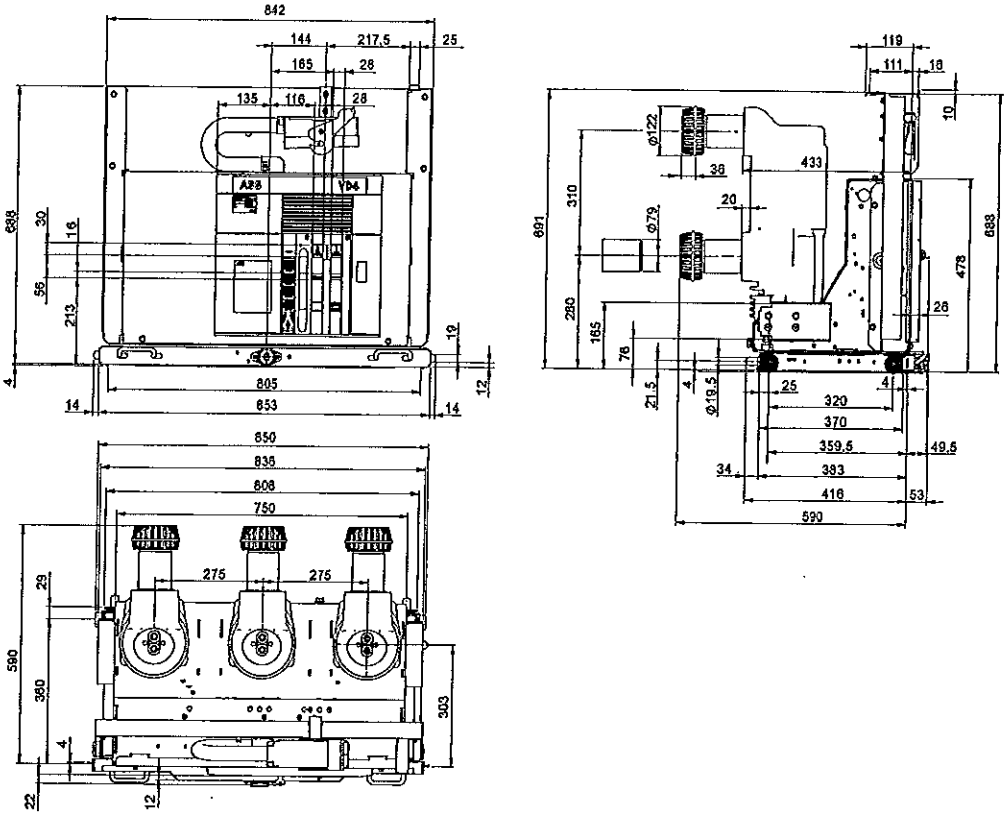
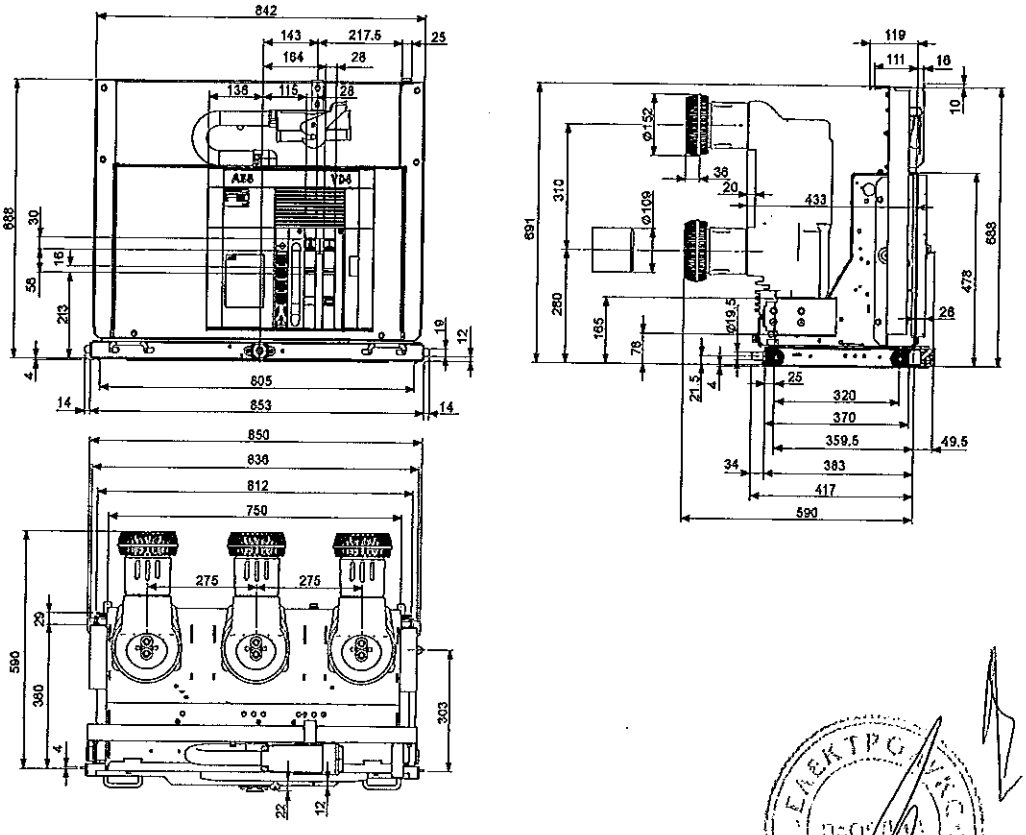
Withdrawable circuit-breakers for UniGear ZS1 switchgear and PowerCube modules

VD4/P	
TN	1VCD003445
Ur	12 kV
	17.5 kV
Ir	1600 A
	2000 A
Isc	50 kA



Withdrawable circuit-breakers for UniGear ZS1 switchgear and PowerCube modules

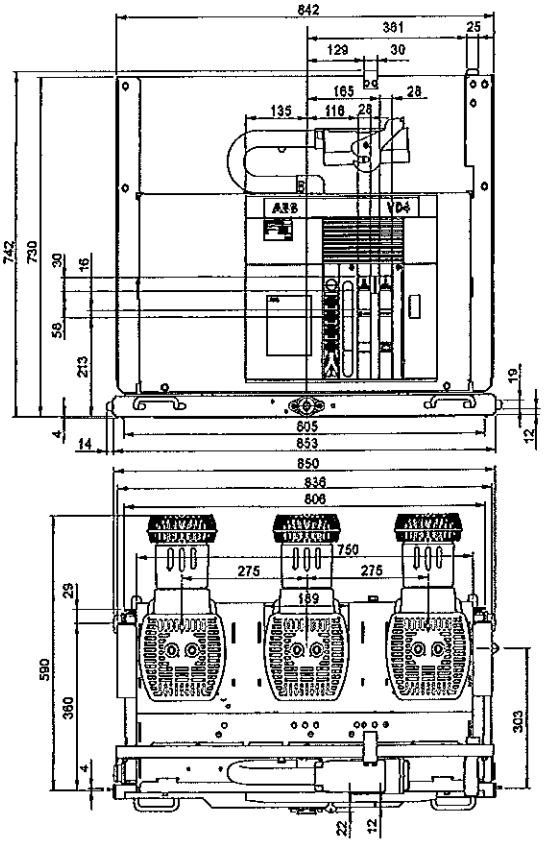
VD4/P	
TN	1VCD003446
Ur	12 kV
	17.5 kV
Ir	2500 A
Isc	50 kA

