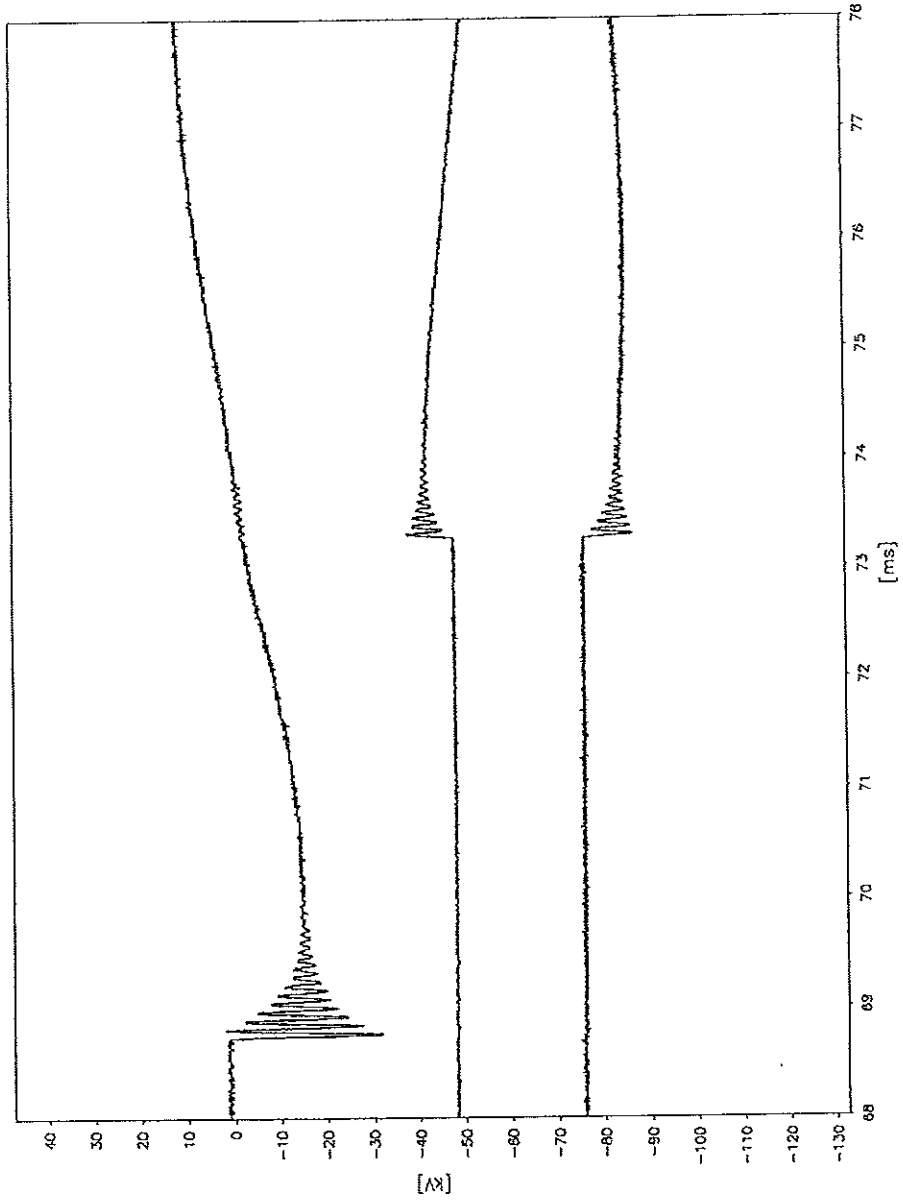
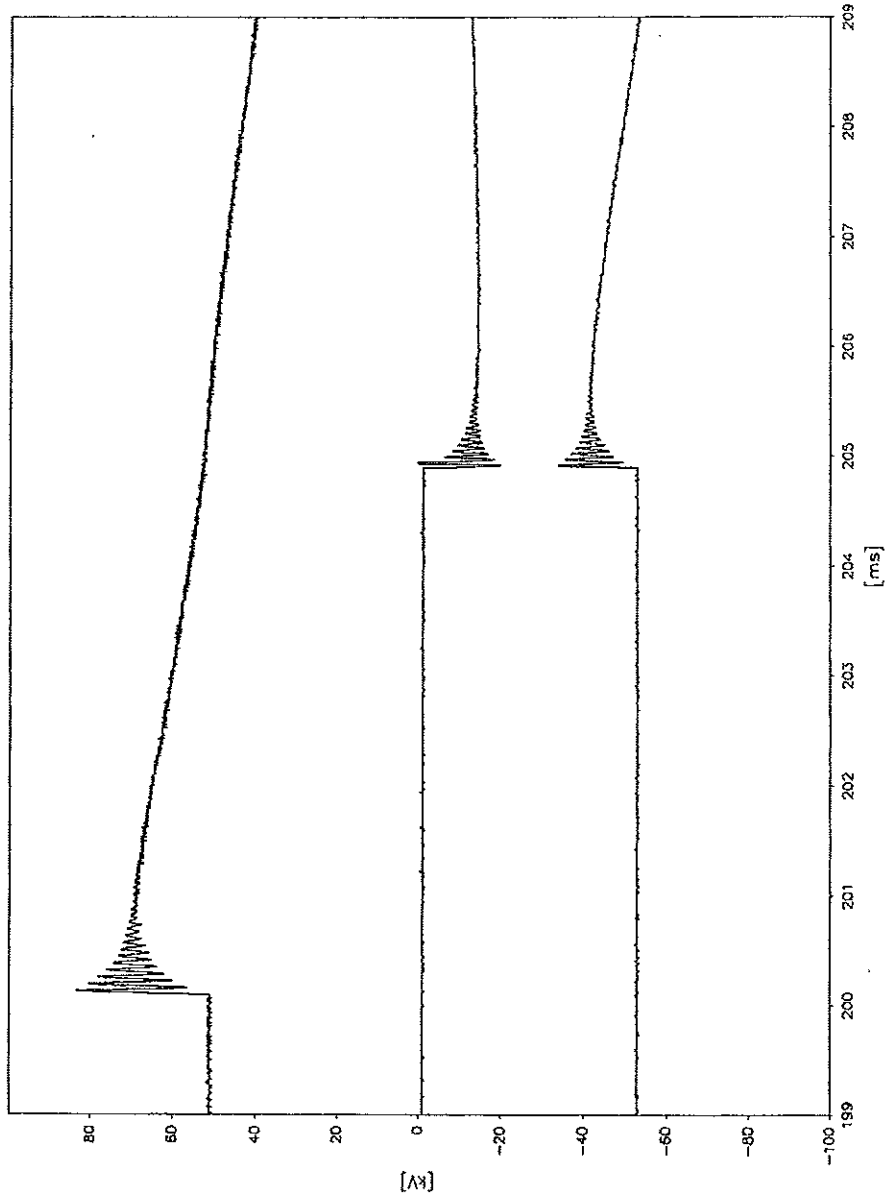


Test no.
PEHLA 0303Ra / 06
Transient Recovery Voltage, First O



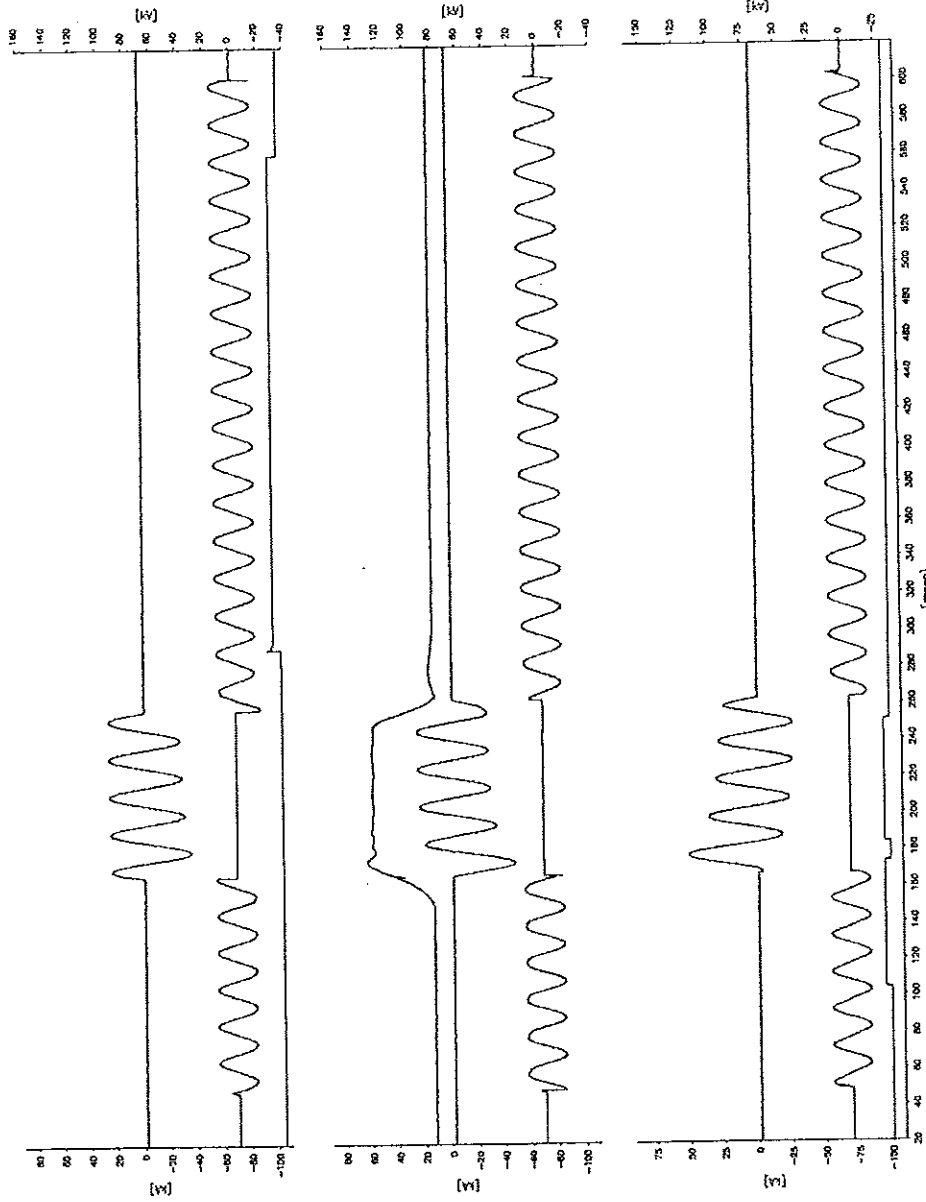
Test no.
PEHLA 0303Ra / 06
Transient Recovery Voltage, Second O



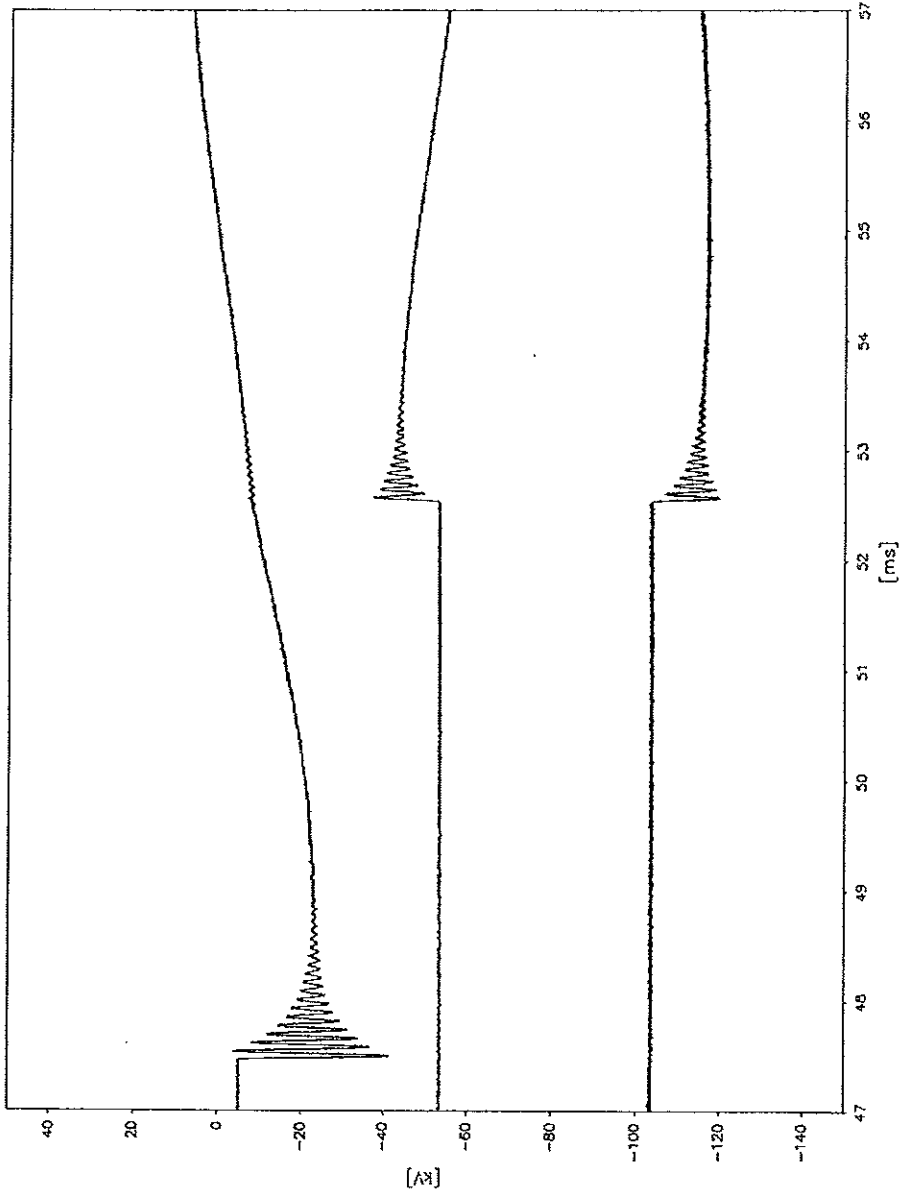
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Test no.
PEHLA 0303Ra / 07



Test no.
PEHLA 0303Ra / 07
Transient Recovery Voltage



Short-Circuit Making and Breaking Tests

Circuit-breaker

Test duty: T100s
Date of test: 09th January 2003
Condition of test object before test: As after test PEHLA 0303Ra / 07.
Connections to test object: By means of copper bars to the upper terminals of the circuit-breaker. Lower terminals of the circuit-breaker short-circuited and earthed.
Arc extinguishing medium: Vacuum

Test No. PEHLA 0303Ra		10		11
Operating sequence		O - 0.3s - CO - 3min - CO		
Applied voltage	kV	-	20.6	20.3
Short-circuit making current	L1	-	56.1	88.8
	kA L2	-	83.7	77.8
	L3	-	84.7	55.6
Short-circuit breaking current	L1	33.9	31.2	32.2
	Short-circuit current kA L2	33.3	32.7	32.5
	L3	32.5	32.9	32.1
	Average value kA	33.2	32.3	32.3
d.c. component	L1	< 20	< 20	< 20
	% L2	< 20	< 20	< 20
	L3	< 20	< 20	< 20
Recovery voltage	L1	12.0	11.0	11.3
	kV L2	12.1	11.4	11.3
	L3	12.0	11.1	11.2
Average value (phase-to-phase)	kV -	20.8	19.3	19.5
Transient Recovery Voltage (TRV), first-pole-to-clear	kV	-	-	-
Arcing time	L1	5.2	8.4	17.5
	ms L2	10.5	8.6	10.1
	L3	10.3	3.0	18.1
Closing time	ms	-	66.2	62.0
Opening time	ms	68.5	70.0	73.3
Result		P	P	P

Legend: P: Positive, breaker cleared or breaker closed and cleared N: Negative, breaker failed

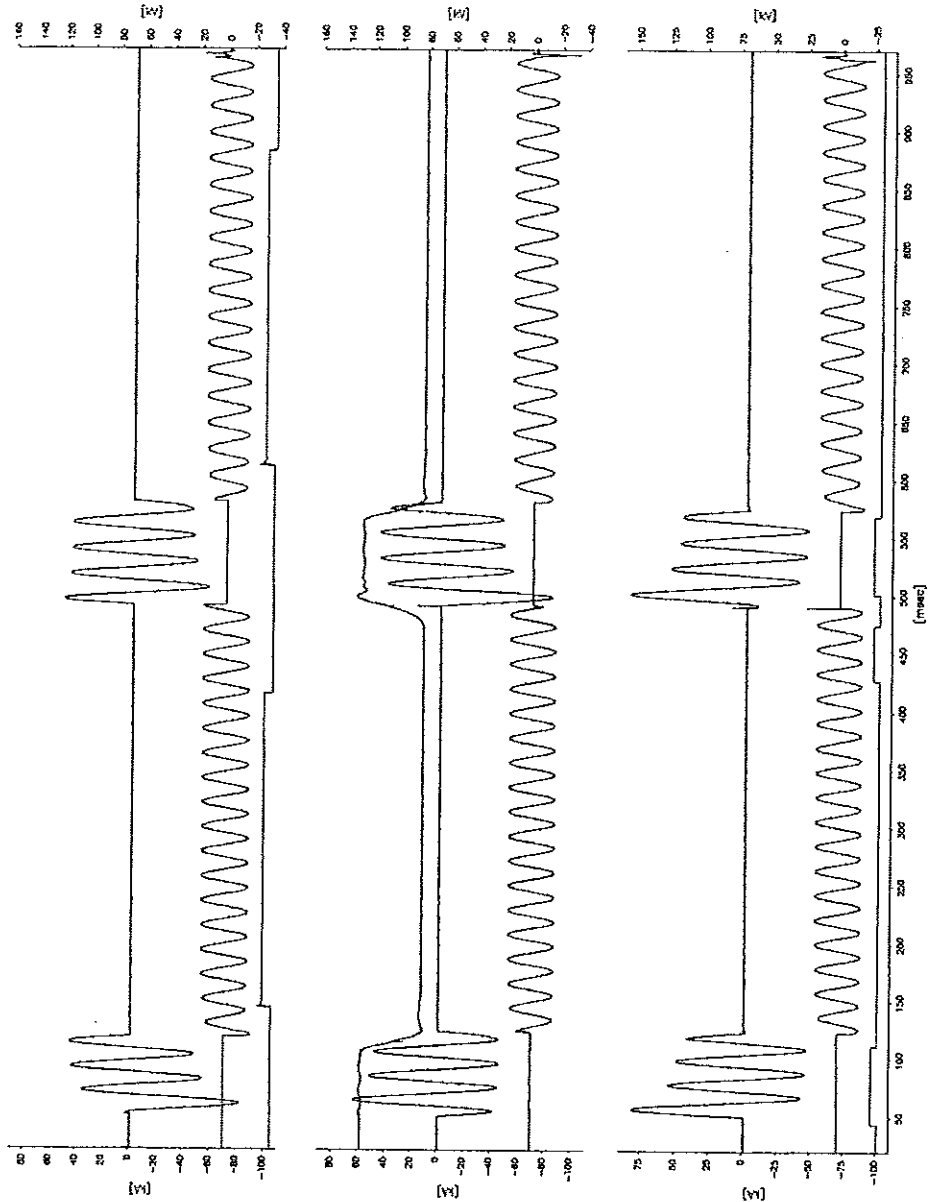
Remarks:

PEHLA 0303Ra / 08 to 10: Tests with reduced values

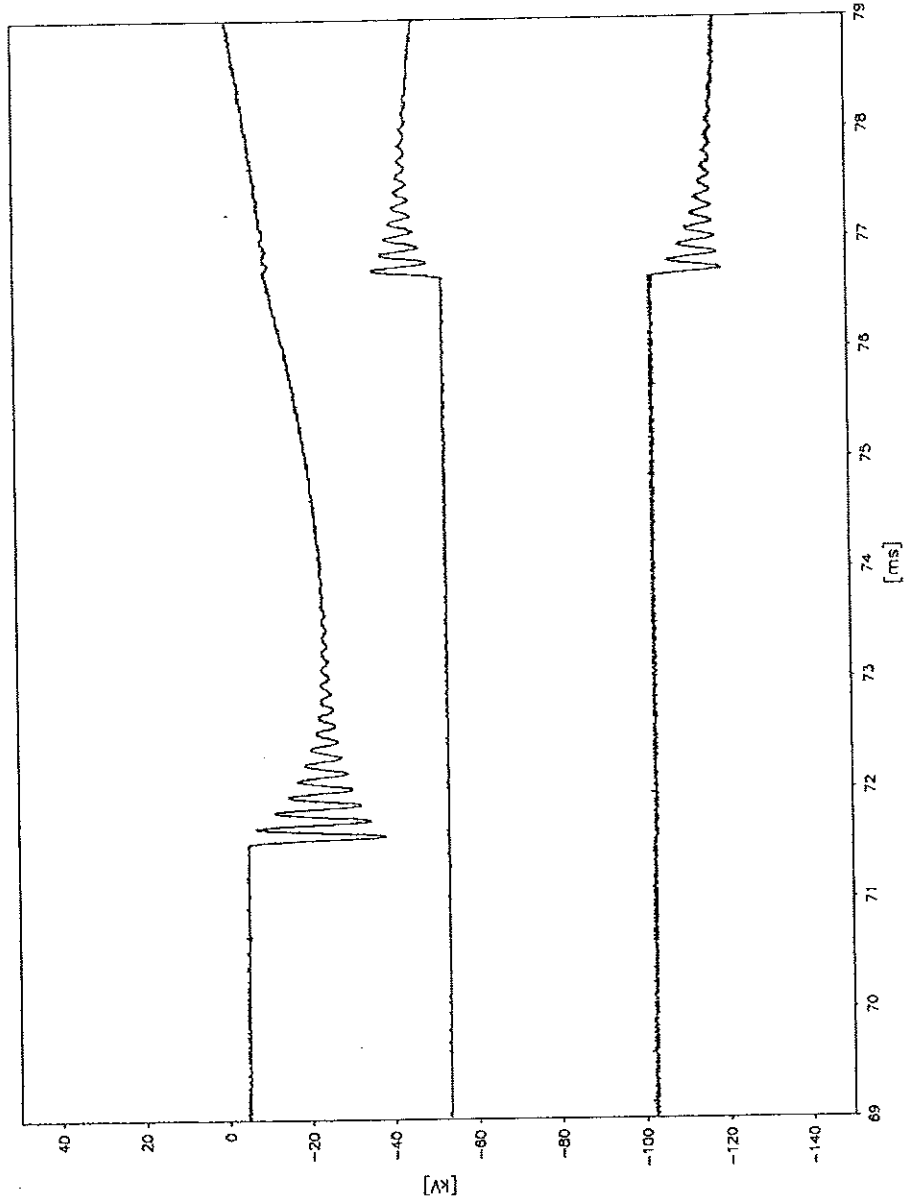
PEHLA 0303Ra / 10 and 11: The operating devices are supplied at their minimum voltage.

Condition of test object after test: Circuit-breaker without functional or visible change.

Test no.
PEHLA 0303Ra / 10



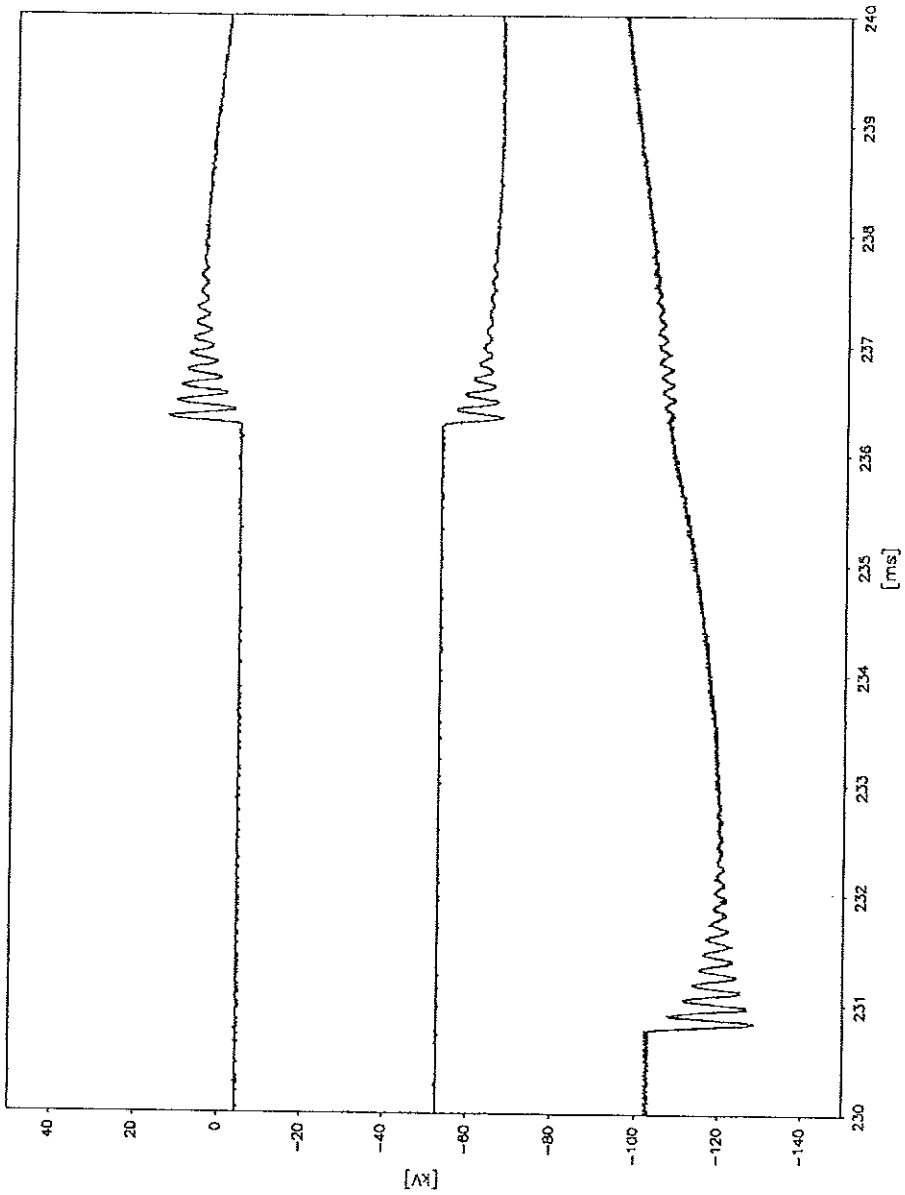
Test no.
PEHLA 0303Ra / 10
Transient Recovery Voltage, First O



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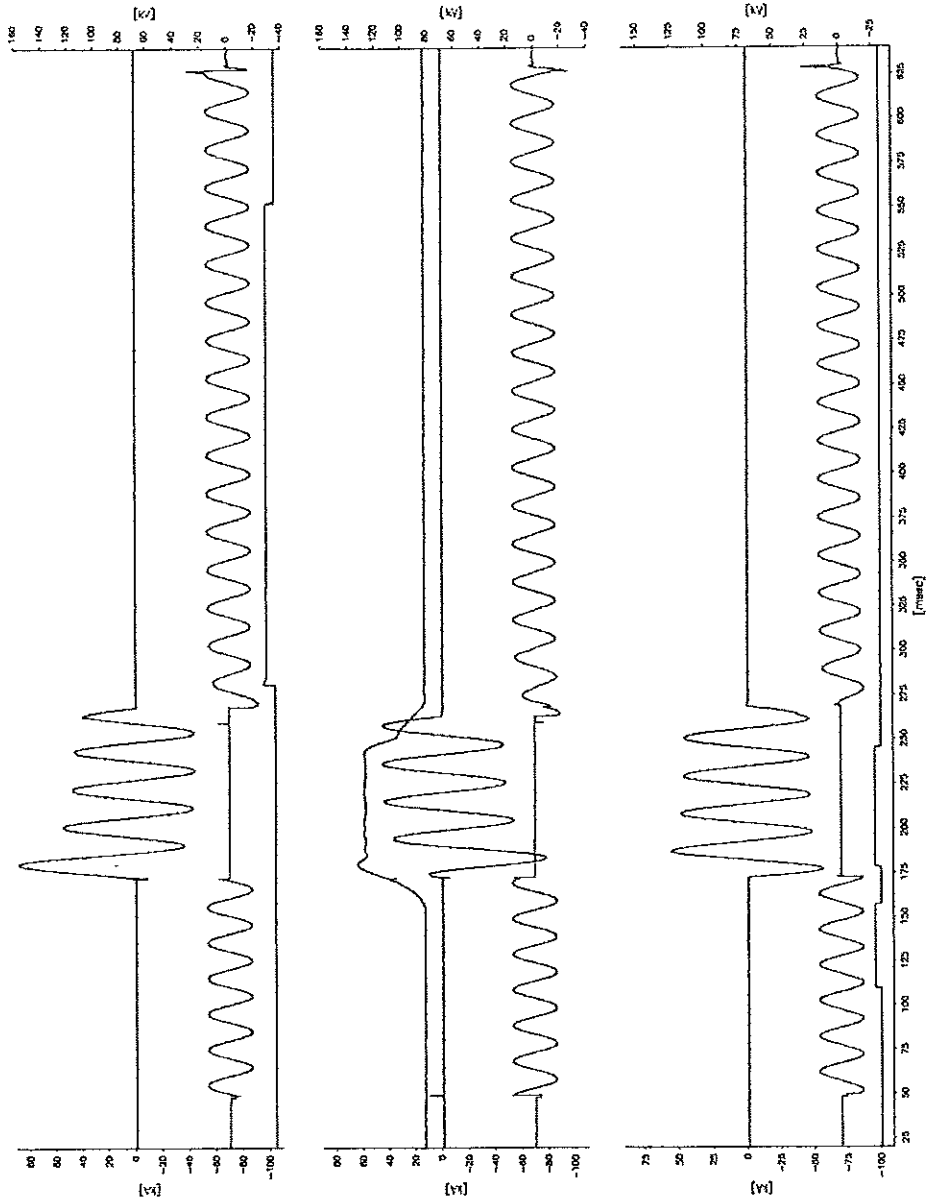
Test no.
PEHLA 0303Ra / 10
Transient Recovery Voltage, Second O



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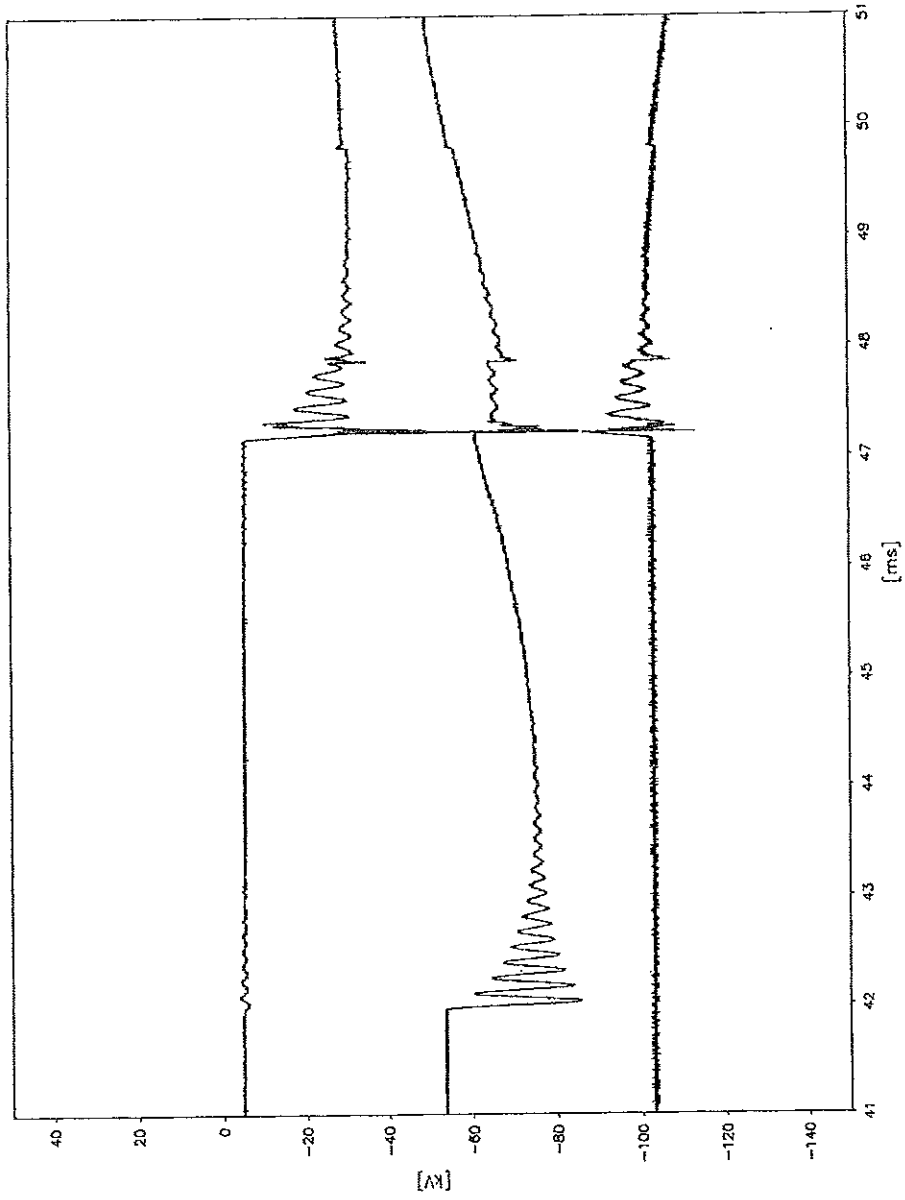
Test no.
PEHLA 0303Ra / 11



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Test no.
PEHLA 0303Ra / 11
Transient Recovery Voltage



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Short-Circuit Making and Breaking Tests

Circuit-breaker

Test duty: T100a
Date of test: 09th January 2003
Condition of test object before test: As after test PEHLA 0303Ra / 11.
Connections to test object: By means of copper bars to the upper terminals of the circuit-breaker. Lower terminals of the circuit-breaker short-circuited and earthed.
Arc extinguishing medium: Vacuum

Test No. PEHLA 0303Ra		17	18	19
Operating sequence		O	O	O
Applied voltage	kV	-	-	-
Short-circuit making current	L1	-	-	-
	kA L2	-	-	-
	L3	-	-	-
Short-circuit breaking current	L1	30.8	31.8	31.3
	Short-circuit current kA L2	31.6	31.8	31.9
	L3	32.0	32.4	31.6
	Average value kA	31.5	32.0	31.6
d.c. component	L1	24.3	< 20	25.3
	% L2	22.8	32.2	< 20
	L3	< 20	25.8	26.8
Δt_i	L1	12.3	-	-
	ms L2	-	12.5	-
	L3	-	-	12.0
Peak last loop	L1	54.9	-	-
	kA L2	-	56.7	-
	L3	-	-	55.4
Recovery voltage	L1	11.2	11.3	11.4
	kV L2	11.7	11.5	11.0
	L3	11.1	11.2	11.5
Average value (phase-to-phase)	kV -	19.6	19.6	19.6
Transient Recovery Voltage (TRV), first-pole-to-clear	kV	-	-	-
Arcing time	L1	5.0	5.6	10.3
	ms L2	9.4	10.9	5.2
	L3	9.4	10.7	9.6
Opening time	ms	45.4	45.2	45.1
Result		P	P	P

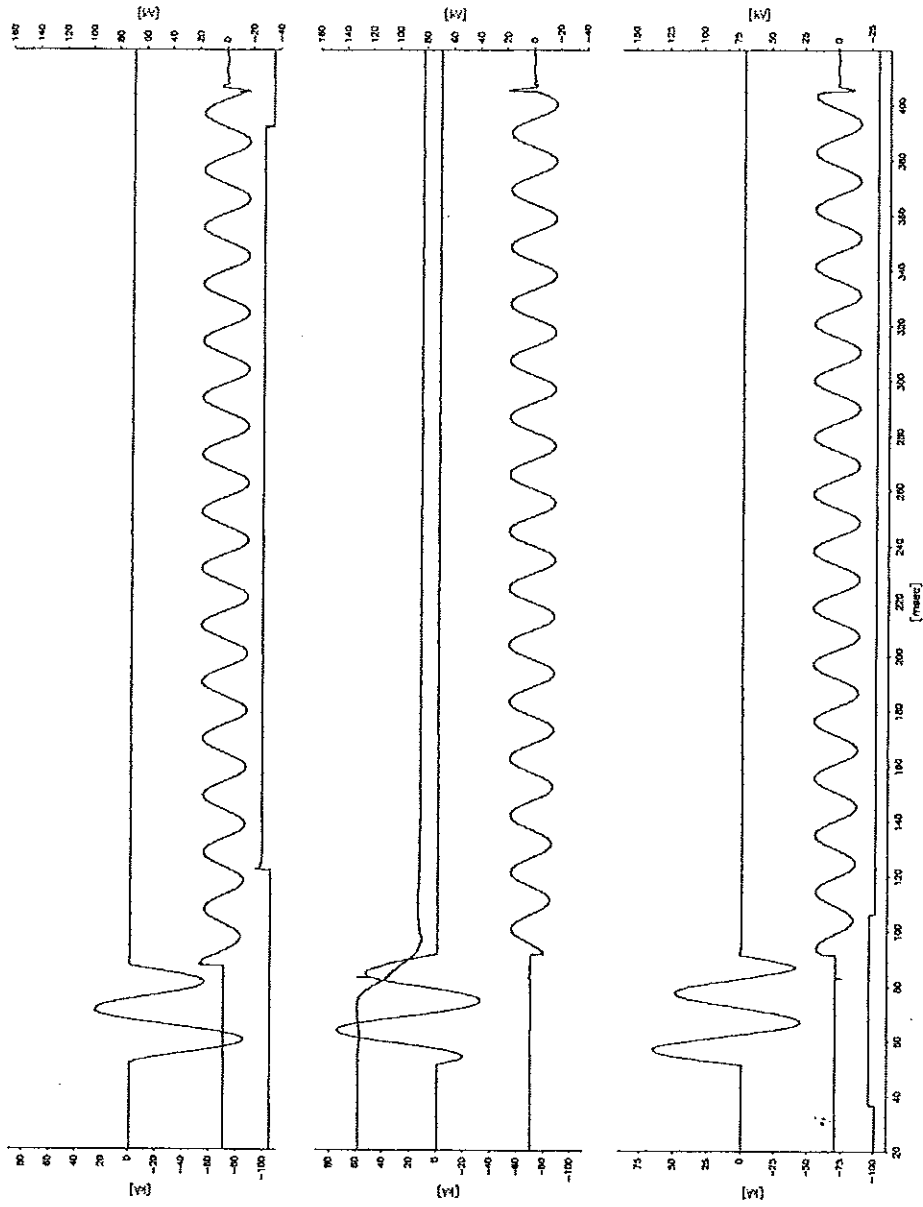
Legend: P: Positive, breaker cleared or breaker closed and cleared N: Negative, breaker failed

Remarks:

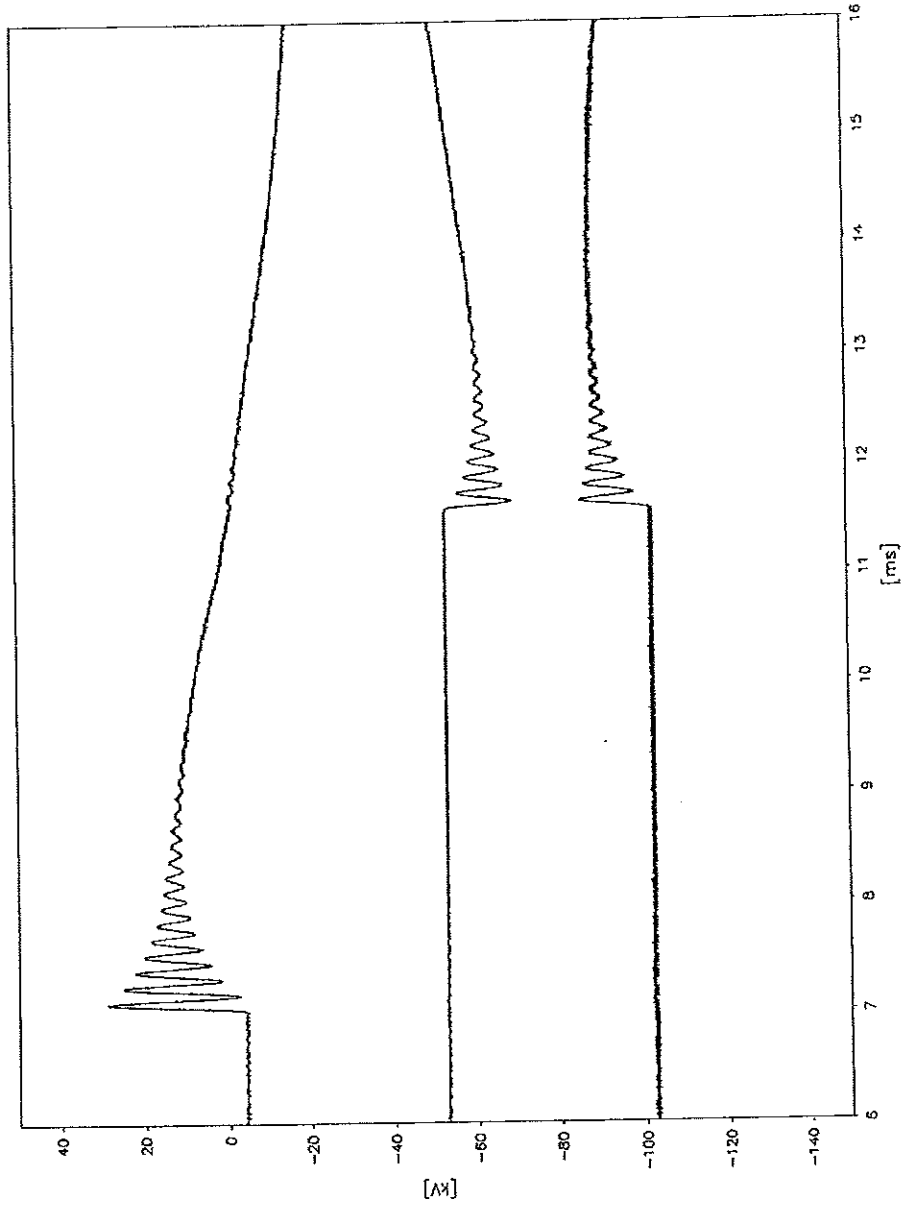
PEHLA 0303Ra / 12 to 16: Tests for determination of the prospective d.c. component.
 PEHLA 0303Ra / 17 to 19: The operating devices are supplied at their maximum voltage.

