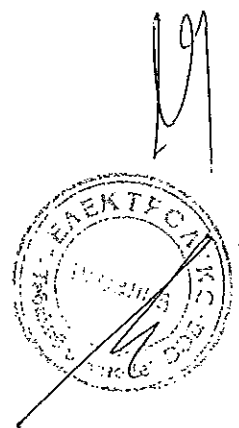


Oscillogram
PEHLA 0511Ra / 07

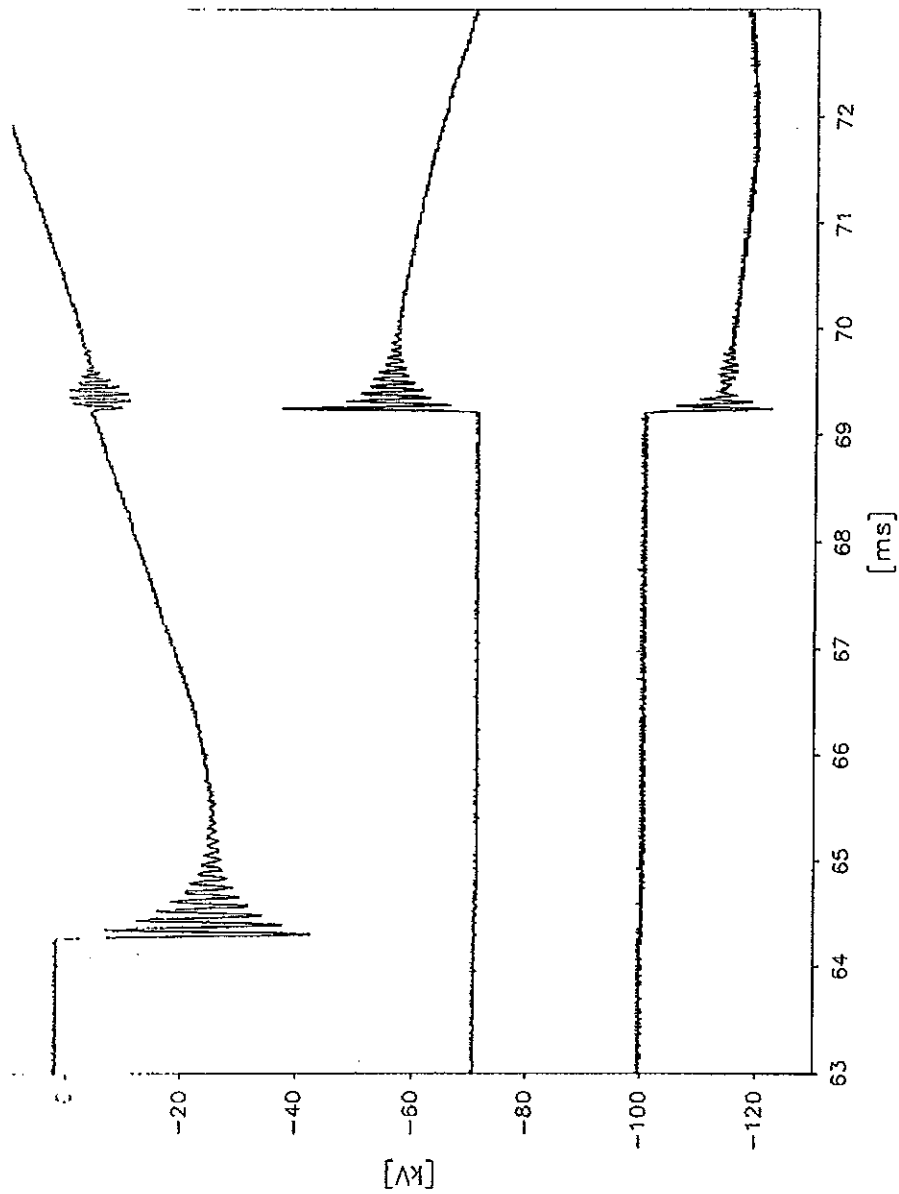


ВЯРНО С ОРИГИНАЛА

18PE0402



Oscillogram
PEHLA 0511Ra / 07

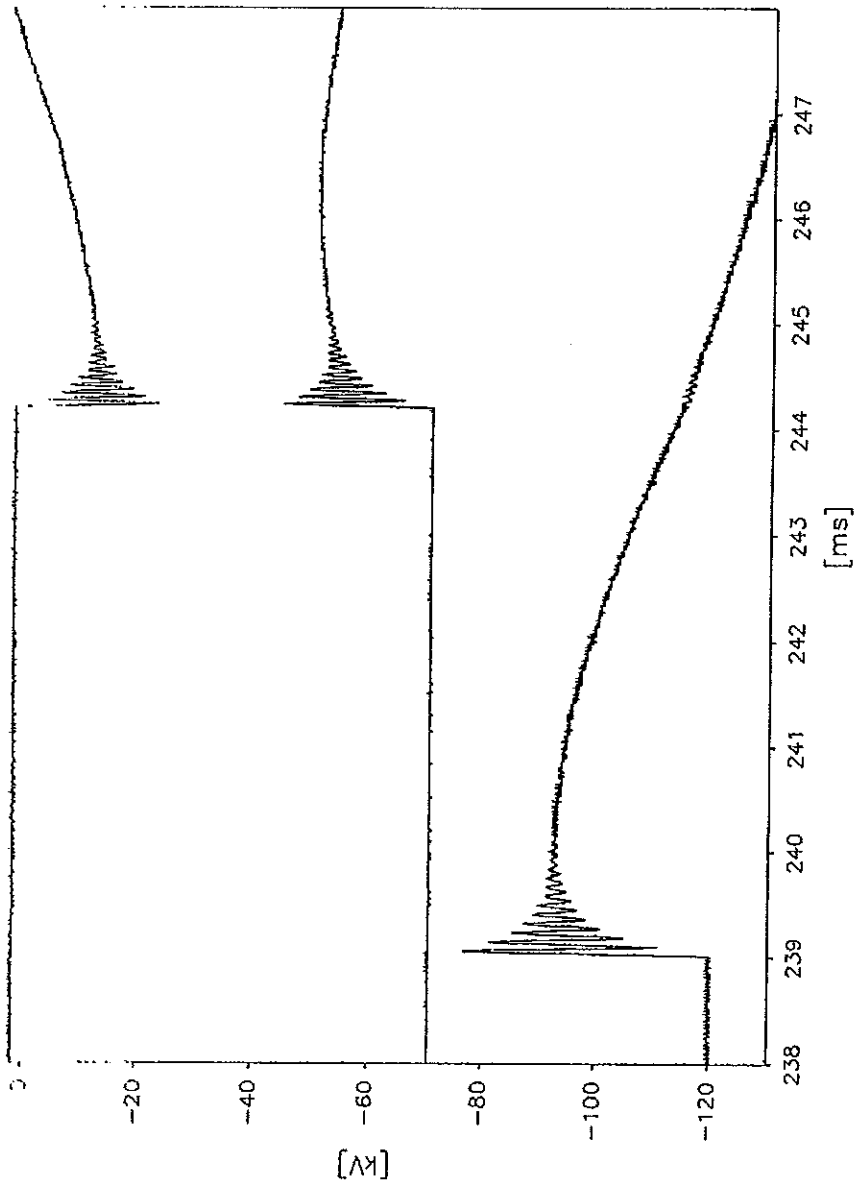


ВЯРНО С ОРИГИНАЛА

18PE0402



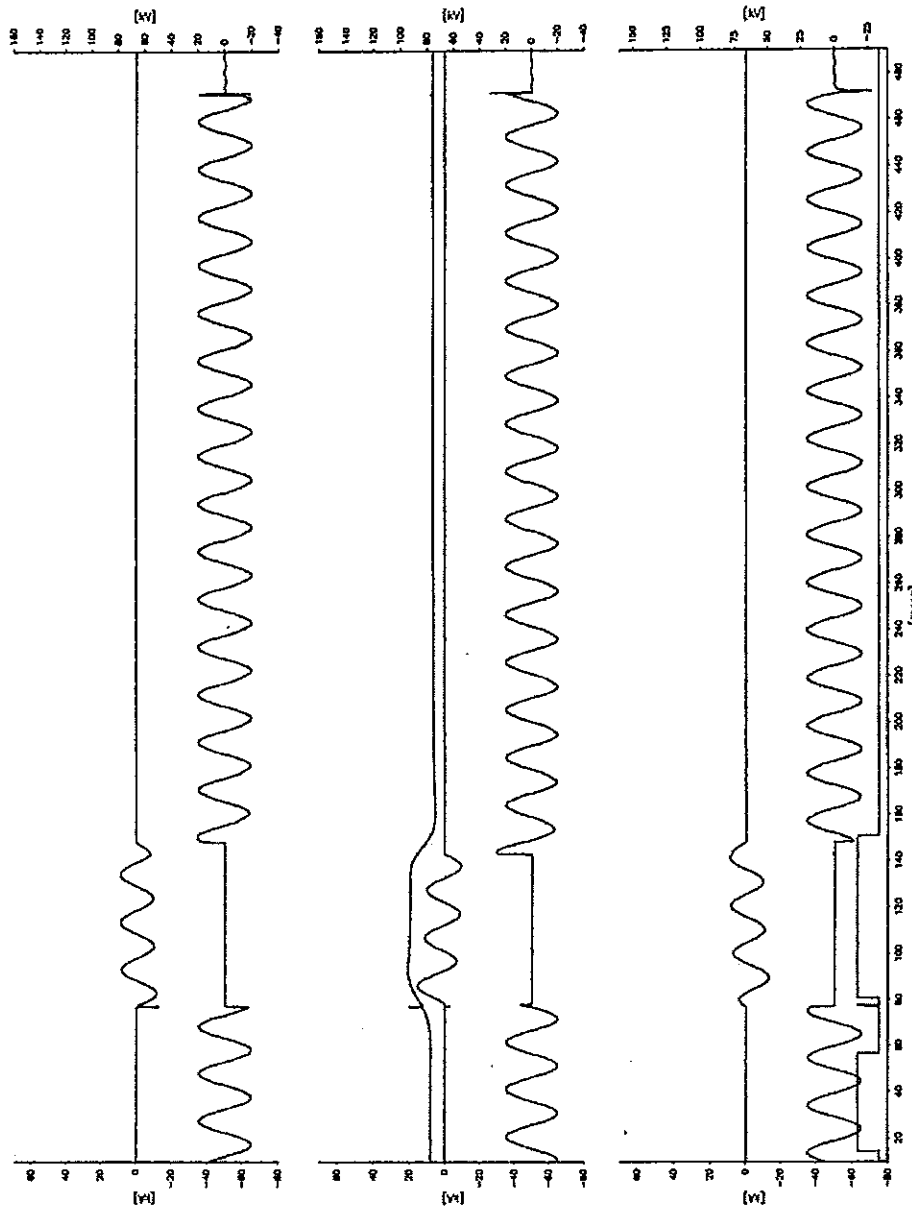
Oscillogram
PEHLA 0511Ra / 07



ВЕРНО С ОРИГИНАЛА
18FEP402



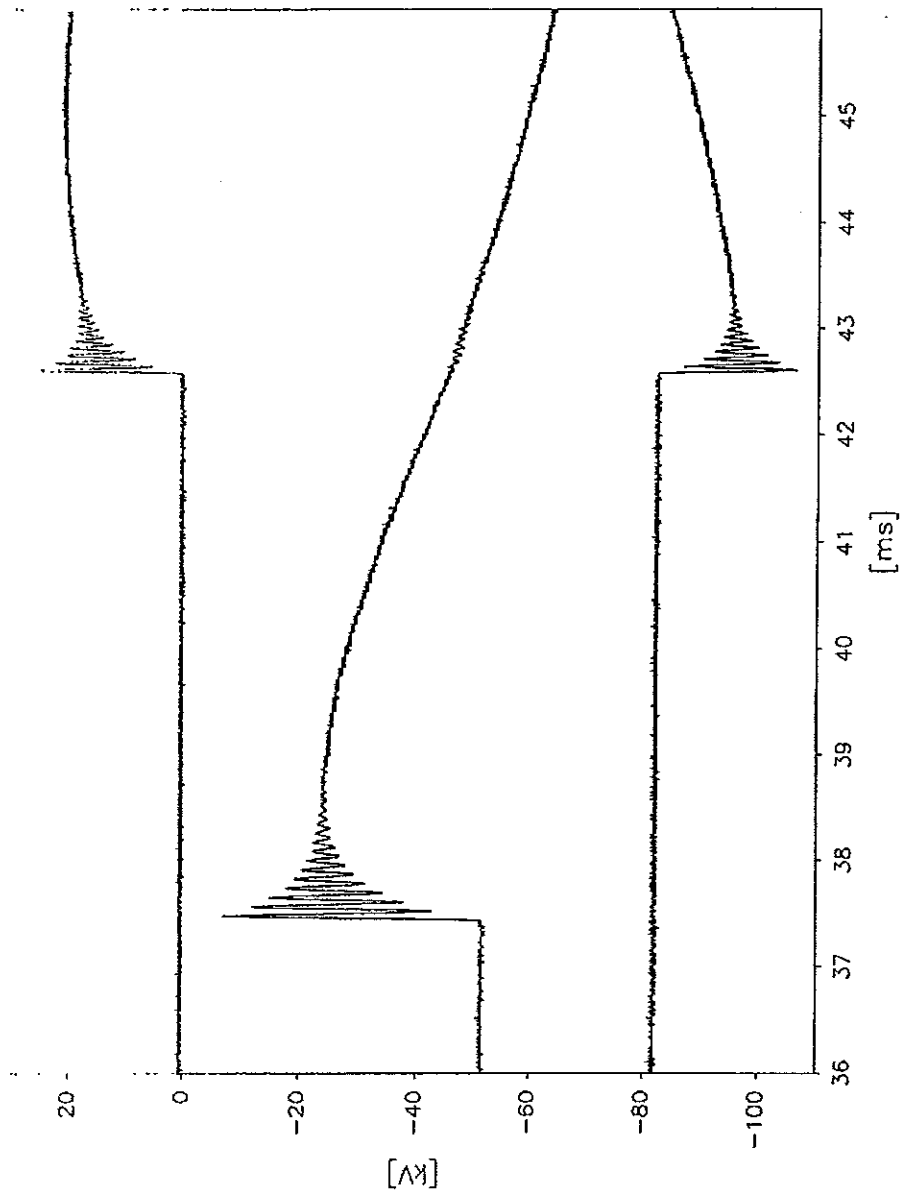
Oscillogram
PEHLA 0511Ra / 08



ВЯРНО С ОРИГИНАЛА
18PE0402



Oscillogram
PEHLA 0511Ra / 08



ВЯРНО С ОРИГИНАЛА
18PE0402



Test Results

Basic Short-Circuit Making and Breaking Tests

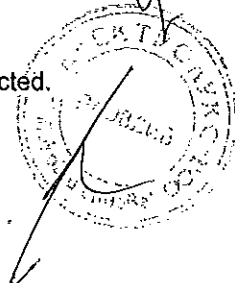
Test performed: Basic short-circuit making and breaking tests (T60)
Date of test: 09th March 2005
Condition of test object before test: As after Test Pehla 0511Ra / 08
Test arrangement: Direct test circuit, circuit-breaker in air-insulated switchgear
Connections to test object: Infeed via copper bars to the busbar connection of the switchgear, short-circuited via copper bar at the cable terminals, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			11	12	-	-	-		
Operating sequence and time intervals			O-0.3s-CO-15s-CO			-	-	-	
Applied voltage	kV		-	25.0	24.1	-	-	-	
Making current (peak)	L1	kA	-	20.1	25.5	-	-	-	
	L2	kA	-	32.5	32.9	-	-	-	
	L3	kA	-	29.8	25.7	-	-	-	
Breaking current (r.m.s.)	L1	kA	12.5	13.0	12.5	-	-	-	
	L2	kA	12.8	13.5	12.8	-	-	-	
	L3	kA	12.6	13.1	13.1	-	-	-	
	Average value	kA	12.6	13.2	12.8	-	-	-	
Recovery voltage (r.m.s)	L1	kV	14.1	14.2	13.6	-	-	-	
	L2	kV	14.2	14.5	13.8	-	-	-	
	L3	kV	14.2	14.8	14.4	-	-	-	
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-	
	Time t_1	μ s	-	-	-	-	-	-	
	TRV peak value u_c	kV	41.6	42.0	42.5	-	-	-	
	Time t_3	μ s	-	-	-	-	-	-	
	Time delay t_d	μ s	-	-	-	-	-	-	
	Rate of rise u_c/t_3	kV/ μ s	-	-	-	-	-	-	
C-Operation	Voltage of closing device	V	-	94	94	-	-	-	
	Closing time	ms	-	62.8	63.5	-	-	-	
	Pre-arcing time	ms	-	-	-	-	-	-	
	Make time	ms	-	62.8	63.5	-	-	-	
O-Operation	Voltage of opening device	V	77	77	77	-	-	-	
	Opening time	ms	58.6	56.5	59.4	-	-	-	
	Arcing time	L1	ms	7.8	7.6	8.2	-	-	-
		L2	ms	3.4	7.6	3.8	-	-	-
		L3	ms	9.0	2.6	8.8	-	-	-
	Break time	ms	67.6	64.1	68.2	-	-	-	
Emission of flame/gas/oil, occurrence of NSDD			no	no	no	-	-	-	
Number of valid test			-	-	-	-	-	-	
Test result			P	P	P	-	-	-	

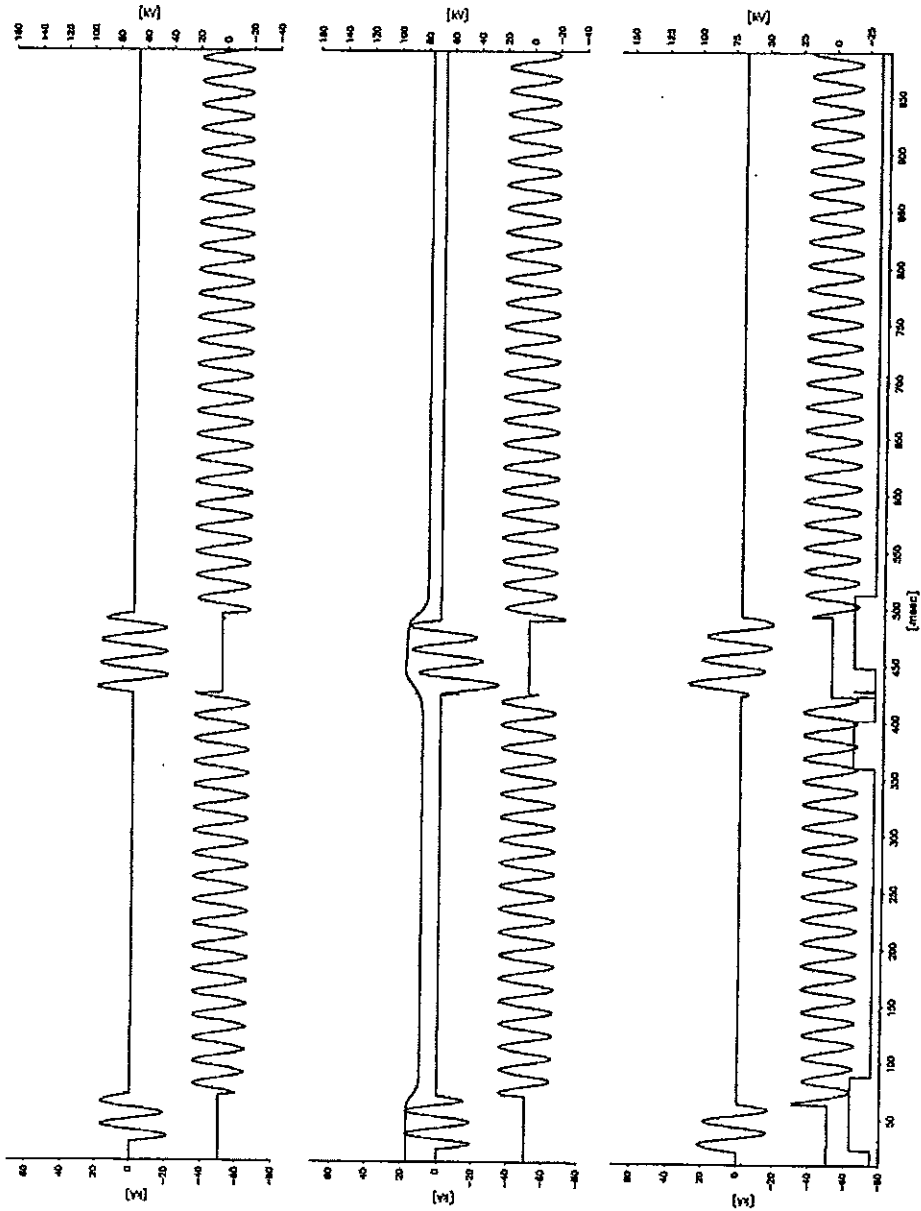
Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

Remarks: PEHLA 0511Ra / 09 and 10: Tests with reduced values

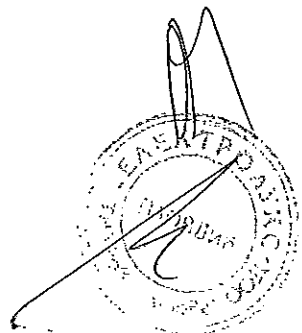
Condition of test object after test: Switchgear and circuit-breaker were not inspected.



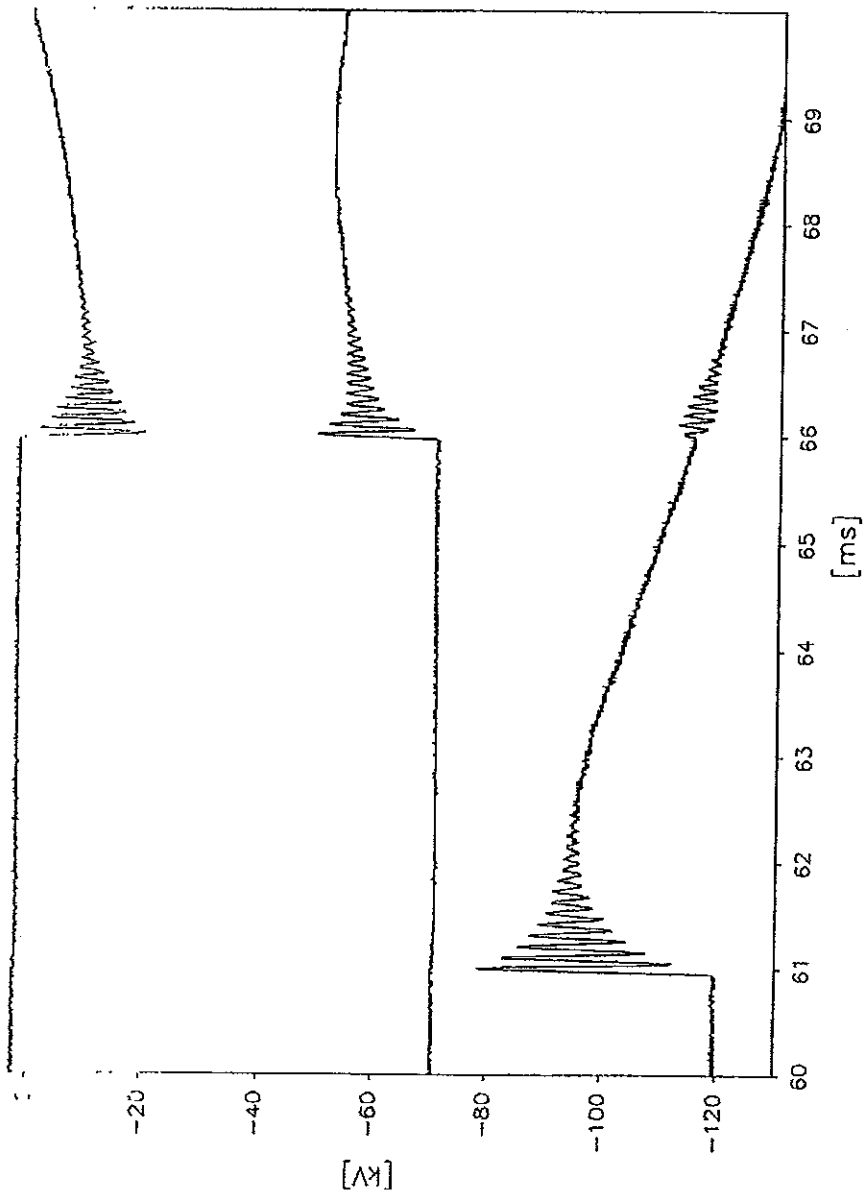
Oscillogram
PEHLA 0511Ra / 11



ВЯРНО С ОРИГИНАЛА
18PE60402

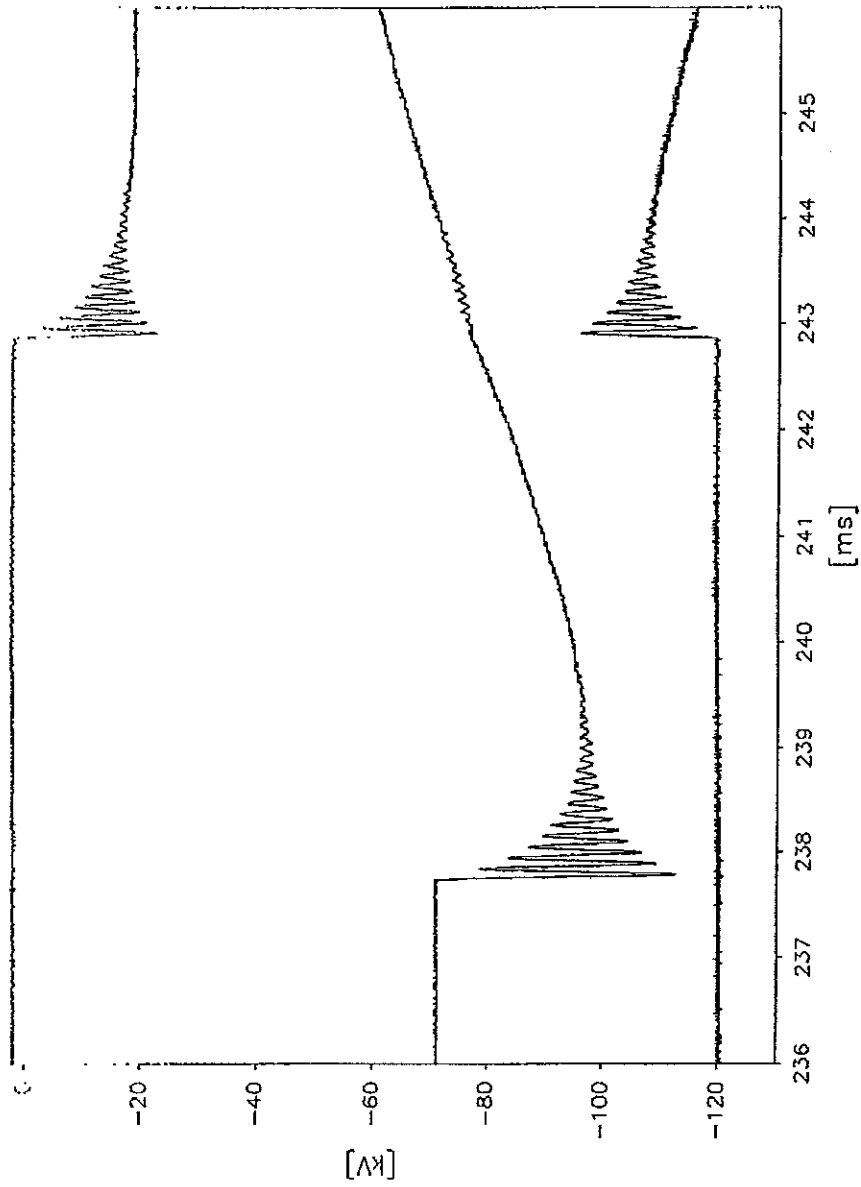


Oscillogram
PEHLA 0511Ra / 11



ВЯРНО С ОРИГИНАЛА
18PE0402

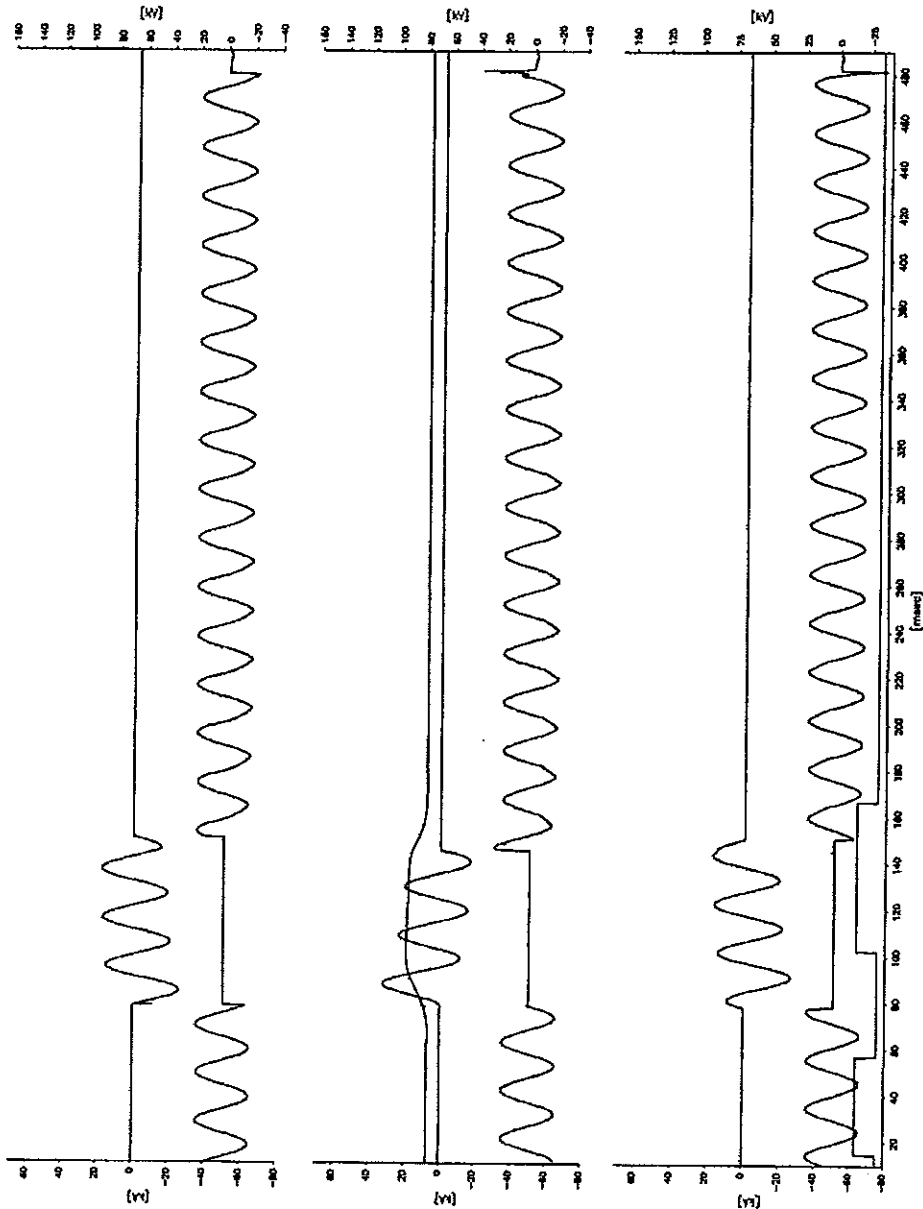
Oscillogram
PEHLA 0511Ra / 11



ВЕРНО С ОРИГИНАЛА
18652402

Handwritten mark

Oscillogram
PEHLA 0511Ra / 12



ВЯРНО С ОРГИНАЛА

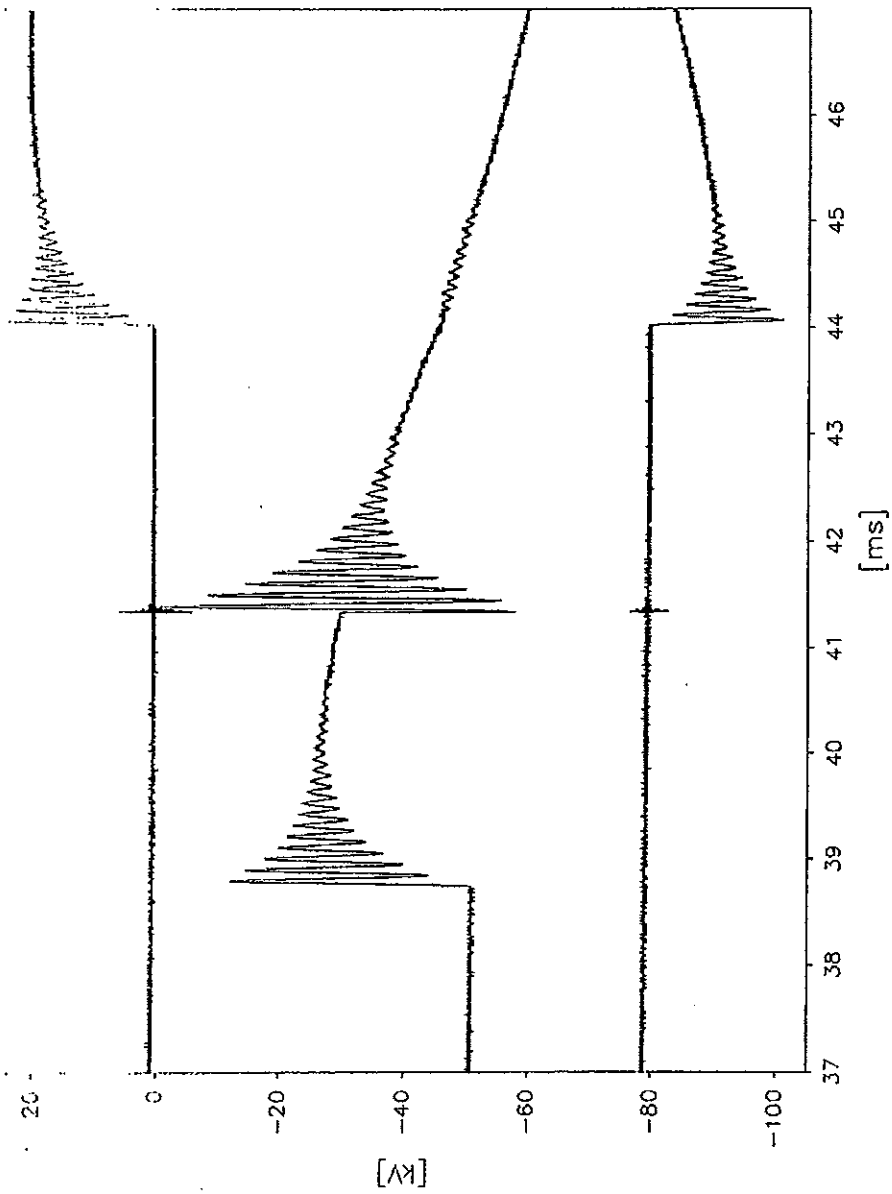
18PE0402

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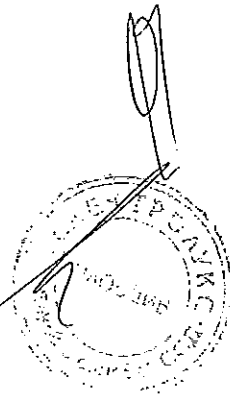


Handwritten mark

Oscillogram
PEHLA 0511Ra / 12



ВЯРНО С ОРИГИНАЛА
6PE0402



Handwritten mark

Test Results

Basic Short-Circuit Making and Breaking Tests

Test performed: Basic short-circuit making and breaking tests (T100s)
Date of test: 09th March 2005
Condition of test object before test: As after PEHLA 0511Ra / 12.
Test arrangement: Direct test circuit, circuit-breaker in gas insulated switchgear
Connections to test object: Infeed via copper bars to the busbar connection of the switchgear, short-circuited via copper bar at the cable terminals, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			15	16	-	-	-	
Operating sequence and time intervals			O-0.3s-CO-15s-CO			-	-	-
Applied voltage		kV	-	25.3	24.3	-	-	-
Making current (peak)	L1	kA	-	40.3	47.5	-	-	-
	L2	kA	-	49.7	49.7	-	-	-
	L3	kA	-	48.0	38.5	-	-	-
Breaking current (r.m.s.)	L1	kA	20.4	20.3	19.8	-	-	-
	L2	kA	20.5	20.0	21.1	-	-	-
	L3	kA	19.6	19.8	20.1	-	-	-
	Average value	kA	20.2	20.0	20.4	-	-	-
Recovery voltage (r.m.s)	L1	kV	13.7	14.1	14.0	-	-	-
	L2	kV	14.2	14.7	14.0	-	-	-
	L3	kV	14.0	14.5	14.1	-	-	-
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-
	Time t_1	μ s	-	-	-	-	-	-
	TRV peak value u_c	kV	41.0	40.0	40.0	-	-	-
	Time t_3	μ s	-	-	-	-	-	-
	Time delay t_d	μ s	-	-	-	-	-	-
	Rate of rise u_c/t_3	kV/ μ s	-	-	-	-	-	-
C-Operation	Voltage of closing device	V	-	94	94	-	-	-
	Closing time	ms	-	62.9	63.0	-	-	-
	Pre-arcing time	ms	-	-	-	-	-	-
	Make time	ms	-	62.9	63.0	-	-	-
O-Operation	Voltage of opening device	V	77	77	77	-	-	-
	Opening time	ms	61.0	61.3	61.6	-	-	-
	Arcing time L1	ms	3.8	7.4	6.6	-	-	-
	L2	ms	8.6	8.4	2.6	-	-	-
	L3	ms	8.8	3.2	6.8	-	-	-
Break time	ms	69.8	69.7	68.4	-	-	-	
Emission of flame/gas/oil, occurrence of NSDD			no	no	no	-	-	-
Number of valid test			-	-	-	-	-	-
Test result			P	P	P	-	-	-

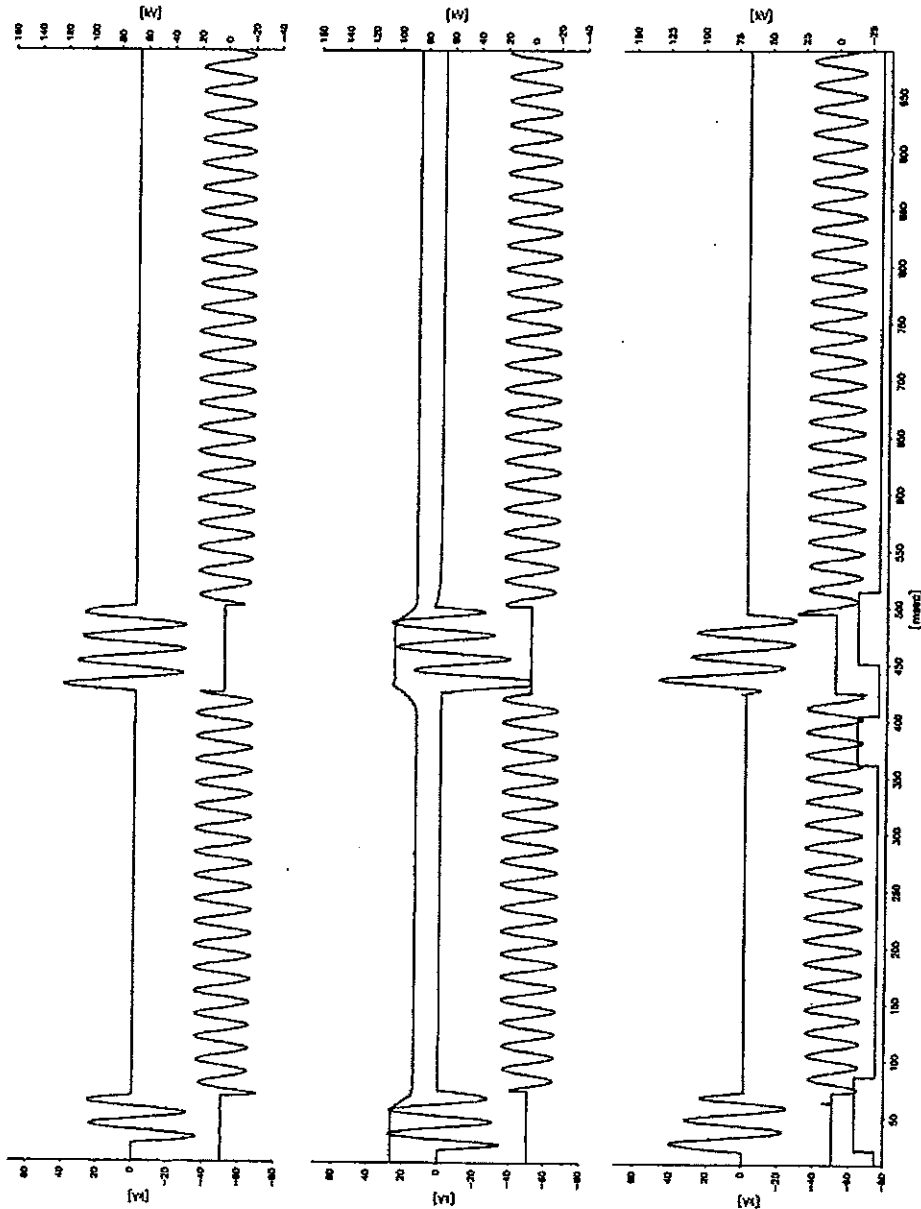
Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

Remarks: PEHLA 0511Ra / 13 and 14: Tests with reduced values

Condition of test object after test: Switchgear and circuit-breaker were not inspected.



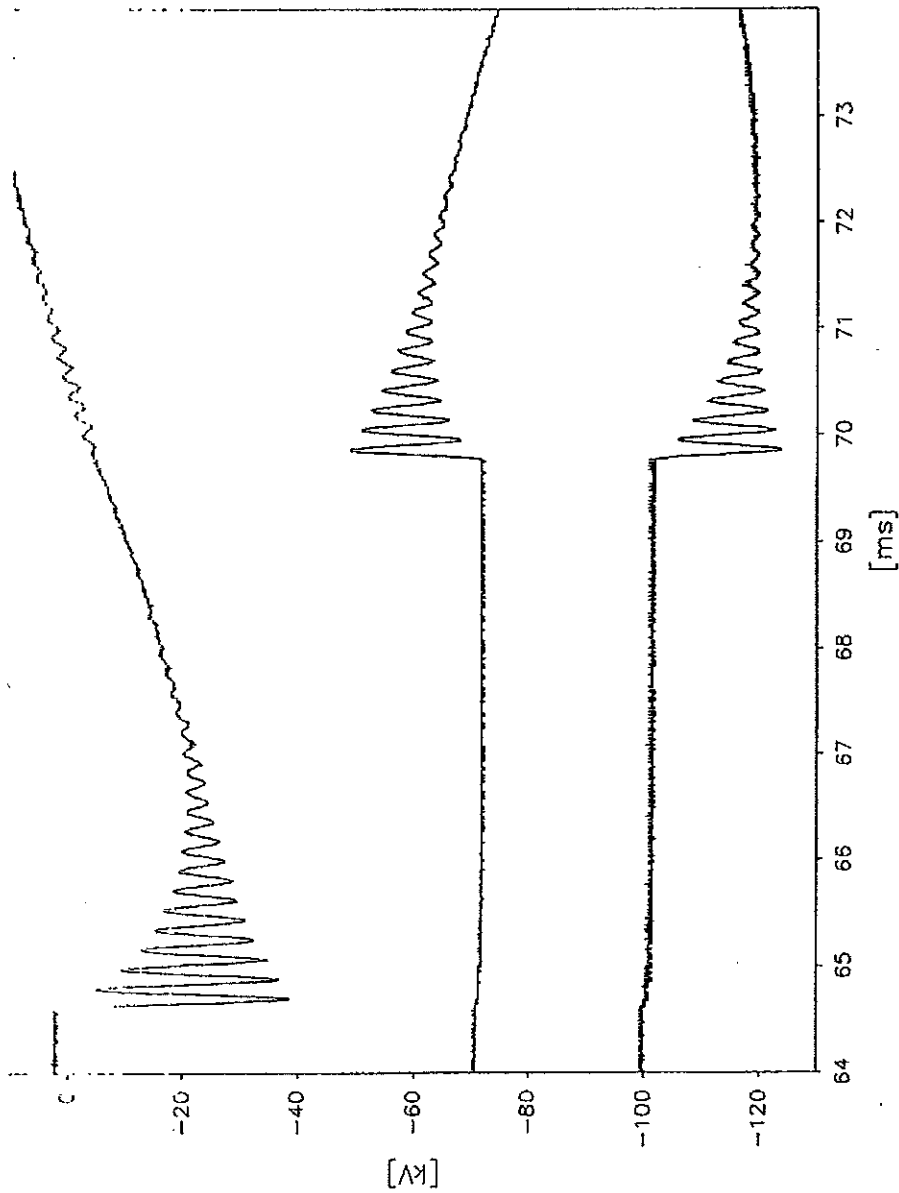
Oscillogram
PEHLA 0511Ra / 15



ВЯРНО С ОРИГИНАЛА
(6PE0402)



Oscillogram
PEHLA 0511Ra / 15



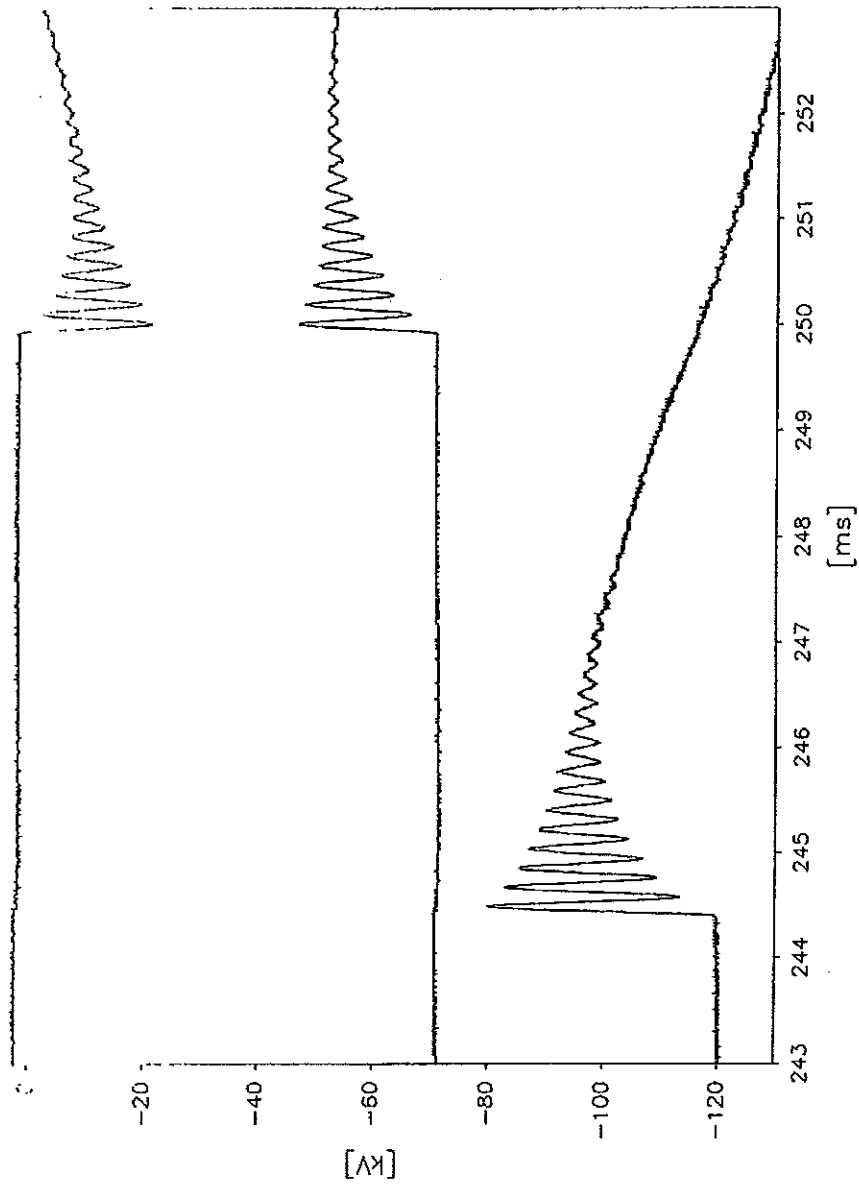
ВЯРНО С ОРИГИНАЛА

18PE0402

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Oscillogram
PEHLA 0511Ra / 15



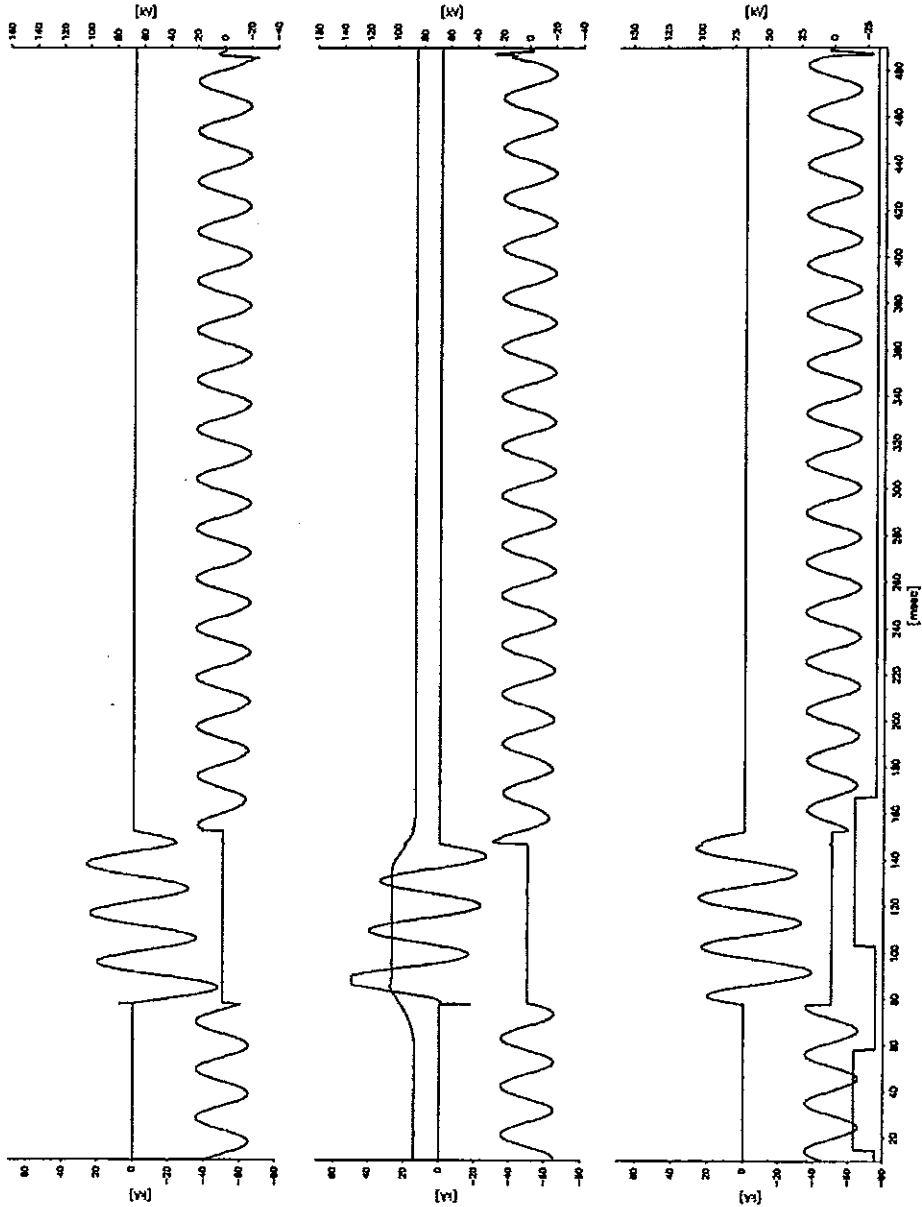
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ВЯРНО С ОРИГИНАЛА

18PE0402



**Oscillogram
PEHLA 0511Ra / 16**

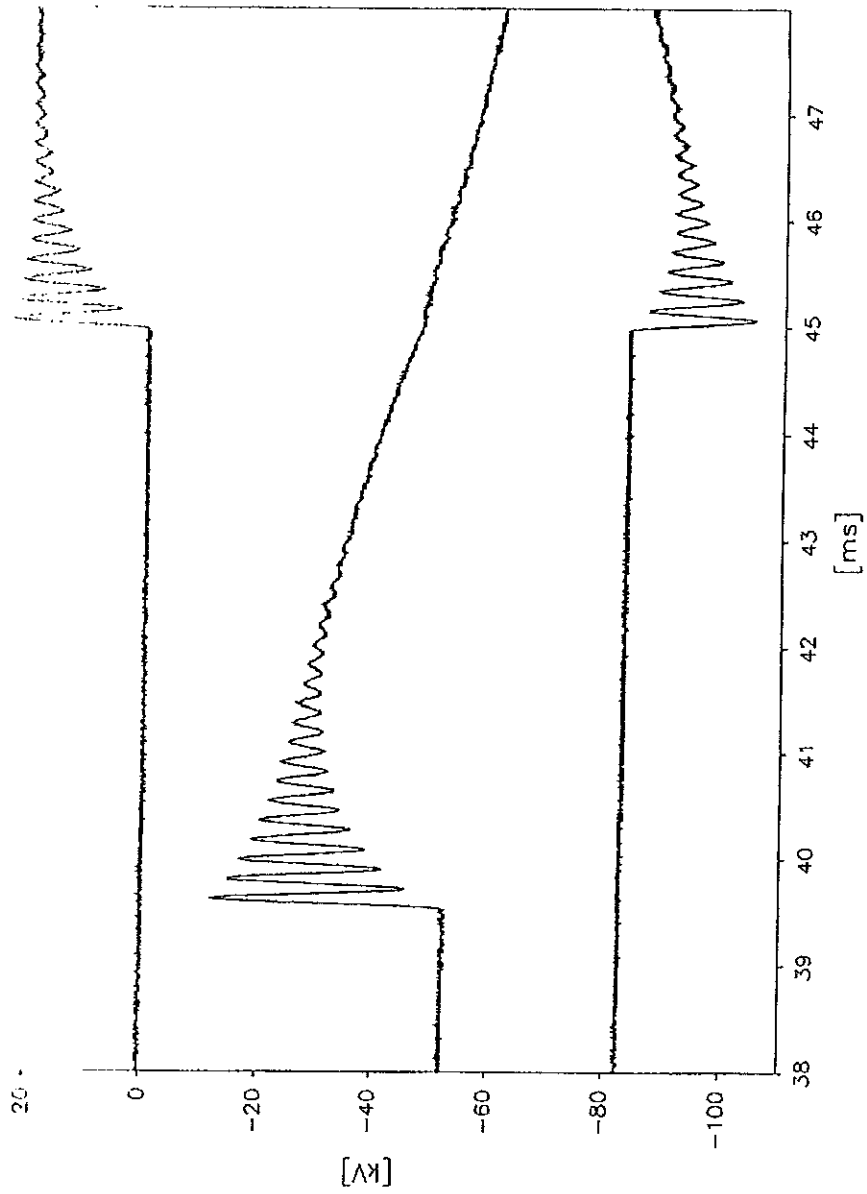


ВЯРНО С ОРИГИНАЛА

18PE0402



Oscillogram
PEHLA 0511Ra / 16



ВЯРНО С ОРИГИНАЛА

18PE0402



Test Results

Basic Short-Circuit Making and Breaking Tests

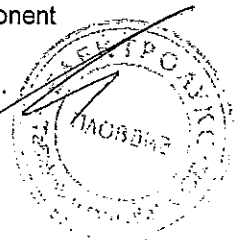
Test performed: Basic short-circuit making and breaking tests (T100a)
Date of test: 09th March 2005
Condition of test object before test: As after PEHLA 0511Ra / 16.
Test arrangement: Direct test circuit, circuit-breaker in gas insulated switchgear
Connections to test object: Infeed via copper bars to the cable terminals of the switchgear, short-circuited via copper bars at the busbar connection, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			19	20	21	-	-	-	
Operating sequence and time intervals			O-3min-O-3min-O			-	-	-	
Applied voltage	kV		-	-	-	-	-	-	
Breaking current (r.m.s.)	L1	kA	18.7	18.6	17.9	-	-	-	
	L2	kA	18.2	19.0	18.7	-	-	-	
	L3	kA	18.7	18.0	18.8	-	-	-	
	Average value		kA	18.5	18.5	18.5	-	-	-
Breaking current - last current loop (peak)	L1	kA	-	-	-	-	-	-	
	L2	kA	-	-	-	-	-	-	
	L3	kA	-	-	-	-	-	-	
Duration of the last current loop	L1	ms	-	-	-	-	-	-	
	L2	ms	-	-	-	-	-	-	
	L3	ms	-	-	-	-	-	-	
DC-component	L1	%	< 20	< 20	< 20	-	-	-	
	L2	%	< 20	< 20	< 20	-	-	-	
	L3	%	< 20	< 20	< 20	-	-	-	
Recovery voltage (r.m.s.)	L1	kV	13.6	13.4	13.7	-	-	-	
	L2	kV	13.9	13.5	13.9	-	-	-	
	L3	kV	13.7	13.8	13.8	-	-	-	
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-	
	Time t_1	μ s	-	-	-	-	-	-	
	TRV peak value u_c	kV	39.9	38.9	38.4	-	-	-	
	Time t_3	μ s	-	-	-	-	-	-	
	Time delay t_d	μ s	-	-	-	-	-	-	
	Rate of rise u_c/t_3	kV/ μ s	-	-	-	-	-	-	
O-Operation	Voltage of opening device	V	121	121	121	-	-	-	
	Opening time	ms	46.6	46.9	47.7	-	-	-	
	Arcing time	L1	ms	5.2	8.4	8.6	-	-	-
		L2	ms	5.2	3.6	8.6	-	-	-
		L3	ms	0.8	8.4	3.8	-	-	-
	Break time	ms	51.8	55.3	56.3	-	-	-	
Emission of flame/gas/oil, occurrence of NSDD			no	no	no	-	-	-	
Number of valid test			-	-	-	-	-	-	
Test result			P	P	P	-	-	-	

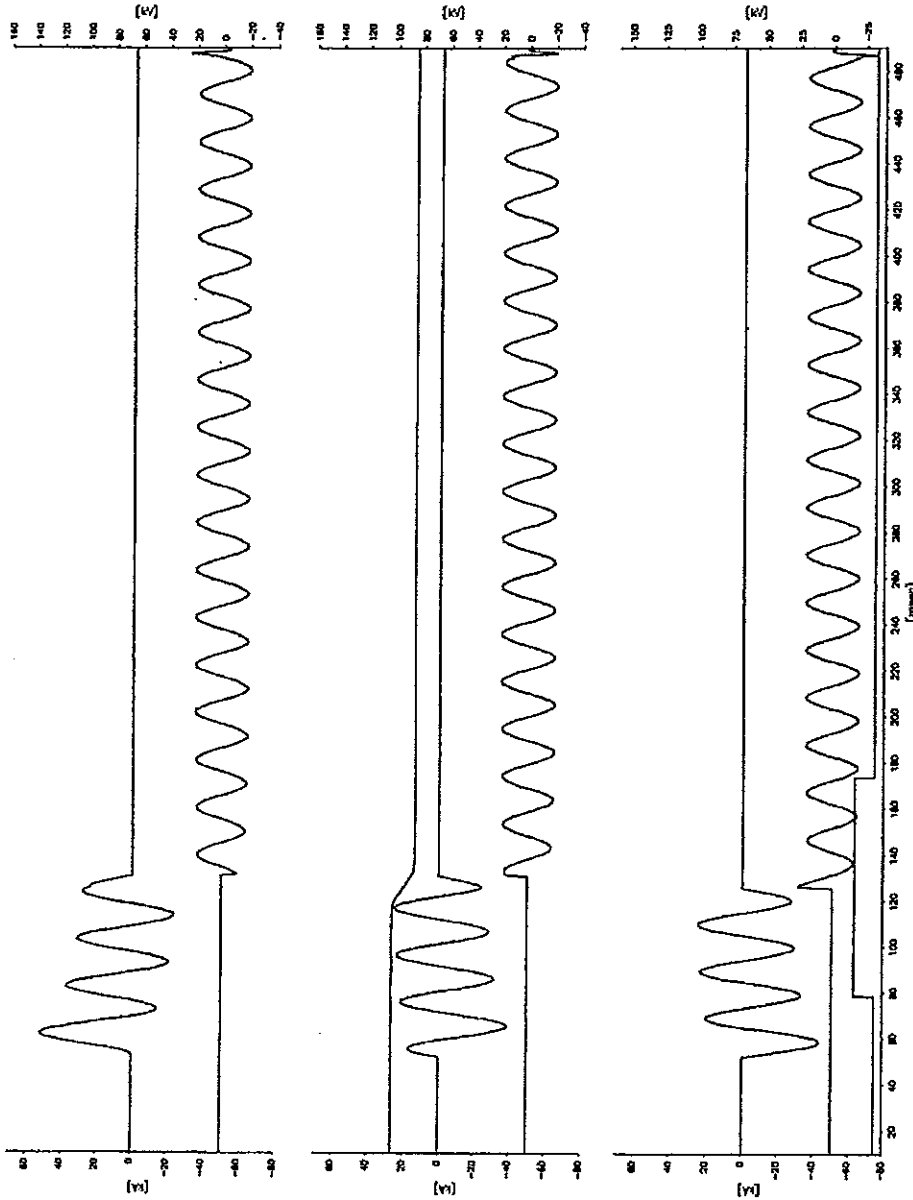
Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

Remarks: Before PEHLA 0511Ra / 17: Infeed direction inverted
 PEHLA 0511Ra / 17 and 18: Test with reduced values
 PEHLA 0511Ra / 19 to 21: Tests for determination of DC-component

Condition of test object after test: Switchgear and circuit-breaker were not inspected.