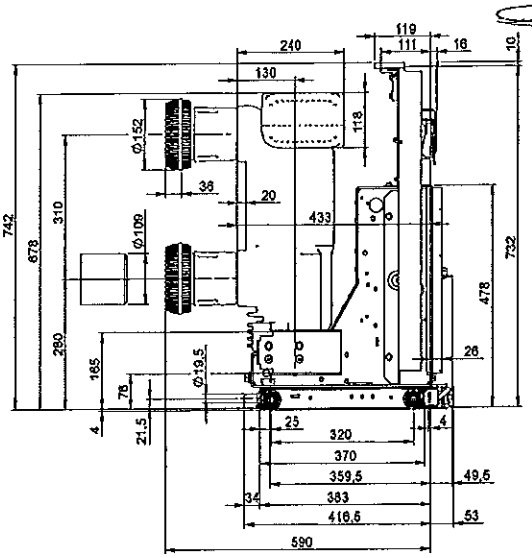


ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for PowerCube modules

VD4/W		
TN	1VCD003596	
Ur	12	kV
	17.5	kV
Ir	3150	A (*)
Isc	50	kA

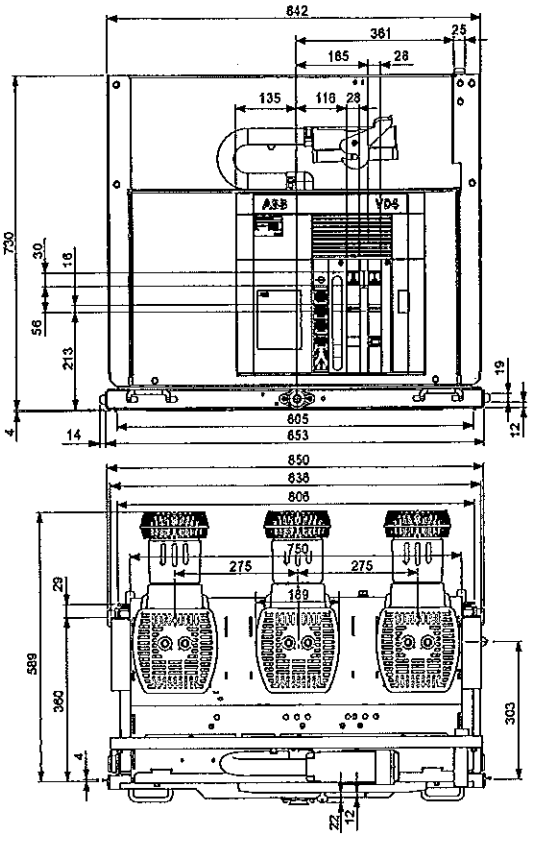


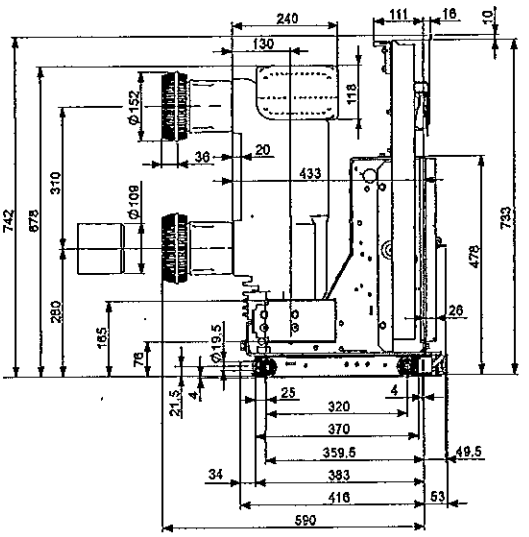


(*) 4000 A with forced ventilation.

Withdrawable circuit-breakers for UniGear ZS1 switchgear

VD4/P		
TN	1VCD003447	
Ur	12	kV
	17.5	kV
Ir	3150	A (*)
Isc	50	kA



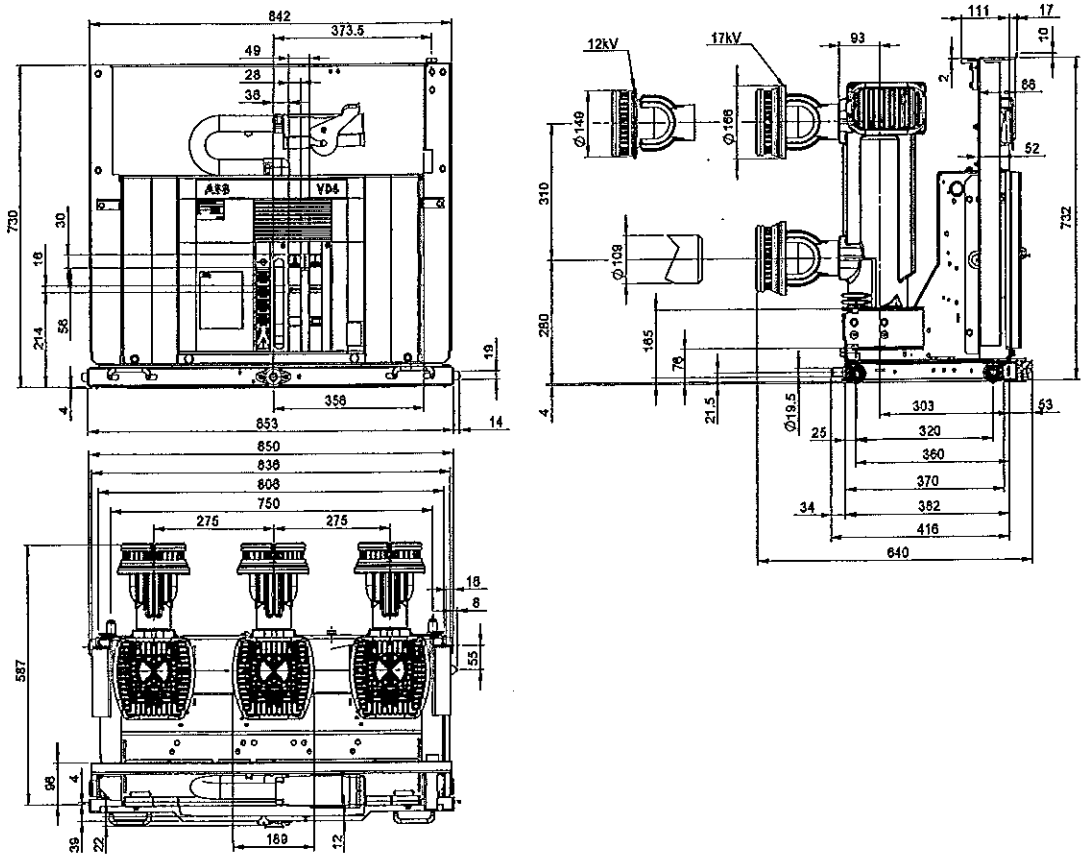


(*) 4000 A with forced ventilation.

ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for UniGear ZS1 switchgear

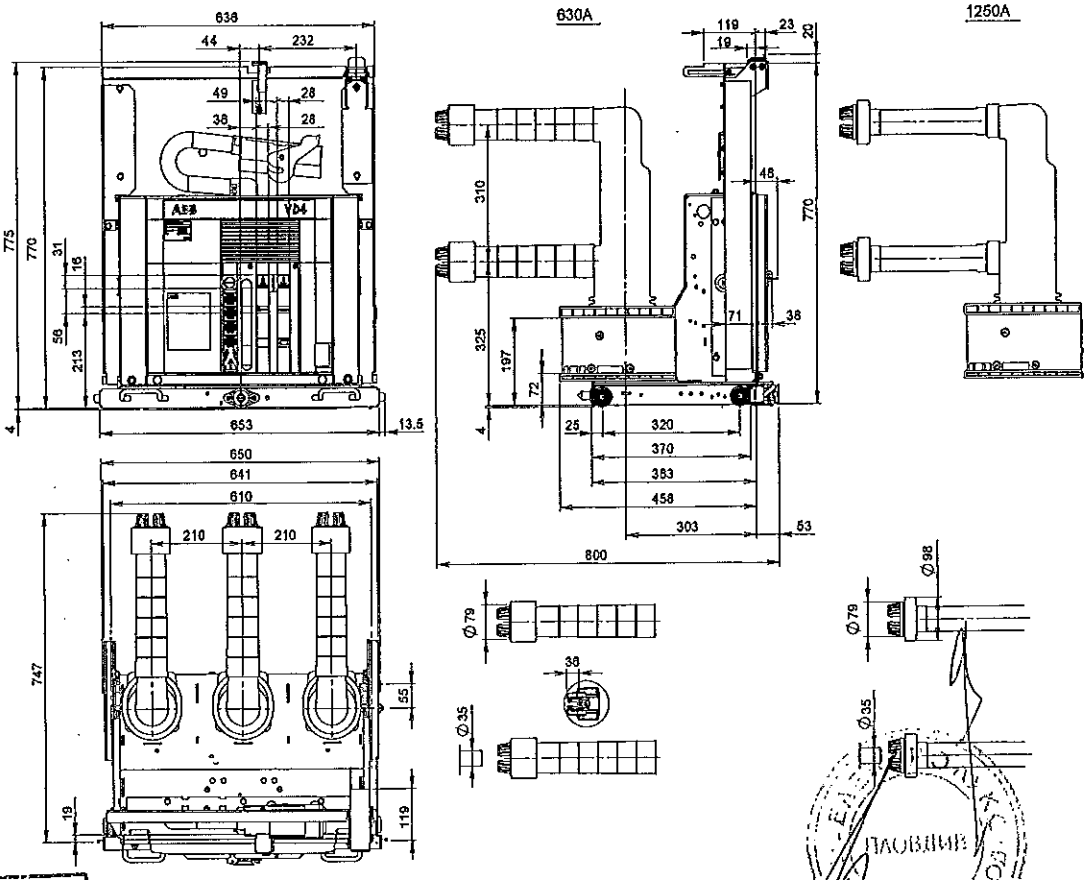
VD4/P		
TN	1VCD000153	
Ur	12	kV
	17.5	kV
Ir	3150	A (*)
Isc	20	kA
	25	kA
	31.5	kA
	40	kA



(*) 4000 A with forced ventilation.

Withdrawable circuit-breakers for UniGear ZS1 switchgear and PowerCube modules

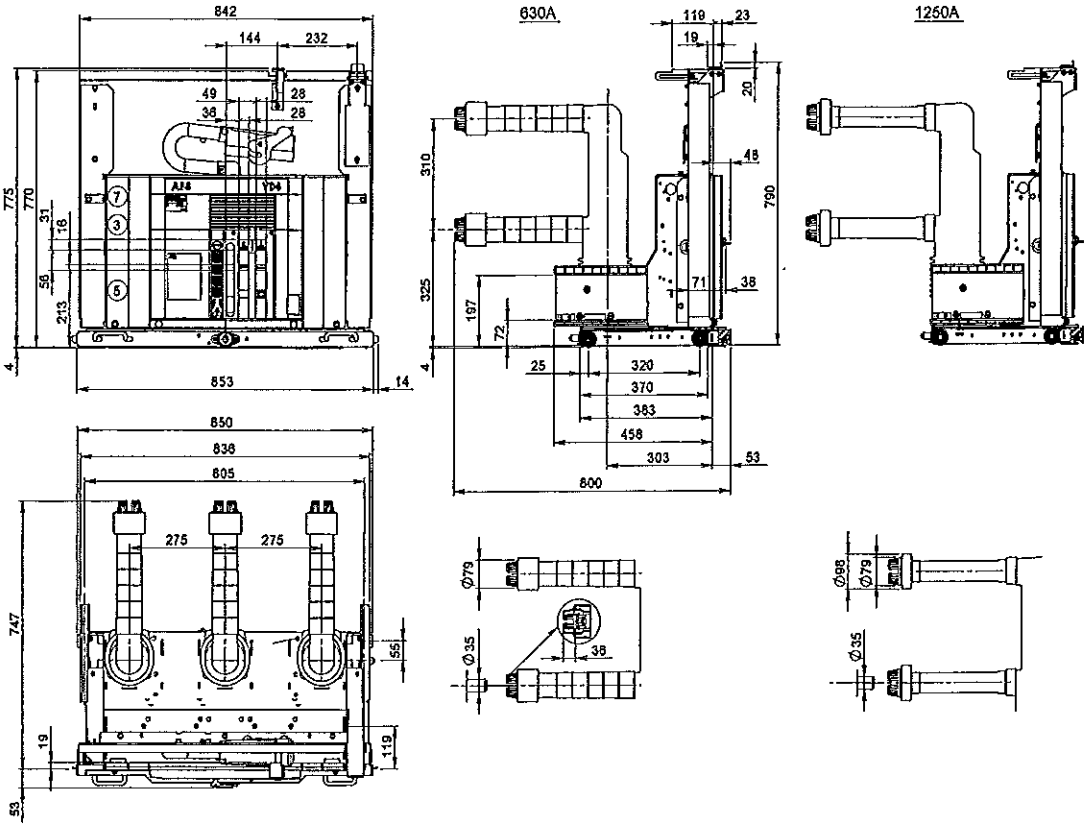
VD4/P		
TN	7413	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA



ВЯРНО С ОРИГИНАЛА

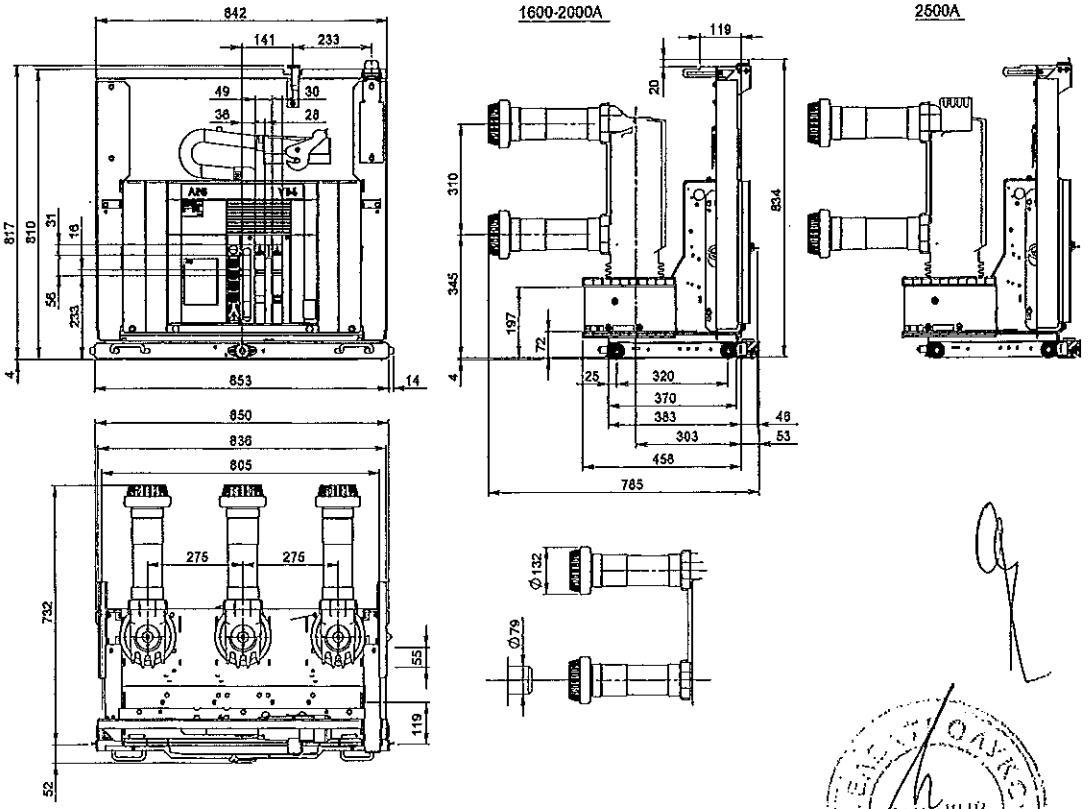
Withdrawable circuit-breakers for UniGear ZS1 switchgear

VD4/P		
TN	7414	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA



Withdrawable circuit-breakers for UniGear ZS1 switchgear

VD4/P		
TN	7418	
Ur	24	kV
Ir	1600	A
	2000	A
	2500	A (1)
Isc	16	kA
	20	kA
	25	kA
	31.5	kA

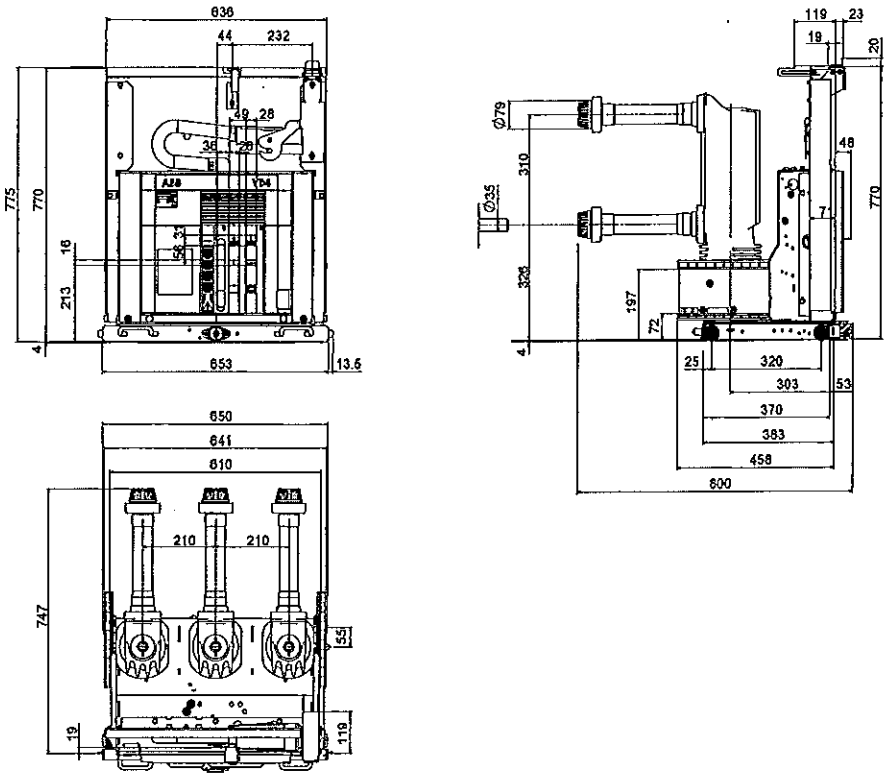


(1) The rated uninterrupted current of 2300 A is guaranteed with natural ventilation. The rated uninterrupted current of 2500 A is guaranteed with forced ventilation.

ВЯРНО С ОРИГИНАЛА

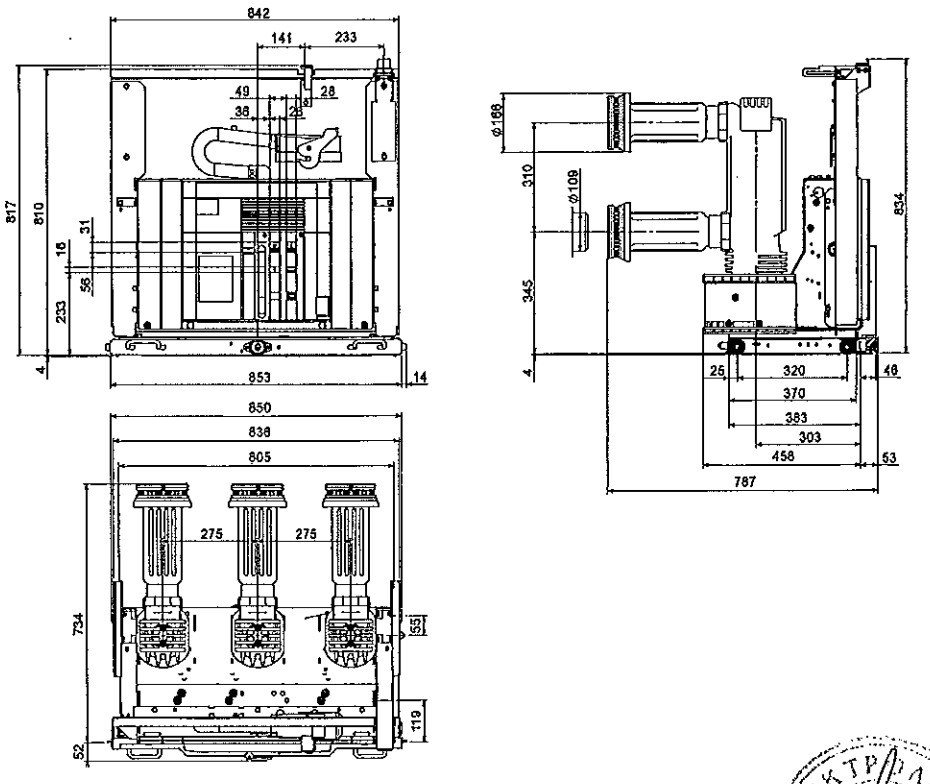
Withdrawable circuit-breakers for UniGear ZS1 switchgear