Condition of test object after test: Circuit-breaker without functional or visible change.

Test no.
PEHLA 0303Ra / 17



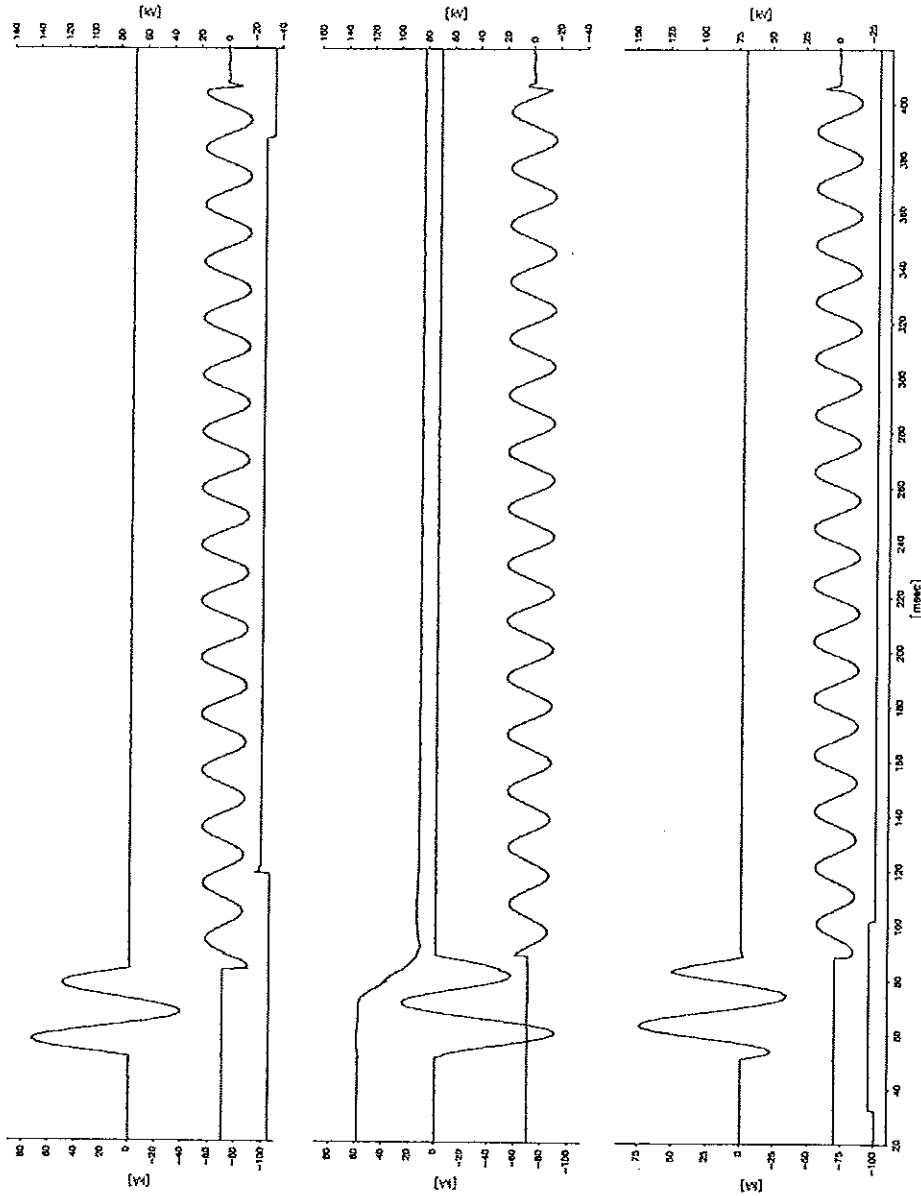
Test no.
PEHLA 0303Ra / 17
Transient Recovery Voltage



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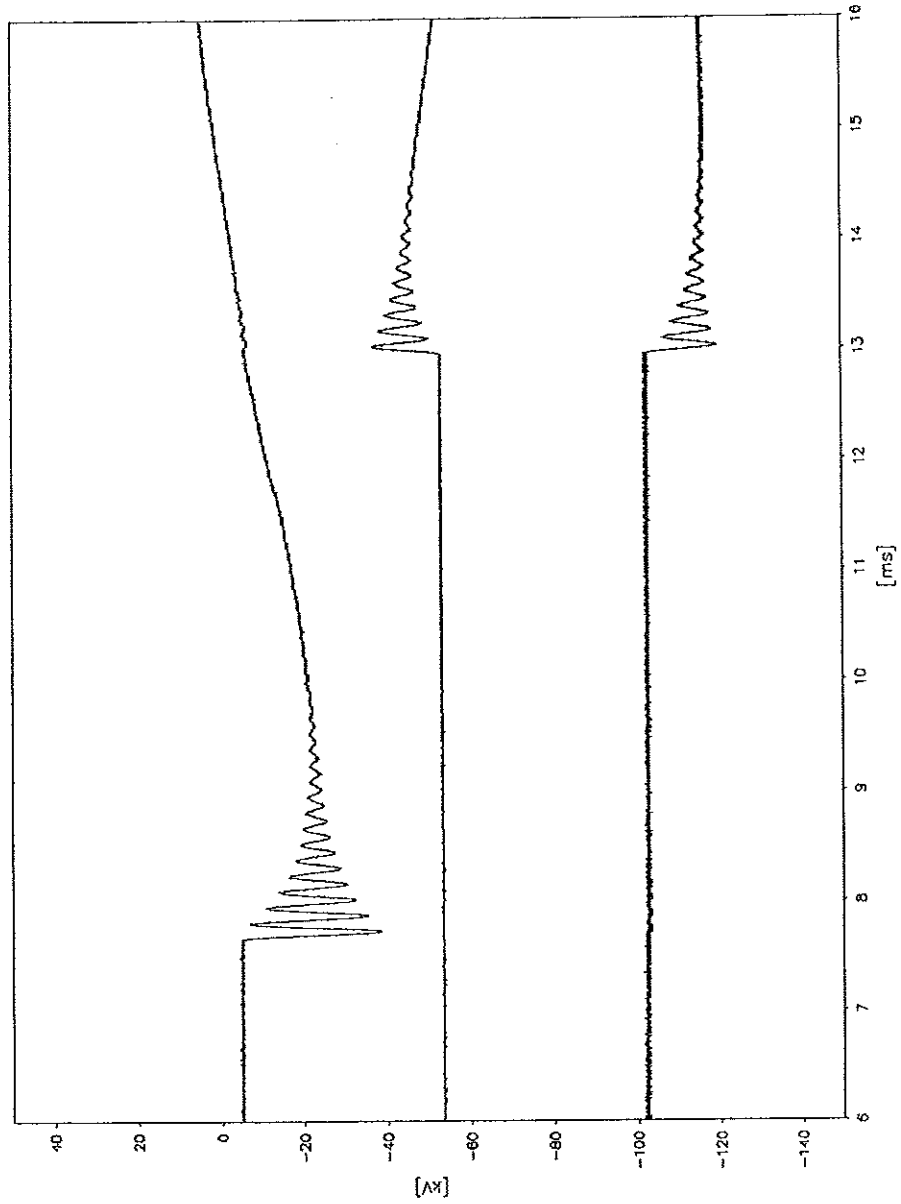
Test no.
PEHLA 0303Ra / 18



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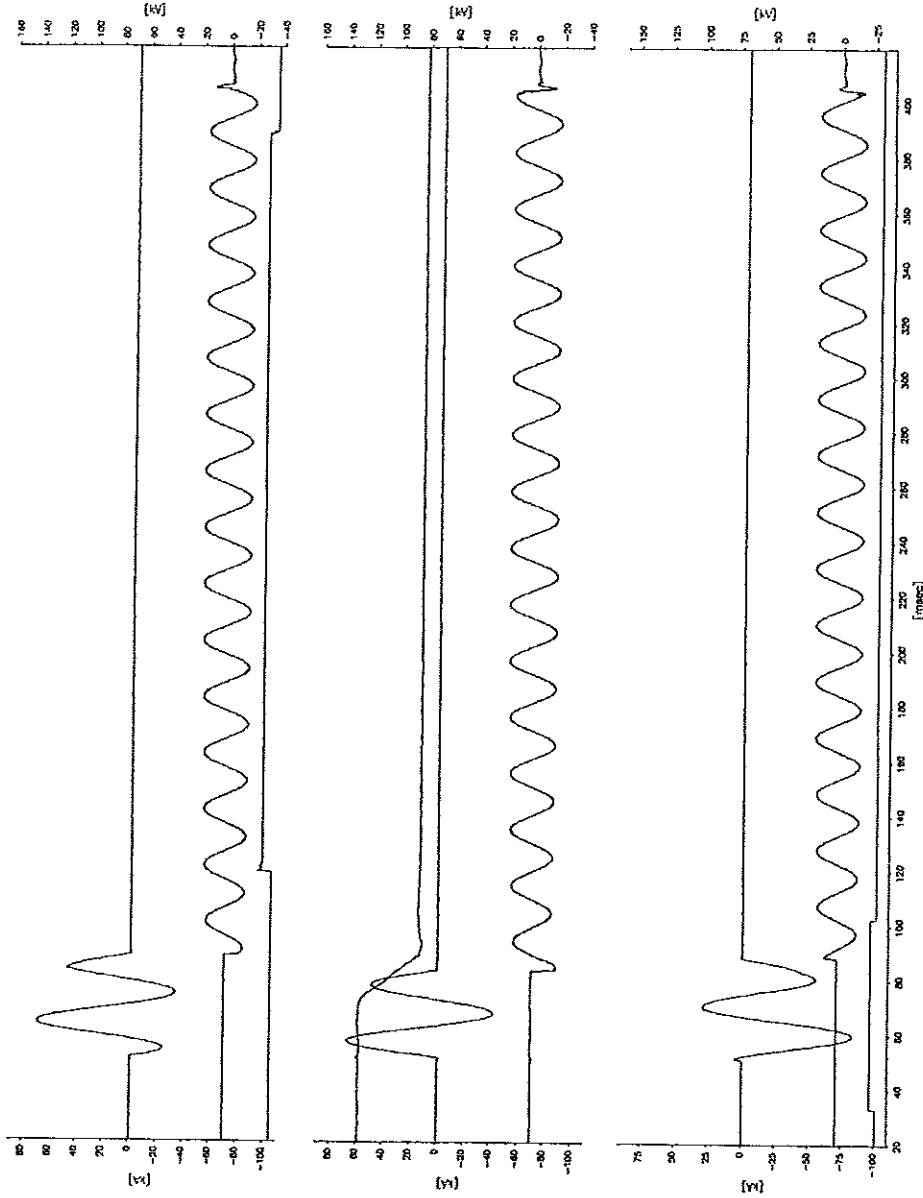
Test no.
PEHLA 0303Ra/ 18
Transient Recovery Voltage



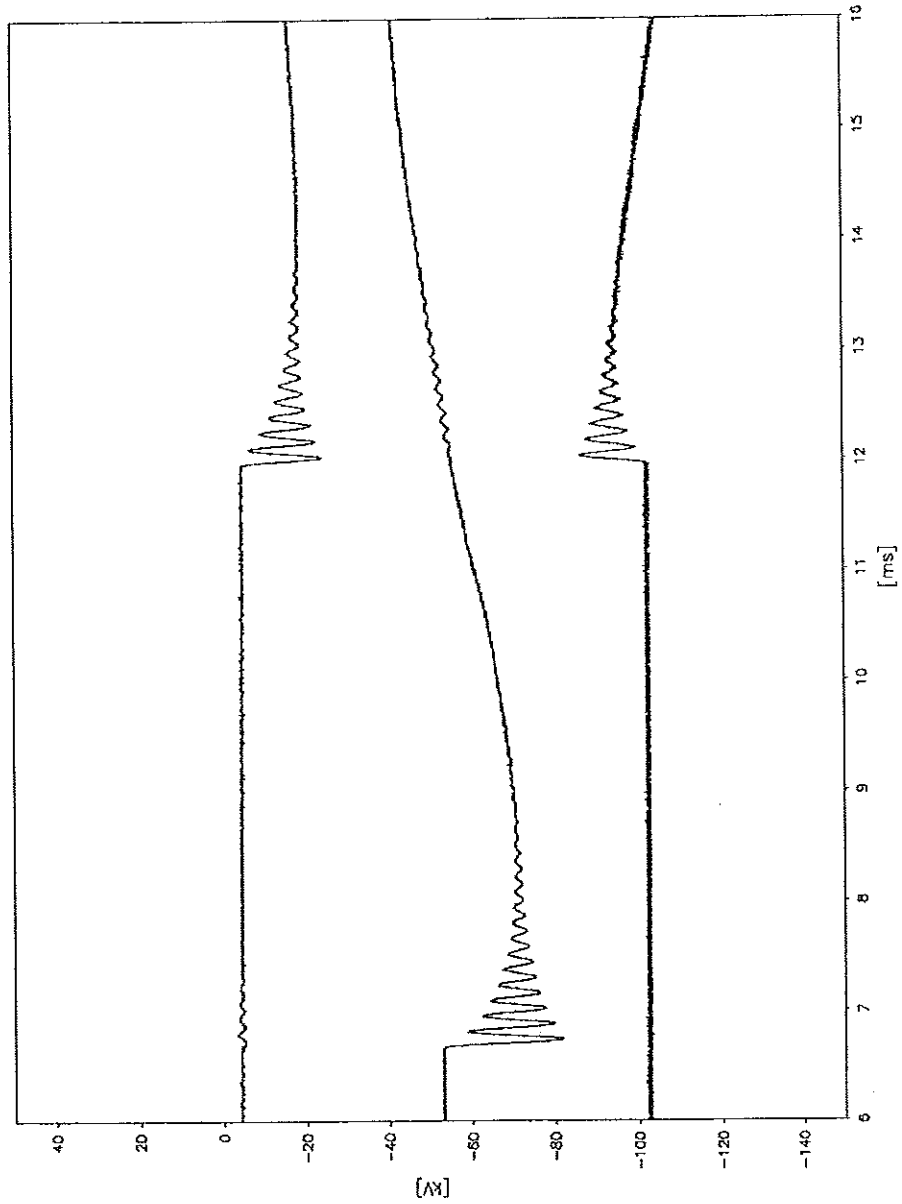
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Test no.
PEHLA 0303Ra / 19



Test no.
PEHLA 0303Ra / 19
Transient Recovery Voltage



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Short-Circuit Making and Breaking Tests

Circuit-breaker

Test duty: T30
Date of test: 10th January 2003
Condition of test object before test: As after test PEHLA 0303Ra / 19
Connections to test object: By means of copper bars to the upper terminals of the circuit-breaker. Lower terminals of the circuit-breaker short-circuited and earthed.
Arc extinguishing medium: Vacuum

Test No. PEHLA 0303Ra		22		23
Operating sequence		O - 0.3s - CO - 3min - CO		
Applied voltage	kV	-	19.2	18.9
Short-circuit making current	L1	-	17.7	16.0
	kA L2	-	23.7	24.7
	L3	-	25.7	24.0
Short-circuit breaking current	L1	10.1	10.2	10.0
	Short-circuit current kA L2	10.3	10.0	9.93
	L3	10.4	10.3	10.2
	Average value kA	10.2	10.2	10.1
d.c. component	L1	< 20	< 20	< 20
	% L2	< 20	< 20	< 20
	L3	< 20	< 20	< 20
Recovery voltage	L1	11.1	10.7	10.5
	kV L2	11.0	10.7	10.8
	L3	11.0	10.9	10.7
Average value (phase-to-phase)	kV -	19.1	18.6	18.5
Transient Recovery Voltage (TRV), first-pole-to-clear	kV	34.2	32.4	31.8
Arcing time	L1	7.0	7.0	7.8
	ms L2	2.0	7.0	3.6
	L3	7.0	2.0	8.0
Closing time	ms	-	64.8	65.4
Opening time	ms	66.1	68.0	68.6
Result		P	P	P

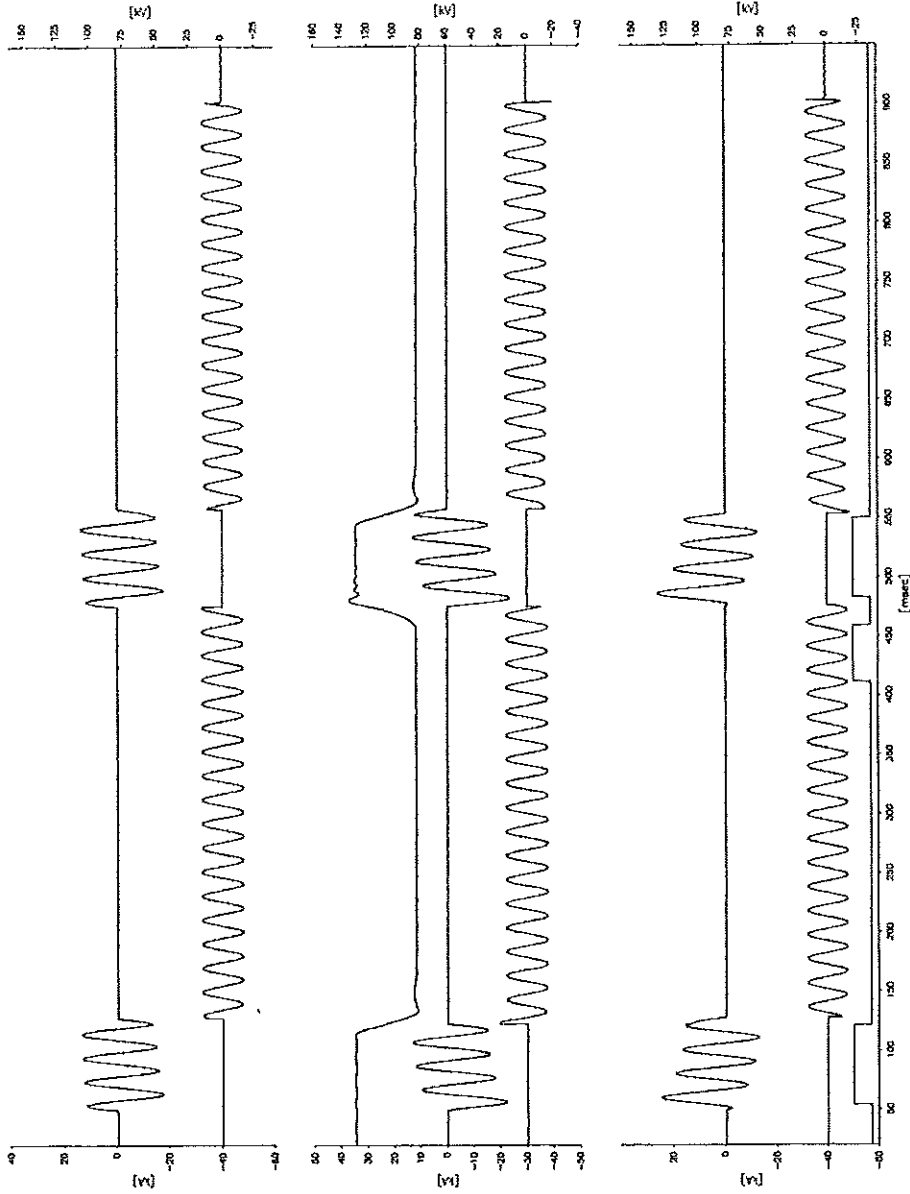
Legend: P: Positive, breaker cleared or breaker closed and cleared N: Negative, breaker failed

Remarks:

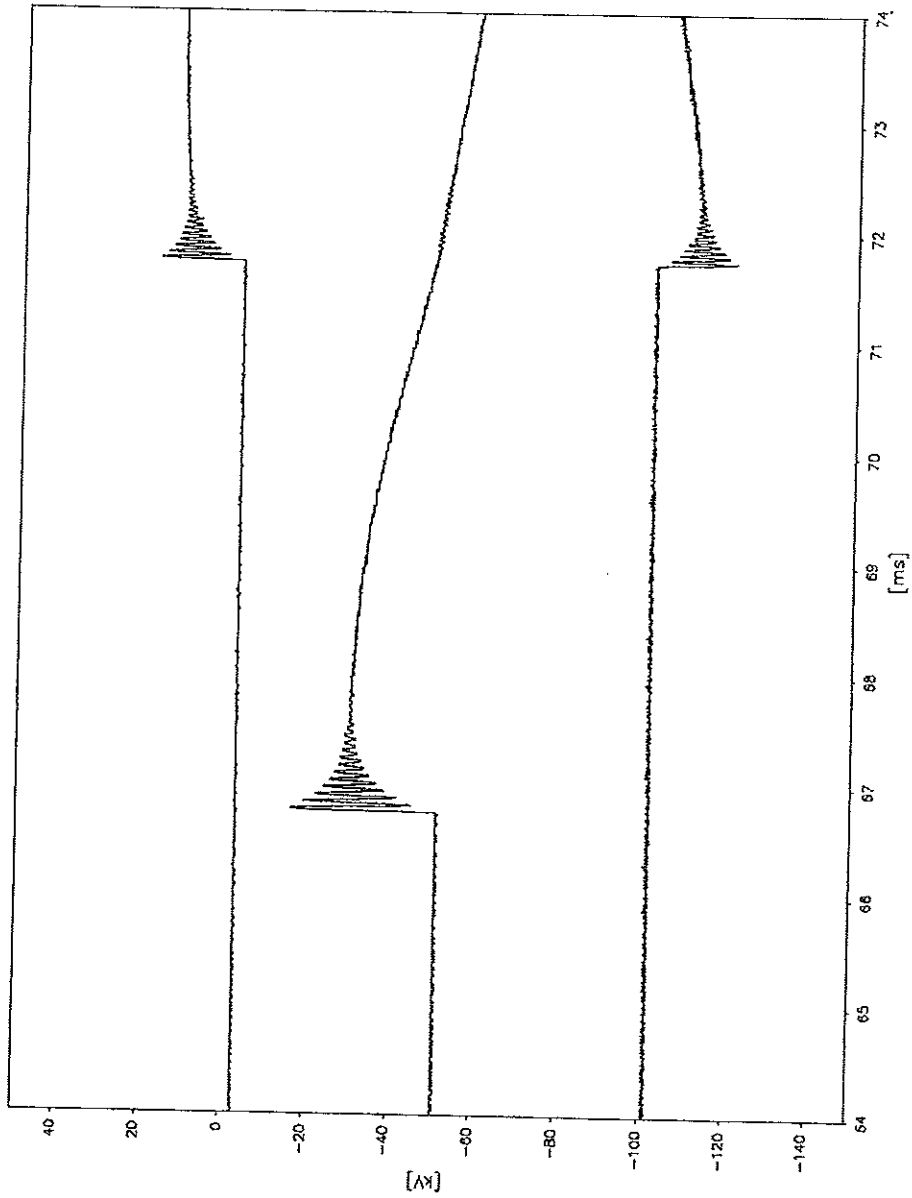
PEHLA 0303Ra / 20 and 21: Tests with reduced values
 PEHLA 0303Ra / 22 and 23: The operating devices are supplied at their minimum voltage.

Condition of test object after test: Circuit-breaker without functional or visible change.

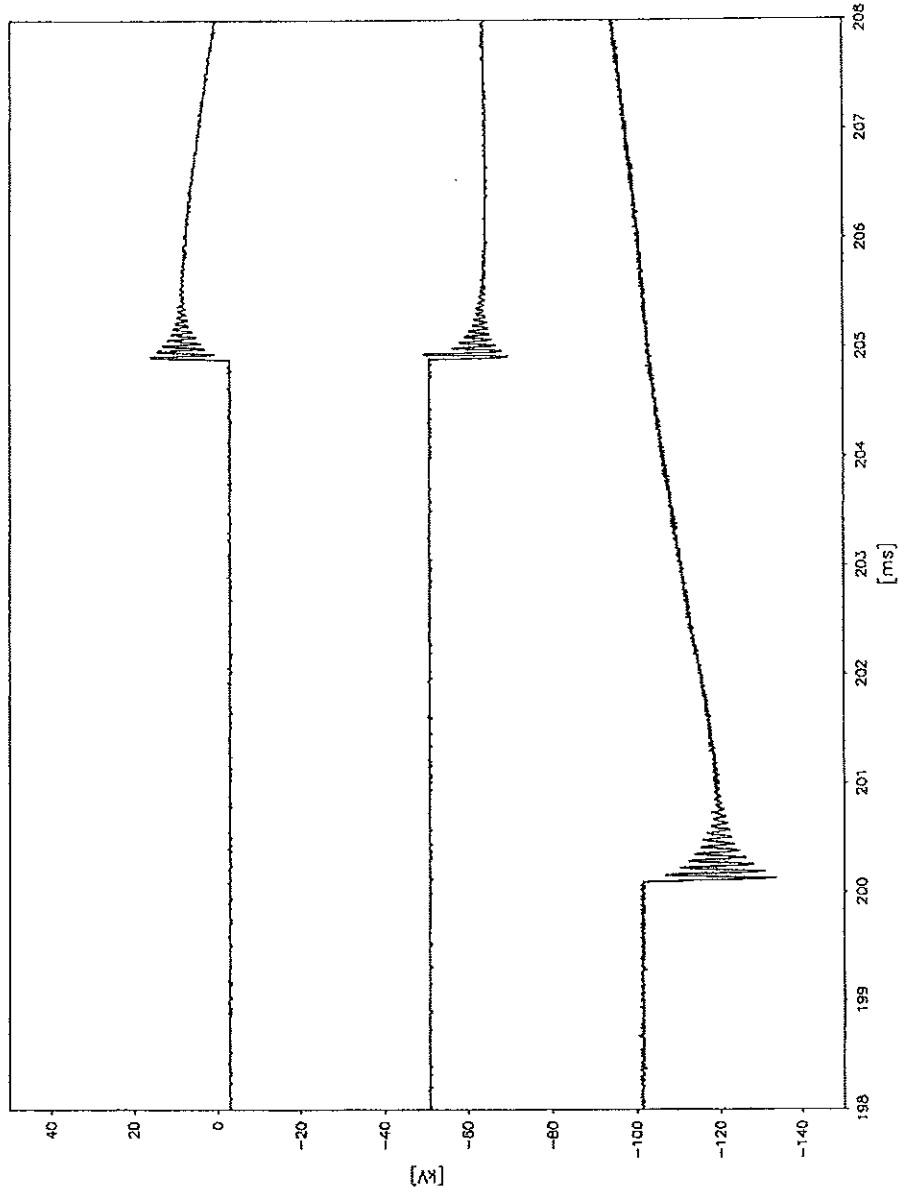
Test no.
PEHLA 0303Ra / 22



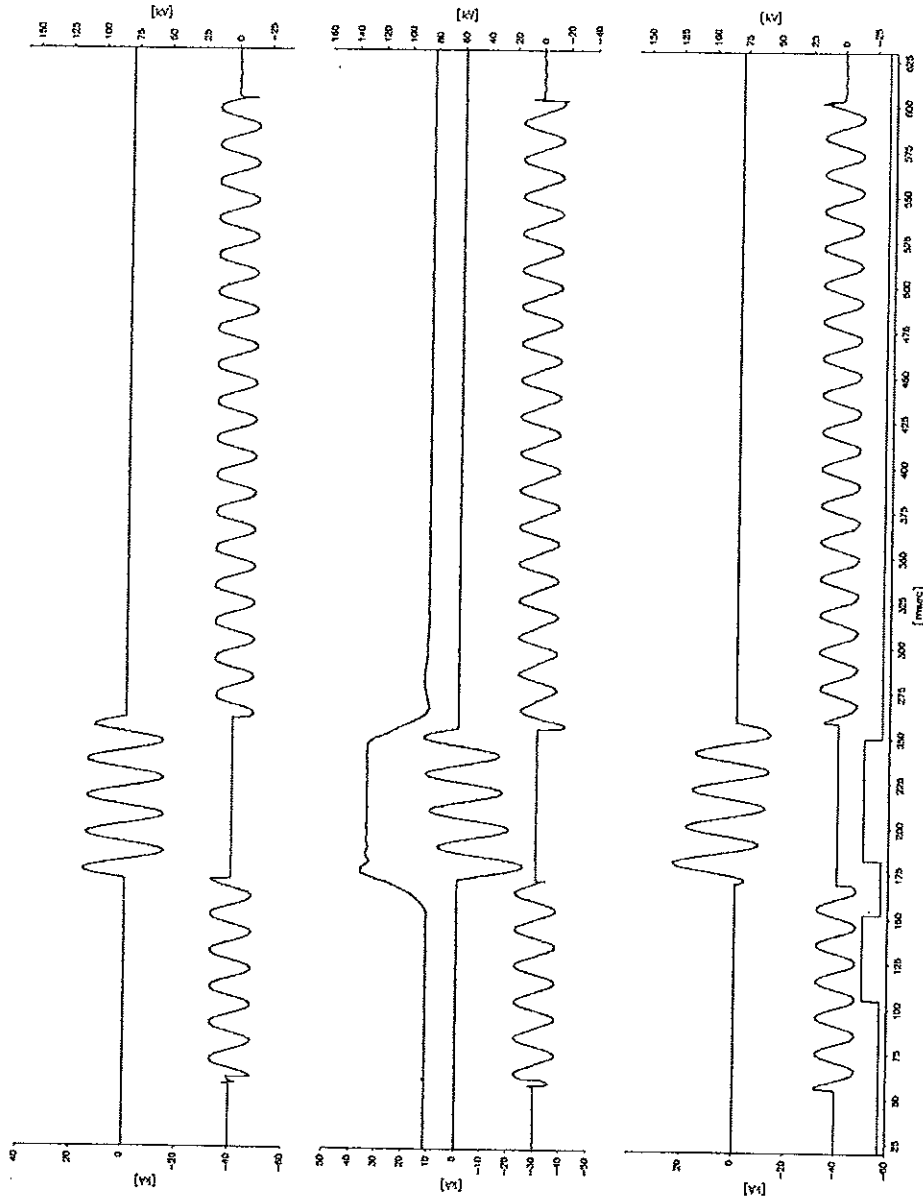
Test no.
PEHLA 0303Ra / 22
Transient Recovery Voltage, First O



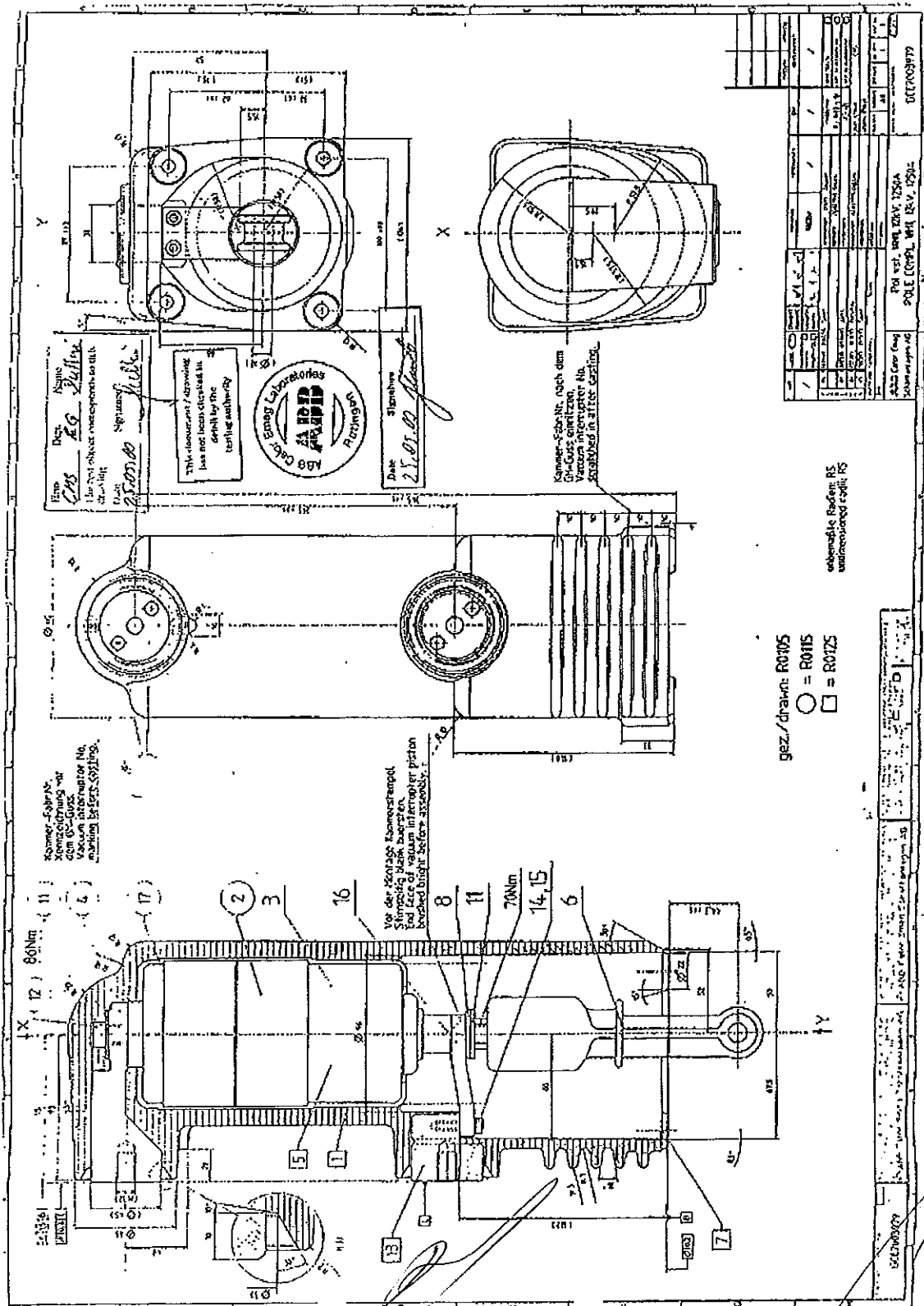
Test no.
PEHLA 0303Ra / 22
Transient Recovery Voltage, Second O

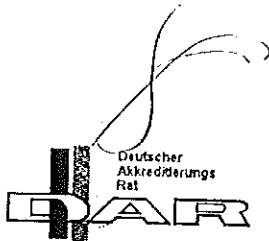


Test no.
PEHLA 0303Ra / 23



Pole Part (Circuit Breaker Panel 4)





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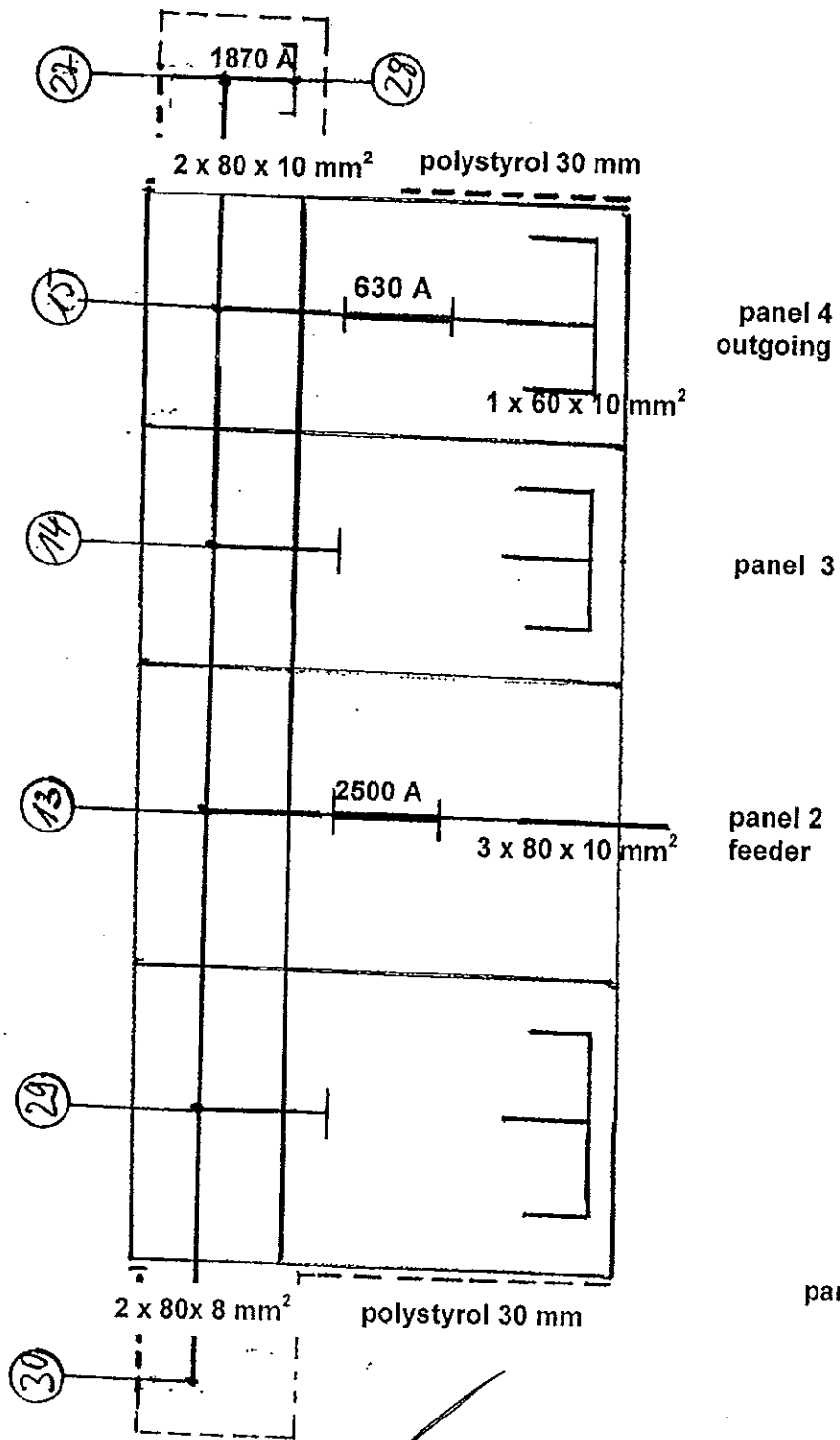
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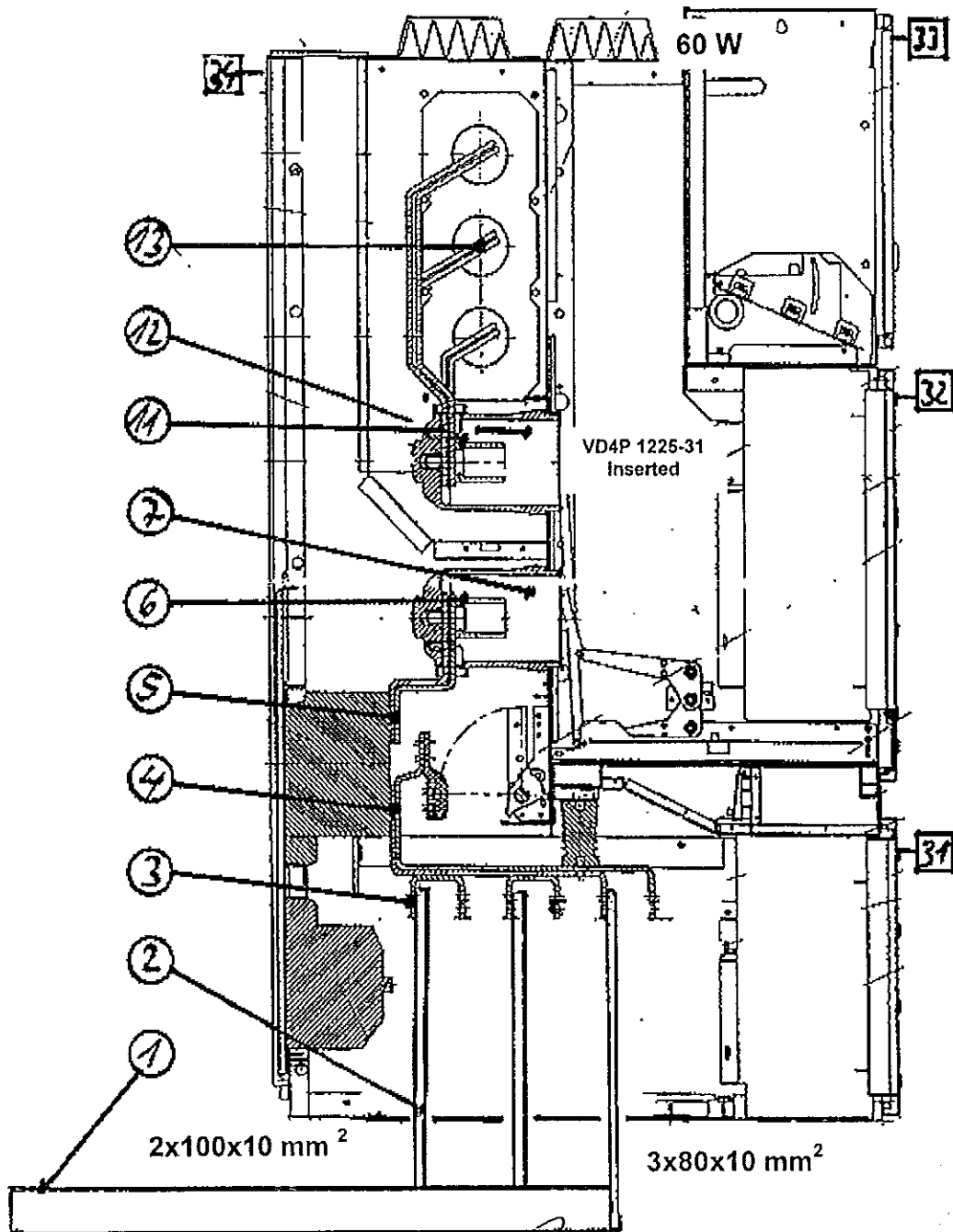
Sheet 18