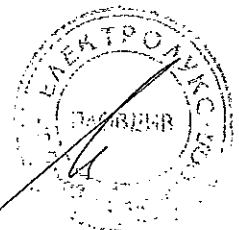
Oscillogram
PEHLA 0511Ra / 19



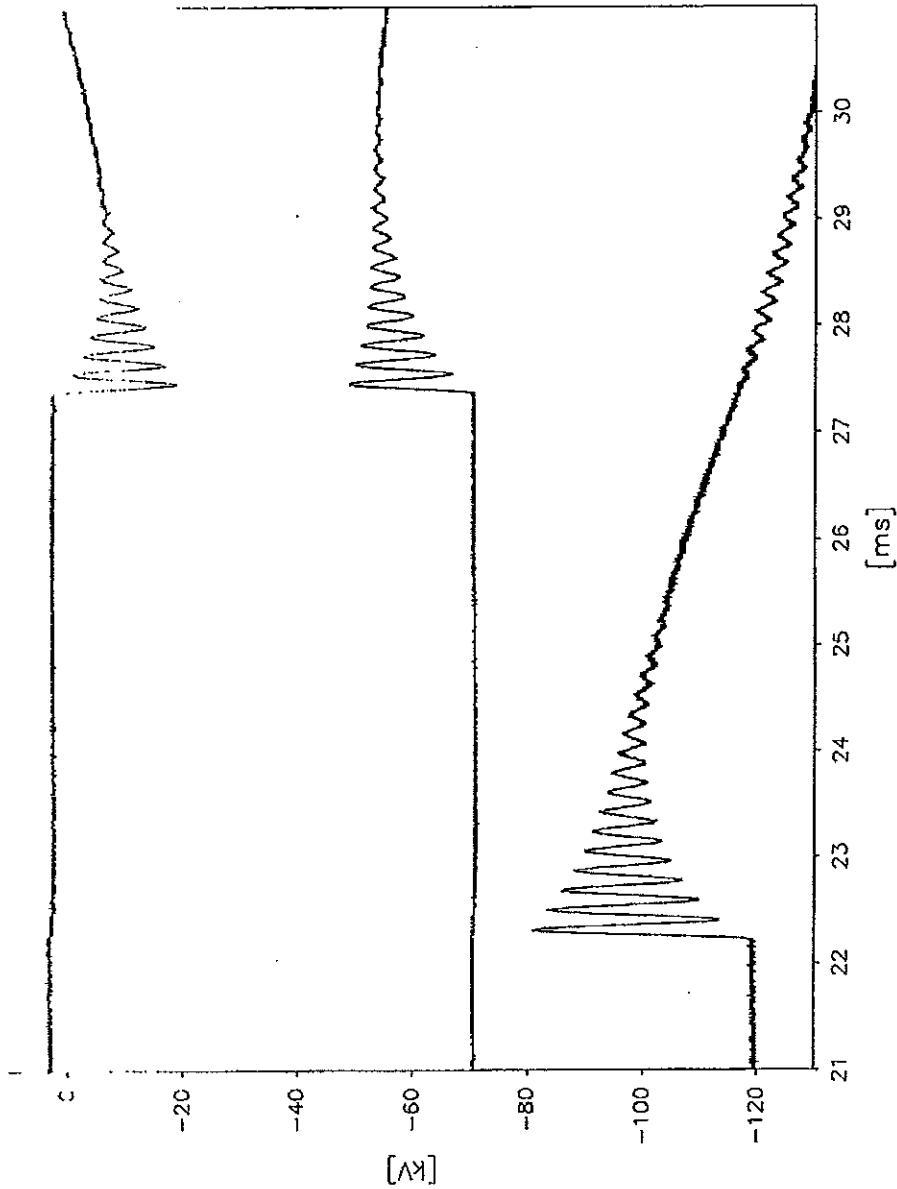
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ВЯРНО С ОРИГИНАЛА

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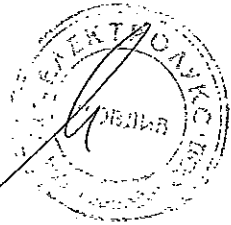


Oscillogram
PEHLA 0511Ra / 19



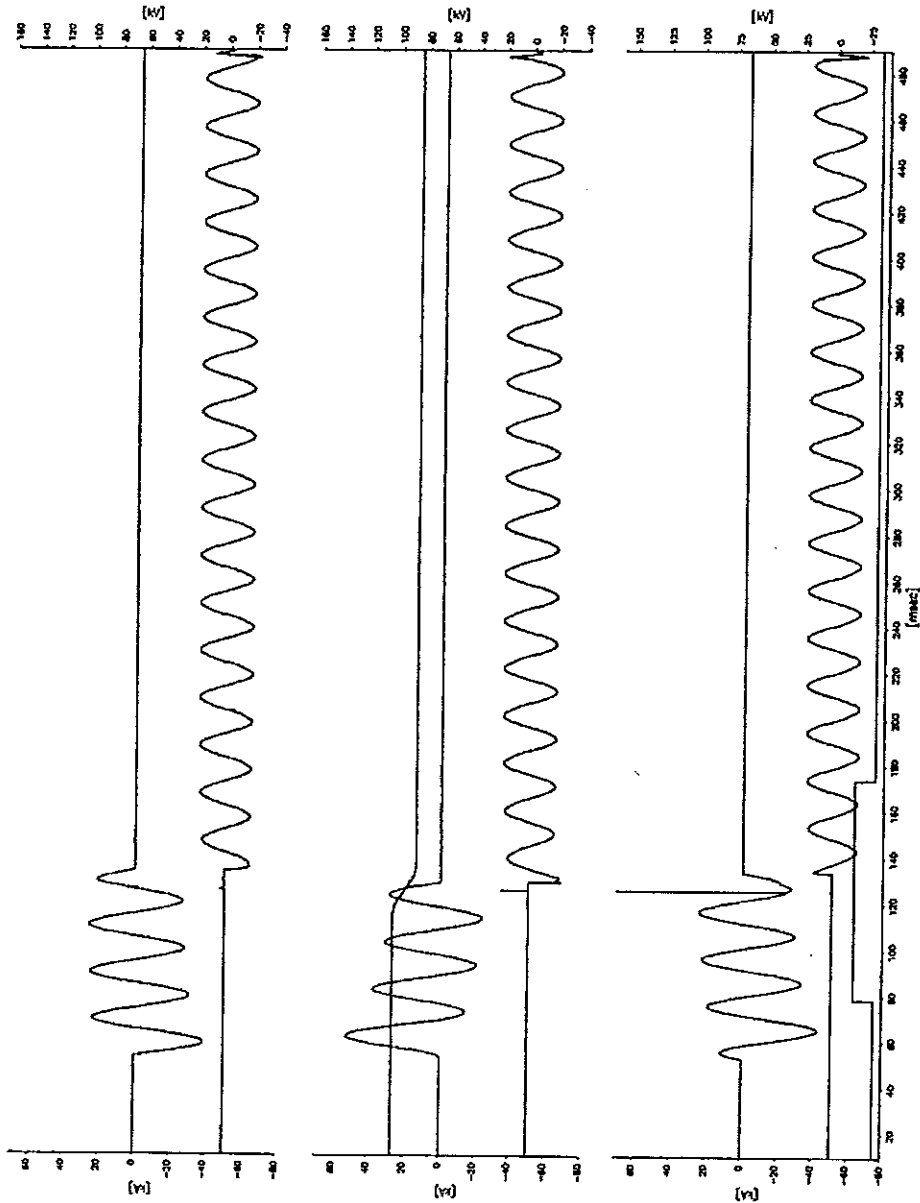
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ВЯРНО С ОРИГИНАЛА
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Oscillogram
PEHLA 0511Ra / 20

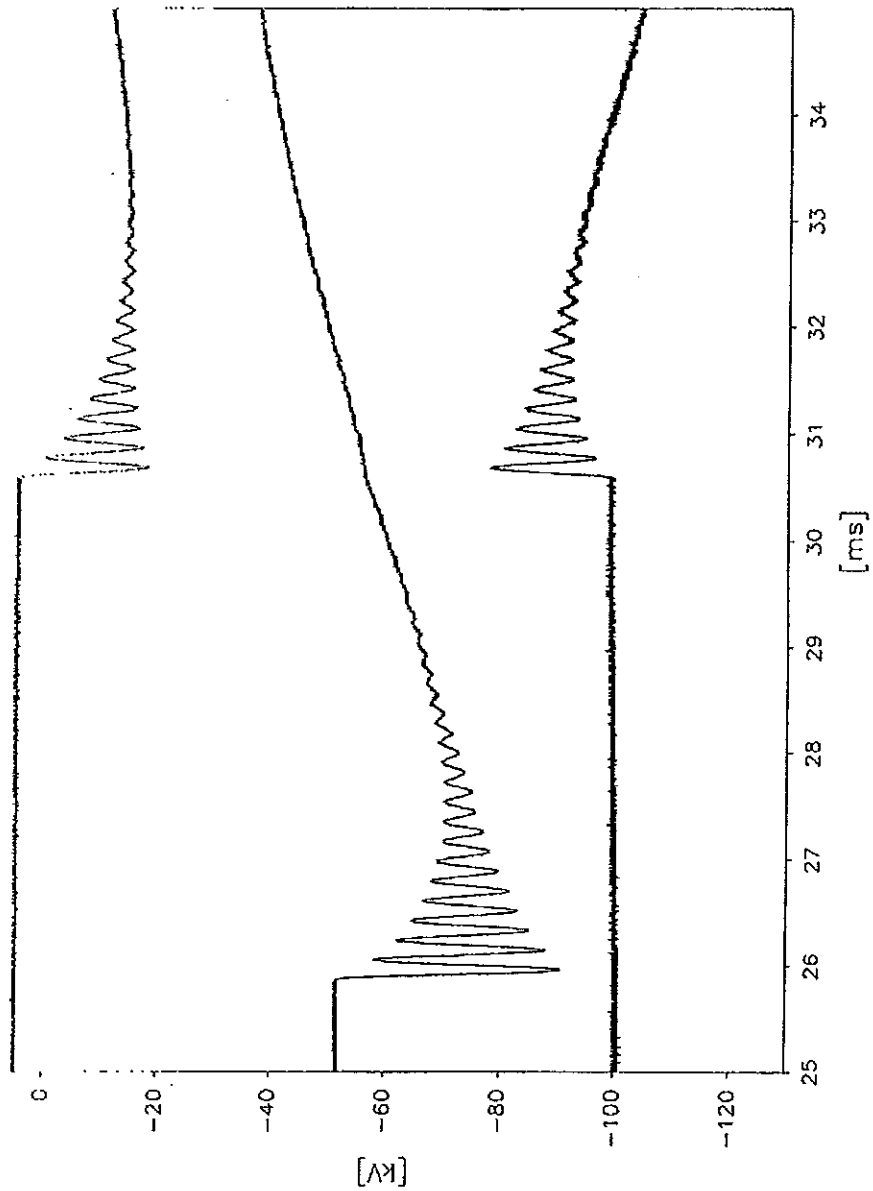


ВЯРНО С ОРИГИНАЛА

18PE0402

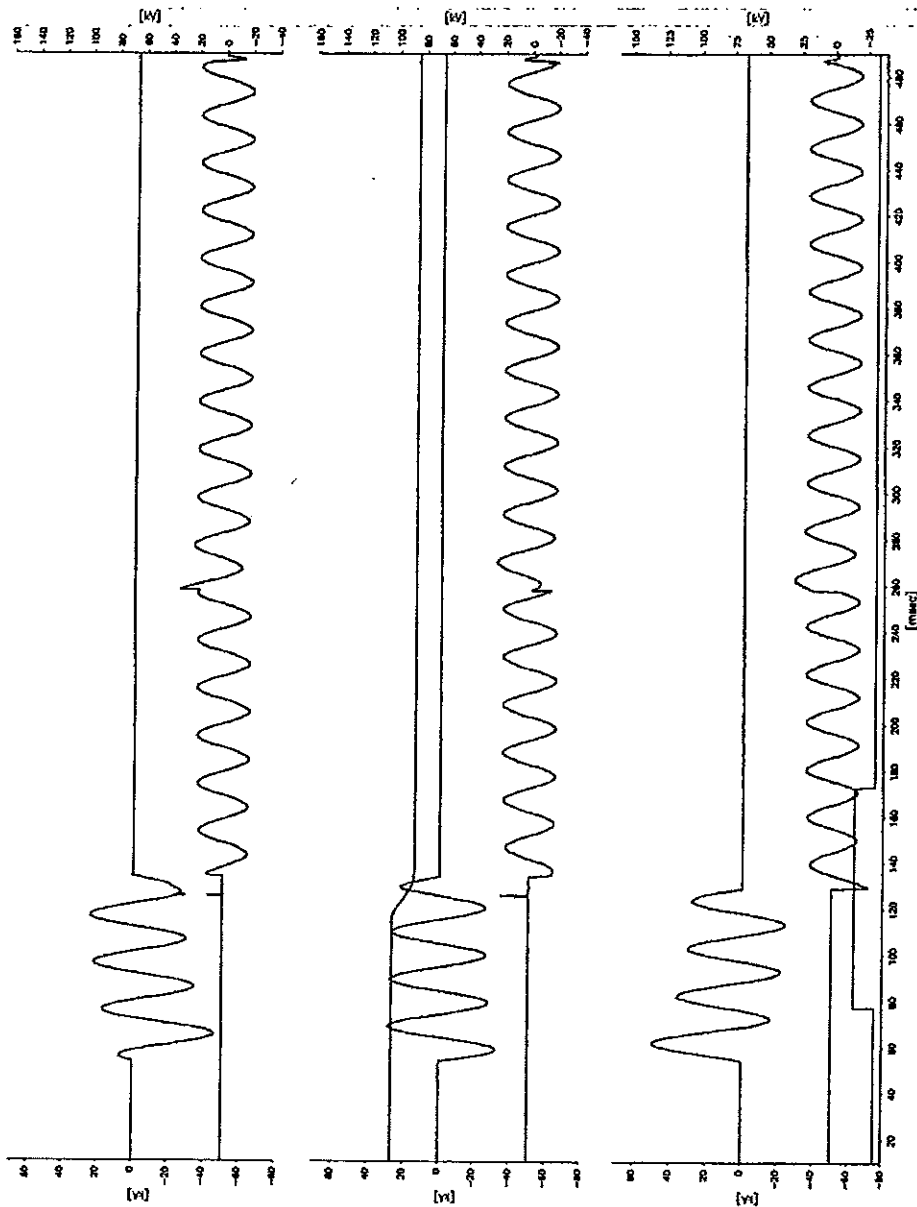


Oscillogram
PEHLA 0511Ra / 20

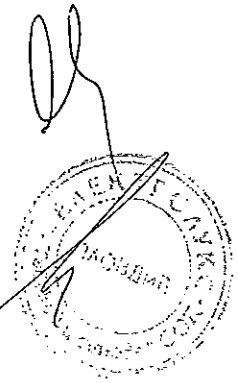


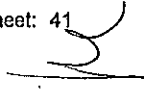
ВЯРНО С ОРИГИНАЛА
18PE0402

Oscillogram
PEHLA 0511Ra / 21

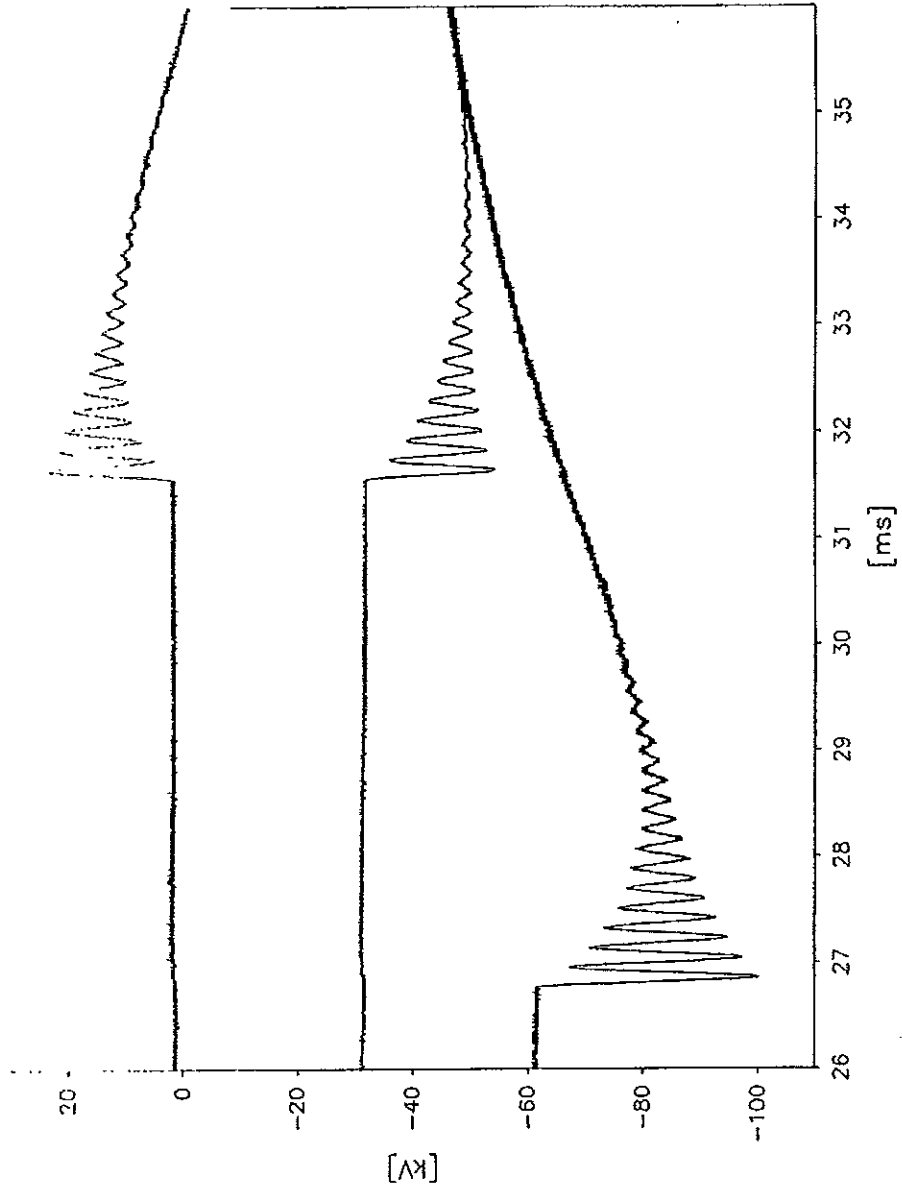


ВЯРНО С ОРИГИНАЛА
18PE0402



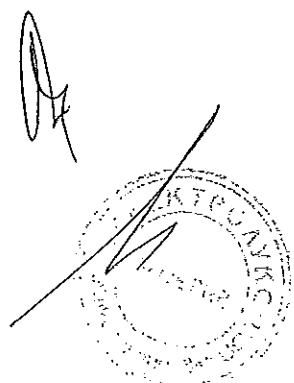


Oscillogram
PEHLA 0511Ra / 21



ВЯРНО С ОРИГИНАЛА

18PE0402



Test Results

Basic Short-Circuit Making and Breaking Tests

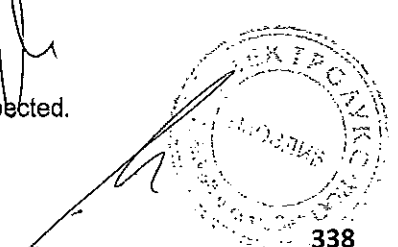
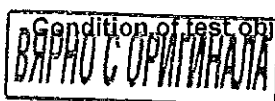
Test performed: Basic short-circuit making and breaking tests (T100a)
Date of test: 09th March 2005
Condition of test object before test: As after PEHLA 0511Ra / 21.
Test arrangement: Direct test circuit, circuit-breaker in gas insulated switchgear
Connections to test object: Infeed via copper bars to the cable terminals of the switchgear, short-circuited via copper bars at the busbar connection, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra		23	24	25	26	27	28		
Operating sequence and time intervals		O-3min-O-3min-O-3min-O-3min-O-3min-O-							
Applied voltage	kV	-	-	-	-	-	-		
Breaking current (r.m.s.)	L1	kA	20.7	20.5	20.6	20.6	20.5	20.5	
	L2	kA	20.1	19.8	19.9	20.9	20.5	20.6	
	L3	kA	20.7	20.1	20.0	20.5	19.7	19.8	
	Average value	kA	20.5	20.1	20.2	20.7	20.2	20.3	
Breaking current - last current loop (peak)	L1	kA	36.9	-	-	-	-	-	
	L2	kA	-	37.3	37.3	37.3	-	-	
	L3	kA	-	-	-	-	36.0	36.0	
Duration of the last current loop	L1	ms	12.8	-	-	-	-	-	
	L2	ms	-	12.6	12.6	12.6	-	-	
	L3	ms	-	-	-	-	12.2	12.2	
DC-component	L1	%	32.2	< 20	< 20	< 20	35.7	35.7	
	L2	%	< 20	37.8	39.9	37.8	< 20	< 20	
	L3	%	< 20	28.3	29.7	28.0	33.7	34.0	
Recovery voltage (r.m.s)	L1	kV	13.9	13.7	13.7	13.7	13.7	13.8	
	L2	kV	13.9	13.6	14.1	13.7	14.1	14.0	
	L3	kV	14.2	13.5	14.1	14.1	14.0	14.1	
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-	
	Time t_1	μ s	-	-	-	-	-	-	
	TRV peak value u_c	kV	40.8	39.6	37.4	41.4	37.4	37.4	
	Time t_3	μ s	-	-	-	-	-	-	
	Time delay t_d	μ s	-	-	-	-	-	-	
	Rate of rise u_d/t_3	kV/ μ s	-	-	-	-	-	-	
O-Operation	Voltage of opening device	V	121	121	121	121	121	121	
	Opening time	ms	47.0	47.3	45.8	44.6	47.0	46.0	
	Arcing time	L1	ms	3.8	6.6	6.4	6.0	0.8	0.8
		L2	ms	7.8	6.4	8.0	10.2	6.6	6.6
		L3	ms	8.0	0.8	1.8	10.4	6.4	6.6
	Break time	ms	55.0	53.7	53.8	55.0	53.6	52.6	
Emission of flame/gas/oil, occurrence of NSDD		no	no	no	no	no	no		
Number of valid test		-	-	-	-	-	-		
Test result		P	P	P	P	P	P		

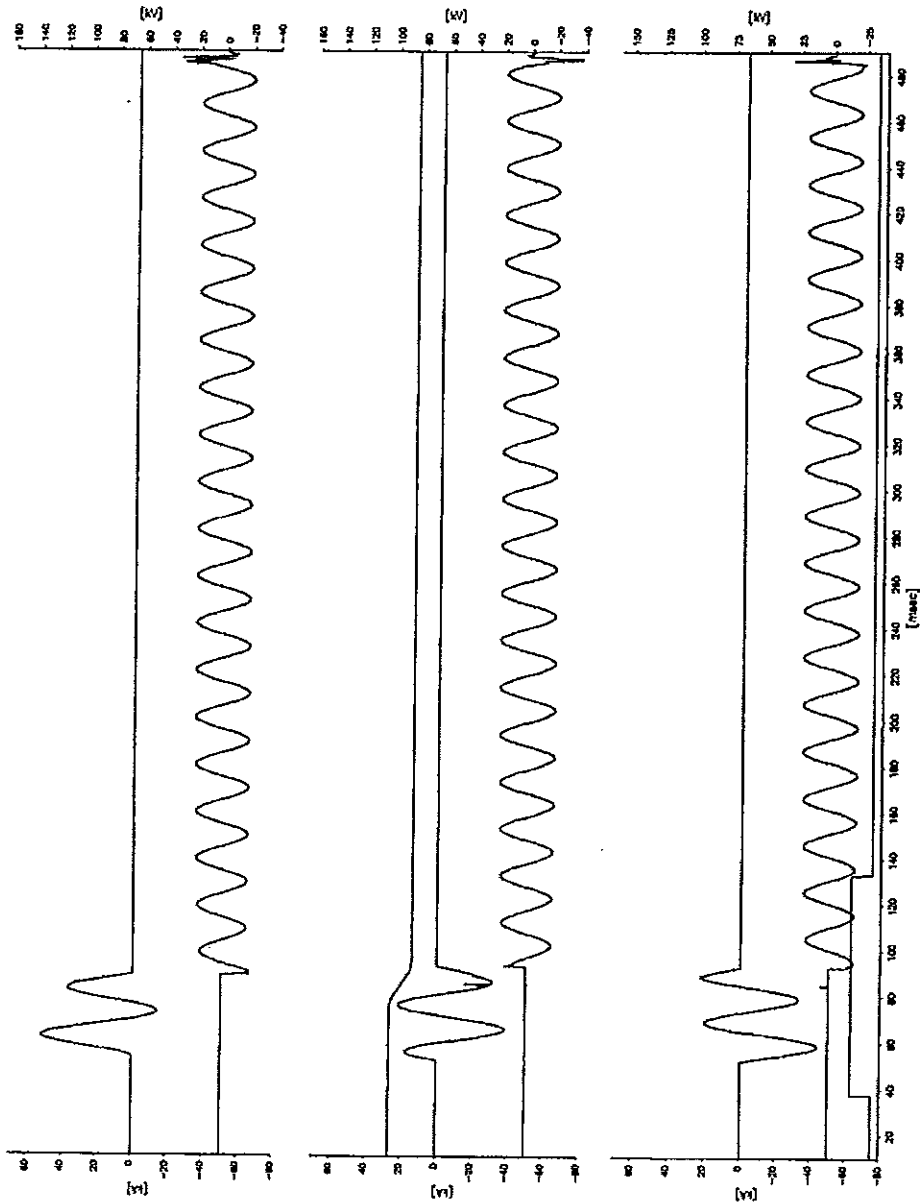
Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard

Remarks: PEHLA 0511Ra / 22: Test with reduced values.

Condition of test object after test: Switchgear and circuit-breaker were not inspected.



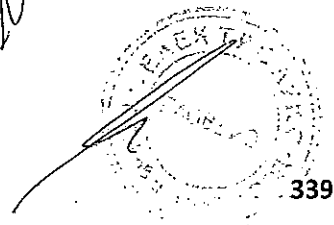
Oscillogram
PEHLA 0511Ra / 23



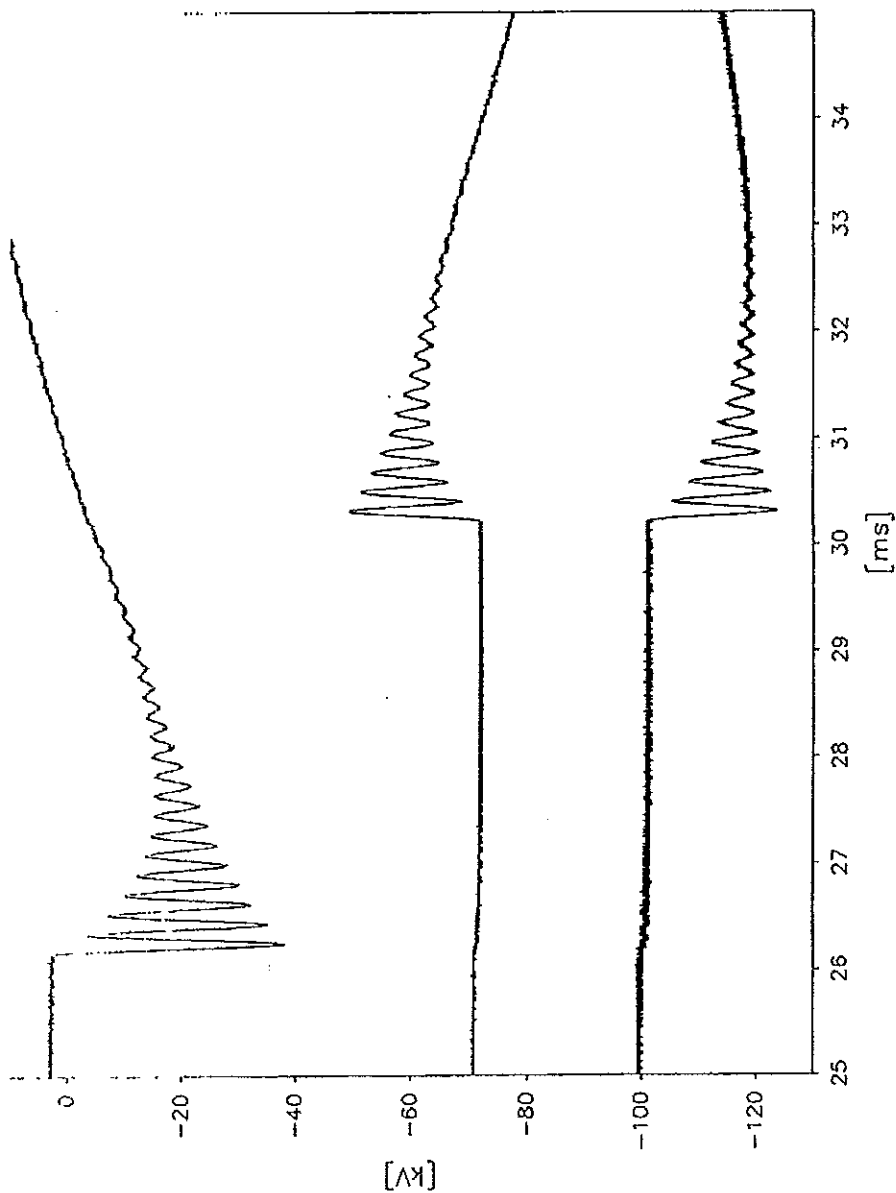
ВЯРНО С ОРИГИНАЛА

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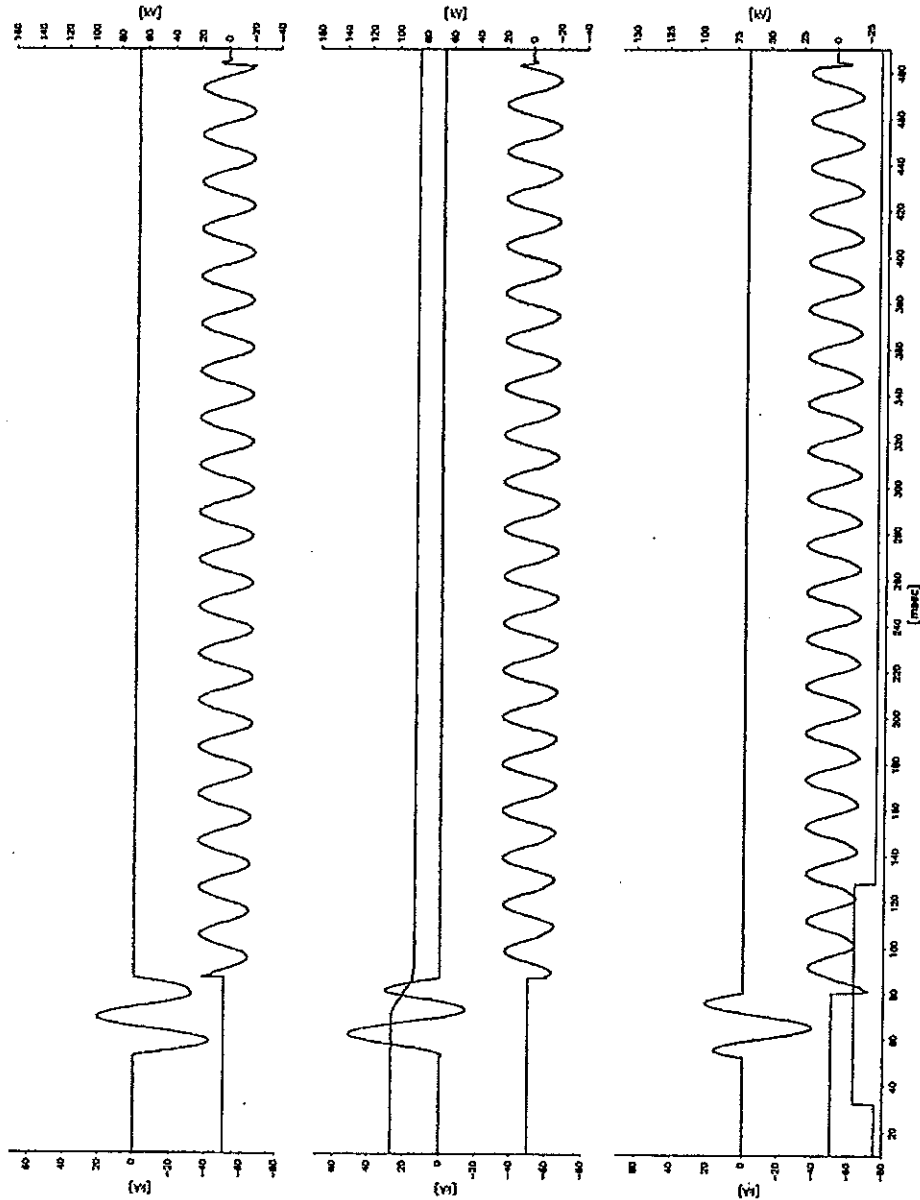
Oscillogram
PEHLA 0511Ra / 23



ВЯРНО С ОРИГИНАЛА
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Oscillogram
PEHLA 0511Ra / 24



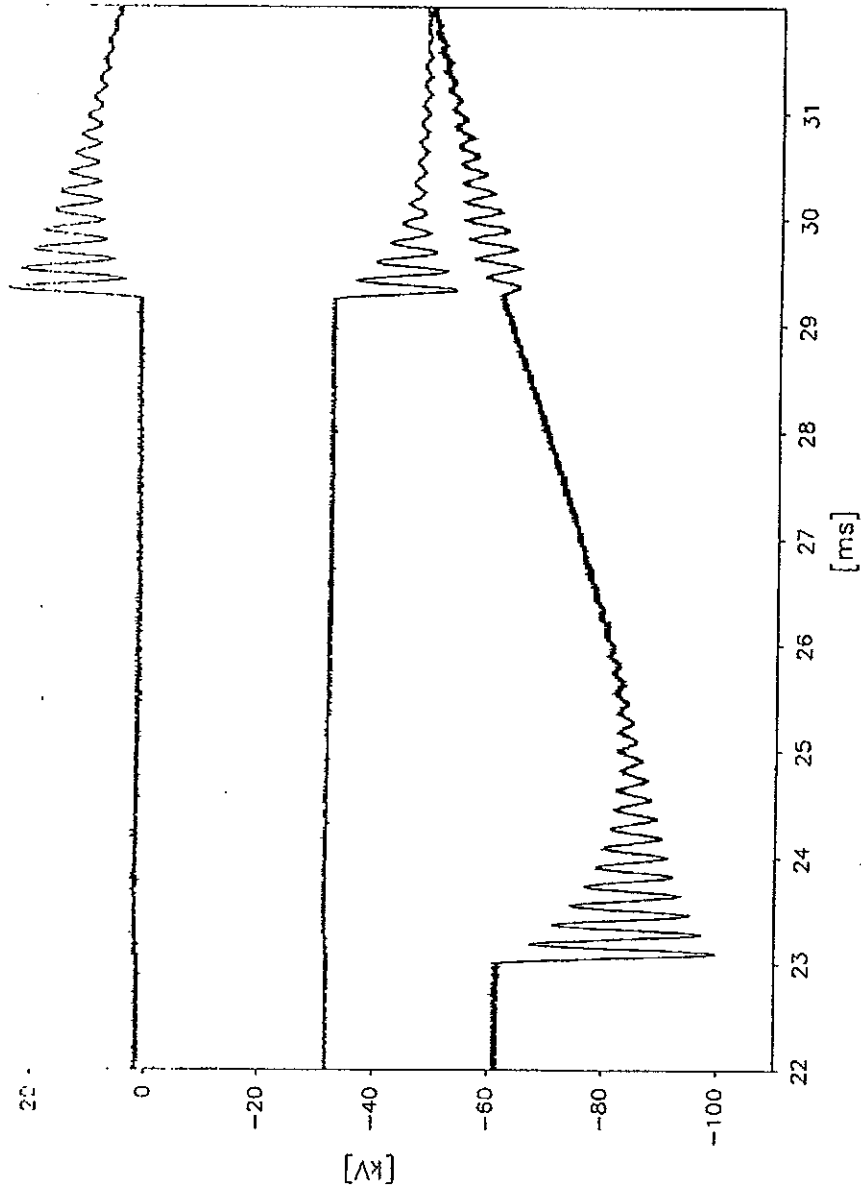
ВЯРНО С ОРИГИНАЛА

18PE0402

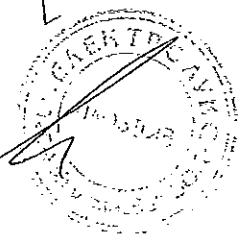
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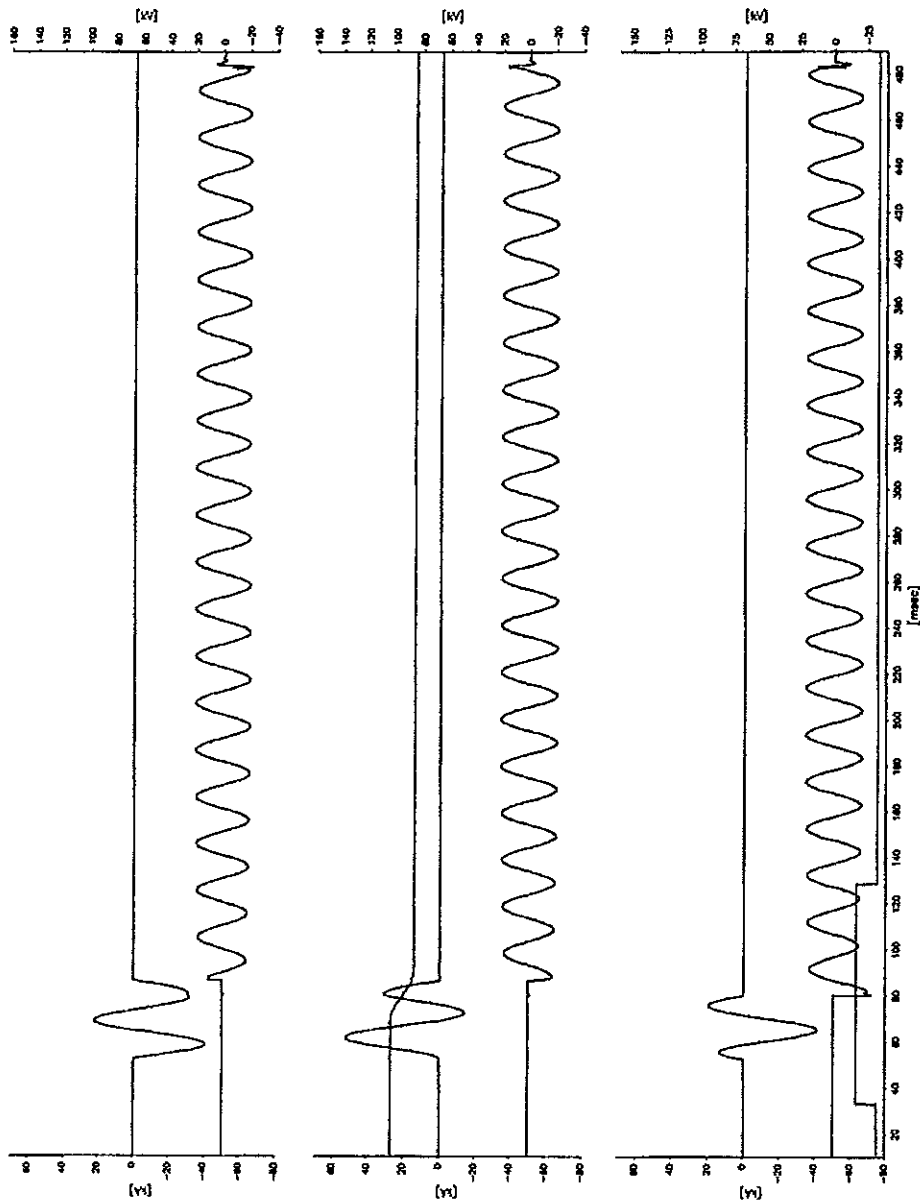
Oscillogram
PEHLA 0511Ra / 24



ВЯРНО С ОРГИНАЛА
18PE9-02



Oscillogram
PEHLA 0511Ra / 25



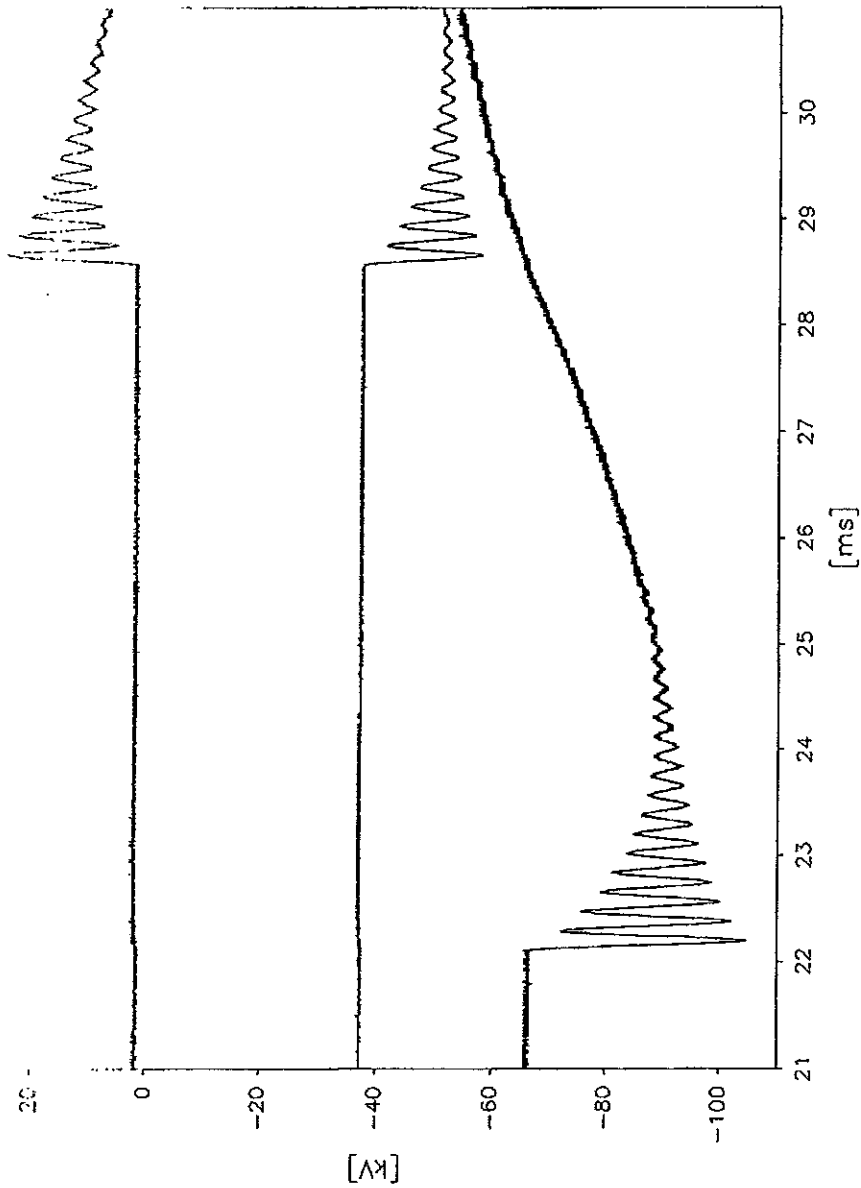
ВЯРНО С ОРИГИНАЛА

18PE0402

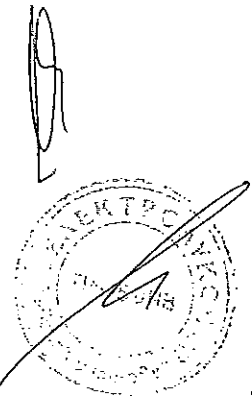
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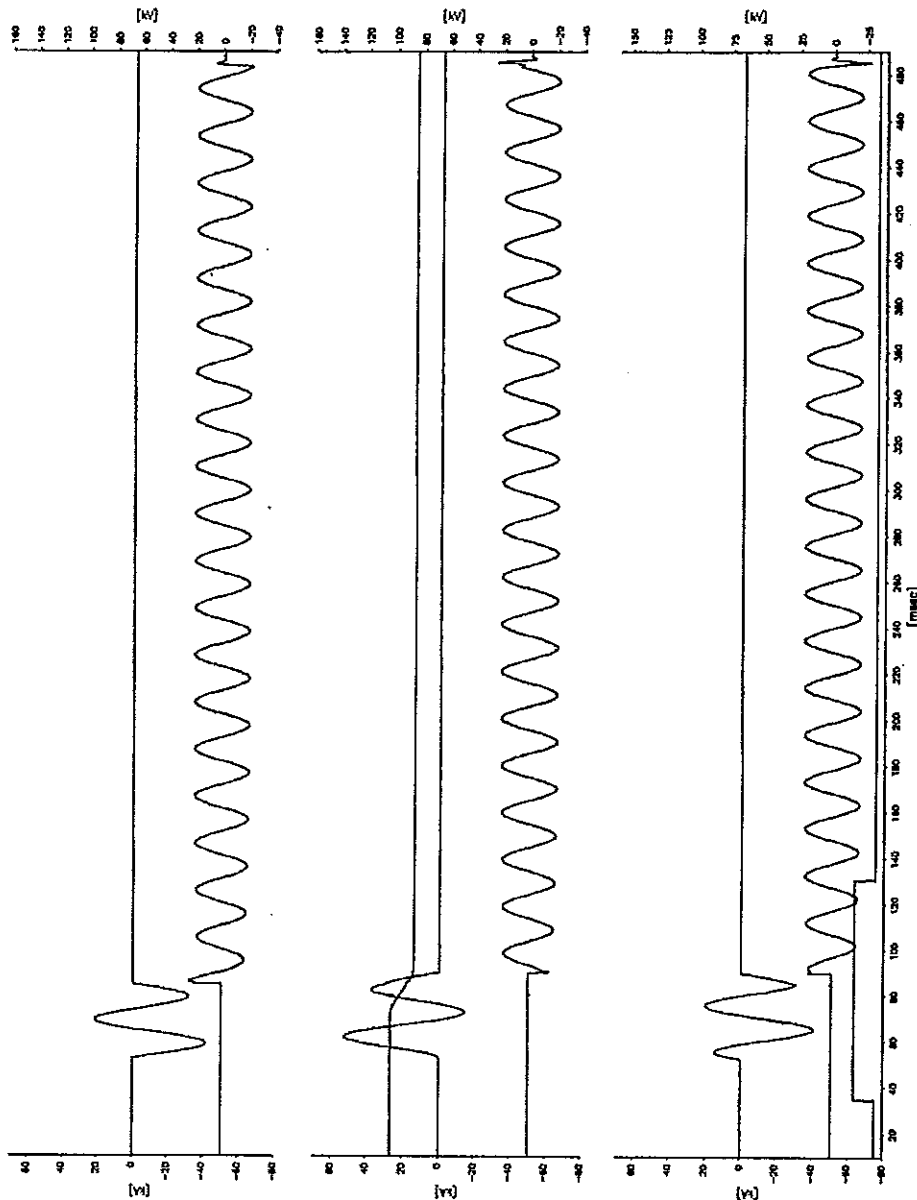
Oscillogram
PEHLA 0511Ra / 25



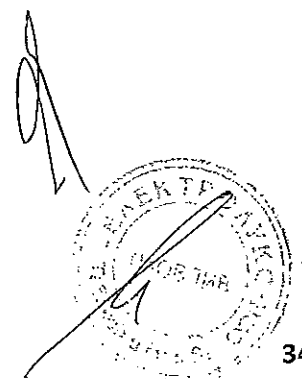
ВЯРНО С ОРИГИНАЛА
ИПЕБД.002



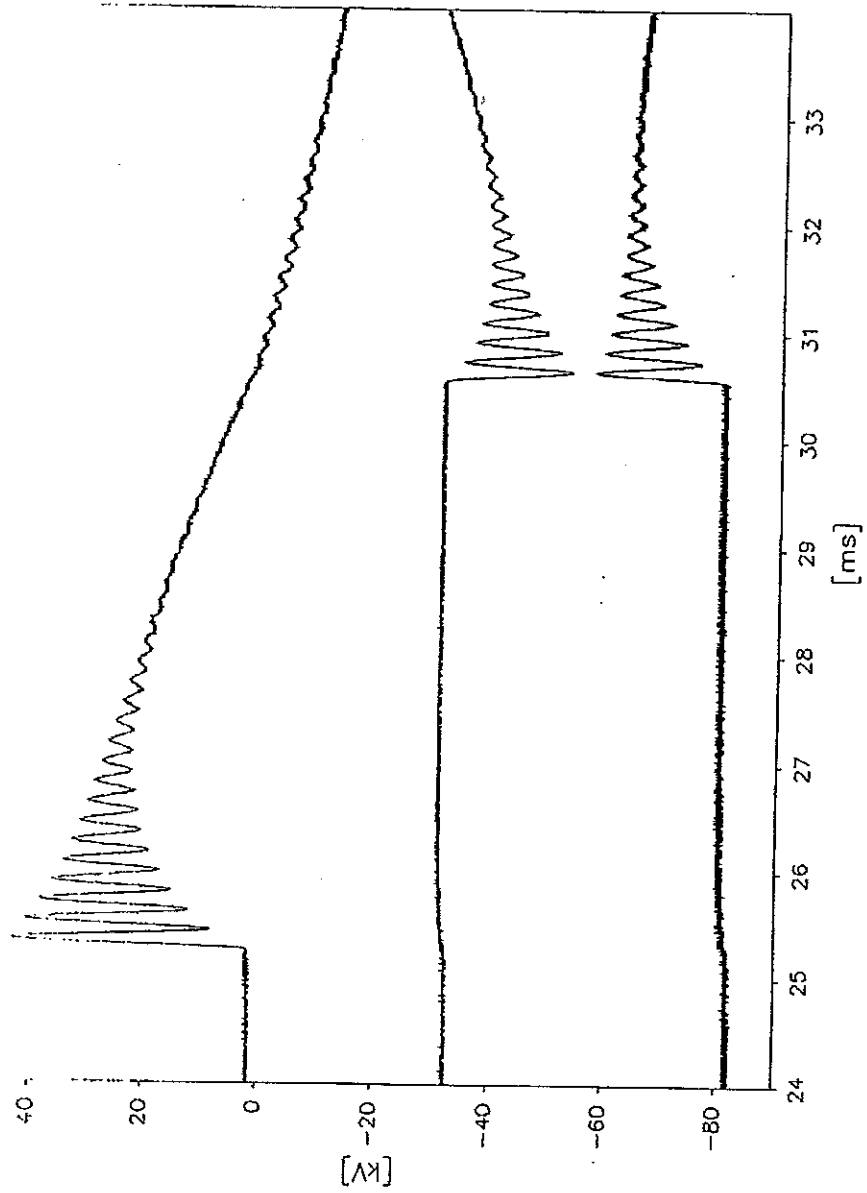
Oscillogram
PEHLA 0511Ra / 26



ВЯРНО С ОРИГИНАЛА
38PE0402



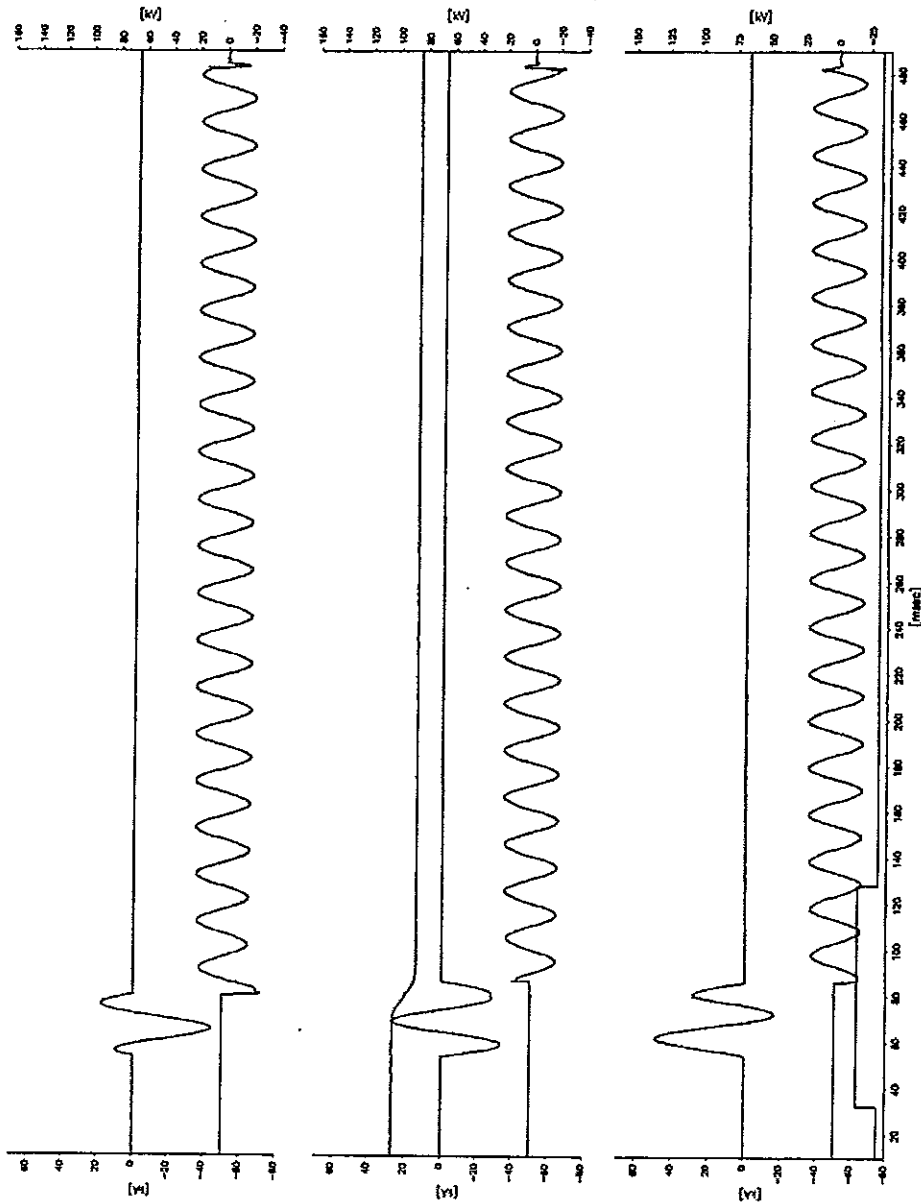
Oscillogram
PEHLA 0511Ra / 26



ВЯРНО С ОРИГИНАЛА



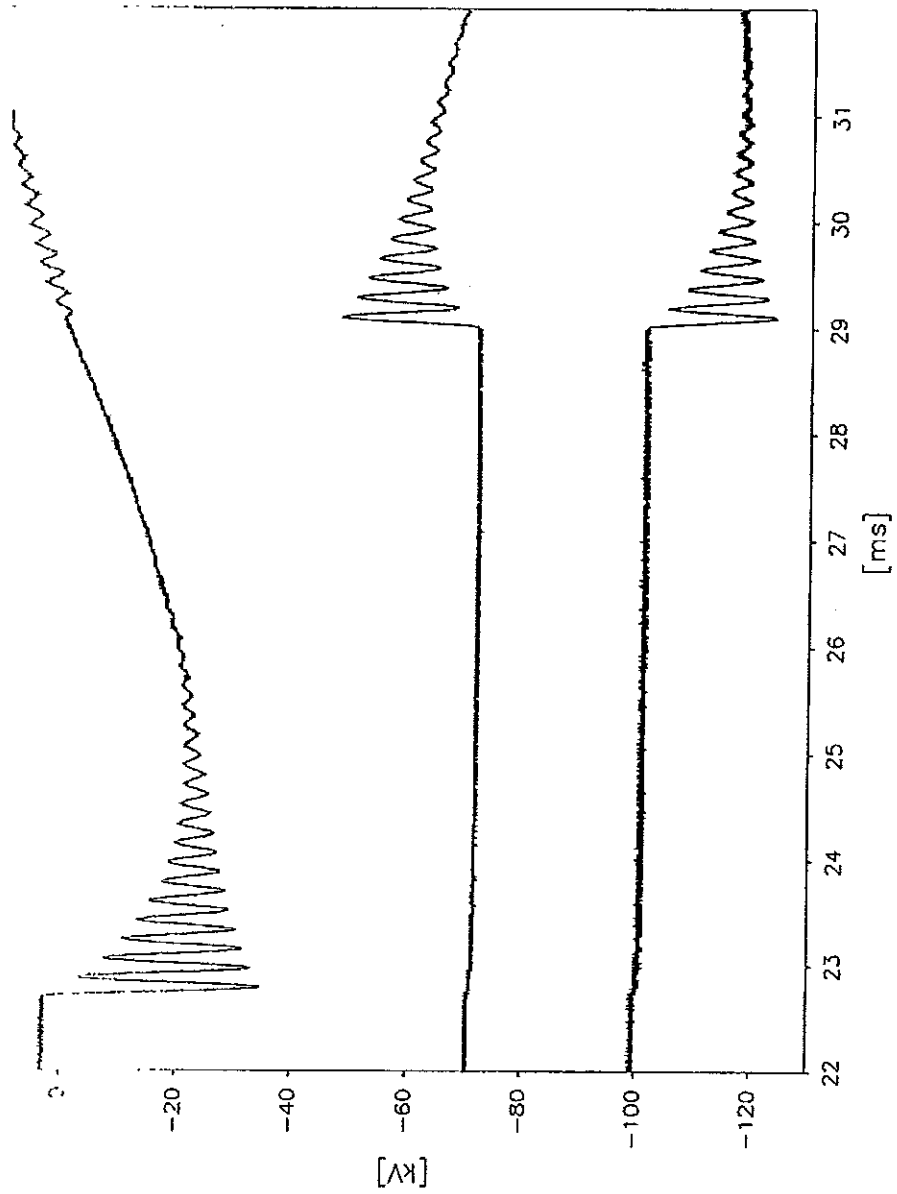
Oscillogram
PEHLA 0511Ra / 27



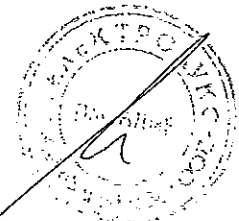
ВЯРНО С ОРИГИНАЛА



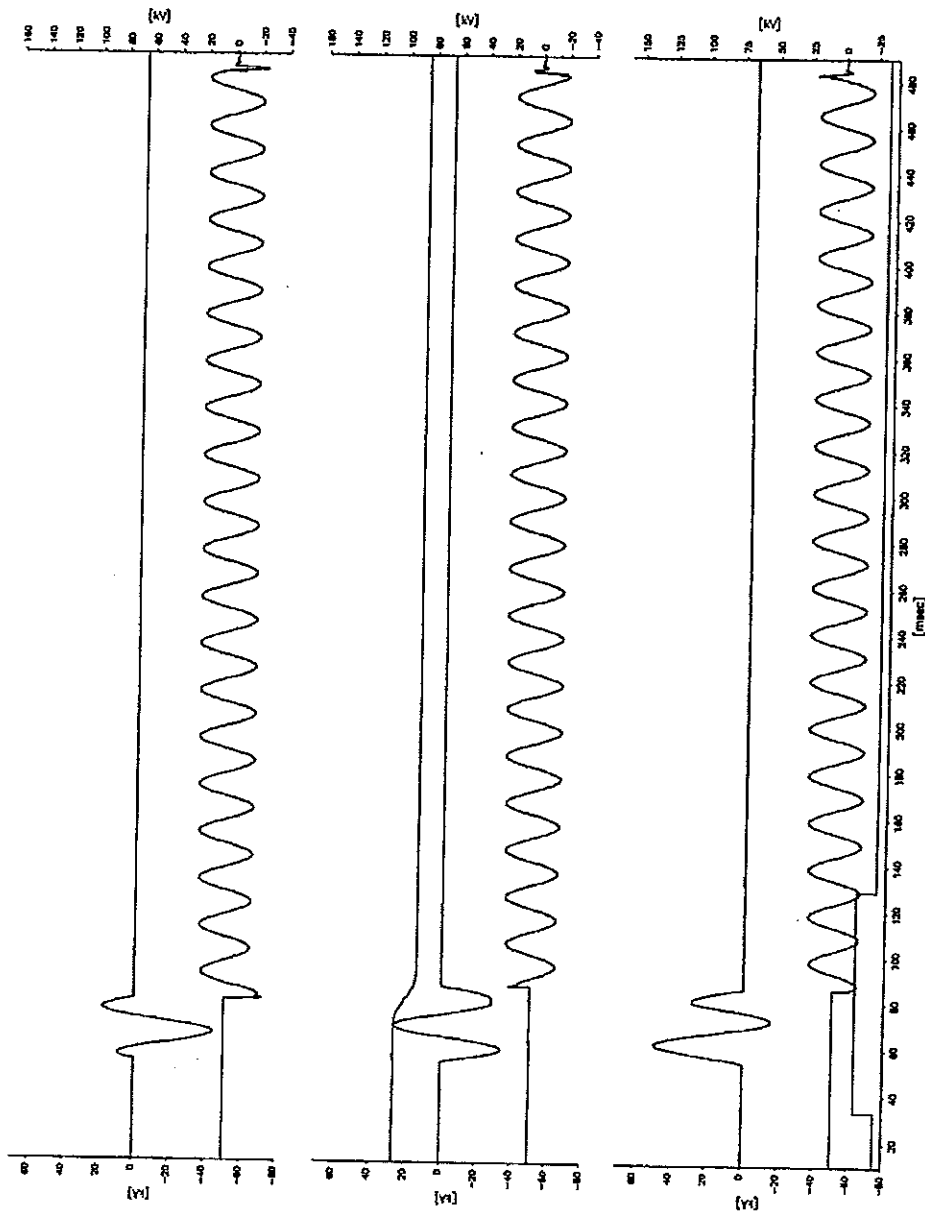
Oscillogram
PEHLA 0511Ra / 27



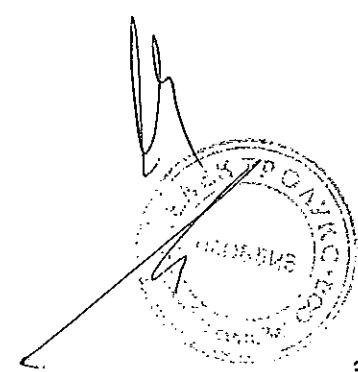
ВЯРНО С ОРИГИНАЛА



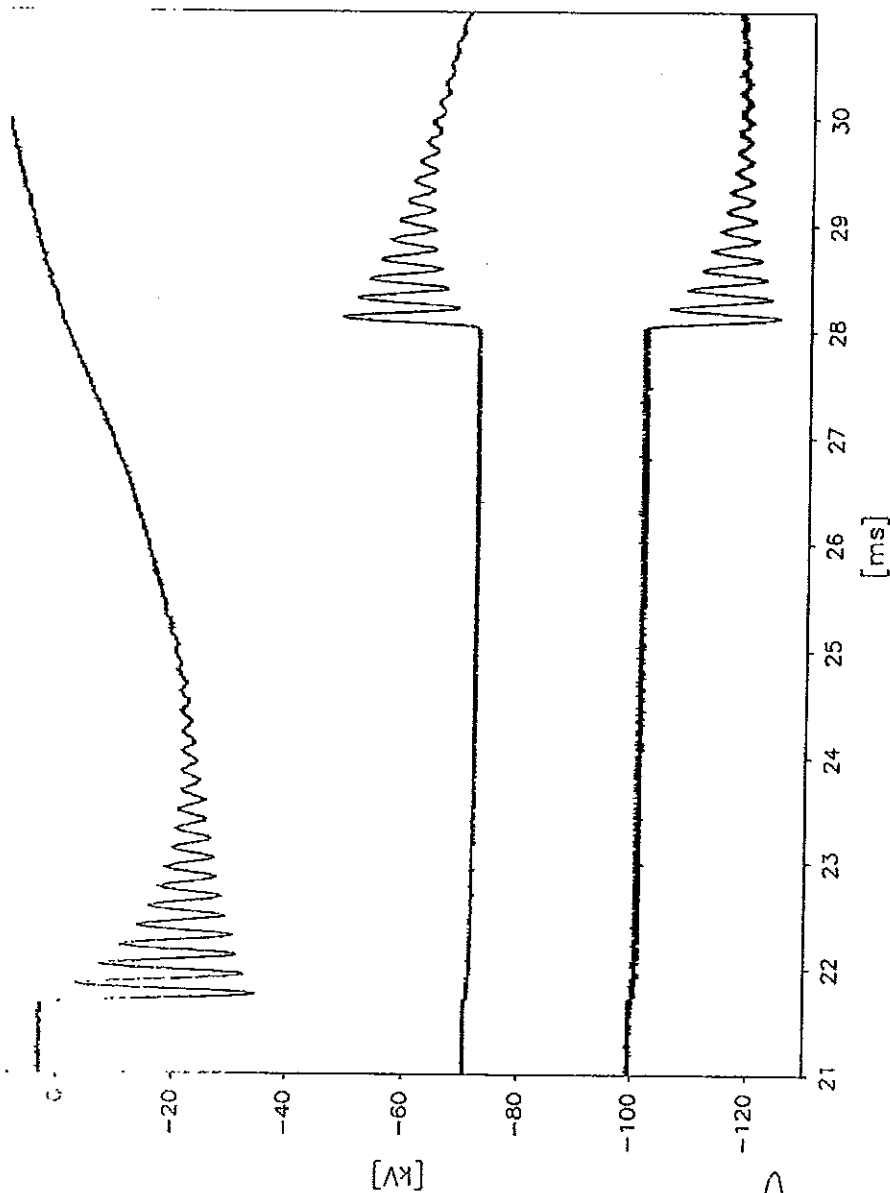
Oscillogram
PEHLA 0511Ra / 28



ВЯРНО С ОРИГИНАЛА



Oscillogram
PEHLA 0511Ra / 28



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ВЯРНО С ОРИГИНАЛА

18PE0402



Test Results

Basic Short-Circuit Making and Breaking Tests

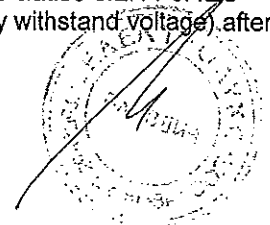
Test performed: Basic short-circuit making and breaking tests (T10)
Date of test: 10th March 2005
Condition of test object before test: As after PEHLA 0511Ra / 28.
Test arrangement: Direct test circuit, circuit-breaker in gas insulated switchgear
Connections to test object: Infeed via copper bars to the busbar connection of the switchgear, short-circuited via copper bar at the cable terminals, short-circuit point earthed via cable.