VD4/P		
TN	1VCD000173	
Ur	24	kV
Ir	1250	A
Isc	31.5	kA



Withdrawable circuit-breakers for UniGear ZS1 switchgear

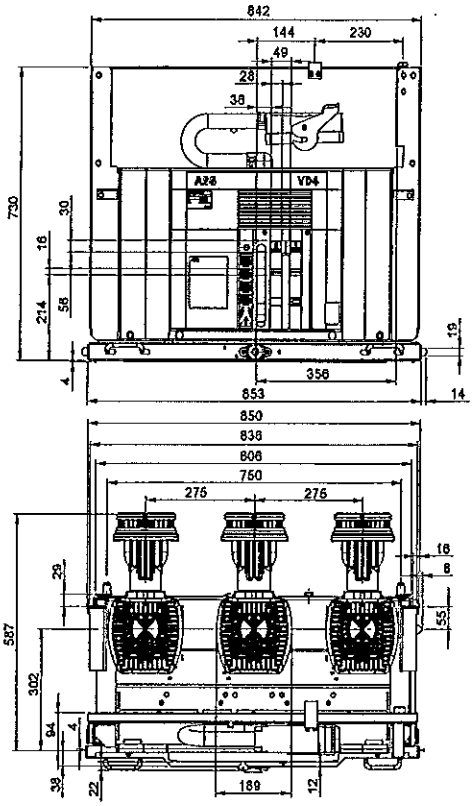
VD4/P		
TN	1VCD000177	
Ur	24	kV
Ir	2700	A
	3150	A
Isc	31.5	kA

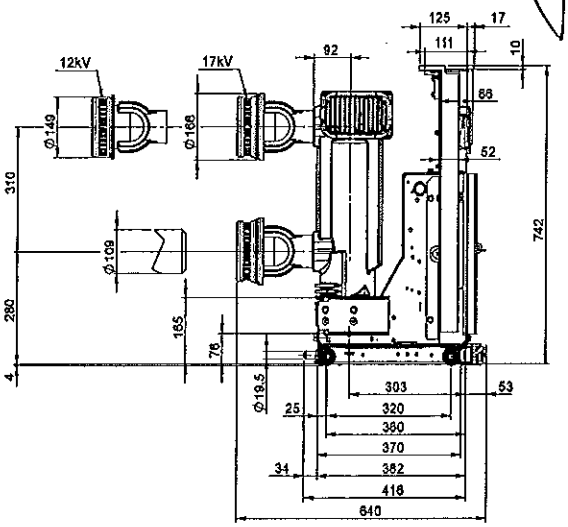


ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for PowerCube modules

VD4/W		
TN	1VCD000152	
Ur	12	kV
	17.5	kV
Ir	3150	A (*)
Isc	20	kA
	25	kA
	31.5	kA
	40	kA



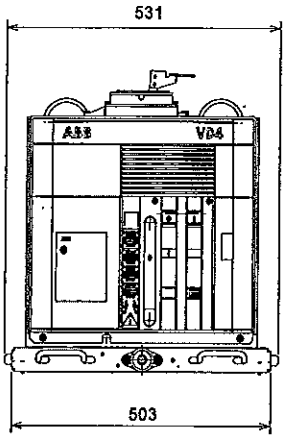


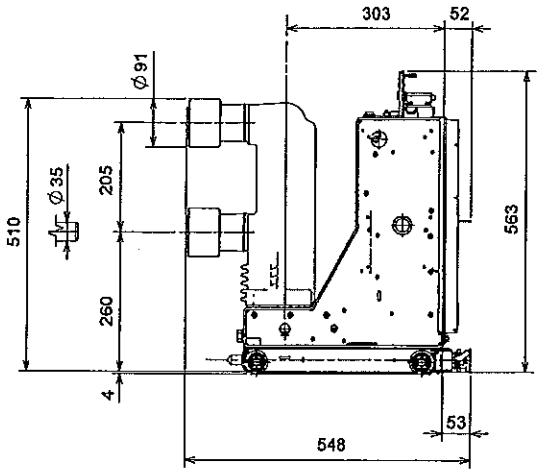
(*) 4000 A with forced ventilation.

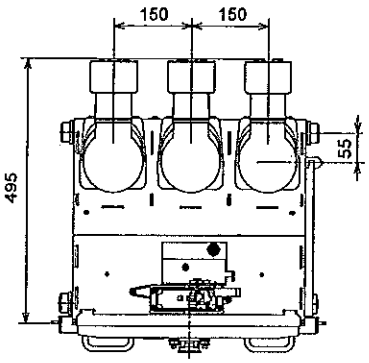
ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/Z8		
TN	1VCD000092	
Ur	12	kV
Ir	630	A
Isc	20	kA
	25	kA

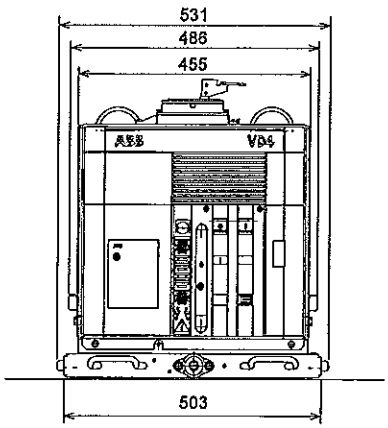


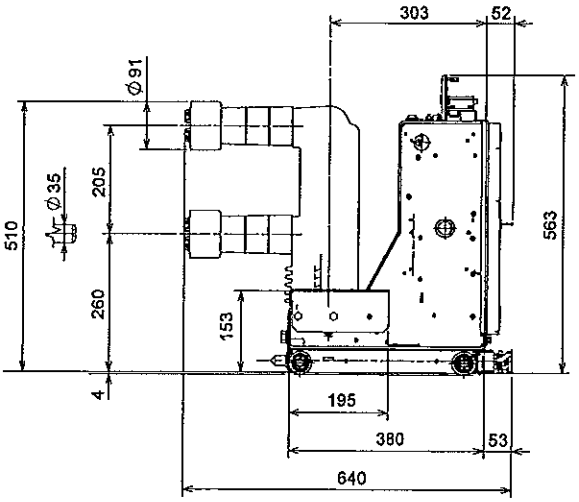


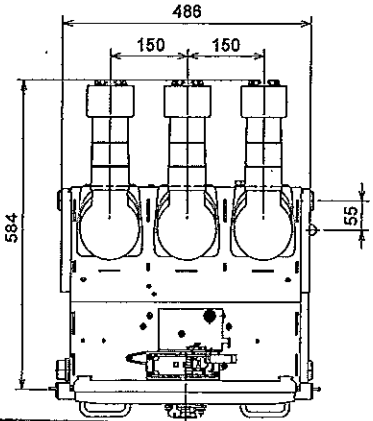


Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/ZT8		
TN	1VCD000093	
Ur	12	kV
Ir	630	A
Isc	20	kA
	25	kA