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

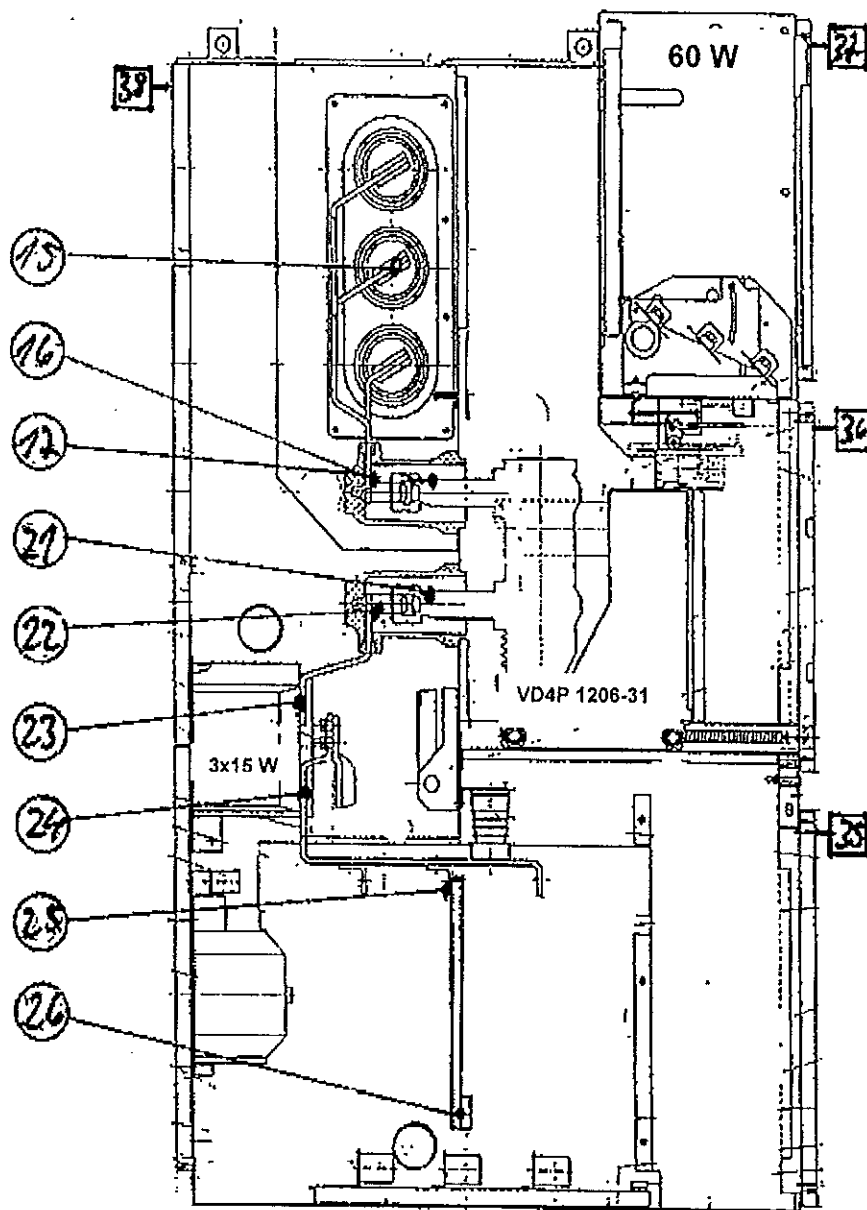


panel 1

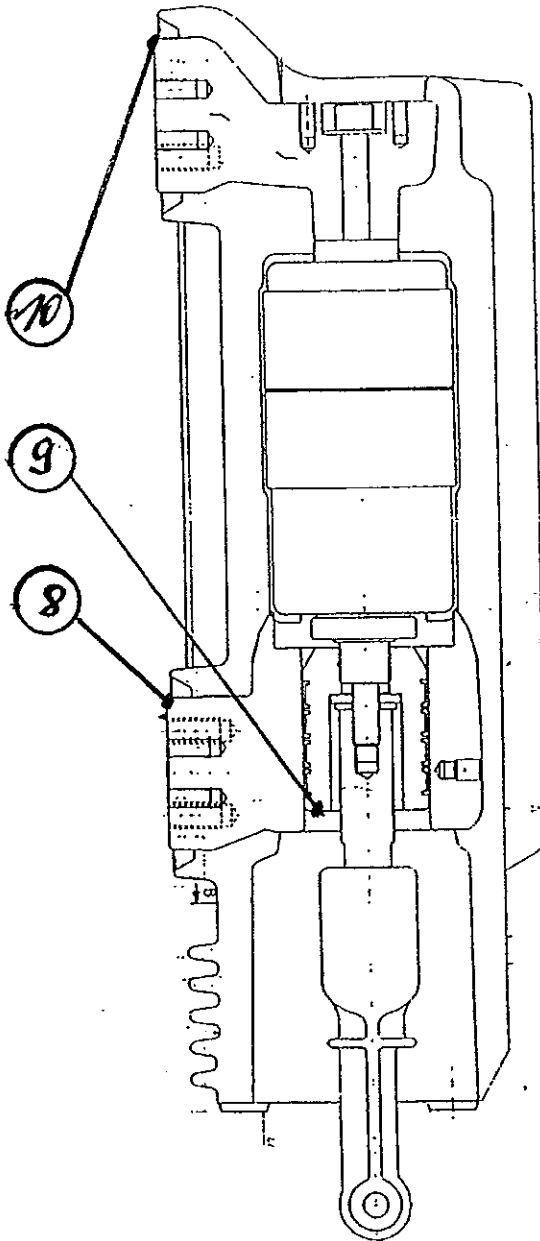
**Measurement Points for Temperatures and Resistances of the
 Feeder Panel (Panel 2)**



**Measurement Points for Temperatures and Resistances of
Feeder Panel (Panel 4)**

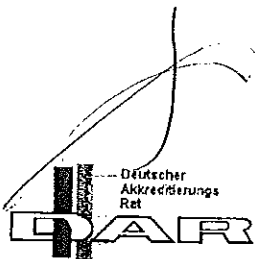


**Measurement Points for Temperatures of the Circuit-Breaker Poles
Panel 2**



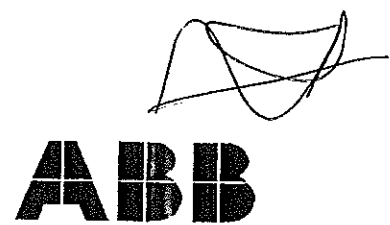
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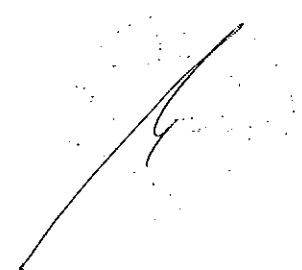
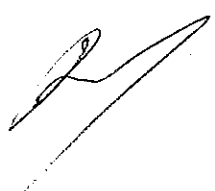
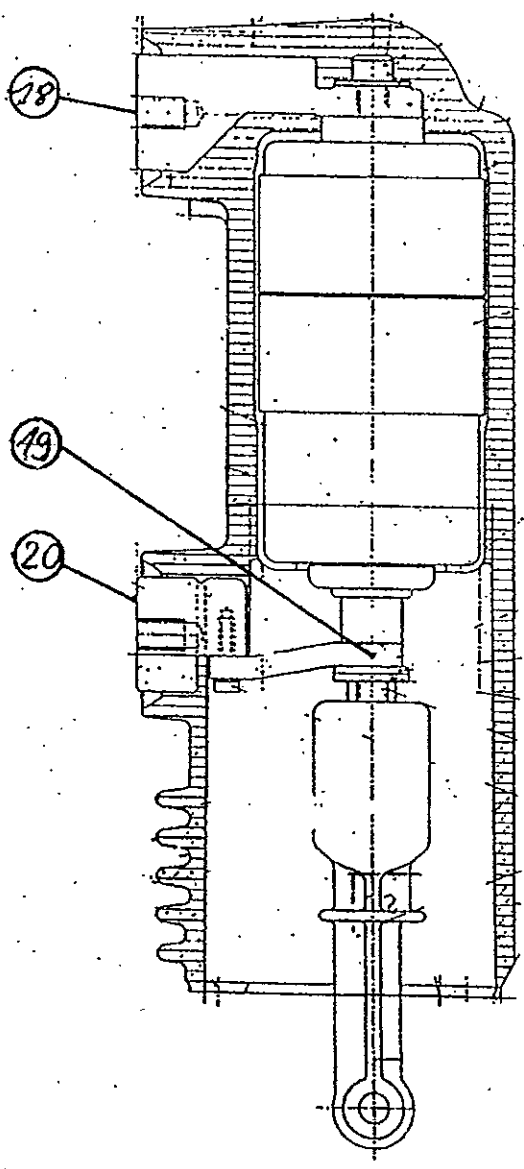
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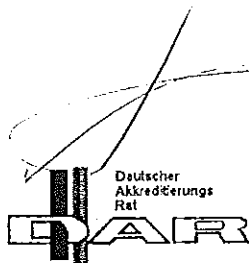


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Sheet 22

Measurement Points for Temperatures of the Circuit-Breaker Poles Panel 4





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Sheet 23

Measurement of the Resistance of the Main Circuit

Date of test: 31st May 2000 - before temperature rise test
01st June 2000 - after temperature rise test

Condition of test object before test: factory new panels

Ambient air temperature: before temperature rise test 21 °C
after temperature rise test 22 °C

Measurement between points (see sheet 20-22)	Resistance of the main circuit $\mu\Omega$		
	L1 before/after ¹⁾	L2 before/after ¹⁾	L3 before/after ¹⁾
2 - 14 (panel 2)	53.7 / 53.5	52.2 / 52.0	50.6 / 50.3
14 - 26 (panel 4)	110 / 109	104 / 103	94.0 / 93.8

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

Resistance measurement at direct current of: 50 A



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Sheet 24

Temperature Rise Test

Date of test: 31st May and 01st June 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
three bars 80x10 mm² Cu, length about 0.8 m inside the panel
neutral points:
1. cable terminal of feeder panel 4 with one bar 80x10 mm² Cu,
length about 0.4
2. extended busbar of panel 4 with two bars 80x10 mm² Cu

Duration of test: 10 h

Ambient air temperature: 28.6 °C

Test current: see below A

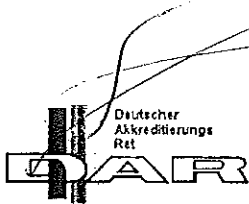
Test frequency: 50 Hz

Distribution of the currents of the panels:

panel or busbar	current in A			
	phase L1	phase L2	phase L3	average value
panel 2, feeder 2000 A	2504	2498	2507	2503
busbar panel 2 - 4	2504	2498	2507	2503
panel 4, outgoing 6300 A	690	667	668	675

Remarks:

- The permitted temperature rises are valid for an ambient air temperature of 40 °C.
- The distribution of the currents at the busbar connections of the feeder panel 4 was done by using iron cores over the extended busbar.
- 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.
- The circuit breakers of the panels 1 and 3 were switched off and in disconnected position.



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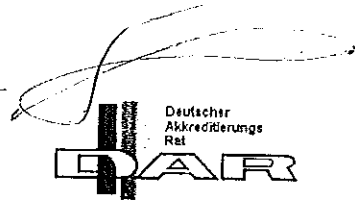
TEST REPORT No. HZ 147 E 10

Sheet 25

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corresponding to EN 45001

Continuation from sheet 25

Measuring point (see sheet 18 - 23)	Description of measuring point	Kind of measuring point	Final temperature rise K	Permitted temperature rise K	
31	-	Front door top cable comp. panel 2	Access. part expected to be touched in normal operation	3.7	30
32	-	Front door top c.b. comp. panel 2	Access. part expected to be touched in normal operation	5.7	30
33	-	Front door top low volt. comp. pan. 2	Access. part expected to be touched in normal operation	12.0	30
34	-	Rear wall top panel 2	Accessible part which need not to be touched in normal op.	15.9	40
35	-	Front door top cable comp. panel 4	Access. part expected to be touched in normal operation	2.7	30
36	-	Front door top c.b. comp. panel 4	Access. part expected to be touched in normal operation	6.6	30
37	-	Front door top low volt. comp. pan. 4	Access. part expected to be touched in normal operation	11.0	30
38	-	Rear wall top panel 4	Accessible part which need not to be touched in normal op.	8.7	40

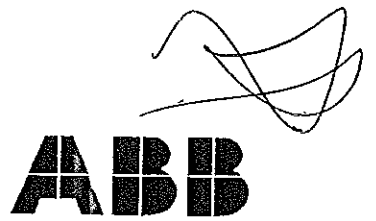


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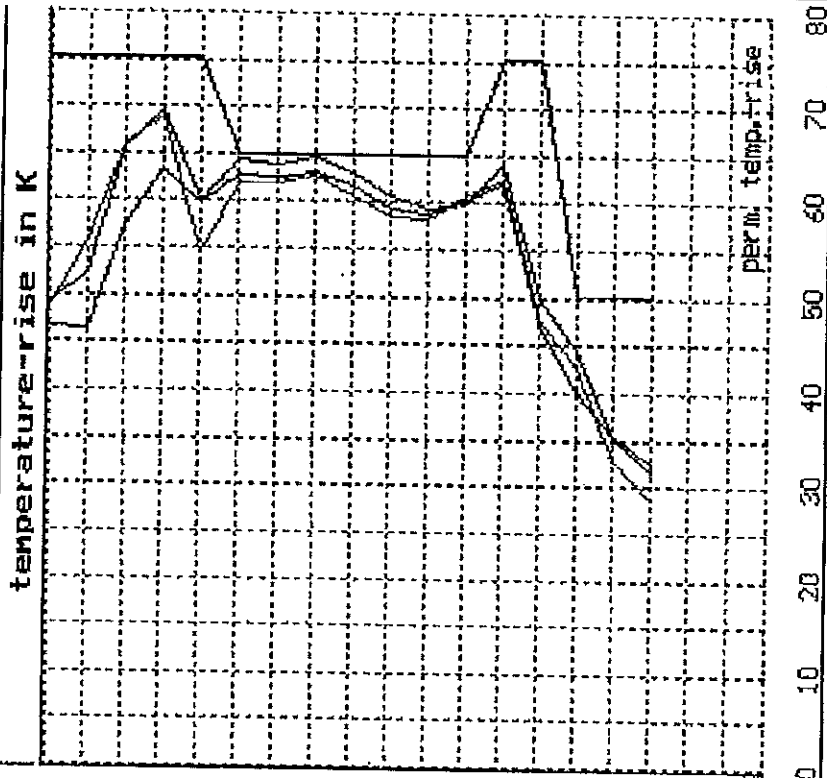
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Sheet 26

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

ABB Calor Emag Laboratory Test report HZ147E10 **01.06.2000**
 Temperature-rise of switchgear ZS1.2 – 12 kV with UD4P 1225-31 with UG4-S

Test Current : 2503 A
 Ambient temperature : 27.8 °C



No.	Measuring points	Temperature rise Δθ / K		
		P1	P2	P3
28	neutral point ext. busbar	48.5	49.0	46.6
27	end of busbar panel 4	55.8	52.3	46.4
15	busbar / jumper bar pan. 4	66.0	65.7	57.5
14	busbar / jumper bar pan. 3	68.8	69.5	63.3
13	jumper bar / busbar pan.2	54.5	60.0	59.8
12	upper disconn. cont. pan.	61.8	64.3	62.6
11	upper disconn. cont. c.b.	61.9	63.8	62.4
10	upper pole terminal	62.6	64.7	62.9
9	contact piston c.b. pan.2	60.6	63.1	61.7
8	lower pole terminal	58.5	60.5	59.2
7	lower disconn. cont. c.b.	58.3	59.2	58.6
6	lower disconn. cont. pan.	60.5	59.8	60.2
5	upper c.t. terminal	62.5	64.0	61.9
4	lower c.t. terminal	47.6	49.9	47.1
3	cable terminal panel 2	42.6	44.5	39.9
2	cable bar bottom inside p.	32.6	35.2	35.3
1	feeder bar 1 m before 2	28.6	31.6	32.4

Temperature rises and Permitted Temperature rises of the Feeder Panel 4

and the Busbar – left side

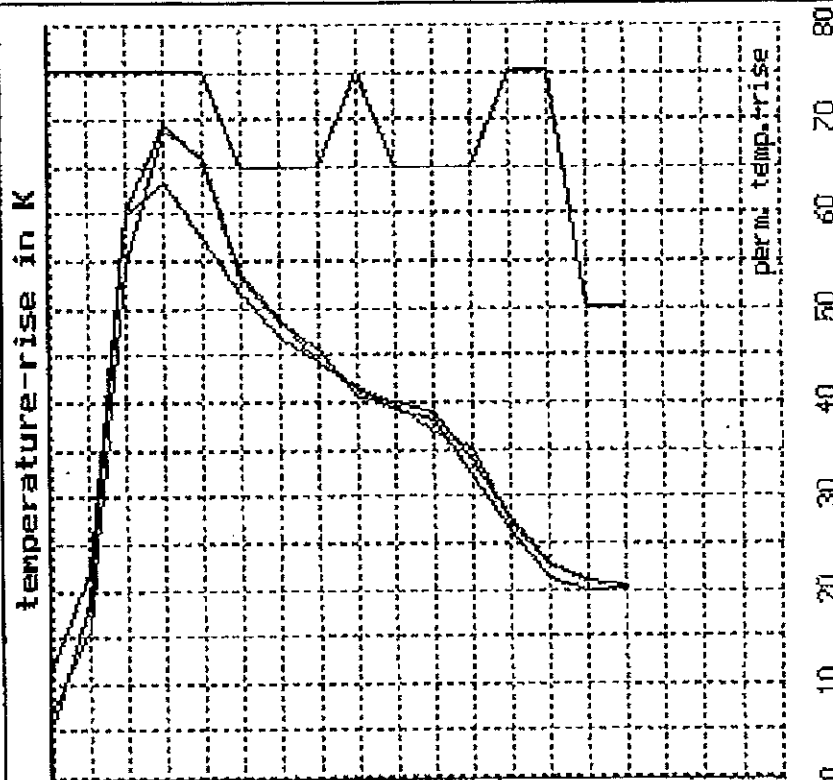
ABB Calor Emag Laboratory Test report HZ147E10 01.06.2000

 Temperature-rise of switchgear ZS1.2 - 12 kV with VD4P 1206-31 with UG4-S

Test current : 675 A

 Ambient temperature : 27.8 °C

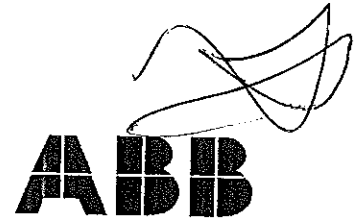
No.	Name	Temperature-rise / K		
		P1	P2	P3
30	end of busbar panel 1	7.4	5.9	12.1
29	busbar / jumper bar pan. 1	15.9	18.7	22.0
13	busbar / jumper bar pan. 2	54.5	60.0	59.8
14	busbar / jumper bar pan. 3	68.8	69.5	63.3
15	jumper bar / busbar pan. 4	66.0	65.7	57.5
16	upper disconn. cont. panel	53.6	53.1	51.6
17	upper disconn. cont. c.b.	48.8	48.6	47.0
18	upper pole terminal	44.2	45.5	44.2
19	current lead / movea. stem	41.6	40.6	41.4
20	lower pole terminal	39.6	39.9	39.2
21	lower disconn. cont. c.b.	36.8	38.8	38.0
22	lower disconn. cont. panel	35.2	33.7	32.2
23	upper c.t. terminal	27.2	27.6	26.3
24	lower c.t. terminal	22.4	22.8	21.3
25	cable terminal panel 4	20.9	20.9	19.9
26	neutral point inside pan.4	20.5	20.3	20.2





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

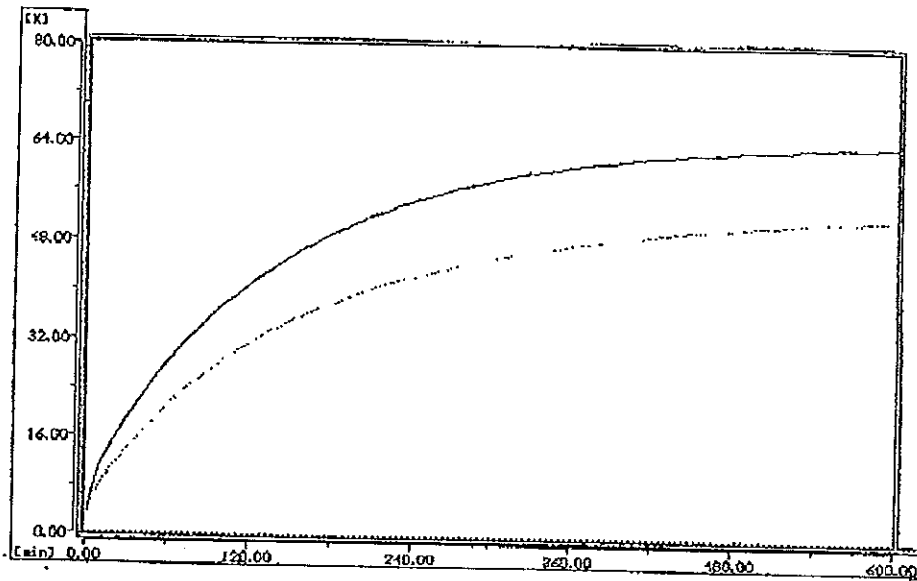
ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 28

Temperature rises of the Upper Pole Terminal of C.B. Panel 2 and Upper Disconnecting Contact of Panel 4



measurement
point 10 / L2
measurement
point 16 / L2



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

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TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 29

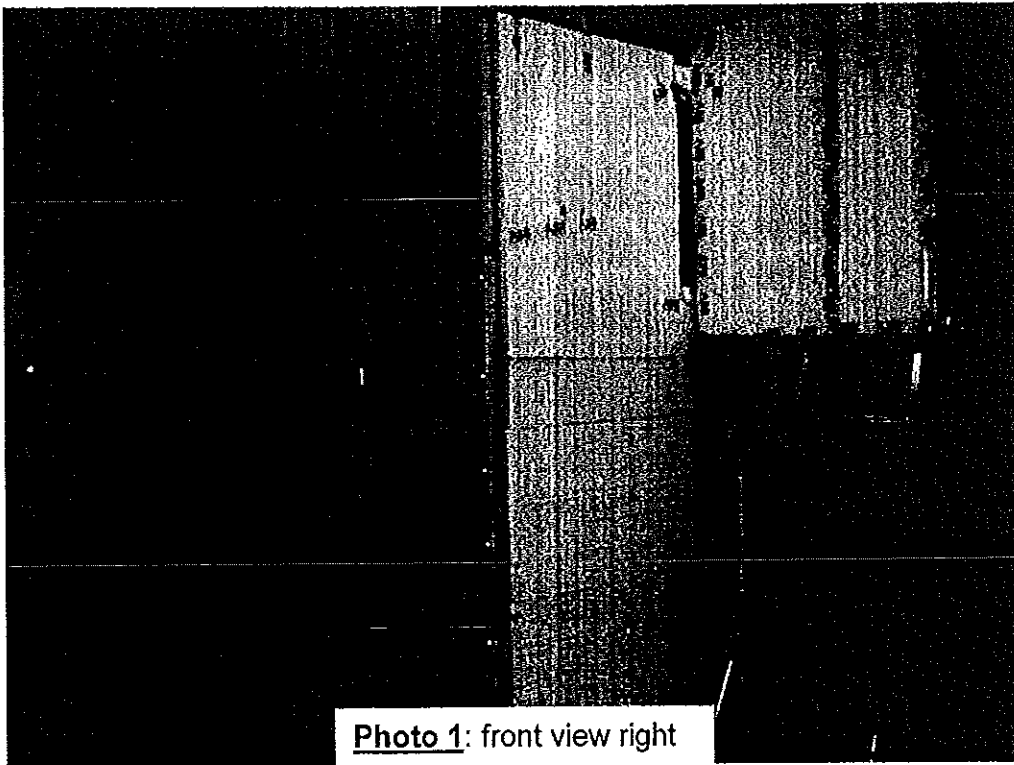


Photo 1: front view right

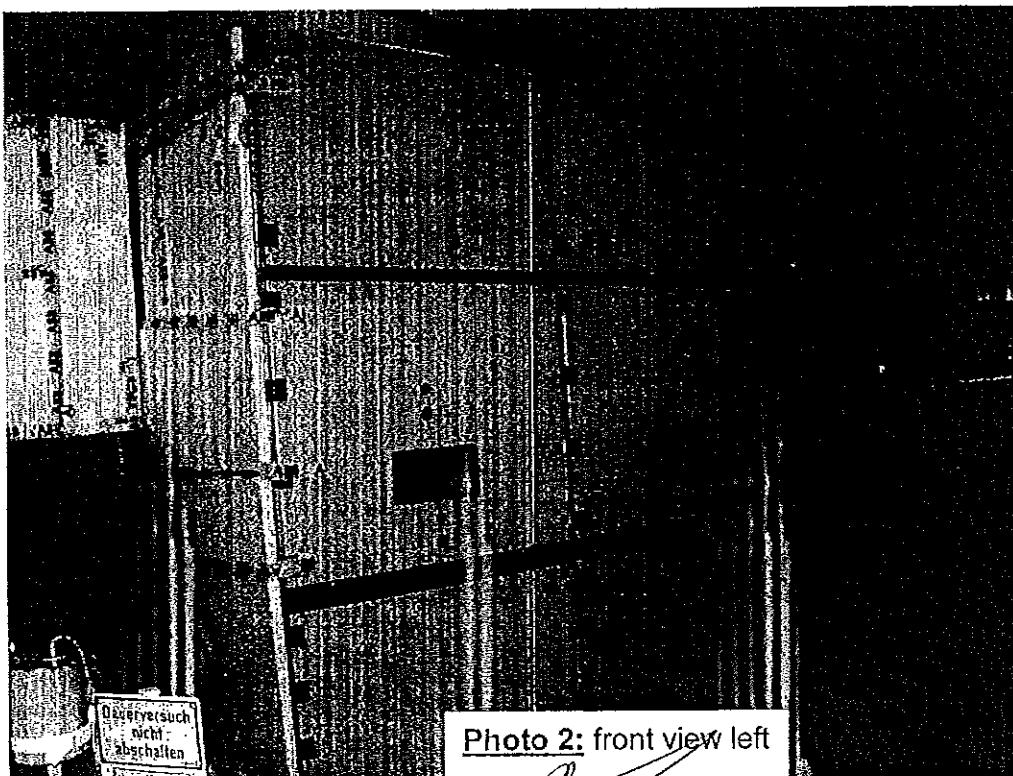


Photo 2: front view left



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DAT-P-032/93

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TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
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Sheet 30

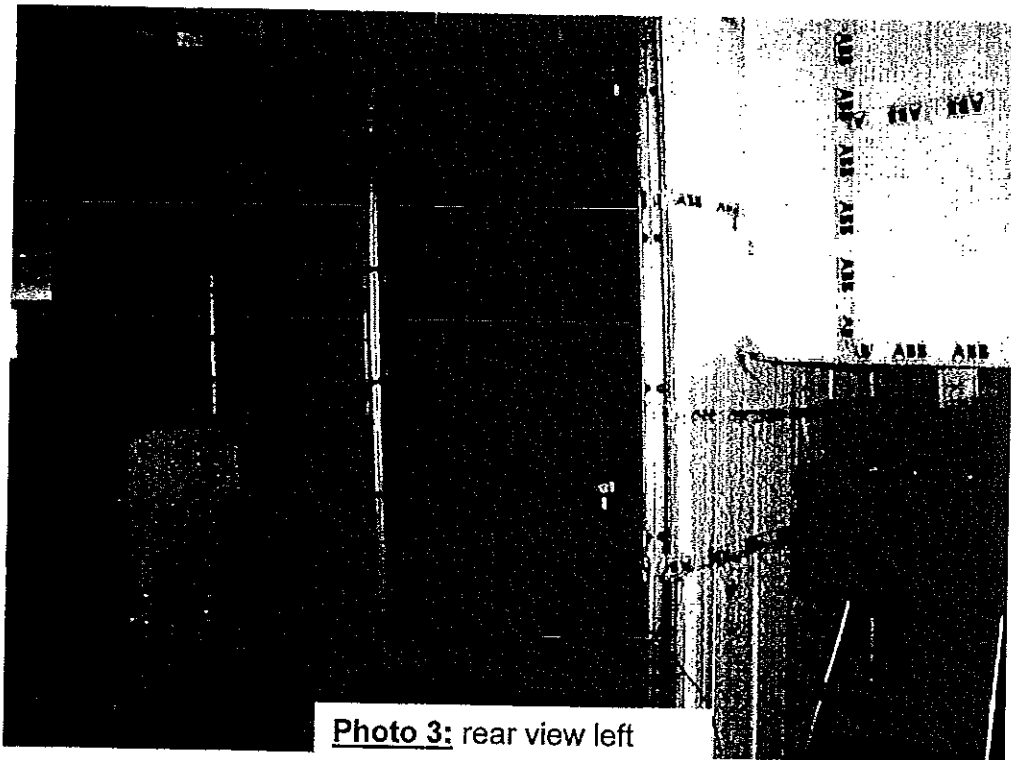


Photo 3: rear view left

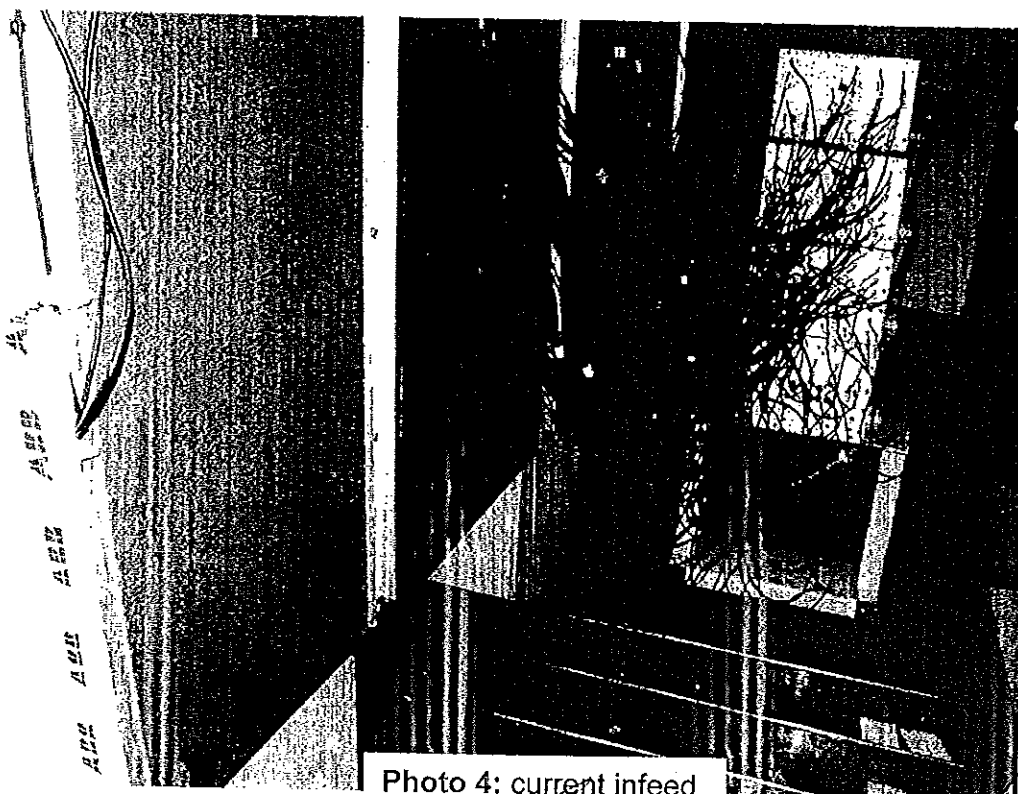


Photo 4: current infeed



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

**ABB Calor Emag
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TEST REPORT No. HZ 147 E 10
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corresponding to EN 45001

Sheet 31

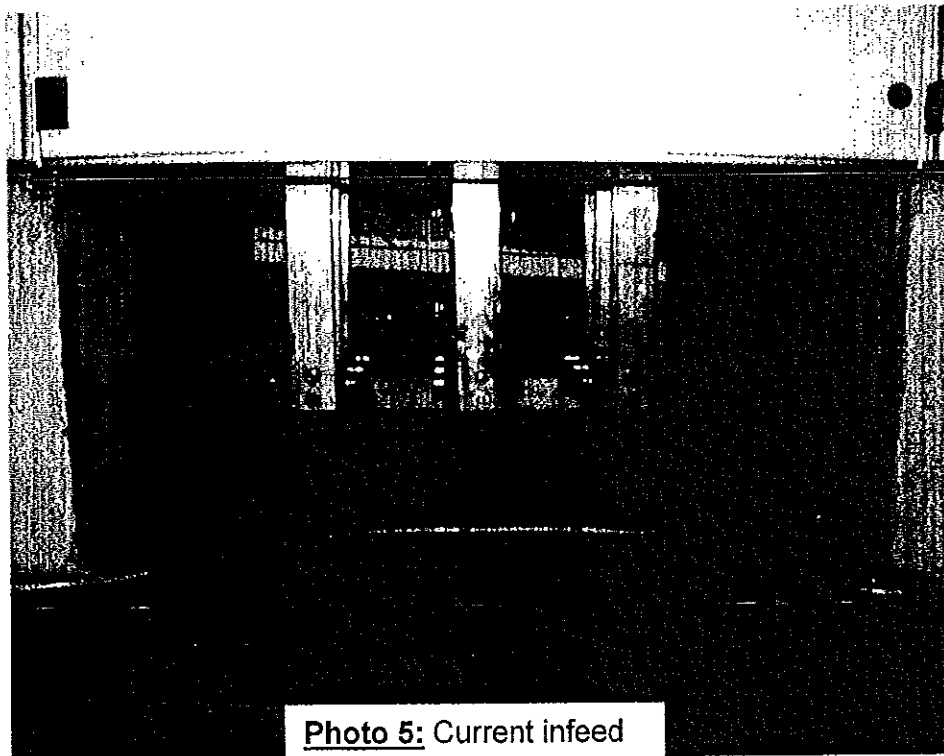


Photo 5: Current infeed



Reg.-Nr.
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TEST REPORT No. HZ 147 E 10
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Sheet 32