Test No. PEHLA 0511Ra			29	30	-	-	-		
Operating sequence and time intervals			O-0.3s-CO-15s-CO			-	-	-	
Applied voltage	kV		-	24.5	24.2	-	-	-	
Making current (peak)	L1	kA	-	4.02	3.6	-	-	-	
	L2	kA	-	4.85	5.2	-	-	-	
	L3	kA	-	5.48	5.3	-	-	-	
Breaking current (r.m.s.)	L1	kA	2.21	2.31	2.30	-	-	-	
	L2	kA	2.28	2.34	2.28	-	-	-	
	L3	kA	2.24	2.31	2.25	-	-	-	
	Average value	kA	2.24	2.32	2.28	-	-	-	
Recovery voltage (r.m.s.)	L1	kV	13.8	14.5	14.3	-	-	-	
	L2	kV	14.0	14.6	14.2	-	-	-	
	L3	kV	13.7	14.6	14.5	-	-	-	
Transient recovery voltage	Voltage u_1	kV	-	-	-	-	-	-	
	Time t_1	μ s	-	-	-	-	-	-	
	TRV peak value u_c	kV	46.5	48.5	44.0	-	-	-	
	Time t_3	μ s	65.0	65.0	65.0	-	-	-	
	Time delay t_d	μ s	-	-	-	-	-	-	
	Rate of rise u_c/t_3	kV/ μ s	0.715	0.746	0.677	-	-	-	
C-Operation	Voltage of closing device	V	-	94	94	-	-	-	
	Closing time	ms	-	63.4	64.4	-	-	-	
	Pre-arcing time	ms	-	-	-	-	-	-	
	Make time	ms	-	63.4	64.4	-	-	-	
O-Operation	Voltage of opening device	V	77	77	77	-	-	-	
	Opening time	ms	61.3	63.1	60.4	-	-	-	
	Arcing time	L1	ms	3.8	2.2	9.4	-	-	-
		L2	ms	9.0	7.0	9.4	-	-	-
		L3	ms	9.0	7.0	4.0	-	-	-
	Break time	ms	70.3	70.1	69.8	-	-	-	
Emission of flame/gas/oil, occurrence of NSDD			no	no	no	-	-	-	
Number of valid test			-	-	-	-	-	-	
Test result			P	P	P	-	-	-	

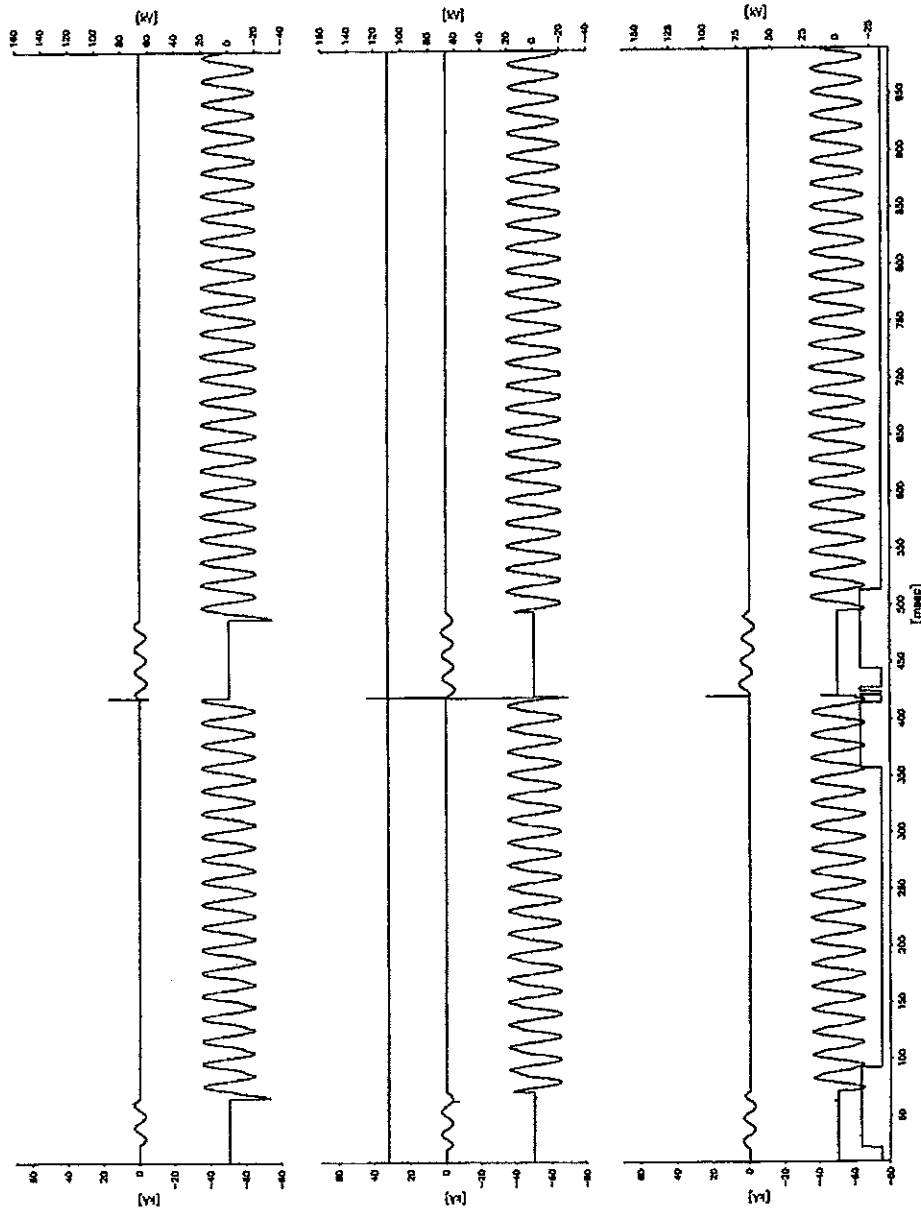
Legend: P: Passed in terms of the applied standard N: Not passed in terms of the applied standard
Remarks: PEHLA 0511Ra / 31: No-load operation

Condition of test object after test: The condition of the circuit-breaker after the test series corresponds to the conditions given in clause 6.102.9.4 of IEC 62271-100 / Ed. 1.1 / 2003-05. Visual inspection, no-load measurements before and after the test series, measurements of the resistance of the main circuit before and after the test series as well as a power frequency voltage check according to clause 6.2.11 of IEC 62271-100 / Ed. 1.1 / 2003-05 (with 80% and 100% of the rated power frequency withstand voltage) after the test series are carried out to prove the condition of the circuit-breaker.

ВЯРНО С ОРИГИНАЛА

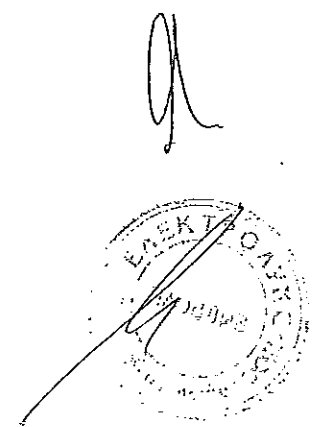


Oscillogram
PEHLA 0511Ra / 29



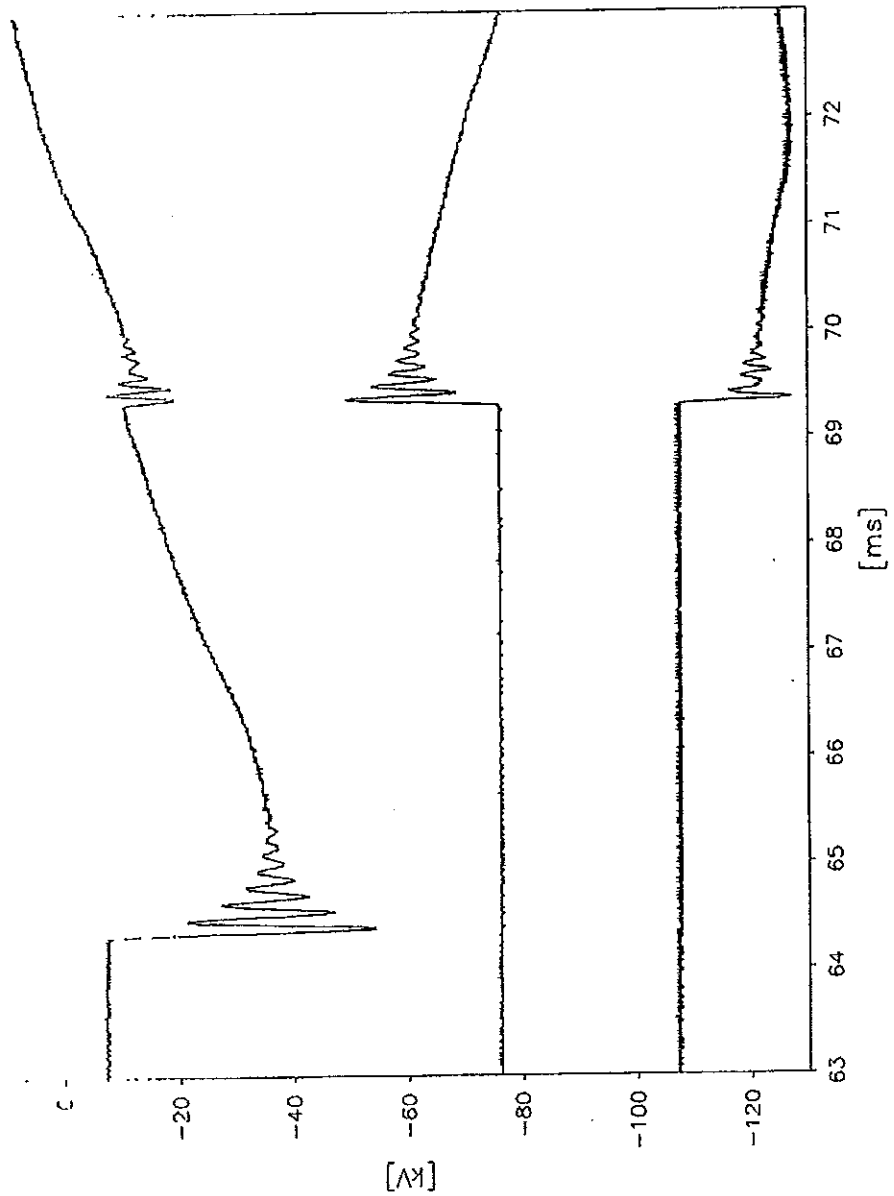
ВЯРНО С ОРГИНАЛА

18PE0402



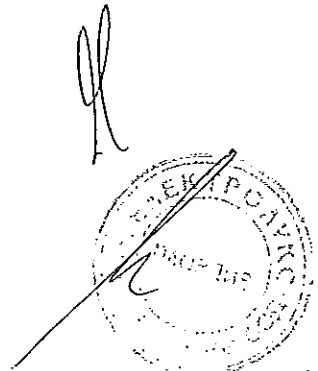
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Oscillogram
PEHLA 0511Ra / 29

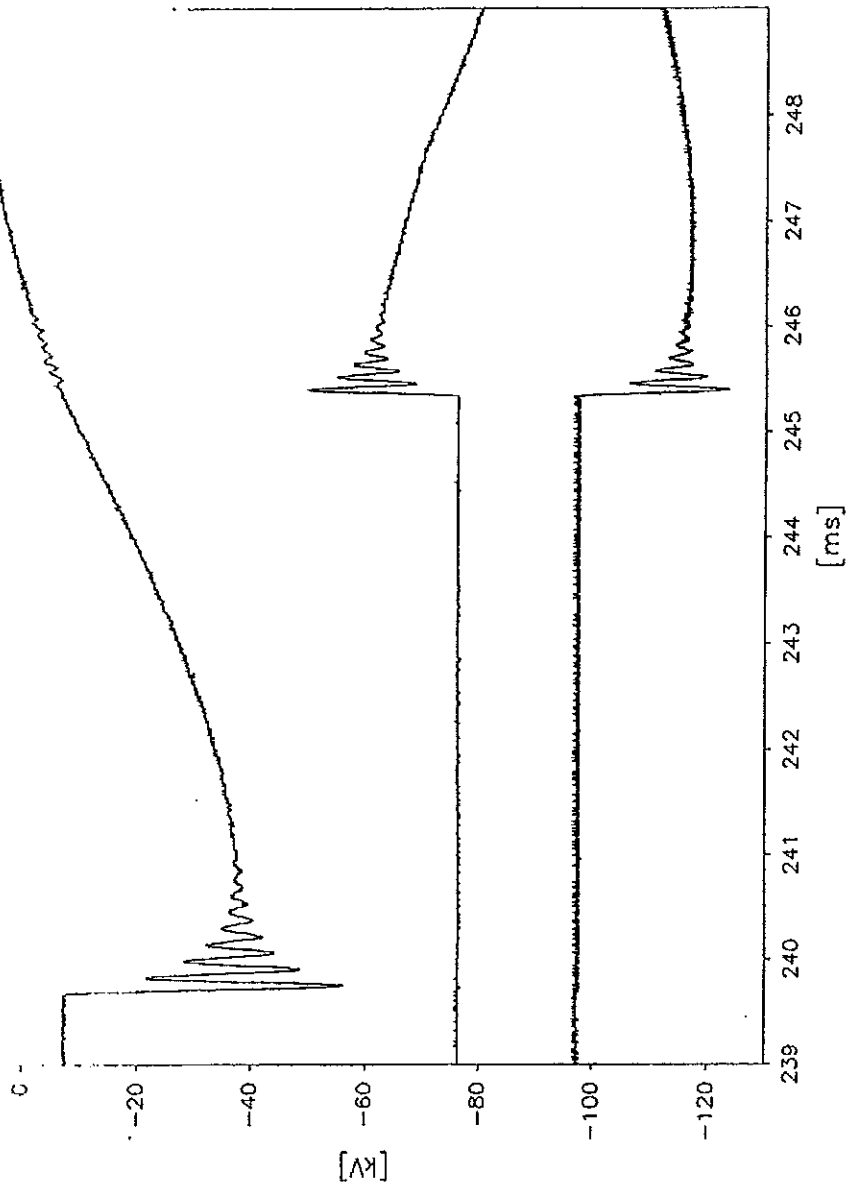


ВЯРНО С ОРИГИНАЛА

18PE0402



Oscillogram
PEHLA 0511Ra / 29

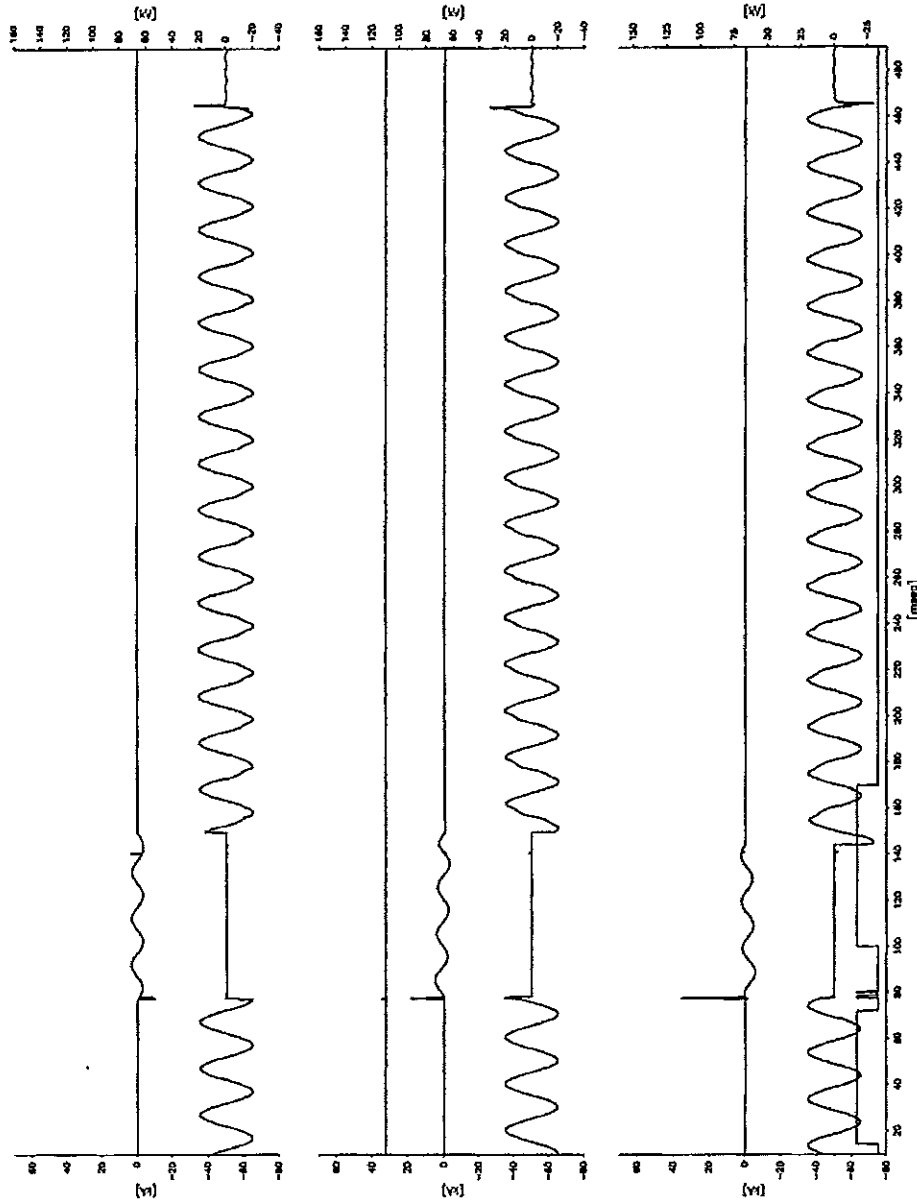


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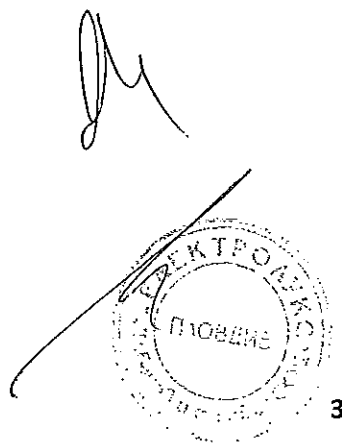
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18EE0402



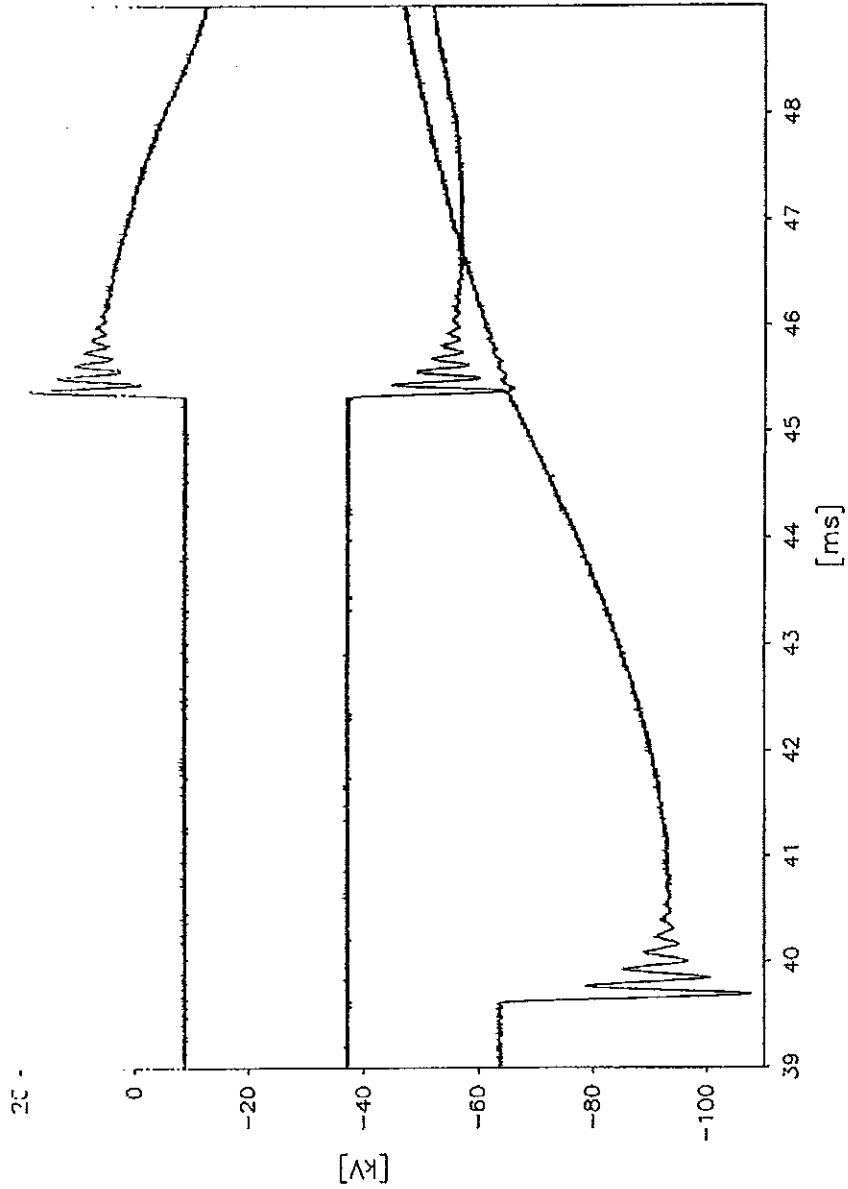
Oscillogram
PEHLA 0511Ra / 30



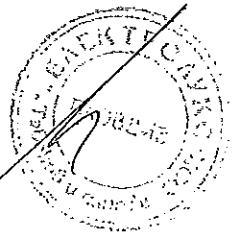
ВЕРНО С ОРИГИНАЛА



Oscillogram
PEHLA 0511Ra / 30



ВЯРНО С ОРГИНАЛА



Test Results
No-load Operations

Test performed: No-load operation
Date of test: 09th March 2005
Condition of test object before test: As after Test PEHLA 0511Ra / 05.

Test No. PEHLA 0511Ra			06		06A		06B		
Operating sequence			O – 0.3s – CO		O – 0.3s – CO		O – 0.3s – CO		
C-Operation	Voltage of closing device	V	-	110	-	121	-	94	
	Closing time	L1	ms	-	59.6	-	57.6	-	63.6
		L2	ms	-	59.8	-	57.8	-	63.8
L3		ms	-	59.6	-	57.4	-	63.4	
O-Operation	Voltage of opening device	V	110	110	121	121	77	77	
	Opening time	L1	ms	46.0	45.6	43.2	43.8	61.0	60.0
		L2	ms	45.8	45.4	43.0	43.6	60.8	59.8
L3		ms	46.0	45.6	43.2	43.8	60.8	60.0	

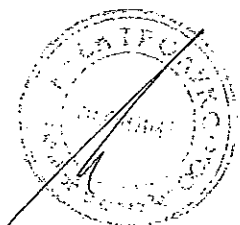
Remarks: The voltage values correspond to 100% of the rated supply voltage in Test PEHLA 0511Ra / 06, 110% in Test PEHLA 0511Ra / 06A and 70% (O) resp. 85% (C) in Test PEHLA 0511Ra / 06B.

Test performed: No-load operation
Date of test: 10th March 2005
Condition of test object before test: As after Test PEHLA 0511Ra / 30.

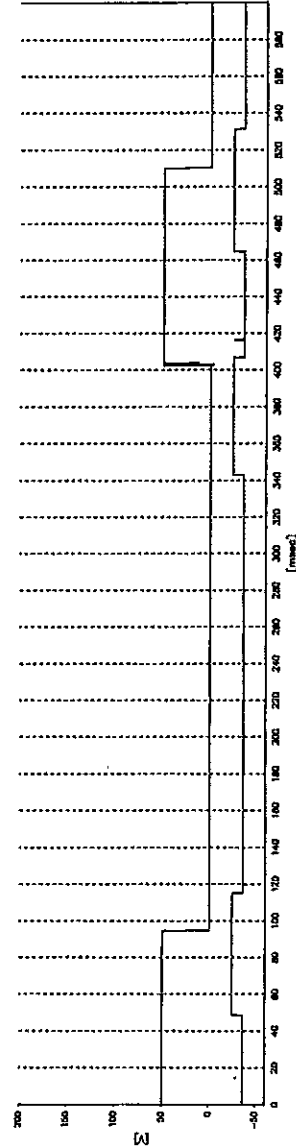
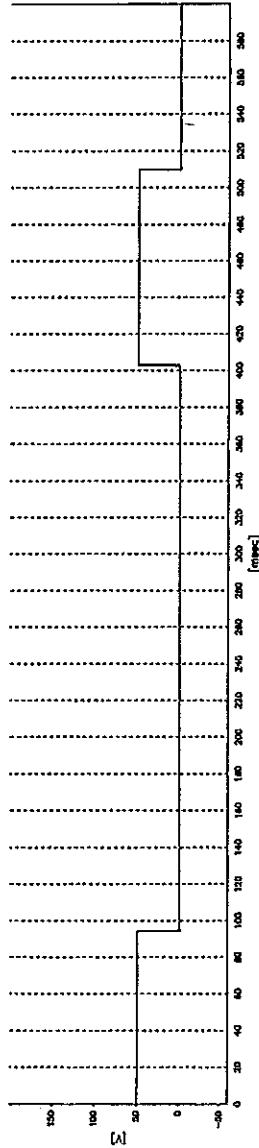
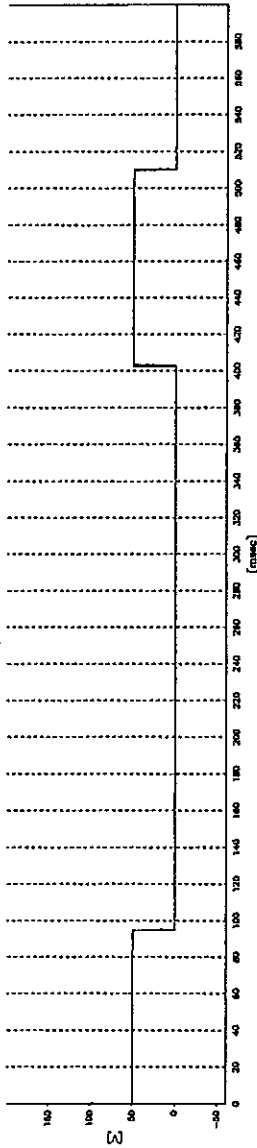
Test No. PEHLA 0511Ra			31		31A		31B		
Operating sequence			O – 0.3s – CO		O – 0.3s – CO		O – 0.3s – CO		
C-Operation	Voltage of closing device	V	-	110	-	121	-	94	
	Closing time	L1	ms	-	60.6	-	58.6	-	64.8
		L2	ms	-	60.6	-	58.6	-	64.8
L3		ms	-	60.0	-	58.0	-	64.2	
O-Operation	Voltage of opening device	V	110	110	121	121	77	77	
	Opening time	L1	ms	46.2	46.0	43.6	43.0	58.8	57.8
		L2	ms	45.8	45.6	43.2	42.6	58.4	57.2
L3		ms	46.4	46.2	43.8	43.4	59.0	58.0	

Remarks: The voltage values correspond to 100% of the rated supply voltage in Test PEHLA 0511Ra / 31, 110% in Test PEHLA 0511Ra / 31A and 70% (O) resp. 85% (C) in Test PEHLA 0511Ra / 31B.

ВЯРНО С ОРГИНАЛА



Oscillogram
PEHLA 0511Ra / 06

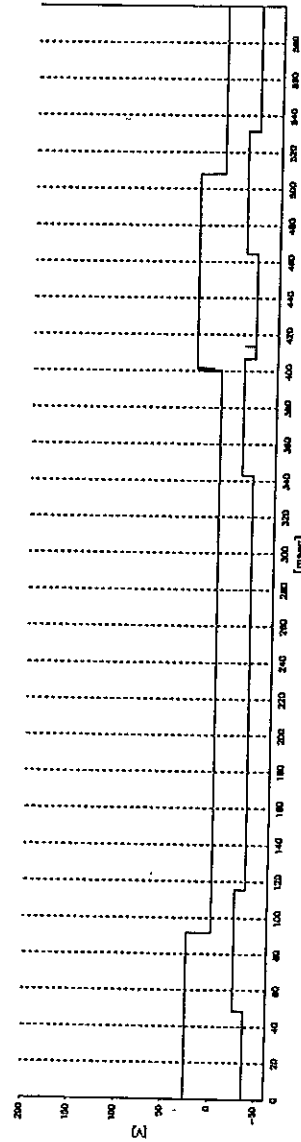
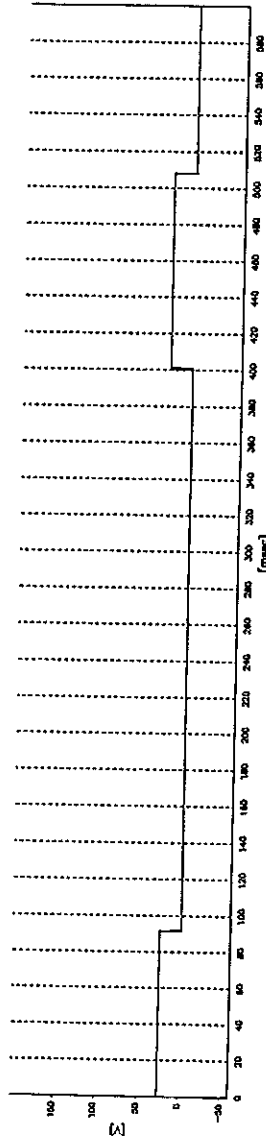
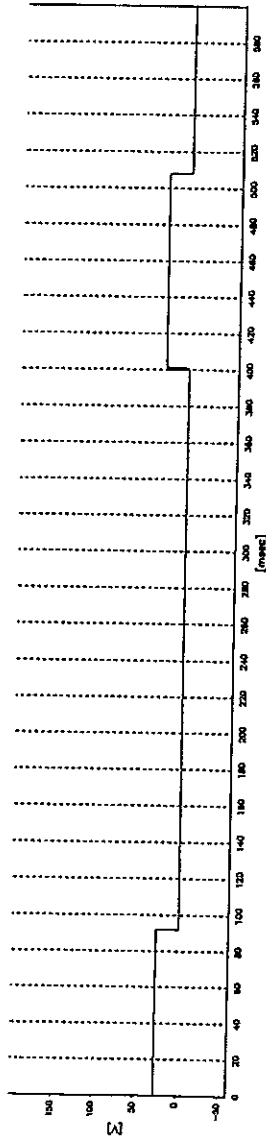


ВЯРНО С ОРИГИНАЛА

18PE0402



Oscillogram
PEHLA 0511Ra / 06A

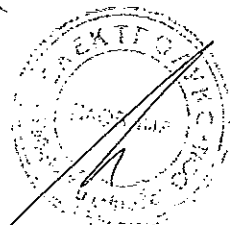


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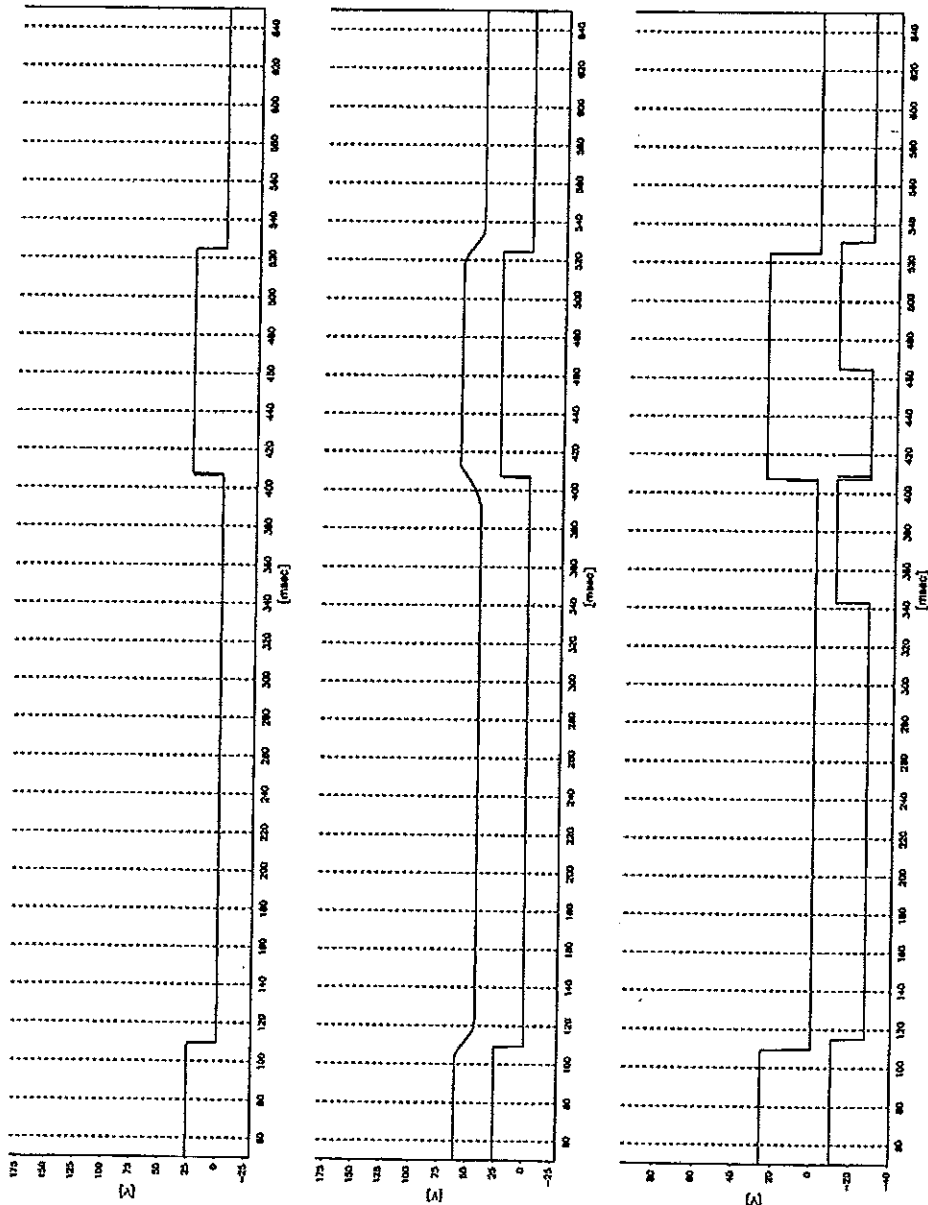
18PE0402

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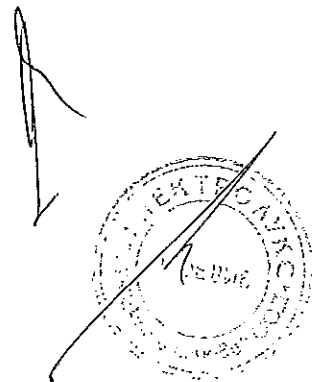
Oscillogram
PEHLA 0511Ra / 06B



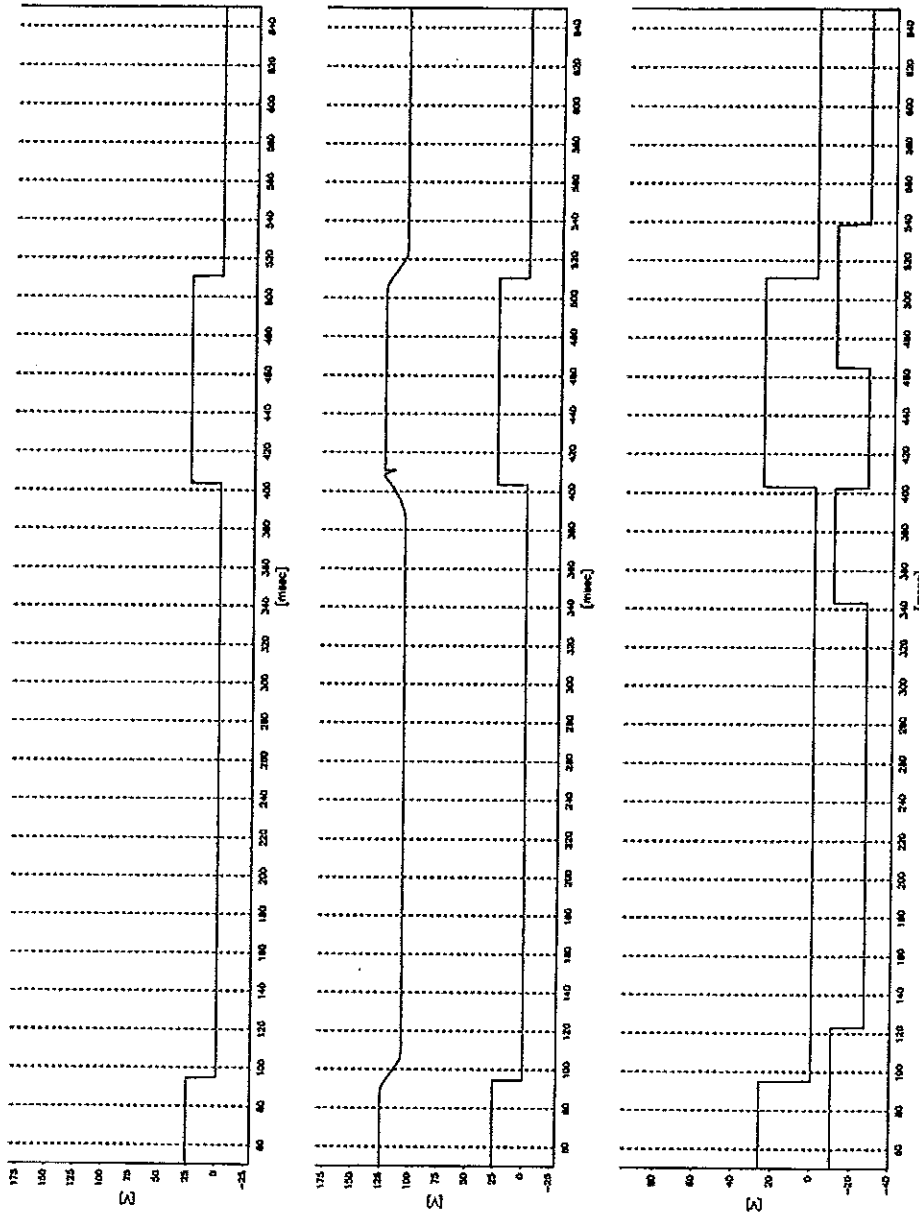
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18PE0402

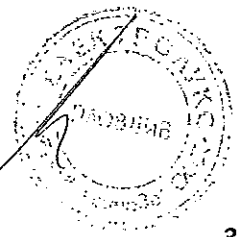
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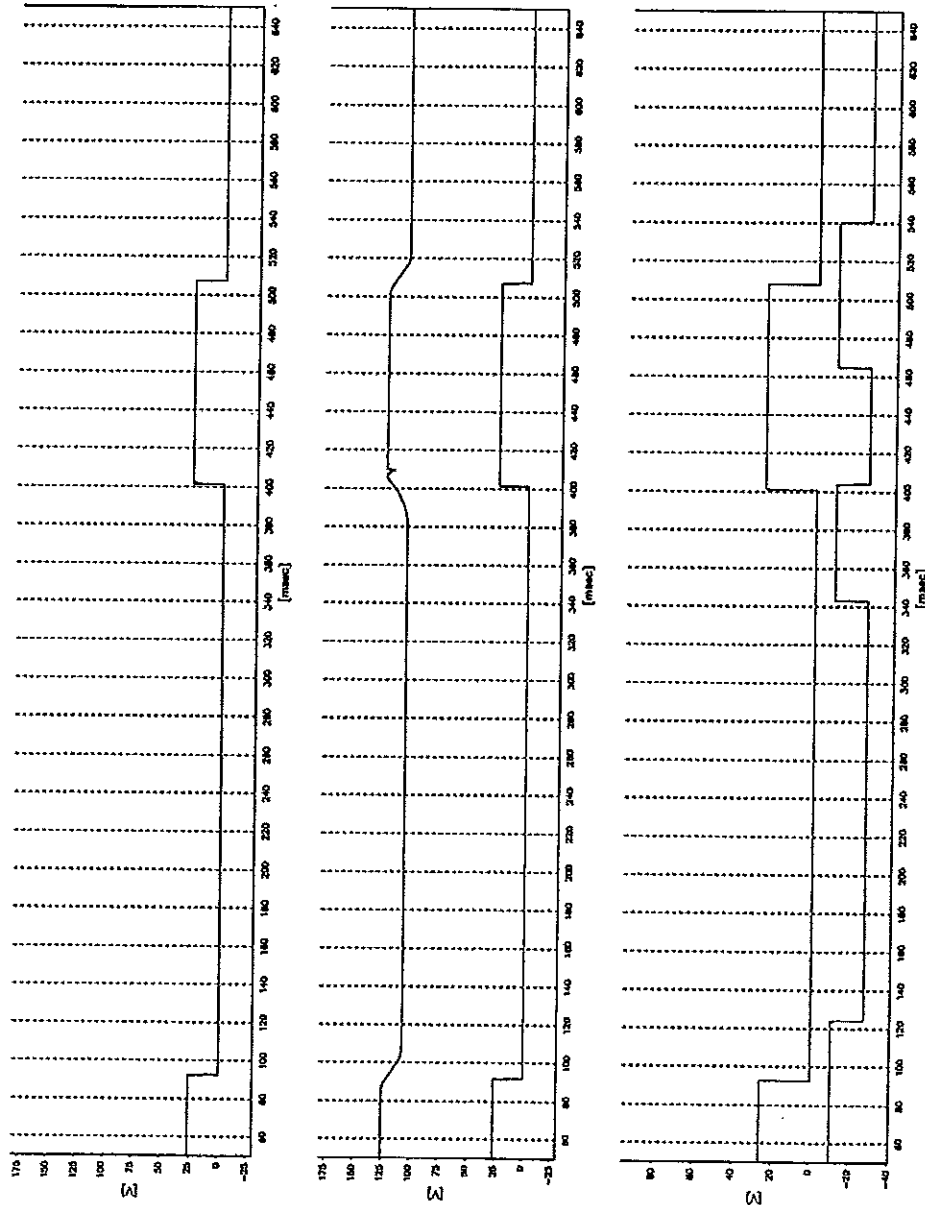
**Oscillogram
PEHLA 0511Ra / 31**



ВЯРНО С ОРИГИНАЛА



Oscillogram
PEHLA 0511Ra / 31A



ВЯРНО С ОРИГИНАЛА

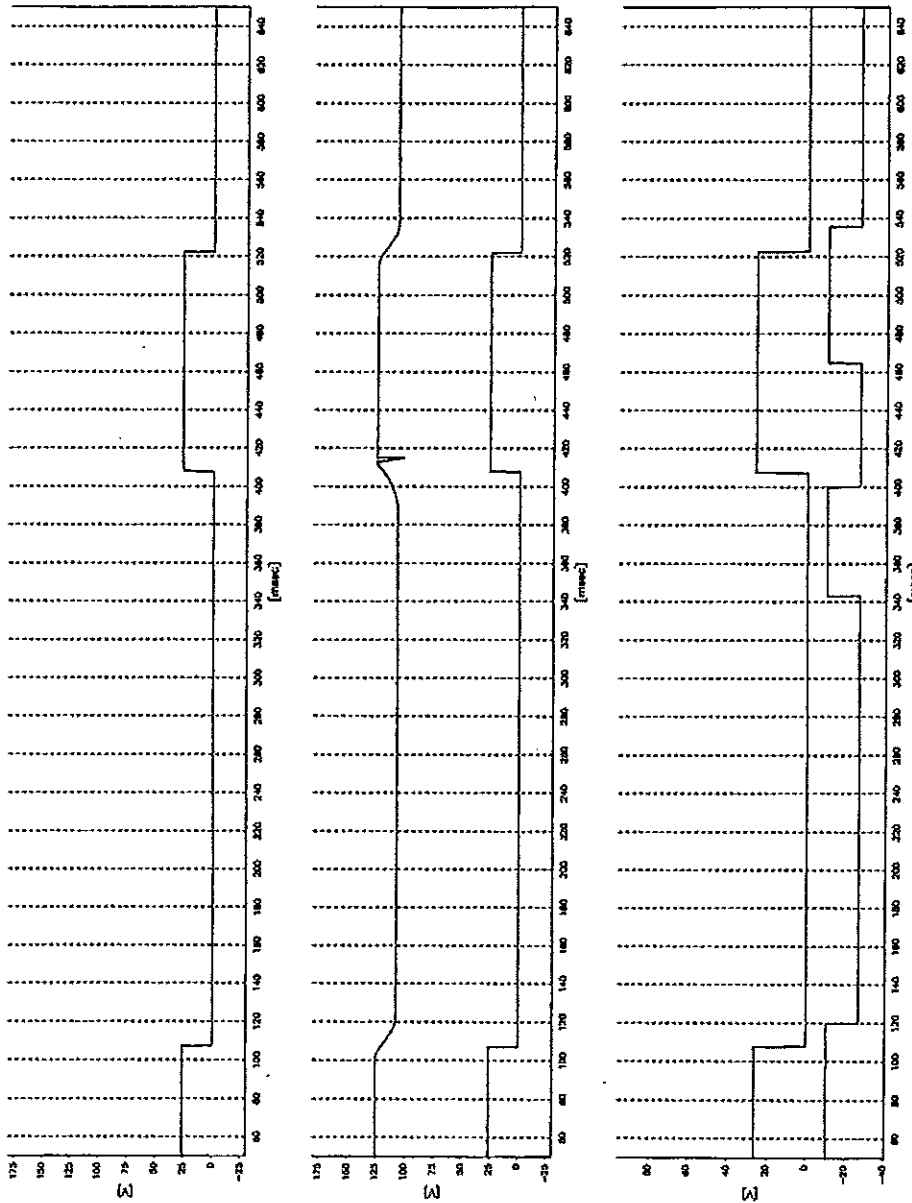
18PE0402

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[Circular stamp]

362

Oscillogram
PEHLA 0511Ra / 31B



ВЯРНО С ОРИГИНАЛА

18PE0402

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Test Results

Voltage Test as a Condition Check

Test performed: Voltage test as a condition check according to IEC 62271-100 Subcl. 6.2.11

Date of test: 10th March 2005

Condition of test object before test: As after test PEHLA 0511Ra / 31

Test arrangement: High voltage test transformer connected to the contact arms of the circuit-breaker

Connections to test object: Connection of high voltage to one contact arm of the open poles via copper wire Ø 0.5 mm, the other contact arm earthed via copper wire Ø 0.5 mm

Test arrangement			Test voltage kV	Result
Condition	Voltage applied to	Earthed		
-	-	-	40.0 – 1 min	ok
-	-	-	50.0 – 1 min	ok

Remarks: -

Condition of test object after test: No visible or functional change or damage.

ВЯРНО С ОПРИГНАЛА

58PE0402



Measurement of the Resistance of the Main Circuit

Test performed: Measurement of the Resistance of the Main Circuit

Date of test: 09th March 2005

Condition of test object: As after Test PEHLA 0511Ra / 06.

Measurement before test No. PEHLA 0511Ra / 07			
Ambient air temperature:		21.0 °C	
Resistance measurement at direct current of:		100 A (d.c.)	
Measurement between points (see sheet 70)	Resistance of the main circuit μΩ		
	L1	L2	L3
1 - 2	26.2	27.1	26.2
-	-	-	-
-	-	-	-

Remarks: -

Date of test: 10th March 2005

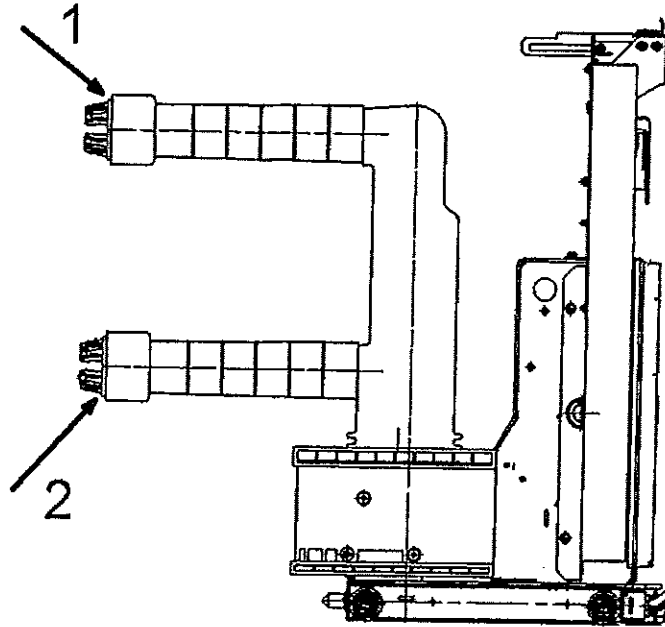
Condition of test object: As after Test PEHLA 0511Ra / 30.

Measurement after test No. PEHLA 0511Ra / 31			
Ambient air temperature:		21.0 °C	
Resistance measurement at direct current of:		100 A (d.c.)	
Measurement between points (see sheet 70)	Resistance of the main circuit μΩ		
	L1	L2	L3
1 - 2	32.2	36.8	29.7
-	-	-	-
-	-	-	-

Remarks: -

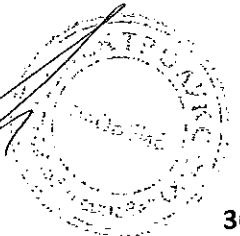
ВЯРНО С ОРИГИНАЛА

**Measurement of the Resistance of the Main Circuit
Measurement points**



ВЯРНО С ОРИГИНАЛА

33PE0402



Photos



Photo No. 01
Before Test no. PEHLA 0511Ra / 03

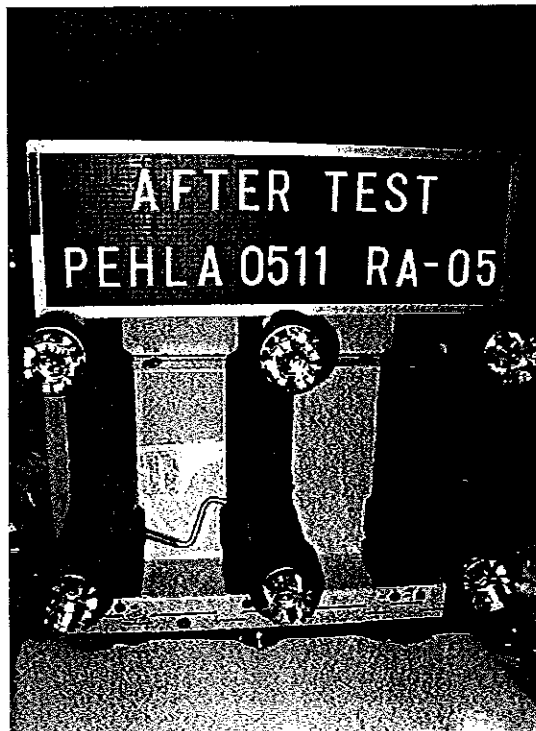
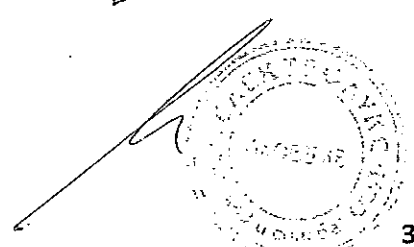


Photo No. 02
After Test no. PEHLA 0511Ra / 05

ВЯРНО С ОРИГИНАЛА

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Photos

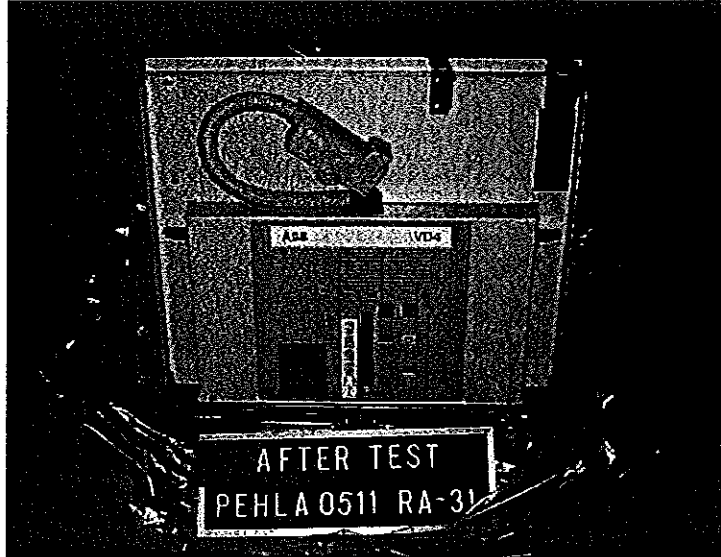


Photo No. 03
After Test no. PEHLA 0511Ra / 31

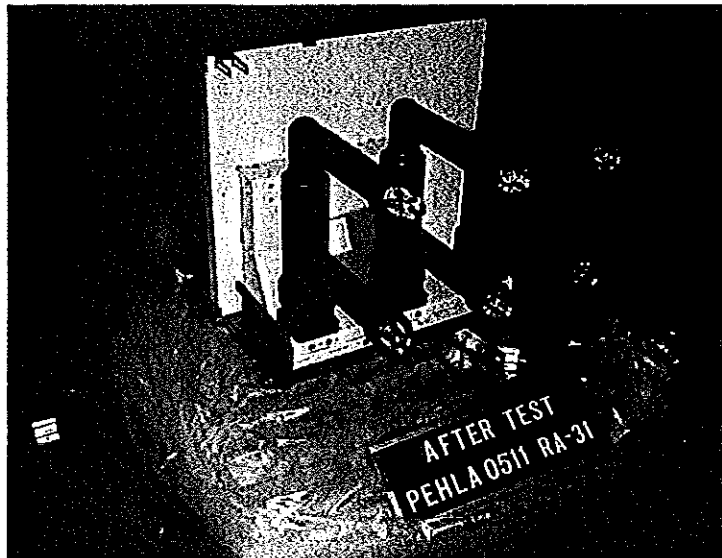
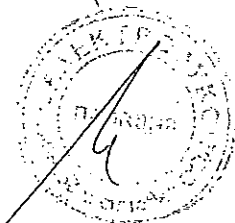


Photo No. 04
After Test no. PEHLA 0511Ra / 31

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ABB Calor Emag Laboratories



TEST REPORT No. MZ 235 A 01

Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 1

Copy-No. 02e

Test Object Metal-clad air-insulated switchgear panel from a 24 kV switchgear type ZS1.2 (T = 1000 mm), drawing-no. GCE 8010459 R0101, with withdrawable vacuum circuit-breaker type VD4 2420-25 and with earthing switch type EK6-2406-275

Ratings of the panel:

Rated voltage	U	24 kV
Rated normal current (tee-off)	I _n	1600 A
Rated frequency	f	50/60 Hz
Rated short-time withstand current	I _{th}	25 kA
Rated peak withstand current	I _p	63 kA
Rated duration of short-circuit current	t _{th}	3 s
Rated short-circuit breaking capacity at 24 kV	I _{sc}	25 kA

Manufacturer ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen / Germany

Tests performed Mechanical operation test comprising 50 operations of the vacuum circuit-breaker, 50 operations of the earthing switch, 50 manual operations of the withdrawable part and 25 insertions and 25 removals of the removable part. The interlocks of the circuit-breaker, the earthing switch, the withdrawable part and the removable part were tested in the respective position. Test procedure and test parameters were based on IEC 60298/3rd. Ed./1990/Clause 6.102

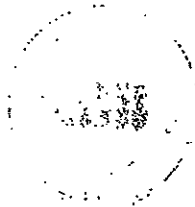
Test Specification IEC 60298/3rd. Ed./1990

Test Results All switching devices, the withdrawable part, the removable part and the mechanical interlocks passed the mechanical operation test successfully. They were in proper working order and the effort to operate them was practically the same before and after the test.

Test Date 07th September 2000

Client ABB Calor Emag Mittelspannung GmbH 40472 Ratingen / Germany

18th October 2000
Date of Issue



Kib
Laboratory Manager

Paul
Test Engineer

Total Number of Sheets: 10 Sheets

This test report refers exclusively to the object tested.
ABB Calor Emag Mittelspannung GmbH is certified according
to DIN ISO 9001 by DQS under Reg. No. 373-03

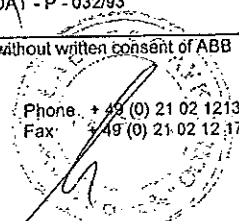
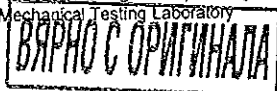
ABB Calor Emag Laboratories Ratingen are accredited according to
EN 45001 by DATech under Reg.No. DAT - P - 032/93

With the exception of the cover sheet and any subsequent sheets mentioned thereon, this document may not be partly copied without written consent of ABB Calor Emag Mittelspannung GmbH Ratingen.