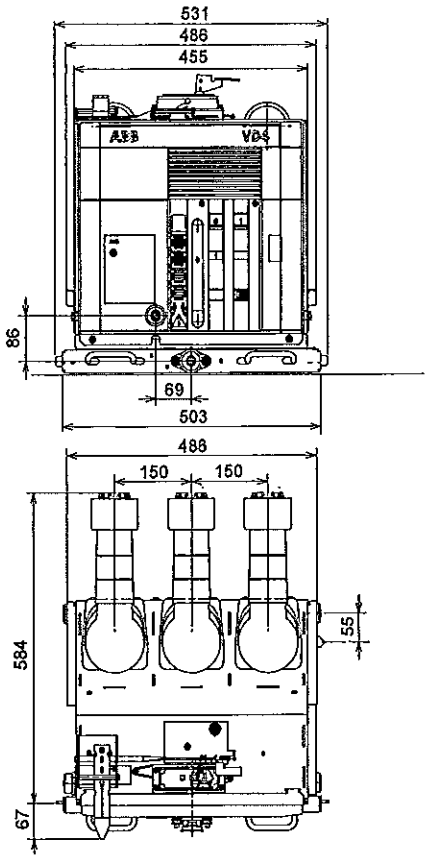


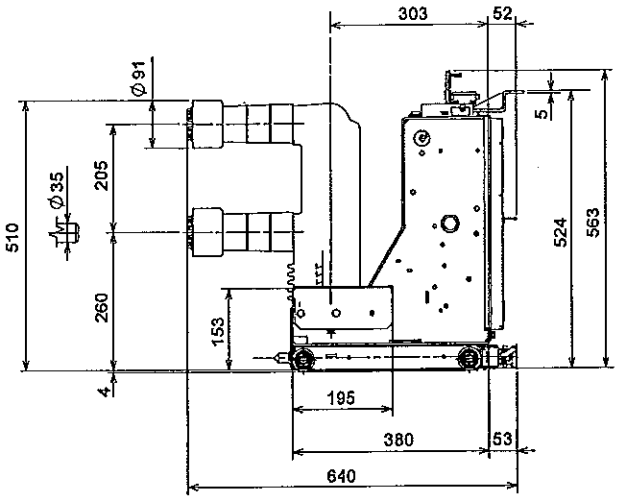


ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

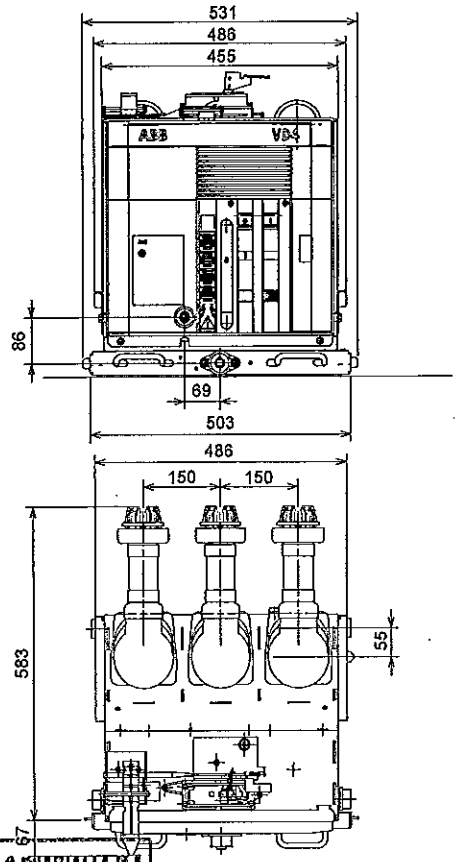
VD4/ZS8		
TN	1VCD000091	
Ur	12	kV
Ir	630	A
Isc	20	kA
	25	kA

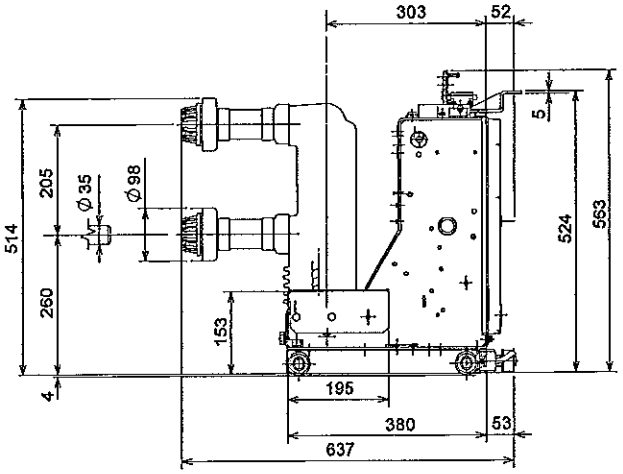




Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/ZS8		
TN	1VCD000133	
Ur	12	kV
Ir	1250	A
Isc	20	kA
	25	kA

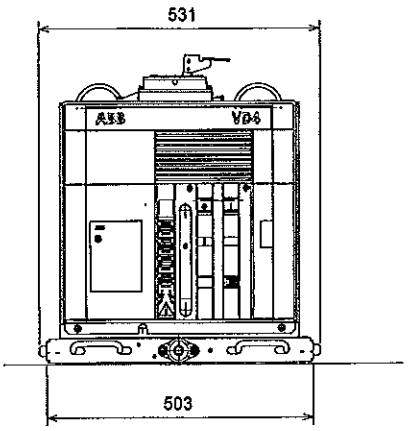


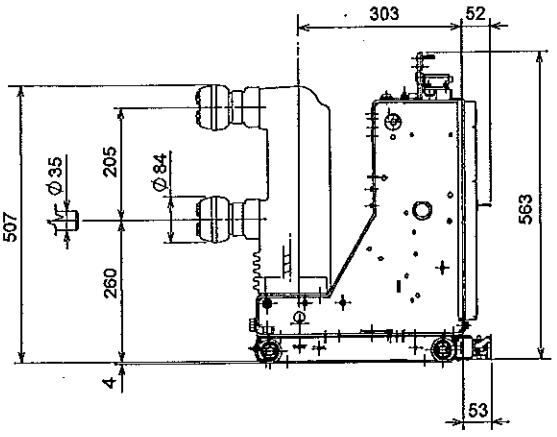


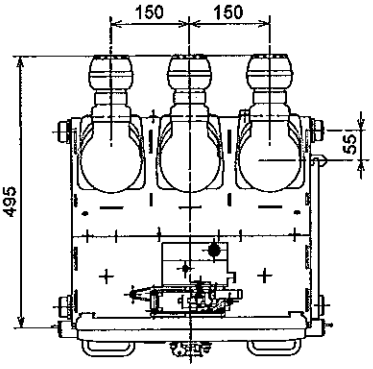
ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/Z8		
TN	1VCD000137	
Ur	12	kV
	17.5	kV
Ir	630	A
	1250	A
Isc	20	kA
	25	kA