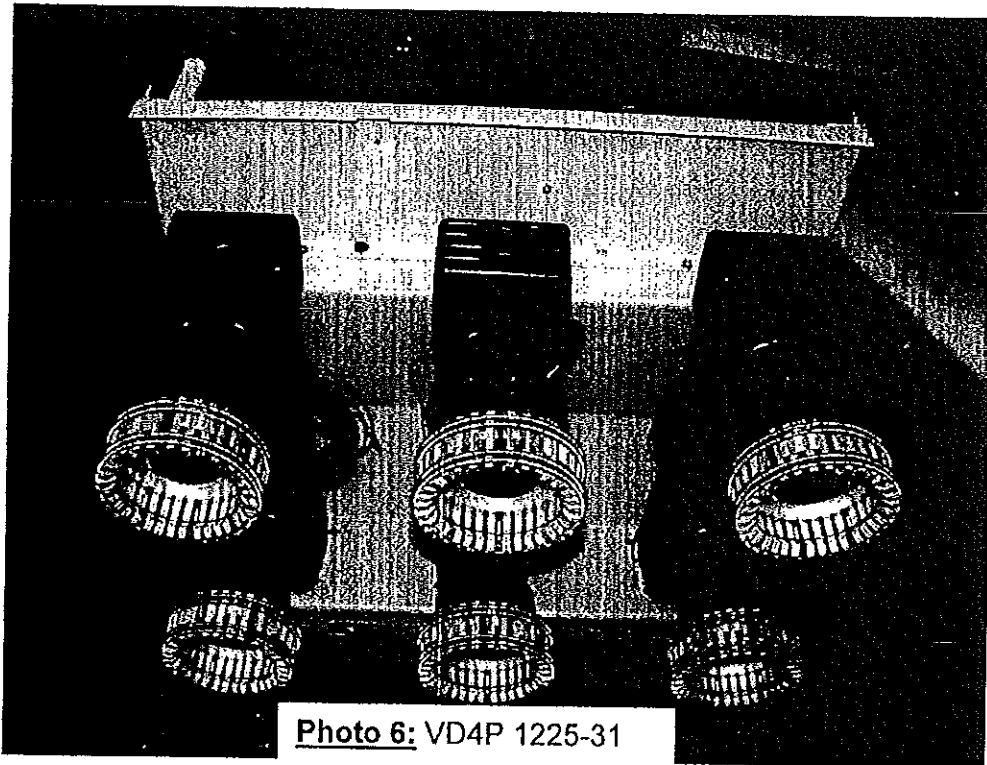


Photo 6: VD4P 1225-31

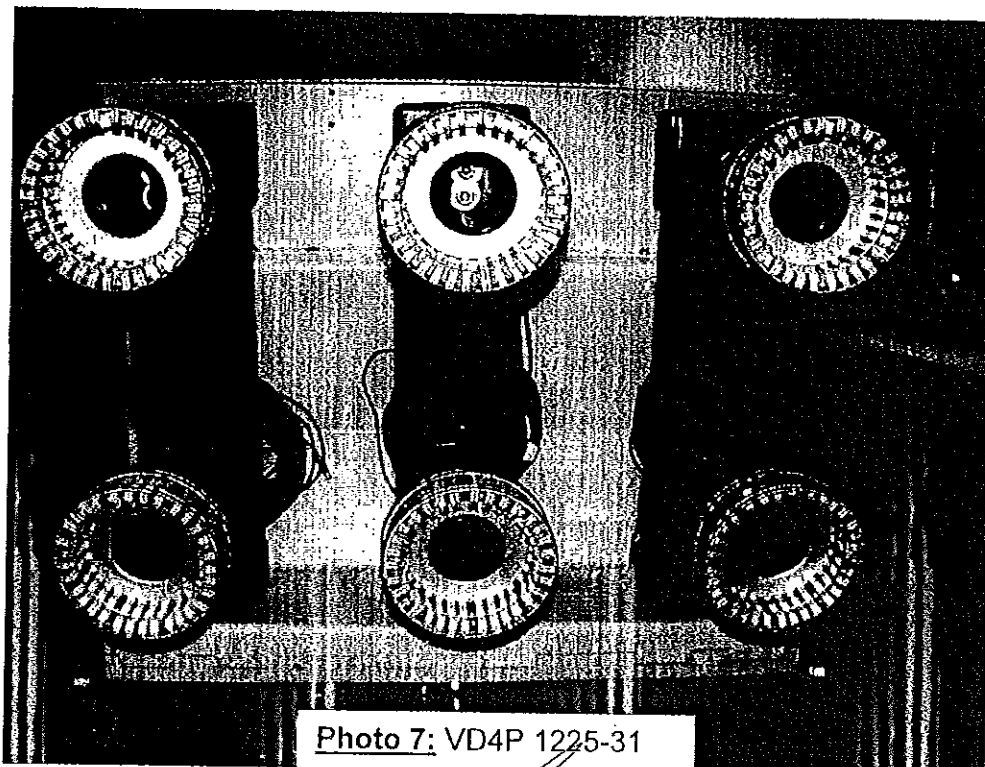


Photo 7: VD4P 1225-31



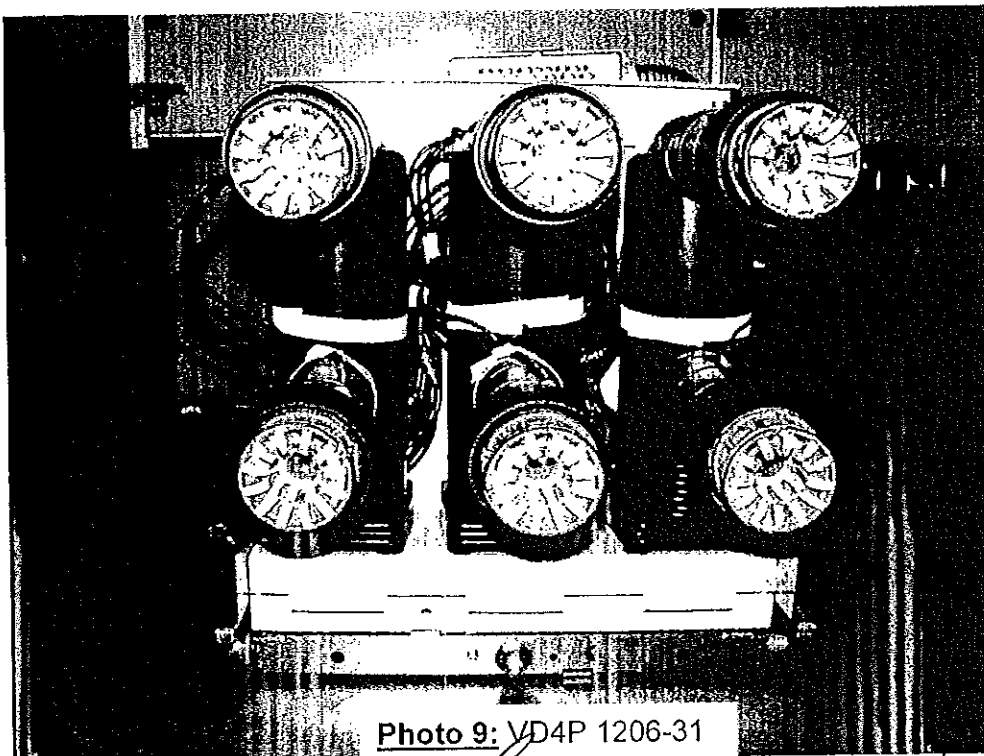
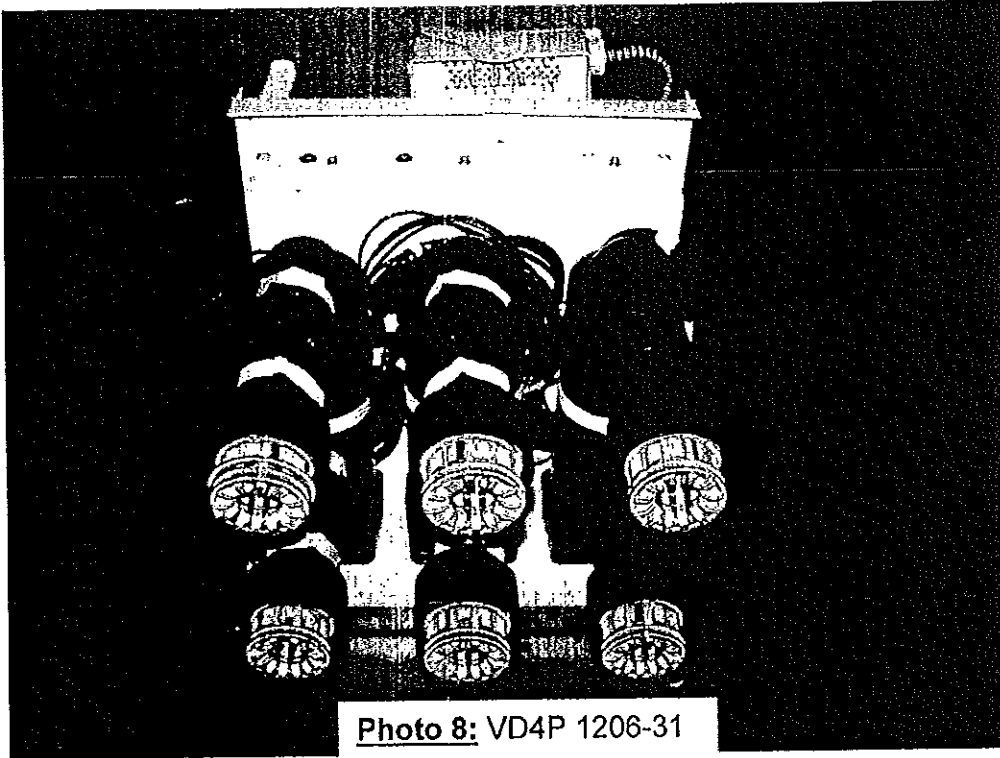
Reg.-Nr.
DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 33



client . ABB Technology Ltd. - Zurich (Switzerland)

equipment under test Three-phase metal-clad switchgear and controlgear, for medium voltage, fitted with vacuum circuit breaker composed by no.1 section designed: UniGear ZS1

tests performed short-time and peak withstand current tests of the main and earthing circuits

normative documents IEC 62271-200 (2003-11) ed. 1.0

receipt date of the sample February 6, 2004

test date from February 9, 2004 to February 9, 2004

no. of pages 20 no. of pages annexed 10

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

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first issue date April 6, 2004

prepared PeC/TEST - C. Del Giorgio

verified PeC/TEST - A. Geroli

approved PeC/TEST - V. Scarioni

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iscrizione CCIAA 00793580150

Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

tests witnessed by: Mr. Zdenek Otrisal ABB s.r.o. organization unit E.JF Brno - Czech Republic
Mr. Vit Badin "
Mr. Frantisek Svoboda "
Mr. Miroslav Vyhnanek "
Mr. Manzoni ABB PT S.p.a. Unità Operativa SACE PT MV

identification of the object: effected

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

These drawings identified by CESI and numbered A4/008152 no.1 to 22 have been returned to the Client.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: MP-A4/004075

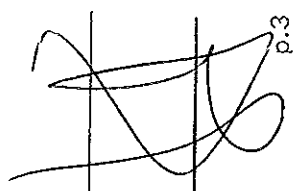
The measurement uncertainties of the test results reported in this document are the following:

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

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

activity code: 406870

contents	page	test date
Rated characteristics of the test objects assigned by the Client Rated characteristics of the apparatus installed in the equipment Connection points for short-circuit tests - Test configuration M8000 Verification of the short-time and peak withstand current - Test arrangements and test procedure - Three-phase short-circuit test results (with no-load operation on the circuit-breaker) - Single-phase short-circuit test results Measurement of the resistance of the main circuit Test circuits MO16 - MO15 Photographs of the test object Pages annexed - Oscillogram from test report MP-A4/04075 (total pages:10) Reference document - drawings identified by CESI and numbered A4/008152 no.1 to 22	4 5 6 7 8 9 10 11 + 12 13 + 20	--- --- --- --- February 9, 2004 February 9, 2004 February 9, 2004 --- ---




MP-A4/010735

Test Report

Rated characteristics of the test objects assigned by the Client

metal enclosed switchgear

manufacturer	ABB s.r.o. organization unit EJV Brno - Czech Republic
designation / type	UniGear ZS1 12.25.31
serial number	1VLS 1000003842/007
voltage	12 kV
insulation level	
power frequency withstand voltage	28 kV rms
lightning impulse withstand voltage	75 kV peak
frequency	50 Hz
normal current	2500 A
short-time withstand current for main circuits	31,5 kA
peak withstand current for main circuits	80 kA
duration of short-circuit for main circuits	3 s
short-time withstand current for earthing circuits	31,5 kA
peak withstand current for earthing circuits	80 kA
duration of short-circuit for earthing circuits	1 s
degree of protection	IP41

Rated characteristics of the apparatus installed in the equipment

Three-pole medium-voltage vacuum insulated circuit-breaker in withdrawable version

manufacturer	ABB
designation / type	VD4/P 12.25.32
serial number	AD00140546
voltage	12 kV
lightning impulse withstand voltage	75 kV peak
power frequency withstand voltage	28 kV rms
frequency	50 ÷ 60 Hz
normal current	2500 A
breaking capacity	31,5 kA
short-time withstand current	31,5 kA for 3s
making capacity	80 kA at 12 kV

earthing switch

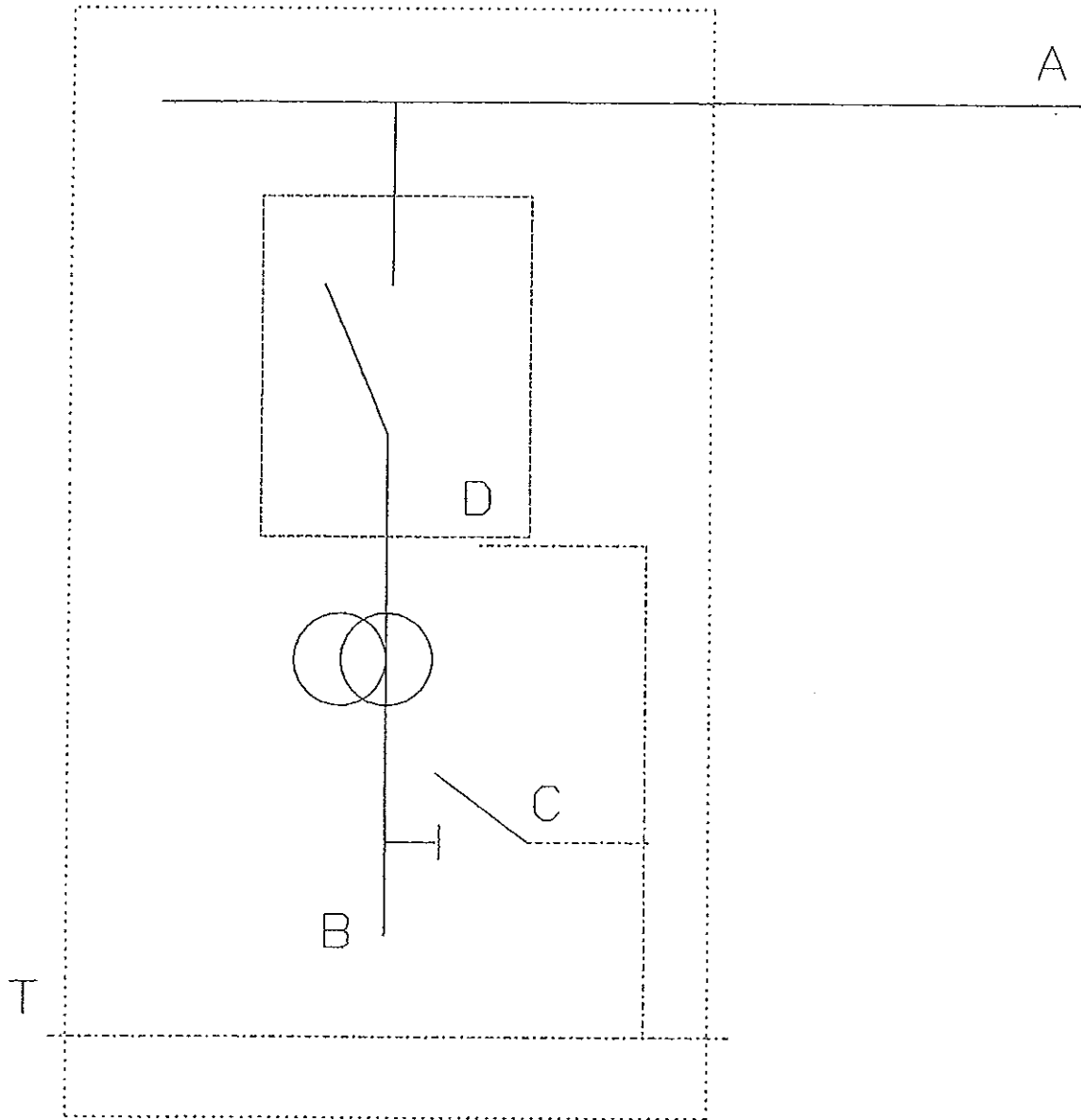
manufacturer	ABB
designation / type	EK6 1208-275
serial number	033522
voltage	12 kV
insulation level	28 - 75
frequency	50 + 60 Hz
short-circuit making current	80 kA
short-time withstand current	31,5 kA
short-circuit duration	3 s

Medium-voltage cast resin current transformer

manufacturer	ABB
designation / type	TPU 46-11
voltage	12 kV
frequency	50 Hz
ratio	2500/5-5 A
short-time withstand current	80 for 1 s
peak withstand current	200 kA

Connection points for short-circuit tests

Test configuration M8000



Verification of the short-time and peak withstand current of the main and earthing circuits

Test arrangements and test procedure

The equipment under test was placed, on a metallic platform, as in normal use and was appropriately insulated from earth.

Main circuits

The tests were performed supplying the terminals of the main busbars (point "A" of the configuration M8000) by one tubular copper conductor per-phase having a cross sectional area of 700 mm²; these conductors were clamped together at a distance of 30 cm from the incoming terminals of the equipment under test. The short-circuit was put in the point "B".

The three-phase short-circuit test on the earthing switch was performed supplying the point "B" and the short-circuit has been made closing the earthing switch at the point "C".

Earthing circuits

The verification of the short-circuit strength of the earthing circuit was performed connecting a single phase supply to one of the main busbars terminal (point "A") and the terminal of the earthing circuit (point "T").

The continuity between the main circuit and the earthing circuit of the withdrawable circuit-breaker was effected connecting one terminal and the metallic frame (point "D").

The single-phase short-circuit test on the earthing switch was performed supplying the point "B" and the terminal of the earthing circuit (point "T"). The short-circuit has been made closing the earthing switch at the points "C".



Three-phase short-circuit test results

Test circuit: M016
 Test configuration: M8000
 Protocol number of the oscillograms: MP-A4/004075

Conditions of the apparatus before the tests: as supplied by the Customer.

Before the short-circuit test the no-load operation on the circuit-breaker have been performed

type of operation	oscillogram	Operational time		
		pole R	pole S	pole T
	No./sheets	ms	ms	ms
closing	101/2	65,2	65,2	64,6
opening		48,7	48,8	49,0

date: February 9, 2004

test no.	oscillogram no./sheets	connection points		voltage V	current values			I ² t MA ² s	duration s	frequency Hz	notes no.
		supply point	shot-circuit point		peak A	r.m.s. A	average A				
1	2/1	A	B	-	82620	31900 32670 32220	32260	-	1,0	50	a b
2	3/1	A	B	-	79200	31740 32410 32000	32050	-	3,0	50	a b c
4	7/1	B	C	-	80120	31590 31940 31550	31690	-	1,0	50	a b
5	8/1	B	C	-	79020	31550 31910 31530	31660	-	3,0	50	a b

conditions of the apparatus after the tests: see notes

- a : the apparatus did not show any permanent deformation of its metallic structure and bars; the insulation of the conductors and the supporting insulating parts did not show any significant sign of deterioration.
- b : the equipments provided into the apparatus operated regularly and did not show any mark of damage.
- c : after the test the no-load operation on the circuit-breaker at rated auxiliary voltage was performed

type of operation	oscillogram	Operational time		
		pole R	pole S	pole T
	No./sheets	ms	ms	ms
closing	102/2	65,2	65,5	65,2
opening		48,4	48,4	48,6

Single-phase short-circuit test results

Test circuit: M015
 Test configuration: M8000
 Protocol number of the oscillograms: MP-A4/004075

Conditions of the apparatus before the tests: as supplied by the Customer

date: February 9, 2004

test no.	oscillogram no./sheets	connection points		voltage V	current values			duration s	frequency Hz	notes no.
		supply point	short-circuit point		peak A	r.m.s. A	I ² t MA ² s			
3	5/1	A-T	D	-	79080	31900	-	1,01	50	a b c
6	10/1	B-T	C	-	79040	31700	-	1,0	50	a b c

conditions of the apparatus after the tests; see notes

- a : the apparatus did not show any permanent deformation of its metallic structure and bars; the insulation of the conductors and the supporting insulating parts did not show any significant sign of deterioration.
- b : the equipments provided into the switchgear and controlgear operated regularly and did not show any mark of damage.
- c : the continuity of the earthing circuit was not impaired.

Measurement of the resistance of the main circuit

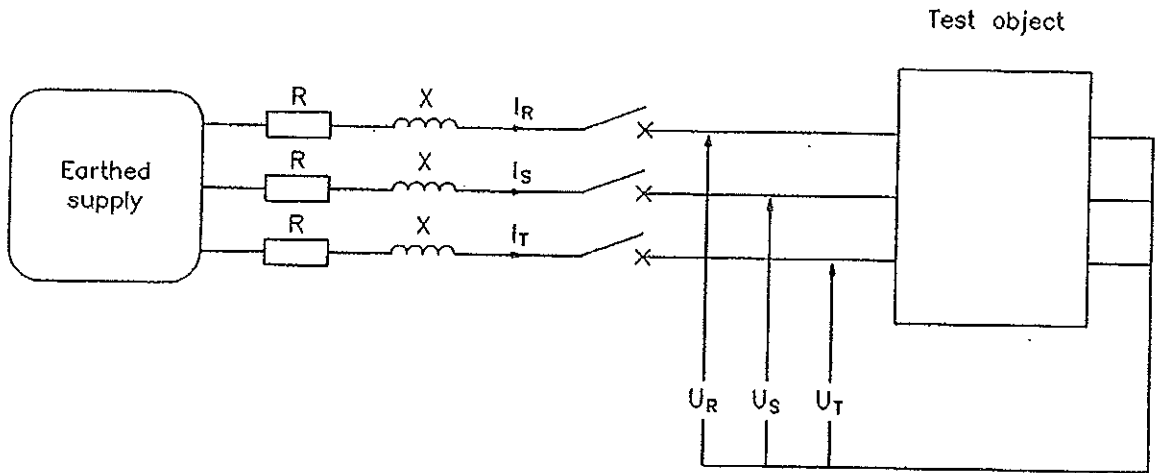
Resistance measured with 100 A d.c.

date: February 9, 2004

measurement effected	resistance ($\mu\Omega$) across the pole			ambient air temperature °C
	R	S	T	
before the tests	14	13	13	16,0
after the test no.3	14	13	13	16,0

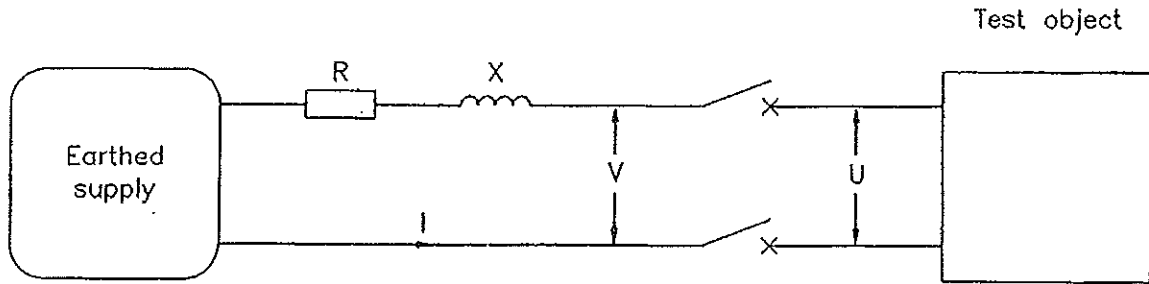
note: -

Test circuit M016



Symbols used in this diagram are the same as those on the oscillograms.

Test circuit M015



Symbols used in this diagram are the same as those on the oscillograms.

[Signature]

[Signature]

Photographs of the test object

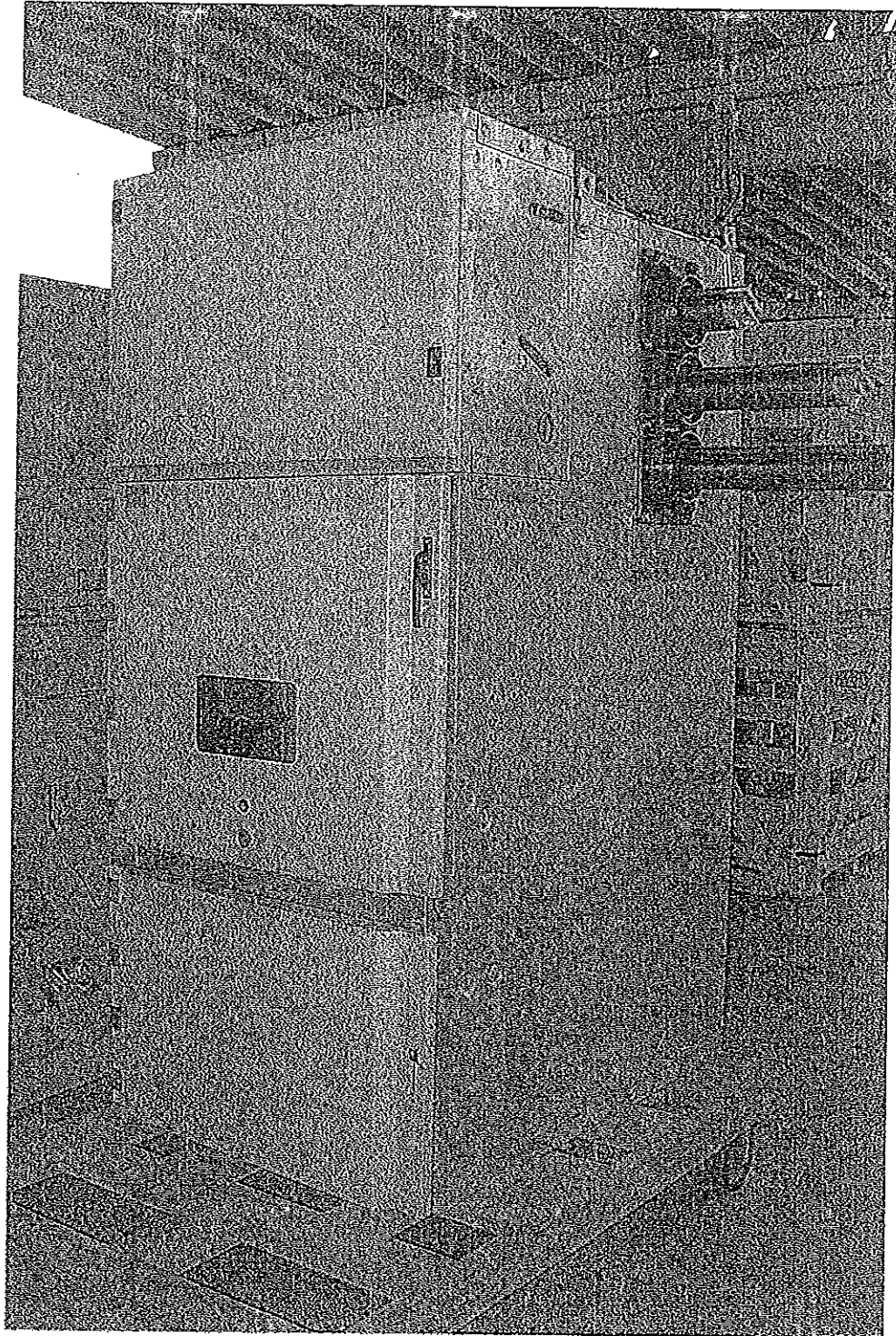


Photo no. 1

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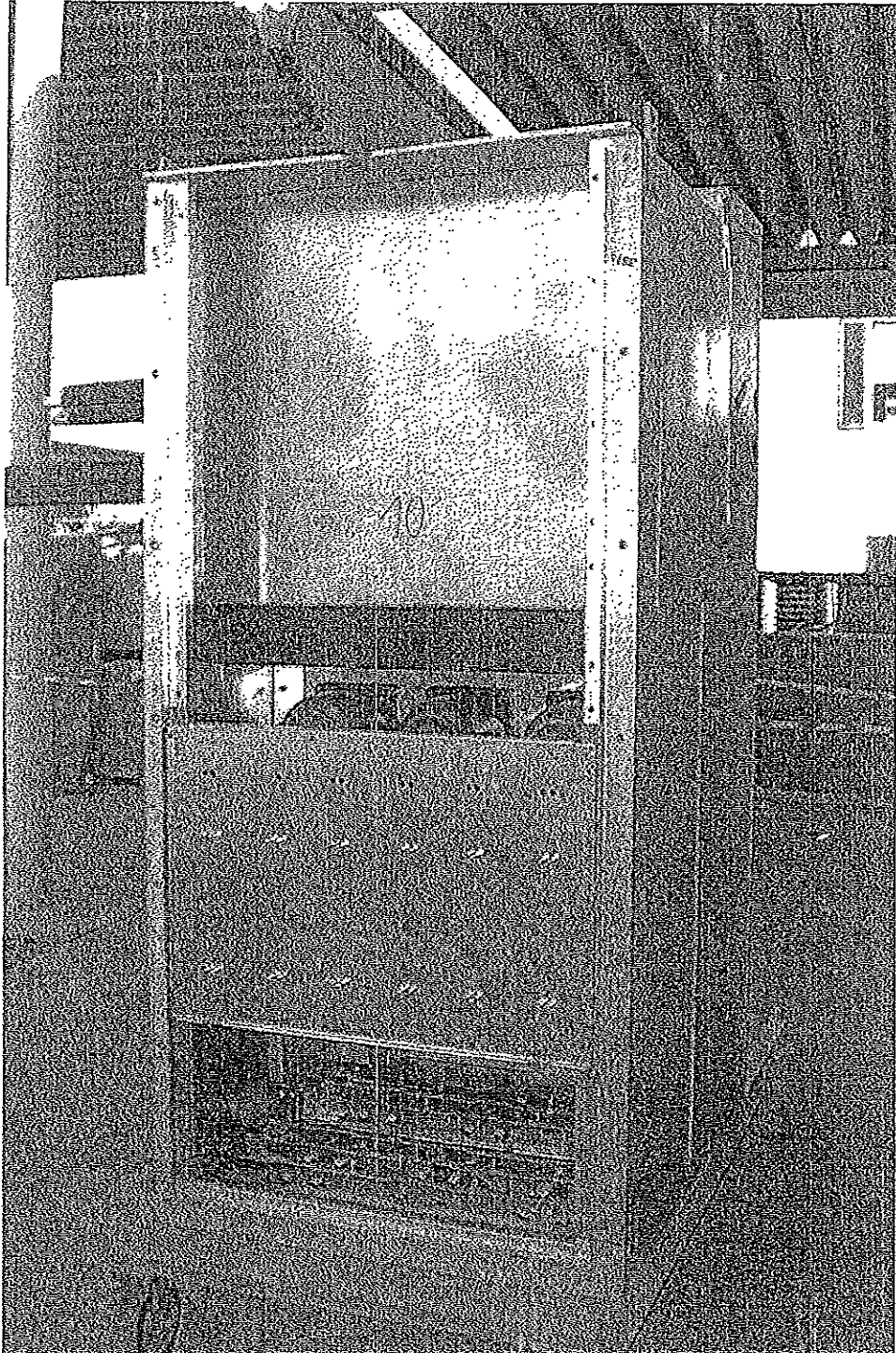


Photo no. 2

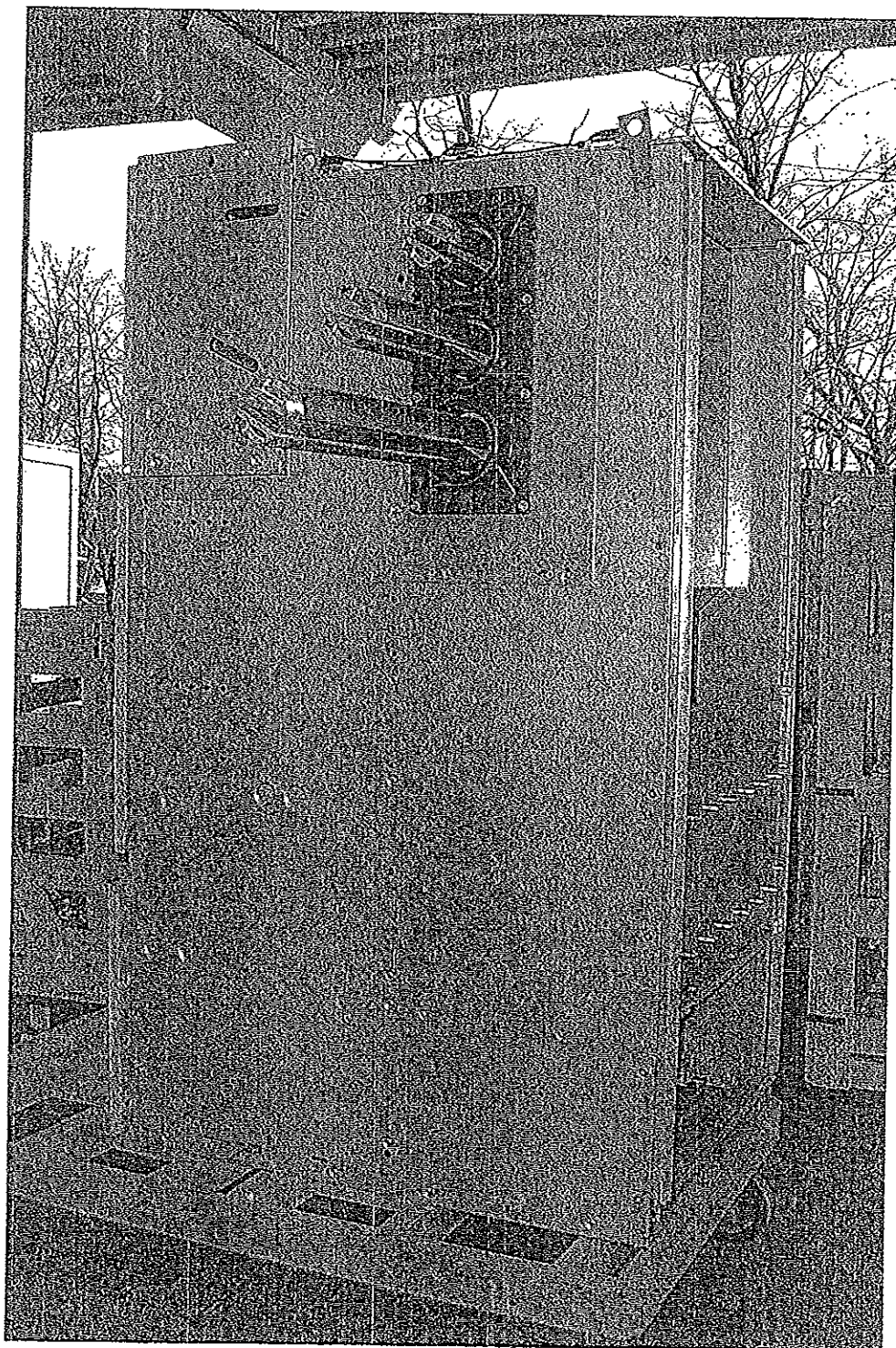


Photo no. 3

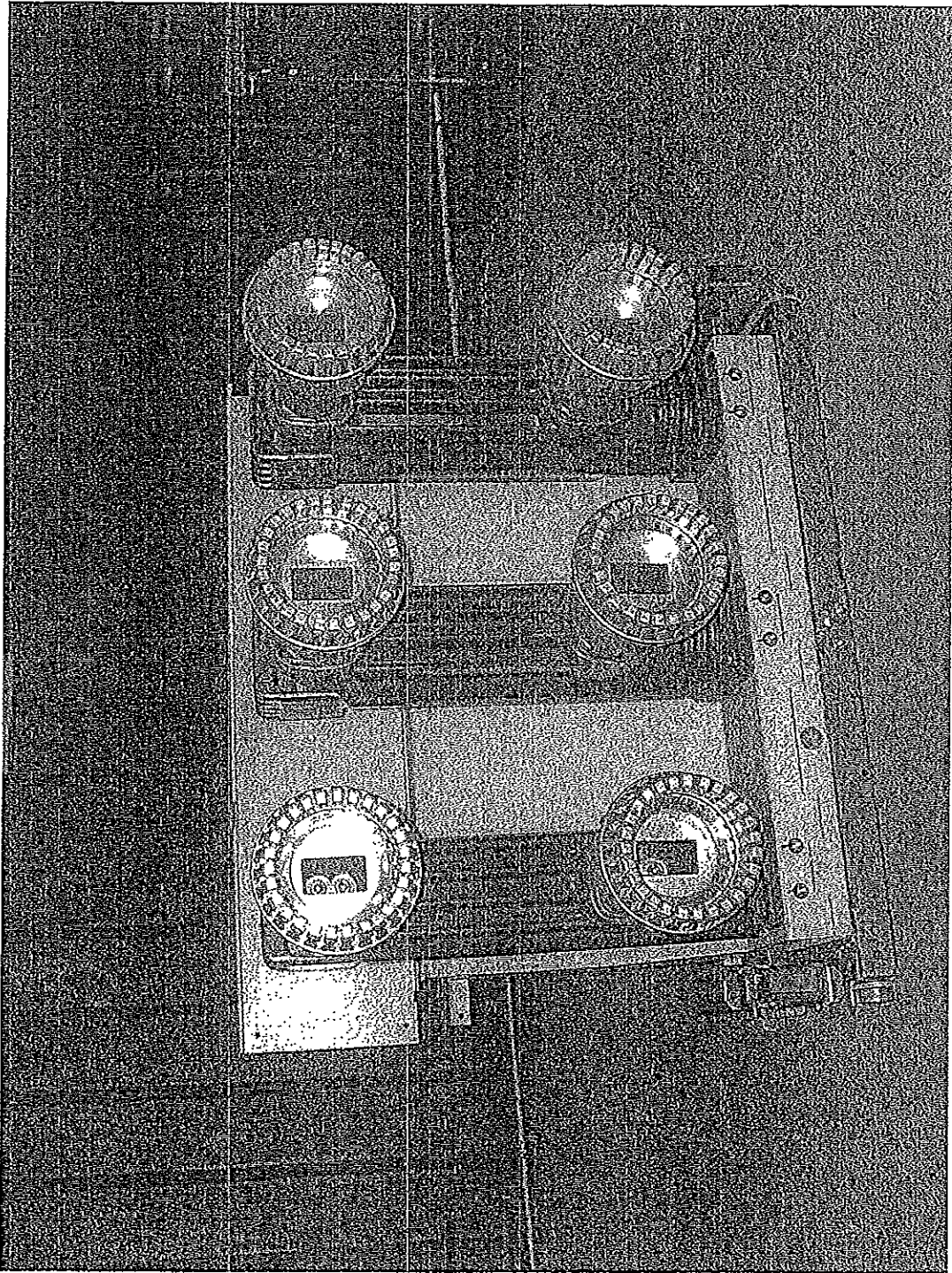


Photo no. 4

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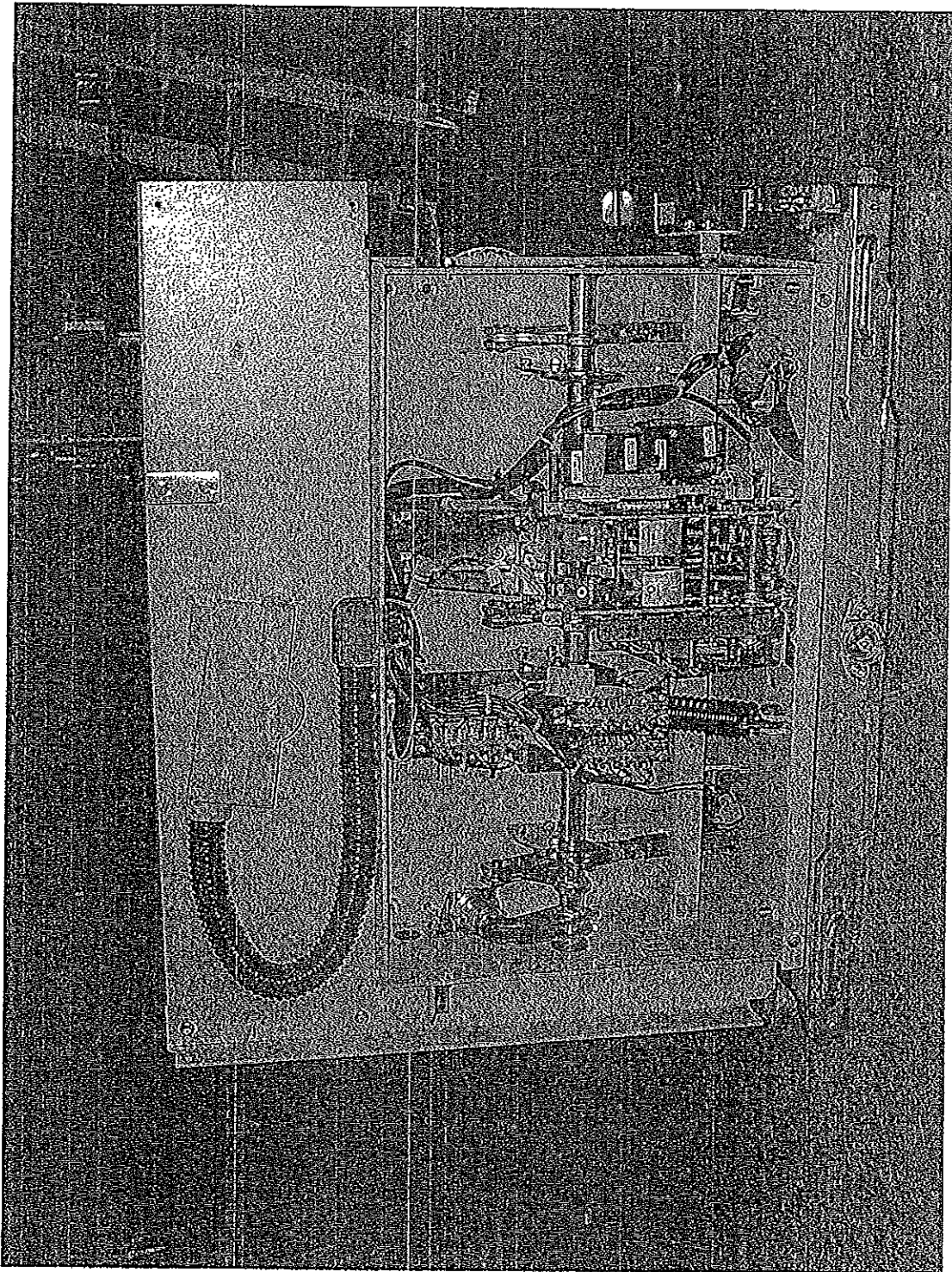