ABB Calor Emag Mittelspannung GmbH Ratingen
Mechanical Testing Laboratory

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D - 40472 Ratingen

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ABB Calor Emag Laboratories



TEST REPORT No. MZ 235 A 01

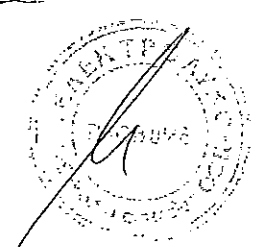
Sheet 2

Issued by an Accredited Laboratory
corresponding to EN 45001

Contents

	Sheet
Test Report - Cover Sheet	1
Test Results - Comments on Test Object	1
Contents	2
1. Technical Data of Test Objects	3
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GCE 7000162 R1104 (Withdrawable vacuum circuit-breaker) ..	7
GCE 7169312 R0118 (Earthing switch)	8
2. Test Location and Set-up	9
3. Mechanical Operation Test	10

ВЯРНО С ОРИГИНАЛА





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ABB Calor Emag Laboratories



TEST REPORT No. MZ 235 A 01

Sheet 3

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1. Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switchgear

Test Object: Metal-clad air-insulated switchgear panel from a 24 kV switchgear
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen/ Germany
Serial-No.: 7550027/2015/00 **Year of manufacture:** 2000
Drawing Nos.: GCE 8010459 R0101

Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV

Rated frequency	50/60	Hz
Rated normal current busbar	2500	A
Rated normal current circuit	1600	A

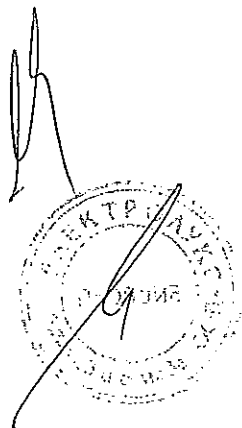
Rated peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated duration of short-circuit	3	s

Prospected values under internal-arc conditions:

Peak withstand current	63	kA
Short-time withstand current	25	kA
Short-circuit duration	3	s

Date of receipt of test object: 24th August 2000

ВЯРНО С ОРИГИНАЛА





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DAT-P-032/93

TEST REPORT No. MZ 235 A 01

Sheet 4

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corresponding to EN 45001

1. Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switching Device

Test Object: Withdrawable vacuum circuit-breaker

Type: VD4 2420-25

Vacuum interrupter: VG4S

Manufacturer: ABB Calor Emag Mittelspannung GmbH

Serial-No.: 7008269/4002/00 **Year of manufacture:** 2000

Drawing Nos.:

Withdrawable breaker:	GCE 7000162 R1104
Operating mechanism:	GCE 7179610 R0104
Pole part:	GCE 7005757 R0122
Interrupters:	GCE 7005535 R0102
Pole Centres:	275 mm

Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV

Rated frequency	50/60	Hz
Rated normal current	2000	A
Rated short-circuit breaking current	25	kA
Rated short-circuit making current	63	kA
DC-component	30	%
Pole factor	1.5	--

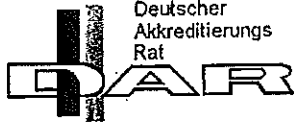
Rated peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated duration of short-circuit	3	s
Rated operating sequence	O-0,3s-CO-3min-CO	
Rated times of circuit-breaker:		
- opening time	≤ 45	ms
- closing time	approx. 60	ms

Number of poles	3
Number of units per pole	1

Date of receipt of test object: 24th August 2000

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DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. MZ 235 A 01

Sheet 5

Issued by an Accredited Laboratory
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1. Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switching Device

Test Object: Earthing switch

Type: EK6-2406-275

Manufacturer: ABB Calor Emag Mittelspannung GmbH

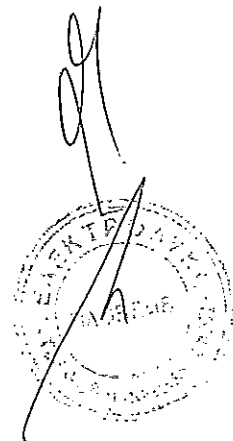
Serial-No.: 06/052/00 **Year of manufacture:** 2000

Drawing Nos.: Earthing switch: GCE 7169312 R0118
Pole Centres: 275 mm

Rated voltage	24	KV
Rated lightning impulse withstand voltage	125	KV
Rated power frequency withstand voltage	50	KV
Rated short-circuit making current	63	KA
Rated peak withstand current	63	KA
Rated short-time withstand current	25	KA
Rated duration of short-circuit	3	s

Date of receipt of test object: 24th August 2000

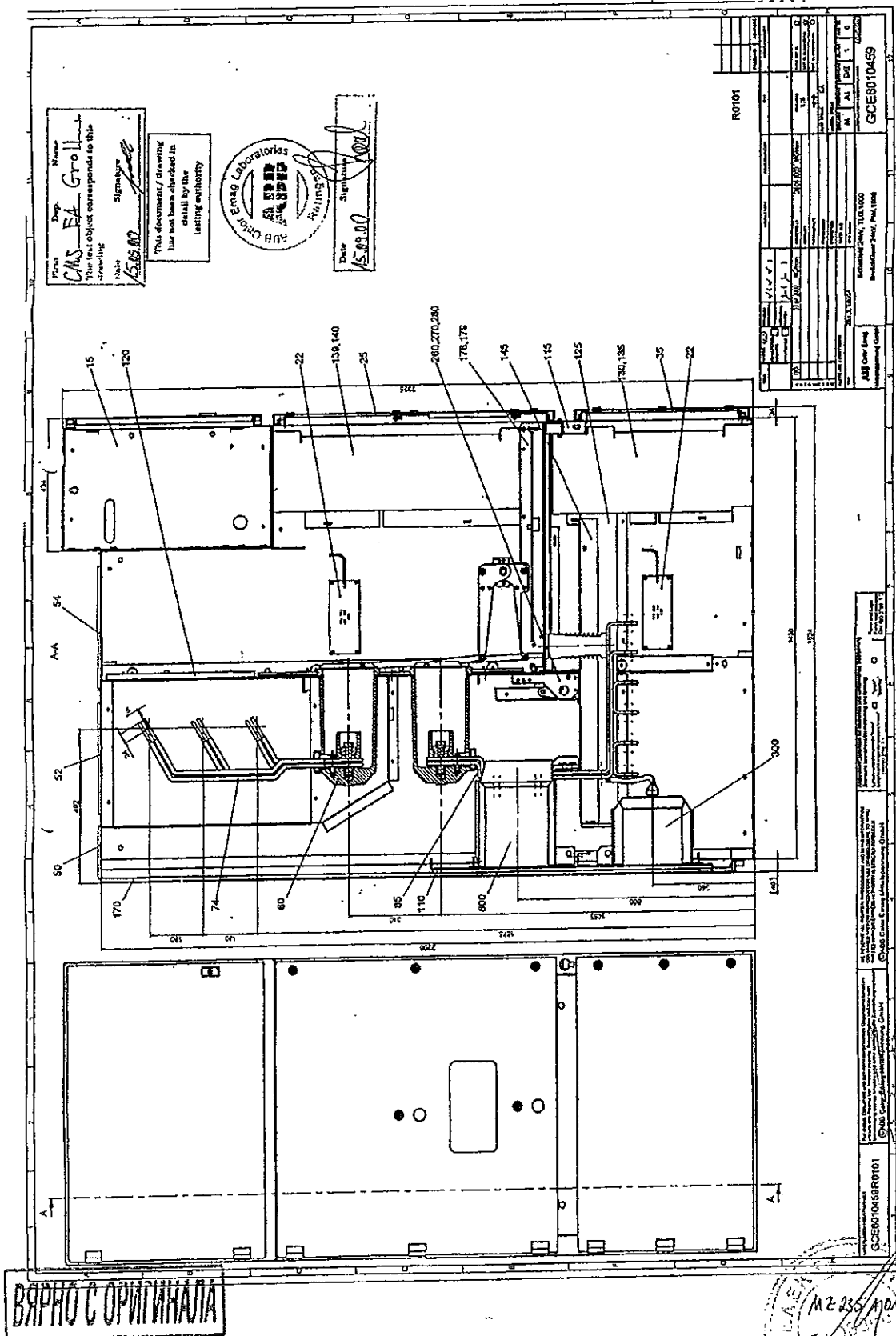
ВЯРНО С ОРИГИНАЛА



Reg.-Nr.
DAT-P-032/93

TEST REPORT No. MZ 235 A 01
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 6



Prüfer
CAS EA Groll
Name
The object corresponds to this
drawing
Date
15.09.00
Signature

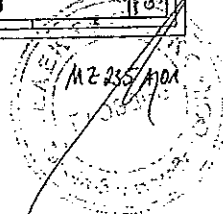
This document / drawing
has not been checked in
detail by the
testing authority



Date
15.09.00
Signature

ABB Calor Emag Laboratories GmbH Schwanenweg 2, TIA 1000 Biberach an der Donau, P.O. Box 1000 72074 Biberach, Germany Tel: +49 7141 23-1333 Fax: +49 7141 23-1334 E-Mail: ABB.Lab@ABB-EMAG.com	
Report No. GCE9010459	Revision 1.0
Date 15.09.00	Drawn by EA
Checked by EA	Approved by EA
Test No. 13	Test Date 15.09.00
Test Location 13	Test Equipment 13
Test Operator EA	Test Witness EA
Test Result 13	Test Conclusion 13

ABB Calor Emag Laboratories GmbH
Schwanenweg 2, TIA 1000
Biberach an der Donau, P.O. Box 1000
72074 Biberach, Germany
Tel: +49 7141 23-1333
Fax: +49 7141 23-1334
E-Mail: ABB.Lab@ABB-EMAG.com



2. Test Locations and Set-up

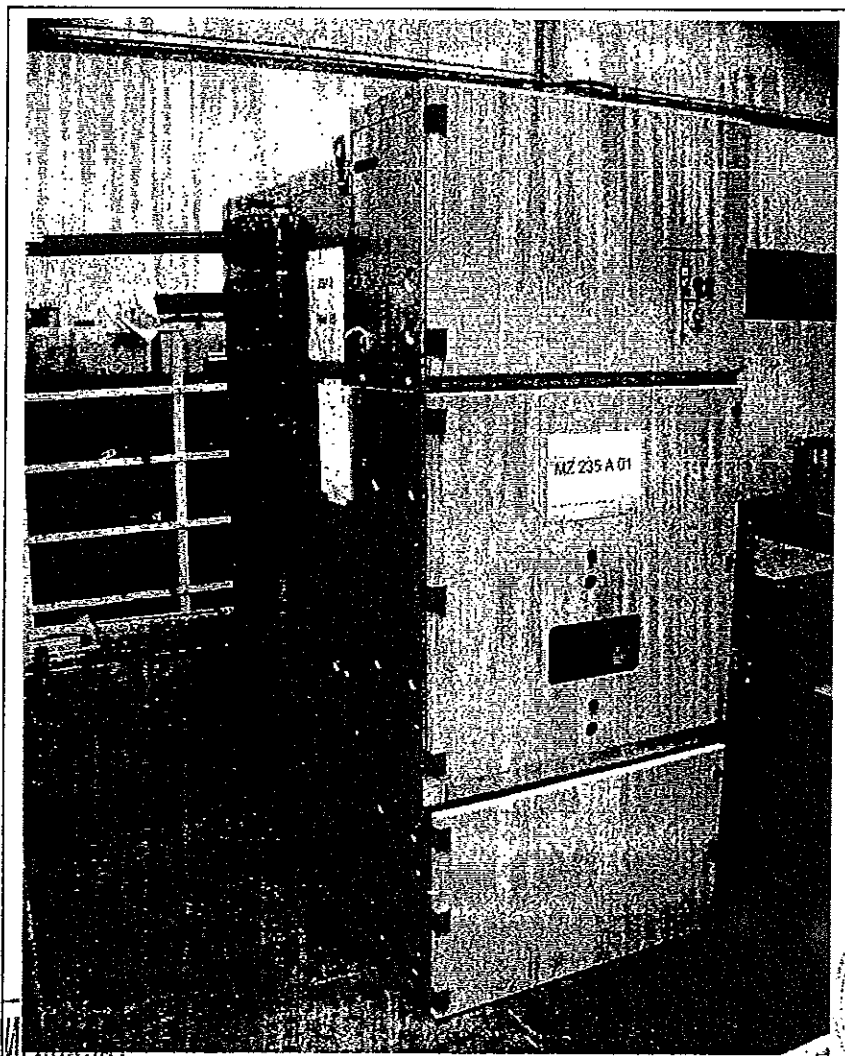
The test was performed in the Mechanical Testing Laboratory

of ABB Calor Emag Mittelspannung GmbH
Dept. LM in Ratingen

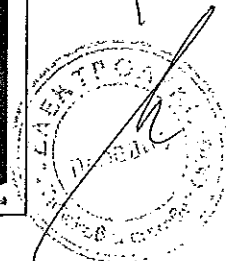
at an ambient temperature of approx. 20°C.

Test job no.: 7550027_024A

Test engineer: Koal



ВЯРНО С ОРИГИНАЛА



3. Mechanical Operation Test

List of interlocks:

1. Withdrawable part in test-position
 - Circuit-breaker ON: prevented to move the withdrawable part in service-position
2. Withdrawable part in service-position
 - Circuit-breaker ON: prevented to move the withdrawable part in test-position
3. Withdrawable part between service and test position:
 - prevented to switch ON the circuit-breaker
4. Withdrawable part in test-position
 - Circuit-breaker OFF and earthing switch ON: prevented to move the withdrawable part in service-position
5. Withdrawable part in test-position
 - circuit-breaker ON and earthing switch ON: prevented to move the withdrawable part in service-position
6. Withdrawable part not in test-position
 - prevented to switch ON the earthing switch
7. Withdrawable part not in test-position
 - prevented to remove the removable part

All the above mentioned interlocks were checked. For this the circuit-breaker, the earthing switch and the withdrawable part were operated 50 times and the removable part was removed and inserted 25 times.

ВЯРНО С ОРИГИНАЛА



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the Short-Circuit-Testing Liaison (STL)

Test Report

Report No.: 0311 Ra Copy No.: 1 Contents: 24 Sheets

Equipment under test: Vacuum circuit-breaker type VD4 24.12.20

Manufacturer:

Circuit-breaker: ABB SACE T.M.S. S.p.A., 4 - 24044 Dalmine (BG), Italy

Pole parts inclusive

vacuum interrupters: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen, Germany

Client: ABB T&D SpA, Divisione Sace T.M.S, 4 - 24044 Dalmine (BG), Italy

Testing station: PEHLA - Testing Laboratory Ratingen

Date of test: 03rd February 2003 - 24th February 2003

Applied test specifications:

IEC 62271-100, 1st Ed, 2001-05, clause 6.101.1 and 6.101.2

IEC 60694, Ed.2.2, 2002-01

Tests performed:

In accordance with the requirements of class M2, 10 000 mechanical operating cycles without voltage on or current in the main circuit were carried out with the vacuum circuit-breaker of type VD4 24.12.20 to demonstrate the mechanical reliability.

Test results:

No changes impairing the function of the circuit-breaker were noted after the endurance test.
The vacuum circuit-breaker type VD4 24.12.20 passed the mechanical type test successfully.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN



[Signature]
Technical Committee

Mannheim, 24th February 2003

The test results relate only to the items tested.

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Accreditation

The PEHLA-Testing Laboratory Ratingen has been approved by the DATech (German accreditation body for technology) according to DIN EN ISO/IEC 17025 for tests in the field of high-voltage switchgear and controlgear and power engineering equipment (Registration-No. DAT-P-032/93).

Under reference to DIN EN ISO/IEC 17025 PEHLA states the following:

- The accreditation of the PEHLA-Testing Laboratory or any of its test reports by themselves in no way constitute or imply product approval by DATech or any other body.
- If someone refers to a test in an accredited PEHLA-Testing Laboratory this reference shall include the accreditation body, i.e. DATech, the relevant scope of the accreditation and the appropriate registration number.

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PEHLA-Documents**A Certificate**

is issued for type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test.

For these tests the equipment under test must be clearly identified by technical description, drawings and additional specifications.

A Test Document

is issued for parts of type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of test.

For these tests the equipment under test must be clearly identified by technical description, drawings and additional specifications.

A Test Report

is issued for all other tests which have been carried out according to specifications, standards or "PEHLA-Richtlinien" (PEHLA Guides) and/or clients instructions.

Similarly, this test report contains all test results, details of the conditions under which the tests were carried out, also details relating to the behaviour of the equipment during test, and its condition after the tests.

Addresses:

Office: PEHLA-Geschäftsstelle
Hallenweg 40
68219 Mannheim; Germany

Testing Station: PEHLA-Testing Laboratory Ratingen
Oberhausener Str. 33
40472 Ratingen; Germany

Manufacturer: ABB SACE T.M.S. S.p.A.
Via Friuli
4 - 24044 Dalmine (BG), Italy

ABB Calor Emag Mittelspannung GmbH
Oberhausener Str. 33
40472 Ratingen, Germany

Client: ABB SACE T.M.S. S.p.A.
Via Friuli
4 - 24044 Dalmine (BG), Italy

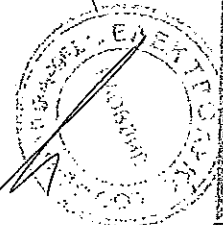
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List of Test Participants

Representatives of the Test Committee:

Mr. G. Heit	PEHLA-Testing Laboratory Mannheim
Mr. U. Köster	PEHLA-Testing Laboratory Ratingen

Test Operator:

Mr. M. Schöttler	PEHLA-Testing Laboratory Ratingen
Mr. J. Mendorf	PEHLA-Testing Laboratory Ratingen
Mr. A. Piglas	PEHLA-Testing Laboratory Ratingen

Representatives of the Client:

Mr. S. Magoni	ABB SACE T.M.S. S.p.A., Italy
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Technical Data of Test Object

Switching Device – Circuit-Breaker

Ratings assigned by the manufacturer

Test Object: Vacuum circuit-breaker
Type: VD4 24.12.20
Manufacturer:
 Circuit-breaker: ABB SACE T.M.S. S.p.A., 4 – 24044 Dalmine (BG), Italy
 Pole parts including vacuum interrupters: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen, Germany
Serial-No.: AD00003052 **Year of manufacture:** 2003
Drawing No.: TN. 7410 (circuit-breaker)
Vacuum interrupter: Type: VG4, L1: No. 1154/3, L2: No. 1135/3, L3: No. 0288/3
Drawing No.: GCE 7004730R0105 (pole part)

Rated voltage	24 kV
Rated lightning impulse withstand voltage	125 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	50 kV
Rated frequency	50 Hz
Rated normal current	1250 A
Rated peak withstand current	50 kA
Rated short-time withstand current	20 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current at 12 kV	20 kA
D.C. component	30 %
Rated short-circuit making current at 12 kV	50 kA
Rated transient recovery voltage:	
Peak value	20.6 kV
Rate of rise	0.34 kV/μs
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3s-CO-3min-CO
Arc extinguishing medium	vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	≤ 45 ms
Rated closing time	approx. 60 ms
Rated voltage of trip coil	110 V-DC
Rated voltage of closing coil	110 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz

Essential characteristics and installed devices:

The circuit-breaker was not equipped with the auxiliary switch BS2 for the spring-charged-signal.
 Motor Drive Type 701 921/803, Serial No. CA2 7GL 02 C (EL1).

Date of receipt of test object: 3rd February 2003

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List of Drawings

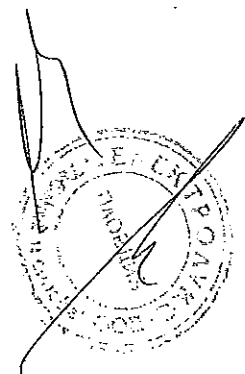
The manufacturer has guaranteed, that the equipment submitted for test has been manufactured in full accordance with the following drawings. PEHLA has verified that these drawings adequately represent the equipment tested. These drawings have been stamped and signed by PEHLA representatives and are kept

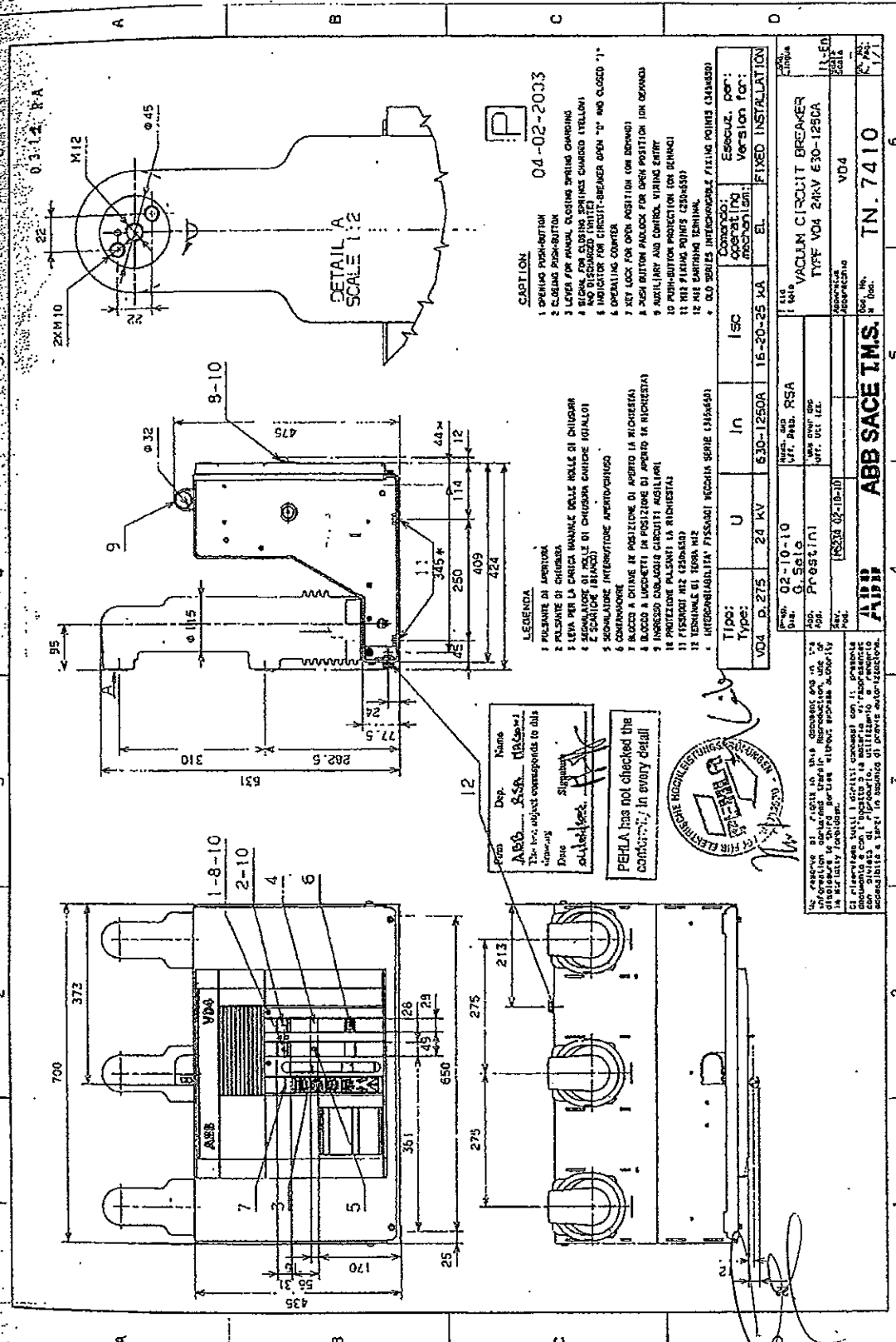
- with the test documents at the test laboratory.
- at the client.

The drawings contained in this document are identical with the checked, stamped and signed drawings.

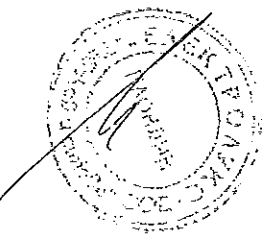
Drawing-No.	Revision	Title	Additional remarks
TN 7410	M5234 02-10-10	Vacuum Circuit Breaker Type VD4 24kV 630-1250A	Included in test report
510507	50538 02-12-13	Assieme Comando Operating Mechanism Assembly	Included in test report
GCE7004730	09	Pol vst. VD4P 24kV 1250A Pole complete VD4P 24kV 1250A	Included in test report
Parts list			
510564		Ass. molle di ch. com. EL1	—
510507		Assieme comando EL1	—
GCE7004730R0104		Pol vst. 40,7 2400N H310 2412-20 VG4	—

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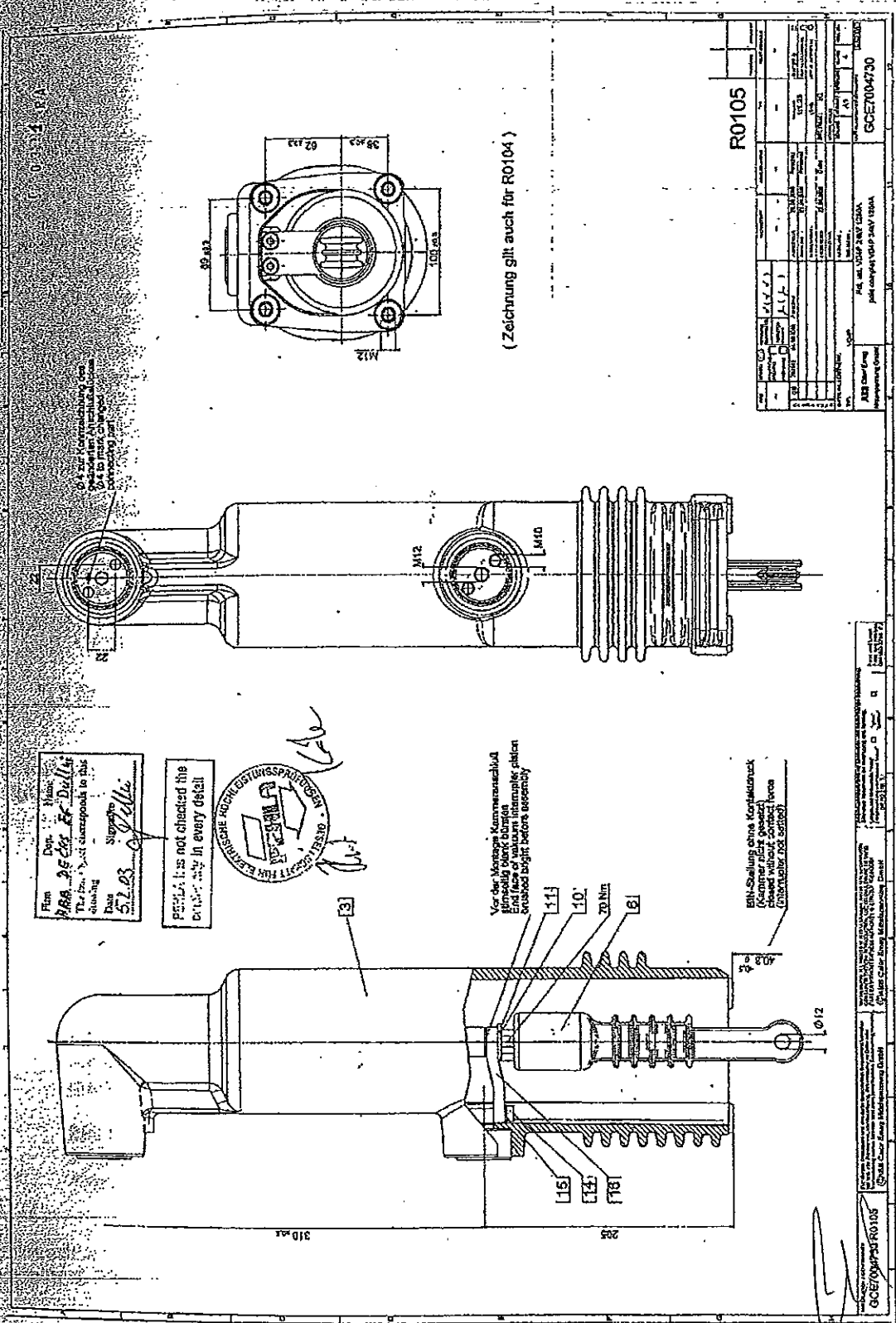




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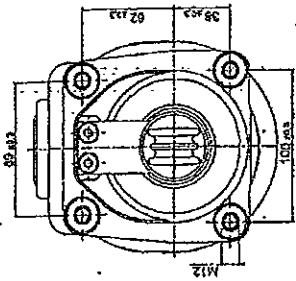
Plan: *PEHLA*
 Date: *03.03.03*
 The drawing corresponds to the drawing of the drawing.

PEHLA: It is not checked the drawing in every detail.



Vor der Montage Kompressenluft einblasen (Kammer nicht geerdet) - die Kontakte müssen poliert sein (Schleifpapier 1000 Körnung)

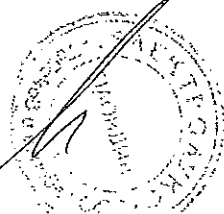
BIN-Sollung ohne Kontaktstück (Kammer nicht geerdet) - die Kontakte müssen poliert sein (Schleifpapier 1000 Körnung)



(Zeichnung gilt auch für R0104)

<p>R0105</p>	
<p>1.01</p>	<p>1.02</p>
<p>1.03</p>	<p>1.04</p>
<p>1.05</p>	<p>1.06</p>
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<p>1.09</p>	<p>1.10</p>
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<p>1.99</p>	<p>1.100</p>

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Details on Performance of the Test

Prior to the endurance test, the following electrical and mechanical data were determined by measurements on the circuit-breaker and its auxiliary systems:

- a) closing time (5 times *)
 - b) opening time (5 times *)
 - c) time spread between units of one pole - not applicable
 - d) time spread between poles (5 times *)
 - e) charging time of the motorized operating mechanism (5 times *)
 - f) consumption of the motorized operating mechanism (5 times *)
 - g) consumption of the tripping devices (5 times *)
 - h) duration of opening and closing command impulse
 - i) tightness
 - j) gas densities or pressures - not applicable
 - k) resistance of the main circuit (5 times *)
 - l) time-travel chart (5 times *)
 - m) other important characteristics
 - contact travel
 - check of vacuum of interrupters
 - verification of the rated operating sequence (refer to clause 6.101.2.5 a))
 - ambient atmospheric conditions
- n) 5 times at rated, minimum and maximum supply voltage.

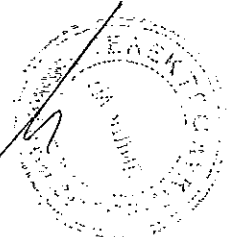
The subsequent endurance test comprising 10 000 mechanical operating cycles was structured as follows and carried out five times:

- 500 operating cycles with operating sequence C - 90 s - O - 90 s at the minimum supply voltage of closing and opening devices and motorized operating mechanism and the minimum pressure for operation
- 500 operating cycles with operating sequence C - 90 s - O - 90 s at the rated supply voltage of closing and opening devices and motorized operating mechanism and the rated pressure for operation
- 500 operating cycles with operating sequence C - 90 s - O - 90 s at the maximum supply voltage of closing and opening devices and motorized operating mechanism and at the maximum pressure for operation
- 250 operating cycles with operating sequence C - 90 s - O - 300 ms - CO - 270 s at the rated supply voltage of closing and opening devices and motorized operating mechanism and at the rated pressure for operation

After each series of 2 000 operating sequences the operating characteristics: a), b), d), e) and l) as listed above have been recorded.

Following the endurance test, the measurements carried out before the mechanical endurance test were measured again for comparison. Check, whether the travel characteristics fell within the envelope curves, taken before the endurance test.

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Results of measurements before the mechanical endurance test

Number of operations: counter: 00035

a/b) Opening and closing time:

Rated supply voltage of closing and opening devices: $U_a = 110 \text{ V DC}$
 Operating time [ms]

measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

U [V]	t_o (opening)			t_c (closing)		
	0.7 x U_a	1.0 x U_a	1.1 x U_a	0.85 x U_a	1.0 x U_a	1.1 x U_a
	80.4	53.1	50.4	72.3	66.0	63.3
	79.8	53.4	50.1	72.3	66.3	63.3
t [ms]	79.8	53.4	50.1	72.3	66.0	63.3
	79.8	53.4	50.1	72.3	66.0	63.6
	80.4	53.4	50.1	72.3	66.0	63.3

d) Time spread between the breaker poles:

The time spread between the breaker poles on closing and on opening of the circuit-breaker was measured to $< 2 \text{ ms}$.

e/f) Charging time and power consumption of the motorized operating mechanism:

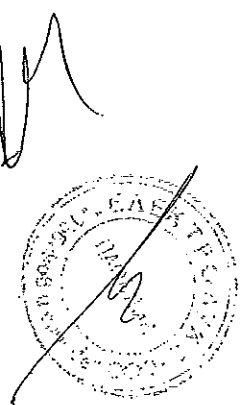
Rated supply voltage of motor charging: $U_a = 220 \text{ V DC}$

Measured values:

Measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

motor voltage	charging time after O-C operation [s]					current consumption [A]					power consumption [W]				
$U = 0.85 \times U_a$ $= 187 \text{ V DC}$	3.57	3.71	3.71	3.78	3.71	0.95	0.97	0.98	0.98	0.97	178	181	183	183	181
$U = 1.0 \times U_a$ $= 220 \text{ V DC}$	2.94	3.00	2.94	2.96	2.97	0.99	0.98	0.96	0.99	0.98	218	216	211	218	216
$U = 1.1 \times U_a$ $= 242 \text{ V DC}$	2.69	2.54	2.53	2.53	2.50	1.00	0.99	0.99	0.98	0.97	242	240	240	237	234

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g) Consumption of the tripping devices:

Measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

Rated operating voltage U_n	Shunt-release ON YC					Shunt-release OFF YO1				
	110 V DC									
Current at minimum supply voltage [A]	1.24	1.24	1.24	1.24	1.24	0.90	0.92	0.92	0.92	0.92
Current at rated supply voltage [A]	1.52	1.56	1.52	1.52	1.52	1.24	1.20	1.20	1.24	1.20
Current at maximum supply voltage [A]	1.68	1.72	1.72	1.72	1.68	1.36	1.36	1.36	1.36	1.36

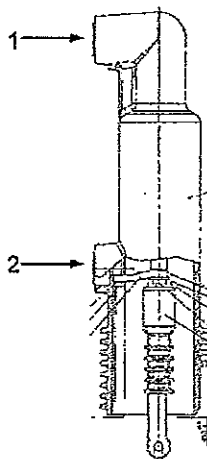
h) Duration of opening and closing command impulse:

Measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

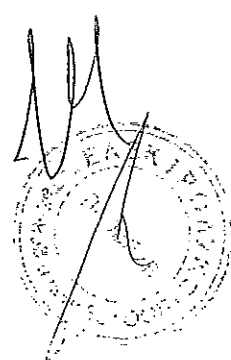
Duration of command impulse at minimum supply voltage [ms]	Shunt-release ON YC					Shunt-release OFF YO1				
		74.6	75.0	74.7	74.7	74.7	80.7	80.1	80.4	84.9
Duration of command impulse at rated supply voltage [ms]	70.5	69.6	69.3	69.3	69.3	54.9	54.9	54.9	54.9	54.9
Duration of command impulse at maximum supply voltage [ms]	67.2	67.2	67.5	67.5	67.5	52.5	52.2	52.2	51.9	52.2

k) Resistance of the main conductors:

Measuring points:



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Contact resistance measured during the 5 x CO operations at the minimum supply voltage of the coils:

Measuring points	L1					L2					L3				
	$\mu\Omega$					$\mu\Omega$					$\mu\Omega$				
1-2	16.9	16.9	16.9	17.0	17.0	16.6	16.6	16.6	16.6	16.6	17.1	17.2	17.2	17.2	17.2

Contact resistance measured during the 5 x CO operations at the rated supply voltage of the coils:

Measuring points	L1					L2					L3				
	$\mu\Omega$					$\mu\Omega$					$\mu\Omega$				
1-2	16.9	16.9	16.9	16.9	16.9	16.6	16.6	16.6	16.6	16.6	17.2	17.2	17.2	17.2	17.2

Contact resistance measured during the 5 x CO operations at the maximum supply voltage of the coils:

Measuring points	L1					L2					L3				
	$\mu\Omega$					$\mu\Omega$					$\mu\Omega$				
1-2	17.0	16.9	17.0	17.0	17.0	16.6	16.6	16.6	16.6	16.7	17.2	17.2	17.2	17.2	17.2

l) Time-travel chart with opening and closing speed: See diagram 1.1 and 1.2

Speed in [m/s]: $U_a = 110 \text{ V DC}$
at $U = 1.0 \times U_a$

L2	V_{01}		V_c
		1.18	1.35

The deviations from the measured mechanical time travel charts are in the allowable limits of the reference mechanical travel characteristics.

m) Other important characteristics:

▪ Contact travel:

	L1	L2	L3
Total Travel [mm]	15.0	15.0	15.1
Cont.-travel [mm]	11.3	11.3	11.2
Contact-spring travel [mm]	3.7	3.7	3.9

▪ Check of vacuum of interrupters:

60 kV DC ok

▪ Verification of the rated operating sequence:

O-0-3s-CO-3min-CO at rated voltage ok

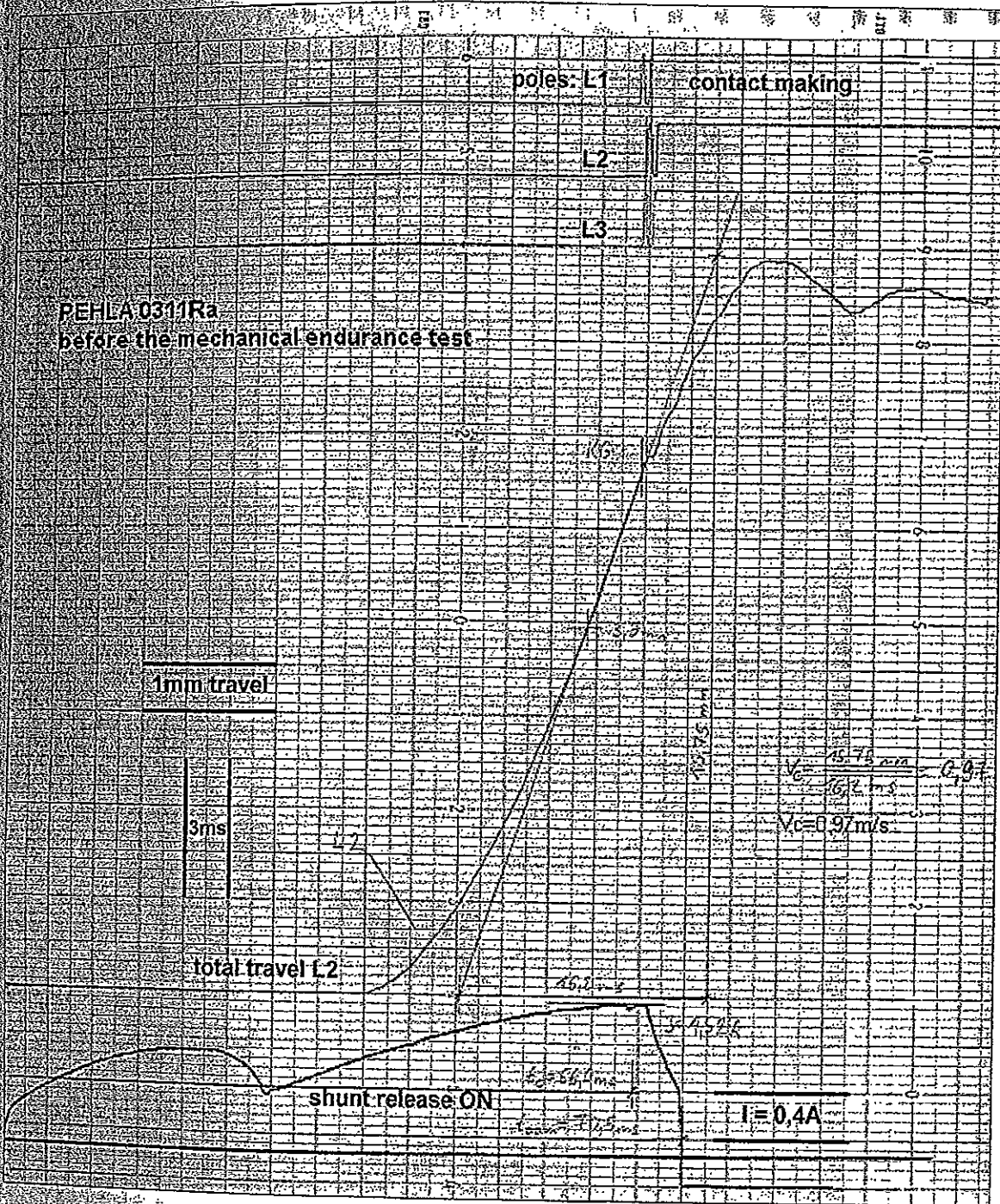
▪ Ambient atmospheric conditions:

Date: 04th February 2003, ambient air temperature: approx. 22°C

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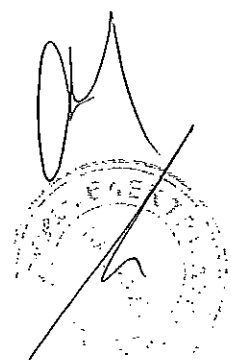
Diagram 1.1: Measurement of the operating speed before the mechanical endurance test



PEHLA 0311Ra
before the mechanical endurance test

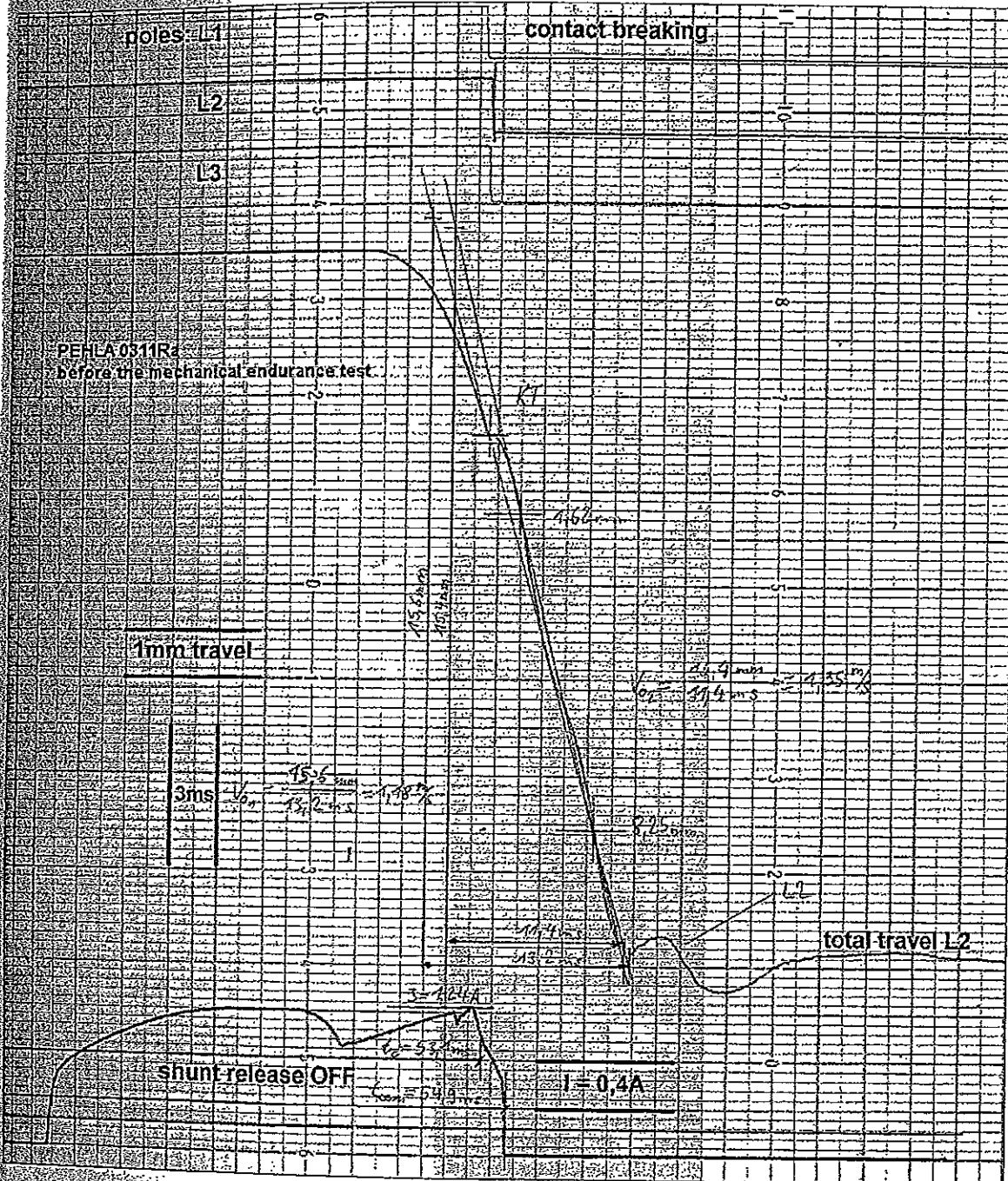
Measuring point: Insulated coupling rod in phase L2
Operating speed measured: $V_c = 0.97 \text{ m/s}$ at $U = 1.0 \times U_a$

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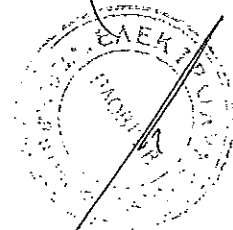
Diagram 1.2: Measurement of the operating speed before the mechanical endurance test



Measuring point: Insulated coupling rod in phase L2

Operating speed measured: $v_{01} = 1.18 \text{ m/s}$ $v_{02} = 1.35 \text{ m/s}$ at $U = 1.0 \times U_a$

ВЯРНО С ОПРИГНАТА



Results of measurements during the mechanical endurance test

a/b) Opening and closing time:

Operating time [ms] U _a = 110 V DC	U [V]	t _{o1} (opening)			t _c (closing)		
		0.7 x U _a	1.0 x U _a	1.1 x U _a	0.85 x U _a	1.0 x U _a	1.1 x U _a
Number of operations: 2 000	t [ms]	82.2	53.7	50.4	72.0	66.0	63.0
Number of operations: 4 000	t [ms]	79.5	53.7	50.4	72.9	66.3	63.3
Number of operations: 6 000	t [ms]	78.0	53.4	50.4	72.9	66.6	64.2
Number of operations: 8 000	t [ms]	78.6	53.7	50.7	72.9	66.6	64.0

d) Time spread between the breaker poles:

The time spread between the breaker poles on closing and on opening of the circuit-breaker was measured to < 2 ms.

e) Charging time of the motorized operating mechanism:

Motor voltage U _a = 220 V DC	charging time for O1-C [s]		
	U = 0.85 x U _a = 187 V DC	U = 1.0 x U _a = 220 V DC	U = 1.1 x U _a = 242 V DC
Number of operations: 2 000	3.64	2.99	2.47
Number of operations: 4 000	3.87	3.12	2.68
Number of operations: 6 000	3.80	3.06	2.69
Number of operations: 8 000	3.81	3.03	2.65

m) Other important characteristics- contact travel:

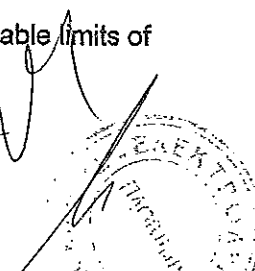
Contact travel in L2	Total Travel [mm]
Number of operations: 2 000	14.8
Number of operations: 4 000	14.7
Number of operations: 6 000	14.7
Number of operations: 8 000	14.7

l) Time-travel chart with opening and closing speed:

Speed in [m/s]; at U _a = 110 V DC L2	V _{o1}		V _c
	8.25	6.6 mm	
Number of operations: 2 000	1.12	1.29	0.91
Number of operations: 4 000	1.11	1.29	0.91
Number of operations: 6 000	1.08	1.24	0.91
Number of operations: 8 000	1.13	1.32	0.93

The deviations from the measured mechanical time travel charts are in the allowable limits of the reference mechanical travel characteristics.

ВРРНО С ОПИГИНАЛА



Results of measurements after the mechanical endurance test

Number of operations counter: 10 199

i/b) Opening and closing time:

Rated supply voltage of closing and opening devices: $U_a = 110 \text{ V DC}$

Operating time [ms]

measured during the 5 x CO operations
 - at the minimum supply voltage
 - at the rated supply voltage
 - at the maximum supply voltage

U [V]	t_o (opening)			t_c (closing)		
	0.7 x U_a	1.0 x U_a	1.1 x U_a	0.85 x U_a	1.0 x U_a	1.1 x U_a
	80.1	55.5	50.7	73.5	67.5	63.3
	79.8	54.0	51.0	73.5	67.5	63.3
t [ms]	80.1	55.2	51.6	73.5	66.3	63.9
	79.8	54.0	51.0	74.1	66.6	63.9
	79.2	53.4	50.7	72.9	67.5	64.2

j) Time spread between the breaker poles:

The time spread between the breaker poles on closing and on opening of the circuit-breaker was measured to < 2 ms.

e/f) Charging time and power consumption of the motorized operating mechanism:

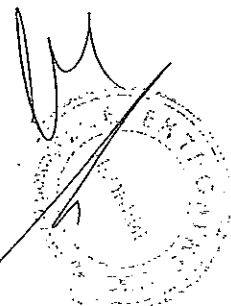
Rated supply voltage of motor charging: $U_a = 220 \text{ V DC}$

Measured values:

Measured during the 5 x CO operations
 - at the minimum supply voltage
 - at the rated supply voltage
 - at the maximum supply voltage

motor voltage	charging time after O-C operation [s]					current consumption [A]					power consumption [W]				
$U = 0.85 \times U_a = 187 \text{ V DC}$	3.60	3.78	3.80	3.86	3.83	0.93	0.92	0.95	0.94	0.93	174	172	178	176	174
$U = 1.0 \times U_a = 220 \text{ V DC}$	3.03	2.86	2.83	2.90	2.93	0.94	0.93	0.92	0.94	0.95	207	205	202	207	209
$U = 1.1 \times U_a = 242 \text{ V DC}$	2.59	2.71	2.69	2.65	2.68	0.90	0.96	0.96	0.95	0.96	218	232	232	230	232

ВЕРНО С ОРИГИНАЛА



g) Consumption of the tripping devices:

Measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

Rated operating voltage U_n	Shunt-release ON YC					Shunt-release OFF YO1				
	110 V DC					110 V DC				
Current at minimum supply voltage [A]	1.24	1.28	1.28	1.28	1.28	0.92	0.92	0.92	0.92	0.92
Current at rated supply voltage [A]	1.56	1.52	1.52	1.52	1.52	1.20	1.20	1.20	1.20	1.20
Current at maximum supply voltage [A]	1.72	1.72	1.72	1.72	1.72	1.36	1.36	1.36	1.32	1.32

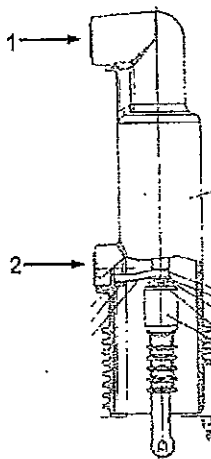
h) Duration of opening and closing command impulse:

Measured during the 5 x CO operations
 at the minimum supply voltage
 at the rated supply voltage
 at the maximum supply voltage

Duration of command impulse at minimum supply voltage [ms]	Shunt-release ON YC					Shunt-release OFF YO1				
		75.9	76.2	76.2	76.8	75.3	79.8	79.8	80.1	79.8
Duration of command impulse at rated supply voltage [ms]	71.4	71.4	69.9	70.5	71.1	56.7	55.5	57.0	55.5	54.6
Duration of command impulse at maximum supply voltage [ms]	67.8	67.8	68.4	68.4	68.7	52.5	52.8	53.4	52.5	52.8

k) Resistance of the main conductors:

Measuring points:



ВЪРНО С ОРИГИНАЛА

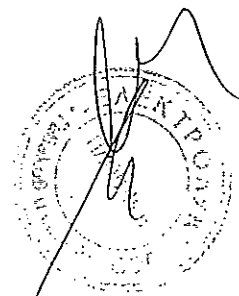
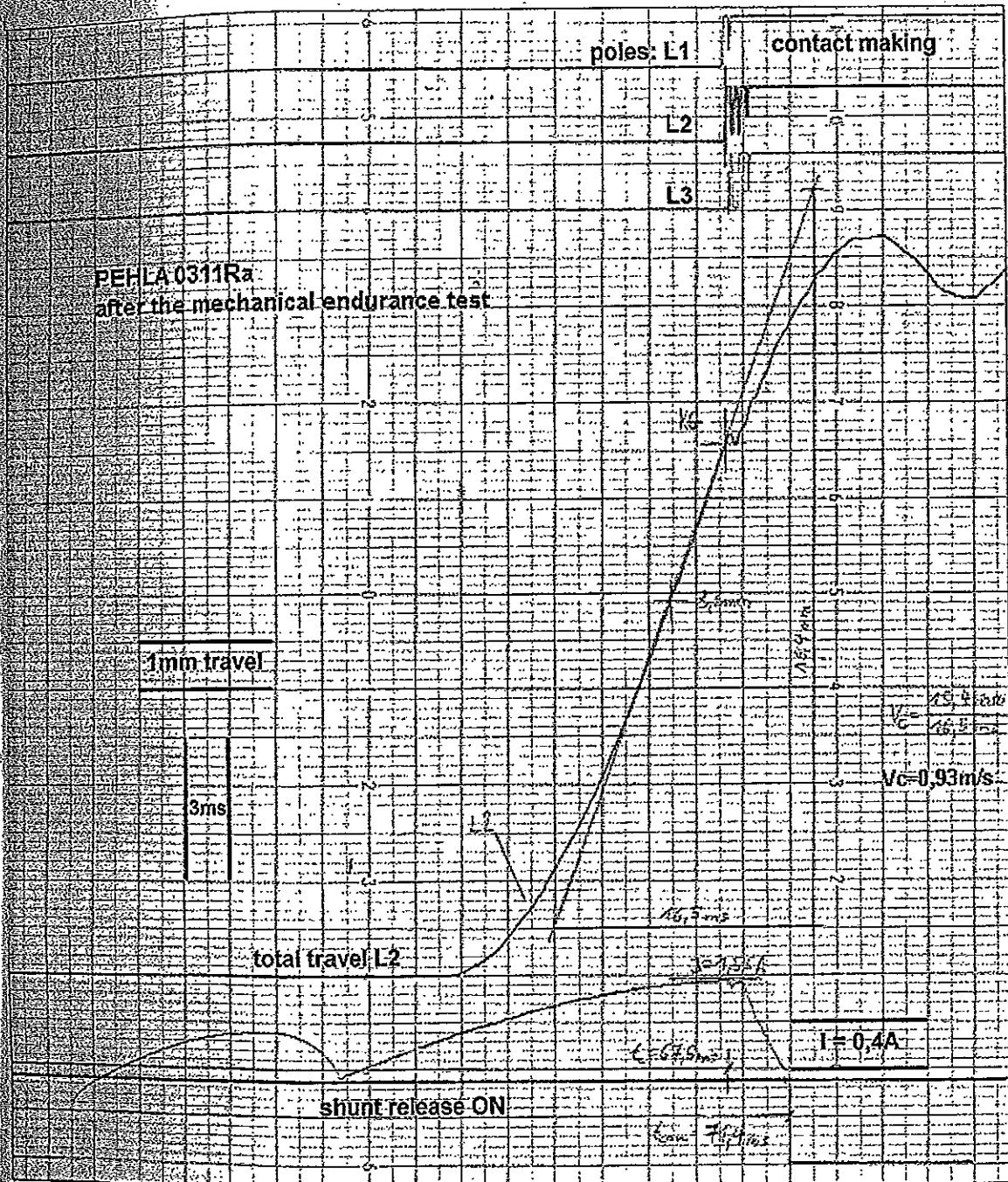
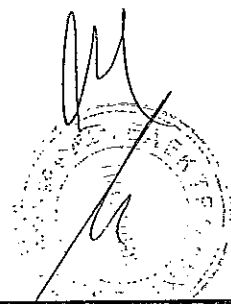


Diagram 2.1: Measurement of the operating speed after the mechanical endurance test



Measuring point: Insulated coupling rod in phase L2
 Operating speed measured: $V_c = 0.93 \text{ m/s}$ at $U = 1.0 \times U_a$

ВЕРНО С ОРИГИНАЛА



Contact resistance measured during the 5 x CO operations at the minimum supply voltage of the coils:

Measuring points	L1 μΩ					L2 μΩ					L3 μΩ				
	1-2	17.1	17.1	17.2	17.1	17.1	16.9	16.9	16.9	16.9	16.8	17.7	17.7	17.7	17.7

Contact resistance measured during the 5 x CO operations at the rated supply voltage of the coils:

Measuring points	L1 μΩ					L2 μΩ					L3 μΩ				
	1-2	17.3	17.2	17.2	17.2	17.2	16.9	17.0	16.9	16.9	16.9	17.7	17.7	17.7	17.8

Contact resistance measured during the 5 x CO operations at the maximum supply voltage of the coils:

Measuring points	L1 μΩ					L2 μΩ					L3 μΩ				
	1-2	17.1	17.1	17.1	17.1	17.1	16.9	17.0	17.0	17.0	17.0	17.7	17.7	17.7	17.7

l) Time-travel chart with opening and closing speed: See diagram 2.1 and 2.2

Speed in [m/s]; $U_a = 110 \text{ V DC}$
at $U = 1.0 \times U_a$

	V_o		V_c
L2	1.12	1.25	0.93

The deviations from the measured mechanical time travel charts are in the allowable limits of the reference mechanical travel characteristics.

m) Other important characteristics:

▪ Contact travel:

	L1	L2	L3
Total Travel [mm]	14.6	14.6	14.7
Cont.-travel [mm]	11.2	11.1	11.2
Contact-spring travel [mm]	3.4	3.5	3.5

▪ Check of vacuum of interrupters:

60 kV DC ok

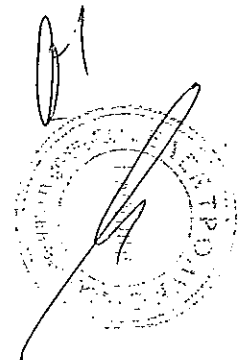
▪ Verification of the rated operating sequence:

O-0.3s-CO-3min-CO at rated voltage ok

▪ Ambient atmospheric conditions:

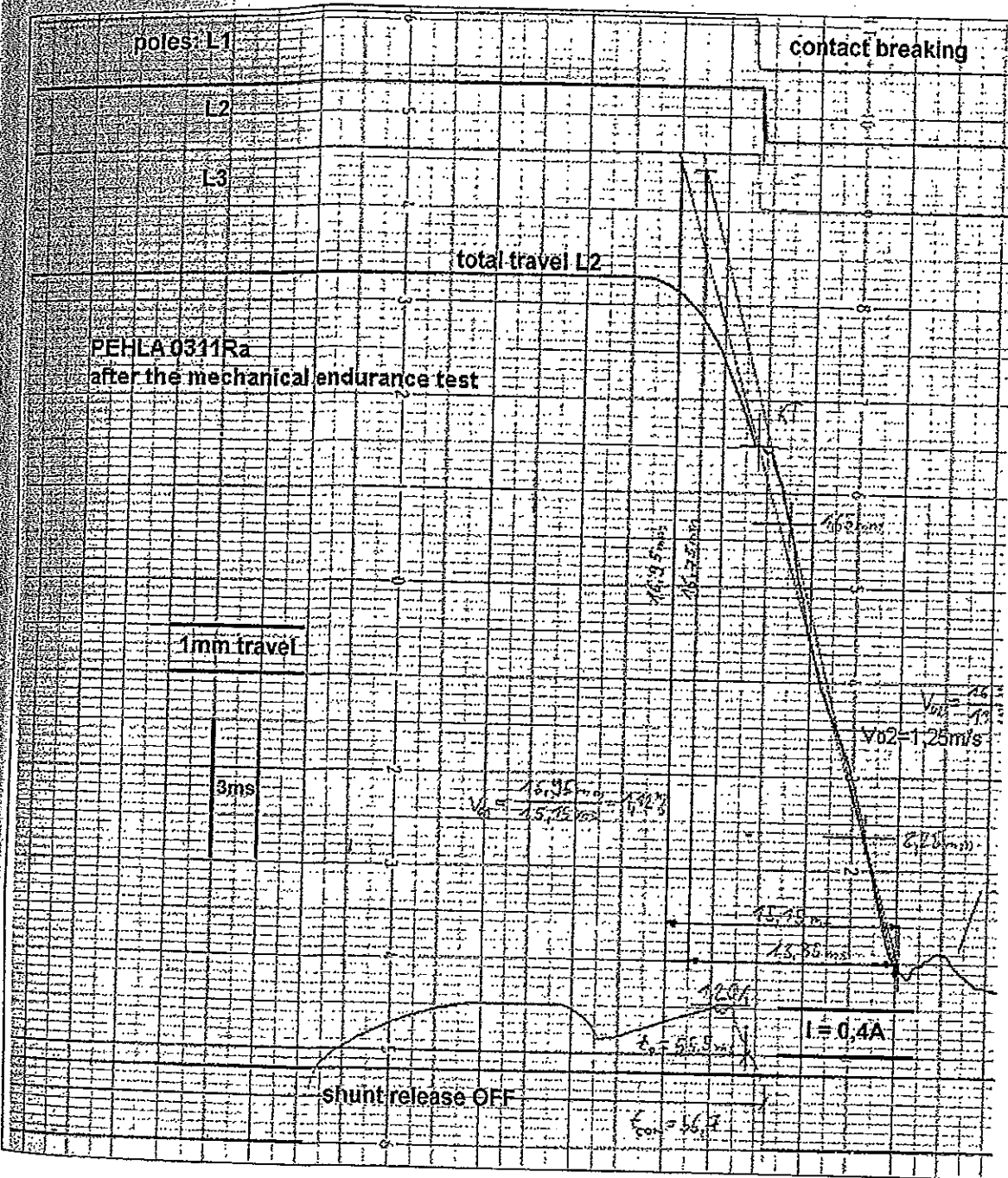
Date: 24th February 2003, ambient air temperature: approx. 22°C

ВЕРНО С ОРИГИНАЛА



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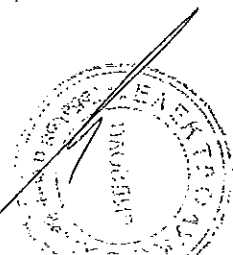
Diagram 2.2: Measurement of the operating speed after the mechanical endurance test



- Measuring point: Insulated coupling rod in phase L2
- Operating speed measured: $V_{01} = 1.12 \text{ m/s}$ $V_{02} = 1.25 \text{ m/s}$ at $U = 1.0 \times U_a$

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ВЕРНО С ОРИГИНАЛА



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Evaluation of the measurements before and after the test program

The reference mechanical travel characteristic was recorded at the rated supply voltage before the endurance test. All measured travel-curves fall within the limits of the two envelope curves which characterize the allowable deviations from the reference curve.

All characteristics measured before and after the test program do not show unacceptable variations.

The circuit-breaker operated only on command and did not operate without command.

ВЯРНО С ОРИГИНАЛА

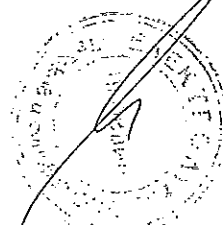


Measuring Instrument Record

Test job no.: 8002374_M06
 Test object: VD4 24.12.20
 Date of test: 03rd Feb. - 24th Feb. 2003
 Test report No: 0311Ra
 Test operator: Mendorf / Schöttler

Instrument	Ident.-no.	Measuring	Remarks
Microohmmeter MO2A 50	ELK 001111	20μΩ / 200μΩ	Resistance measurement
resistive travel pick-up type lino pot Ts 50 502	ELK 001024	5 kΩ	Travel time measurement
DM 7100 transient memory	ELK 000466	±2 V / full scale 50μs/word channel 4 (12 bit)	
YEW-3063 Multi-pen	ELK 000464	0.25 V/cm-vernier 10 cm/min, channel 4	
Slide caliper rule	LAE 002162	0 - 300 mm	
Shunt 1.5A/150mV DM 7100 Transient memory	ELK 001044 ELK 000466	1.5A/150mV ±20/0.2 V/full scale 50 μsec/word/10ms/word channel 1, 2, 3, 8 (8 bit)	Current measurement (y2/y3) Operating time measurement,
YEW-3063 Multi-pen	ELK 000464	Channel 1, 2, 3, 8, 0.25/1 V/cm-cal/vernier 10 cm/min	
Electronic time clock	ELK 001231	0-100s	Charging time measurement
Motor 6E	ELK 000389	1 A	Motor current measurement
Vacuum-Checker-Test device	DRU 000026	40/60kV DC	Vacuum-Checker-Test
BBC M2110	ELK 000359	300 V DC	Voltage measurement
Hygrometer Hygronom	FEU 000022	-30°C - +50°C	temperature measurement

ВЯРНО С ОПРИГНАЛА



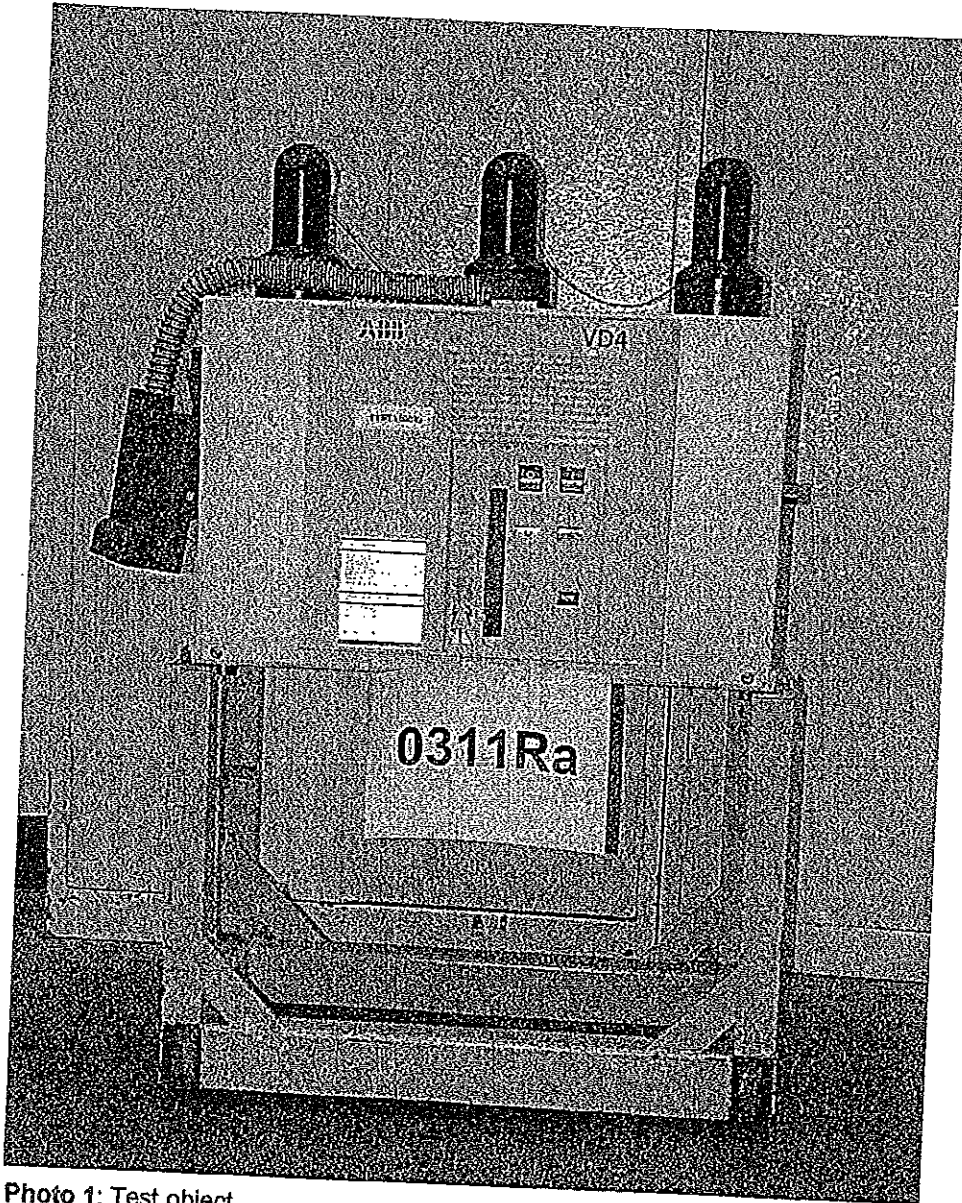


Photo 1: Test object

ВЯРНО С ОРИГИНАЛА



АББ Трансмисионе & Дистрибуционе С.п.А.