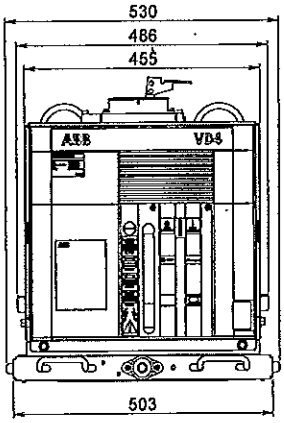


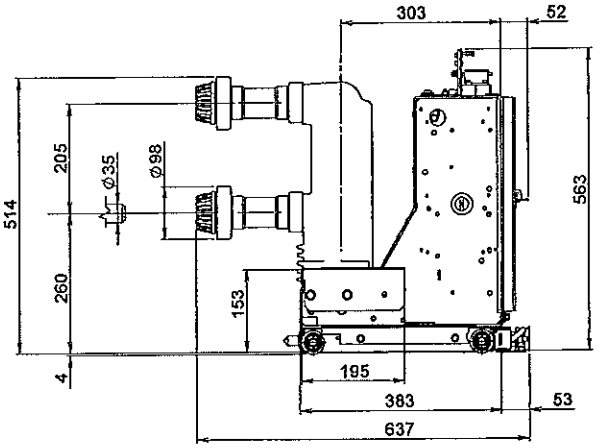


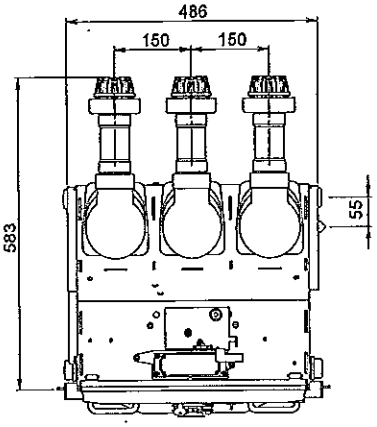


Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/ZT8		
TN	1VCD000134	
Ur	12	kV
	17.5	kV
Ir	630	A
	1250	A
Isc	20	kA
	25	kA



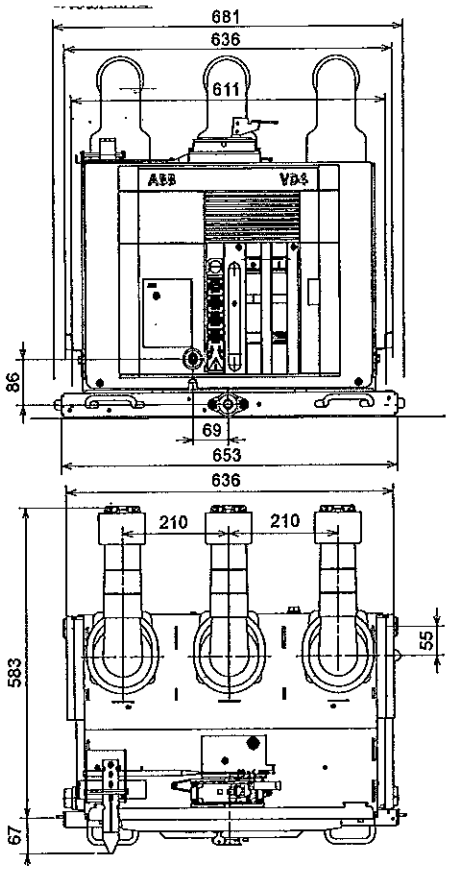


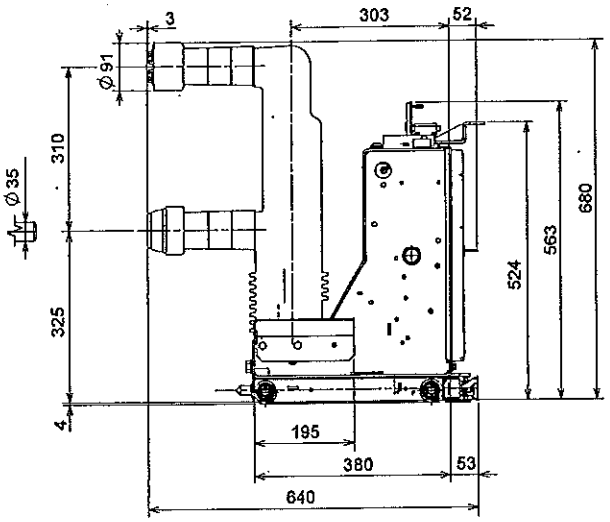


ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

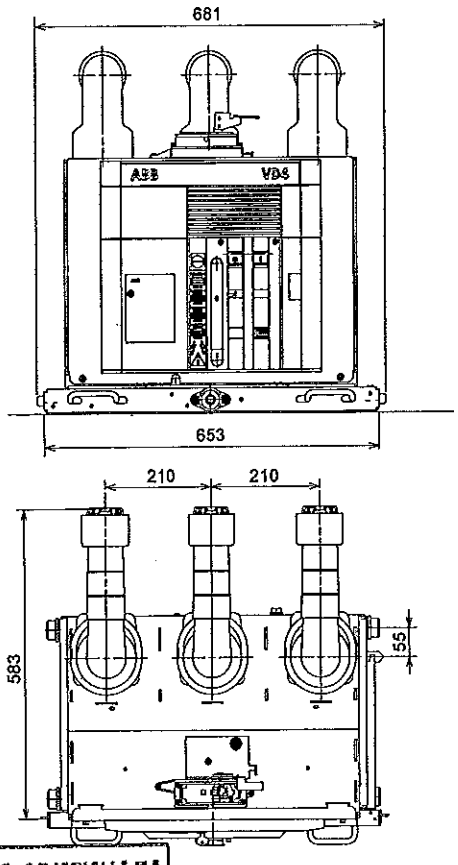
VD4/ZS8		
TN	1VCD000088	
Ur	24	kV
Ir	630	A
Isc	16	kA
	20	kA
	25	kA

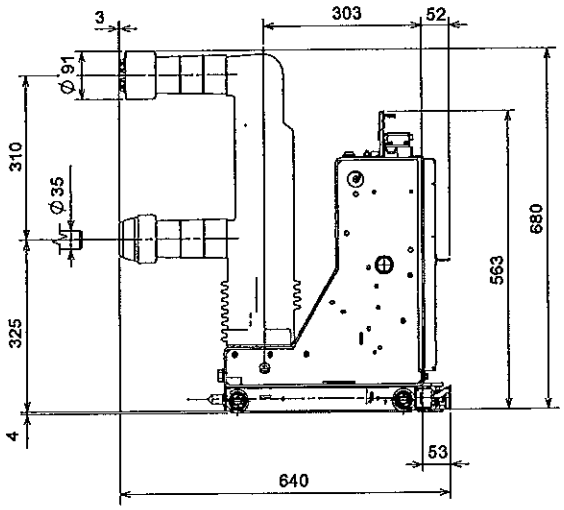




Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/Z8		
TN	1VCD000089	
Ur	24	kV
Ir	630	A
Isc	16	kA
	20	kA
	25	kA