Photo no. 5

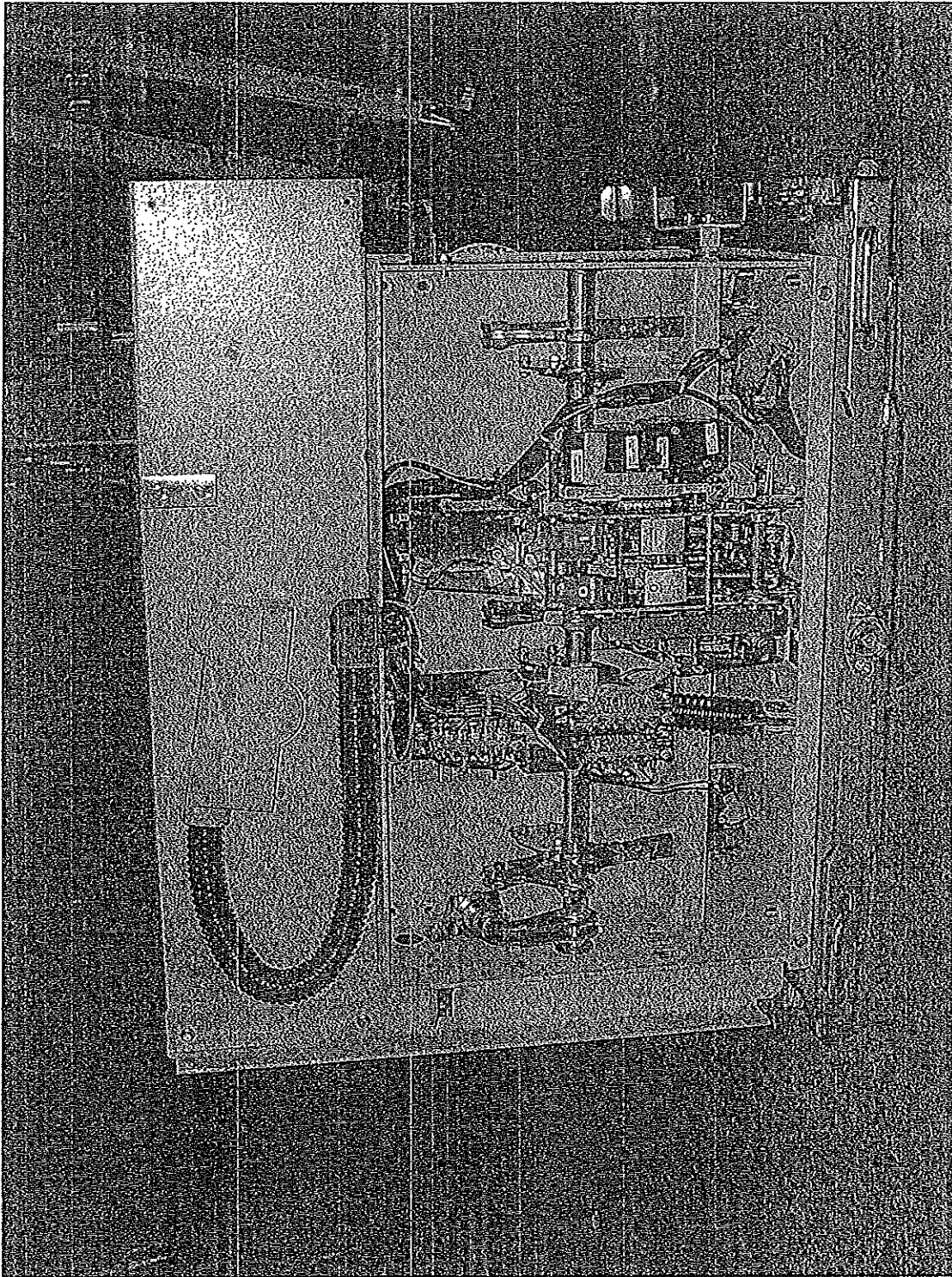


Photo no. 6

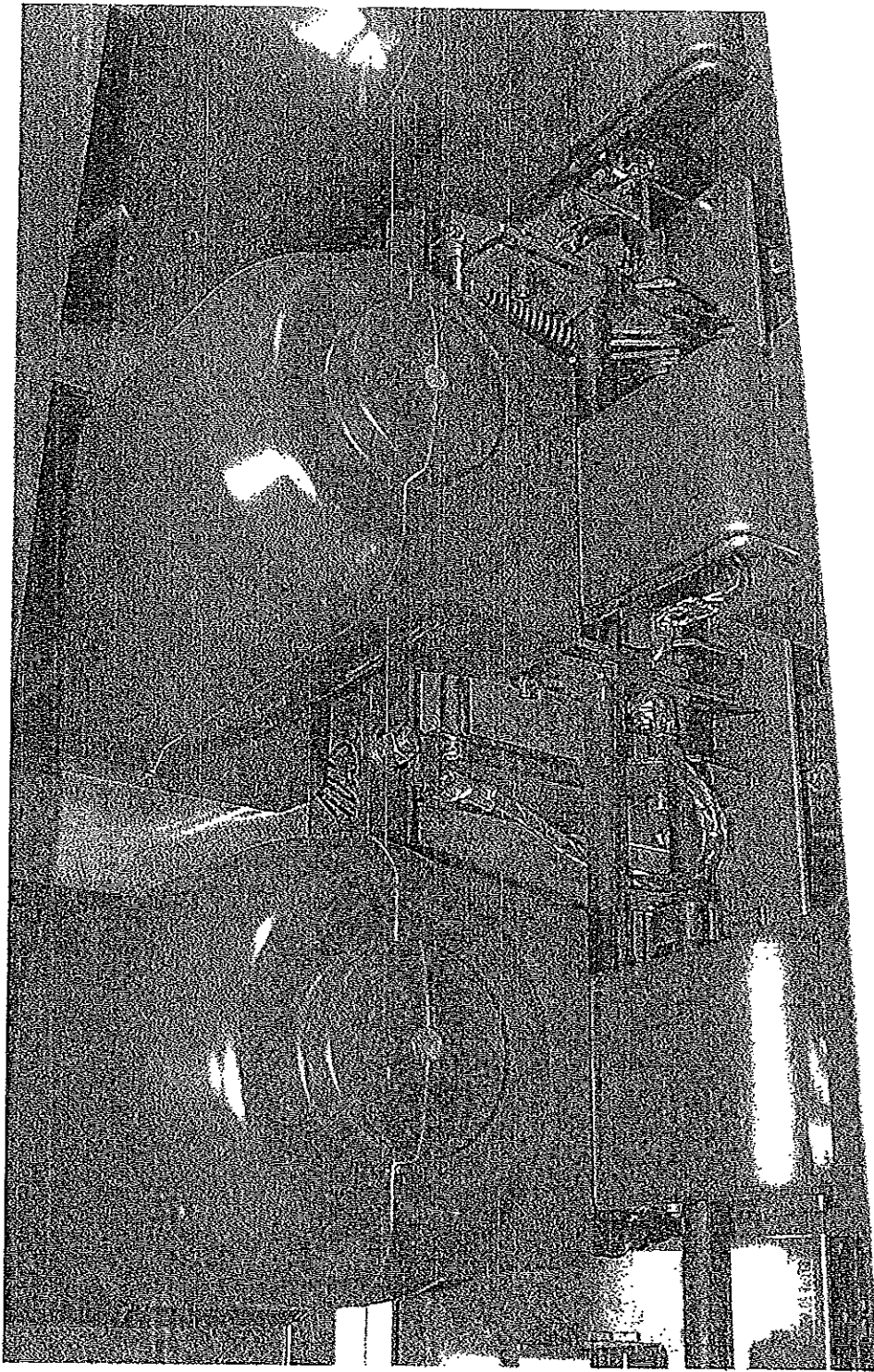


Photo no. 7

PS

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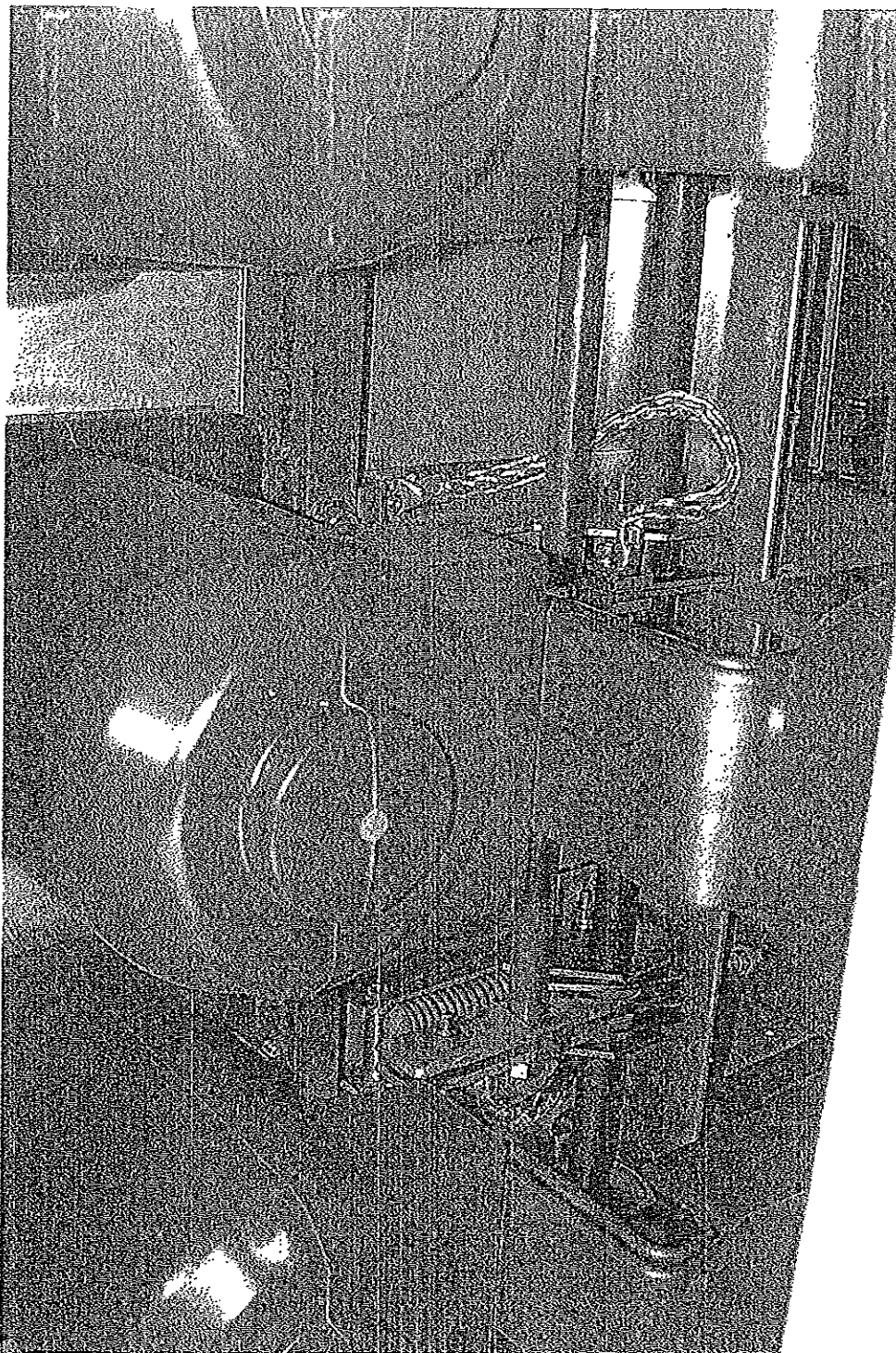


Photo no. 8

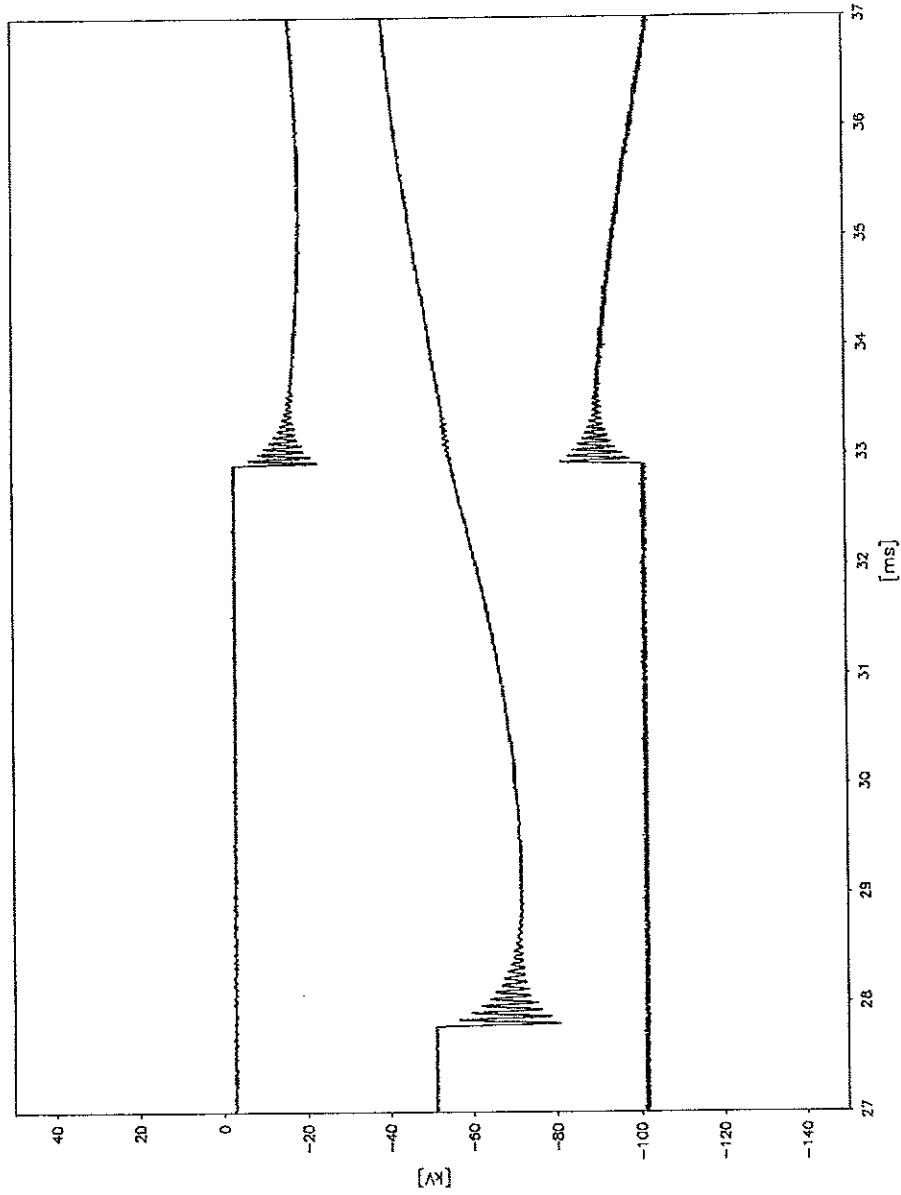
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Test no.
PEHLA 0303Ra / 23
Transient Recovery Voltage



Short-Circuit Making and Breaking Tests Circuit-breaker

Test duty: T10
Date of test: 10th January 2003
Condition of test object before test: As after test PEHLA 0303Ra / 23
Connections to test object: By means of copper bars to the upper terminals of the circuit-breaker. Lower terminals of the circuit-breaker short-circuited and earthed.
Arc extinguishing medium: Vacuum

Test No. PEHLA 0303Ra		25		26
Operating sequence		O - 0.3s - CO - 3min - CO		
Applied voltage	kV	-	19.0	18.4
Short-circuit making current	L1	-	6.1	5.3
	kA L2	-	8.1	8.2
	L3	-	8.6	8.5
Short-circuit breaking current	L1	3.54	3.61	3.56
	Short-circuit current kA L2	3.60	3.50	3.49
	L3	3.54	3.50	3.63
	Average value kA	3.56	3.54	3.56
d.c. component	L1	< 20	< 20	< 20
	% L2	<20	< 20	< 20
	L3	<20	< 20	< 20
Recovery voltage	L1	10.9	10.8	9.87
	kV L2	10.8	11.0	11.2
	L3	11.1	10.8	10.8
Average value (phase-to-phase)	kV	18.9	18.8	18.8
Transient Recovery Voltage (TRV), first-pole-to-clear	kV	36.6	31.8	33.1
Arcing time	L1	8.0	7.5	7.6
	ms L2	3.0	7.5	2.8
	L3	8.0	2.5	7.8
Closing time	ms	-	64.0	67.0
Opening time	ms	65.0	67.0	67.5
Result		P	P	P

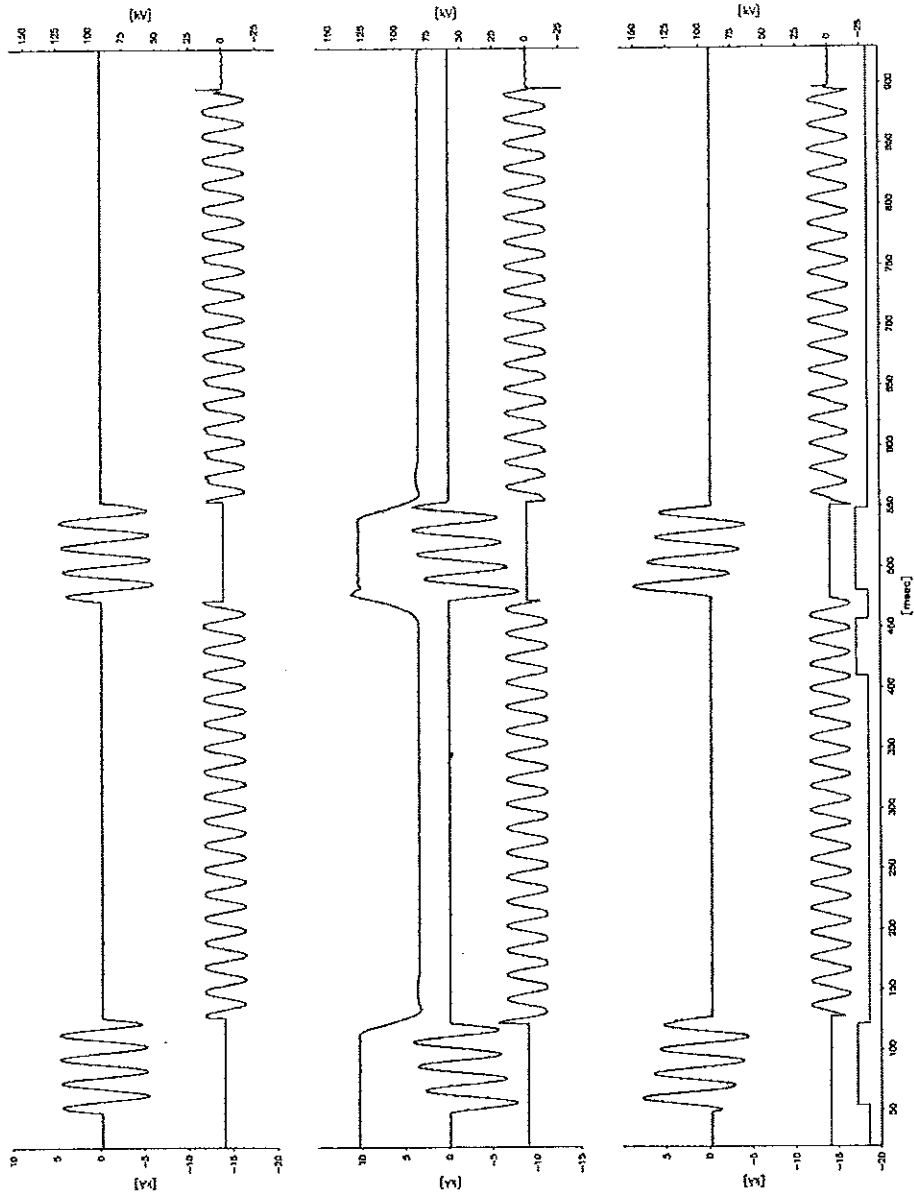
Legend: P: Positive, breaker cleared or breaker closed and cleared N: Negative, breaker failed

Remarks:

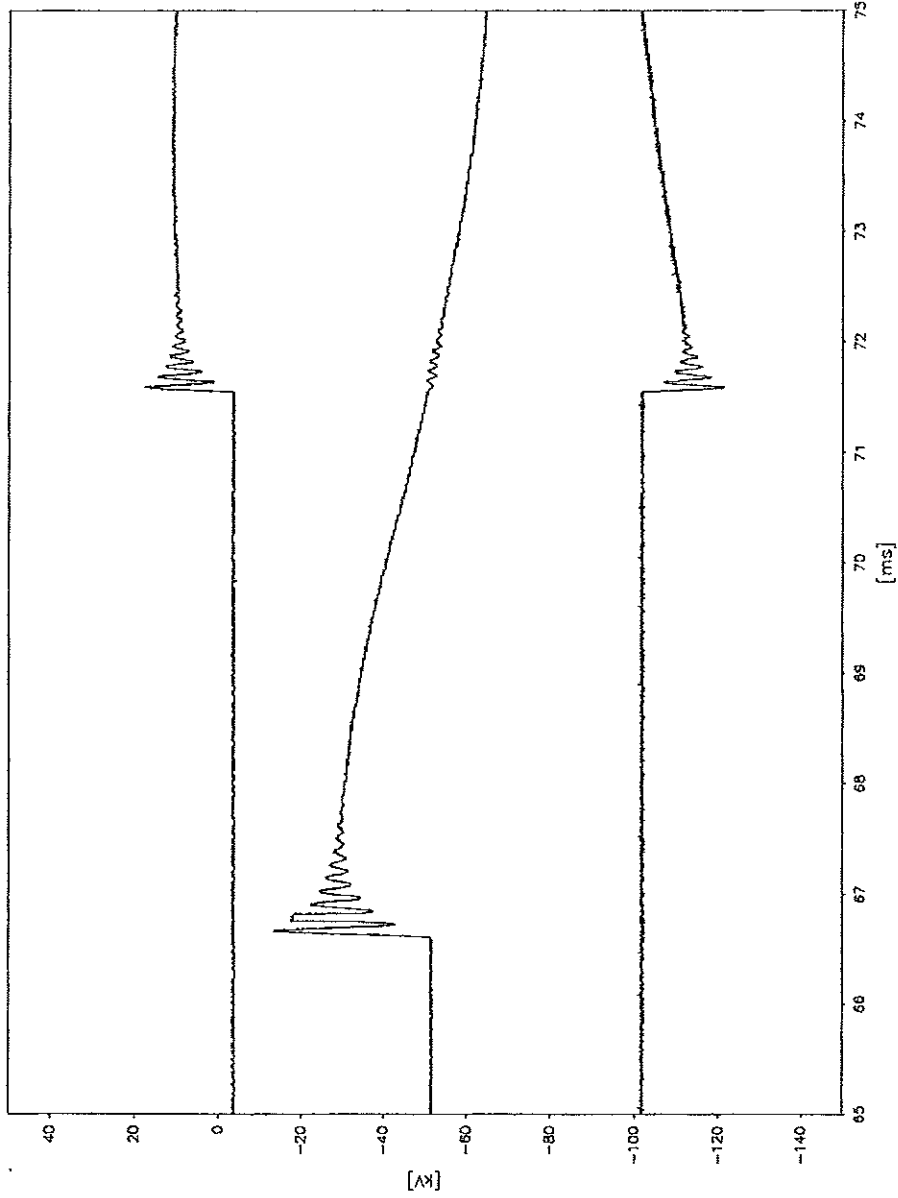
PEHLA 0303Ra / 24: Test with reduced values
 PEHLA 0303Ra / 25 and 26: The operating devices are supplied at their minimum voltage.

Condition of test object after test: Circuit-breaker without functional or visible change.

Test no.
PEHLA 0303Ra / 25



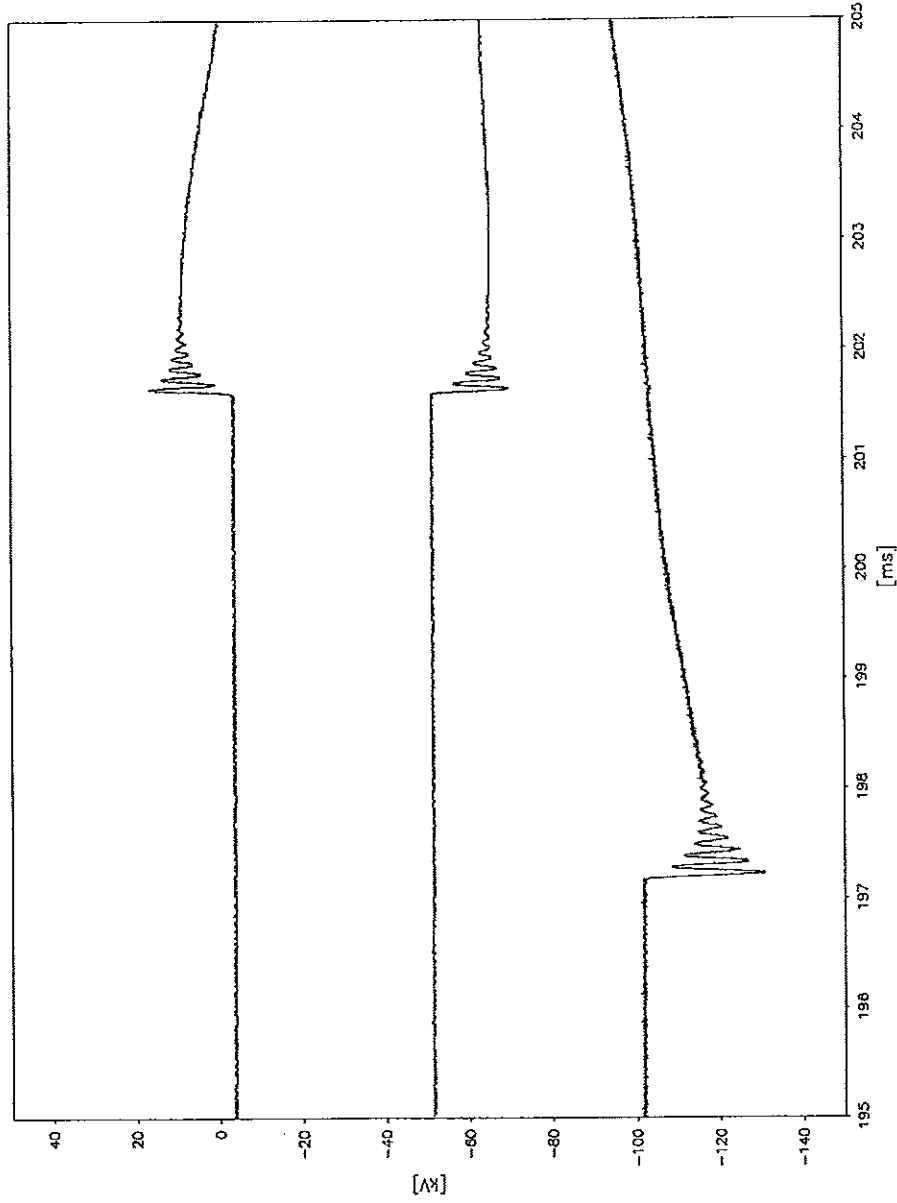
Test no.
PEHLA 0303Ra / 25
Transient Recovery Voltage, First O



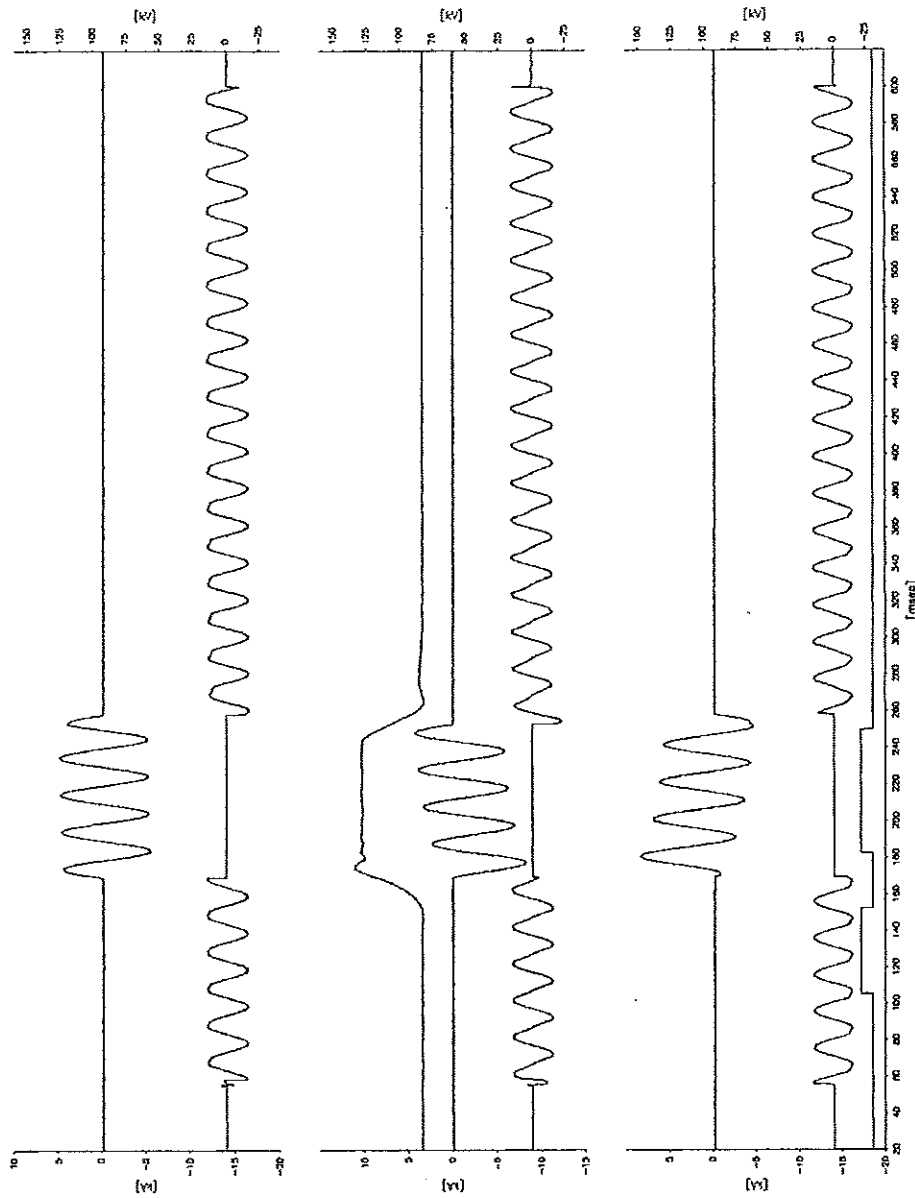
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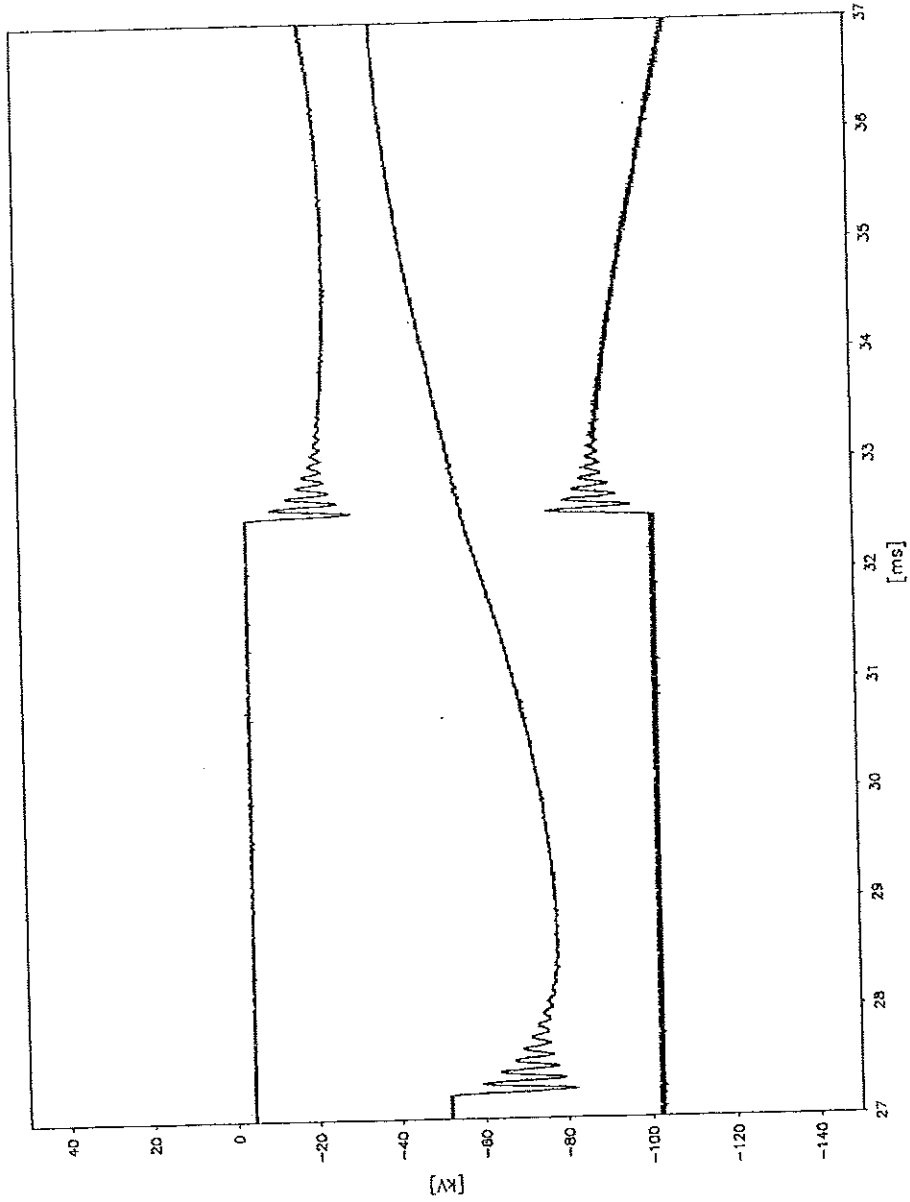
Test no.
PEHLA 0303Ra / 25
Transient Recovery Voltage, Second O



Test no.
PEHLA 0303Ra / 26



Test no.
PEHLA 0303Ra / 26
Transient Recovery Voltage



Short-Circuit Making and Breaking Tests
Circuit-breaker

Test duty: Double-earth fault test
Date of test: 10th January 2003
Condition of test object before test: As after test PEHLA 0303Ra / 26
Connections to test object: Phase L3 of the Test Laboratory connected by means of a copper bar to the upper terminal of phase L3 of the circuit-breaker, lower terminal of phase L3 of the circuit-breaker connected to phase L1 of the laboratory.
Arc extinguishing medium: Vacuum

Test No. PEHLA 0303Ra		33	-	-
Operating sequence		O	-	-
Applied voltage	kV	-	-	-
Short-circuit making current	L1	-	-	-
	kA L2	-	-	-
	L3	-	-	-
Short-circuit breaking current	L1	27.8	-	-
	Short-circuit current kA L2	-	-	-
	L3	-	-	-
	Average value kA	-	-	-
d.c. component	L1	< 20	-	-
	% L2	-	-	-
	L3	-	-	-
Recovery voltage	L1	18.7	-	-
	kV L2	-	-	-
	L3	-	-	-
Average value (phase-to-phase)	kV -	-	-	-
Transient Recovery Voltage (TRV), first-pole-to-clear	kV	32.8	-	-
Arcing time	L1	11.1	-	-
	ms L2	-	-	-
	L3	-	-	-
Opening time	ms	46.8	-	-
Result		P	-	-

Legend: P: Positive, breaker cleared or breaker closed and cleared N: Negative, breaker failed

Remarks:

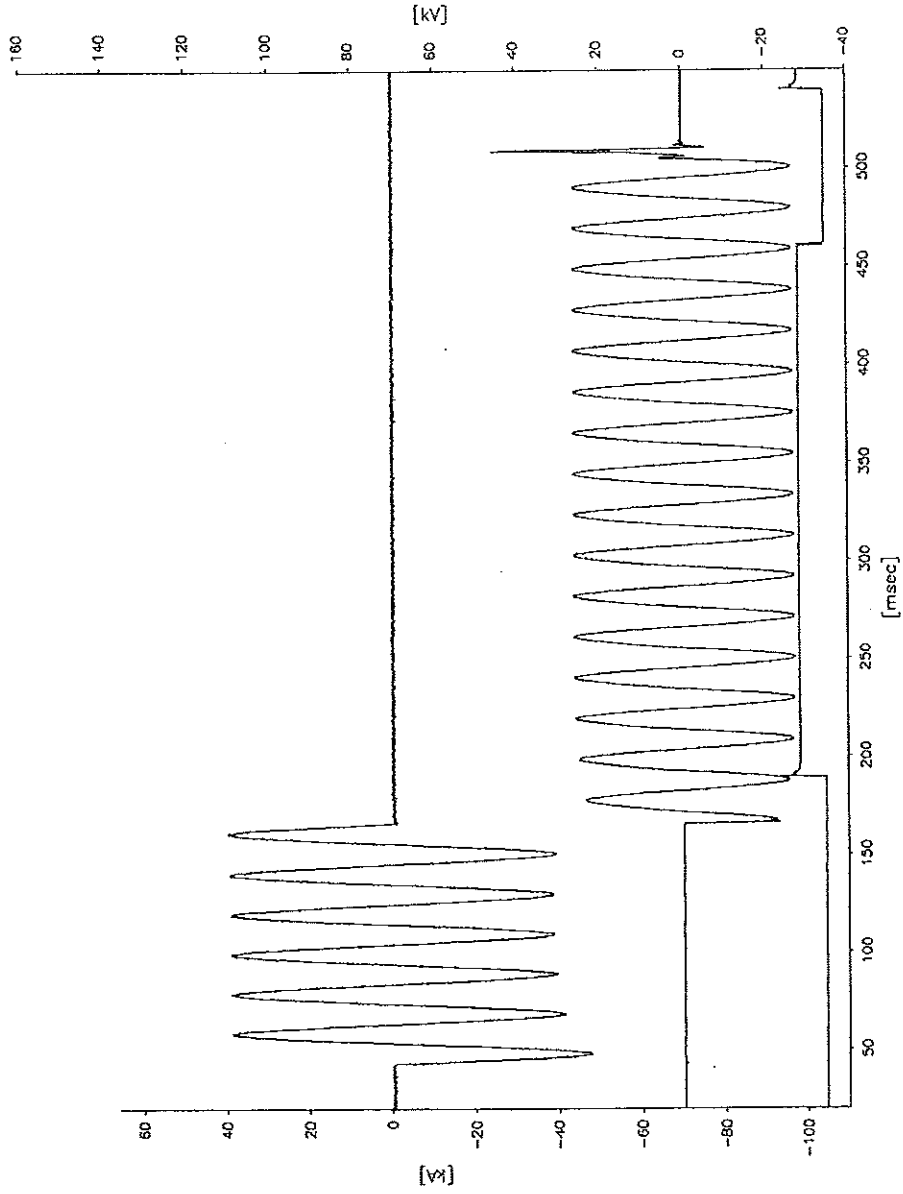
PEHLA 0303Ra / 27 to 32: Tests with reduced values
 PEHLA 0303Ra / 33: The operating devices are supplied at their rated voltage.

Condition of test object after test: Circuit-breaker without functional or visible change.

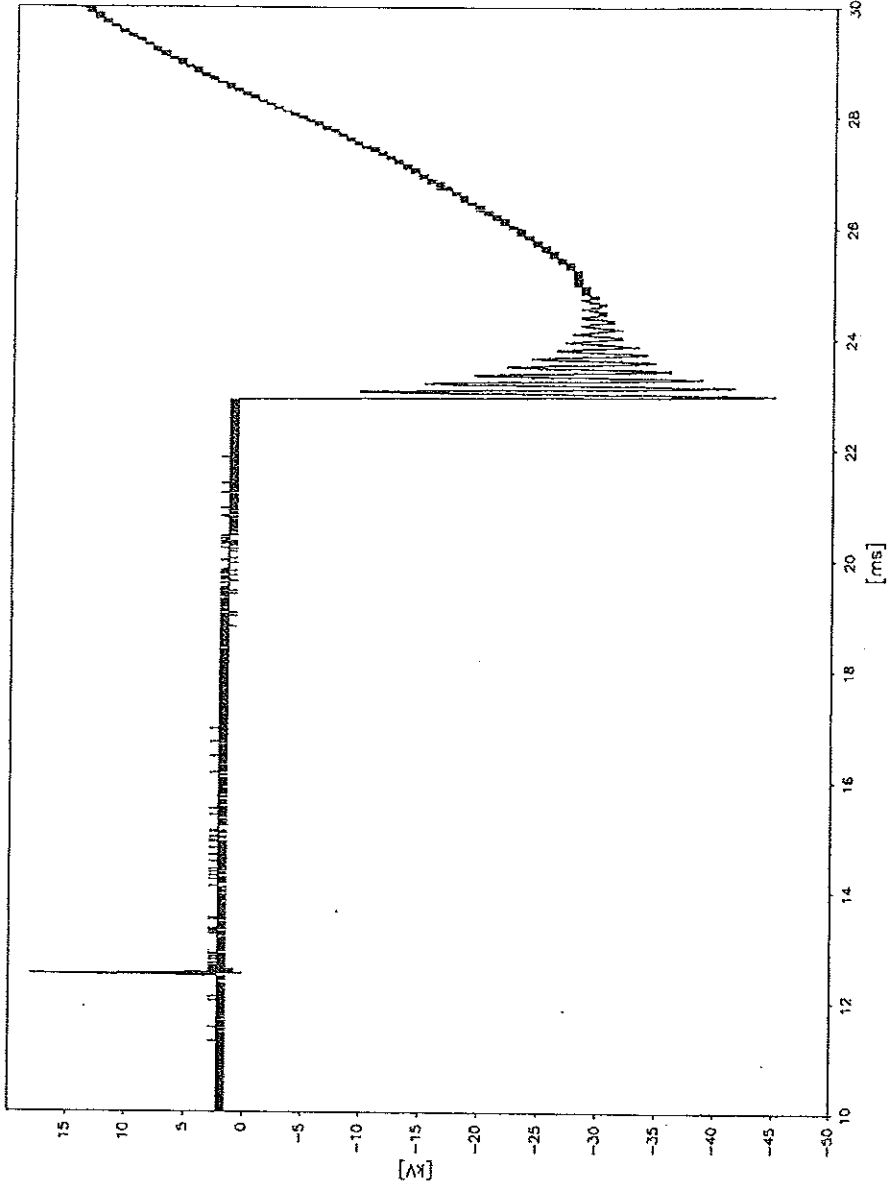
Power frequency withstand voltage test at 38 kV – 1 min successfully performed after test PEHLA 0303Ra/ 32.