Унита Оператива Саче Т.М.С.

Виа Фриули 4
I 24044 – Далмине (BG)
Италия

тел.: 0039.035.395111
факс: 0039.035.395874
E-mail: sacetms.tipm@it.abb.com
интернет: [//www.abb.com](http://www.abb.com)



ПРОТОКОЛ ЗА ТИПОВИ ИЗПИТАНИЯ No. 100089_C СТРАНЦИ 1/1

Apparatus: КРУ тип ZS1 изд. 1.2 с вакуумнен прекъсвач тип VD4/P
24.12.20 p=275

Идентификация: 1VCP0000138-Rev.-,en-Технически каталог-2003-04

Параметри:

Номинално напрежение:	24	kV
Ном. Издържано импулсно напрежение:	125	kV
Ном. Издържано напрежение с 50Hz:	75	kV
Номинална честота:	50-60	Hz
Номинален ток на шината:	1250	A
Номинален ток на ошиновката:	1250	A
Ном. Издържан ток, пикова стойност:	63	kA
Ном. Издържан кратковременен ток на к.с.:	20	kA
Ном. Продължителност на к.с.:	3	s

Test reports verifying rating assigned by the manufacturer:

Изпитания	Тест съгласно стандарт	Тестов протокол	
		No.	Издаден от
Диелектричени изпитания	IEC 60298 Subclause 6.1	0045 Ra	ПЕХЛА Високо-мощностни лаборатории
Тест с повишаване на температурата	IEC 60298 Subclause 6.3/6.4	HZ 236 E06	АББ Калор Емаг Лаборатории
Тест за кратковременен т.к.с. и пиков т.к.с.	IEC 60298 Subclause 6.5	HZ 235 F01	АББ Калор Емаг Лаборатории в лаборатория CESI Лаб.
Механична работа и тест за блокировка	IEC 60298 Subclause 6.102	MZ 235 A01	АББ Калор Емаг Лаборатории
Тест за вътрешна дъга	IEC 60298 Annex AA	HZ 235 L02	АББ Калор Емаг Лаборатории
Тест за механична работа	IEC 62271-100 subclause 6.101.2	0311 Ra	ПЕХЛА Високо-мощностни лаборатории
Тест за способност за изкл. на т.к.с. и вкл. върху т.к.с.	IEC 62271-100 subclause 6.106	0511 Ra	ПЕХЛА Високо-мощностни лаборатории

Лабораторията на АББ ТИД Унита Оператива САЧЕ Т.М.С. в гр. Далмине е акредитирана съгласно UNI CEI EN ISO/IEC 17025 от SINAL с регистрационен номер Reg. No. 0253

Лабораторията на АББ Калор Емаг в гр. Ратинген, Германия е акредитирана съгласно UNI CEI EN ISO/IEC 17025 от DATech под регистрационен номер No. DAT-P-032/93

Високо-мощностните лаборатории ПЕХЛА са акредитирани съгласно UNI CEI EN ISO/IEC 17025 от DATech с регистрационен номер No. DAT-P-032/93 и сертификат Д-ПЛ-12072-06-01

ЧЕЗИ Лаборатории Милано са акредитирани съгласно UNI CEI EN ISO/IEC 17025 от SINAL с регистрационен номер Reg. No. 0030

Дата на издаване:

04/09/16
ВЯРНО С ОРИГИНАЛА

Отдел за Развойна дейност

Г.М. Граванзола

ABB T&D Unità operativa Sace T.M.S. is accredited by DET NORSKE VERITAS QUALITY CERTIFICATE Quacer Certificate No. CERT-07978-2001-AQ-MIL-SINCERT/B according to ISO 9001.

Test Report

Report No.: **0045 Ra** Copy No.: **0** Contents: **19 Sheets**

Equipment under test: Metal-clad air-insulated switchgear panel type ZS1.2, rated voltage 24 kV, drawing-no. GCE 8010459 R0104, with vacuum circuit-breaker type VD4P 2420-25.

Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany

Client: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany

Testing station: PEHLA - Testing Station Ratingen

Date of test: 28th November 2000

Applied test specifications: IEC 60298: 1990-12, clauses 6.1.1, 6.1.3 - 6.1.7,
IEC 60694: 1996-05, clauses 6.2.1, 6.2.3 - 6.2.6.

Tests performed: Dielectric type test.
Standard lightning impulse withstand voltage test at 125 kV and power-frequency withstand voltage test at 50 kV to earth, between phases and across open switching device.

Test results: The ZS1.2-type panel passed the dielectric type test successfully.
The respective requirements are met.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

[Signature]
Technical Committee

Mannheim, 07th December 2000

The test results relate only to the items tested

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Accreditation

The PEHLA-Testing Station Ratingen has been approved by the DATech (German accreditation body for technology) according to DIN EN 45001 for tests in the field of high-voltage switchgear and controlgear and power engineering equipment (Registration-No. DAT-P-032/93).

Under reference to DIN EN 45001 PEHLA states the following:

- The accreditation of the PEHLA-Testing Station or any of its test reports by themselves in no way constitute or imply product approval by DATech or any other body.
- If someone refers to a test in an accredited PEHLA-Testing Station this reference shall include the accreditation body, i.e. DATech, the relevant scope of the accreditation and the appropriate registration number.

STL-Member

PEHLA is foundation-member of the Short-Circuit Testing Liaison (STL) which has been founded in March 1969. STL is a forum for the international cooperation of the testing organisations with the further full members ASTA (GB), CESI (I), ESEF (F), KEMA (NL), SATS (N; S, SF) and STLNA (USA). In the framework of EC, STL has been recognised in 1992 by EOTC as agreement group.

PEHLA-Documents**A Certificate**

is issued for type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test.

For these tests the equipment under test must be clearly identified by technical description, drawings and additional specifications.

A Test Document

is issued for parts of type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of test.

For these tests the equipment under test must be clearly identified by technical description, drawings and additional specifications.

A Test Report

is issued for all other tests which have been carried out according to specifications, standards or "PEHLA-Richtlinien" (PEHLA Guides) and/or clients instructions.

Similarly, this test report contains all test results, details of the conditions under which the tests were carried out, also details relating to the behaviour of the equipment during test, and its condition after the tests.

Addresses:

Office: PEHLA-Geschäftsstelle
Hallenweg 40
D-68219 Mannheim

Testing Station: PEHLA-Testing Station Ratingen
Oberhausener Str. 33
D-40472 Ratingen

Manufacturer: ABB Calor Emag Mittelspannung GmbH
Oberhausener Str. 33
D-40472 Ratingen

Client: ABB Calor Emag Mittelspannung GmbH
Oberhausener Str. 33
D-40472 Ratingen

ВЕРНО С ОРИГИНАЛА

04FE9302

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ВЯРНО С ОРИГИНАЛА



List of Test Participants

Representatives of the Test Committee:

Mr. A. Meier	PEHLA- Testing Station Ratingen
Mr. W. Stolz	PEHLA- Testing Station Mannheim

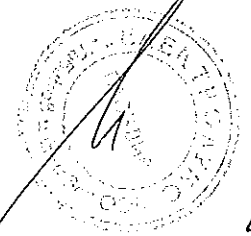
Test Engineer:

Mr. U. Lisseck	PEHLA- Testing Station Ratingen
----------------	---------------------------------

Other Participants:

-

ВЯРНО С ОРИГИНАЛА



Technical Data of Test Object

Switchgear

Ratings assigned by the manufacturer

Test Object: Metal-clad air-insulated switchgear panel
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 07550027/2017/00
Drawing No.: GCE8010459 R0104 index 00
Year of manufacture: 2000

Rated voltage	24 kV
Rated lightning impulse withstand voltage	125 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	50 kV
Rated frequency	50/60 Hz
Rated normal current of busbar	2500 A
Rated normal current of tee-off	2500 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Insulating medium	air
Rated operating pressure (abs./20 °C)	- kPa
Minimum operating pressure (abs./20 °C)	- kPa
Permissible values for internal arc faults:	
Peak current	63 kA
Short-time current	25 kA
Duration of short-circuit	1 s
Max. ambient air temperature	40 °C

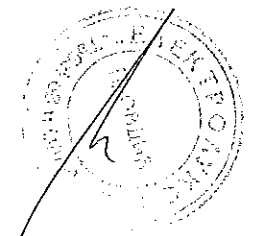
The above switchgear panel is fully described in the mentioned drawings.

Essential characteristics and installed devices:

- busbar 2 x 80 mm x 10 mm / R 5 mm, Cu, insulated, with bushing plate (left and right).
- busbar tee-off conductor 2 x 100 mm x 10 mm / R 5 mm, Cu, insulated.
- tulip insulator with contact pin $\varnothing = 79$ mm.
- current transformer type TPU 65.11, manufacturer: ABB, serial-no. L1: 058 246; L2: 058 247; L3: 058 248.
- earthing switch type EK6 2406-275, serial-no. 06/050/00.
- cable conductor 2 x 100 mm x 10 mm / R 5 mm, Cu, bare.

Date of receipt of test object: 27th November 2000

ВЯРНО С ОРИГИНАЛА



Technical Data of Test Object

Switching Device - Circuit-Breaker

Ratings assigned by the manufacturer

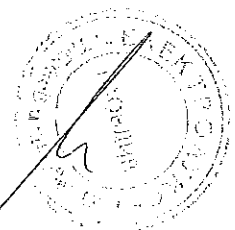
Test Object: Vacuum circuit-breaker
Type: VD4P 2420-25
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7008269/4002/00 **Year of manufacture:** 2000
Drawing No.: GCE 7000162 R1104 index 00 (circuit-breaker)
Vacuum Interrupter: Type VG4S, L1: No. 00G4S01196, L2: No. 00G4S01192, L3: No. 00G4S01194
Drawing No.: GCE 7005535 R0102 index 02 (interrupter)

Rated voltage	24 kV
Rated lightning impulse withstand voltage	125 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	50 kV
Rated frequency	50/60 Hz
Rated normal current	2000 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	25 kA
D.C. component	30 %
Rated short-circuit making current	63 kA
Rated transient recovery voltage:	
Peak value	41 kV
Rate of rise	0.47 kV/ μ s
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3 s -CO-3 min-CO
Arc extinguishing medium	Vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	\leq 45 ms
Rated closing time	approx. 60 ms
Rated voltage of trip coil	220 V-DC
Rated voltage of closing coil	220 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz
Max. ambient air temperature	40 °C
Further specifications:	-

Essential characteristics: -

Date of receipt of test object: 27th November 2000

ВЯРНО С ОРИГИНАЛА



List of Drawings

The manufacturer has guaranteed, that the equipment submitted for test has been manufactured in full accordance with the following drawings. PEHLA has verified that these drawings adequately represented the equipment tested. These drawings have been stamped and signed by PEHLA representatives and are kept

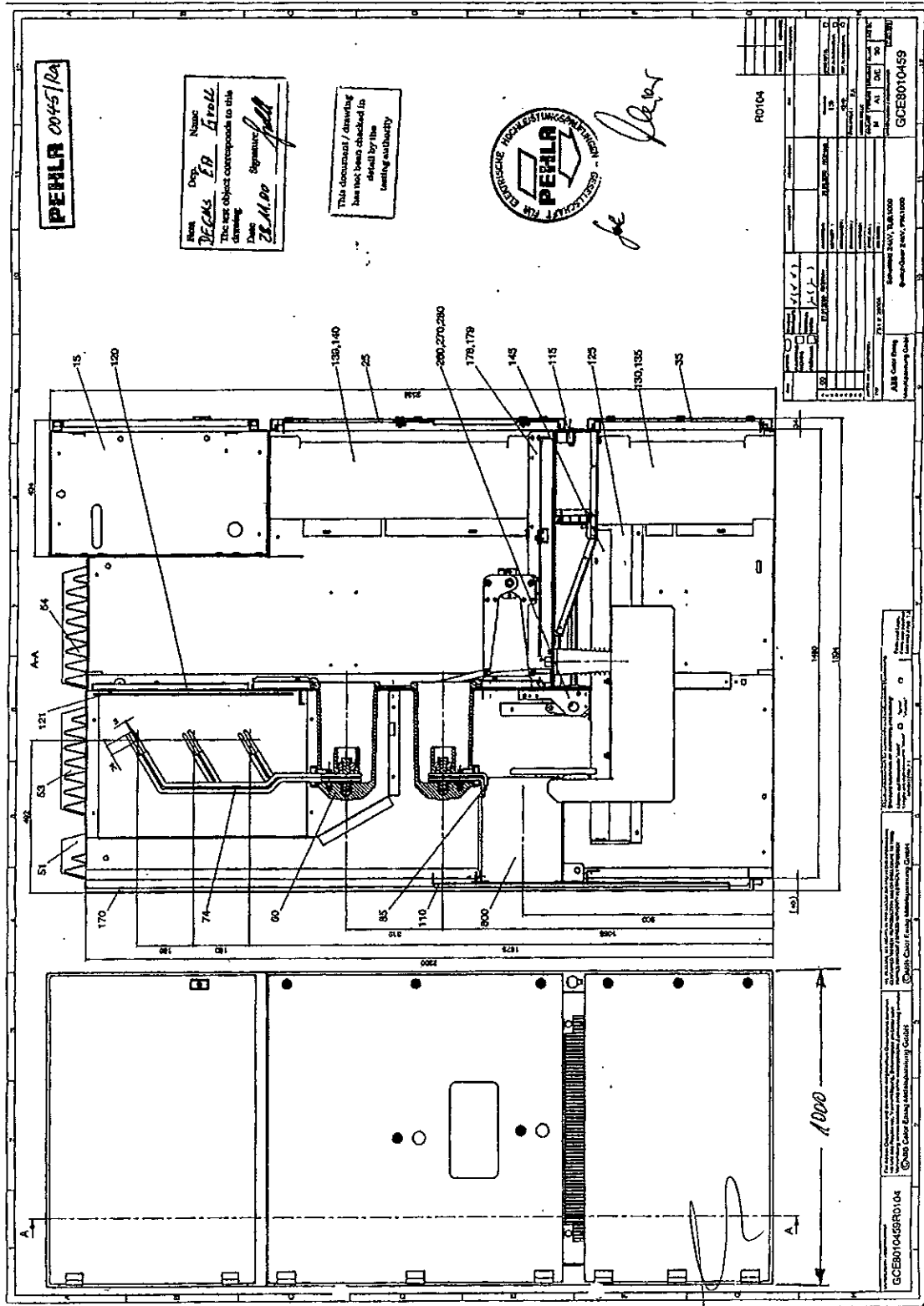
- with the test documents at the test laboratory.
 at the client.

A copy of the following drawings is part of this Test Report.

Drawing-No.	Index	Title	Additional remarks
GCE 8010459 R0104	00	SwitchGear 24kV; PW.1000	-
GCE 8012050 R0101	01	Cable connecting bar system 2500A	-
GCE 7000162 R1104	00	Einschub für ZS1.2 24kV VD4P 2420..25	-

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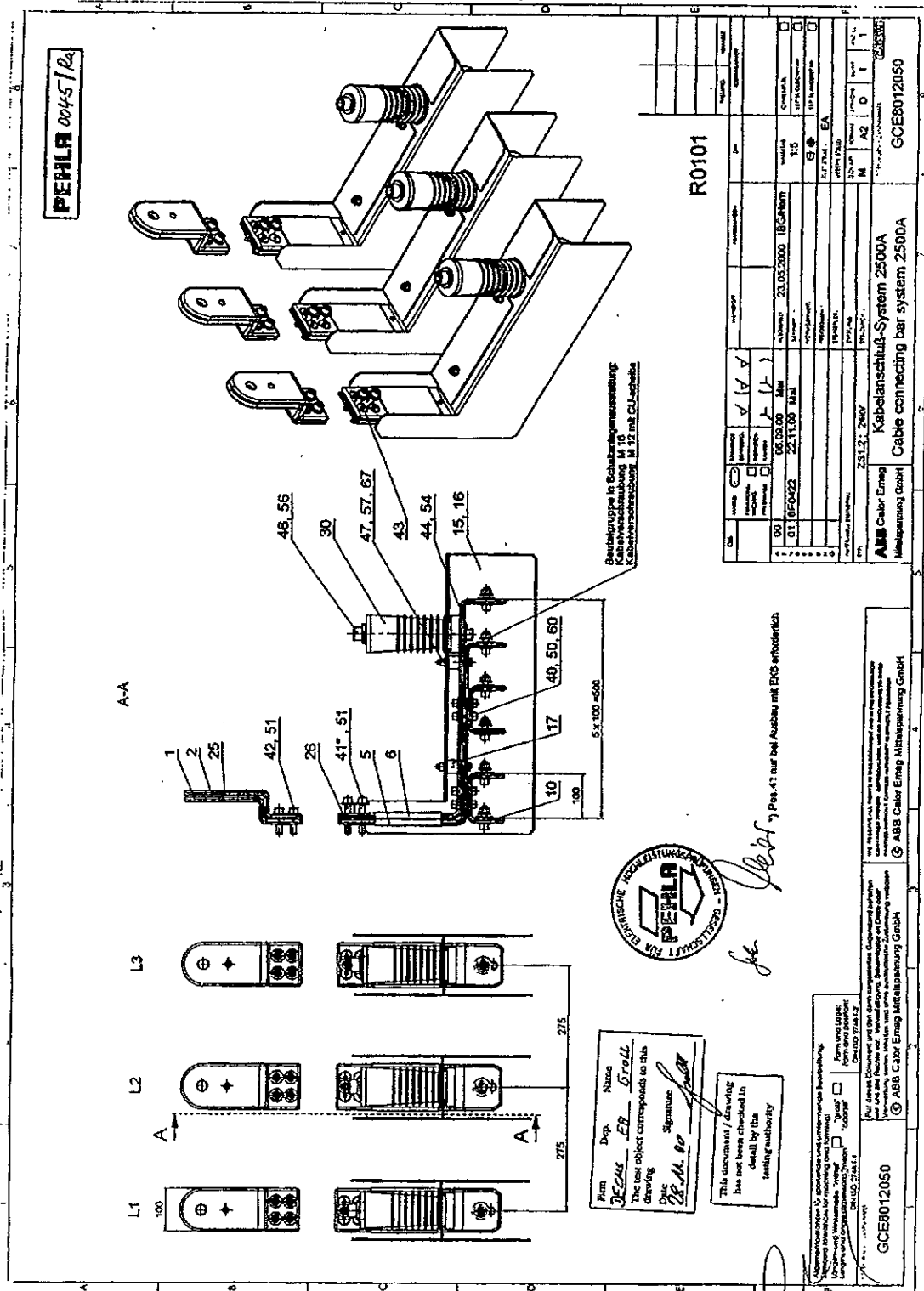
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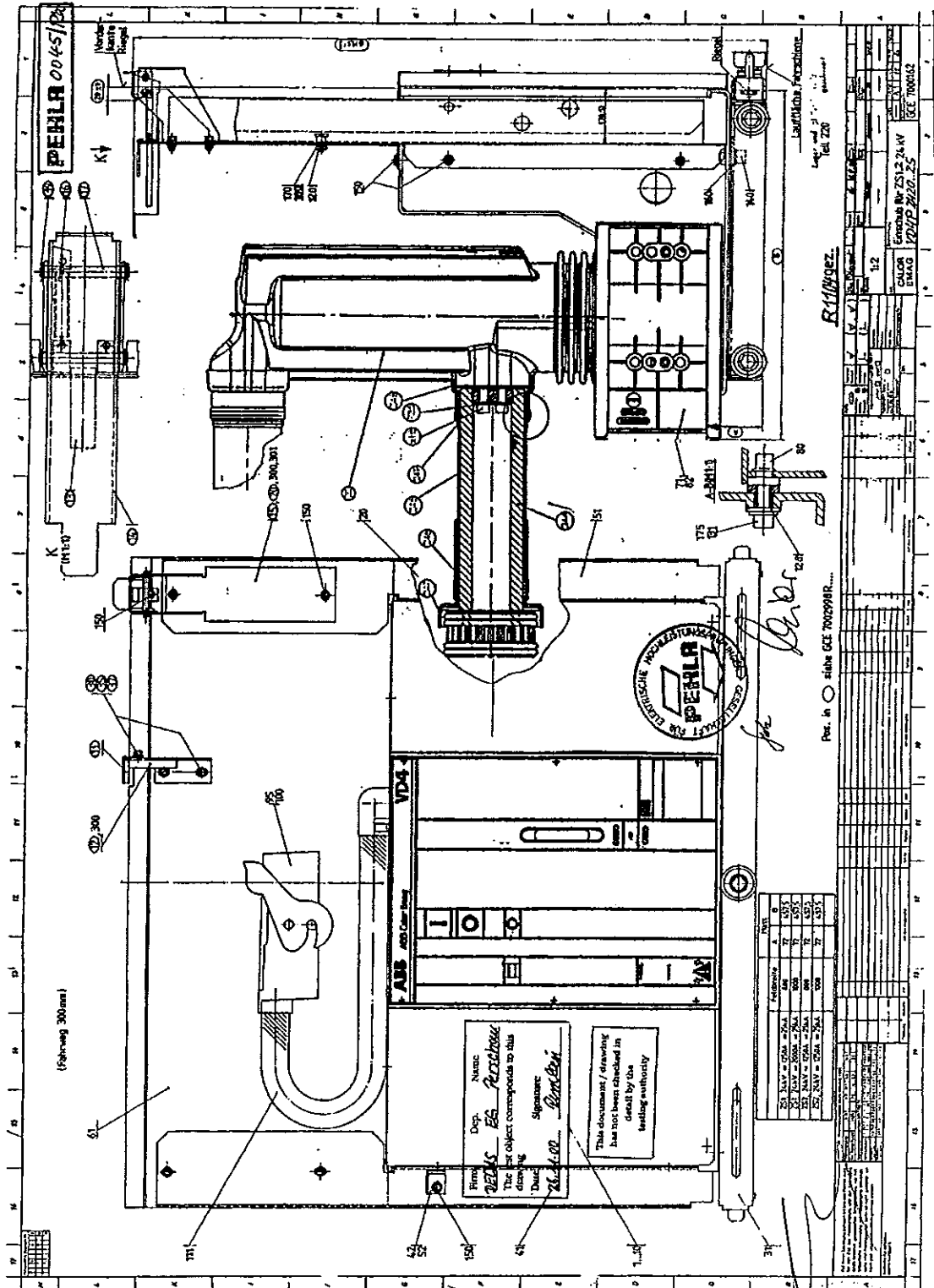


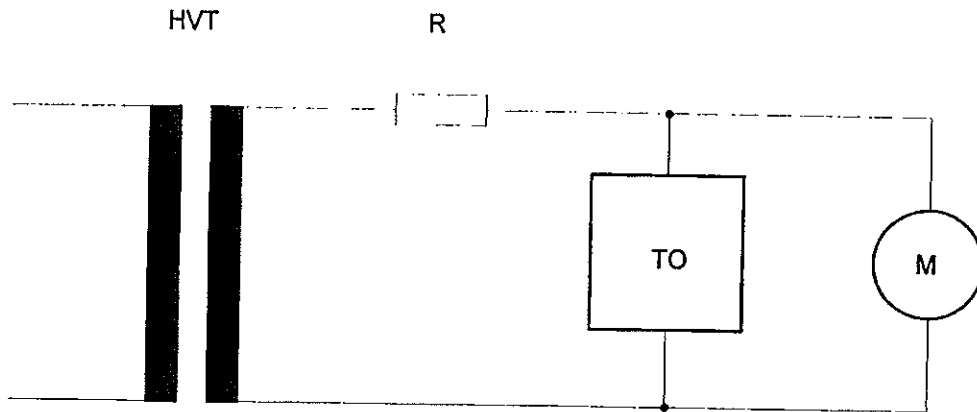
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Technical Data of Test Circuit
Power Frequency VoltageTechnical Data

HVT - High Voltage Test Transformer: Type TEO 250/20, serial-no. 268 734,
manufacturer: Meßwandler-Bau, Bamberg

Rated Voltage	260 kV
Rated Capacity	50 kVA
Short Circuit Impedance	14.6 %

TO - Test Object: ZS1.2/24 kV-type panel, 2500 A

M - Voltage Measurement: Capacitive Divider Type CM 300 (Ident-No. ELK-000994) in
connection with a Peak Voltmeter Type DMI 551/Haefely
(Ident-No. ELK-000989)

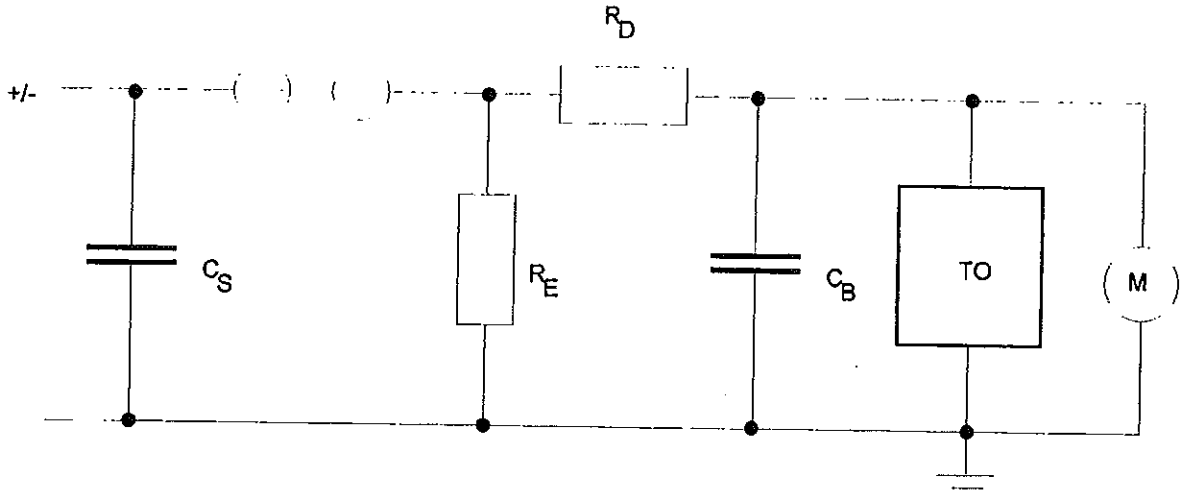
Verification of Calibration:

- Capacitive Divider (Ident-No. ELK-000994, ELK-000990, ELK-000992):
calibrated on April 1998 at DEACE/LH,
Calibration Report-No. 9800086.
- Peak Voltmeter Typ DMI 551 (Ident-No. ELK-000989):
calibrated on April 2000 at DECMS/LK,
Calibration Report No. 2000353.

ВЯРНО С ОРИГИНАЛА

A handwritten signature is written over a circular stamp. The stamp contains text around its perimeter, including 'PEHLA' and 'ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN'. The signature is a stylized 'M'.

Technical Data of Test Circuit
Lightning Impulse Voltage 1.2/50



Technical Data

Impulse Generator Type SGS-200/6, WO: 513809, manufacturer: Haefely

Maximum Charging Voltage	U_{Σ}	=	200 kV
Number of Stages	n	=	2
Surge Capacity per Stage	C_S	=	600 nF
Load Capacitance	C_B	=	1000 pF
Damping Resistance	R_D	=	$R_{s1} + R_{sE}$
Internal Front Resistance per Stage	R_{s1}	=	20 Ω
External Front Resistance	R_{sE}	=	300 Ω
Discharge Resistance	R_E	=	2 R_P
Tail Resistance per Stage	R_P	=	115 Ω

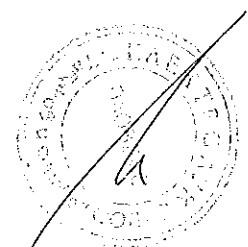
TO - Test Object: ZS1.2/24 kV-type panel, 2500 A

M - Voltage Measurement: Capacitive Divider Type CS 200 SPZ (Ident-No. ELK-000893, ELK-000894) in connection with a Peak Voltmeter Type DMI 551/ Haefely (Ident-No. ELK-000989) and Oscilloscope Type TDS520 (Ident-No. ELK-000545).

Verificatin of Calibration:

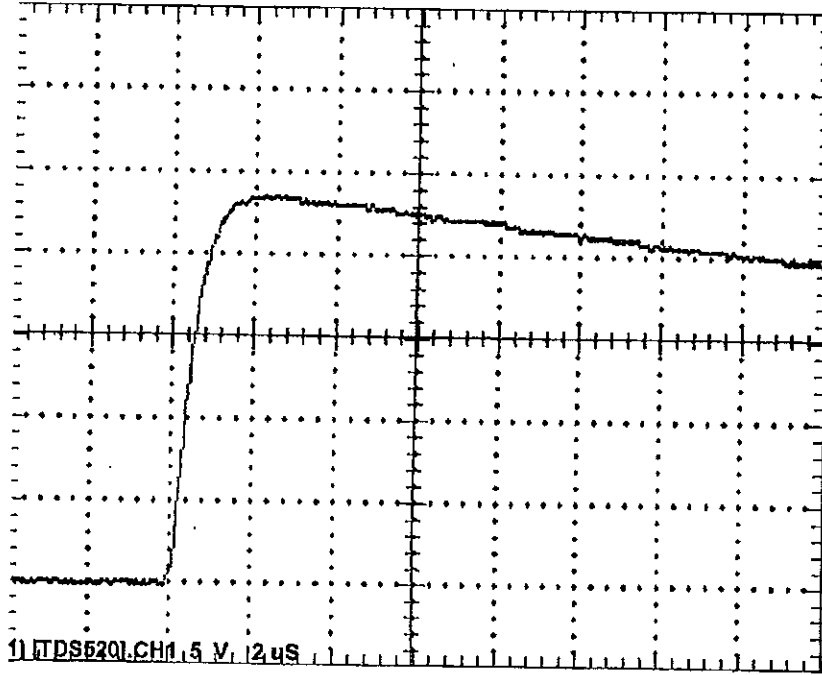
- Capacitive Divider (Ident-No. ELK-000893, ELK-000894, ELK-000922, ELK-001074):
 Calibrated in February 1998 at FGH Mannheim,
 FGH-Calibration-Report-No. 050 DKD-K-15901 98-02.
- Peak Voltmeter Type DMI 551 (Ident-No. ELK-000989):
 Calibrated in Mai 2000 at FGH Mannheim,
 FGH-Calibration-Report-No. 073 DKD-K-15901 00-05.
- Oscilloscope Type TDS520 (Ident-No. ELK-000545):
 calibrated in March 2000 at DECMS/LK,
 Calibration-Report-No. 2000297.

ВЯРНО С ОПРИГНАЛА

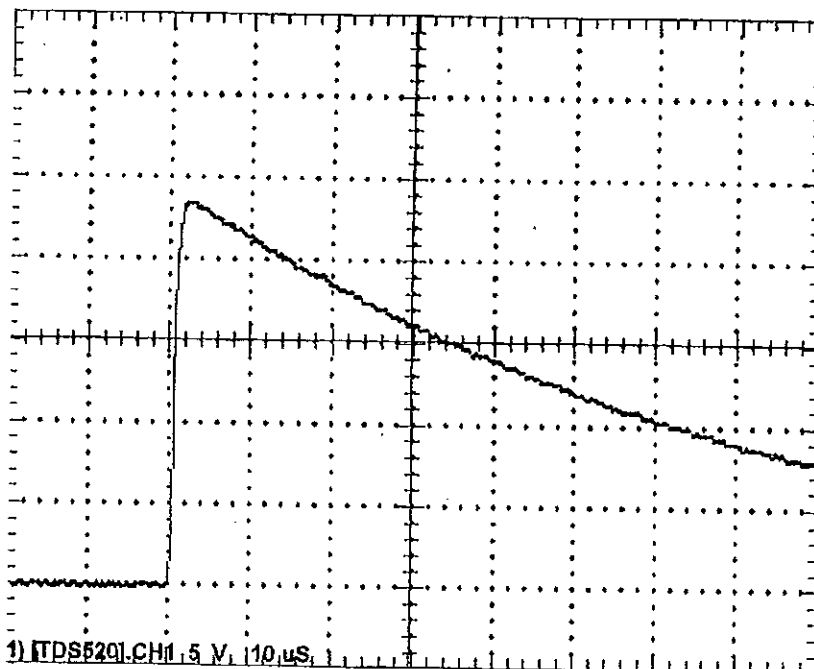


Lightning Impulse Voltage with the Test Object connected

(Standard Value: $1.2 \pm 30\%$ / $50 \pm 20\%$ / peak $\pm 3\%$)

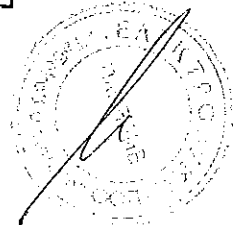


$T_1 = 1.26 \mu s$



$T_2 = 51.0 \mu s$

ВЯРНО С ОРГИНАЛА



Atmospheric Conditions during Tests

Date of test: 28th November 2000

IEC17A/567/Q: Corrigendum to subclause 6.2.1 of IEC60694, 2000-01					
(Indices: ~ power frequency voltage; + positive lightning impulse voltage; - negative lightning impulse voltage)					
Input data		Correction factors		calculated	applied
air temperature t:	19.5 °C	air density	k _{1~} :	1.006	-
air pressure b:	1017 hPa	correction factors	k ₁₊ :	1.006	-
air humidity h:	7.212 g/m ³		k ₁₋ :	1.006	-
50% disruptive-discharge voltages	U _{B~} :	air humidity correction factors	k _{2~} :	0.954	-
	U _{B+} :		k ₂₊ :	0.962	-
	U _{B-} :		k ₂₋ :	0.962	-
minimum discharge path L:	m	atmospheric correction factors	K _{1~} :	0.960	0.960
			K ₁₊ :	0.967	0.967
			K ₁₋ :	0.967	0.967

ВЯРНО С ОРЪИГИНАЛА



Lightning Impulse Voltage Test Power Frequency Voltage Test

Test performed: Test of insulation phase-to-phase, phase-to-ground and against shutter.

Date of test: 28th November 2000

Condition of test object before test: Factory new, clean and dry.

Connections to test object: For further details see the entry in column 'Condition'

Front time T_1 : 1.26 μ s

Time to half-value T_2 : 51.0 μ s

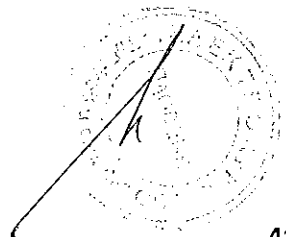
Test frequency f : 50 Hz

All voltage values are corrected with the applied atmospheric correction factor.
The applied test voltages refer to the standard atmosphere of 20 °C, 1013 hPa and 11 g/m³.

Test Arrangement 1:			Applied power frequency voltage ~ kV	Result
Condition	Voltage applied to	Earthed		
Vacuum circuit-breaker in test position, shutters closed. Infeed of the test voltage at the led-out busbar right hand.	A	BCabcF	50 +125 -125	1 minute/0 15/0 15/0
	B	ACabcF	50 +125 -125	1 minute/0 15/0 15/0
	C	ABabcF	50 +125 -125	1 minute/0 15/0 15/0
Vacuum circuit-breaker in test position, shutters closed. Infeed at the cable connecting bar in the cable compartment.	a	ABCbcF	50 +125 -125	1 minute/0 15/0 15/0
	b	ABCacF	50 +125 -125	1 minute/0 15/0 15/0
	c	ABCabF	50 +125 -125	1 minute/0 15/0 15/0

Remarks: A,a = Phase L1, B,b = Phase L2, C,c = Phase L3, F = Frame

ВЯРНО С ОПРИГНАЛА



Lightning Impulse Voltage Test Power Frequency Voltage Test

Test performed: Test of insulation phase-to-phase, phase-to-ground and across open switching device.

Date of test: 28th November 2000

Condition of test object before test: Factory new, clean and dry.

Connections to test object: For further details see the entry in column 'Condition'

Front time T_1 : 1.26 μ s

Time to half-value T_2 : 51.0 μ s

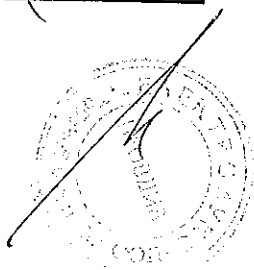
Test frequency f : 50 Hz

All voltage values are corrected with the applied atmospheric correction factor.
The applied test voltages refer to the standard atmosphere of 20 °C, 1013 hPa and 11 g/m³.

Test arrangement 2:			Applied power frequency voltage ~ kV	Result
Condition	Voltage applied to	Earthed		
Vacuum circuit-breaker in service position and open. Infeed of the test voltage at the led-out busbar right hand.	A	BCabcF	50 +125 -125	1 minute/0 15/0 15/0
	B	ACabcF	50 +125 -125	1 minute/0 15/0 15/0
	C	ABabcF	50 +125 -125	1 minute/0 15/0 15/0
Vacuum circuit-breaker in service position and open. Infeed of the test voltage at the cable connecting bar in the cable compartment.	a	ABCbcF	50 +125 -125	1 minute/0 15/0 15/0
	b	ABCacF	50 +125 -125	1 minute/0 15/0 15/0
	c	ABCabF	50 +125 -125	1 minute/0 15/0 15/0

Remarks: A,a = Phase L1, B,b = Phase L2, C,c = Phase L3, F = Frame

ВЯРНО С ОПРИГНАЛА



Lightning Impulse Voltage Test Power Frequency Voltage Test

Test performed: Test of insulation phase-to-phase and phase-to-ground.

Date of test: 28th November 2000

Condition of test object before test: Factory new, clean and dry.

Connections to test object: Infeed of the test voltage at the led-out busbar right hand.

Front time T_1 : 1.26 μ s

Time to half-value T_2 : 51.0 μ s

Test frequency f : 50 Hz

All voltage values are corrected with the applied atmospheric correction factor.
The applied test voltages refer to the standard atmosphere of 20 °C, 1013 hPa and 11 g/m³.

Test Arrangement 3:			Applied power frequency voltage ~ kV	Result
Condition	Voltage applied to	Earthed		
Vacuum circuit-breaker in service position and closed	Aa	BCbcF	50 +125 -125	1 minute/0 15/0 15/1
	Bb	ACacF	50 +125 -125	1 minute/0 15/0 15/0
	Cc	ABabF	50 +125 -125	1 minute/0 15/0 15/0

Remarks: A,a = Phase L1, B,b = Phase L2, C,c = Phase L3, F = Frame

ВЯРНО С ОРИГИНАЛА



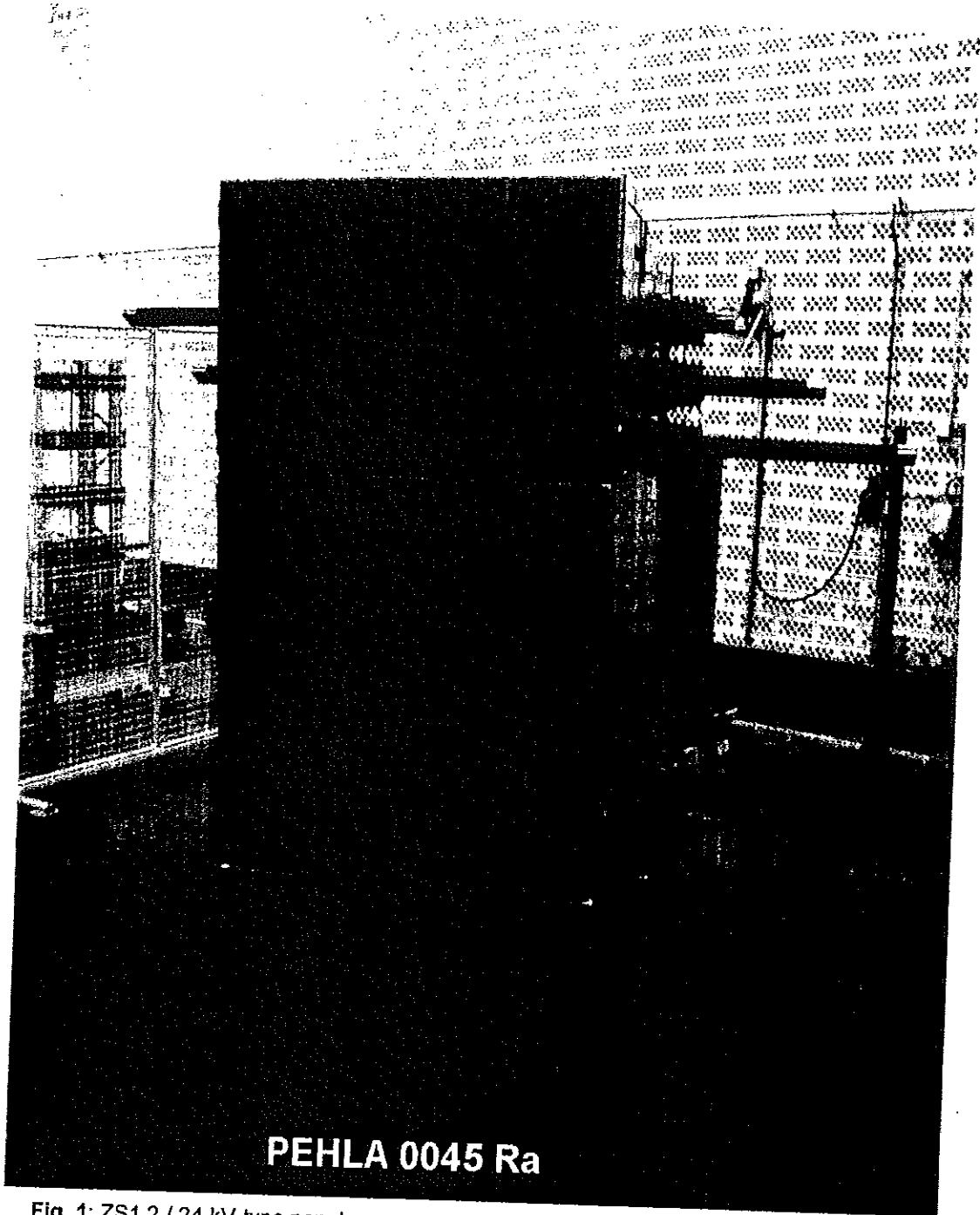


Fig. 1: ZS1.2 / 24 kV-type panel

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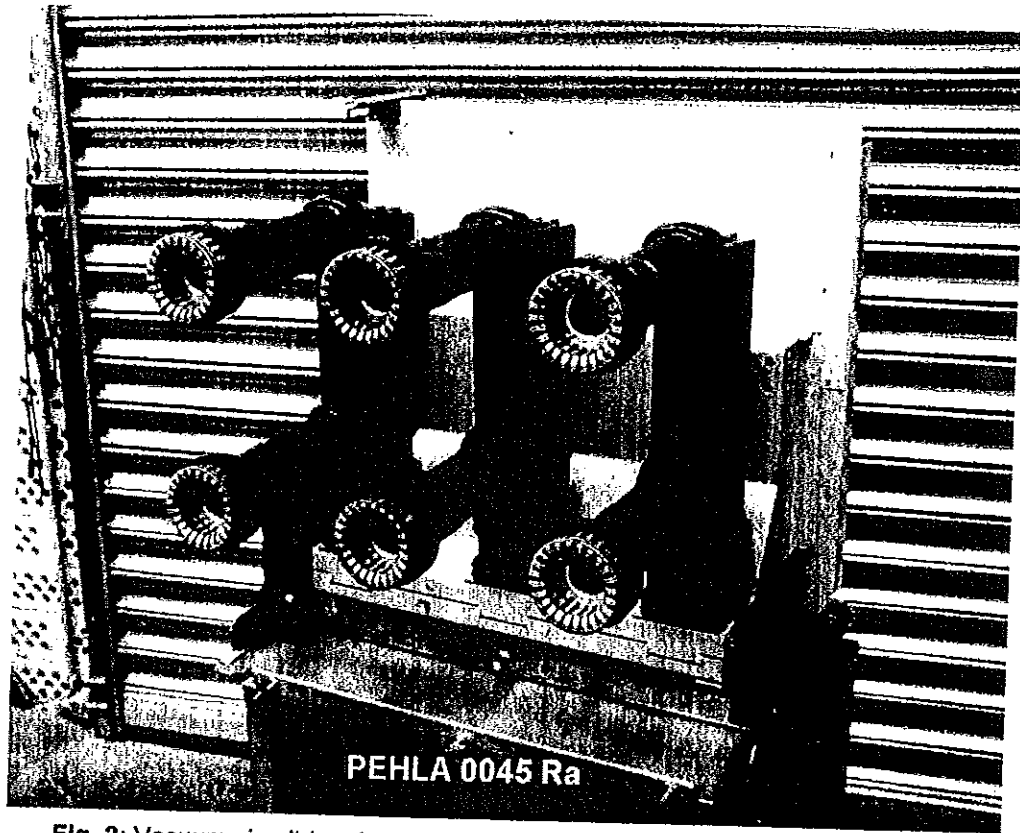


Fig. 2: Vacuum circuit-breaker type VD4P 2420-25

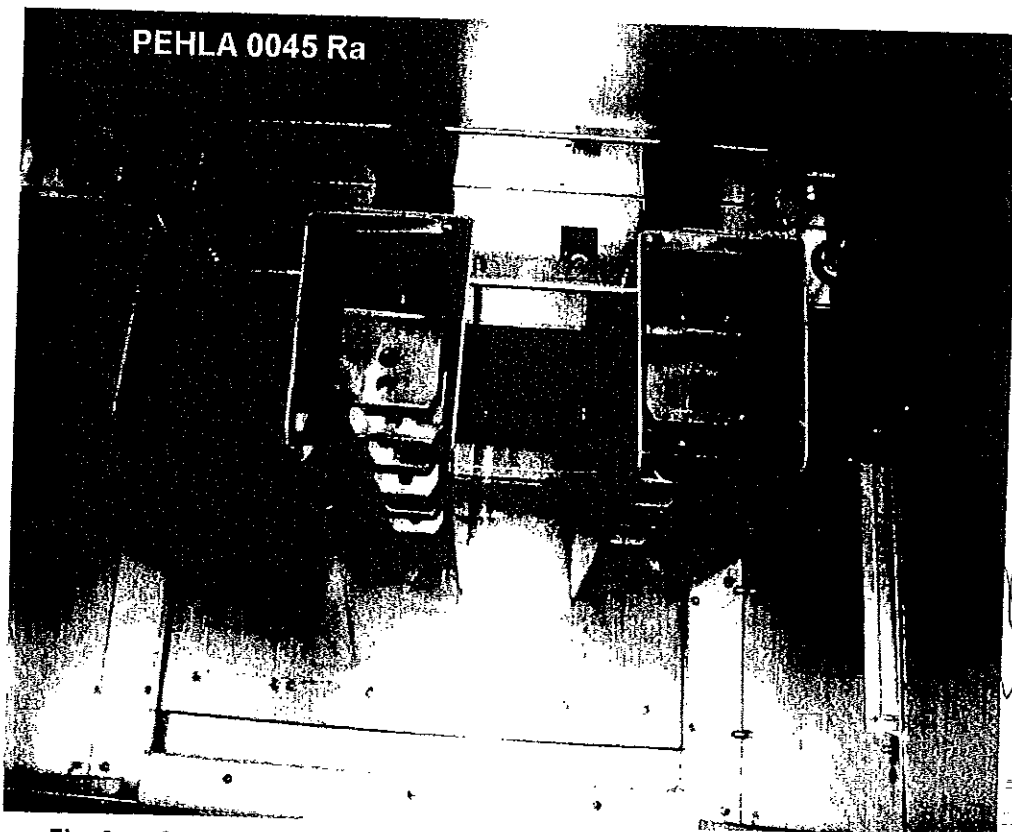
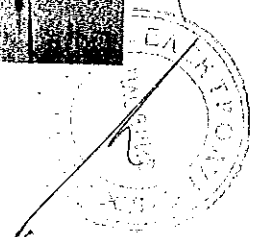


Fig. 3: Cable-compartment

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ABB Calor Emag Laboratories



TEST REPORT No. HZ 235 L 02

Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 1

Copy-No. 1

Test Object Three-panel arrangement of metal-clad, air insulated switchgear type ZS1.2 (1000 mm, 1000 mm, 800 mm width) equipped with bushing plates

Rated voltage	U_r	24 kV
Rated normal current	I_r	1600/1600/1000 A
Rated frequency	f_r	50/60 Hz
Rated short-time withstand current	I_k	25 kA
Rated peak withstand current	I_p	63 kA
Rated duration of short-circuit current	t_k	3 s

Manufacturer ABB Calor Emag Mittelspannung GmbH, Oberhausener Str. 33, 40472 Ratingen, Deutschland

Tests performed Testing of the behaviour of the metal-clad switchgear under conditions of arcing due to internal faults with 25 kA - 1.0 s in different compartments of the three panels. For further details see sheet-no. 2 to 5.

Test Specification The test has been carried out in accordance with the client's instructions. Test procedure and test parameters were based on IEC 60298/3rd Ed/1990-12, Clause 6.108, Annex AA in conjunction with PEHLA-Recommendation No. 4 / 3.1995.
(Accessibility Type A: Metal-enclosed switchgear and controlgear with accessibility restricted to authorized personnel only).

Test Results The assessment of the test was carried out in accordance with criteria 1 to 6 of the above mentioned test specifications. For further details see sheet-no. 2 to 5 and 16 to 20.

Test Date 12th and 14th December 2000

Client ABB Calor Emag Mittelspannung GmbH, Oberhausener Str. 33, 40472 Ratingen, Deutschland



19th February 2002
Date of Issue

Dr. S. Göttlich
Dr. S. Göttlich
Laboratory Manager

A. Brandt
A. Brandt
Test Engineer

Total Number of Sheets: 30 Sheets

11 Oszillograms

This test report refers exclusively to the object tested.
ABB Calor Emag Mittelspannung GmbH is certified according to DIN ISO 9001 by DQS under Reg. No. 373-02

ABB Calor Emag Laboratories Ratingen are accredited according to EN 45001 by DATech under Reg.No. DAT-P-032/93

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High-Power Test Laboratory

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40472 Ratingen, Deutschland

Phone +49 (0) 21 02 12-1352
Fax +49 (0) 21 02 12-1713



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**ABB Calor Emag
Laboratories**



TEST REPORT No. HZ 235 L 02

Sheet 2

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Comments on Test Arrangement and on the Test

The test object was a three-panel arrangement of a metal-clad, air insulated switchgear type ZS1.2 for 24 kV, consisting of a 1000 mm width outgoing panel left-handed, of a 1000 mm width incoming panel in centre and a 800 mm width outgoing panel right-handed. The switchgear was installed in a room mock up with a ceiling height of approximately 3 m. The distance between the rear wall of the switchgear and the room mock up was approximately 0.2 m. The pressure relief took place by a top mounted pressure relief duct overcoming 1800 mm at the side wall of the left-handed panel.

Each panel was equipped with a VD4 vacuum circuit-breaker dummy and a common earthing bar of copper 30 x 8 mm².

Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

For all tests black cretonne indicators (cotton fabric approximately 150 g/m²) were placed in front of and on one side of the switchgear as stated in the relevant test regulations.

During the tests the pressure gauge in the compartment under test was measured and recorded. The tests were filmed with a high-speed video camera with a frequency of 500 frames/s.

The evaluation of the RMS-value of the short-circuit current was made according to the Simpson-Formula.

ВЕРНО С ОРИГИНАЛА



Test Results

Test-no.: HZ 235 L 02 / 03 Internal arcing test in the cable compartment of the right-handed panel (800 mm width), ignition of arc three-phase by means of a copper wire \varnothing 0.5 mm at the cable terminals.

Peak short-circuit current: 59.7 kA
Short-circuit current: 24.7 kA - 1.03 s equivalent to 25.0 kA - 1.02 s

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

Test-no.: HZ 235 L 02 / 04 Internal arcing test in the cable compartment of the left-handed panel (1000 mm width), ignition of arc three-phase by means of a copper wire \varnothing 0.5 mm at the cable terminals.

Peak short-circuit current: 59.7 kA
Short-circuit current: 24.9 kA - 1.04 s equivalent to 25.0 kA - 1.03 s

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

ВЕРНО С ОРИГИНАЛА



Test Results

Test-no.: HZ 235 L 02 / 05 Internal arcing test in the circuit-breaker compartment of the right-handed panel (800 mm width), ignition of arc three-phase by means of a copper wire \varnothing 0.5 mm across the lower contact arms of the circuit-breaker.

Peak short-circuit current: 58.8 kA
Short-circuit current: 24.7 kA - 1.04 s equivalent to 25.0 kA - 1.02 s

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

Test-no.: HZ 235 L 02 / 06 Internal arcing test in the busbar compartment of the left-handed panel (1000 mm width), ignition of arc three-phase by means of a copper wire \varnothing 0.5 mm across the busbars.

Peak short-circuit current: 56.8 kA
Short-circuit current: 24.7 kA - 1.04 s equivalent to 25.0 kA - 1.03 s

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

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TEST REPORT No. HZ 235 L 02

Sheet 5

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Test Results

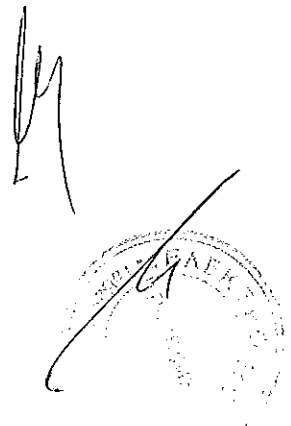
Test-no.: HZ 235 L 02 / 07 Internal arcing test in the circuit-breaker compartment of the centre panel (1000 mm width), ignition of arc three-phase by means of a copper wire \varnothing 0.5 mm across the upper contact arms of the circuit-breaker.

Peak short-circuit current: 59.6 kA
Short-circuit current: 24.7 kA - 1.04 s equivalent to 25.0 kA - 1.03 s

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

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TEST REPORT No. HZ 235 L 02

Sheet 6

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Test Results	3 - 5
Contents	6
Assessment of the Test	7
Participants of the Test	8
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Table of Drawings of Test Objects	11
Drawings	12 - 14
Technical Data of Test Circuit	15
Principle Diagram of Test Circuit	16
Determination of the Prospective Short-Circuit Current	17
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**ABB Calor Emag
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TEST REPORT No. HZ 235 L 02

Sheet 7

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Assessment of the Test

Extraction of IEC 60298/3rd Ed/1990-12, Annex AA

The following criteria allow for the arcing effects.
It is to be observed:

Criterion No. 1

Whether correctly secured doors, covers, etc., do not open.

Criterion No. 2

Whether parts (of the metal-enclosed switchgear and controlgear), which may cause a hazard, do not fly off. This includes large parts or those with sharp edges, for example, inspection windows, pressure relief flaps, cover plates, etc.

Criterion No. 3

Whether arcing does not cause holes to develop in the freely accessible parts of the enclosure as a result of burning or other effects.

Criterion No. 4

Whether the indicators arranged vertically do not ignite. Indicators ignited as a result of paint or stickers burning are excluded from this assessment.

Criterion No. 5

Whether the indicators arranged horizontally do not ignite. Should they start to burn during the test, the assessment criterion may be regarded as having been met, if proof is established of the fact that the ignition was caused by glowing particles rather than hot gases. Pictures taken by high-speed cameras should be produced in evidence.

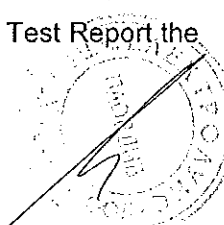
Criterion No. 6

Whether all earthing connections are still effective.

Remark:

When the PEHLA-Recommendation No. 4 is stated under *Test Specification* in the Test Report the results of each test were assessed by all six criteria.

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TEST REPORT No. HZ 235 L 02

Sheet 8

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Participants of the Tests

Client: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen,
Deutschland

Representatives of the client:

Mr. Aufermann ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen,
Deutschland
Dept. EA

Mr. Groll ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen,
Deutschland
Dept. EA

Representatives of the laboratory:

Mr. Dr. Göttlich ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen,
Deutschland
Dept. LL

Test Engineer:

Mr. Brandt ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen,
Deutschland
Dept. LL

ВЯРНО С ОРИГИНАЛА





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TEST REPORT No. HZ 235 L 02

Sheet 9

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Technical Data of Test Object
(Ratings assigned by the manufacturer)
Switchgear (left-handed and centre)

Test Object: Metal-clad, air insulated switchgear

Type: ZS1.2, 1000 mm width

Manufacturer: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen, Deutschland

Serial-No.: 7550027/2027/00
7550027/2025/00

Year of manufacture: 2000

Drawing Nos.: See sheet-no. 10

Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV
Rated frequency	50/60	Hz
Rated current (busbar)	2000	A
Rated current (tee-off)	1600	A
Rated short-circuit peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated short-circuit duration	3	s
Insulating medium	air	
Rated filling pressure (abs., 20 ° C)	-	kPa

Prospective values under internal-arc conditions:

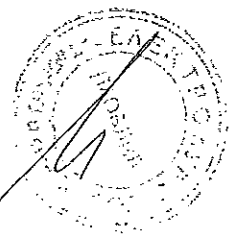
Peak withstand current	63	kA
Short-time withstand current	25	kA
Short-circuit duration	1	s

Additional specifications and data:

- busbars 2 x 80 mm x 10 mm / R 5 mm, Cu, insulated
- tee-off bars 2 x 80 mm x 10 mm / R 5 mm, Cu, insulated

Date of receipt of test object: 11th December 2000

ВЯРНО С ОРМИНАЛА





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Sheet 10

Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switchgear (right-handed)

Test Object: Metal-clad, air insulated switchgear

Type: ZS1.2, 800 mm width

Manufacturer: ABB Calor Emag Mittelspannung GmbH, 40472 Ratingen, Deutschland

Serial-No.: 7550027/2022/00

Year of manufacture: 2000

Drawing Nos.: See sheet-no. 10

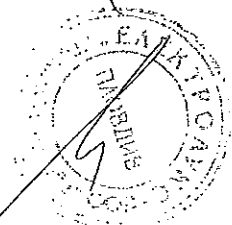
Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV
Rated frequency	50/60	Hz
Rated current (busbar)	2000	A
Rated current (tee-off)	1000	A
Rated short-circuit peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated short-circuit duration	3	s
Insulating medium	air	
Rated filling pressure (abs., 20 ° C)	-	kPa
Prospective values under internal-arc conditions:		
Peak withstand current	63	kA
Short-time withstand current	25	kA
Short-circuit duration	1	s

Additional specifications and data:

- busbars 2 x 80 mm x 10 mm / R 5 mm, Cu, insulated
- tee-off bars 1 x 60 mm x 10 mm / R 5 mm, Cu, insulated

Date of receipt of test object: 11th December 2000

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Laboratories**



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Sheet 11

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Table of Drawings of Test Objects

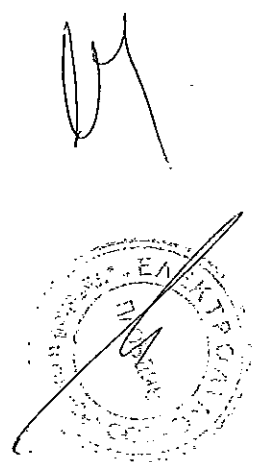
The drawings submitted for identification of the test object were stamped and signed by the test engineer.

The manufacturer/client has guaranteed by signature on the drawings that the equipment submitted for tests has been manufactured in accordance with the given drawings.