The deviations from the reference mechanical travel characteristic are in the allowable limits.

Test no.
PEHLA 0303Ra / 33



Test no.
PEHLA 0303Ra / 33
Transient Recovery Voltage



Actual Values of No-load Operations

Rated supply voltage of closing coil: 220 V DC
 Rated supply voltage of opening coil: 220 V DC

	Operation	Voltage closing coil (V)	Closing time (ms)	Voltage opening coil (V)	Opening time (ms)
Before basic short-circuit test duties					
Test 0303Ra / 002	O-	--	--	220	46.4
	CO	220	58.9	220	46.9
Test 0303Ra / 02A	O-	--	--	154	79.1
	CO	187	62.9	154	79.7
Test 0303Ra / 02B	O-	--	--	242	43.7
	CO	242	56.5	242	44.1
After double-earth fault test					
Test 0303Ra / 034	O-	--	--	220	45.3
	CO	220	60.1	220	46.3
Test 0303Ra / 34A	O-	--	--	154	70.7
	CO	187	64.9	154	73.8
Test 0303Ra / 34B	O-	--	--	242	43.2
	CO	242	57.7	242	44.1

Measurement of the Resistance

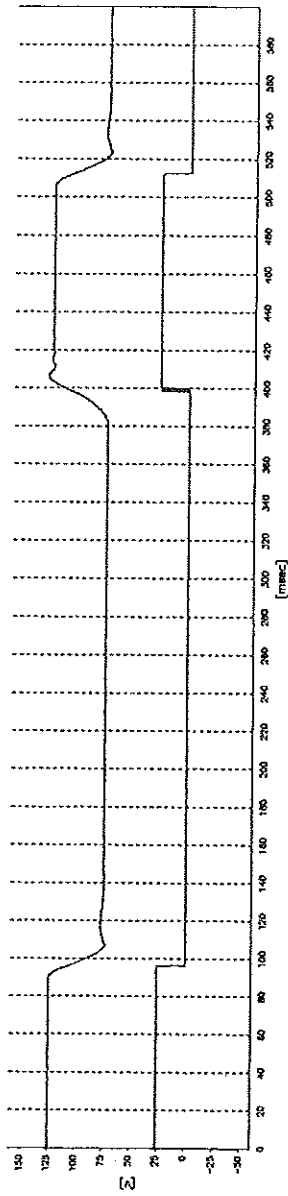
Ambient air temperature: $\approx 18 \text{ }^\circ\text{C}$

		Resistance of the pole parts $\mu\Omega$		
		L1	L2	L3
Before test	0303Ra / 004	12.3	12.7	12.1
After test	0303Ra / 034	18.8	17.8	17.8

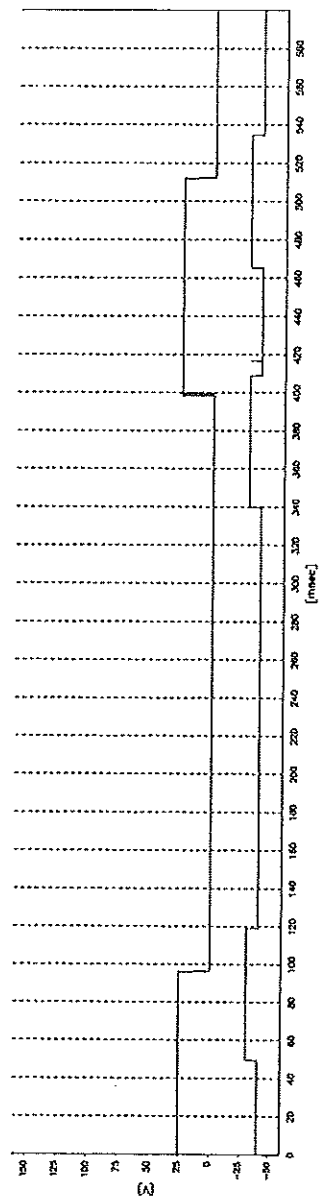
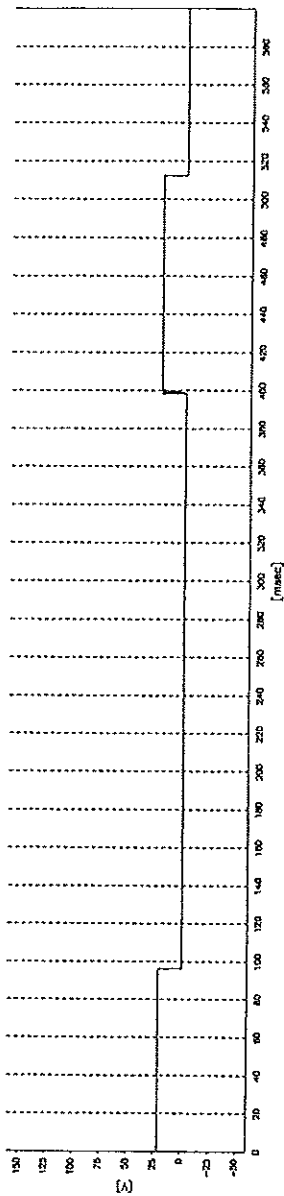
(The resistance values fulfill the requirements of STL-Guide to IEC56: 4th Edition: 1987, Amendment Slip No. 2).

Remarks:
 Resistance measurement at direct current of: 50 A

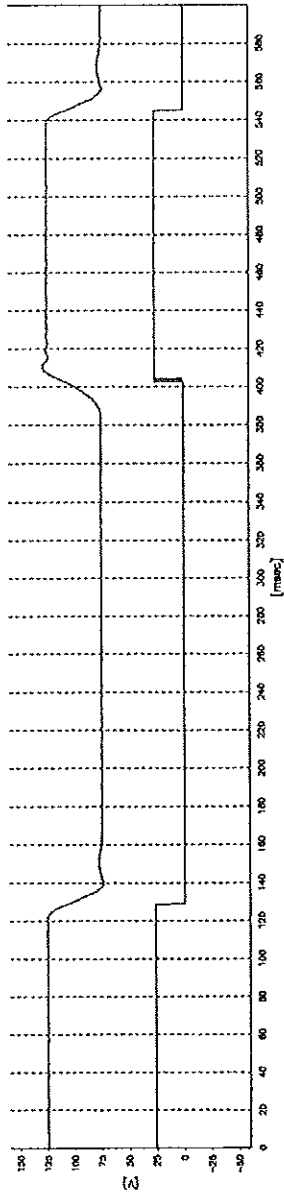
Tesi no.
PEHLA 0303Ra / 02



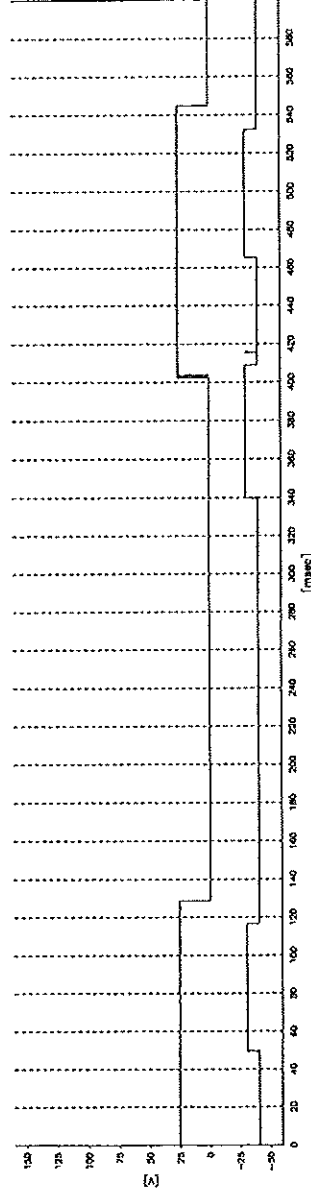
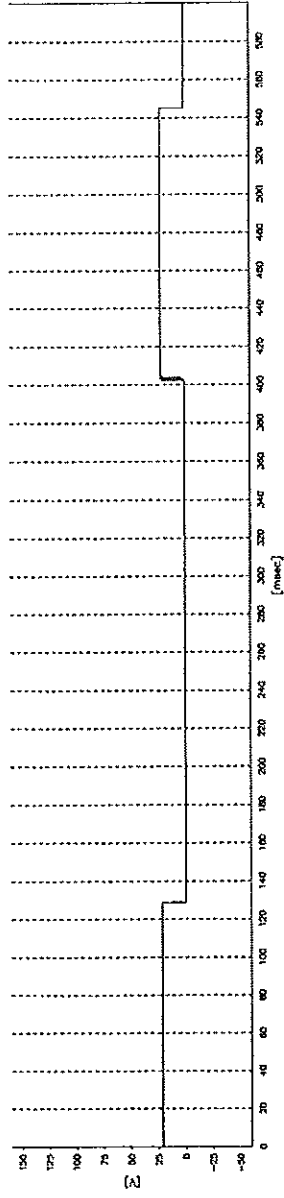
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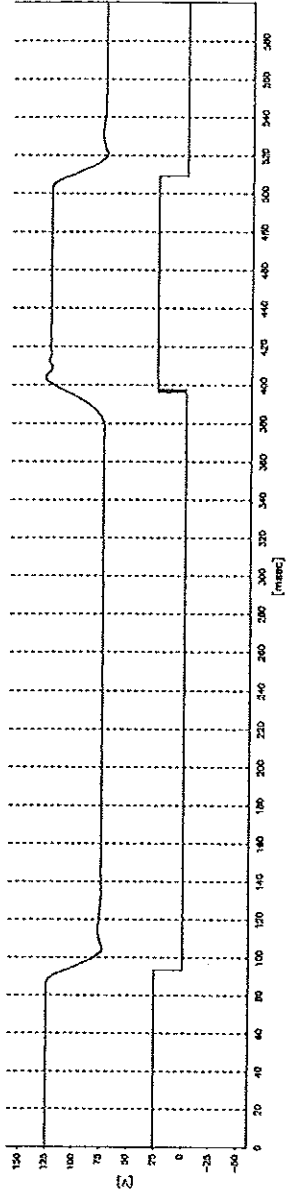
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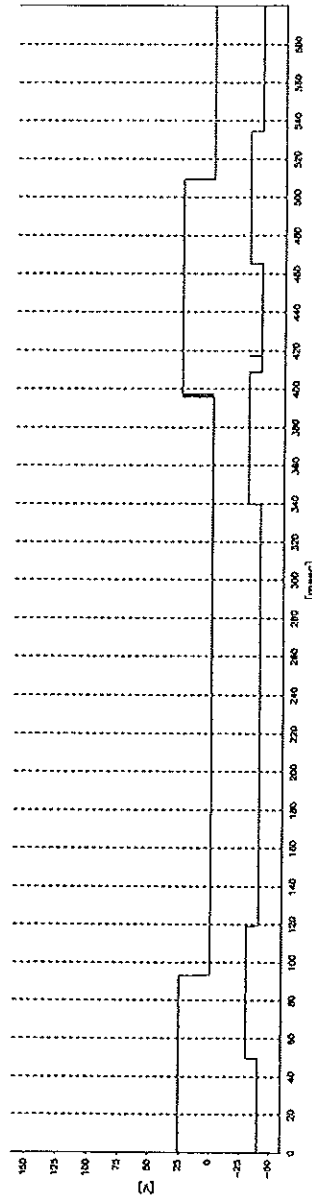
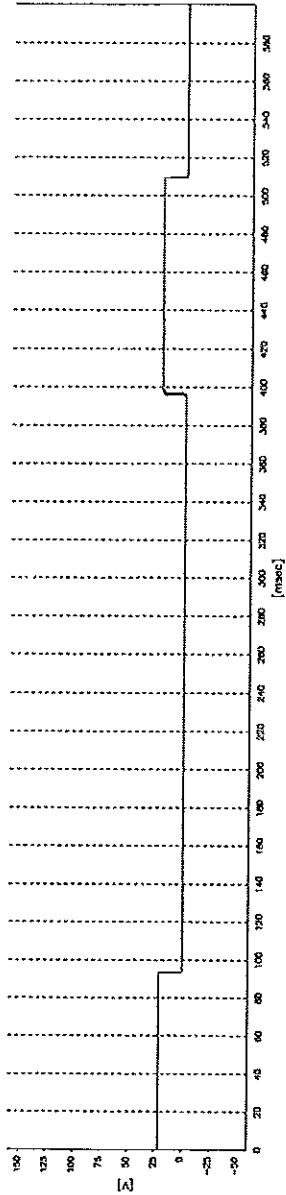
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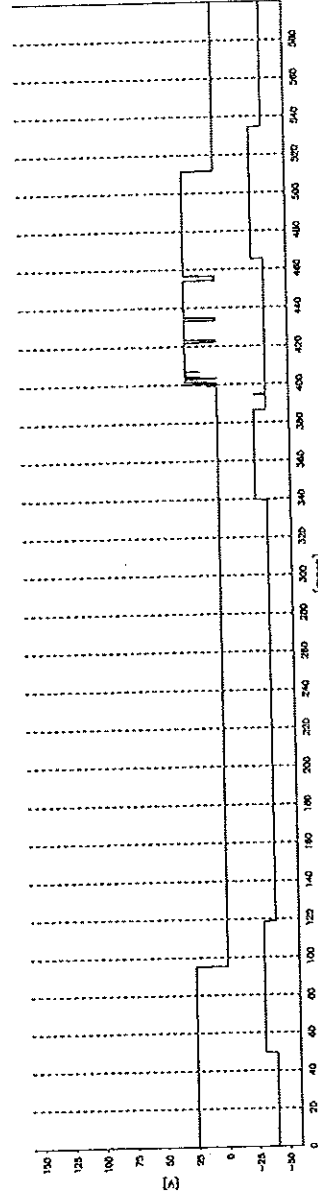
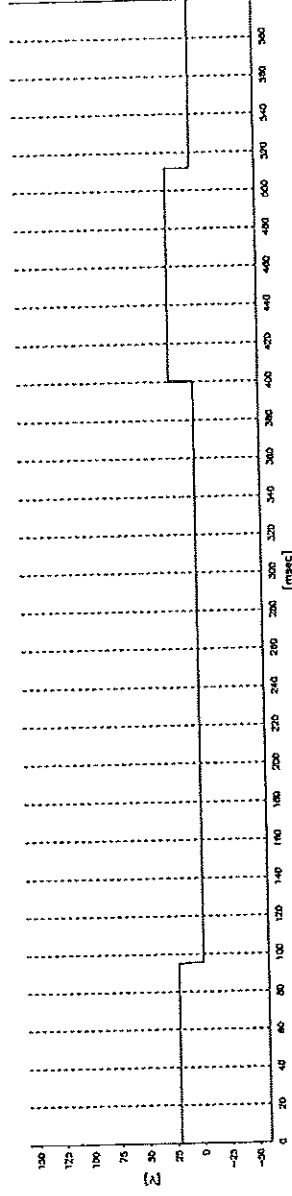
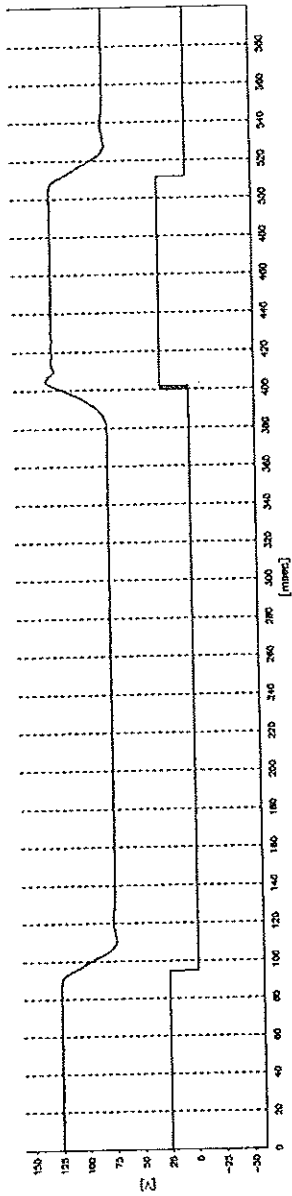
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PEHLA 0303Ra / 02B



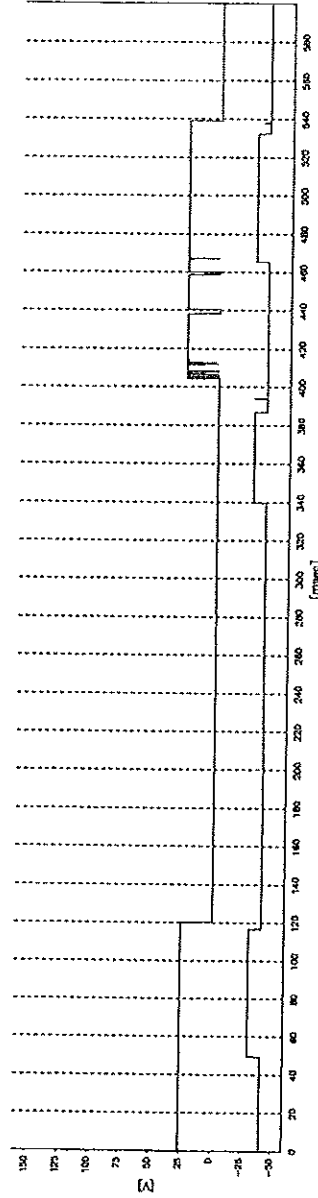
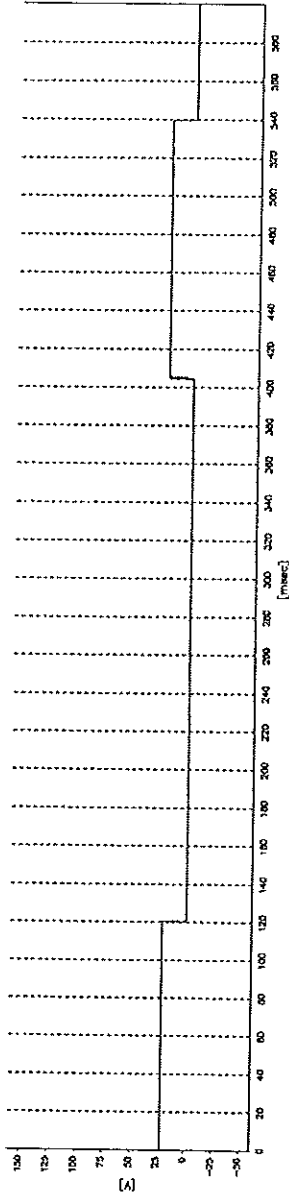
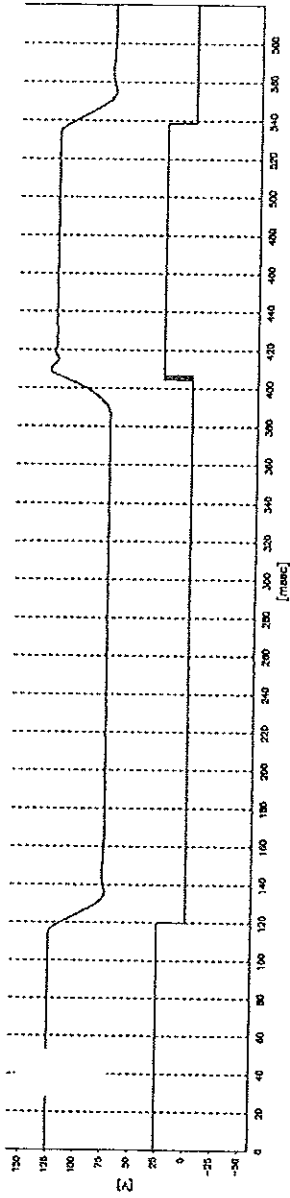
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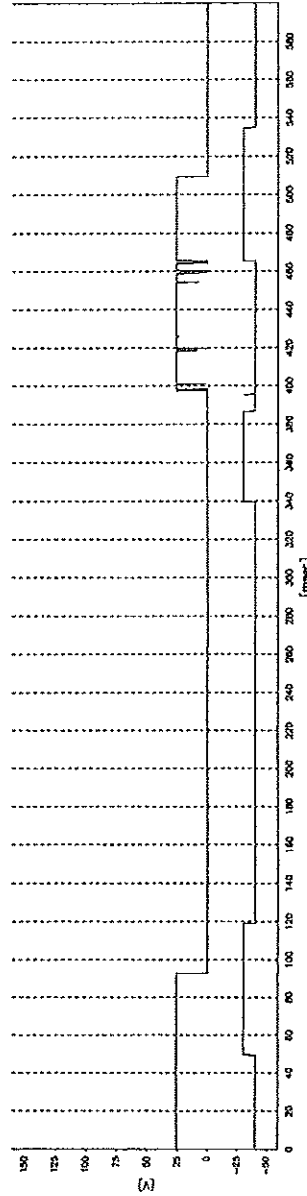
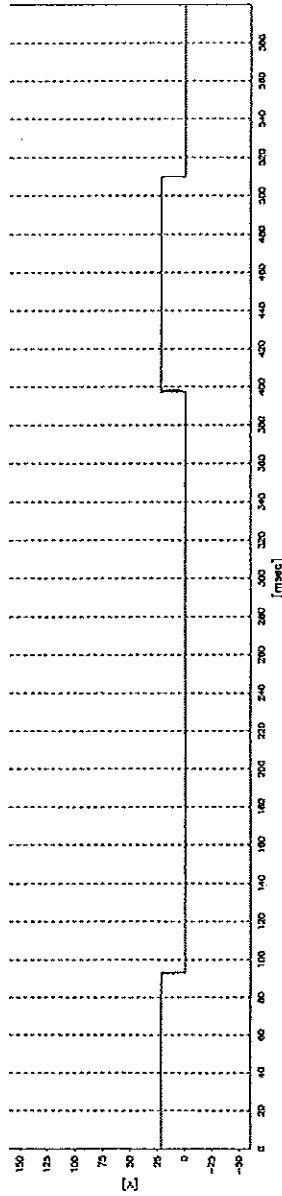
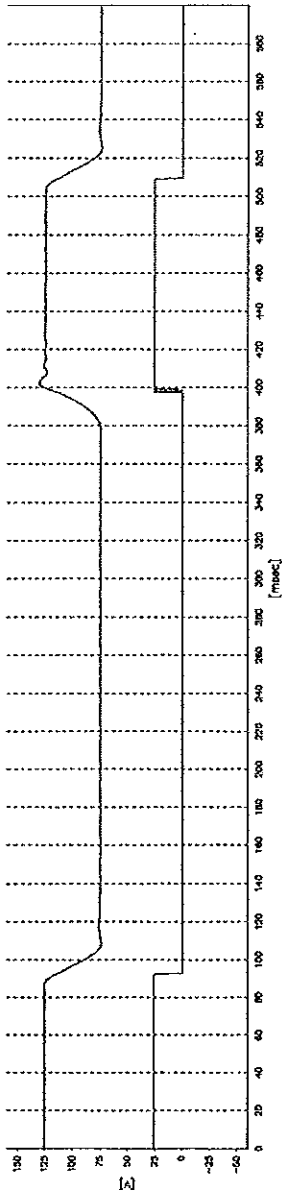
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PEHLA 0303Ra / 34



Test no.
PEHLA 0303Ra / 34A



Test no.
PEHLA 0303Ra / 034B



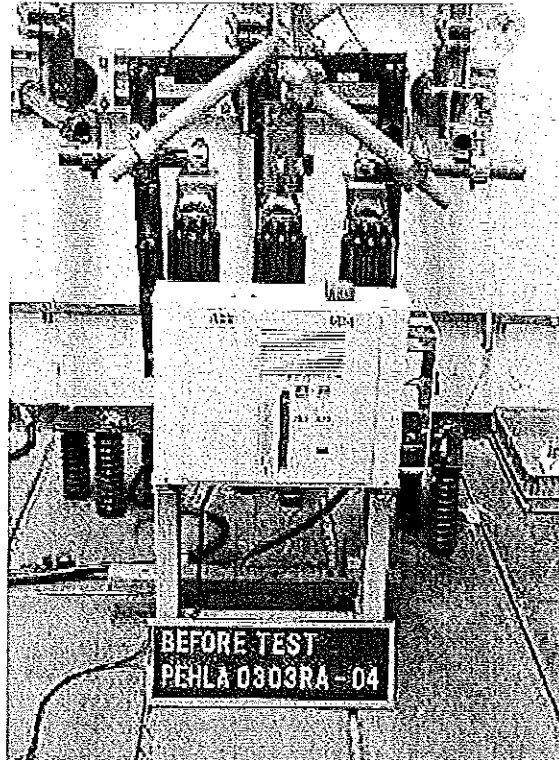


Photo No. 01
Before Test 0303Ra / 04

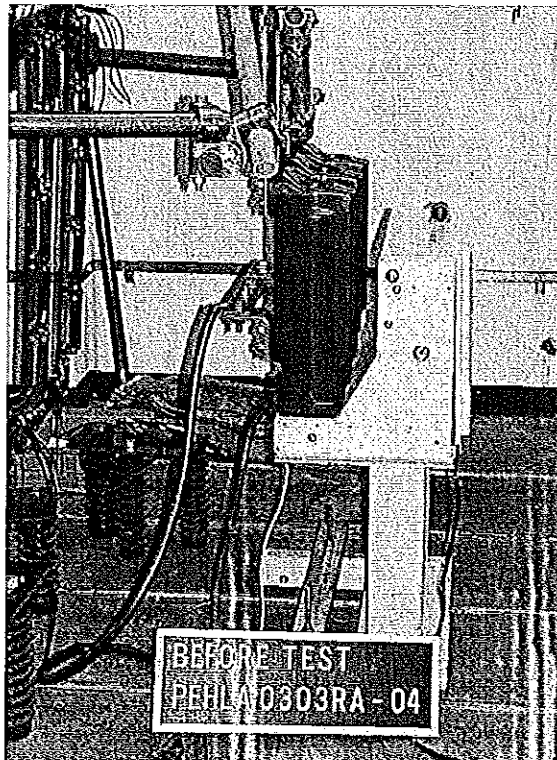


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Before Test 0303Ra / 04

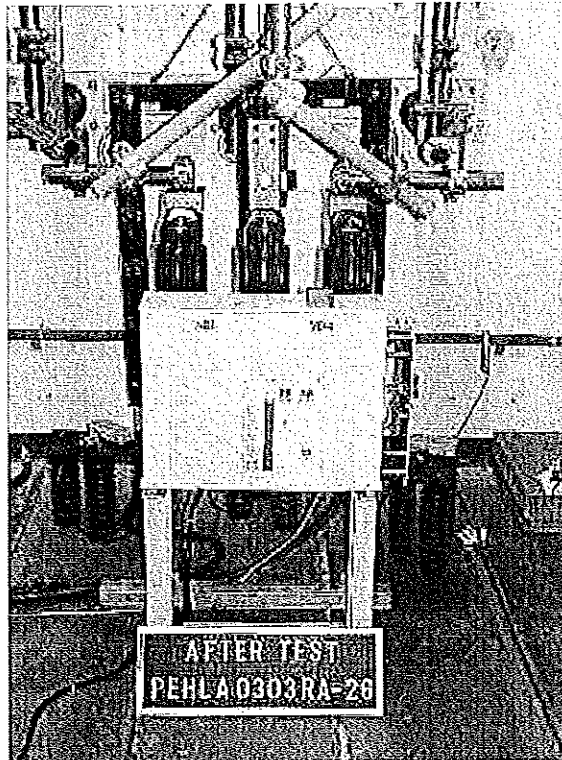


Photo No. 03
After Test 0303Ra / 26

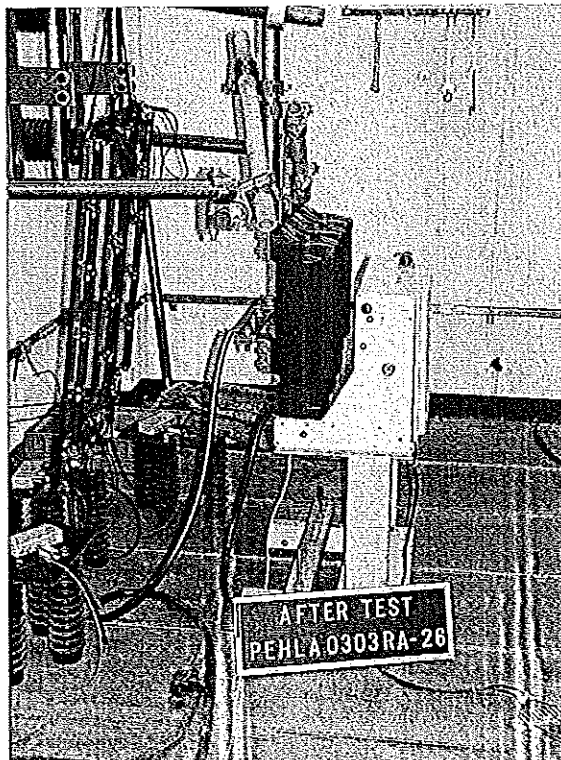


Photo No. 04
After Test 0303Ra / 26

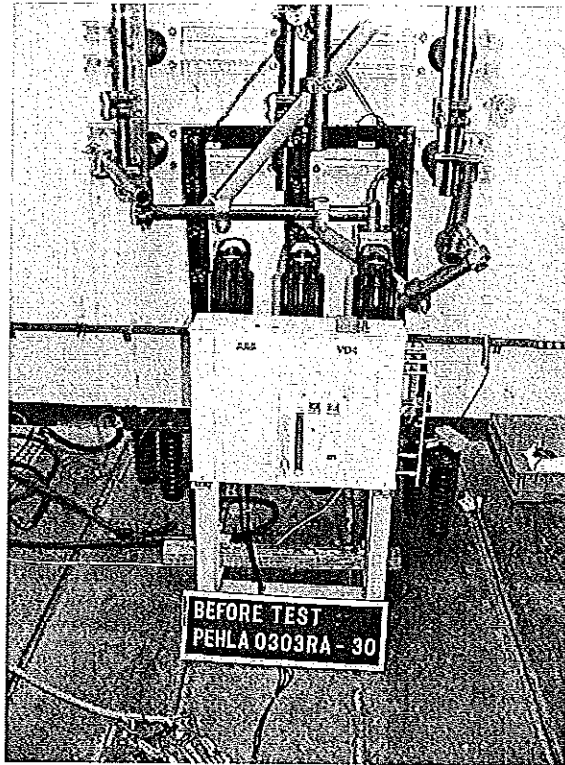


Photo No. 05
Before Test 0303Ra / 30

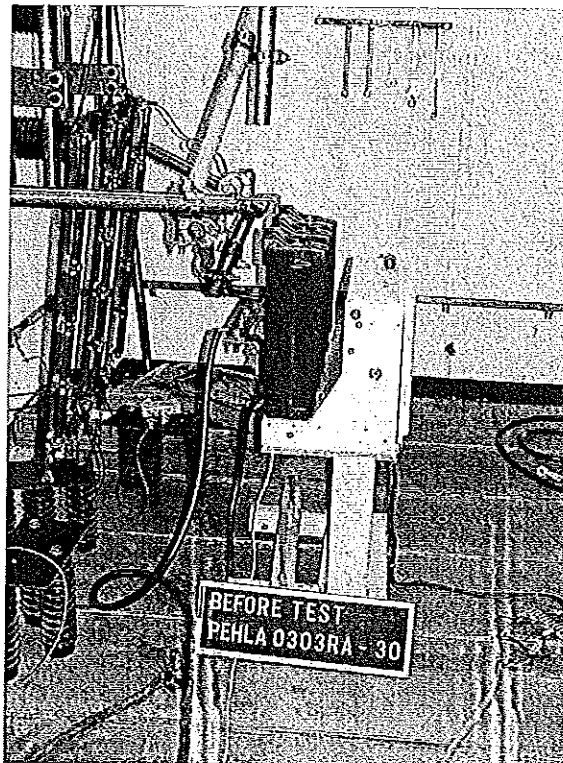


Photo No. 06
Before Test 0303Ra / 30

Remark: Photos of the test object after test 0303Ra / 34 are not available.



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TEST REPORT No. HZ 147 E 10

Sheet 1

Issued by an Accredited Laboratory
corresponding to EN 45001

Copy-No. 1e

Test Object 4-panel metal-clad air-insulated switchgear type ZS1.2 – 12 kV
consisting of

- feeder panel 2000 A with vacuum circuit-breaker type VD4P 1220-31
- feeder panel 2500 A with vacuum circuit-breaker type VD4P 1225-31
- feeder panel 1600 A with vacuum circuit-breaker type VD4P 1216-31,
- feeder panel 630 A with vacuum circuit-breaker type VD4P 1206-31

max. ambient temperature $\vartheta_{u\max} = 40\text{ }^{\circ}\text{C}$,

Rated voltage	U	12	kV
Rated normal current panel	I_n	2500 / 630	A
Rated frequency	f	50	Hz
Rated short-time withstand current	I_{th}	31.5	kA
Rated peak withstand current	I_p	80	kA
Rated duration of short-circuit current	t_{th}	3	s
Rated short-circuit breaking capacity at 12 kV	I_{sc}	31.5	kA
Max. ambient temperature	ϑ_u	40	$^{\circ}\text{C}$

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

Tests performed Three-phase temperature-rise test at the rated currents of 2500 / 630 A at a power frequency of 50 Hz.
Measuring of the resistances of the main circuit.

Test Specification IEC Standard 60694/2nd Ed./1996-5, clause 6.4 and 6.5
IEC Standard 60298/3rd Ed./1990-12, clause 6.3 and 6.4

Test Results The 4-panel ZS1.2-type arrangement passed the above mentioned tests successfully. The respective requirements are met. The test results are tabulated on sheets 23 to 28.

Test Date May 31th - June 01st, 2000

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

March 20th, 2001
Date of Issue



Gottlieb
Laboratory Manager

Smith
Test Engineer

Total Number of Sheets: 33 Sheets (Test Report)

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

ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 1

Copy-No. 0e

Test Object 4-panel metal-clad air-insulated switchgear type ZS1.2 – 12 kV consisting of

- feeder panel 2000 A with vacuum circuit-breaker type VD4P 1220-31
- feeder panel 2500 A with vacuum circuit-breaker type VD4P 1225-31
- feeder panel 1600 A with vacuum circuit-breaker type VD4P 1216-31,
- feeder panel 630 A with vacuum circuit-breaker type VD4P 1206-31

max. ambient temperature $\vartheta_{u_{max}} = 40 \text{ }^\circ\text{C}$,

Rated voltage	U	12	kV
Rated normal current panel	I_n	2500 / 630	A
Rated frequency	f	50	Hz
Rated short-time withstand current	I_{th}	31.5	kA
Rated peak withstand current	I_p	80	kA
Rated duration of short-circuit current	t_{th}	3	s
Rated short-circuit breaking capacity at 12 kV	I_{sc}	31.5	kA
Max. ambient temperature	ϑ_u	40	$^\circ\text{C}$

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

Tests performed Three-phase temperature-rise test at the rated currents of 2500 / 630 A at a power frequency of 50 Hz.
Measuring of the resistances of the main circuit.

Test Specification IEC Standard 60694/2nd Ed./1996-5, clause 6.4 and 6.5
IEC Standard 60298/3rd Ed./1990-12, clause 6.3 and 6.4

Test Results The 4-panel ZS1.2-type arrangement passed the above mentioned tests successfully. The respective requirements are met. The test results are tabulated on sheets 23 to 28.

Test Date May 31th - June 01st, 2000

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

March 20th, 2001

Date of Issue

Laboratory Manager

Test Engineer

Total Number of Sheets: 33 Sheets (Test Report)

This test report refers exclusively to the object tested.
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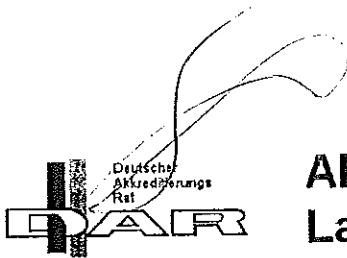
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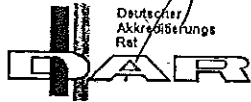


TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 2

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TEST REPORT No. HZ 147 E 10

Sheet 3

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Technical Data of Test Object

Switchgear – Feeder Panel 1

Ratings assigned by the manufacturer

Test Object: Metal-clad air-insulated switchgear panel with vacuum circuit-breaker type VD4P
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7550027/2011/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010452R0111

Rated voltage 12 kV
 Rated lightning impulse withstand voltage 75 kV
 Rated switching impulse withstand voltage - kV
 Rated power frequency withstand voltage 28 kV

Rated frequency 50 Hz

Rated normal current of busbar 2500 A
 Rated normal current of feeder 2000 A

Rated peak withstand current 80 kA
 Rated short-time withstand current 31.5 kA
 Rated duration of short-circuit 3 s

Insulating medium air / vacuum
 Rated functional pressure (abs. / 20°C) - kPa
 Minimum functional pressure (abs. / 20°C) - kPa

Permissible values for internal arc faults:

Peak current 80 kA
 Short-time current 31.5 kA
 Duration of short-circuit 1 s

Max. ambient air temperature 40 °C

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

Essential characteristics and installed devices:

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Current transformer:

Manufacturer	Type	Year of manufacture	Insulation class
WIRGES GmbH	ASS 12-20	2000	E
Voltages	Frequency	Sort-time withst. current	Peak withstand current
12/28/975 kV	50 Hz	31.5 kA / 3 s	80 kA
Serial Nos.	L1 166472 L2 167473; L3 166474		
Core 1	2000 / 5 A; 15 VA, accuracy class 1		
Core 2	2000 / 5 A; 15 VA, 5P 10		

Date of receipt of test object: 19th May 2000



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Sheet 4

Technical Data of Test Object

Switchgear – Feeder Panel 2

Ratings assigned by the manufacturer

Test Object: Metal-clad air-insulated switchgear panel with vacuum circuit-breaker type VD4P
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7550027/2012/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010452R0112

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current of busbar	2500 A
Rated normal current of feeder	2500 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Insulating medium	air / vacuum
Rated functional pressure (abs. / 20°C)	- kPa
Minimum functional pressure (abs. / 20°C)	- kPa
Permissible values for internal arc faults:	
Peak current	80 kA
Short-time current	31.5 kA
Duration of short-circuit	1 s
Max. ambient air temperature	40 °C

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

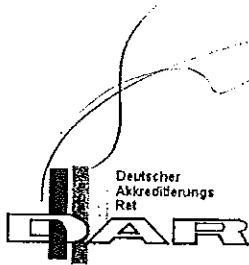
Essential characteristics and installed devices:

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Current transformer:

Manufacturer	Type	Year of manufacture	Insulation class
WIRGES GmbH	ASS 12-20	2000	E
Voltages	Frequency	Sort-time withst. current	Peak withstand current
12/28/975 kV	50 Hz	31.5 kA / 3 s	80 kA
Serial Nos.	L1 166479 L2 167480; L3 166481		
Core 1	2500 / 5 A; 15 VA, accuracy class 1		
Core 2	2500 / 5 A; 15 VA, 5P 10		

Date of receipt of test object: 19th May 2000



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Sheet 5

Technical Data of Test Object

Switchgear – Feeder Panel 3

Ratings assigned by the manufacturer

Test Object: Metal-clad air-insulated switchgear panel with vacuum circuit-breaker type VD4P
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7550027/2007/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010452R0103

Rated voltage 12 kV
 Rated lightning impulse withstand voltage 75 kV
 Rated switching impulse withstand voltage - kV
 Rated power frequency withstand voltage 28 kV

Rated frequency 50 Hz

Rated normal current of busbar 2500 A
 Rated normal current of feeder 1600 A

Rated peak withstand current 80 kA
 Rated short-time withstand current 31.5 kA
 Rated duration of short-circuit 3 s

Insulating medium air / vacuum
 Rated functional pressure (abs. / 20°C) - kPa
 Minimum functional pressure (abs. / 20°C) - kPa

Permissible values for internal arc faults:

Peak current 80 kA
 Short-time current 31.5 kA
 Duration of short-circuit 1 s

Max. ambient air temperature 40 °C

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

Essential characteristics and installed devices:

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Current transformer:

Manufacturer	Type	Year of manufacture	Insulation class
WIRGES GmbH	ASS 12-20	2000	E
Voltages	Frequency	Sort-time withst. current	Peak withstand current
12/28/975 kV	50 Hz	31.5 kA / 3 s	80 kA
Serial Nos.	L1 166458 L2 167459; L3 166460		
Core 1	1600 / 5 A; 15 VA, accuracy class 1		
Core 2	1600 / 5 A; 15 VA, 5P 10		

Date of receipt of test object: 19th May 2000



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ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10

Sheet 6

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Technical Data of Test Object

Switchgear – Feeder Panel 4

Ratings assigned by the manufacturer

Test Object: Metal-clad air-insulated switchgear panel with vacuum circuit-breaker type VD4P
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7550027/2003/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010450R0101

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current of busbar	2500 A
Rated normal current of feeder	630 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Insulating medium	air / vacuum
Rated functional pressure (abs. / 20°C)	- kPa
Minimum functional pressure (abs. / 20°C)	- kPa
Permissible values for internal arc faults:	
Peak current	80 kA
Short-time current	31.5 kA
Duration of short-circuit	1 s
Max. ambient air temperature	40 °C

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

Essential characteristics and installed devices:

In order to generate the power losses of the 630 A current transformers a heat power of 5 W was feeded to each c.t.. The heating resistors were adhered on the surface of each c.t.

The power loss of the controlgear in the low voltage compartment was simulated by a heating resistor of 60 W.

Current transformer:

Manufacturer	Type	Year of manufacture	Insulation class
ABB EJF Czech Republic	TPU 43.11	2000	E
Voltages	Frequency	Sort-time withst. current	Peak withstand current
12/28/95 kV	50 Hz	31.5 kA / 3 s	80 kA
Serial Nos.	L1 957055 L2 957056; L3 957057		
Core 1	1250 / 5 A; 15 VA, accuracy class 0.5		
Core 2	1250 / 5 A; 15 VA, accuracy class 5P		

Date of receipt of test object: 19th May 2000



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DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10

Sheet 7

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Technical Data of Test Object

Switching Device – Circuit-Breaker in Feeder Panel 1

Ratings assigned by the manufacturer

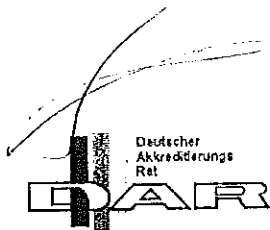
Test Object: Vacuum circuit-breaker (draw-out unit)
Type: VD4P 1220-31
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7007054/4001/00 **Year of manufacture:** 2000
Drawing No.: GCE7000162R1173 (circuit-breaker)
Vacuum interrupter: Type: VG4-S L1: No. 1115, L2: No. 1116, L3: No. 1117
Drawing No.: GCE7005745R0122 (pole part)

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current	2000 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	31.5 kA
D.C. component	30 %
Rated short-circuit making current	80 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-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Rated pressure / Minimal pressure (20 °C)	- ka
Insulating medium	
Rated pressure / Minimal pressure (20 °C)	- kPa
Driving mechanism	
Rated pressure / Minimal pressure (20 °C)	- kPa
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	220 V-DC
Rated voltage of closing coil	220 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:

The breaker was switched off and in disconnecting position during the test.

Date of receipt of test object: 19th May 2000



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

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TEST REPORT No. HZ 147 E 10

Sheet 8

Issued by an Accredited Laboratory
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Technical Data of Test Object

Switching Device – Circuit-Breaker in Feeder 2 Ratings assigned by the manufacturer

Test Object: Vacuum circuit-breaker (draw-out unit)
Type: VD4P 1225-31
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7007054/4005/00 **Year of manufacture:** 2000
Drawing No.: GCE7000162R01178 (circuit-breaker) P=275
Vacuum interrupter: Type: VG4-S L1: No. 1172, L2: No. 1173, L3: No. 1110
Drawing No.: GCE7005745R0122 (pole part)

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current	2500 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	31.5 kA
D.C. component	30 %
Rated short-circuit making current	80 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-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Rated pressure / Minimal pressure (20 °C)	- kPa
Insulating medium	- kPa
Rated pressure / Minimal pressure (20 °C)	- kPa
Driving mechanism	- kPa
Rated pressure / Minimal pressure (20 °C)	- kPa
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	220 V-DC
Rated voltage of closing coil	220 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:

-

Date of receipt of test object: 19th May 2000



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DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10

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Sheet 9

Technical Data of Test Object

Switching Device – Circuit-Breaker in Feeder Panel 3 Ratings assigned by the manufacturer

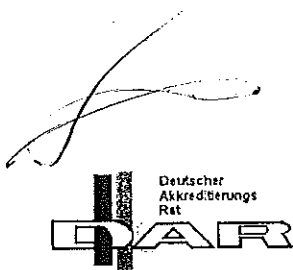
Test Object: Vacuum circuit-breaker (draw-out unit)
Type: VD4P 1216-31
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen, Germany
Serial-No.: 7007054/4004/00 **Year of manufacture:** 2000
Drawing No.: GCE7000162R1172 (circuit-breaker) P=210
Vacuum interrupter: Type: VG4-S L1: No. 1126, L2: No. 1109, L3: No. 1125
Drawing No.: GCE7005745R0122 (pole part)

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current	1600 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	31.5 kA
D.C. component	30 %
Rated short-circuit making current	80 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-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Rated pressure / Minimal pressure (20 °C)	- kPa
Insulating medium	
Rated pressure / Minimal pressure (20 °C)	- kPa
Driving mechanism	
Rated pressure / Minimal pressure (20 °C)	- kPa
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	220 V-DC
Rated voltage of closing coil	220 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:

The breaker was switched off and in disconnecting position during the test.

Date of receipt of test object: 19th May 2000



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

ABB Calor Emag Laboratories



TEST REPORT No. HZ 147 E 10

Sheet 10

Issued by an Accredited Laboratory
corresponding to EN 45001

Technical Data of Test Object

Switching Device – Circuit-Breaker in Feeder Panel 4

Ratings assigned by the manufacturer

Test Object: Vacuum circuit-breaker (draw-out unit)
Type: VD4P 1206-31
Manufacturer: ABB Calor Emag Mittelspannung GmbH, Ratingen, Germany
Serial-No.: 7006082/4002/99 **Year of manufacture:** 1999
Drawing No.: GCE7002291R0150 (circuit-breaker) P=150
Vacuum Interrupter: Type VG4-S L1: No. 55830, L2: No. 55838, L3: No. 55829
Drawing No.: GCE7003979R0104 (pole part)

Rated voltage	12 kV
Rated lightning impulse withstand voltage	75 kV
Rated switching impulse withstand voltage	- kV
Rated power frequency withstand voltage	28 kV
Rated frequency	50 Hz
Rated normal current	630 A
Rated peak withstand current	80 kA
Rated short-time withstand current	31.5 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	31.5 kA
D.C. component	30 %
Rated short-circuit making current	80 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-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Rated pressure / Minimal pressure (20 °C)	- kPa
Insulating medium	
Rated pressure / Minimal pressure (20 °C)	- kPa
Driving mechanism	
Rated pressure / Minimal pressure (20 °C)	- kPa
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	220 V-DC
Rated voltage of closing coil	220 V-DC
Rated supply voltage	220 V-DC
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:

-

Date of receipt of test object: 19th May 2000

List of Drawings

The manufacturer has guaranteed, that the equipment submitted for test has been manufactured in full accordance with the following drawings. These drawings have been stamped and signed by the manufacturer representative. The drawings has not been checked in detail by the testing authority. The drawings are kept

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

Drawing no.	Description
GCE8010452R0112 index 00	Switchgear 12 kV, PW1000
GCE8010450R0101 index 00	Cubicle 12 kV, ≤ 1000 A; T. 650
GCE7000162R1178 index 00	Einschub für ZS1.2, VD4-P
GCE7002291R0150 index 00	Draw-out VD4P 12/17.5 kV, ZS1.2
GCE7005745R0102 index 05	Pole compl. VM1 12 kV, 2000 A
GCE7003979R0104 index 05	Pole compl. VM1 12 kV, 1250 A





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

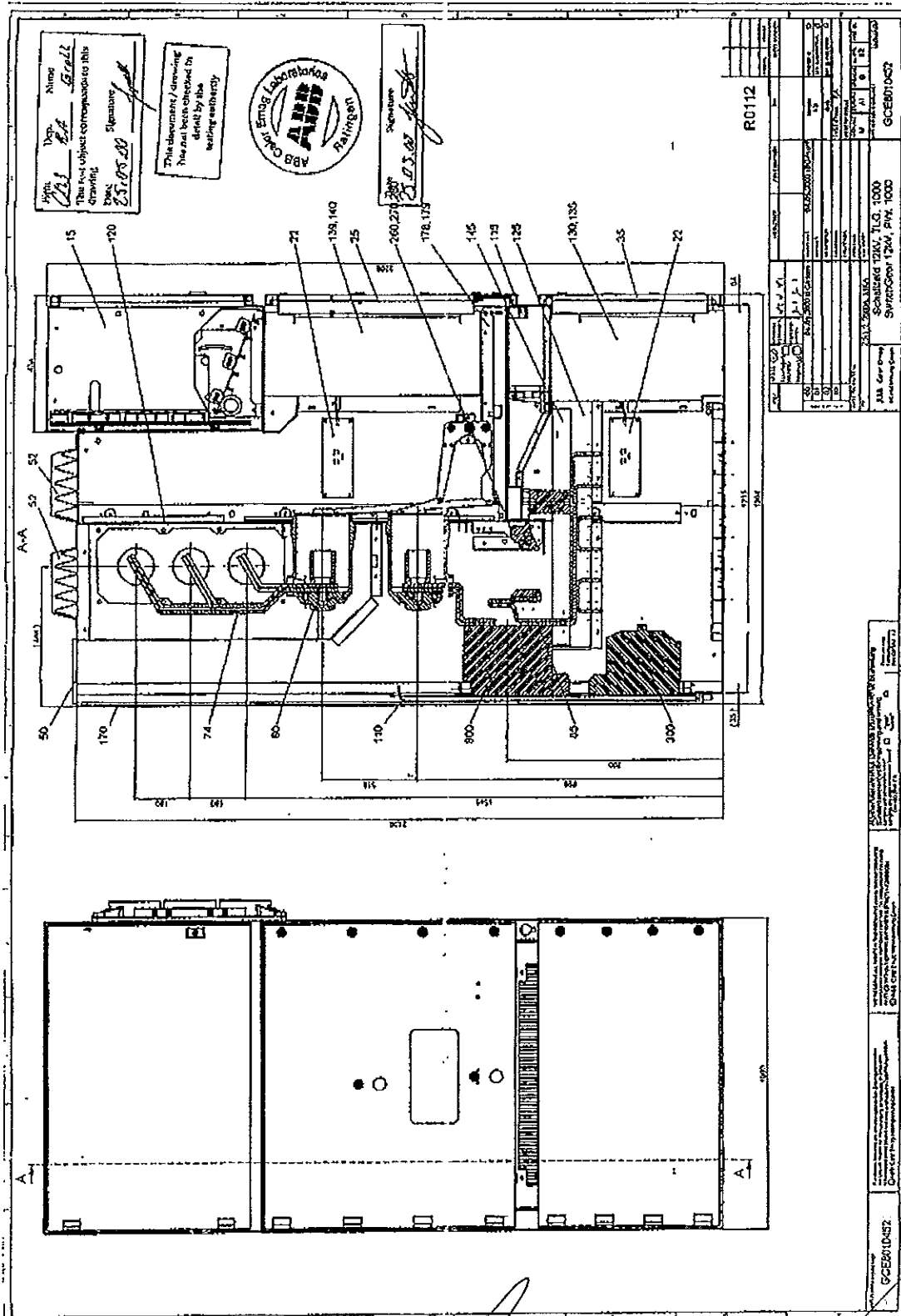
ABB Calor Emag Laboratories



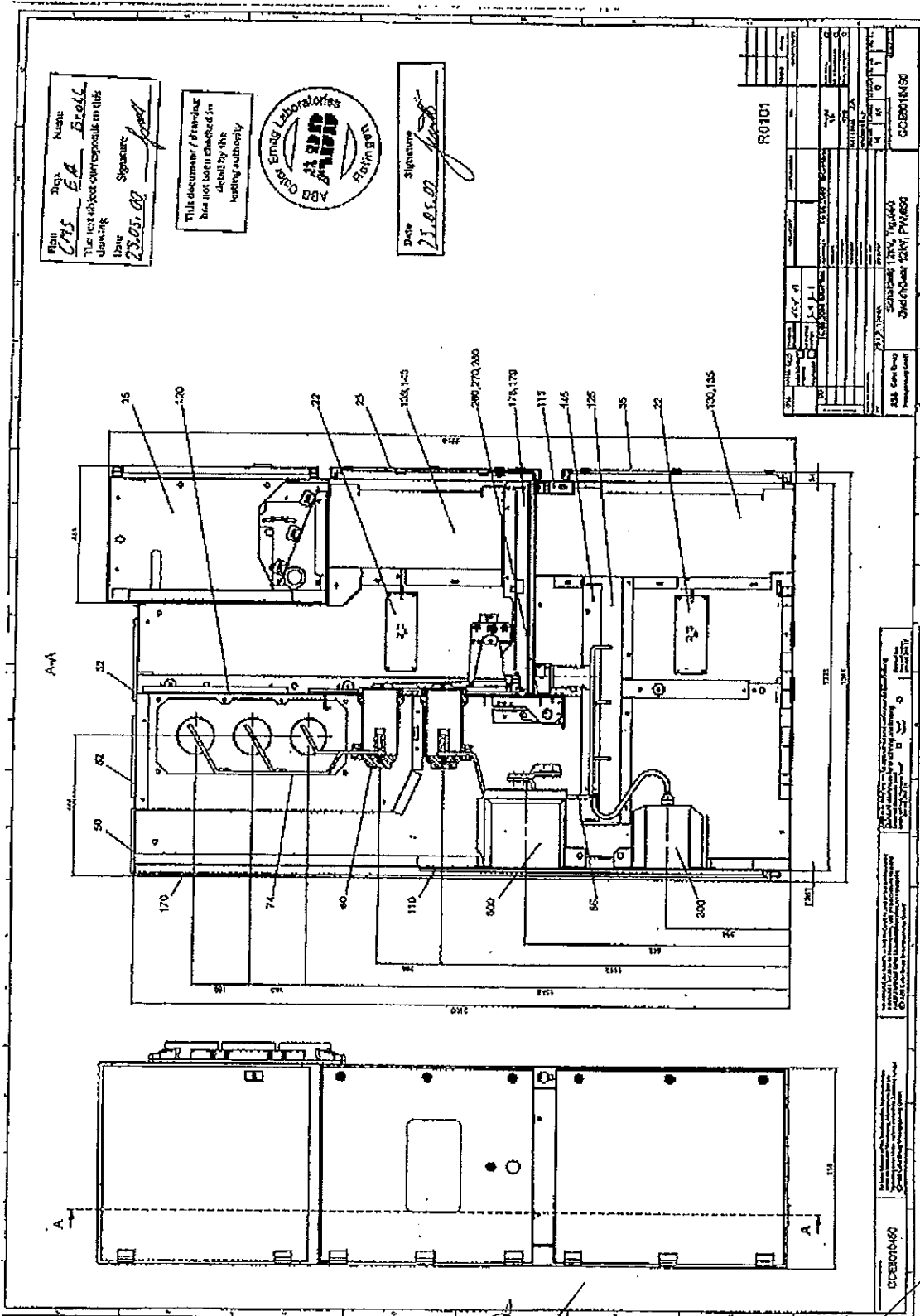
TEST REPORT No. HZ 147 E 10
Issued by an Accredited Laboratory
corresponding to EN 45001

Sheet 12

Feeder Panel (Panel 2)



Feeder Panel (Panel 4)



Rev: 01
Name: EA
This document corresponds to this drawing
Date: 23.05.07
Signature: [Signature]

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

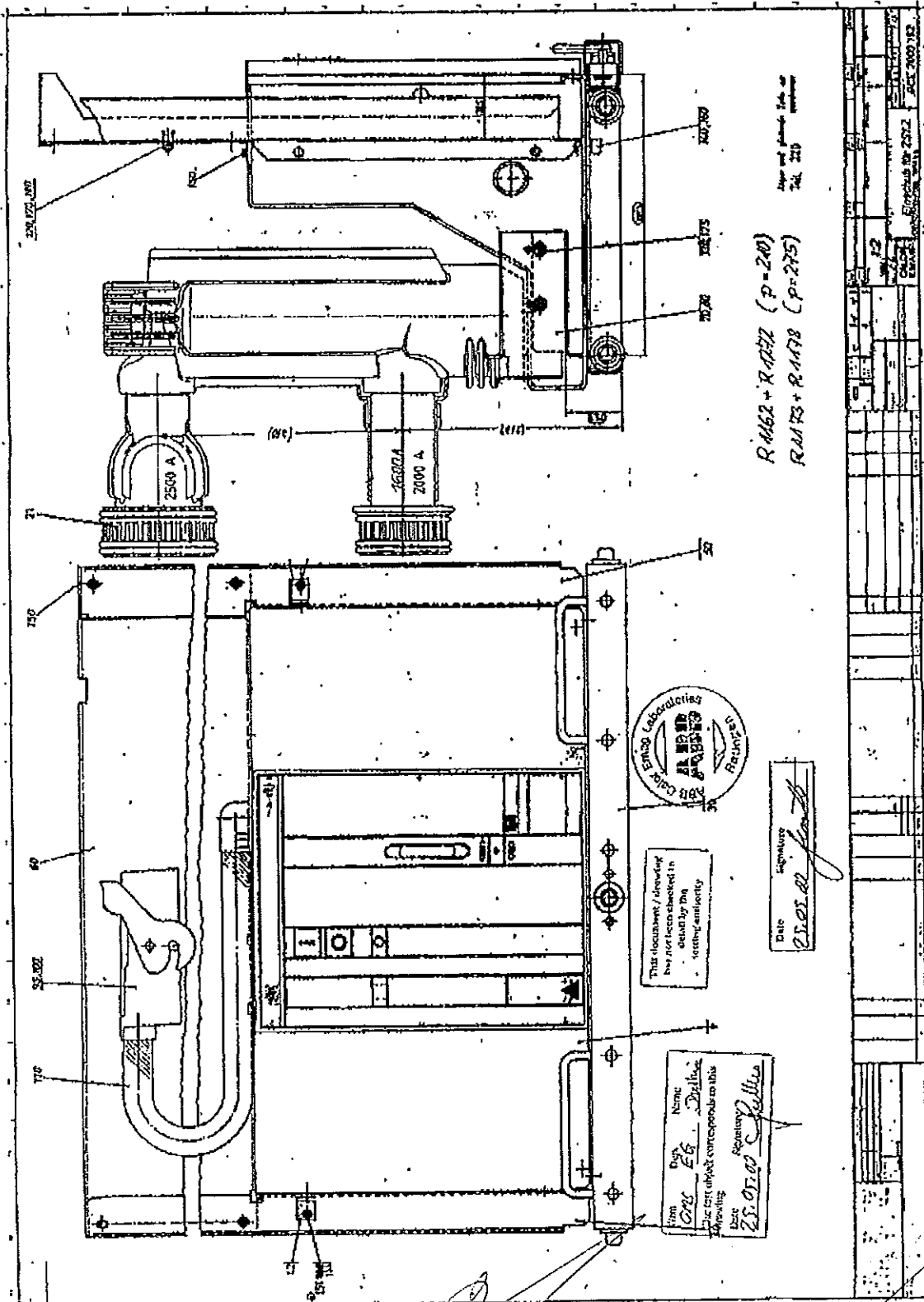


Date: 23.05.07
Signature: [Signature]

R0101	
Customer	ABB Calor Emag
Product	Feeder Panel 12kV PM659
Order No.	20040000000000000000
Project No.	20040000000000000000
Revision	01
Scale	1:1
Material	Steel
Color	Grey
Weight	100 kg
Volume	100 m³
Manufacturer	ABB Calor Emag
Manufacturer Code	00000000000000000000
Manufacturer Name	ABB Calor Emag
Manufacturer Address	ABB Calor Emag
Manufacturer Phone	ABB Calor Emag
Manufacturer Fax	ABB Calor Emag
Manufacturer Email	ABB Calor Emag
Manufacturer Website	ABB Calor Emag
Manufacturer Logo	ABB Calor Emag
Manufacturer Code	00000000000000000000
Manufacturer Name	ABB Calor Emag
Manufacturer Address	ABB Calor Emag
Manufacturer Phone	ABB Calor Emag
Manufacturer Fax	ABB Calor Emag
Manufacturer Email	ABB Calor Emag
Manufacturer Website	ABB Calor Emag
Manufacturer Logo	ABB Calor Emag

ABB Calor Emag
Feeder Panel 12kV PM659
R0101
01

Circuit-Breaker (Panel 2)





Reg.-Nr.

DAT-P-032/93

ABB Calor Emag Laboratories

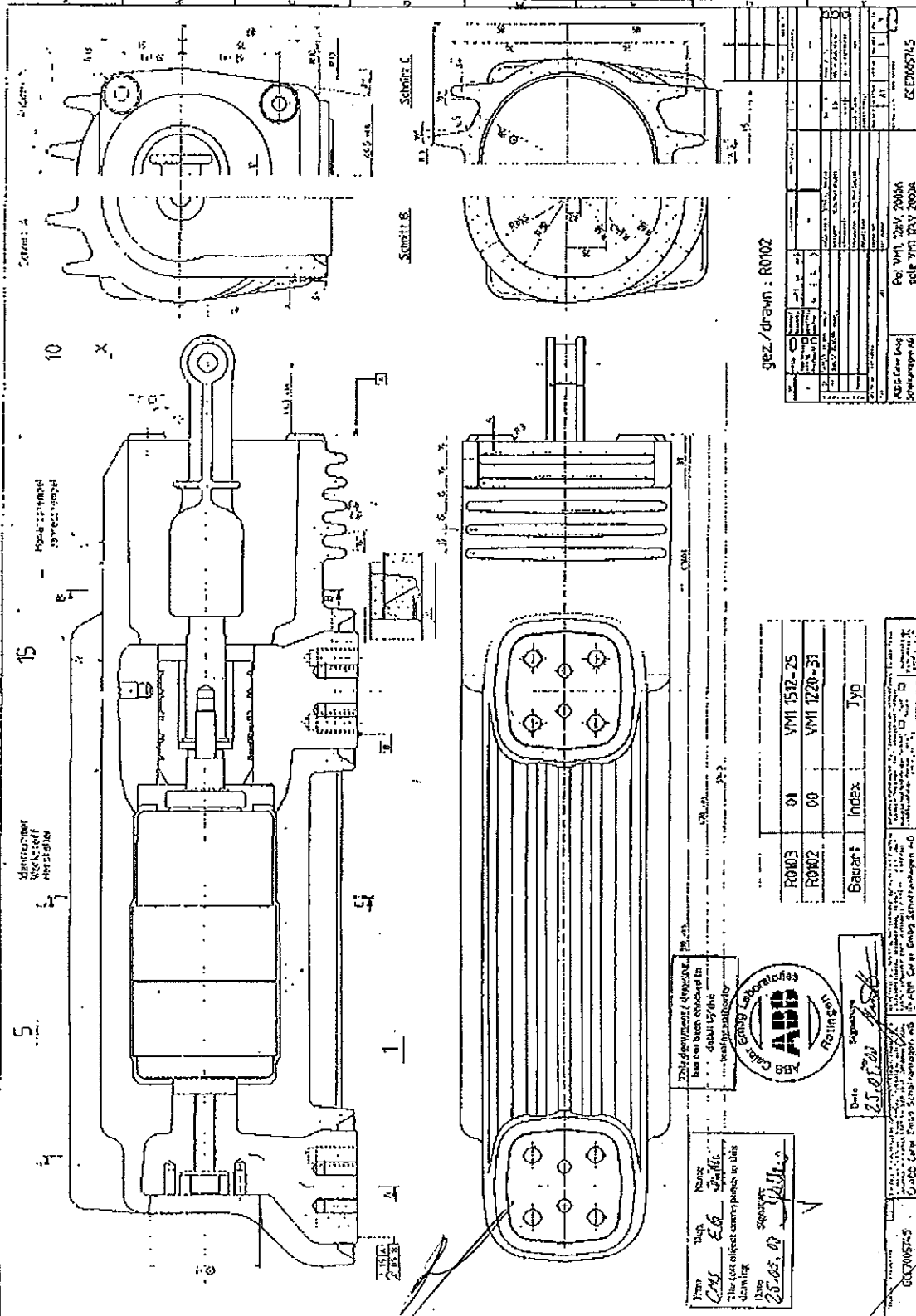


TEST REPORT No. HZ 147 E 10

Sheet 16

Issued by an Accredited Laboratory corresponding to EN 45001

Pole Part (Circuit Breaker Panel 2)



gez./drawn: R0102

R0103	01	VMI 1512-25		
R0102	00	VMI 1220-31		
Bauart	Index	Typ		



This document / This document has not been checked in detail by the test laboratory.
 Datum: 20.05.07
 Zeichner: [Signature]
 Unterschrift: [Signature]

Date: 25.05.07
 Signature: [Signature]

ABB Calor Emag Spezialwerkzeuge AG		Pole VMI 12xV 200A pole VMI 12xV 200A		CE17052745	
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C.

C.

ABB Trasmissione & Distribuzione S.p.A.

Unità operativa Sace T.M.S.

Via Friuli 4
I-24044 Dalmine (BG)
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Fax: 0039.035.395874
E-mail: sacetms.tipm@it.abb.com
Internet: [//www.abb.com](http://www.abb.com)



TYPE TEST DOCUMENTATION No. 100087_C Page 1/1

Apparatus: Metal-clad switchgear type ZS1 rel 1.2 with vacuum circuit-breaker type VD4/P 12.25.31 p=210

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

Performances:

Rated voltage :	12	kV
Rated lightning impulse withstand voltage :	75	kV
Rated power-frequency withstand voltage :	28	kV
Rated frequency :	50-60	Hz
Rated normal current (busbar) :	2500	A
Rated normal current (tee-off) :	2500	A
Rated peak withstand current :	63	kA
Rated short-time withstand current :	31.5	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	0016 Ra	PEHLA High-power Laboratories
Temperature-rise test	IEC 60298 Subclause 6.3/6.4	HZ 147 E10	PEHLA High-power Laboratories
Short-time and peak withstand current test	IEC 60298 Subclause 6.5	MP— A4/010735	CESI Laboratories
Mechanical operation and interlock test	IEC 60298 Subclause 6.102	0020 Ra	PEHLA High-power Laboratories
Internal arc test	IEC 60298 Annex AA	HZ 146 L02	Calor Emag Laboratories
Mechanical operation test	IEC 62271-100 subclause 6.101.2	0317_2 Ra	PEHLA High-power Laboratories
Making and breaking capacity test	IEC 62271-100 subclause 6.106	0303 Ra	PEHLA High-power Laboratories

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 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:
04/07/05

Development Dept.
G.M. Cravanzola

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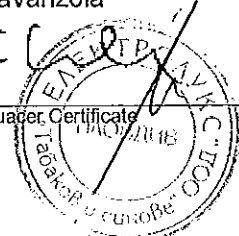
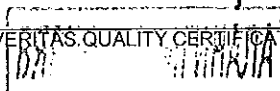
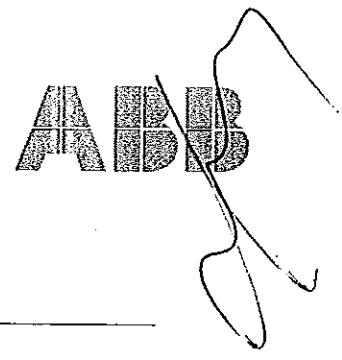


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 Fax: 0039.035.395874
 E-mail: sacetms.tipm@it.abb.com
 Internet: //www.abb.com

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 Subclausole 6.1	0045 Ra	PEHLA High-power Laboratories
Temperature-rise test	IEC 60298 Subclausole 6.3/6.4	HZ 236 E06	Calor Emag Laboratories
Short-time and peak withstand current test	IEC 60298 Subclausole 6.5	HZ 235 F01	Calor Emag Laboratories
Mechanical operation and interlock test	IEC 60298 Subclausole 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

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 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
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Date of issue:
 04/09/16

Development Dept.
 G.M. Cravanzola

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ПРОТОКОЛ ЗА ТИПОВИ ИЗПИТАНИЯ No. 100089_С 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 блокировки	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 АБВ 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 АБВ 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

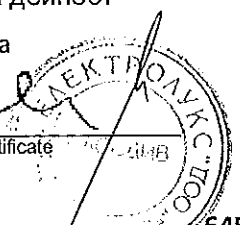
Дата на издаване:
04/09/16

Отдел за Развойна дейност

Г.М. Граванзола

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ПРОМО С ОПРИГИНАЛА



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

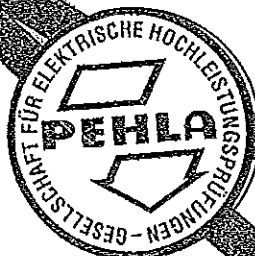
Tests performed:

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

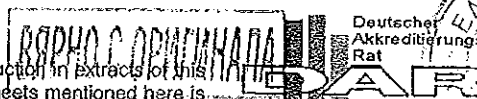


[Signature]
Technical Committee

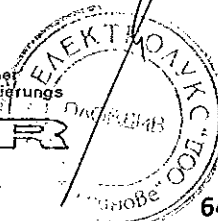
Mannheim, 24th February 2003

The test results relate only to the items tested.

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DAT-P-032/93



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.

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 co-operation of the testing organisations with the further full members ASTA (GB), CESI (I), ESEF (F), KEMA (NL), SATS (N, S, AIR) 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
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

ИЗДАНО С ОПРАВИХАТА

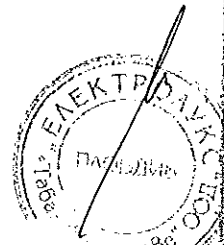


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ВЯРНО С ОРИГИНАЛА



List of Test Participants

Representatives of the Test Committee:

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

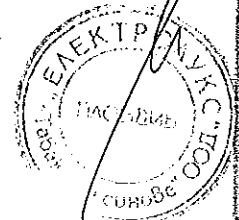
Test Operator:

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 SACET.M.S. S.p.A., Italy

ВЯРНО С ОРИГИНАЛА



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

ВЯРКО С ОПРИГНАЛА



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.

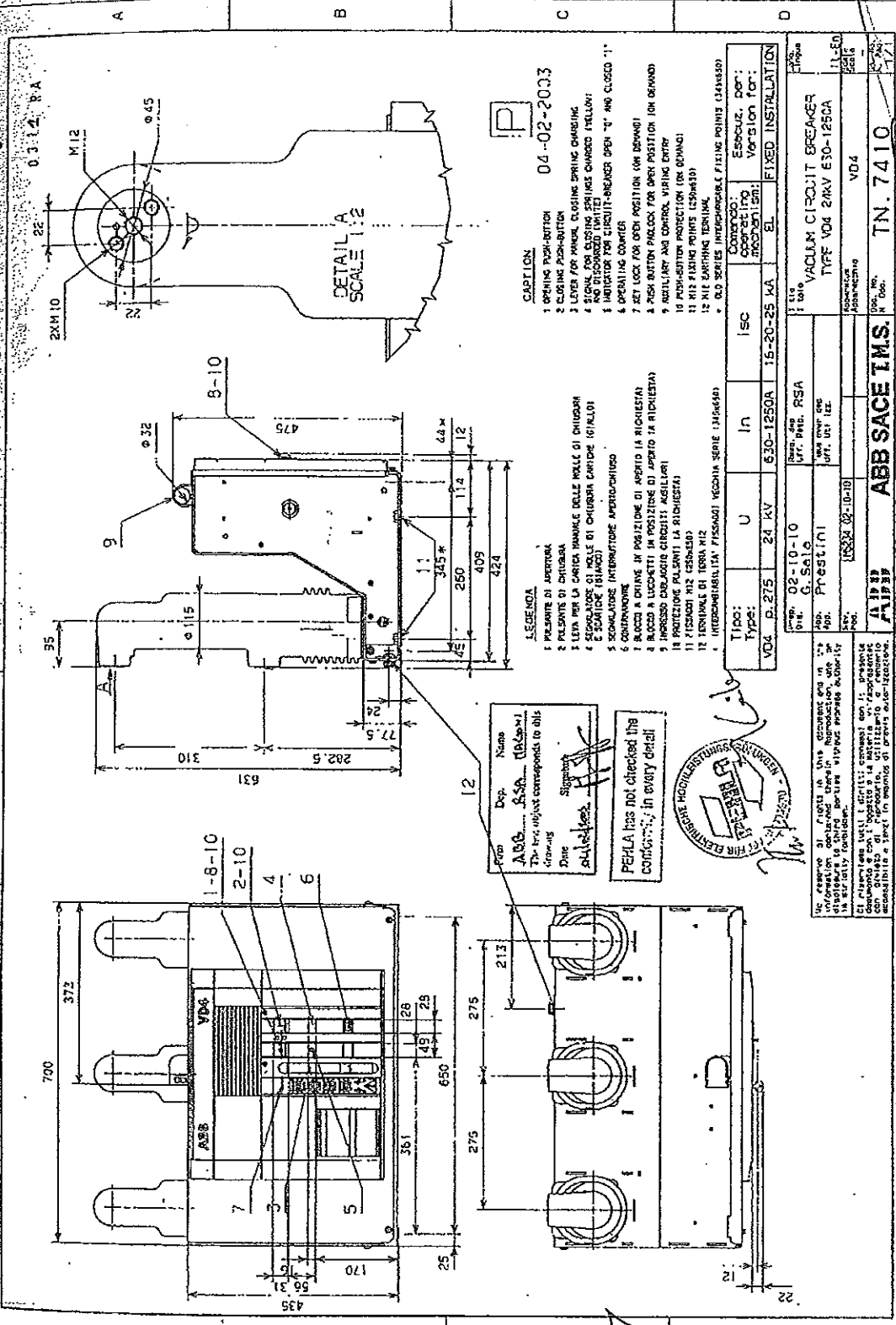
The drawings contained in this document are identical with the checked, stamped and signed drawings.

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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ВЯРНО С ОПРИМНАТА





CAPTION
04-02-2033

- 1 OPENING PUSH-BUTTON
- 2 CLOSING PUSH-BUTTON
- 3 LEVER FOR MANUAL CLOSING SPRING CHARGING
- 4 SIGNAL FOR CLOSING SPRING CHARGED (YELLOW)
- 5 INDICATOR FOR CIRCUIT-BREAKER OPEN "O" AND CLOSED "1"
- 6 OPERATING COILS
- 7 SET LOCK FOR OPEN POSITION (ON DEMAND)
- 8 LOCK DETENT PULLER FOR OPEN POSITION (ON DEMAND)
- 9 REGULATORY AND CONTROL WIRING ENTRY
- 10 PUSH-BUTTON PROTECTOR (ON DEMAND)
- 11 RIZ FILING POINTS (Z504430)
- 12 RIZ EXHAUSTING TERMINAL
- 13 OLD SERIES INTERCHANGEABLE FILING POINTS (Z504430)

- 1 PRELIMINARE DI APERTURA
- 2 PRELIMINARE DI CHIUSURA
- 3 LEVA PER LA CARICA MANUALE DELLE MOLLE DI CHIUSURA
- 4 SEGNALE DI CARICA MANUALE DELLE MOLLE DI CHIUSURA CARICATA (GIALLO)
- 5 SEGNALORE INTERRUZIONE APERTO/CHIUSO
- 6 COINVOLGENTE
- 7 BLOCCA A CHIAVE IN POSIZIONE DI APERTO (A RICHIESTA)
- 8 BLOCCA A CHIAVE IN POSIZIONE DI CHIUSO (A RICHIESTA)
- 9 INGRESSO CAVI PER I CIRCUITI DI CONTROLLO
- 10 PULSANTE PROTETTORE (A RICHIESTA)
- 11 PUNTI DI FILETTATURA PER I RIZ
- 12 TERMINALE PER L'ESHAUSTIONE
- 13 INTERCAMBIABILI PER I RIZ (SERIE ANTICA)

ABB SACE TMS
The first signpost corresponds to this drawing
Date: 12/11/83
Signature: [Handwritten]

PEHLA has not checked the conformity in every detail



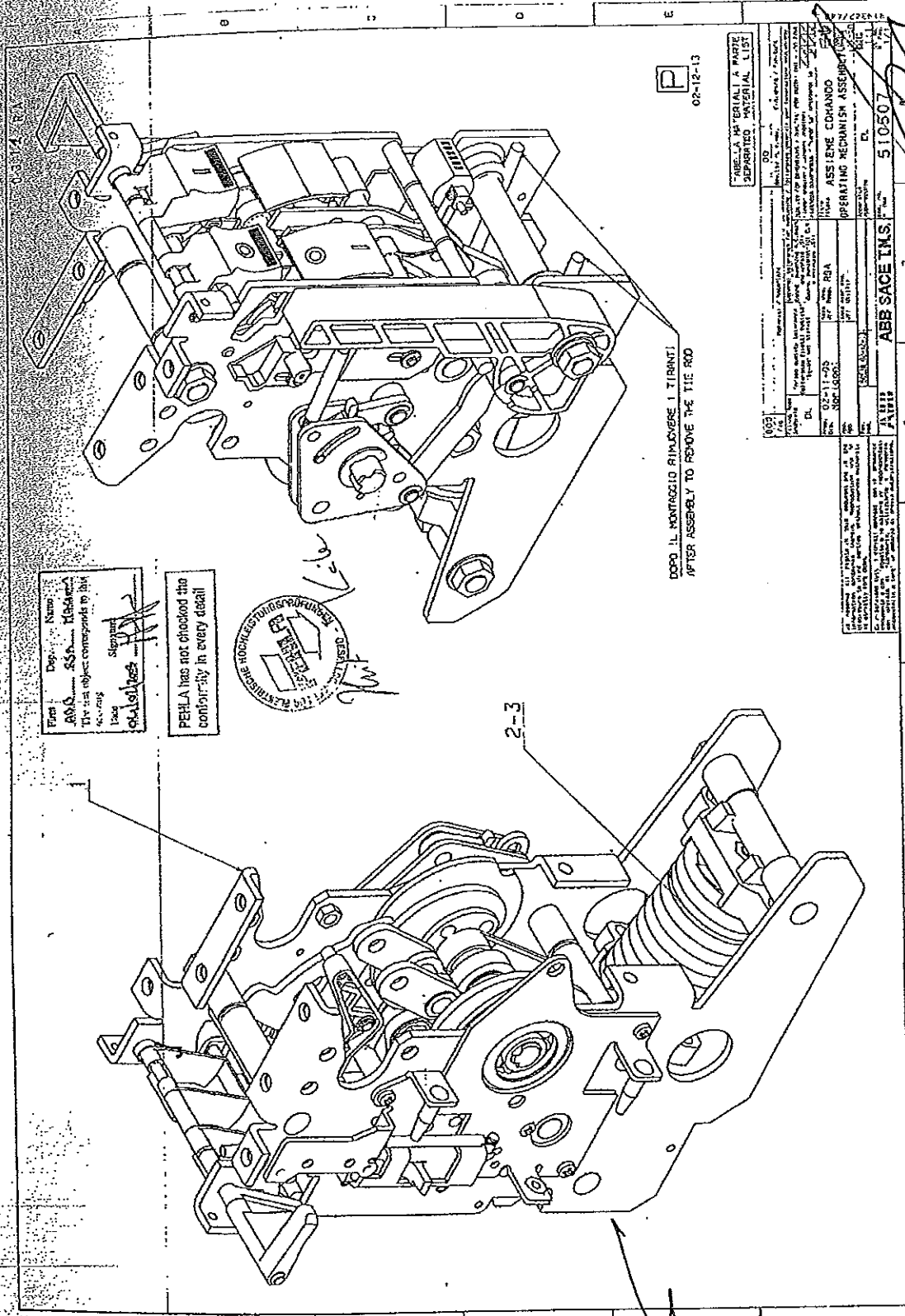
Contract No.	ESC 02-10-10	ISC	15-20-25 KA	EL	FIXED INSTALLATION
Ordering Institution	ABB SACE	U	24 KV	630-1250A	15-20-25 KA
Version for:	V04	In	24 KV	630-1250A	15-20-25 KA
Executed by:	G. Sale	U	24 KV	630-1250A	15-20-25 KA
Checked by:	Prostini	In	24 KV	630-1250A	15-20-25 KA
Approved by:	[Signature]	In	24 KV	630-1250A	15-20-25 KA
Scale:	1:1	In	24 KV	630-1250A	15-20-25 KA
Material:	ABB SACE TMS	In	24 KV	630-1250A	15-20-25 KA
Accessories:	V04	In	24 KV	630-1250A	15-20-25 KA
Drawn by:	G. Sale	In	24 KV	630-1250A	15-20-25 KA
Checked by:	Prostini	In	24 KV	630-1250A	15-20-25 KA
Approved by:	[Signature]	In	24 KV	630-1250A	15-20-25 KA
Scale:	1:1	In	24 KV	630-1250A	15-20-25 KA
Material:	ABB SACE TMS	In	24 KV	630-1250A	15-20-25 KA
Accessories:	V04	In	24 KV	630-1250A	15-20-25 KA

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ВРЪЧНО С ОПРИНАЖАТА



Report No.: 0311 Ra



Firm: ABB Name: ABB
 Design: ABB Title: ABB
 The test subject corresponds to this drawing.
 Date: 06/10/2005 Signature: [Signature]

PEHLA has not checked the conformity in every detail



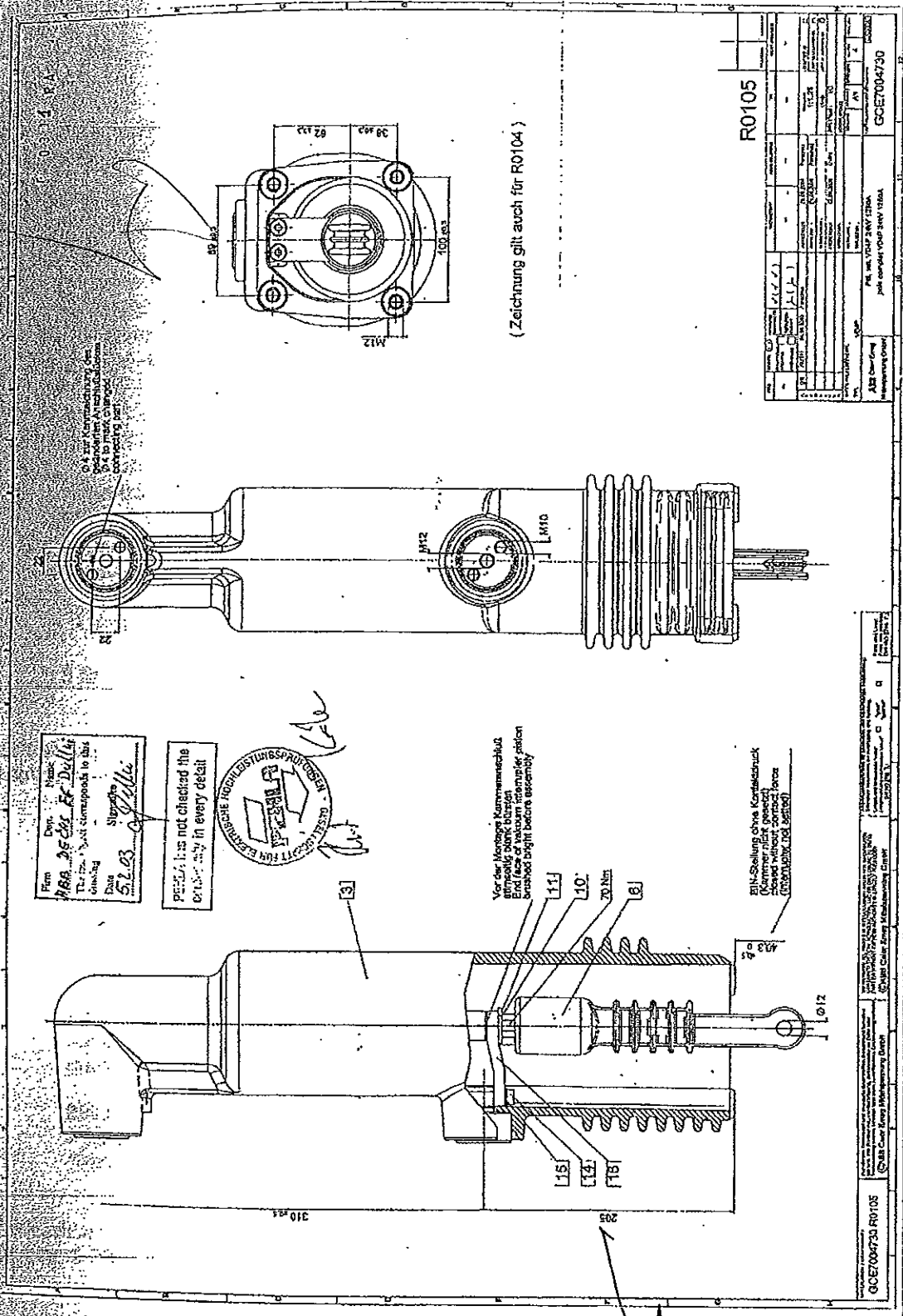
Dopo il montaggio rimovere il tirante!
After assembly to remove the tie rod

P 02-12-13

BELLA SP. S.p.A. - Via ... DEPARTAMENTO: ...	
0031 02-11-025 277 80111	ASSIEME COORDINATO OPERATING MECHANISM ASSEMBLY
510507	ABB SACE I.N.S.