A copy of the following drawing is part of this Test Report:

ZS 1.2, feeder panel 24 kV, PW.1000	GCE8010459R0101, sheet 1, index 01,
ZS 1.2, feeder panel 24 kV, PW.800	GCE8010457R0101, sheet 1, index 01,
Type Test Arrangement (internal fault) ZS1.2 – Panel 24kV	GCEP800240 sheet 1, index 00

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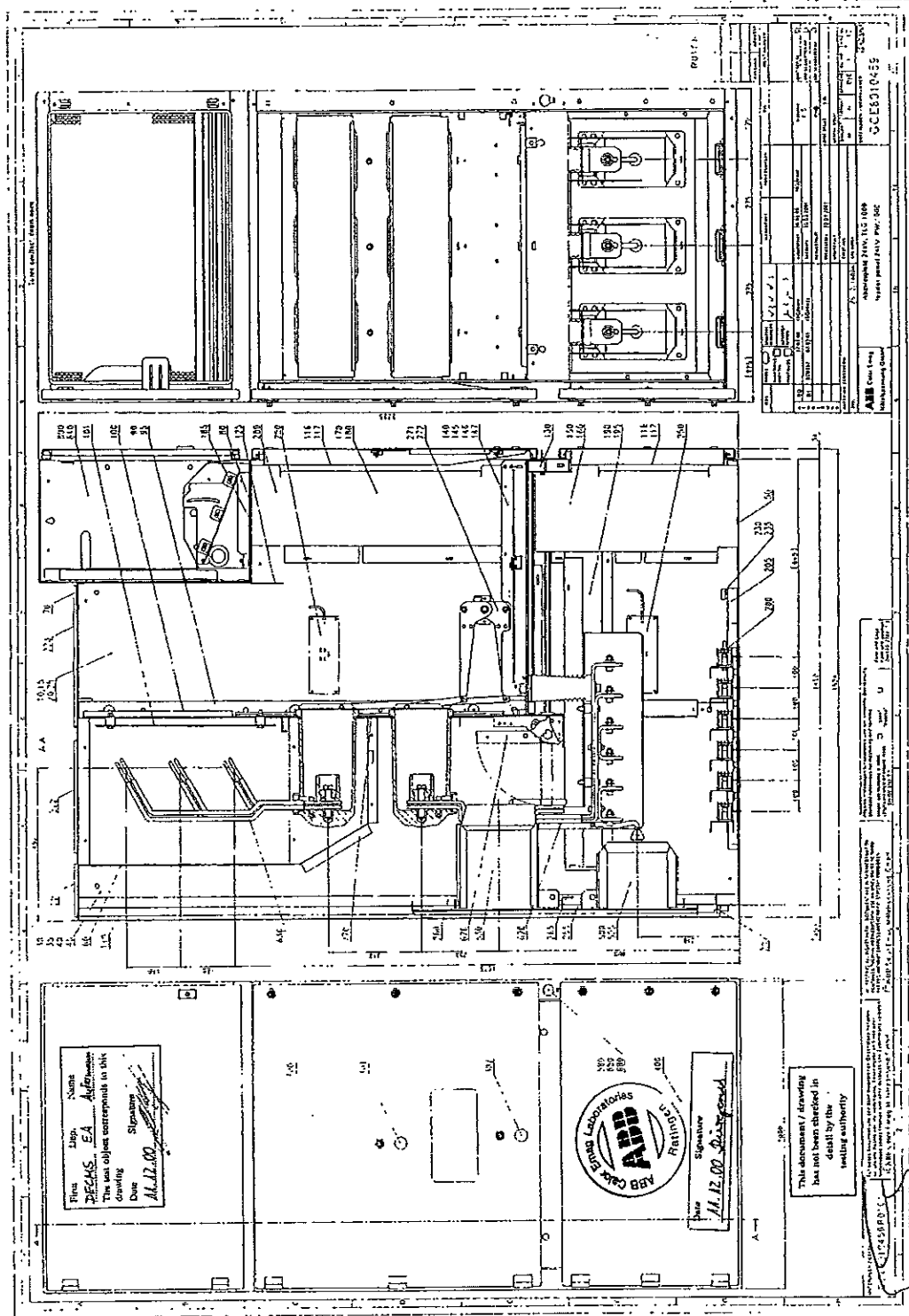
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Sheet 12

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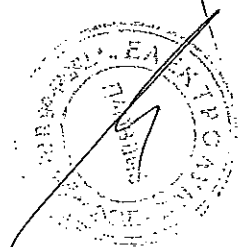


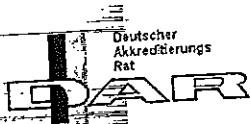
Name: *EA*
 Date: *11.12.00*
 Signature: *[Signature]*
 This document / drawing has not been changed in detail by the issuing authority.

Signature: *[Signature]*
 Date: *11.12.00*
 Position: *Quality Control*

This document / drawing has not been changed in detail by the issuing authority.

ВЕРНО С ОРИГИНАЛА





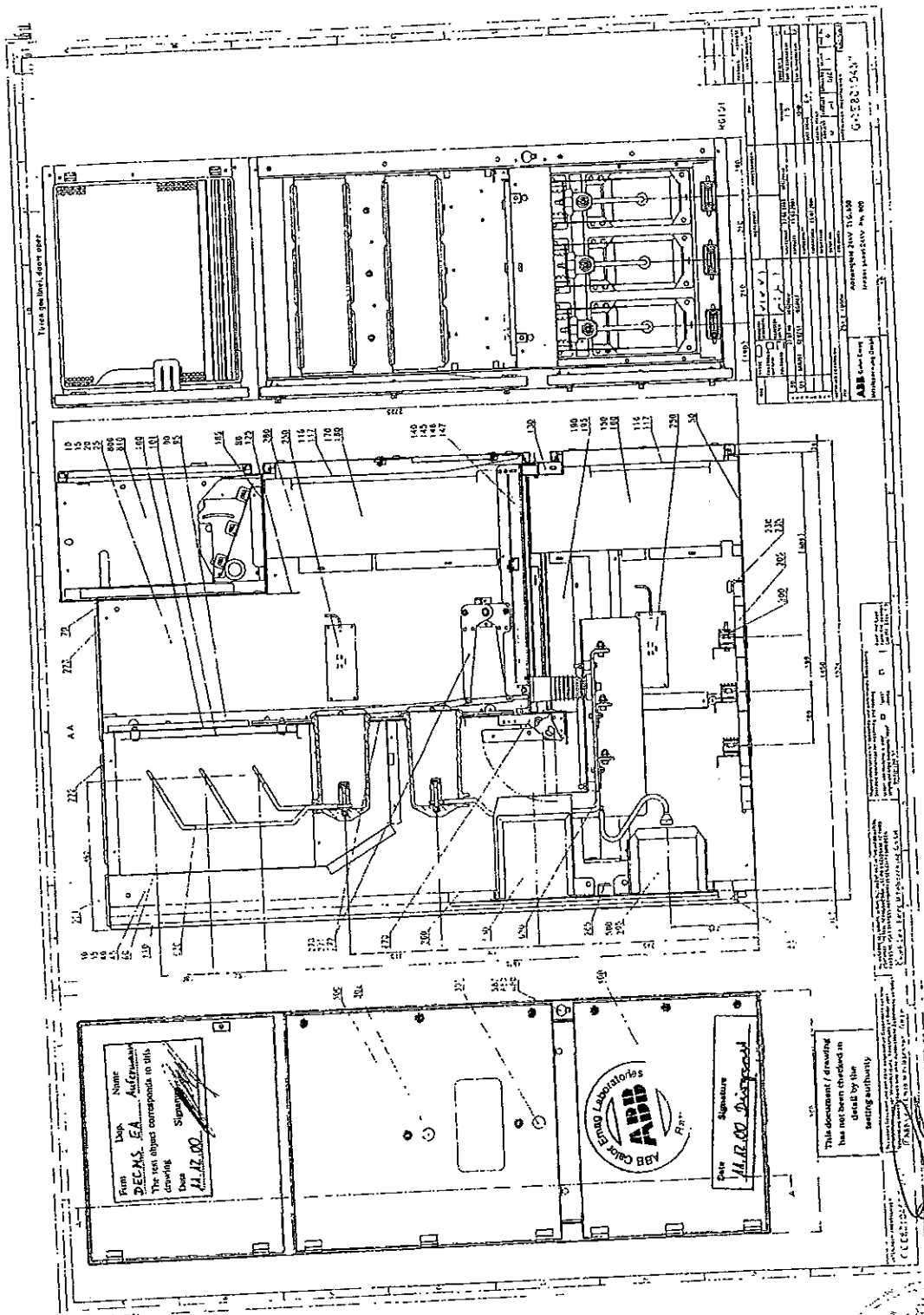
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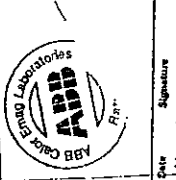


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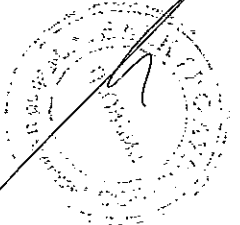


From: Name: DECA S. EA Auftragsnr. HZ 235 L 02
The test object corresponds to this drawing.
Date: 11.12.00
Signature: [Signature]



Date: 11.12.00
Signature: [Signature]

This document / drawing has not been checked in detail by the testing authority.

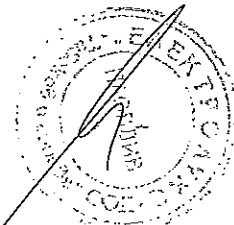


Technical Data of Test Circuit

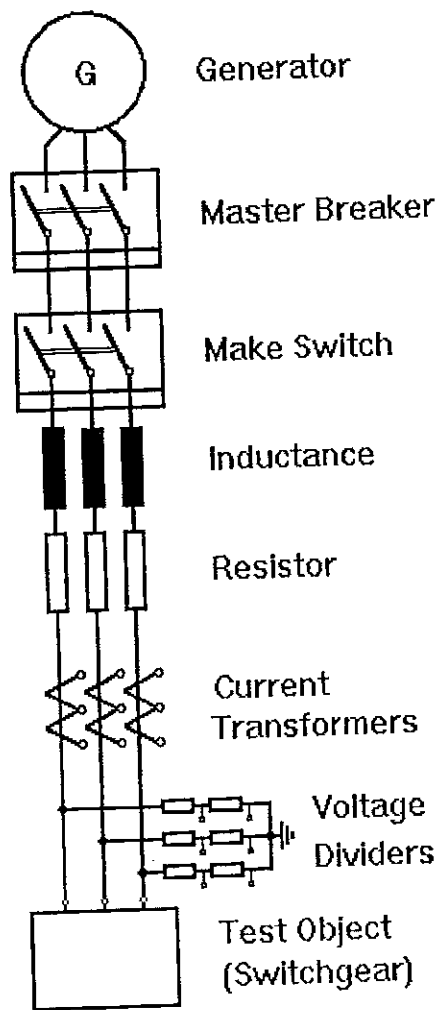
Test	Internal fault	-	-	-
Oscillogram-No. HZ 235 L 02	02 - 07	-	-	-
Number of phases (circuit)	3	-	-	-
Number of poles/phases (test object)	3	-	-	-
Power frequency Hz	50	-	-	-
Power factor $\cos \varphi$	≤ 0.15	-	-	-
Earthing	Generator	earthed via 5 k Ω	-	-
	Transformer	not earthed	-	-
	Short-circuit point	not earthed	-	-
Circuit diagram Sheet no.:	16	-	-	-
Circuit impedance m Ω	≈ 170	-	-	-
	-	-	-	-
TRV control elements	-	-	-	-
Capacitance in parallel μF	-	-	-	-
Resistance in series Ω	-	-	-	-
	-	-	-	-
Prospective TRV	-	-	-	-
TRV peak value u_c kV	-	-	-	-
Time co-ordinate t_3 μs	-	-	-	-
Time delay t_d μs	-	-	-	-
Based on kV	-	-	-	-
Rate-of-rise kV/ μs	-	-	-	-
	-	-	-	-
	-	-	-	-
Voltage measurements	Divider 375 k Ω / 2 k Ω	-	-	-
Current measurements	Transformer 50 kA / 5 A	-	-	-

Remarks:
 HZ 235 L 02 / 01: Current calibration

ВЯРНО С ОПРИГНАЛА



Principle Diagram of Test Circuit



ВЯРНО С ОРИГИНАЛА

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Sheet 17

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Determination of the Prospective Short-Circuit Current

Condition of test object before test: -

Arrangement: See sheet-no. 2

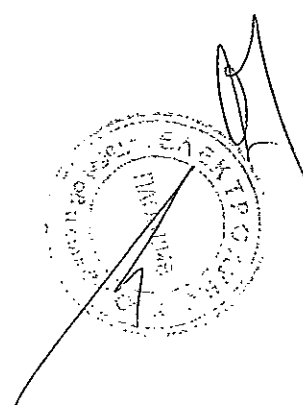
Connection: Infeed of current was made three-phase by means of a three core cable
1 x 3 x 185 mm² through the closed bottom of the centre panel.

For the determination of the prospective short-circuit current the infeeding busbars of the test plant were short-circuited and earthed outside the switchgear under test.

Test-No.: HZ 235 L 02 / 02		Applied voltage (phase-to-phase) 7.30 kV		Duration of short-circuit current 1.03 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	65.8	27.2	25.8	25.0
L2	19.6	26.9	25.9	25.1
L3	51.3	26.9	25.5	24.8
Average value		27.0	25.7	25.0
Equivalent duration of short-circuit current 1.03 s			corresponding to a short-circuit current of 25.0 kA	

Remarks: -

ВЯРНО С ОРИГИНАЛА





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Sheet 18

Internal Arcing Test

Condition of test object before test: Switchgear factory-new.

Arrangement: See sheet-no.: 2

Connection: Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

Ignition: Internal arcing test in the cable compartment of the right-handed panel (800 mm width), ignition of arc three-phase by means of a copper wire Ø 0.5 mm at the cable terminals.

Test-No.: HZ 235 L 02 / 03		Applied voltage (phase-to-phase) 7.45 kV		Duration of short-circuit current 1.03 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	59.7	26.9	25.6	24.8
L2	18.3	26.3	25.7	24.9
L3	45.4	26.4	25.2	24.4
Average value		26.5	25.5	24.7
Equivalent duration of short-circuit current 1.02 s			corresponding to a short-circuit current of 25.0 kA	

Remarks and condition of test object after test:

The condition of the switchgear before and after test is shown on the photos on sheet-no. 23 to 29: The measured pressure gauge was about 42 kPa.

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

ВЕРНО С ОРИГИНАЛА



Internal Arcing Test

Condition of test object before test: as after test HZ 235 L 02 / 03.

Arrangement: See sheet-no.: 2

Connection: Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

Ignition: Internal arcing test in the cable compartment of the left-handed panel (1000 mm width), ignition of arc three-phase by means of a copper wire Ø 0.5 across the cable terminals.

Test-No.: HZ 235 L 02 / 04		Applied voltage (phase-to-phase) 7.45 kV		Duration of short-circuit current 1.04 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	59.7	27.1	25.8	25.1
L2	20.5	26.0	25.7	25.0
L3	47.5	26.6	25.4	24.6
Average value		26.6	25.7	24.9
Equivalent duration of short-circuit current 1.03 s			corresponding to a short-circuit current of 25.0 kA	

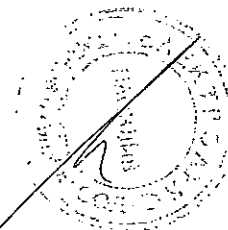
Remarks and condition of test object after test:

The condition of the switchgear before and after test is shown on the photos on sheet-no. 23 to 29. The measured pressure gauge was about 45 kPa.

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2)
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

ВЯРНО С ОРИГИНАЛА



Internal Arcing Test

Condition of test object before test: as after test HZ 235 L 02 / 04.

Arrangement: See sheet-no.: 2

Connection: Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

Ignition: Internal arcing test in the circuit-breaker compartment of the right-handed panel (800 mm width), ignition of arc three-phase by means of a copper wire Ø 0.5 mm across the lower contact arms of the circuit-breaker.

Test-No.: HZ 235 L 02 / 05		Applied voltage (phase-to-phase) 7.45 kV		Duration of short-circuit current 1.04 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	58.8	26.8	25.3	24.5
L2	19.4	26.3	25.7	24.8
L3	46.4	27.0	25.6	24.7
Average value		26.7	25.5	24.7
Equivalent duration of short-circuit current 1.02 s				corresponding to a short-circuit current of 25.0 kA

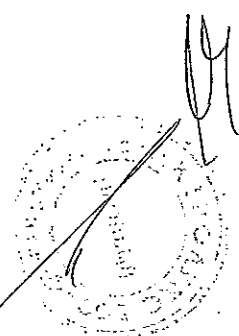
Remarks and condition of test object after test:

The condition of the switchgear before and after test is shown on the photos on sheet-no. 23 to 29. The measured pressure gauge was about 31 kPa.

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

ВЯРНО С ОПРИГНАЛА



Internal Arcing Test

Condition of test object before test: as after test HZ 235 L 02 / 05.

Arrangement: See sheet-no.: 2

Connection: Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

Ignition: Internal arcing test in the busbar compartment of the left-handed panel (1000 mm width), ignition of arc three-phase by means of a copper wire Ø 0.5 mm across the busbars.

Test-No.: HZ 235 L 02 / 06		Applied voltage (phase-to-phase) 7.45 kV		Duration of short-circuit current 1.04 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	56.8	26.6	25.5	24.7
L2	19.3	25.3	26.5	25.0
L3	44.1	26.9	24.7	24.2
Average value		26.3	25.6	24.7
Equivalent duration of short-circuit current 1.03 s				corresponding to a short-circuit current of 25.0 kA

Remarks and condition of test object after test:

The condition of the switchgear before and after test is shown on the photos on sheet-no. 23 to 29. The measured pressure gauge was about 60 kPa.

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

ВЯРНО С ОРИГИНАЛА



Internal Arcing Test

Condition of test object before test: as after test HZ 235 L 02 / 06.

Arrangement: See sheet-no.: 2

Connection: Infeed of current was made three-phase by means of a three core cable 1 x 3 x 185 mm² through the closed bottom of the centre panel.

Ignition: Internal arcing test in the circuit-breaker compartment of the centre panel (1000 mm width), ignition of arc three-phase by means of a copper wire Ø 0.5 mm across the upper contact arms of the circuit-breaker.

Test-No.: HZ 235 L 02 / 07		Applied voltage (phase-to-phase) 7.45 kV		Duration of short-circuit current 1.04 s
	Peak short-circuit current kA	Short-circuit current:		Arithmetic mean value kA
		first cycle kA	last cycle kA	
L1	59.6	26.7	25.2	24.6
L2	18.7	26.7	25.8	25.0
L3	45.9	27.0	25.3	24.7
Average value		26.8	25.5	24.7
Equivalent duration of short-circuit current 1.03 s				corresponding to a short-circuit current of 25.0 kA

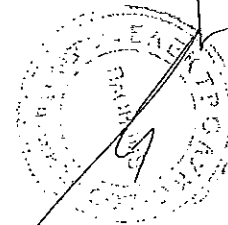
Remarks and condition of test object after test:

The condition of the switchgear before and after test is shown on the photos on sheet-no. 23 to 29. The measured pressure gauge was about 28 kPa.

Assessment of the test:

- Correctly secured doors, covers, etc. did not open (Criterion No. 1).
- Parts of the switchgear, which may cause injury to persons, did not fly off (Criterion No. 2).
- Arc did not cause holes to develop in the outer, freely accessible parts of the enclosure as a result of burning or other effects (Criterion No. 3).
- The indicators arranged vertically did not ignite (Criterion No. 4).
- The indicators arranged horizontally did not ignite (Criterion No. 5).
- All earthing connections were still effective (Criterion No. 6).

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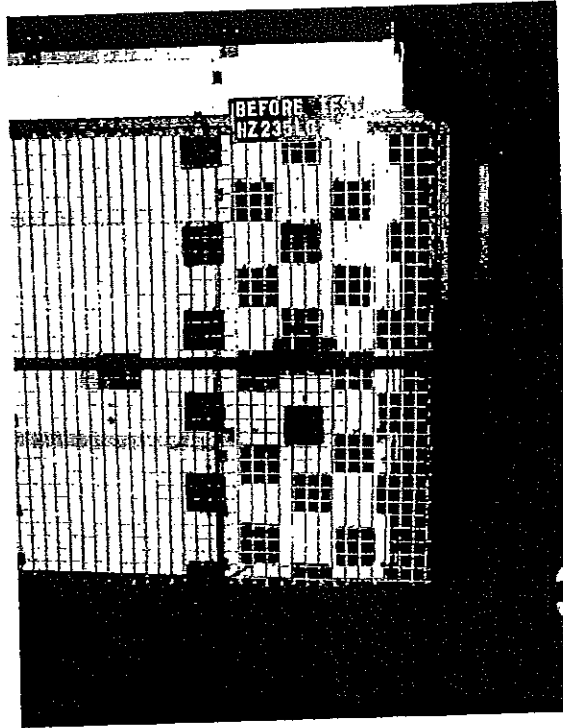


Photo No. 01
Before Test HZ 235 L 02 / 03

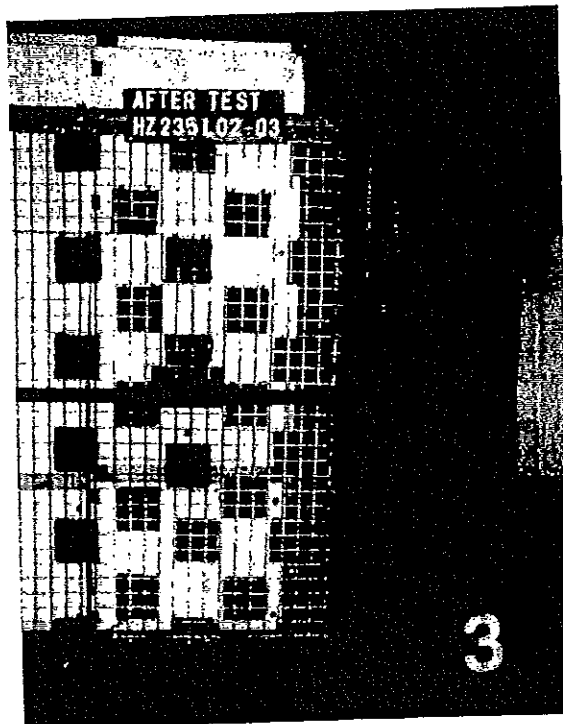
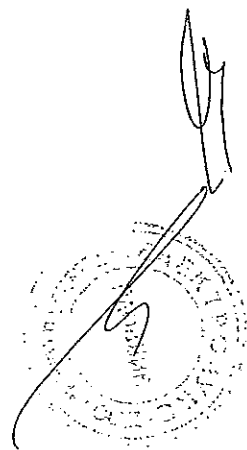


Photo No. 02
After Test HZ 235 L 02 / 03

ВЯРНО С ОРИГИНАЛА



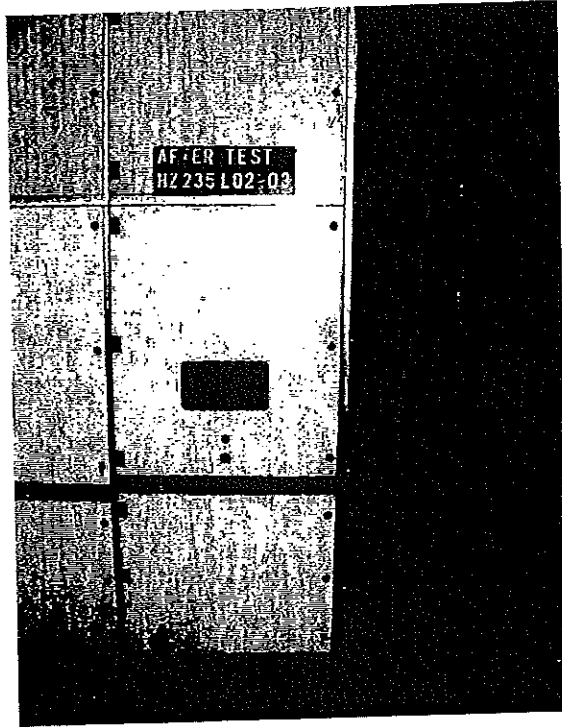


Photo No. 03
After Test HZ 235 L 02 / 03

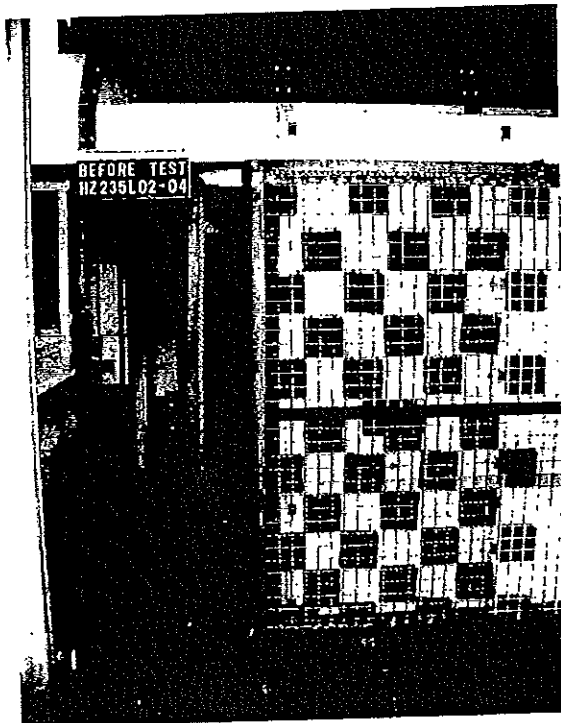


Photo No. 04
Before Test HZ 235 L 02 / 04

ВЯРНО С ОРИГИНАЛА

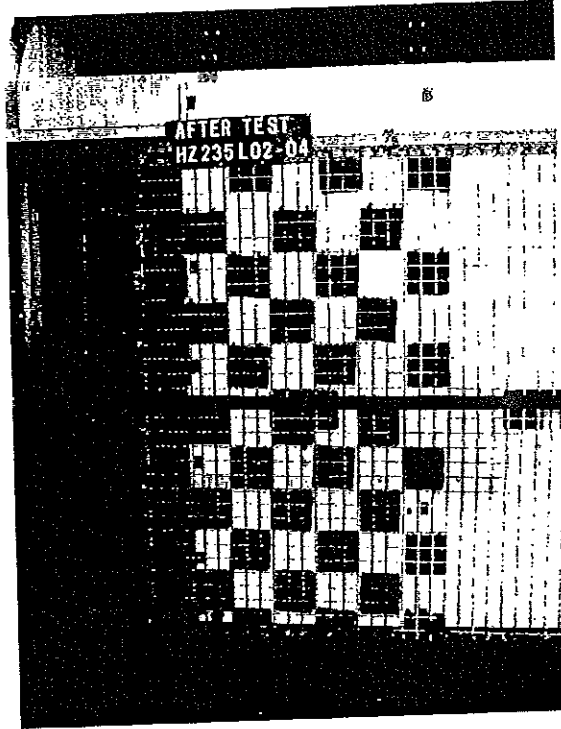


Photo No. 05
After Test HZ 235 L 02 / 04

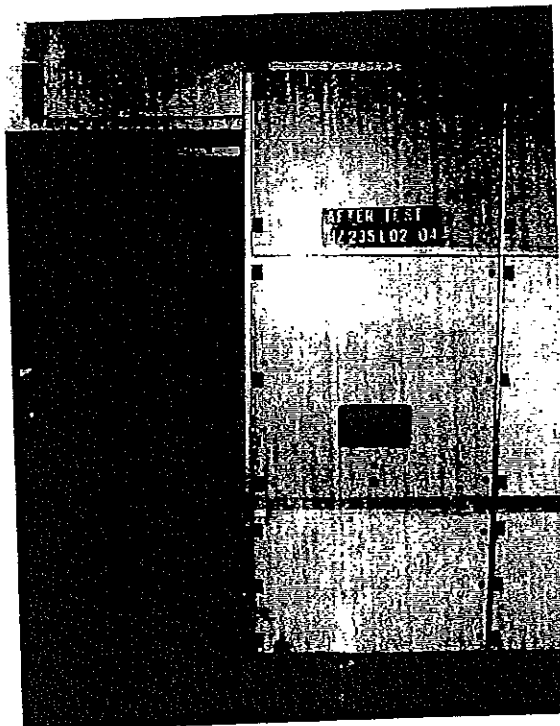


Photo No. 06
After Test HZ 235 L 02 / 04

ВЯРНО С ОРИГИНАЛА

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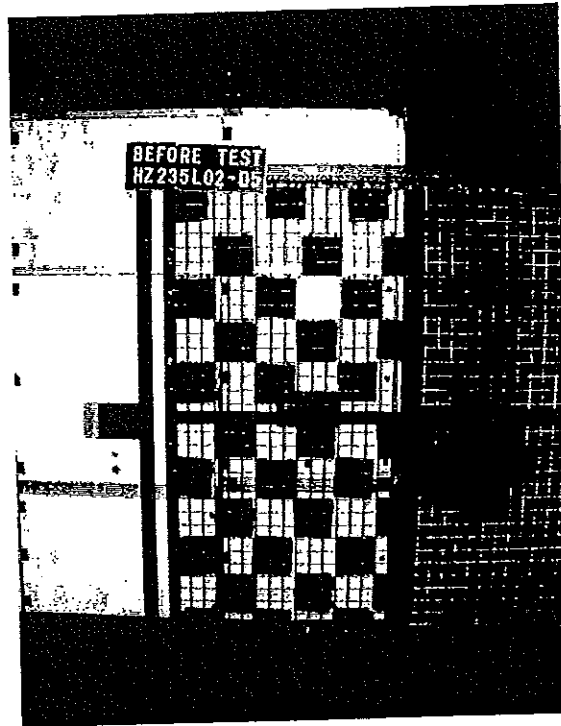


Photo No. 07
Before Test HZ 235 L 02 / 05

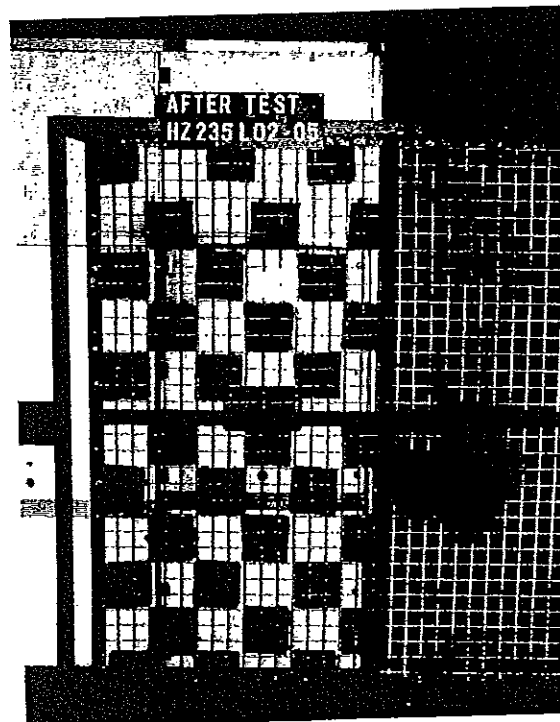


Photo No. 08
After Test HZ 235 L 02 / 05

ВЯРНО С ОРИГИНАЛА

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[Circular stamp]



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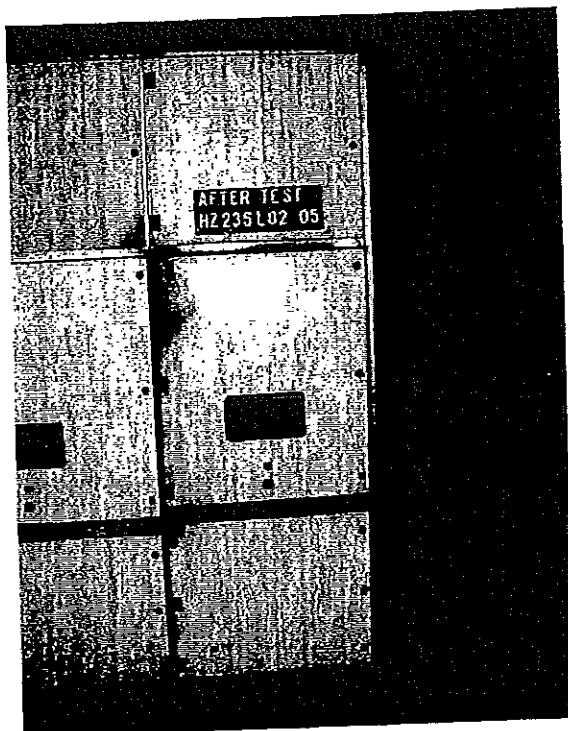


Photo No. 09
After Test HZ 235 L 02 / 05

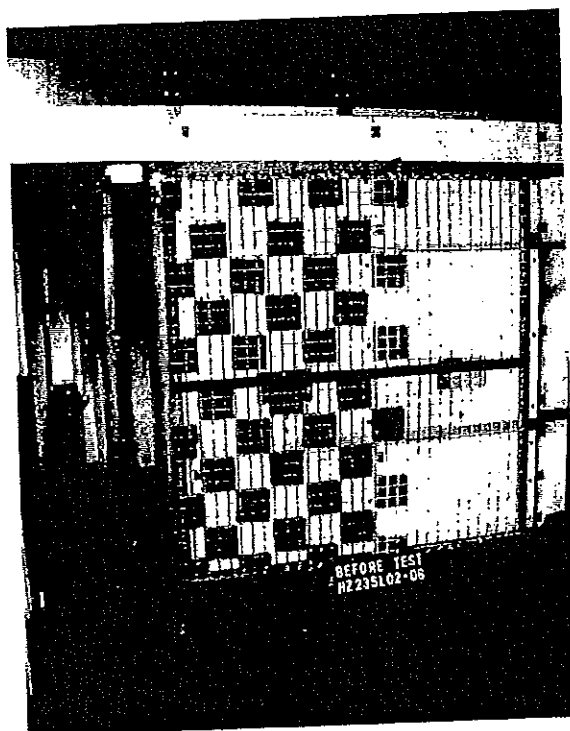
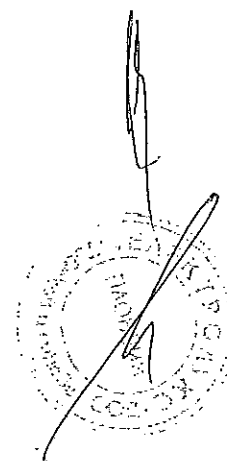


Photo No. 10
Before Test HZ 235 L 02 / 06

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Sheet 28

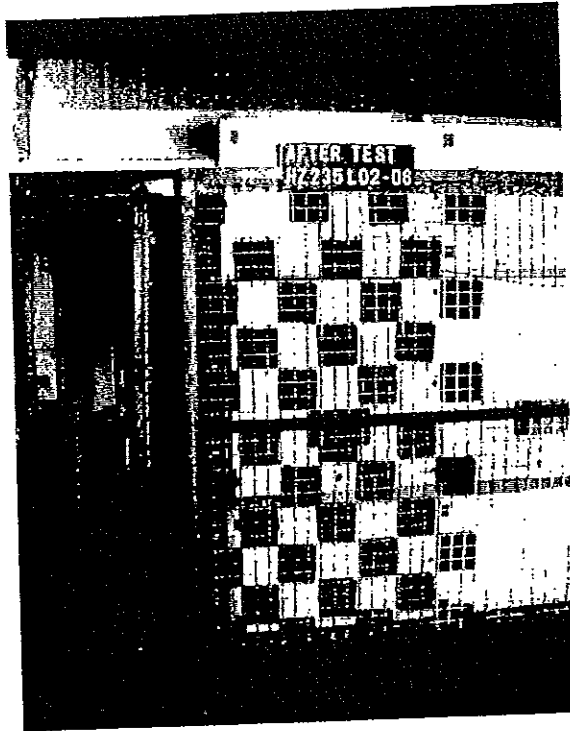


Photo No. 11
After Test HZ 235 L 02 / 06

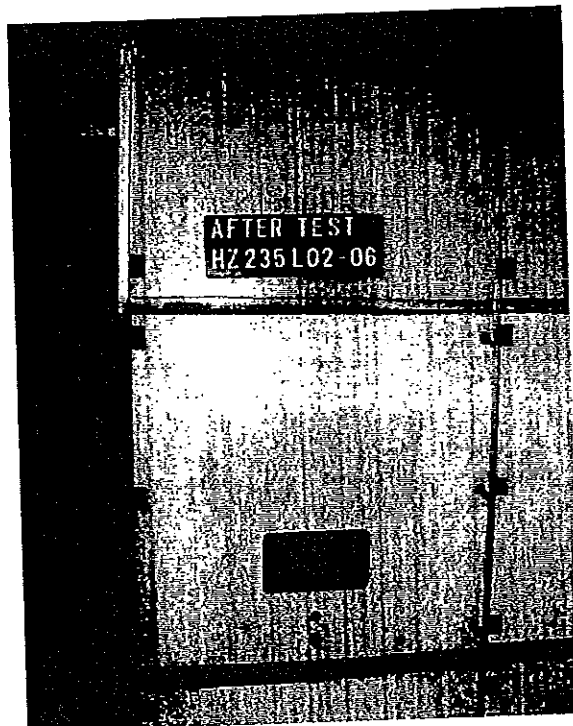
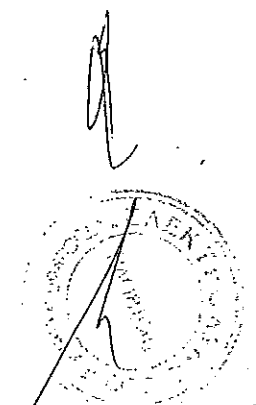


Photo No. 12
After Test HZ 235 L 02 / 06

ВЯРНО С ОРИГИНАЛА



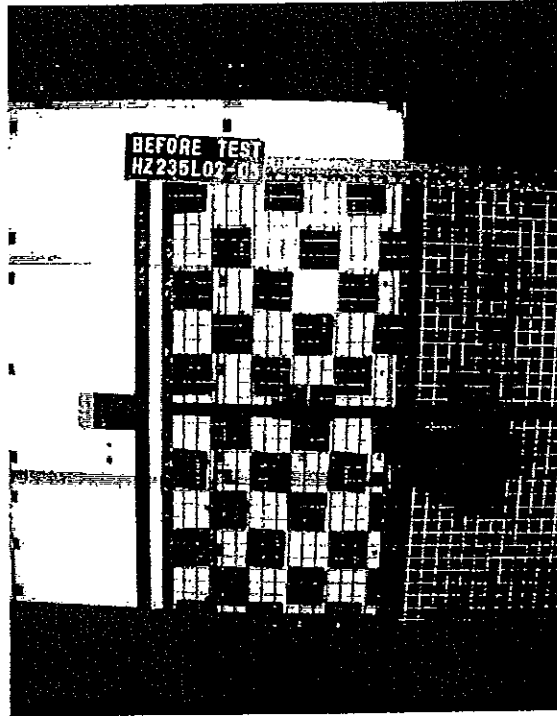


Photo No. 13
Before Test HZ 235 L 02 / 07

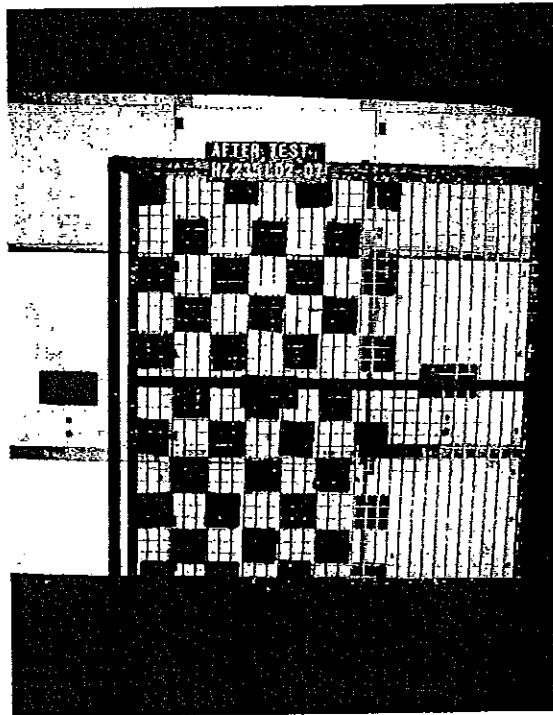
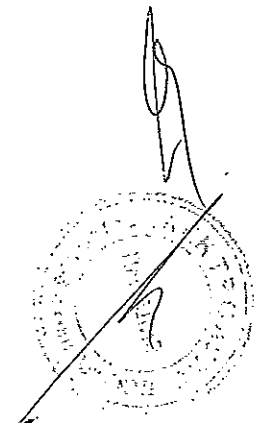


Photo No. 14
After Test HZ 235 L 02 / 07

ВЯРНО С ОРИГИНАЛА



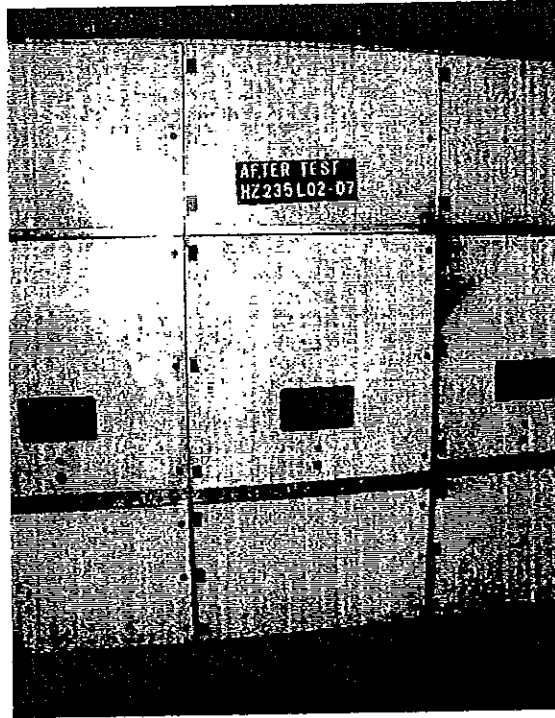
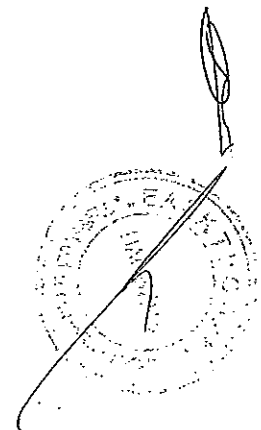
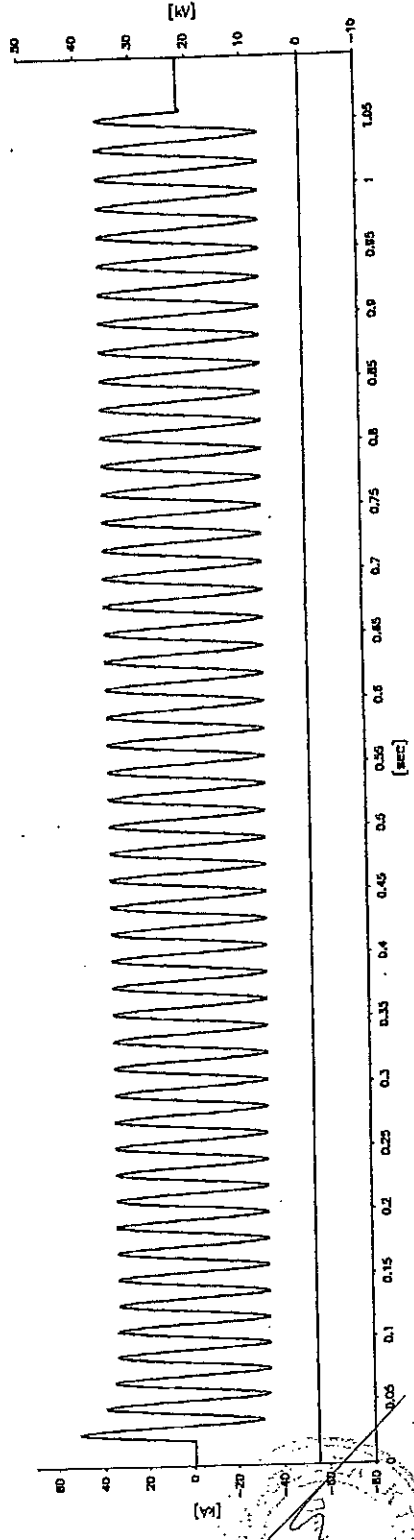
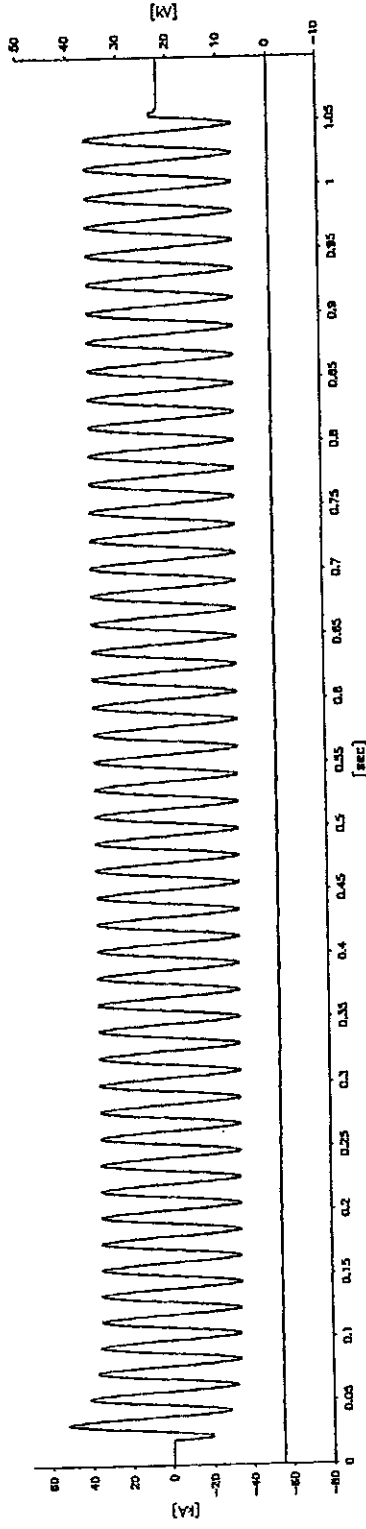
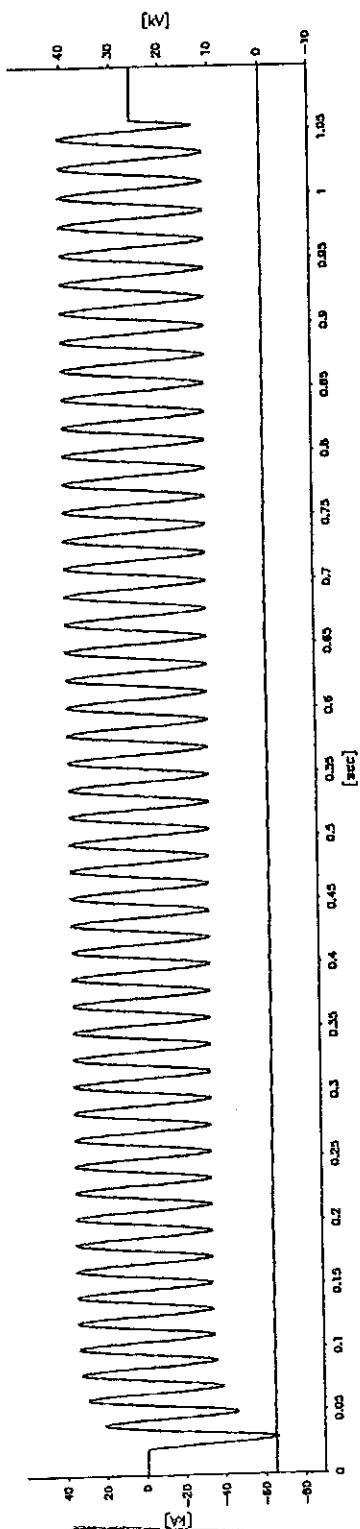


Photo No. 15
After Test HZ 235 L 02 / 07

ВЯРНО С ОРИГИНАЛА

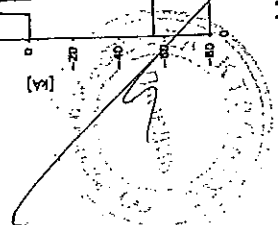


62

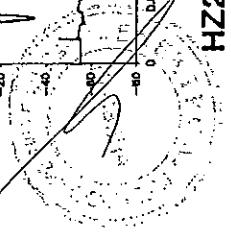
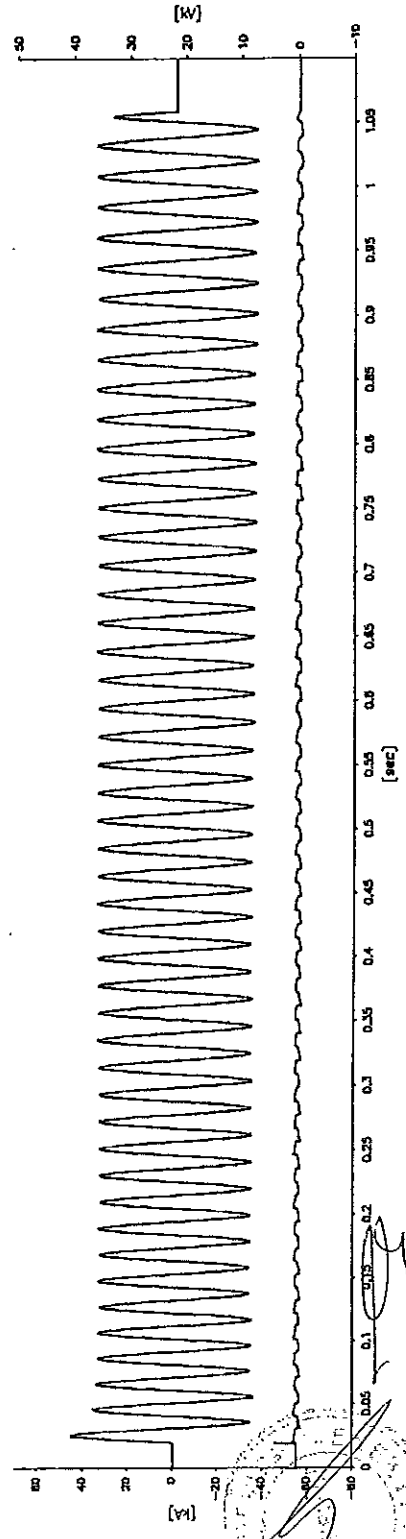
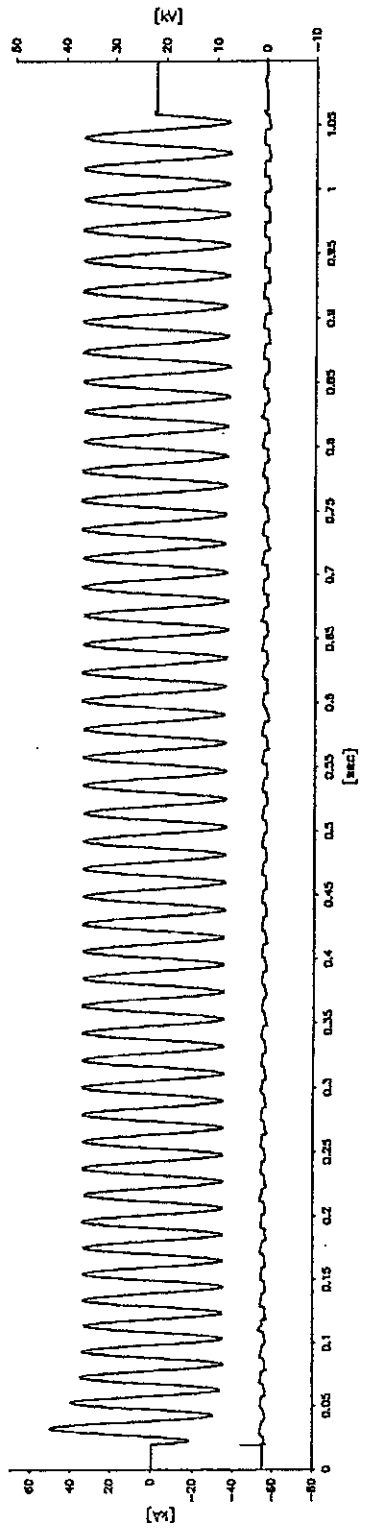
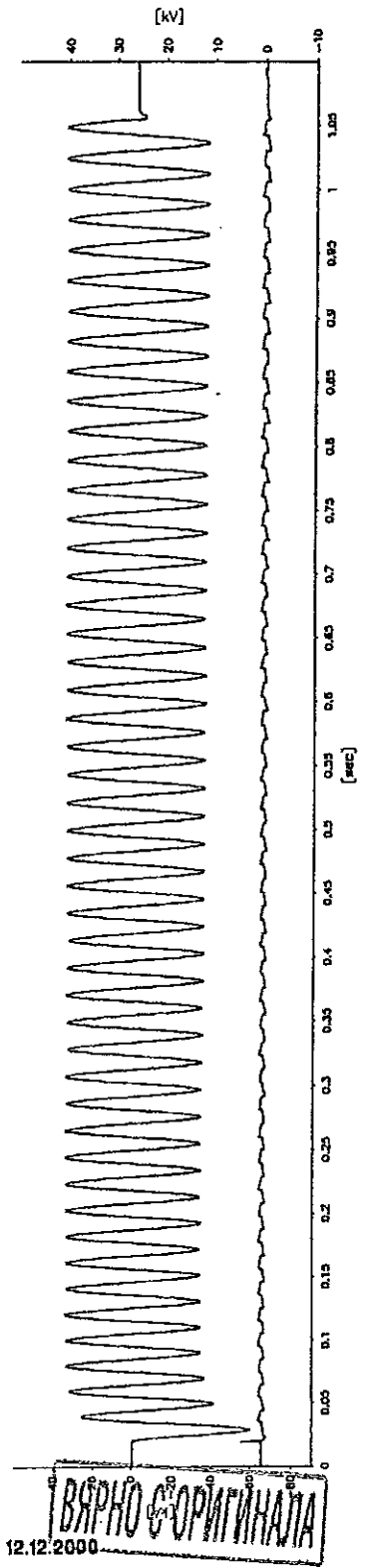


12.12.2009
ВЯРНО С ОРИГИНАЛА

HZ2351E02:002

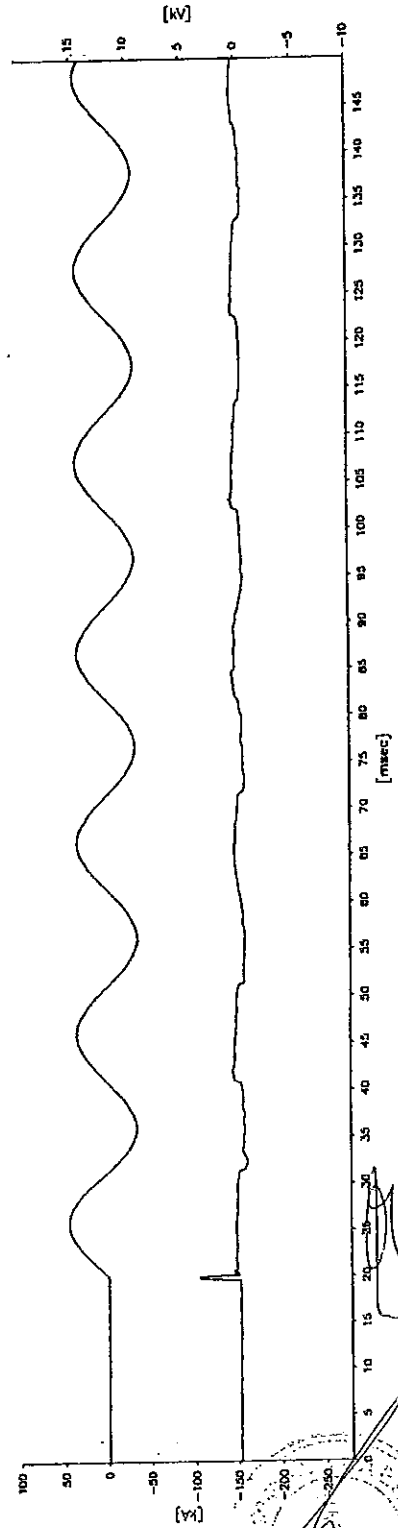
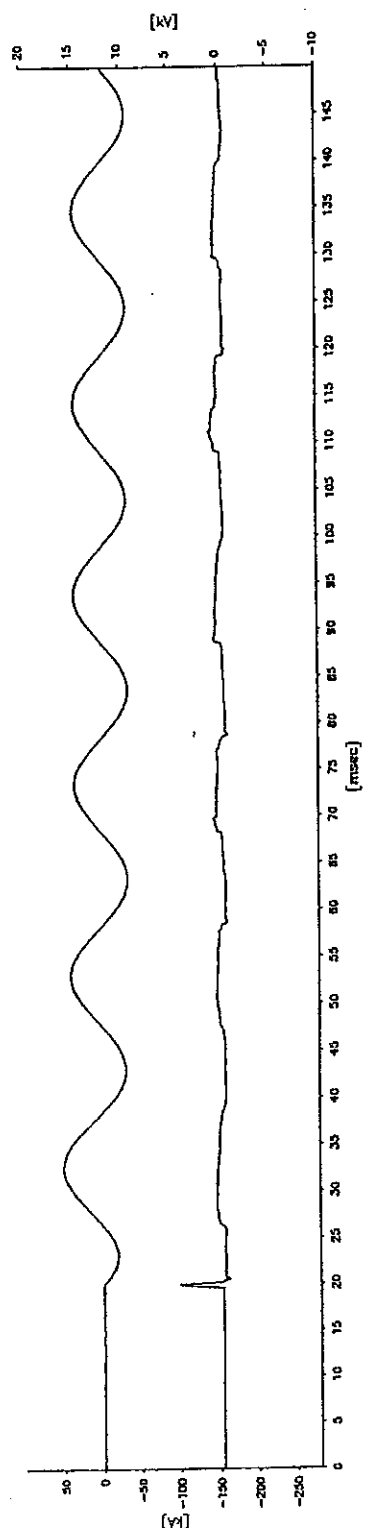
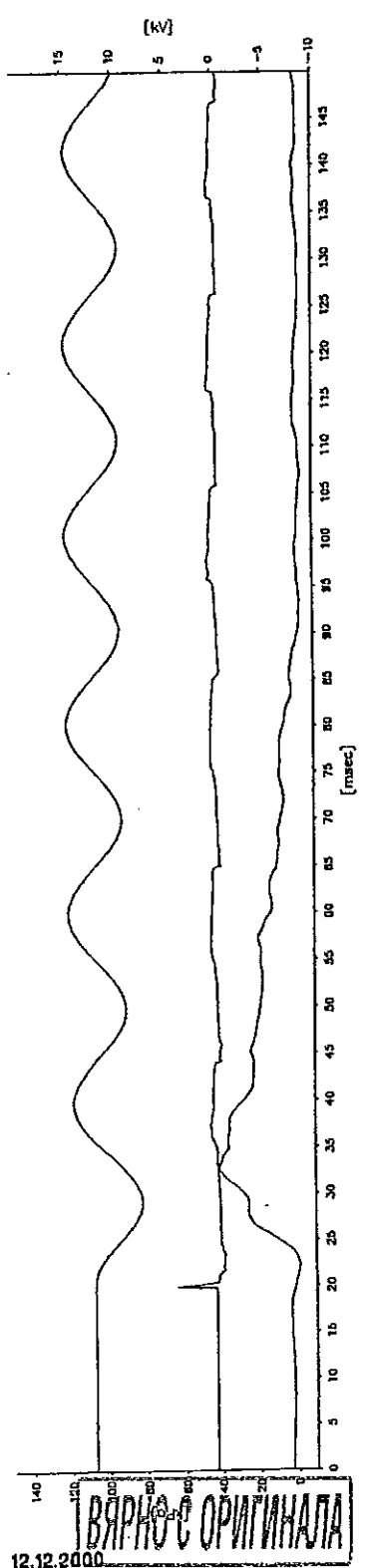


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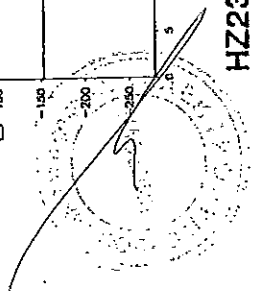