ВЕРНО С ОРИГИНАЛА





Rev. 01
 Date: 05.12.03
 Drawn: M. B. Decker
 Checked: S. L. B. (Signature)
 The drawing corresponds to this drawing.

PEHLA has not checked this drawing in every detail

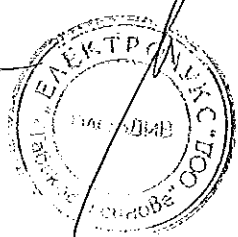


Vor der Montage Kammer evakuieren
 End face of vacuum interrupter piston
 brushed bright before assembly

Ein-Stellung ohne Kontaktstück
 (Kammer nicht evakuiert)
 Adjusted without contact force
 (EVACUATION NOT SET)

Drawing No.		R0105	
Drawing Title		Vakuumschaltapparat	
Drawing Scale		1:1	
Drawing Date		05.12.03	
Drawing Author		M. B. Decker	
Drawing Checker		S. L. B.	
Drawing Approver		[Signature]	
Drawing No.		GCE7004730	
Drawing Title		Vakuumschaltapparat	
Drawing Scale		1:1	
Drawing Date		05.12.03	
Drawing Author		M. B. Decker	
Drawing Checker		S. L. B.	
Drawing Approver		[Signature]	
Drawing No.		GCE7004730	
Drawing Title		Vakuumschaltapparat	
Drawing Scale		1:1	
Drawing Date		05.12.03	
Drawing Author		M. B. Decker	
Drawing Checker		S. L. B.	
Drawing Approver		[Signature]	

ВЕРНО С ОПИСАНИЕМ



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

*) 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.

ВЫПОЛНО С ОПИШУВАНА



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
$U = 1.1 \times U_a$ $= 242 \text{ V DC}$	2.59	2.54	2.53	2.53	2.50	1.00	0.99	0.99	0.98	0.97	242	240	240	237	234

ВСТАНОВКА С ОПИШУВАНА



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	1.24	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

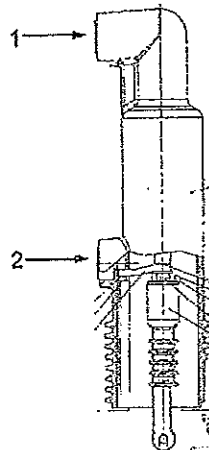
h) Duration of opening and closing command impulse:

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

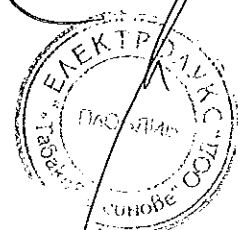
Duration of command impulse at	Shunt-release ON YC					Shunt-release OFF YO1				
	[ms]					[ms]				
at minimum supply voltage [ms]	74.6	75.0	74.7	74.7	74.7	80.7	80.1	80.4	84.9	80.4
at rated supply voltage [ms]	70.5	69.6	69.3	69.3	69.3	54.9	54.9	54.9	54.9	54.9
at maximum supply voltage [ms]	67.2	67.2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

k) Resistance of the main conductors:

Measuring points:



ВЯРНО С ОРГИНАЛА



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 $U = 1.0 \times U_a$

	V_{01}		V_c
L2	1.18	1.35	0.97

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

ВРЪНО С ОРМЪННАТА

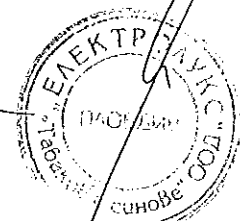
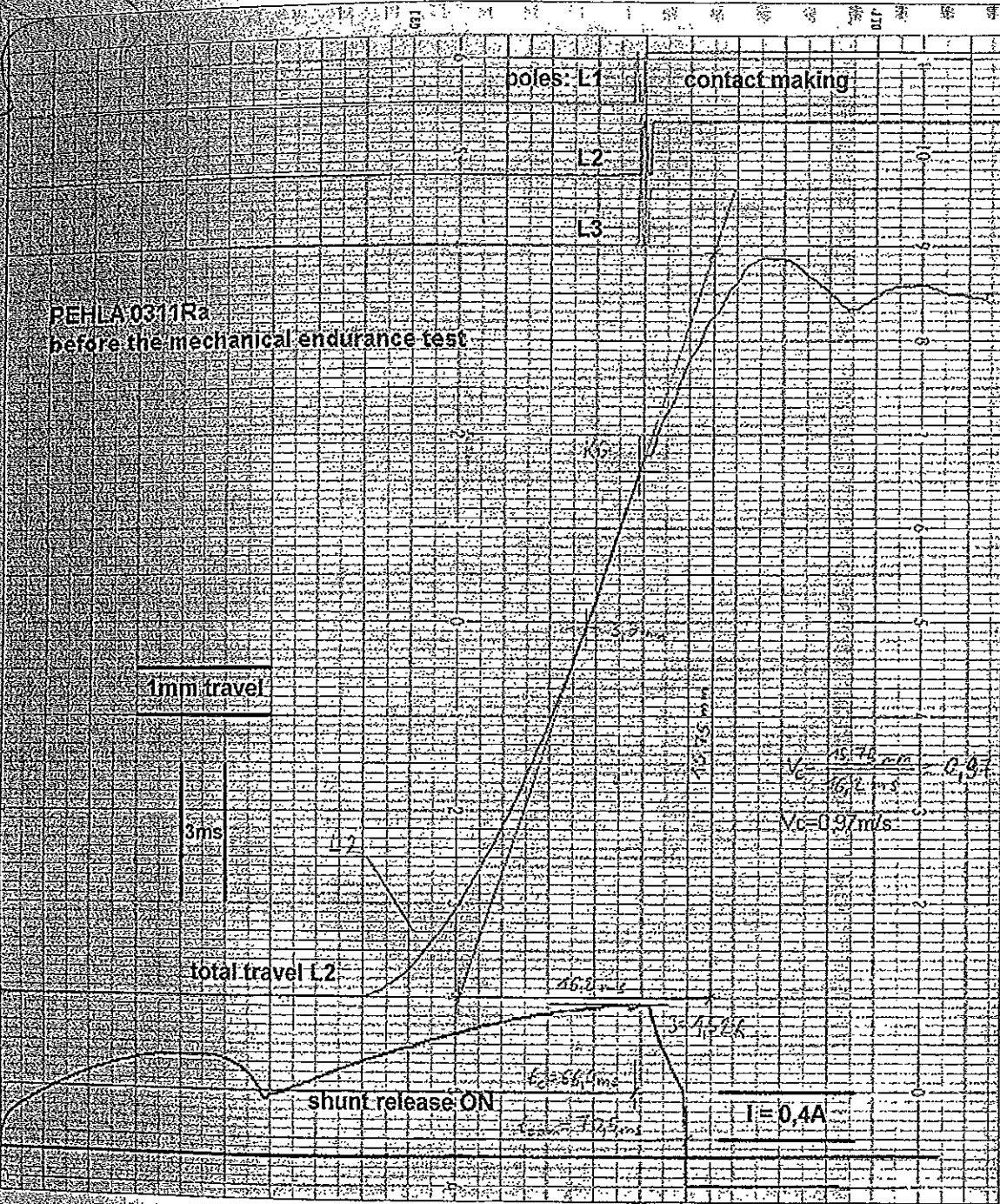


Diagram 1.1: Measurement of the operating speed before the mechanical endurance test



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

ВЯРНО С ОПРИМНАТА

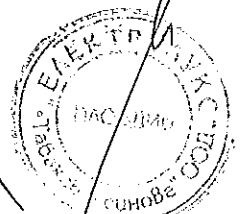
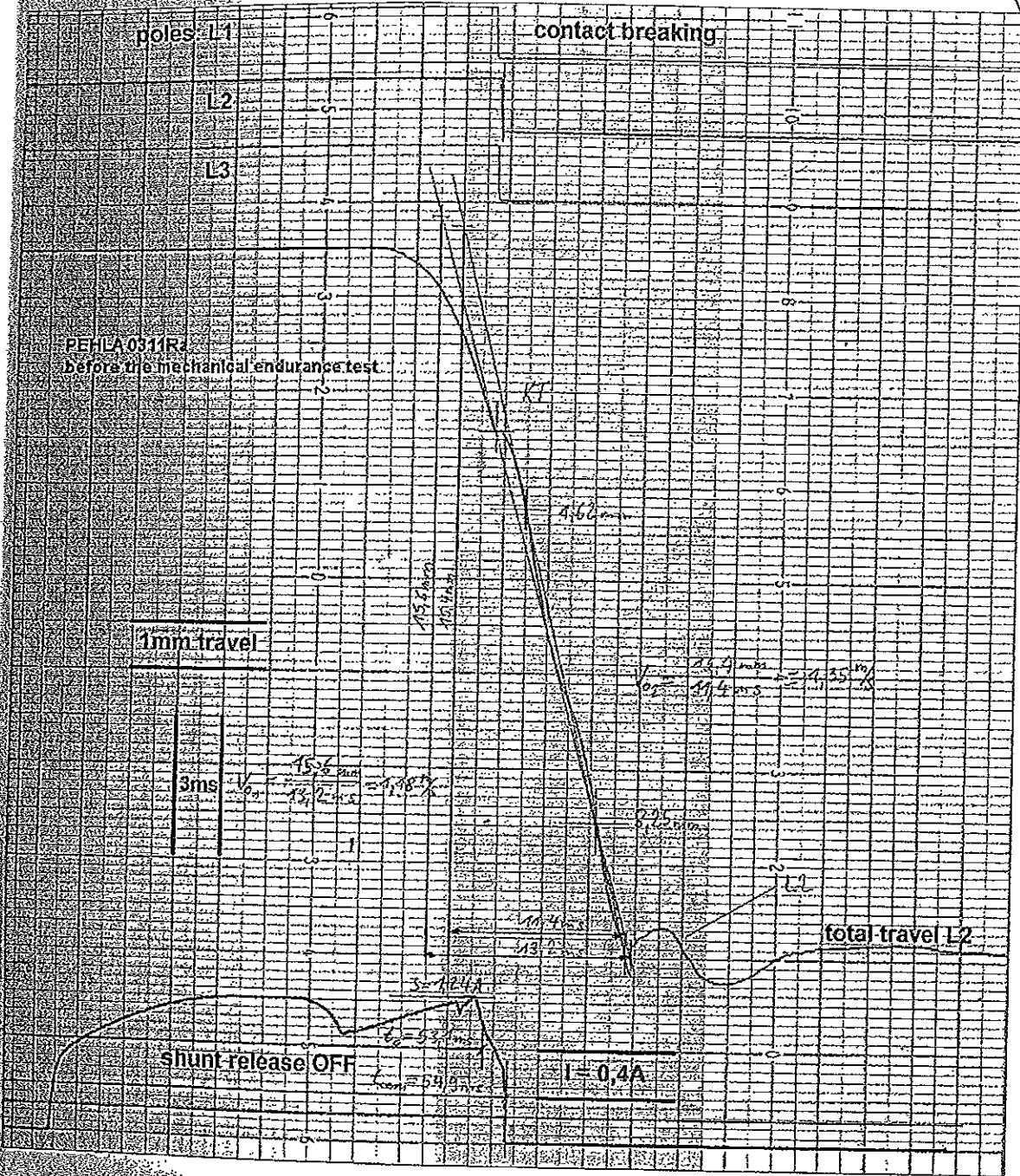
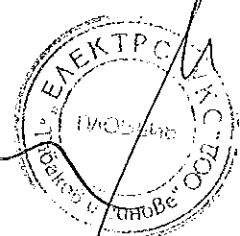


Diagram 1.2: Measurement of the operating speed before the mechanical endurance test



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 $U = 1.0 \times U_a$

ВРЕМЯ С ОПИШИВАНИЯ



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Results of measurements during the mechanical endurance test

a/b) Opening and closing time:

Operating time [ms] Ua = 110 V DC	U [V]	t ₀₁ (opening)			t _c (closing)		
		0.7 x Ua	1.0 x Ua	1.1 x Ua	0.85 x Ua	1.0 x Ua	1.1 x Ua
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 Ua = 220 V DC	charging time for O1-C [s]		
	U = 0.85 x Ua = 187 V DC	U = 1.0 x Ua = 220 V DC	U = 1.1 x Ua = 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:

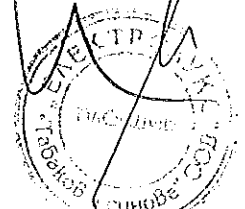
Contact travel in L2	Total Travel [mm]
Number of operations: 2 000	14.8
Number of operations: 4 000	14.7
Number of operations: 6 000	14.7
Number of operations: 8 000	14.7

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

Speed in [m/s]; at Ua = 110 V DC L2	V ₀₁		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.

ВЯРНО С ОПРИГНАЛА



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

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]				
$U = 0.85 \times U_a = 187 \text{ V DC}$	3.60	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

ВЯРНО С ОРГАНИЗАЦИЯ



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

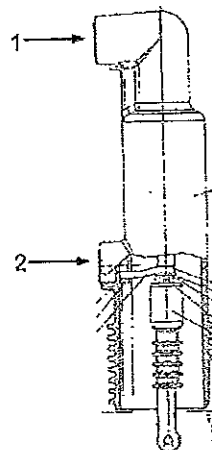
h) Duration of opening and closing command impulse:

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	79.2
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:



ВЫПРОБОВАНО

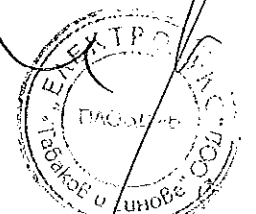
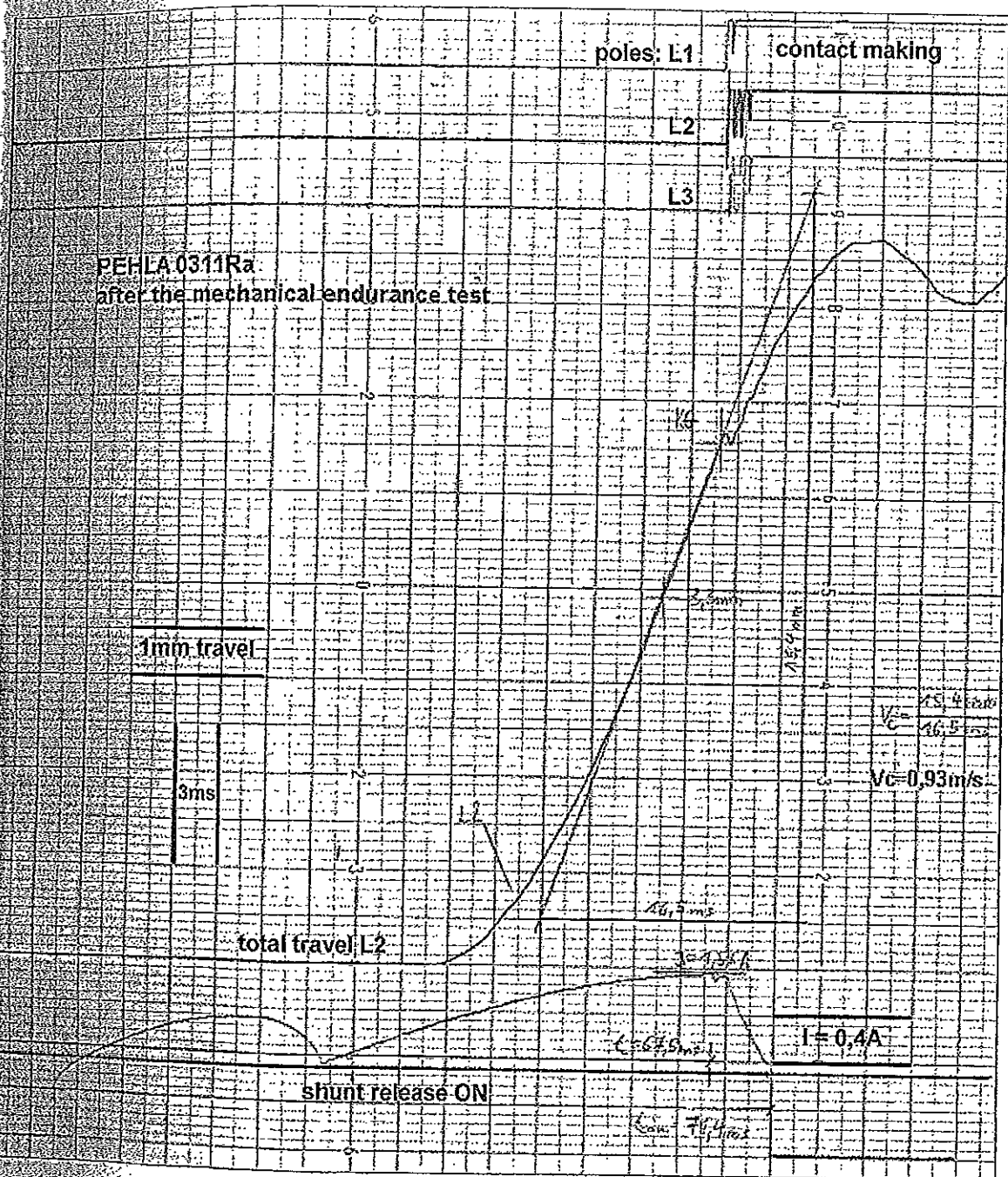


Diagram 2.1: Measurement of the operating speed after the mechanical endurance test



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

ВРАЧНО С ОРВИЧНАТА



Report No. 0311 Ra

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]; Ua = 110 V DC
at U = 1.0 x Ua

	Vo		Vc
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:

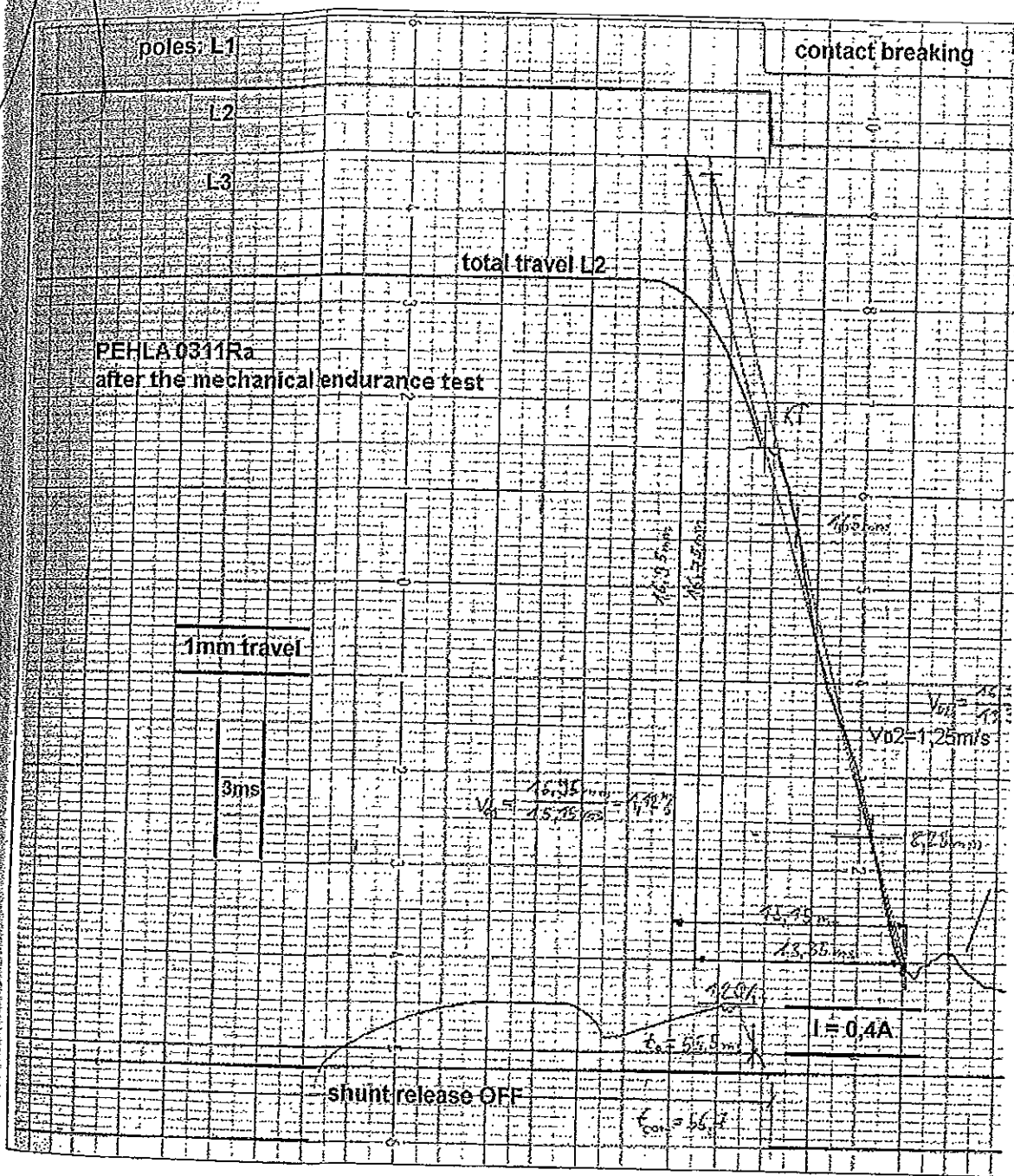
	L1	L2	L3
Total Travel [mm]	14.6	14.6	14.7
Cont.-travel [mm]	11.2	11.1	11.2
Contact-spring travel [mm]	3.4	3.5	3.5

- 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

ВЯРНО С ОПРИГНАЛА



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 $U = 1.0 \times U_a$

ВЕРНО С ОПРИМНАТА



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.

BRUNO C. OPINIKHADA



Report No.: 0311 Ra

Sheet: 23

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	20 $\mu\Omega$ / 200 $\mu\Omega$	Resistance measurement
resistive travel pick-up type lino pot Ts 50 502	ELK 001024	5 k Ω	Travel time measurement
DM 7100 Transient memory	ELK 000466	± 2 V / full scale 50 μ s/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 $\pm 20/0.2$ V/full scale 50 μ sec/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 igor 6E	ELK 001231 ELK 000389	0-100s 1 A	Charging time measurement
Vidar-Vacuum- Checker-Test device	DRU 000026	40/60kV DC	Motor current measurement Vacuum-Checker-Test
BBC M2110	ELK 000359	300 V DC	Voltage measurement
Hygrometer Hygronom	FEU 000022	-30°C - +50°C	temperature measurement

ВЯРНО С ОРГНИЗАТА



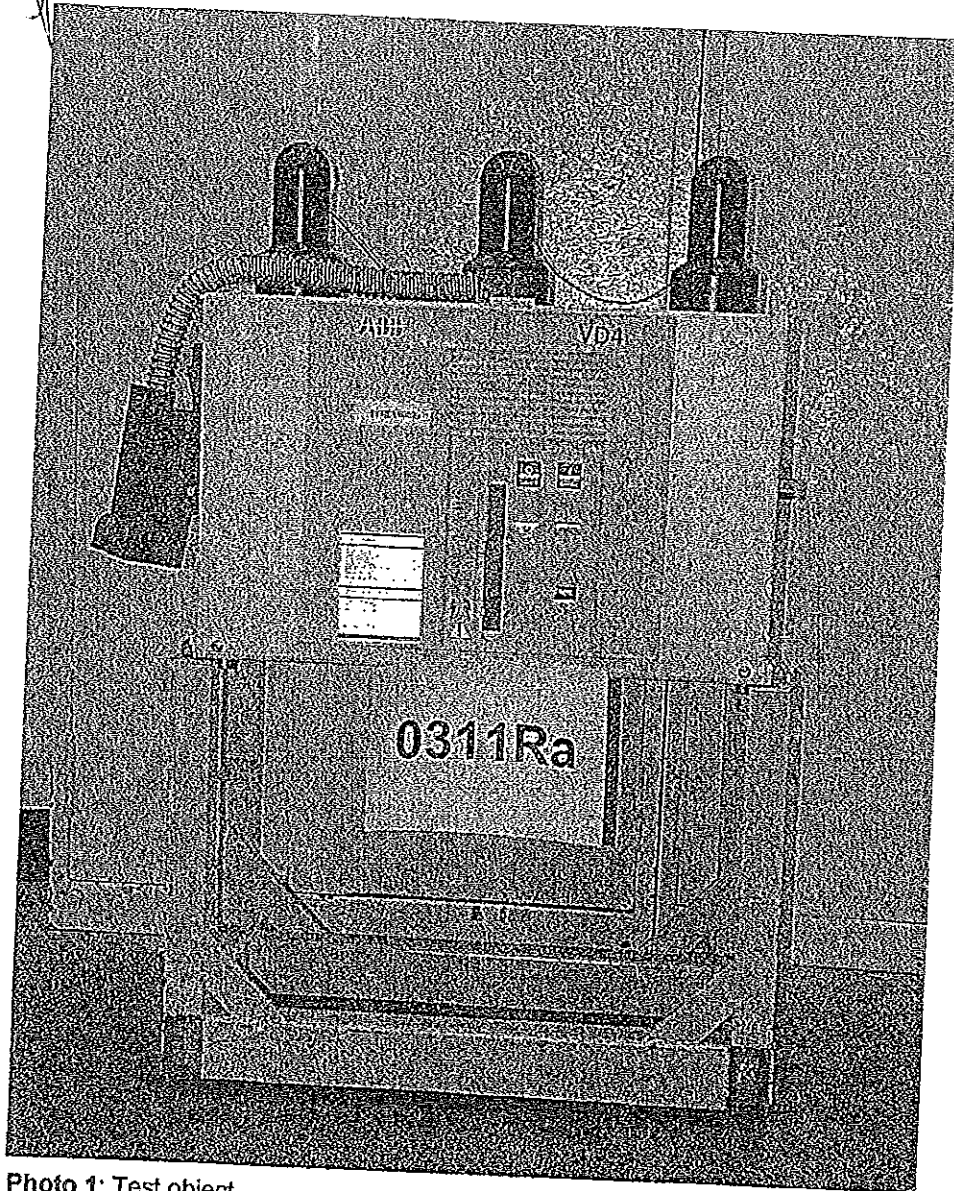


Photo 1: Test object

ВЫПИСЬ С ОПИСАНИЯ





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DAT-P-032/93

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

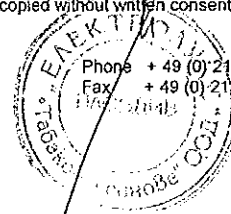
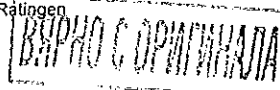
This test report refers exclusively to the object tested.
ABB Calor Emag Mittelspannung GmbH is certified according
to DIN ISO 9001 by DQS under Reg. No. 373-03

ABB Calor Emag Laboratories Ratingen are accredited according to
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Reg.-Nr.
DAT-P-032/93

ABB Calor Emag Laboratories



TEST REPORT No. MZ 235 A 01

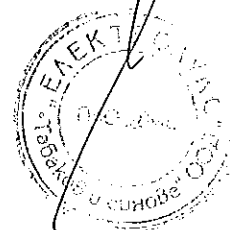
Sheet 2

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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





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TEST REPORT No. MZ 235 A 01

Sheet 4

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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

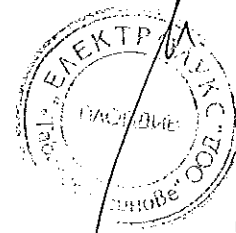
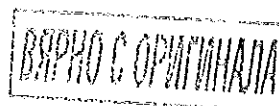
Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV

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

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TEST REPORT No. MZ 235 A 01

Sheet 5

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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

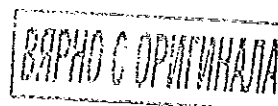
Manufacturer: ABB Calor Emag Mittelspannung GmbH

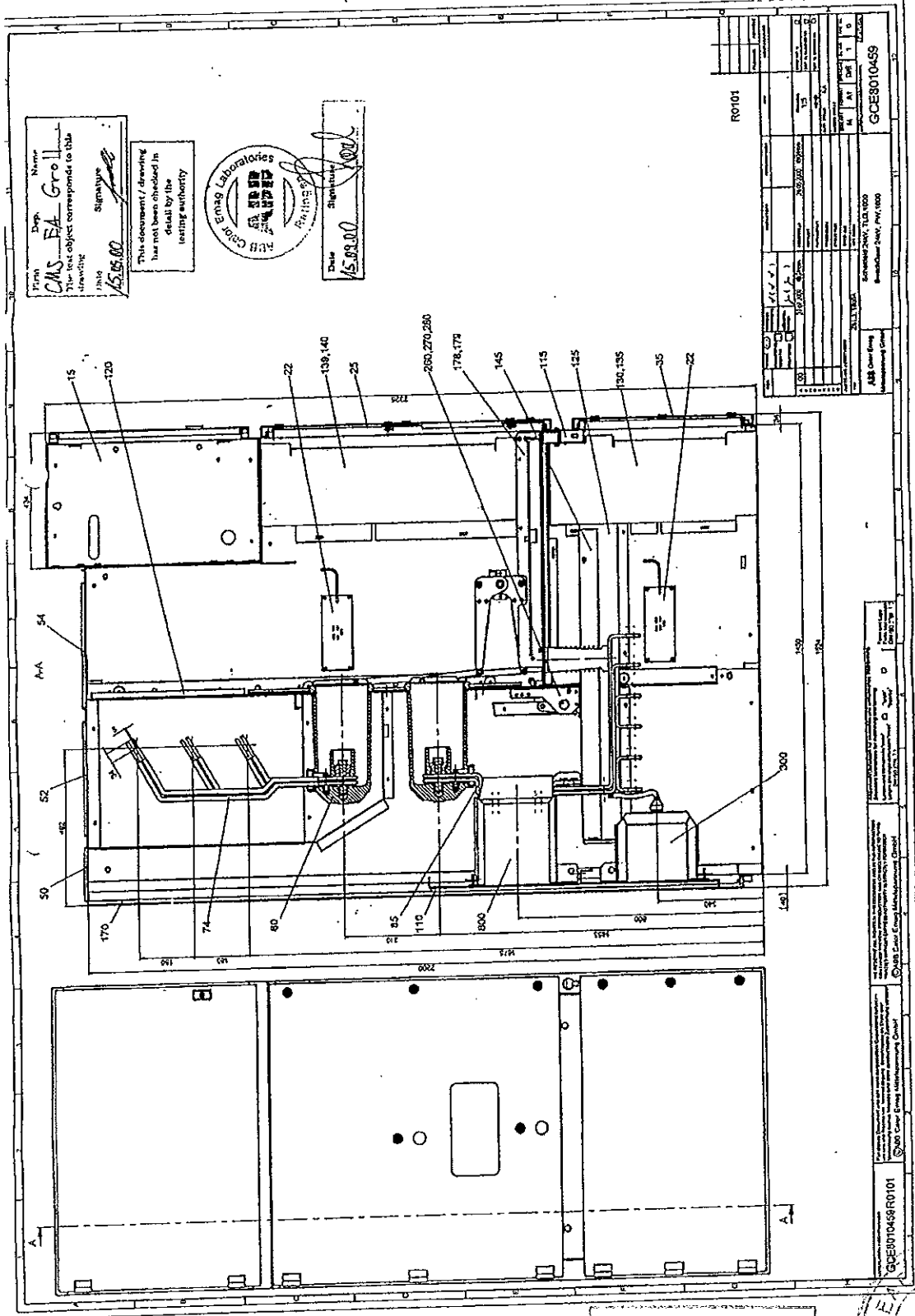
Serial-No.: 06/052/00 **Year of manufacture:** 2000

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





Techn. Zeichnung
Name: Groll
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Date: 15.05.00
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Date: 15.05.00
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ABB Calor Emag Laboratories
Schwanau, T. 07143 1000
Bismarckstr. 24, D-74638 Schwanau
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ВЕРНО С ОПИШУВАНА

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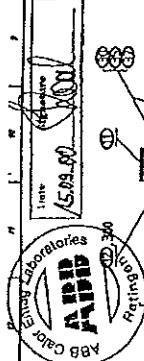
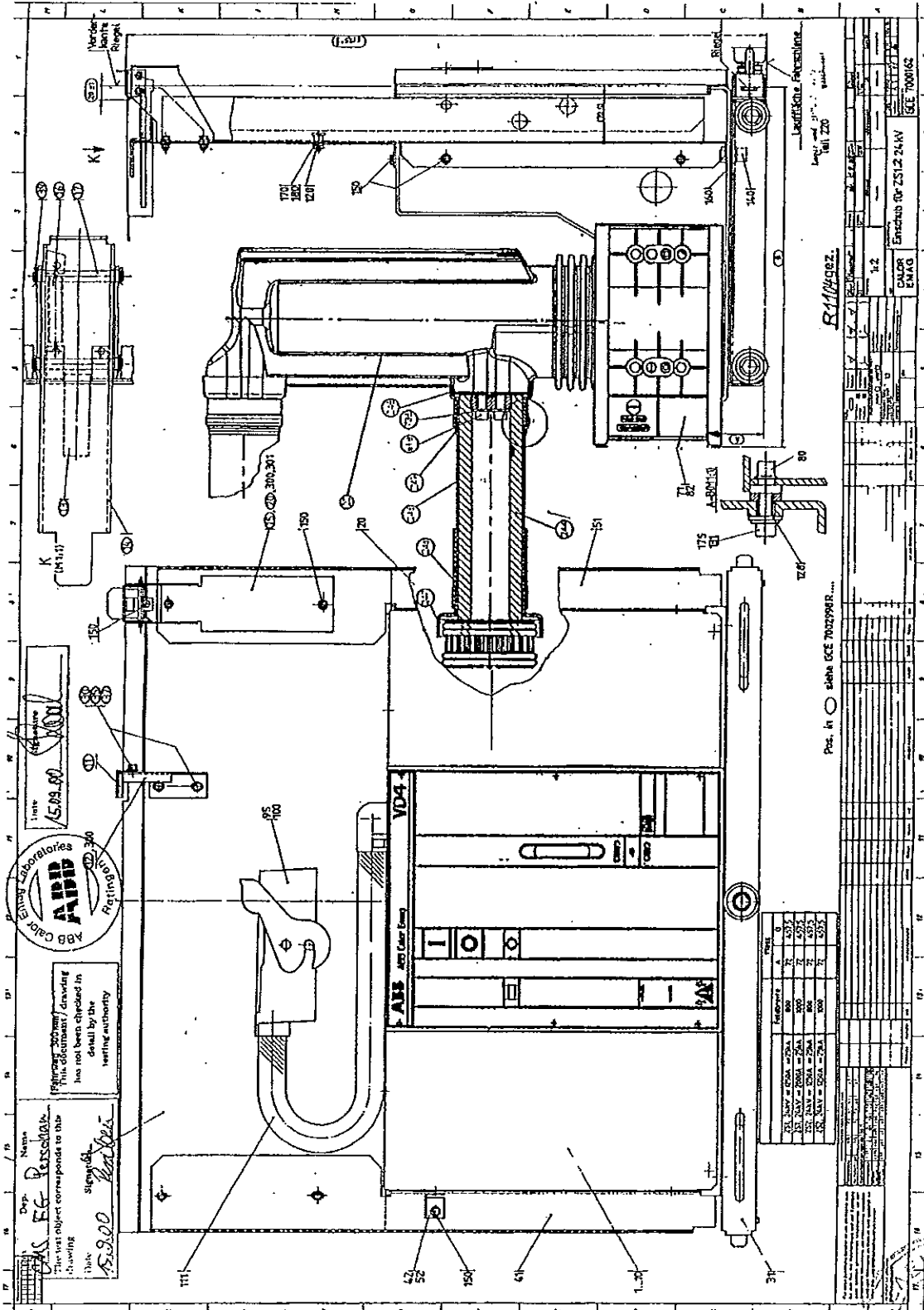
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Sheet 7

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Date: 15.09.00
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ВЪРНО С ОПРИГНАЛА