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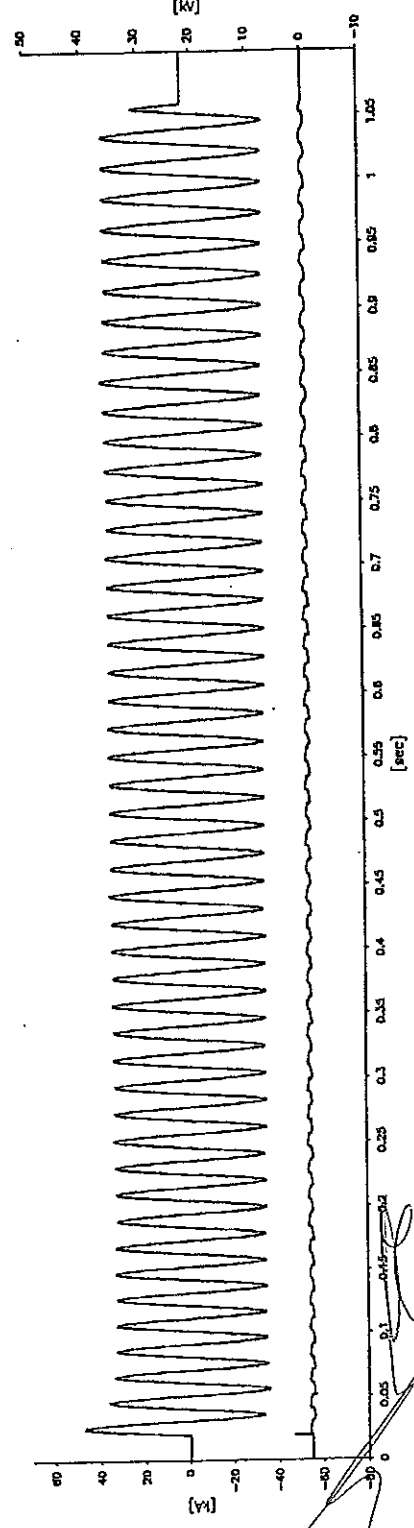
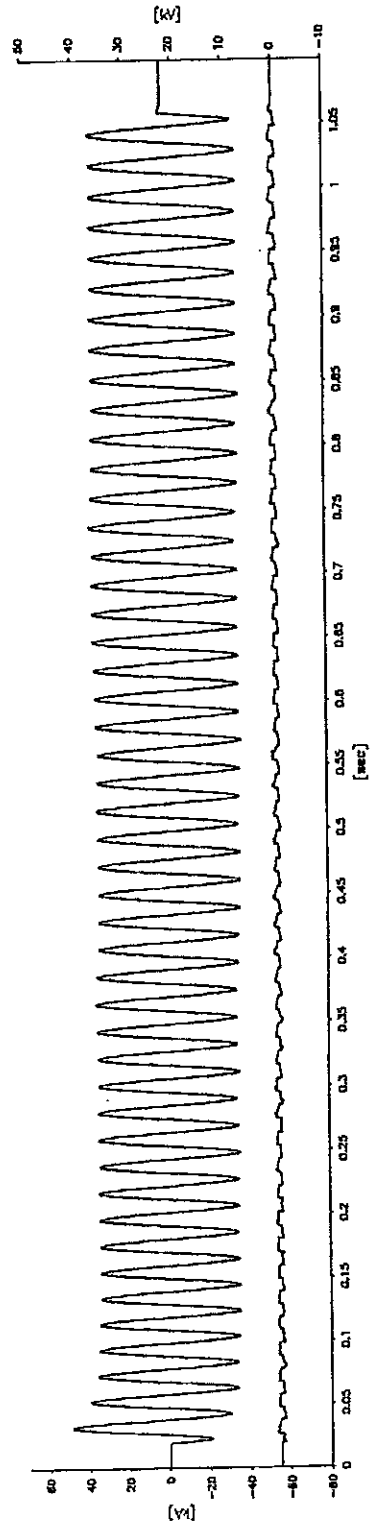
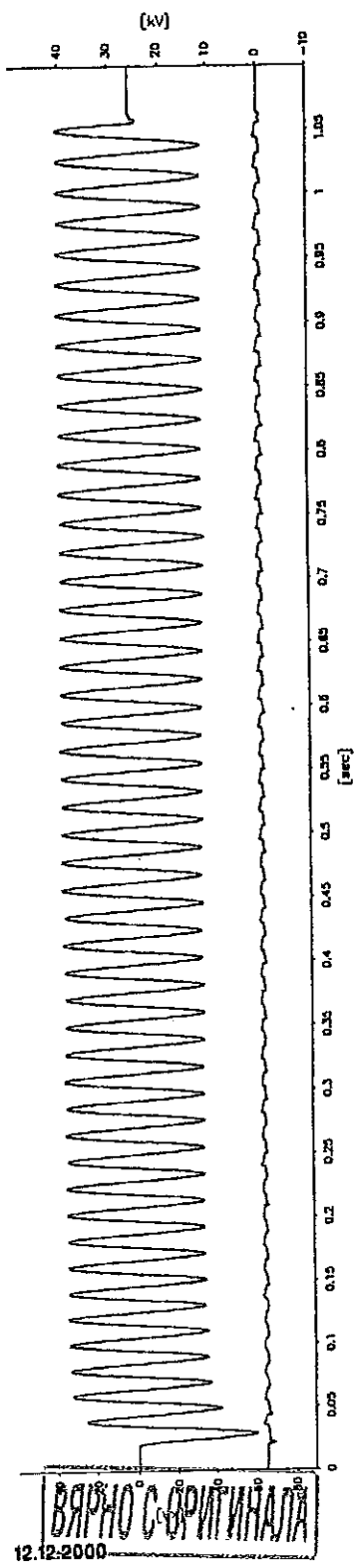
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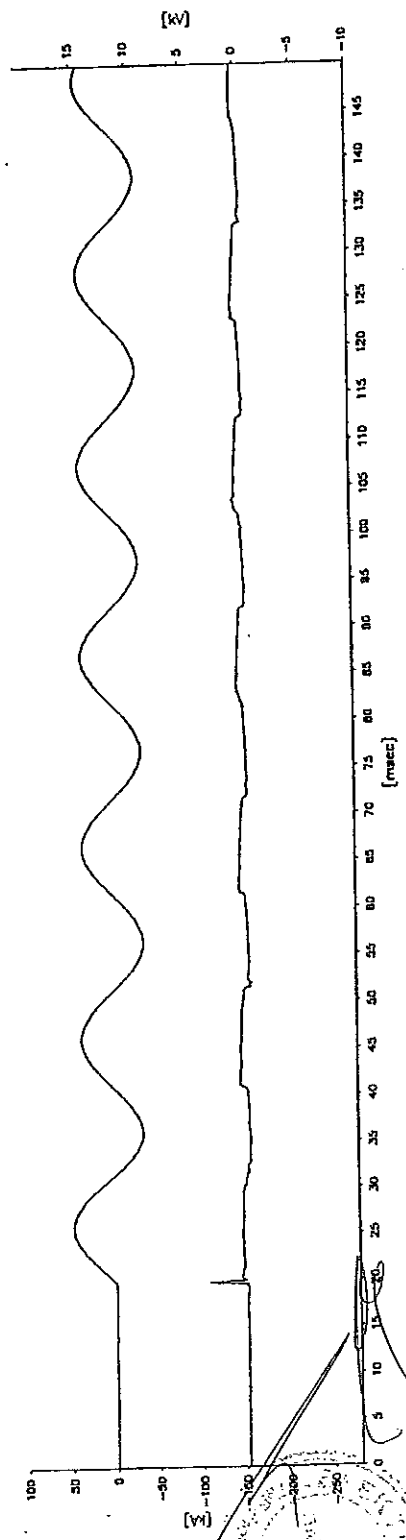
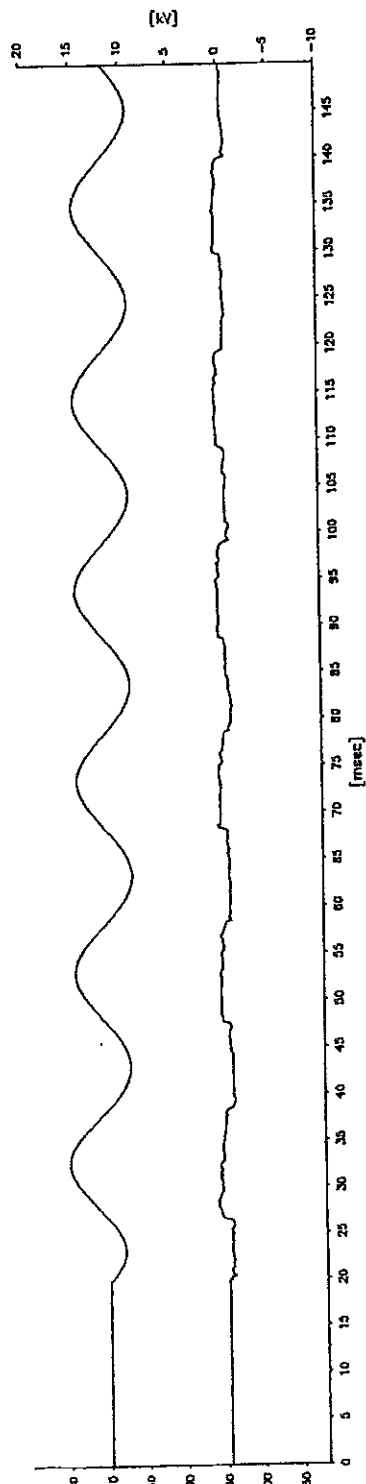
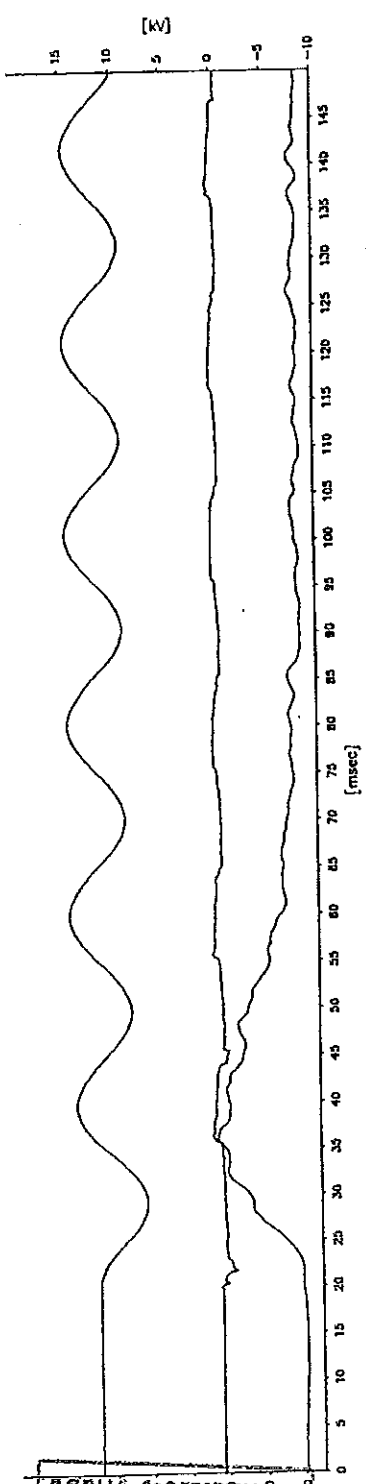
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HZ235L02.004

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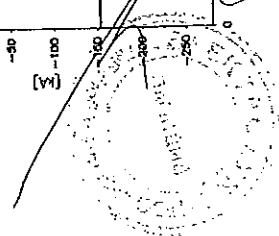
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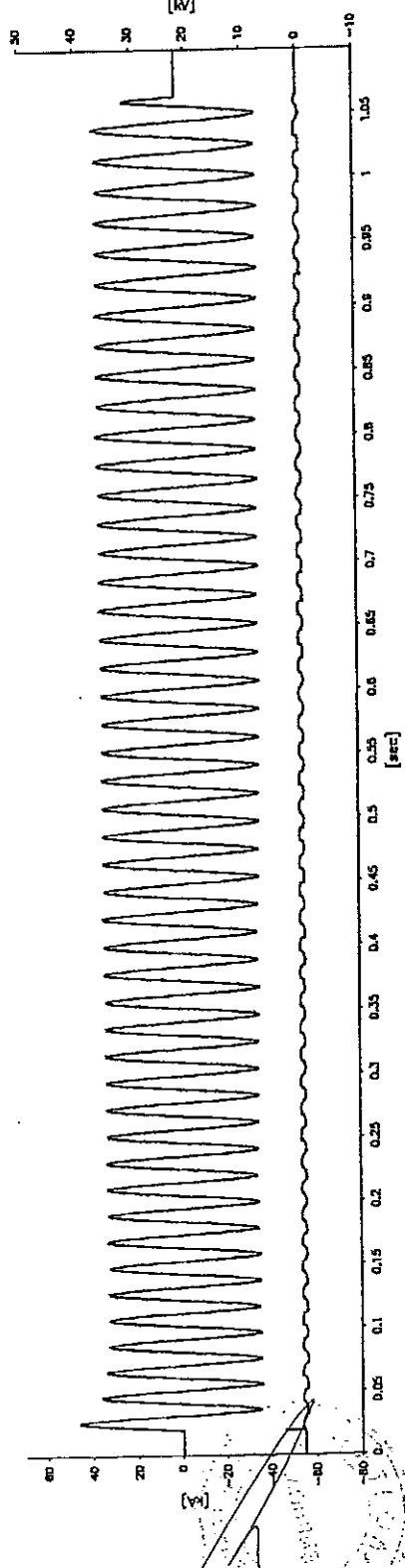
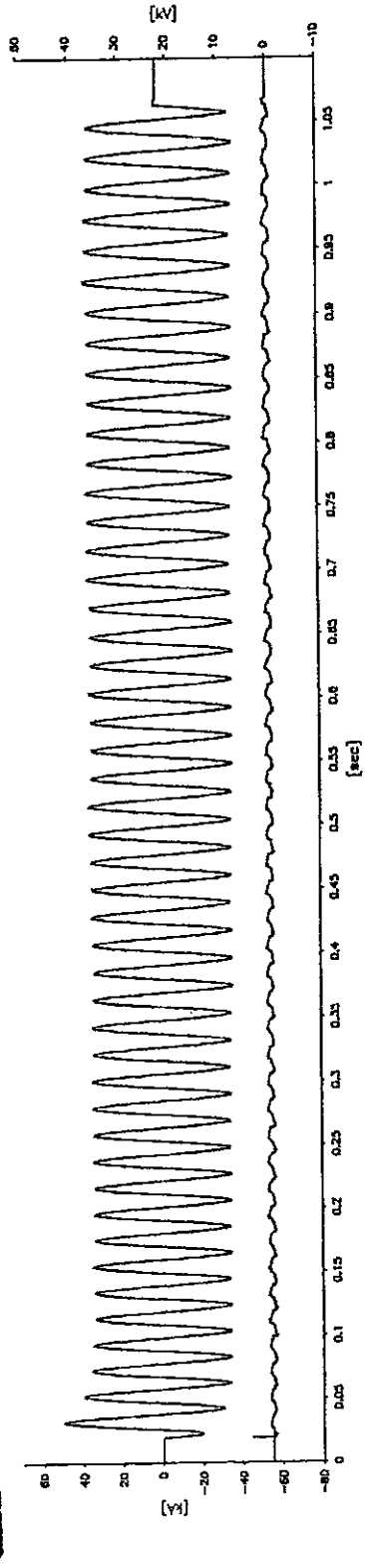
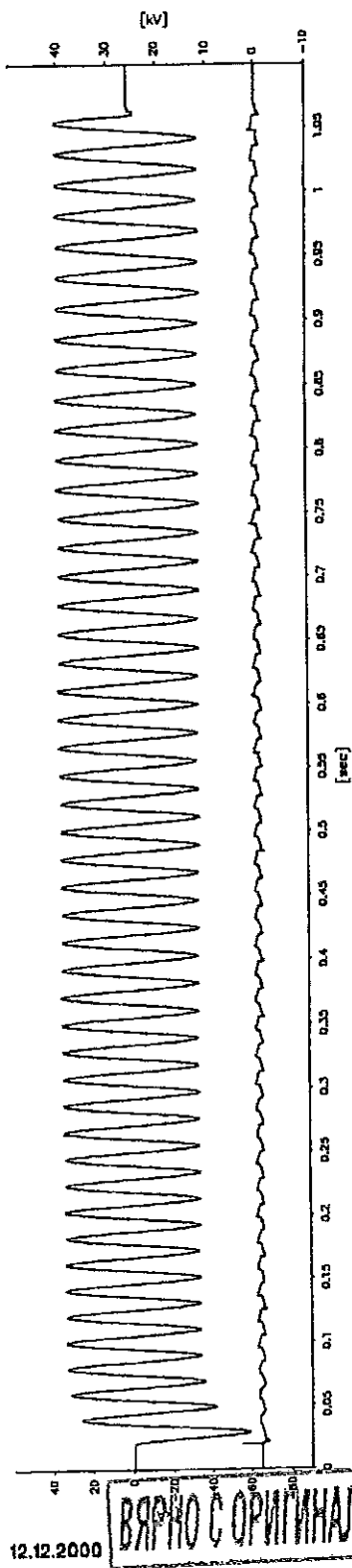
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12.12.2000

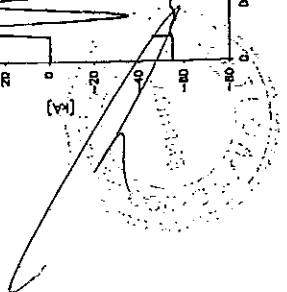
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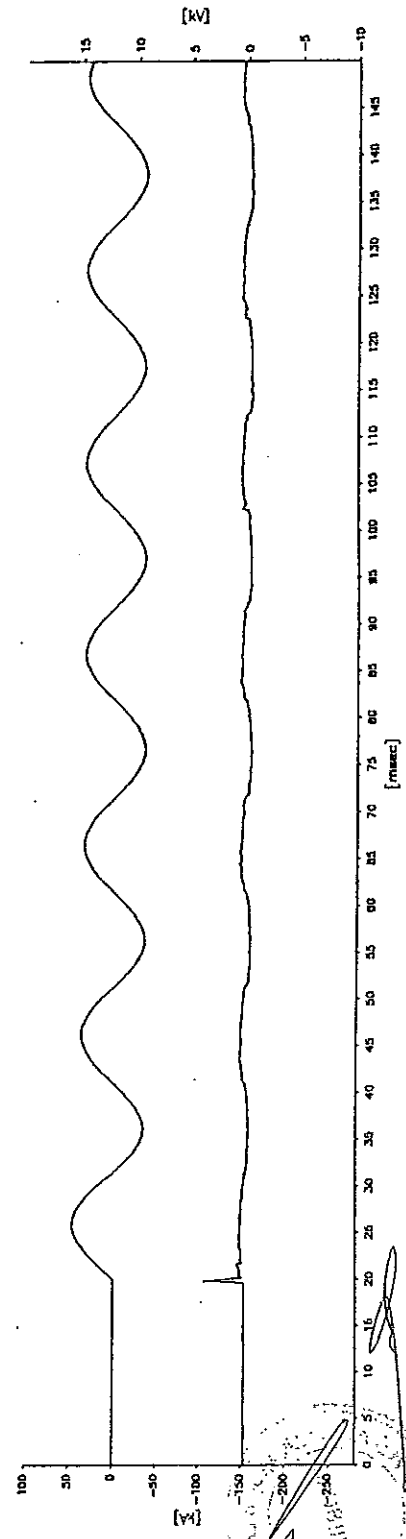
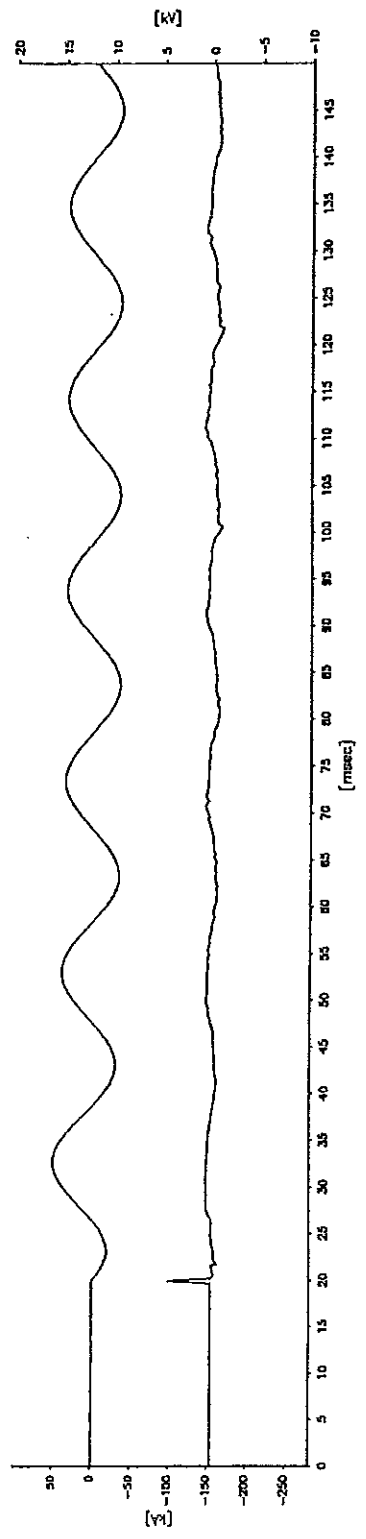
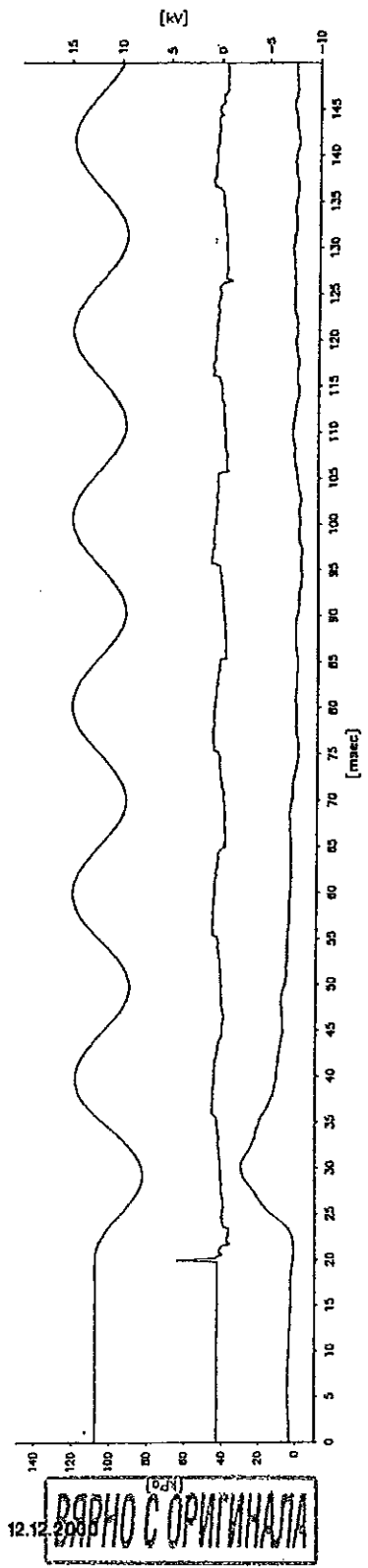


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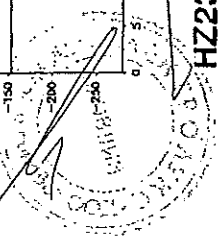


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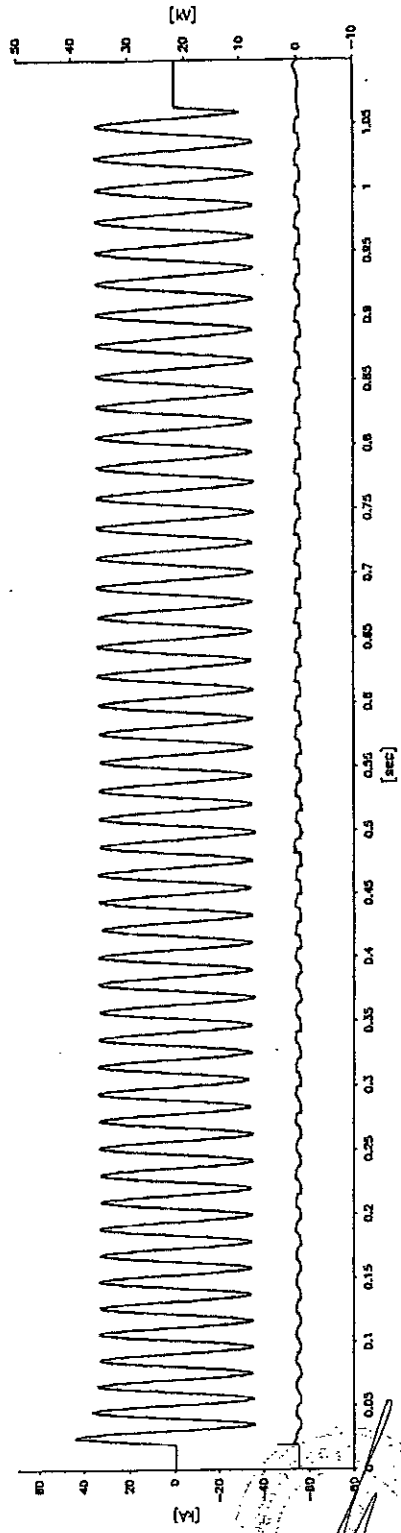
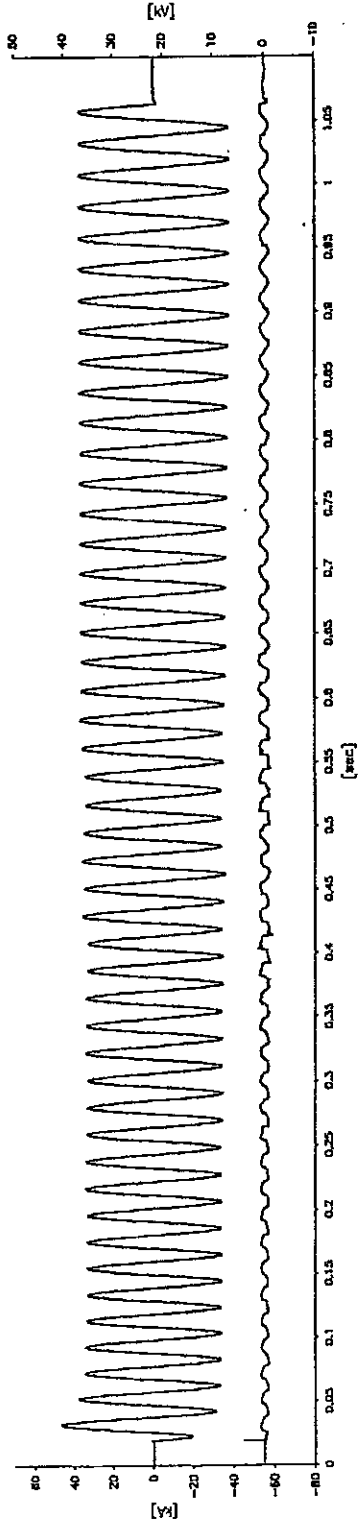
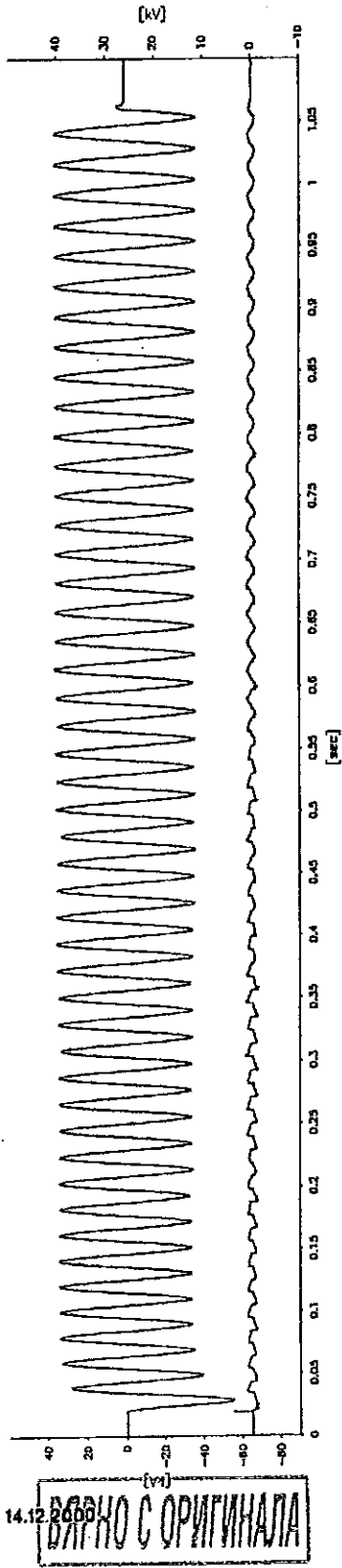


12.12.2008
ВЕРНО С ОРИГИНАЛА



HZ235L02.005

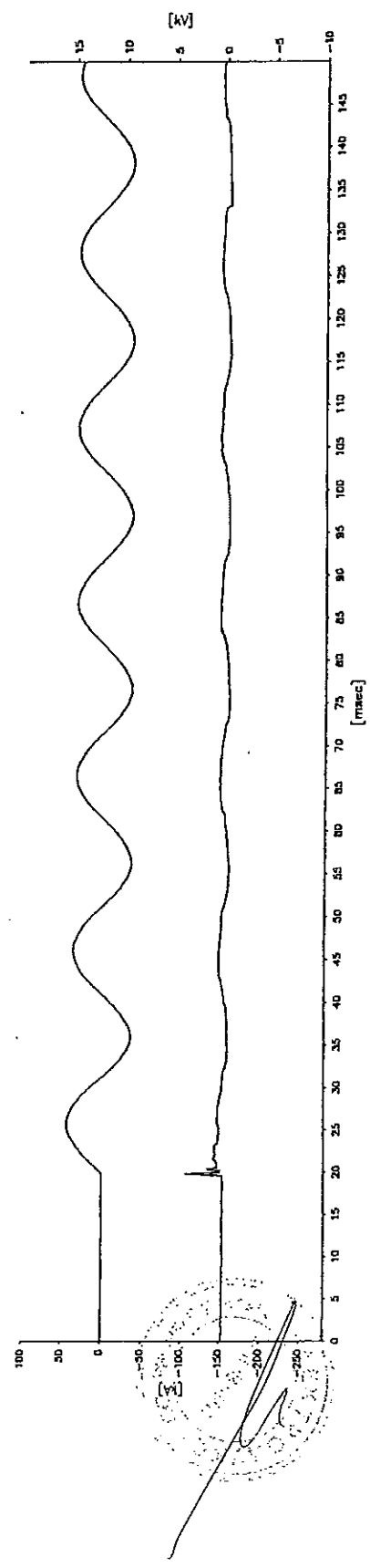
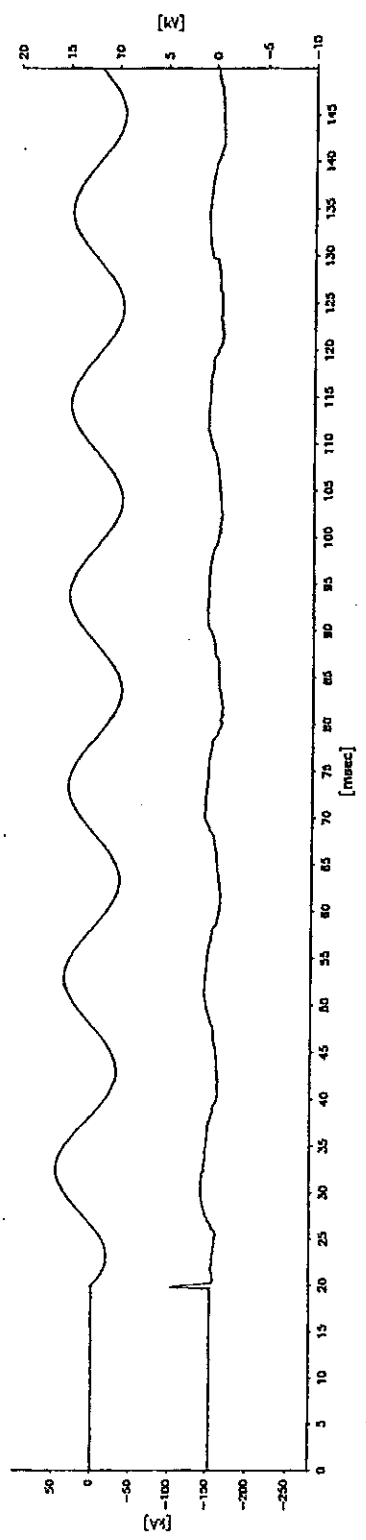
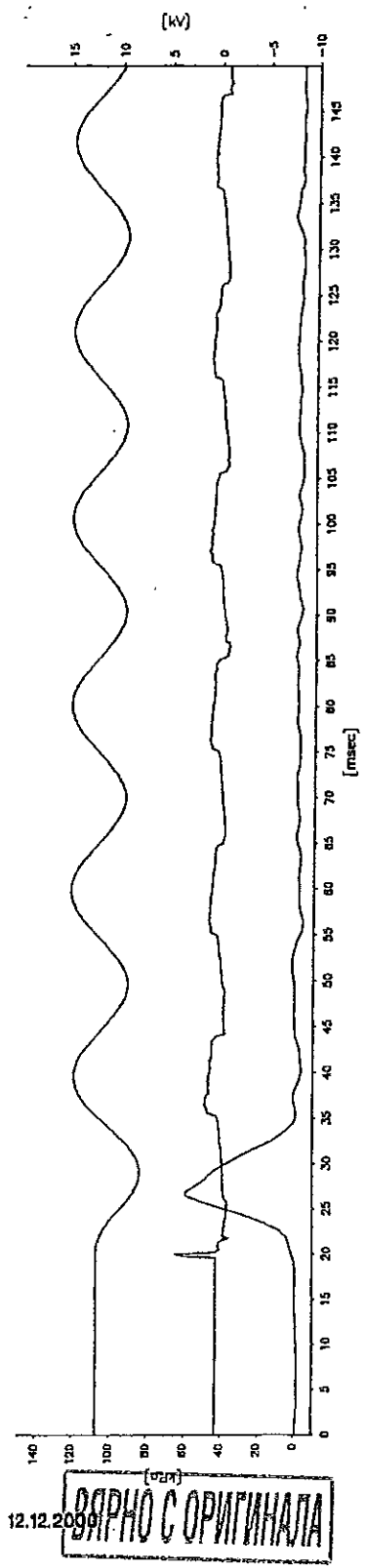
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H2235L02.006

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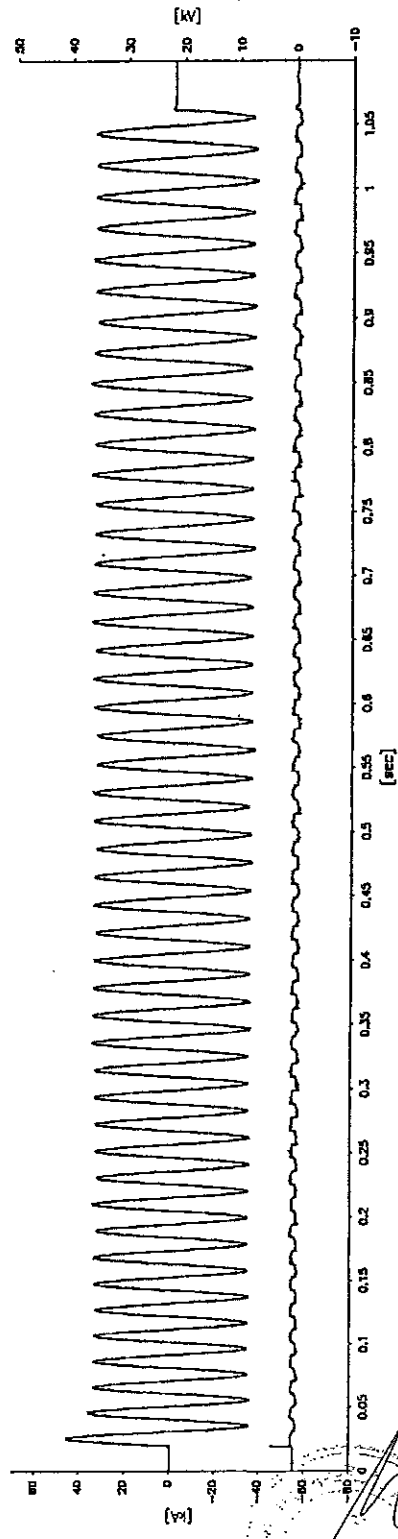
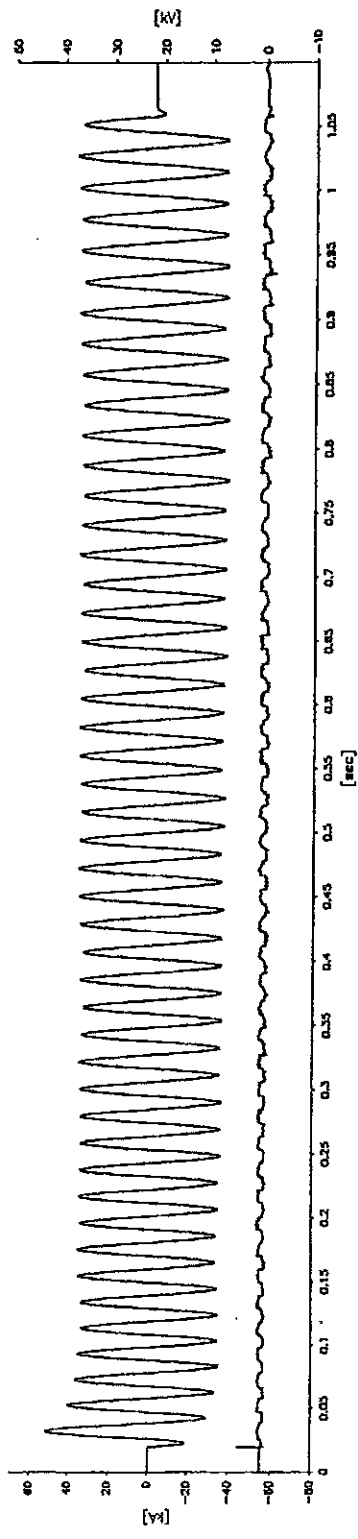
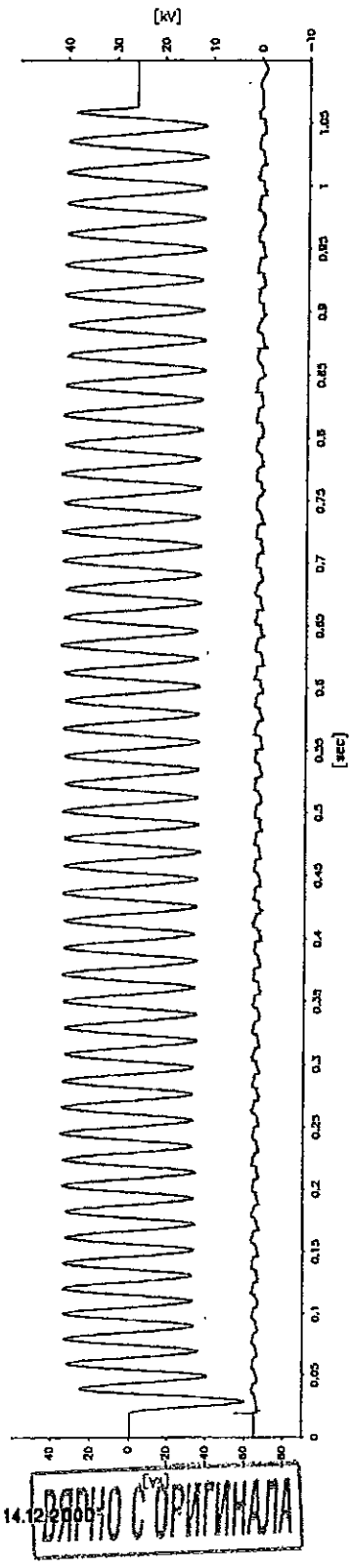
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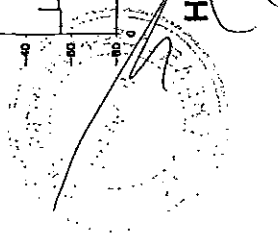
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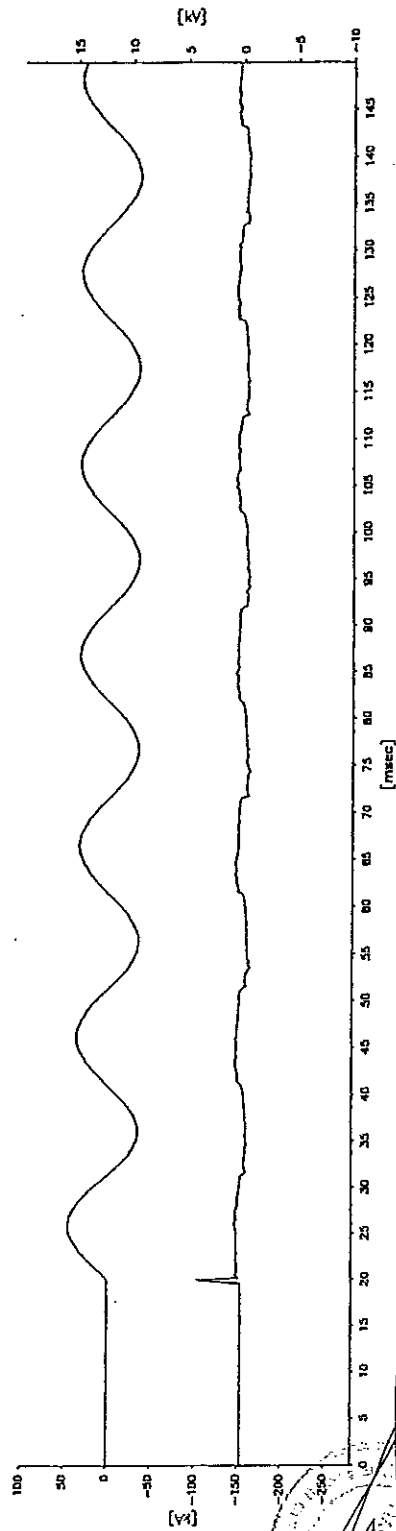
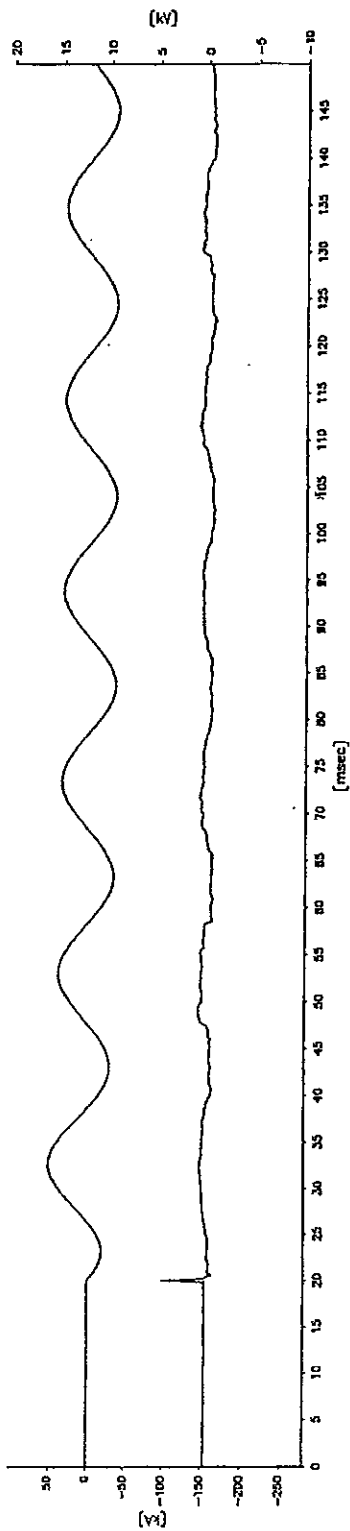
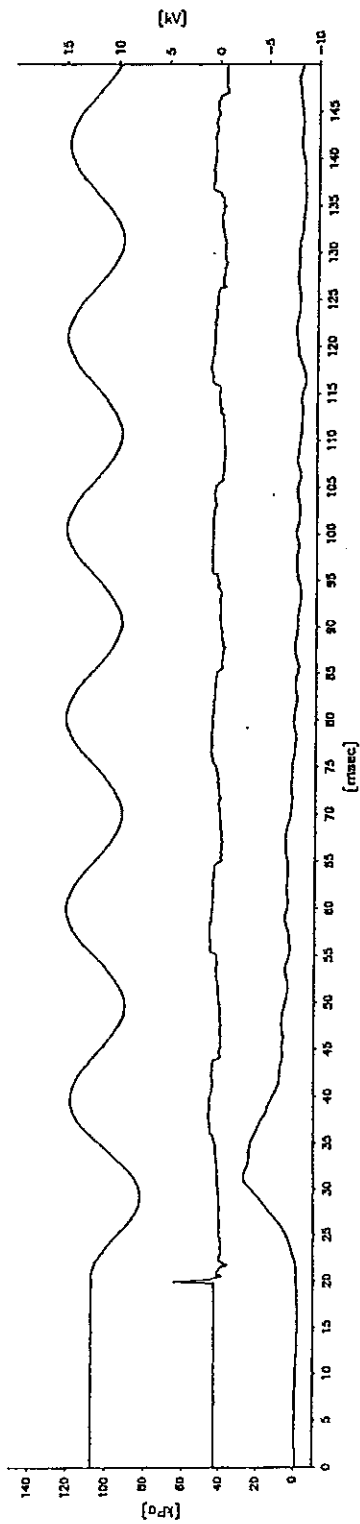
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HZ285E02.D07



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12.12.2000

ВЯРНО С ОРИГИНАЛА

HZ235L02.007

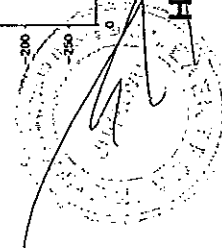


ABB Trasmissione & Distribuzione S.p.A.

Unità operativa Sace T.M.S.

Via Friuli 4
I 24044 - Dalmine (BG)
Italy

Tel.: 0039.035.395111
Fax: 0039.035.395874
E-mail: sacetms.tipm@it.abb.com
Internet: [//www.abb.com](http://www.abb.com)



TYPE TEST DOCUMENTATION No. 100089_C Page 1/1

Apparatus: Metal-clad switchgear type ZS1 rel 1.2 with vacuum circuit-breaker type VD4/P 24.12.20 p=275

Identification: 1VCP0000138-Rev.-,en-Technical catalogue-2003-04

Performances:

Rated voltage :	24	KV
Rated lightning impulse withstand voltage :	125	KV
Rated power-frequency withstand voltage :	50	KV
Rated frequency :	50-60	Hz
Rated normal current (busbar) :	1250	A
Rated normal current (tee-off) :	1250	A
Rated peak withstand current :	63	KA
Rated short-time withstand current :	20	KA
Rated duration of short circuit :	3	s

Test reports verifying rating assigned by the manufacturer:

Performances	Test according to	Test reports	
		No.	Issued by
Dielectric test	IEC 60298 Subclause 6.1	0045 Ra	PEHLA High-power Laboratories
Temperature-rise test	IEC 60298 Subclause 6.3/6.4	HZ 236 E06	Calor Emag Laboratories
Short-time and peak withstand current test	IEC 60298 Subclause 6.5	HZ 235 F01	Calor Emag Laboratories
Mechanical operation and interlock test	IEC 60298 Subclause 6.102	MZ 235 A01	Calor Emag Laboratories
Internal arc test	IEC 60298 Annex AA	HZ 235 L02	Calor Emag Laboratories
Mechanical operation test	IEC 62271-100 subclause 6.101.2	0311 Ra	PEHLA High-power Laboratories
Making and breaking capacity test	IEC 62271-100 subclause 6.106	0511 Ra	PEHLA High-power Laboratories

ABB T&D Unità operativa SACE T.M.S. Laboratories Dalmine are accredited according UNI CEI EN ISO/IEC 17025 by SINAL under Reg. No. 00243
ABB Calor Emag Laboratories Ratingen are accredited according UNI CEI EN ISO/IEC 17025 by DATech under Reg. No. DAT-P-032/93
PEHLA High-power Laboratories are accredited according UNI CEI EN ISO/IEC 17025 by DATech under Reg. No. DAT-P-032/93 and certificate D-PL-12072-06-01
CESI Laboratories Milano are accredited according UNI CEI EN ISO/IEC 17025 by SINAL under Reg. No. 030

Date of issue:
04/09/16

Development Dept.

G.M. Cravanzola



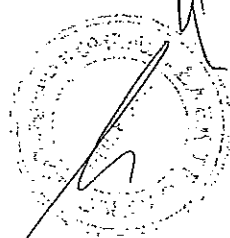
ABB T&D Unità operativa Sace T.M.S. is accredited by DET NORSKE VERITAS QUALITY CERTIFICATE Quacer Certificate
No. CERT-07978-2001-AQ-MIL-SINCERT/B according to ISO 9001.

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Приложение 1.3 - Акредитация

ВЯРНО С ОРГИНАЛА

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Handwritten initials

CERTIFICATO DI ACCREDITAMENTO Accreditation Certificate

Accreditamento n° **0253**
Accreditation n°

Rev. **1**

Si dichiara che
We declare that

ABB S.p.A. Power Products Division

Sede/Headquarters:
Via Friuli 4 - 24044 Dalmine BG

è conforme ai requisiti
della norma

meets the requirements
of the standard

UNI CEI EN ISO/IEC 17025:2005 "Requisiti generali per la competenza del
Laboratori di prova e taratura"

EN ISO/IEC 17025:2005 "General Requirements for the Competence of Testing
and Calibration Laboratories" standard

quale **Laboratorio di Prova**
as **Testing Laboratory**

L'accREDITAMENTO attesta la competenza tecnica del Laboratorio relativamente allo scopo riportato nelle schede allegate al presente certificato. Le schede possono variare nel tempo. I requisiti gestionali della ISO/IEC 17025:2005 (sezione 4) sono scritti in un linguaggio idoneo all'attività del Laboratorio di Prova, sono conformi ai principi della ISO 9001:2008 ed allineati con i suoi requisiti applicabili. Il presente certificato non è da ritenersi valido se non accompagnato dalle schede allegate e può essere sospeso o revocato in qualsiasi momento nel caso di inadempienza accertata da parte di ACCREDIA. La vigenza dell'accREDITAMENTO può essere verificata sul sito WEB (www.accredia.it) o richiesta direttamente ai singoli Dipartimenti.

The accreditation certifies the technical competence of the laboratory limited to the scope detailed in the attached Enclosure. The scope may vary in the time. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in a language relevant to Testing Laboratories operations and meet the principles of ISO 9001:2008 and are aligned with its pertinent requirements. The present certificate is valid only if associated to the annexed schedule, and can be suspended or withdrawn at any time in the event of non fulfilment as ascertained by ACCREDIA. The in force status of the accreditation may be checked in the WEB site (www.accredia.it) or on direct request to appointed Department.

Data di 1ª emissione
1st issue date
1999-07-08

Data di modifica
Modification date
2015-07-16

Data di scadenza
Expiring date
2019-07-11

Il Direttore Generale
The General Director
(Dr. Filippo Trifiletti)

Il Direttore di Dipartimento
Department Director
(Dr.ssa Silvia Tramontin)

Il Presidente
The President
(Ing. Giuseppe Rossi)

Handwritten initials

Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation



The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

PEHLA GbR
PEHLA-Prüffeld Ratingen
Oberhausener Straße 33, 40472 Ratingen

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

**High-Voltage Switchgear and Controlgear,
Low-Voltage Switchgear and Controlgear Assemblies,
Current and Voltage Transformers,
Power transformers and Busbar Systems**

The accreditation certificate shall only apply in connection with the notice of accreditation of 2012-05-08 with the accreditation number D-PL-12072-06 and is valid until 2017-05-08. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.

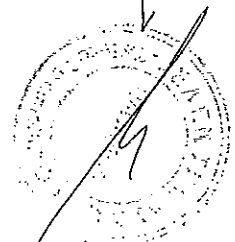
Registration number of the certificate: D-PL-12072-06-01

Frankfurt am Main, 2012-05-09

Dipl.-Ing. (FH) Ralf Egner
Head of Division 2



This is a copy of the accreditation certificate. The definitive version is the original German accreditation certificate.



Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:

EA: www.european-accreditation.org

ILAC: www.ilac.org

IAF: www.iaf.nu

ВЯРНО С ОРМИНАЛА

CERTIFICATO DI ACCREDITAMENTO
Accreditation Certificate

Accreditamento n°
Accreditation n°

0030

Rev. **2**

Si dichiara che
We declare that

CESI S.p.A.
Sede/Headquarters:
Via Rubattino 54 - 20134 Milano MI

è conforme ai requisiti
della norma

UNI CEI EN ISO/IEC 17025:2005 "Requisiti generali per la competenza dei
Laboratori di prova e taratura"

meets the requirements
of the standard

EN ISO/IEC 17025:2005 "General Requirements for the Competence of Testing
and Calibration Laboratories" standard

quale

Laboratorio di Prova

as

Testing Laboratory

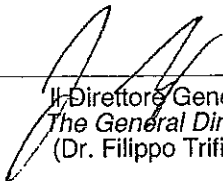
L'accREDITAMENTO attesta la competenza tecnica del Laboratorio relativamente allo scopo riportato nelle schede allegate al presente certificato. Le schede possono variare nel tempo. I requisiti gestionali della ISO/IEC 17025:2005 (sezione 4) sono scritti in un linguaggio idoneo all'attività dei Laboratori di Prova, sono conformi ai principi della ISO 9001:2008 ed allineati con i suoi requisiti applicabili. Il presente certificato non è da ritenersi valido se non accompagnato dalle schede allegate e può essere sospeso o revocato in qualsiasi momento nel caso di inadempienza accertata da parte di ACCREDIA. La vigenza dell'accREDITAMENTO può essere verificata sul sito WEB (www.accredia.it) o richiesta direttamente ai singoli Dipartimenti.

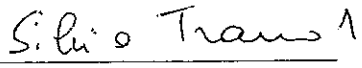
The accreditation certifies the technical competence of the laboratory limited to the scope detailed in the attached Enclosure. The scope may vary in the time. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in a language relevant to Testing Laboratories operations and meet the principles of ISO 9001:2008 and are aligned with its pertinent requirements. The present certificate is valid only if associated to the annexed schedule, and can be suspended or withdrawn at any time in the event of non fulfillment as ascertained by ACCREDIA. The in force status of the accreditation may be checked in the WEB site (www.accredia.it) or on direct request to appointed Department.

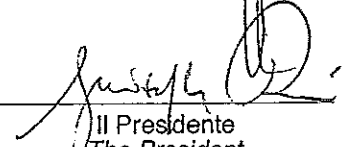
Data di 1ª emissione
1st issue date
1992-02-27

Data di modifica
Modification date
2016-04-14

Data di scadenza
Expiring date
2020-03-09


Il Direttore Generale
The General Director
(Dr. Filippo Trifiletti)


Il Direttore di Dipartimento
Department Director
(Dr. ssa Silvia Tramontin)


Il Presidente
The President
(Ing. Giuseppe Rossi)

Mod. CA-01

REPUBBLICA ITALIANA

Pag. 1 di 2

ll

CERTIFICATO DI ACCREDITAMENTO *Accreditation Certificate*

Accreditamento n°
Accreditation n°

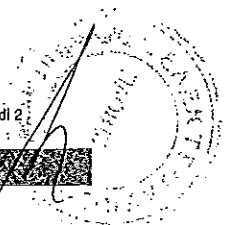
0030

Rev. **2**

Si dichiara che
We declare that

Sedi operative:

CESI S.p.A.
Via Rubattino 54
20134 Milano MI
CESI S.p.A. - Sede di Piacenza
Via Nino Bixio 39
29100 Piacenza PC
CESI S.p.A. - Sede di Seriate
Via Pastrengo 9
24068 Seriate BG



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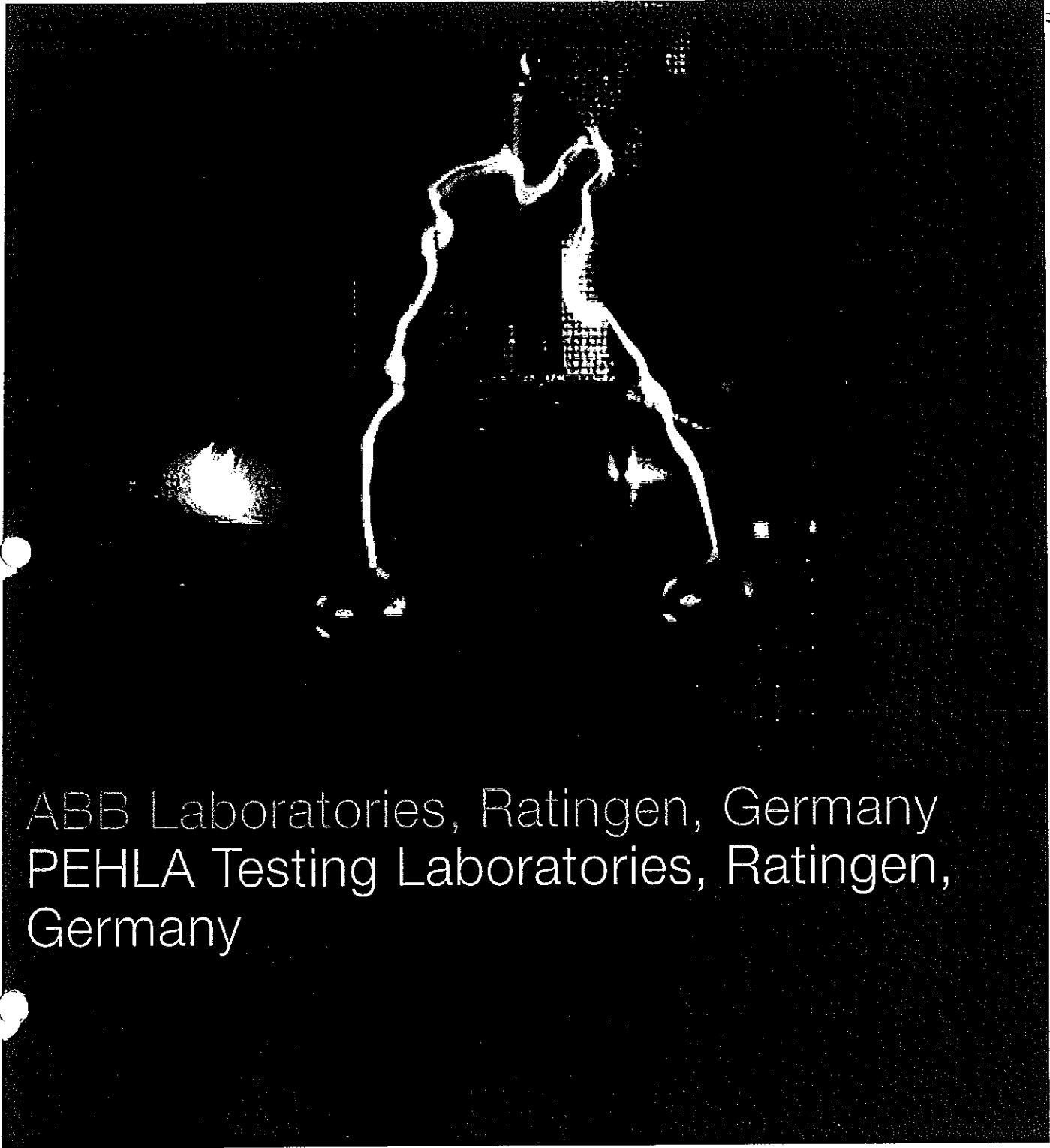


ABB Laboratories, Ratingen, Germany
PEHLA Testing Laboratories, Ratingen,
Germany


ВЯРНО С ОРИГИНАЛА

Power and productivity
for a better world™ **ABB**

Introducing Laboratories Ratingen


Since 1954, the laboratories of ABB AG – Calor Emag Medium Voltage Products have performed tests on medium voltage equipment. Our laboratories, which are located in Ratingen, Germany, contain all the facilities necessary for tests in the medium voltage range.

The ABB Laboratories Ratingen and PEHLA Testing Laboratories Ratingen are accredited by the German Accreditation Authority (DAkkS). As a shareholder of PEHLA GbR we are also a member laboratory of the Short-circuit Testing Liaison. We provide our customers with high performance and independent testing carried out in accordance with customer requirements or national and international standards.



Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation 

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

ABB AG
Calor Emag Mittelspannungsprodukte
Oberhausener Straße 33, 40472 Ratingen

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

High-Voltage Switchgear and Controlgear,
Low-Voltage Switchgear and Controlgear Assemblies,
Current and Voltage Transformers,
Power transformers and Busbar Systems

The accreditation certificate shall only apply in connection with the notice with the accreditation number D-PL-12115-01 and is valid until 2017-05-05. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.

Registration number of the certificate: D-PL-12115-01-01


Frankfurt am Main, 2012-05-09

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Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation 

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

PEHLA GbR
PEHLA-Prüffeld Ratingen
Oberhausener Straße 33, 40472 Ratingen

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

High-Voltage Switchgear and Controlgear,
Low-Voltage Switchgear and Controlgear Assemblies,
Current and Voltage Transformers,
Power transformers and Busbar Systems

The accreditation certificate shall only apply in connection with the notice of accreditation of 2012-05-09 with the accreditation number D-PL-12072-06 and is valid until 2017-05-05. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.

Registration number of the certificate: D-PL-12072-06-01

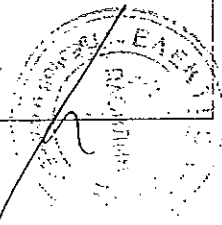
Frankfurt am Main, 2012-05-09

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Why testing at Laboratories Ratingen?

With 60 years of experience we know how to perform tests professionally. Starting with the planning and preparation phase we cooperate closely with our customers in order to ensure an optimal testing. Our organization provides flexible planning which ensures short-term reservation.

When testing at the Laboratories Ratingen our customers may choose to either prepare the test objects on their own or make use of our assembly and installation service. By request an on-site testing can be performed in the customer's facilities. All test results will be evaluated by our team of highly qualified and experienced experts in close cooperation with the customers. Our laboratories are equipped with a SF₆ module to handle and recycle the gas for environmental safety. The accreditation as ABB Laboratories Ratingen and as PEHLA Testing Laboratories Ratingen ensures that all tests are fully independent.

Services we provide:

- On-site testing and diagnostics with mobile test equipment
- Independent witnessing of tests
- Inspections, examinations and diagnostics
- Manufacturing of prototypes and individual parts
- Assembly of prototypes and test objects
- Assembly and installation work
- Calibration of electrical and mechanical measuring equipment



Our documentation to the customers

When testing at Laboratories Ratingen different types of documentation can be issued.

Type test certificate

A type test certificate is issued for type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

Test document

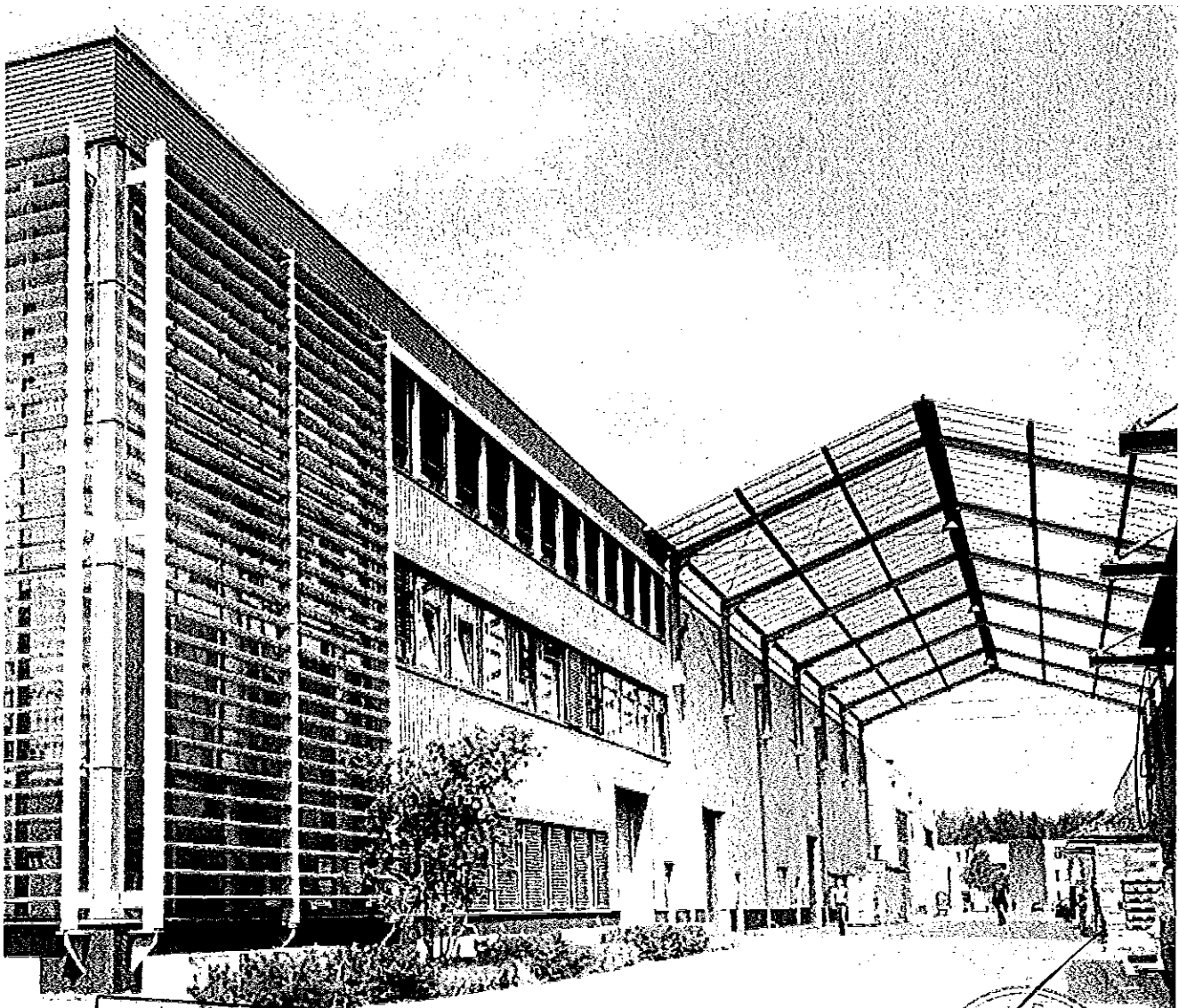
A test document is issued for parts of type tests which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of test. For these tests the test object must be clearly identified by technical description, drawings and additional specifications.

Test report

A test report is issued for all other tests which have been carried out according to specifications, standards or "PEHLA-Richtlinien" (PEHLA Guides) and/or clients' instructions. Similarly, this test report contains all test results, details of the conditions under which the tests were carried out, also details relating to the behaviour of the test object, and its condition after the tests.

Test confirmation

A test confirmation is issued immediately after the tests. It confirms that the tests have been conducted and is valid only until publishing the detailed results in an entire document.



Development tests, type tests or acceptance tests

Laboratories Ratingen are able to offer any kind of test your company needs.

The laboratories are fully equipped to perform complete type tests on medium voltage equipment with state-of-the-art technology. All tests can be carried out as ABB tests or as PEHLA tests.

Tests we provide

- Type tests
- Development tests
- Acceptance tests (also in other test laboratories)
- Certification tests

Our test portfolio:

Tests	Products											
	MV circuit-breaker	Metal enclosed switchgear	Power transformer	Disconnecter & earthing switch	Switch fuse unit	Earthing facility	Bushing	Instrument transformer	Fuse	Cable accessory	Auxiliary circuit	Substation
Making and Breaking test	●	●		●	●				●		●	●
STC test	●	●	●	●		●	●	●		●	●	●
Internal arc test		●										●
Capacitive switching test	●			●								
Temperature rise test	●	●		●	●	●	●	●	●	●	●	●
Climatic test	●	●	●	●	●	●	●	●	●	●	●	
Dielectric test	●	●		●	●	●	●	●	●	●	●	●
IP/IK-coding test	●	●										●
Partial discharge test	●	●		●	●	●	●	●		●		●
Mechanical operation test	●	●		●	●						●	
Mechanical endurance test	●			●	●						●	
High and low temperature test	●	●		●			●		●		●	
Tightness test	●	●		●			●					
Pressure test	●	●		●								

Tests at Ratingen possible
 Tests not applicable to this product

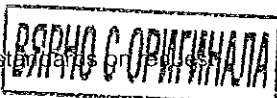
ВЯРНО С ОПРИГНИНАТА

Laboratories Ratingen | 5

Overview of standards

High-voltage switchgear and controlgear	IEC 62271-1	IEC 62271-100	IEC 62271-102
	IEC 62271-103	IEC 62271-104	IEC 62271-105
	IEC 62271-106	IEC 62271-110	IEC 62271-111
	IEC 62271-200	IEC 62271-201	IEC 62271-202
	IEC 62271-203	IEC 62271-304	IEC 60529
High-voltage test techniques	IEC 60060-1	IEC 60060-2	IEC 60270
Power transformers	IEC 60076-5	IEC 60076-11	
High-voltage fuses	IEC 60282-1	IEC 60282-2	
Bushings	IEC 60137		
Insulators	IEC 60660		
Instrument transformers	IEC 61869-1	IEC 61869-2	IEC 61869-3
Live working	IEC 60832-1	IEC 60832-2	IEC 61230
Low-voltage switchgear and controlgear	IEC 60947-1	IEC 60947-2	IEC 60947-3
ANSI / IEEE	IEEE C37.04 ANSI C37.54	ANSI C37.06 IEEE C37.60	IEEE C37.09

Other standards for products



6 | Laboratories Ratingen



Testing facilities

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The Laboratories Ratingen are coordinating tests very well even if different kind of tests in more than one laboratory are required. Customers, who need various tests, can therefore rely on well-organized test procedures – quickly and at fair conditions.

High-power testing laboratory

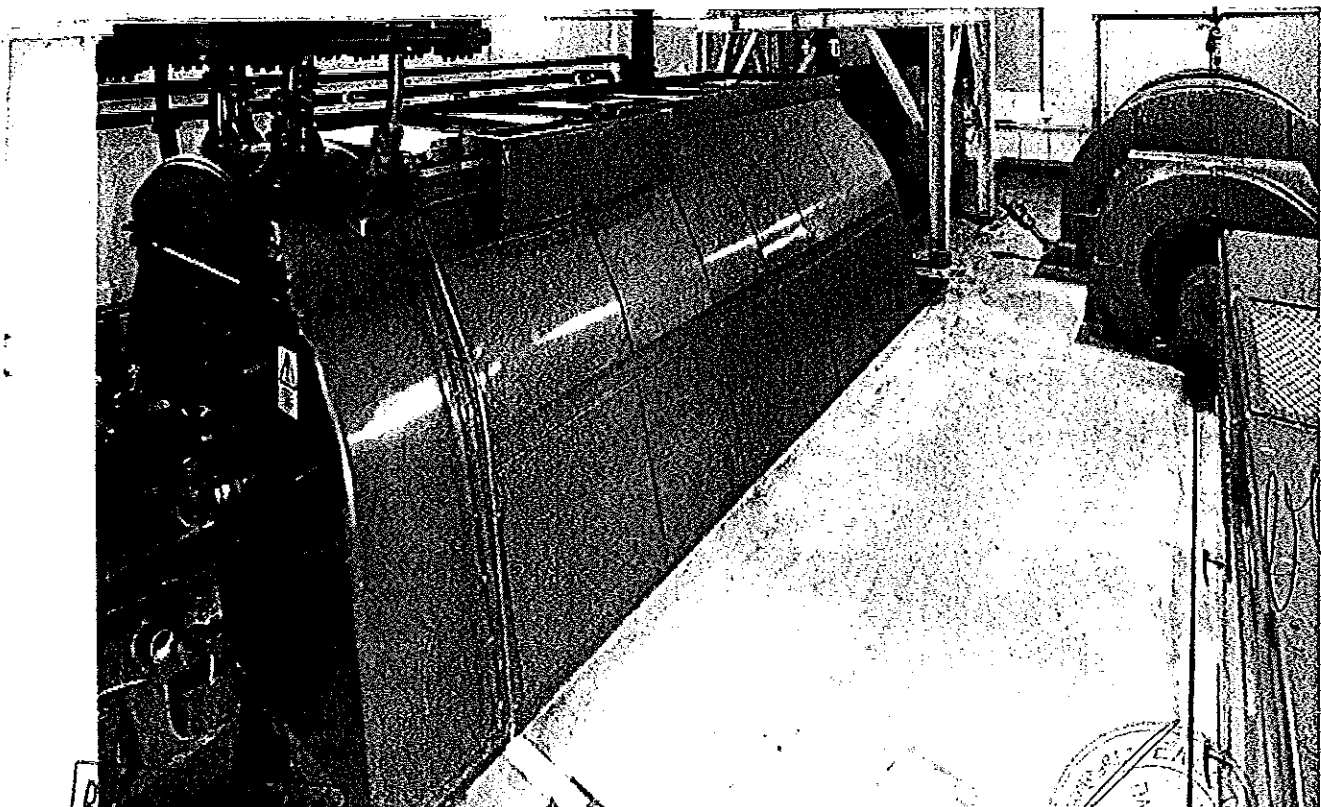
The high power testing laboratory is equipped with a 2800 MVA short-circuit test generator and oil-insulated power transformers and is therefore able to perform making and breaking tests at several voltage- and short-circuit current levels.

A special dry-type power transformer is available to perform peak-withstand current- and short-time withstand current test up to 250 kA and 100 kA r.m.s for three seconds.

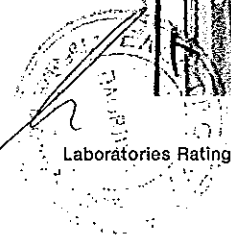
Inside the room simulation of the arcing test bay, internal arcing tests can be performed for switchgear, containers or even substations.

A capacitor bank allows to perform different capacitive tests (e.g. line- or cable-charging current switching tests, back-to-back- and single-capacitor-bank current switching tests).

With the miscellaneous equipment like different reactors and resistors, measurement equipment etc., it is possible to perform a wide range of load current switching tests as well.



ВАННО С ОПИ ВИНАТА



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Testing facilities

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The tests, which can be performed at our high power testing laboratory, are:

- Short-circuit making and breaking capacity test up to

- 50 kA at 12 kV
- 31.5 kA at 17.5 kV
- 25 kA at 24 kV
- 16 kA at 40.5 kV

- Switching capacity test

Load currents

- Capacitive
- Inductive
- Ohmic
- Inductive-ohmic

- Peak withstand current test

- Up to 250 kA

- Short-time withstand current test

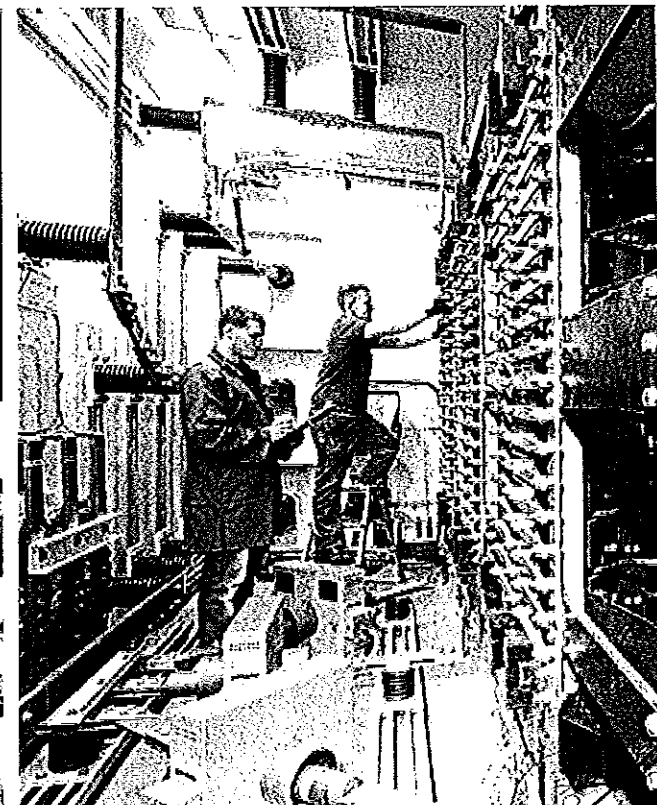
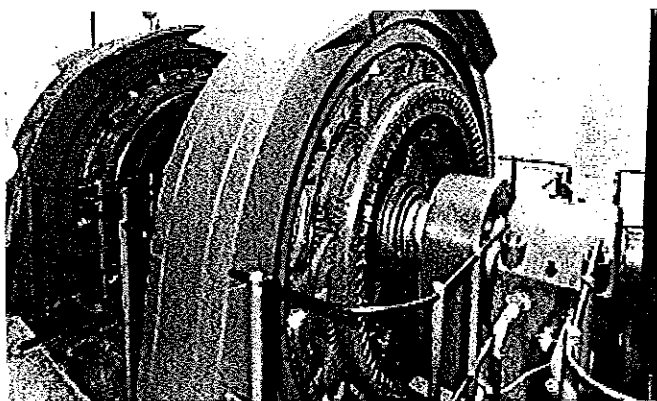
- Up to 100 kA and up to 3s (4s)

- Internal arc fault test

- Up to 50 kA

- Different tests

- beyond the standards according to client's instructions



БЪРЗО С ОПИТИВАНИЯ

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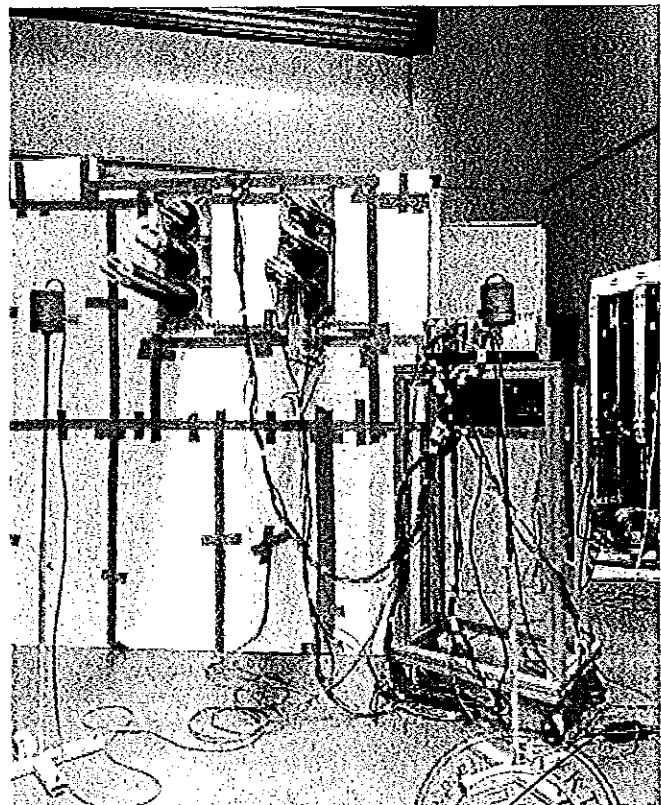
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Temperature-rise testing laboratory

The temperature-rise testing laboratory is suited to perform tests with a continuous current up to 5000 A on switchgear and switching devices. Through automated and computer controlled tests we use our recourses in the most efficient and effective way. Therefore we can offer precise, reliable and quick tests during day and night-time to our customers.

During the test, currents and temperatures are checked every 10 minutes. Shorter measurement intervals for currents and temperatures are possible. A control circuit guarantees a constant three-phase current through the entire test. The test is automatically stopped if a temperature limit is exceeded or the test duration is over.

- Temperature-rise tests
 - Up to 180 measuring points can be connected
 - Single-phase and three-phase
 - Up to 5000 A at 50 Hz
 - Up to 4000 A at 60 Hz
- Additionally we can offer
 - Magnetic field measurement
 - Thermal imaging



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Testing facilities

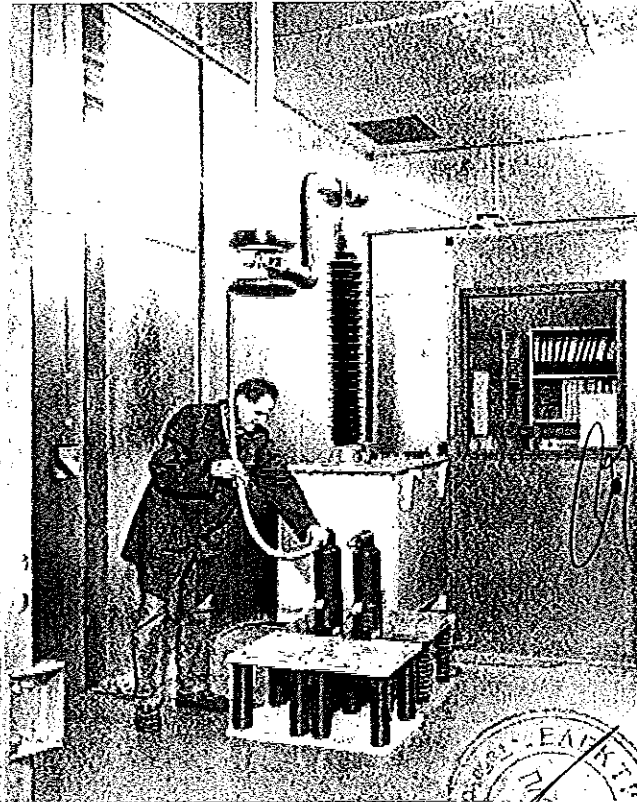
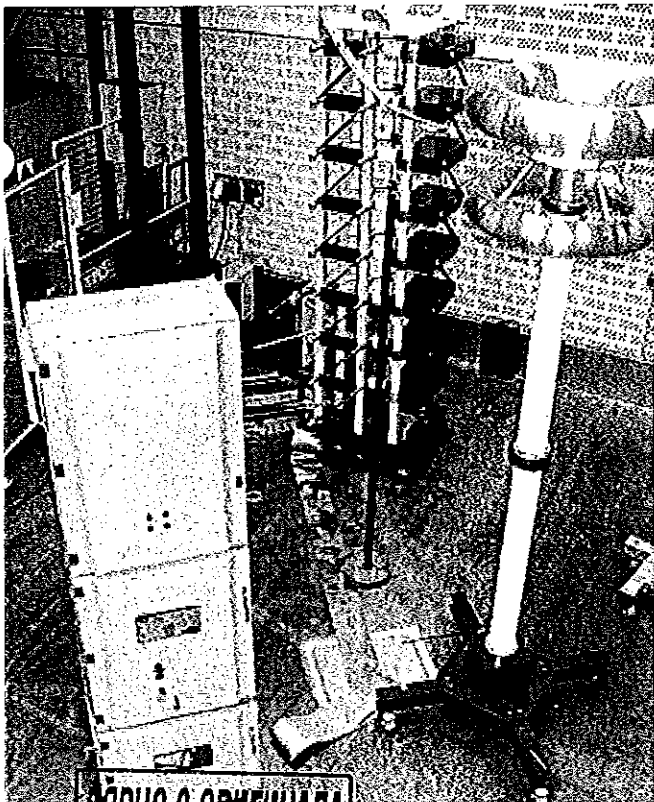
High-voltage testing laboratory

With the test facilities in our high voltage testing laboratory all dielectric and partial discharge tests for medium voltage equipment can be carried out. For sensitive partial discharge tests a special test chamber is available with a background level $< 1 \text{ pC}$.

In order to offer on-site testing the high-voltage laboratory has mobile test equipment.

The high-voltage testing laboratory performs the following tests:

- Standard lightning impulse voltage tests
 - Up to 800 kV
- Power-frequency voltage tests
 - Stationary up to 260 kV
 - Mobile up to 230 kV
- Partial discharge tests
 - Stationary up to 150 kV
 - Mobile up to 230 kV
- Degree of protection tests
- Tests on auxiliary and control circuits



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Mechanical testing laboratory

The mechanical testing laboratory offers different functional, environmental and material tests especially on medium and low voltage equipment and their components.

The functional tests include endurance tests on switching devices, kinematic chain tests and function tests on any kind of interlocking or control system. For long-duration tests automatic control and monitoring systems are available to supervise various signals for diagnostics.

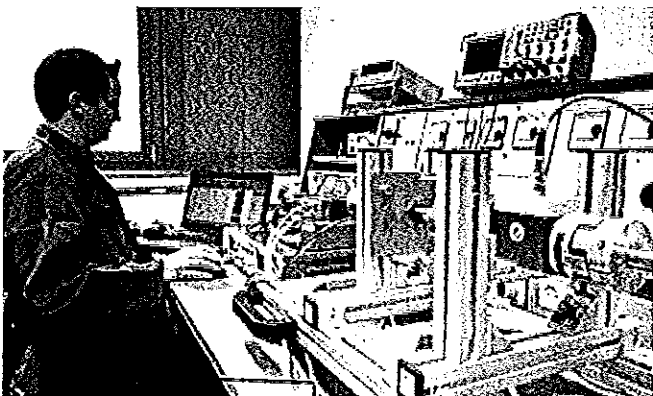
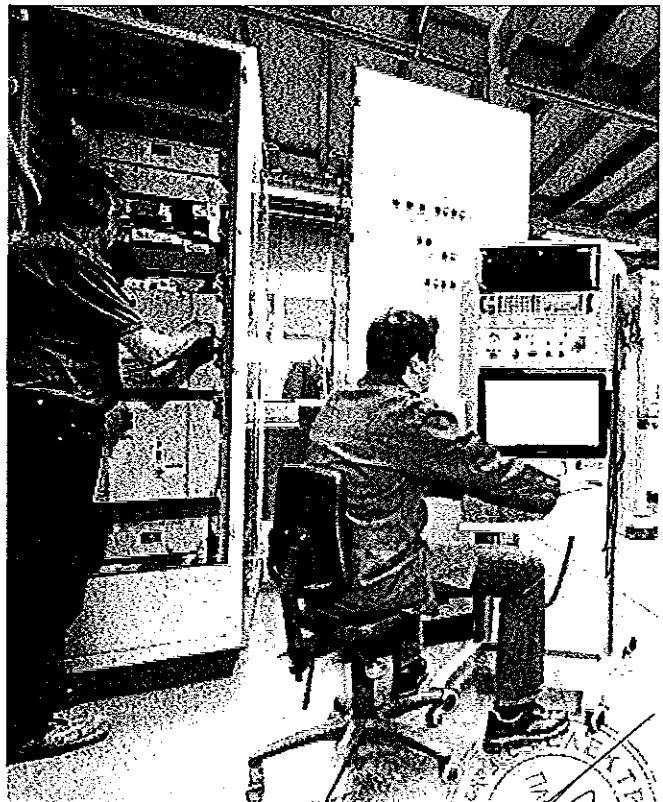
A wide range of measurement equipment is able to record via special sensors many additional data for detailed investigation of the test objects characteristics, like travels, rotation angles, forces, torques, pressures, temperatures, binary signal states and gas densities.

For gas-filled equipment we offer additionally gas-tightness and pressure withstand tests.

The environmental tests combine the above mentioned measurements and functional tests with special conditions during storage and/or operation like extreme temperatures, humidity, vibrations, inclination and other impacts.

Material testing concentrates on load tests like tensile, compression, mechanical impact IK-coding, torsion and bending tests.

High-speed video recording can be used for visual examination of very fast processes (up to 10,000 pic./s).



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Testing facilities

Material testing laboratory

In this laboratory various climatic tests on materials, components and complete medium voltage switchgear panels can be carried out.

The testing facilities include two accessible climatic / thermo chambers. The main tests offered by the material testing laboratory are:

- Temperature tests
 - Range: -70 °C to +150 °C
 - Test voltage: 95 kV (1-phase)
- Climatic tests
 - Temperature range: +20 °C to +90 °C
 - Humidity range: 10 - 98 %
 - Test voltage: 95 kV (1-phase)
- Corrosion tests
 - Salt fog tests
 - Fog tests with sulfur dioxide
 - Tests with condensed water containing chloride

Calibration service

At the calibration laboratory we are able to calibrate electrical measurement instruments, force measurement instruments, length measurement equipment, torque wrenches and pressure gas equipment.



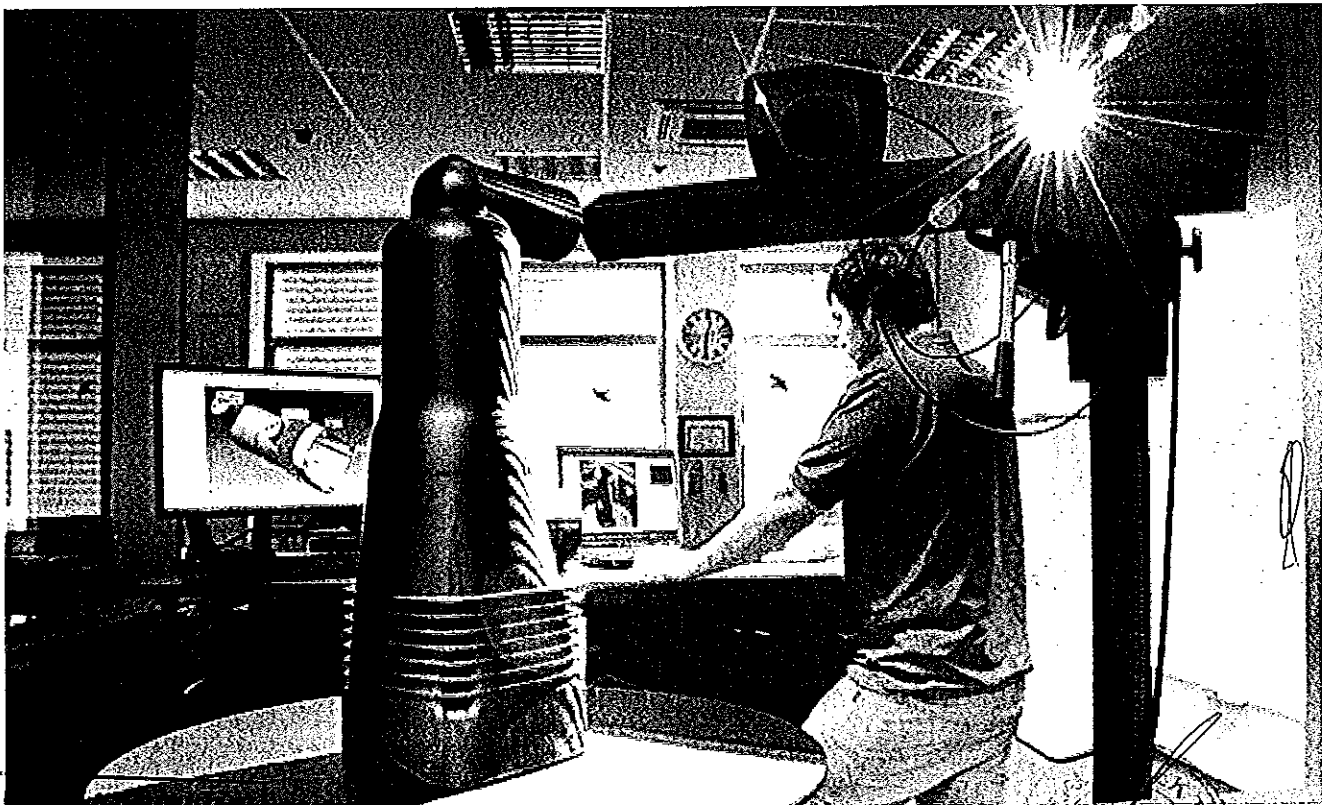
62

Initial sampling inspection

Objects with different size can be digitized with top-quality by 3D-scanning.

The 3D scanner will also be used for

- Quality checks
 - Comparison of nominal/actual measurement data according to CAD data set
 - Measurement of form and position tolerances without complex construction
 - Measurement of free formed surfaces
 - Serial measurement for quality checks, process safety
- Toolroom
 - Generation of drawings for CAD system derives from scan process
 - Check of initial batches



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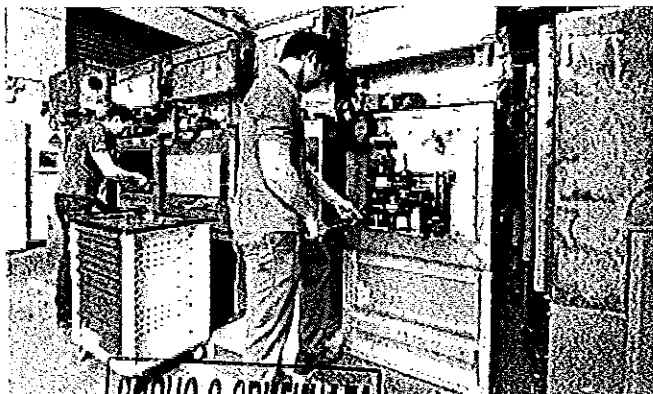
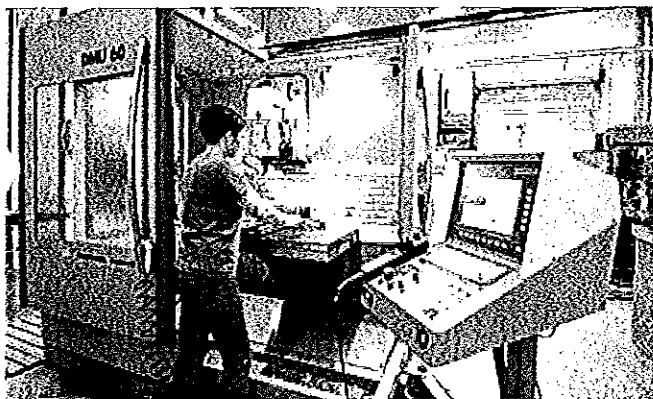
66

Workshop of the Laboratories

The workshop manufactures prototypes and test arrangements as well as provides complete assembly and installation service in connection with tests.

If defects occur during tests our workshop offers immediate repair service and manufacturing of spare parts.

In order to offer optimal service the workshop is fully equipped for all kind of metal processing.



ВЪРНО С ОПИТИНАТА

Contacts at the Laboratories Ratingen

If you need more information on Laboratories Ratingen or if you would like to make reservations for a test please contact:

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ВЯРНО С ОРИГИНАЛА

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Contact

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www.abb.com/laboratories-ratingen

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Power and productivity
for a better world™



Deutsche Akkreditierungsstelle GmbH

Anlage zur Akkreditierungsurkunde D-PL-12115-01-00 nach DIN EN ISO/IEC 17025:2005

Gültigkeitsdauer: 20.04.2017 bis 19.04.2022 Ausstellungsdatum: 20.04.2017

Urkundeninhaber:

ABB AG
Kallstater Str. 1, 68309 Mannheim

Standort:

ABB AG
Calor Emag Mittelspannungsprodukte
Oberhausener Straße 33, 40472 Ratingen

Prüfungen in den Bereichen:

Geräte und Anlagen der Nieder-, Mittel- und Hochspannung

Dem Prüflaboratorium ist, ohne dass es einer vorherigen Information und Zustimmung der DAkks bedarf, die Anwendung der hier aufgeführten genormten oder ihnen gleichzusetzenden Prüfverfahren mit unterschiedlichen Ausgabeständen gestattet.

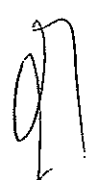
Das Prüflaboratorium verfügt über eine aktuelle Liste aller Prüfverfahren im flexiblen Akkreditierungsbereich.

Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 61869-1 VDE 0414-9-1: April 2010 IEC 61869-1 Edition 1.0, 2007-10	Messwandler – Teil 1: Allgemeine Anforderungen (IEC 61869-1:2007, modifiziert); Deutsche Fassung EN 61869-1:2009 Instrument transformers – Part 1: General requirements (IEC 61869-1:2007, modified); German version EN 61869-1:2009	

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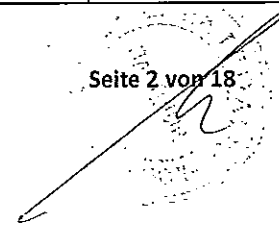



Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 61869-2 VDE 0414-9-2: 2013-07 + DIN EN 61869-2 Berichtigung 1: 2014- 06; VDE 0414-9-2 Berichtigung 1: 2014-06 IEC 61869-2 Edition 1.0, 2012-09	Messwandler – Teil 2: Zusätzliche Anforderungen für Stromwandler (IEC 61869-2:2012); Deutsche Fassung EN 61869-2:2012 Instrument transformers – Part 2: Additional requirements for current transformers (IEC 61869-2:2012); German version EN 61869-2:2012	
Elektrotechnik	DIN EN 61869-3 (VDE 0414-9-3): Mai 2012 IEC 61869-3 Edition 1.0, 2011-07	Messwandler – Teil 3: Zusätzliche Anforderungen für induktive Spannungswandler (IEC 61869-3:2011); Deutsche Fassung EN 61869-3:2011 Instrument transformers – Part 3: Additional requirements for inductive voltage transformers (IEC 61869-3:2011); German version EN 61869-3:2011	
Elektrotechnik	DIN EN 61869-4 VDE 0414-9-4: April 2015 IEC 61869-4 Edition 1.0, 2013-11	Messwandler - Teil 4: Zusätzliche Anforderungen für kombinierte Wandler (IEC 61869-4:2013) Deutsche Fassung EN 61869-4:2014 Instrument transformers - Part 4: Additional requirements for combined transformers German version EN 61869-4:2014	
Elektrotechnik	DIN EN 61869-5 (VDE 0414-9-5) Mai 2012 IEC 61869-5 Edition 1.0, 2011-07	Messwandler - Teil 5: Zusätzliche Anforderungen für kapazitive Spannungswandler (IEC 61869-5:2011); Deutsche Fassung EN 61869-5:2011 Instrument transformers – Part 5: Additional requirements for capacitor voltage transformers (IEC 61869-5:2011); German version EN 61869-5:2011	

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 Gültigkeitsdauer 20.04.2017 bis 19.04.2022

Ausstellungsdatum: 20.04.2017

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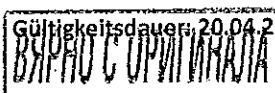
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60060-1 (VDE 0432-1) Oktober 2011 IEC 60060-1 Edition 3.0, 2010-09	Hochspannungs-Prüftechnik – Teil 1: Allgemeine Begriffe und Prüfbedingungen (IEC 60060-1:2010); Deutsche Fassung EN 60060-1:2010 High-voltage test techniques – Part 1: General definitions and test requirements (IEC 60060-1:2010); German version EN 60060-1:2010	
Elektrotechnik	DIN EN 60060-2 (VDE 0432-2) Oktober 2011 IEC 60060-2 Edition 3.0, 2010-11	Hochspannungs-Prüftechnik – Teil 2: Messsysteme (IEC 60060-2:2010); Deutsche Fassung EN 60060-2:2011 High-voltage test techniques – Part 2: Measuring systems (IEC 60060-2:2010); German version EN 60060-2:2011	(without annex A) (ohne Anhang A)
Elektrotechnik	DIN EN 60076-5 (VDE 0532-76-5) Januar 2007 IEC 60076-5 Third Edition, 2006-02	Leistungstransformatoren – Teil 5: Kurzschlussfestigkeit (IEC 60076-5:2006); Deutsche Fassung EN 60076-5:2006 Power transformers – Part 5: Ability to withstand short-circuit (IEC 60076-5:2006); German version EN 60076-5:2006	
Elektrotechnik	DIN EN 60076-11 (VDE 0532-76-11) April 2005 IEC 60076-11 First Edition, 2004-05	Leistungstransformatoren – Teil 11: Trockentransformatoren (IEC 60076-11:2004); Deutsche Fassung EN 60076-11:2004 Power transformers – Part 11: Dry-type transformers (IEC 60076-11:2004); German version EN 60076-11:2004	
Elektrotechnik	DIN EN 60137 (VDE 0674-5) Juli 2009 IEC 60137	Isolierte Durchführungen für Wechselspannungen über 1 000 V (IEC 60137:2008); Deutsche Fassung EN 60137:2008 Insulated bushings for alternating voltages above	



Anlage zur Akkreditierungsurkunde D-PL-12115-01-00

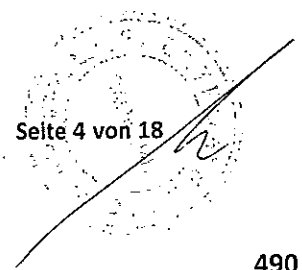
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
	Edition 6.0, 2008-07	1000 V (IEC 60137:2008); German version EN 60137:2008	
Elektrotechnik	DIN EN 62271-103 (VDE 0671-103) April 2012 IEC 62271-103 Edition 1.0, 2011-06	Hochspannungs-Schaltgeräte und -Schaltanlagen – Teil 103: Lastschalter für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-103:2011); Deutsche Fassung EN 62271-103:2011 High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV (IEC 62271-103:2011); German version EN 62271-103:2011	
Elektrotechnik	DIN EN 62271-104 (VDE 0671-104) November 2015 IEC 62271-104 Edition 2.0, 2015-02	Hochspannungs-Schaltgeräte und -Schaltanlagen – Teil 104: Wechselstrom-Lastschalter für Bemessungsspannungen über 52 kV (IEC 62271-104:2015); Deutsche Fassung EN 62271-104:2015 High-voltage switchgear and controlgear – Part 104: Alternating current switches for rated voltages higher than 52 kV (IEC 62271-104:2015); German version EN 62271-104:2015	


Gültigkeitsdauer: 20.04.2017 bis 19.04.2022





Ausstellungsdatum: 20.04.2017

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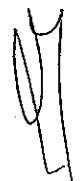
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60270 (VDE 0434) August 2001 + DIN EN 60270 Berichtigung 1: November 2002; VDE 0414-9-2 Berichtigung 1: November 2002 IEC 60270 Third edition, 2000-12 + Amendment 1 Third edition, 2015-11	Hochspannungs-Prüftechnik Teilentladungsmessungen (IEC 60270:2000) Deutsche Fassung EN 60270:2001 High-voltage test techniques – Partial discharge measurement (IEC 60270:2000); German version EN 60270:2001	
Elektrotechnik	DIN EN 60282-1 (VDE 0670-4) August 2010 IEC 60282-1 Edition 7.1, 2014-07	Hochspannungssicherungen Teil 1: Strombegrenzende Sicherungen (IEC 60282-1:2009) Deutsche Fassung EN 60282-1:2009 High-voltage fuses – Part 1: Current-limiting fuses (IEC 60282-1:2009); German version EN 60282-1:2009	
Elektrotechnik	IEC 60282-2 Edition 3.0, 2008-04	High-voltage fuses – Part 2: Expulsion fuses	
Elektrotechnik	DIN EN 62271-106 (VDE 0671-106) Juni 2011 IEC 62271-106 Edition 1.0, 2011-08	Hochspannungs-Schaltgeräte und -Schaltanlagen – Teil 106: Wechselstrom-Schütze, Kombinationsstarter und Motorstarter mit Schützen (IEC 62271-106:2011); Deutsche Fassung EN 62271-106:2011 High-voltage switchgear and controlgear – Part 106: Alternating current contactors, contactor-based controllers and motor-starters (IEC 62271-106:2011); German version EN 62271-106:2011	

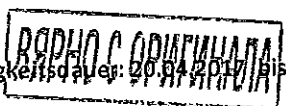
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60529 (VDE 0470-1) September 2014 IEC 60529 Edition 2.2, 2013-08	Schutzarten durch Gehäuse (IP-Code) (IEC 60529:1989 + A1:1999 + A2:2013) Deutsche Fassung EN 60529:1991 + A1: 2000 + A2:2013 Degree of protection provided by enclosures (IP Code) (IEC 60529:1989 + A1:1999 + A2:2013) German version EN 60529:1991 + A1: 2000 + A2:2013	
Elektrotechnik	DIN EN 60660 (VDE 0441-3) Dezember 2000 IEC 60660 Edition 2.0, 1999-10	Isolatoren Prüfungen an Innenraum-Stützern aus organischem Werkstoff für Netze mit Nennspannungen über 1 kV bis kleiner 300 kV (IEC 60660:1999) Deutsche Fassung EN 60660:1999 Insulators – Tests on indoor post insulators of organic material for systems with nominal voltages greater than 1 kV up to but not including 300 kV (IEC 60660:1999); German version EN 60660:1999	
Elektrotechnik	DIN EN 60832-1 (VDE 0682-211) Dezember 2010 IEC 60832-1 Edition 1.0, 2010-02	Arbeiten unter Spannung – Isolierende Stangen und auswechselbare Arbeitsköpfe – Teil 1: Isolierende Stangen (IEC 60832-1:2010) Deutsche Fassung EN 60832-1:2010 + Cor.:2010 Live working - Insulating sticks and attachable devices - Part 1: Insulating sticks (IEC 60832-1:2010) German version EN 60832-1:2010 + Cor.:2010	
Elektrotechnik	DIN EN 60832-2 (VDE 0682-212) Dezember 2010 IEC 60832-2 Edition 1.0, 2010-02	Arbeiten unter Spannung – Isolierende Stangen und auswechselbare Arbeitsköpfe Teil 2: Auswechselbare Arbeitsköpfe (IEC 60832-2:2010); Deutsche Fassung EN 60832-2:2010 + Cor.:2010 Live working - Insulating sticks and attachable devices - Part 2: Attachables devices (IEC 60832-2:2010); German version EN 60832-2:2010 + Cor.:2010	




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Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60947-1: (VDE 0660-100) Oktober 2011	Niederspannungsschaltgeräte – Teil 1: Allgemeine Festlegungen (IEC 60947-1:2007 + A1:2010); Deutsche Fassung EN 60947-1:2007 + A1:2011	
	DIN EN 60947-1/A2 (VDE 0660-100/A2) Mai 2014	Niederspannungsschaltgeräte – Teil 1: Allgemeine Festlegungen (IEC 17B/1806/CDV:2013); Deutsche Fassung EN 60947-1:2007/FprA2:2013	
	IEC 60947-1 Edition 5.2 2014-09 + Amendement 1 + 2	Low-voltage switchgear and controlgear - Part 1: General rules (IEC 60947-1:2007 + A1:2010); German version EN 60947-1:2007 + A1:2011	
Elektrotechnik	DIN EN 60947-2: VDE 0660-101 Januar 2014	Niederspannungsschaltgeräte – Teil 2: Leistungsschalter (IEC 60947-2:2006 + A1:2009 + A2:2013); Deutsche Fassung EN 60947-2:2006 + A1:2009 + A2:2013	
	DIN EN 60947-2 (VDE 0660-101) März 2015	Niederspannungsschaltgeräte – Teil 2: Leistungsschalter (IEC 121A/26/CDV:2014); Deutsche Fassung FprEN 60947-2:2014	
	IEC 60947-2 Edition 5.0 2016-06	Low-voltage switchgear and controlgear – Part 2: Circuit-breakers (IEC 60947-2: 2016); German version EN 60947-2:2006 + A1:2009 + A2:2013	



 Gültigkeit bis: 19.04.2022


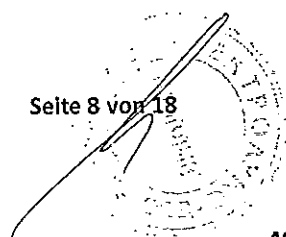
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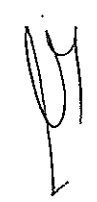

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Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60947-3: VDE 0660-10 Dezember 2012	Niederspannungsschaltgeräte - Teil 3: Lastschalter, Trennschalter, Lasttrennschalter und Schalter-Sicherungs-Einheiten (IEC 60947- 3:2008 + A1:2012); Deutsche Fassung EN 60947- 3:2009 + A1:2012	
	DIN EN 60947-3 Berichtigung 1 (VDE 0660-107 Berichtigung 1) März 2015	Niederspannungsschaltgeräte – Teil 3: Lastschalter, Trennschalter, Lasttrennschalter und Schalter-Sicherungs- Einheiten (IEC 60947-3:2008 + A1:2012); Deutsche Fassung EN 60947-3:2009 + A1:2012, Berichtigung zu DIN EN 60947-3 (VDE 0660- 107):2012-12; (IEC-Cor.:2013 zu IEC 60947- 3:2008/A1:2012)	
	DIN EN 60947- 3/A2:2015-03; VDE 0660-107/A2:2015-03	Niederspannungsschaltgeräte – Teil 3: Lastschalter, Trennschalter, Lasttrennschalter und Schalter-Sicherungs- Einheiten (IEC 121A/7/CDV:2014); Deutsche Fassung EN 60947-3:2009/FprA2:2014	
	IEC 60947-3 Edition 3.1 2012-04 + Amendment 1	Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch- disconnectors and fuse-combination units (IEC 60947-3:2008 + A1:2012); German version EN 60947-3:2009 + A1:2012	
Elektrotechnik	DIN EN 61230, (VDE 0683-100) Juli 2009	Ortsveränderliche Geräte zum Erden oder Erden und Kurzschließen (IEC 61230:2008); Deutsche Fassung EN 61230:2008	
	IEC 61230 Edition 2.0, 2008-07	Live working - Portable equipment for earthing or earthing and short-circuiting (IEC 61230:2008); German version EN 61230:2008	

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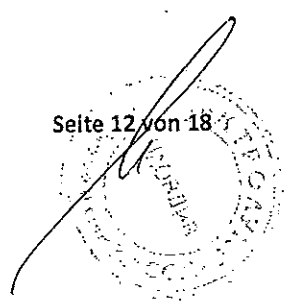
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 61869-1 VDE 0414-9-1 April 2010 IEC 61869-1 Edition 1.0, 2007-10	Messwandler Teil 1: Allgemeine Anforderungen (IEC 61869-1:2007, modifiziert); Deutsche Fassung EN 61869-1:2009 Instrument transformers - Part 1: General requirements (IEC 61869-1:2007, modified); German version EN 61869-1:2009	
Elektrotechnik	DIN EN 62271-1 VDE 0671-1 August 2009 + DIN EN 62271-1/A1 VDE 0671-1/A1 April 2012 IEC 62271 Edition 1.1, 2011-08	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 1: Gemeinsame Bestimmungen (IEC 62271-1:2007); Deutsche Fassung EN 62271-1:2008 Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 1: Gemeinsame Bestimmungen (IEC 62271-1:2007/A1:2011); Deutsche Fassung EN 62271-1:2008/A1:2011 High-voltage switchgear and controlgear - Part 1: Common specifications (IEC 62271-1:2007); German version EN 62271-1:2008	
Elektrotechnik	DIN EN 62271-100 VDE 0671-100 August 2013 IEC 62271-100 Edition 2.1, 2012-09	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 100: Wechselstrom-Leistungsschalter (IEC 62271-100:2008 + A1:2012); Deutsche Fassung EN 62271-100:2009 + A1:2012 High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers (IEC 62271-100:2008 + A1:2012); German version EN 62271-100:2009 + A1:2012	

Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 62271-102 VDE 0671-102 August 2013 +	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 102: Wechselstrom-Trennschalter und - Erdungsschalter (IEC 62271-102:2001 + Corrigenda 2002 & 2003 + A1:2011); Deutsche Fassung EN 62271-102:2002 + Cor.:2008 + A1:2011	
	DIN EN 62271-102/A2 VDE 0671-102/A2 Dezember 2013	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 102: Wechselstrom-Trennschalter und - Erdungsschalter (IEC 62271-102:2001/A2:2013); Deutsche Fassung EN 62271-102:2002/A2:2013	
	IEC 62271-102 Edition 1.2, 2013-02	High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches (IEC 62271-102:2001 + Corrigenda 2002 & 2003 + A1:2011 + A2:2013); German version EN 62271-102:2002 + Cor.:2008 + A1:2011 + A2:2013	
Elektrotechnik	DIN EN 62271-105 VDE 0671-105 August 2013	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 105: Wechselstrom-Lastschalter-Sicherungs- Kombinationen für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-105:2012); Deutsche Fassung EN 62271-105:2012	
	IEC 62271-105 Edition 2.0, 2012-09	High-voltage switchgear and controlgear – Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV (IEC 62271-105:2012); German version EN 62271-105:2012	
Elektrotechnik	DIN EN 62271-110 VDE 0671-110 August 2013	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 110: Schalten induktiver Lasten (IEC 62271-110:2012 + corrigendum Oct. 2012); Deutsche Fassung EN 62271-110:2012	
	IEC 62271-110 Edition 3.0, 2012-09	High-voltage switchgear and controlgear – Part 110: Inductive load switching (IEC 62271-110:2012 + corrigendum Oct. 2012); German version EN 62271-110:2012	


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Elektrotechnik	E DIN EN 62271-111 VDE 0671-111 September 2014 IEC 62271-111: 2012(E) IEEE Std C37.60- 2012(E) Edition 2.0 2012-09	Hochspannungs-Schaltgeräte -und Schaltanlagen Teil 111: Automatische Wiedereinschalter und Fehlerunterbrecher für Wechselspannungssysteme bis 38 kV (IEC 17A/1060/CD:2014) High-voltage switchgear and controlgear – Part 111: Automatic circuit reclosers and fault interrupters for alternating current systems up to 38 kV	
Elektrotechnik	DIN EN 62271-200 VDE 0671-200 August 2012 + Berichtigung 1 IEC 62271-200 Edition 2.0, 2011-10 + Corrigendum 1	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 200: Metallgekapselte Wechselstrom- Schaltanlagen für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-200:2011); Deutsche Fassung EN 62271-200:2012 + Berichtigung 1:2016-01 High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-200:2011 + Corrigenda 2015); German version EN 62271-200:2012 + Berichtigung 1:2016-01	
Elektrotechnik	DIN EN 62271-201 VDE 0671-201 Juli 2007 IEC 62271-201 Edition 2.0, 2014-03	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 201: Isolierstoffgekapselte Wechselstrom- Schaltanlagen für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-201:2006); Deutsche Fassung EN 62271-201:2006 High-voltage switchgear and controlgear - Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-201:2014);	




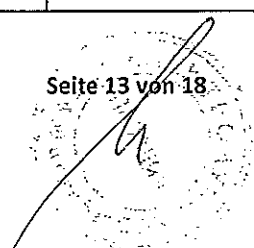
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 62271-202 VDE 0671-202 August 2007 IEC 62271-202 Edition 2.0, 2014-03	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 202: Fabrikfertige Stationen für Hochspannung/Niederspannung (IEC 62271-202:2006); Deutsche Fassung EN 62271-202:2007 High-voltage switchgear and controlgear – Part 202: High-voltage/ low-voltage prefabricated substation (IEC 62271-202:2014);	
Elektrotechnik	DIN EN 62271-203 VDE 0671-203 November 2012 IEC 62271-203 Edition 2.0, 2011-09	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 203: Gasisolierte metallgekapselte Schaltanlagen für Bemessungsspannungen über 52 kV (IEC 62271-203:2011); Deutsche Fassung EN 62271-203:2012 High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV (IEC 62271-203:2011); German version EN 62271-203:2012	
Elektrotechnik	E DIN EN 62271-304 VDE 0671-304 April 2007 IEC/TS 62271-304 Edition 1.0, 2008-05	Zusätzliche Anforderungen an gekapselte Schaltgerätekombinationen und Hochspannungsschaltanlagen von 1 kV bis 52 kV für den Einsatz unter erschwerten klimatischen Bedingungen (IEC 17C/373/CD:2006) High-voltage switchgear and controlgear – Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV to be used in severe climatic conditions (IEC/TS 62271-304:2008)	




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Elektrotechnik	E DIN IEC 62271-37-013 VDE 0671-37-013: 2012-09 IEC/IEEE 62271-37-013 Edition 1.0, 2015-10	Hochspannungs-Schaltgeräte und -Schaltanlagen Teil 37-013: Wechselstrom-Generatorschalter (IEC 17A/993/CD:2011) High-voltage switchgear and controlgear – Part 37-013: Alternating-current generator circuit-breakers	
Elektrotechnik	DIN EN 60068-2-1 VDE 0468-2-1 Januar 2008 IEC 60068-2-1 Edition 6.0, 2007-03	Umgebungseinflüsse - Teil 2-1: Prüfverfahren - Prüfung A: Kälte (IEC 60068-2-1:2007); Deutsche Fassung EN 60068-2-1:2007 Environmental testing – Part 2-1: Tests – Test A: Cold (IEC 60068-2-1:2007); German version EN 60068-2-1:2007	
Elektrotechnik	DIN EN 60068-2-2 VDE 0468-2-2 Mai 2008 IEC 60068-2-2 Edition 5.0, 2007-07	Umgebungseinflüsse - Teil 2-2: Prüfverfahren - Prüfung B: Trockene Wärme (IEC 60068-2-2:2007); Deutsche Fassung EN 60068-2-2:2007 Environmental testing – Part 2-2: Tests – Test B: Dry heat (IEC 60068-2-2:2007) German version EN 60068-2-2:2007	
Elektrotechnik	DIN EN 60068-2-30 Juni 2006 IEC 60068-2-30 Edition 3.0, 2005-08	Umgebungseinflüsse - Teil 2-30: Prüfverfahren - Prüfung Db: Feuchte Wärme, zyklisch (12 + 12 Stunden) (IEC 60068-2-30:2005); Deutsche Fassung EN 60068-2-30:2005 Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30:2005) German version EN 60068-2-30:2005	
Elektrotechnik	IEC 62262 Edition 1.0, 2002-02	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) German version SN EN 62262:2002	


 ВЕРНО С ОПРИМКАТА



Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 60068-2-75 VDE 0468-2-75 2015-08 IEC 60068-2-75 Edition 2.0, 2014-09	Umgebungseinflüsse - Teil 2-75: Prüfungen - Prüfung Eh: Hammerprüfungen (IEC 60068-2-75:2014); Deutsche Fassung EN 60068-2-75:2014 Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests (IEC 60068-2-75:2014) German version EN 60068-2-75:2014	
Elektrotechnik	IEEE Std C37.04- 1999 June 1999	IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers IEEE Std C37.04-1999 (Revision of IEEE Std C37.04-1979)	
Elektrotechnik	IEEE Std C37.06-2009 November 2009	IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V IEEE Std C37.06-2009 (Revision of ANSI C37.06-2000)	
Elektrotechnik	IEEE Std C37.09-1999 (R2007) June 1999	IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis IEEE Std C37.09™-1999 (R2007) (Revision of IEEE Std C37.09-1979)	
Elektrotechnik	ANSI C37.54- 2002 March 2003	American National Standard For Indoor Alternating Current High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear— Conformance Test Procedures	
Elektrotechnik	ANSI C37.20.2-2015	IEEE Standard for Metal-Clad Switchgear	
Elektrotechnik	ANSI C37.20.7-2007	IEEE Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults	
Elektrotechnik	ANSI C37.122.2- 2011	IEEE Guide for the Application of Gas Insulated Substations 1kV to 52kV	
Elektrotechnik	IEEE Std C57.13-2008	IEEE Standard Requirements for Instrument Transformers	



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Elektrotechnik	E DIN EN 61180 VDE 0432-10 Juli 2013	Hochspannungs-Prüftechnik für Niederspannungsgeräte Begriffe, Prüfung und Prüfbedingungen, Prüfgeräte	
	DIN EN 61180-1 VDE 0432-10 Mai 1995	Hochspannungs-Prüftechnik für Niederspannungsgeräte Begriffe, Prüfung und Prüfbedingungen (IEC 61180-1:1992); Deutsche Fassung EN 61180-1:1994	
	IEC 61180-1 Edition 1.0, 1992-10	High-voltage test techniques for low voltage equipment – Part 1: Definitions, test and procedure requirements (IEC 61180-1:1992); German version EN 61180-1:1994	
	DIN EN 61180-2 VDE 0432-11 Mai 1995	Hochspannungs-Prüftechnik für Niederspannungsgeräte Prüfgeräte (IEC 61180-2:1994); Deutsche Fassung EN 61180-2:1994	
	IEC 61180-2 Edition 1.0, 1994-06	High-voltage test techniques for low-voltage equipment – Part 2: Test equipment (IEC 61180-2:1994); German version EN 61180-2:1994	






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Elektrotechnik	DIN EN 61439-1 VDE 0660-600-1 Juni 2012 +	Niederspannungs-Schaltgerätekombinationen Teil 1: Allgemeine Festlegungen (IEC 61439-1:2011); Deutsche Fassung EN 61439-1:2011	
	DIN EN 61439-1 Bbl 1 VDE 0660-600-1 Bbl 1 Berichtigung 1 Dezember 2014 +	Berichtigung zu DIN EN 61439-1 Beiblatt 1 (VDE 0660-600-1 Beiblatt 1):2014-06	
	DIN EN 61439-1 VDE 0660-600-1 Beiblatt 1: Juni 2014	Niederspannungs-Schaltgerätekombinationen Teil 1: Allgemeine Festlegungen; Beiblatt 1: Leitfaden für die Spezifikation von Schaltgerätekombinationen (IEC/TR 61439-0:2013)	
	IEC 61439-1 Edition 2.0, 2011-08	Low-voltage switchgear and controlgear assemblies – Part 1: General rules (IEC 61439-1:2011); German version EN 61439-1:2011	
	IEC/TR 61439-0 Edition 2.0, 2013-04	Low-voltage switchgear and controlgear assemblies – Part 0: Guidance to specifying assemblies	
Elektrotechnik	DIN EN 61439-2 VDE 0660-600-2 Juni 2012	Niederspannungs-Schaltgerätekombinationen Teil 2: Energie-Schaltgerätekombinationen (IEC 61439-2:2011); Deutsche Fassung EN 61439-2:2011	
	IEC 61439-1 Edition 2.0, 2011-08	Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies (IEC 61439-2:2011); German version EN 61439-2:2011	




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Elektrotechnik	DIN EN 61439-3 VDE 0660-600-3 Februar 2013 +	Niederspannungs-Schaltgerätekombinationen Teil 3: Installationsverteiler für die Bedienung durch Laien (DBO) (IEC 61439-3:2012); Deutsche Fassung EN 61439-3:2012	
	DIN EN 61439-3 VDE 0660-600-3 Berichtigung 1 Oktober 2014	Berichtigung zu DIN EN 61439-3 (VDE 0660-600-3):2013-02; (IEC-Cor.:2013 zu IEC 61439-3:2012)	
	IEC 61439-3 Edition 1.0, 2012-02	Low-voltage switchgear and controlgear assemblies – Part 3: Distribution boards intended to be operated by ordinary persons (DBO) (IEC 61439-3:2012); German version EN 61439-3:2012	
Elektrotechnik	DIN EN 61439-4 VDE 0660-600-4 September 2013	Niederspannungs-Schaltgerätekombinationen Teil 4: Besondere Anforderungen für Baustromverteiler (BV) (IEC 61439-4:2012); Deutsche Fassung EN 61439-4:2013	
	IEC 61439-4 Edition 1.0, 2012-11	Low-voltage switchgear and controlgear assemblies – Part 4: Particular requirements for assemblies for construction sites (ACS) (IEC 61439-4:2012); German version EN 61439-4:2013	

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Anlage zur Akkreditierungsurkunde D-PL-12115-01-00

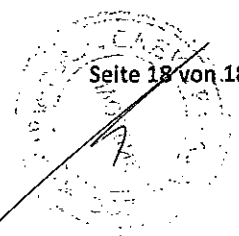
Fachbereich	Norm / Hausverfahren / Version	Titel der Norm oder des Hausverfahrens (ggf. Abweichungen / Modifizierungen von Normverfahren angeben)	Prüfbereich / Einschränkung
Elektrotechnik	DIN EN 61439-5 VDE 0660-600-5 Oktober 2011	Niederspannungs-Schaltgerätekombinationen Teil 5: Schaltgerätekombinationen in öffentlichen Energieverteilungsnetzen (IEC 61439-5:2010); Deutsche Fassung EN 61439-5:2011	
	E DIN EN 61439-5 VDE 0660-600-5 Juli 2014	Niederspannungs-Schaltgerätekombinationen Teil 5: Schaltgerätekombinationen in öffentlichen Energieverteilungsnetzen (IEC 17D/492/CDV:2013); Deutsche Fassung FprEN 61439-5:2013	
	IEC 61439-5 Edition 2.0, 2014-08	Low-voltage switchgear and controlgear assemblies - Part 5: Assemblies for power distribution in public networks (IEC 61439-5:2014);	
Elektrotechnik	DIN EN 60439-1 VDE 0660-500 Beiblatt 2 Mai 2009	Niederspannungs-Schaltgerätekombinationen Teil 1: Typgeprüfte und partiell typgeprüfte Kombinationen – Technischer Bericht: Verfahren für die Prüfung unter Störlichtbogenbedingungen (IEC/TR 61641:2008)	
	IEC TR 61641 Edition 3.0, 2014-09	Enclosed low-voltage switchgear and controlgear assemblies – Guide for testing under conditions of arcing due to internal fault	

Gültigkeitsdauer: 20.04.2017 bis 19.04.2022

Ausstellungsdatum: 20.04.2017

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ВЯРНО С ОПИГВНАТА



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ДЕКЛАРАЦИЯ

за конфиденциалност и извършен оглед на обект по предмета на поръчката

Долуподписаният Георги Николов Табаков в качеството ми на представляващ „Електролюкс Табаков и синове“ ООД, участник в процедура за възлагане на обществена поръчка с реф. № РРД 17 – 052 и предмет: „Модернизация (ретрофит) на електрически уредби 110/20 (10) kV и въвеждането им в режим на телемеханика“,

ДЕКЛАРИРАМ, ЧЕ:


1/ Представител на участника, когото представлявам е извършил оглед на енергийния обект от обхвата на Обособена позиция 5 /ОП 5/ - Модернизация (ретрофит) на закрыта разпределителна уредба 20 kV в подстанция „Студентски град“, а именно: п/ст „Студентски град“ и съм запознат със съществуващото положение в обекта.

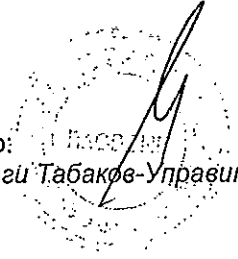
2/ Няма да разпространявам поверителна информация, във връзка с извършения оглед на обекта на Възложителя, като ми е известно, че за поверителна се счита всяка информация, относно пропускателния режим в обекта, организацията на работната сила и работния процес, наличното оборудване и техническите схеми на функционирането му, системите за защита и сигурност в обекта и всичко, което е свързано с наличното оборудване, съоръжения и тяхното функциониране в съответния обект.

3/ Прилагам документ за извършен оглед, съставен на място в подстанцията.

Приложение: съгласно текста

Дата 25.07.2017 г.

Декларатор: 
/Георги Табаков-Управител/



ДЕКЛАРАЦИЯ
за конфиденциалност във връзка с посещение на обект

Долуподписаният Стефан Георгиев Колев
(собствено, бащино и фамилно име)

ЕГН 661213485, притежаващ лична карта № 640386823, издадена на 30.06.2010

от МВР - Пловдив, с постоянен адрес: ул. Пловдивска №11
Б. 14 Вр Б

Представител на "Електротехника Табачар и сестри" ООД
(наименование на юридическото лице/физическото лице и вид на
търговеца)

Със седалище и адрес на управление:

ул. Пловдивска, ул. "Веделин" 9

заинтересовано лице по смисъла на §2, т.14 от Допълнителните разпоредби на Закона за обществените поръчки за открита процедура за възлагане на обществена поръчка с предмет: „Модернизация (ретрофит) на електрически уредби 110/20 (10) kV и въвеждането им в режим на телемеханика”, реф. № PPD 17 - 052, във връзка с посещението на обекта, предмет на обществената поръчка, с цел запознаване със съществуващото му положение, включително с действащите електрически съоръжения и спецификата на ПС Студентски град

ДЕКЛАРИРАМ:

1. Няма да разгласявам по никакъв начин информацията станала ми известна при запознаване със съществуващото му положение, включително с действащите електрически съоръжения и спецификата на ПС Студентски град
2. Наясно съм, че разгласяване на информация по смисъла на настоящата декларация представлява всякакъв вид устно или писмено изявление, предаване на информация на хартиен, електронен или друг носител, включително по поща, факс или електронна поща, както и всякакъв друг начин на разгласяване на информация, в това число чрез средствата за масово осведомяване, печатните издания или интернет.

Известна ми е отговорността по чл.313 от Наказателния кодекс.

Дата 19.07.17 г.



Декларатор: [Signature]

подпис

трите имена

Аще къ възложител: Крумчир Румитров 506

ДЕКЛАРАЦИЯ

за приемане на условията в проекта на договор

Долуподписаният Георги Николов Табаков в качеството ми на представляващ „Електролукс Табаков и синове“ ООД, участник в обществена поръчка с реф. № РРД 17 – 052 и предмет: „Модернизация (ретрофит) на електрически уредби 110/20 (10) kV и въвеждането им в режим на телемеханика“, Обособена позиция 5 /ОП 5/ - Модернизация (ретрофит) на закрыта разпределителна уредба 20 kV в подстанция „Студентски град“;

ДЕКЛАРИРАМ, ЧЕ:

Приемам условията в проекта на договор, приложен в документацията за участие.

Дата 25.07.2017 г.

Декларатор:
/Георги Табаков-Управител/



ДЕКЛАРАЦИЯ

за срока на валидност на офертата

Долуподписаният Георги Николов Табаков, притежаващ лична карта №641449027, издадена на 17.11.2010 г. от МВР– гр. Пловдив, адрес с.Белащица, общ.Родопи, обл.Пловдив, ул."Съединение" №2Б в качеството ми на Управител на „Електролюкс Табаков и синове“ ООД участник в процедура за възлагане на обществена поръчка с предмет: „Модернизация (ретрофит) на електрически уредби 110/20 (10) kV и въвеждането им в режим на телемеханика“, реф. № PPD 17-052, Обособена позиция 5 /ОП 5/ - Модернизация (ретрофит) на закрыта разпределителна уредба 20 kV в подстанция „Студентски град“;

ДЕКЛАРИРАМ, ЧЕ:

С подаване на офертата за участие в обществената поръчка, направените от нас предложения и поети ангажименти са валидни за срока, посочен в обявлението, считано от крайния срок за подаване на офертите.

Дата 25.07.2017 г.

Декларатор:
Георги Табаков-Управител