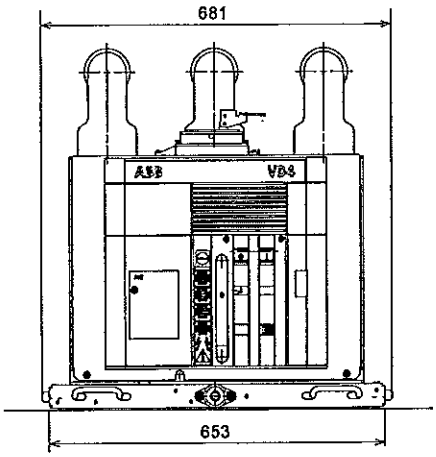


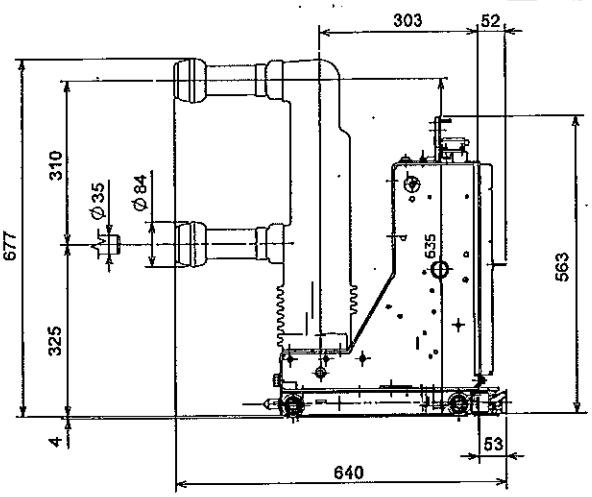


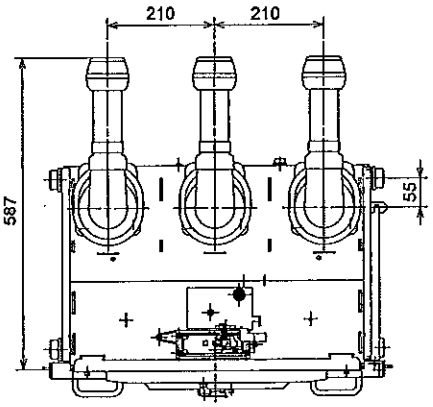
ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/Z8		
TN	1VCD000138	
Ur	24	kV
Ir	1250	A
Isc	16	kA
	20	kA
	25	kA

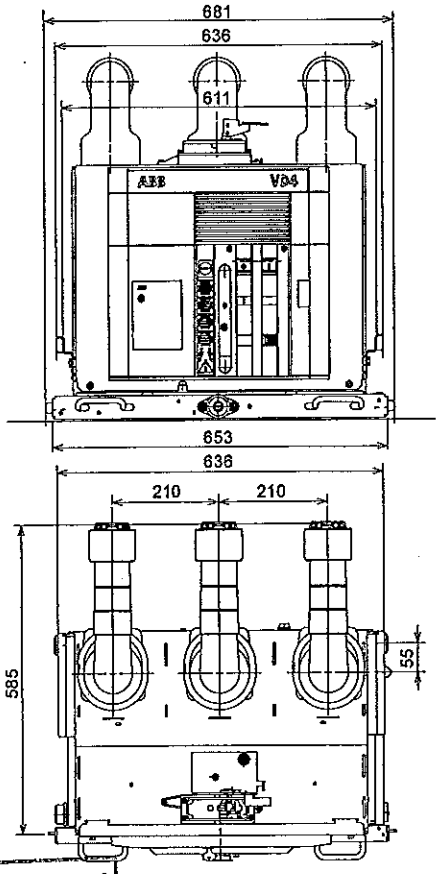


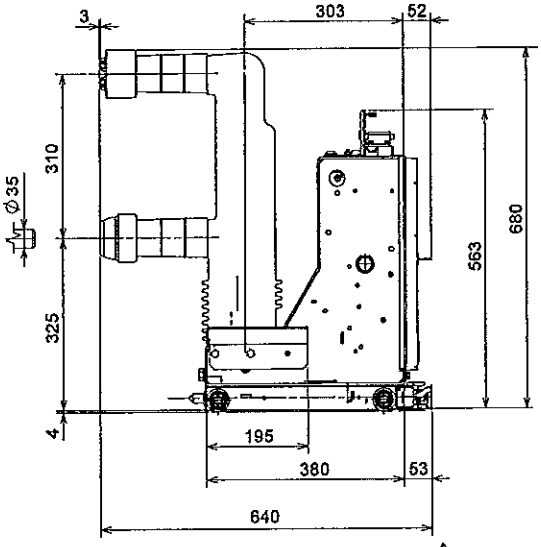




Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/ZT8		
TN	1VCD000090	
Ur	24	kV
Ir	630	A
Isc	16	kA
	20	kA
	25	kA

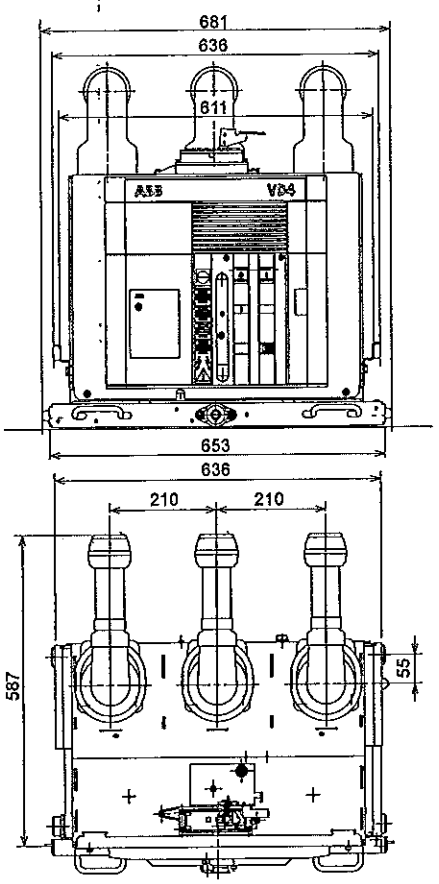


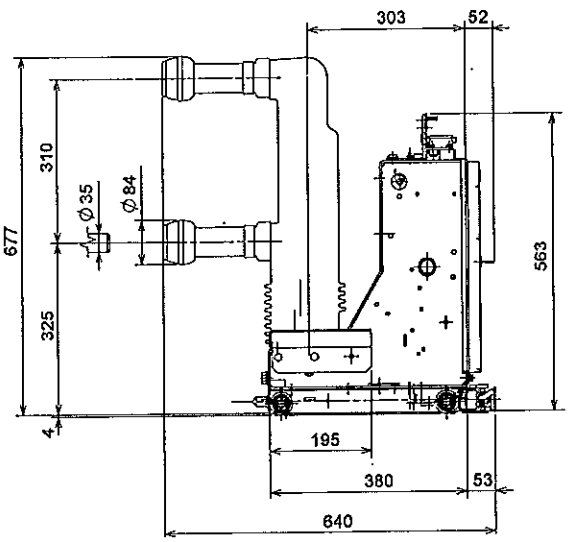


ВЯРНО С ОРИГИНАЛА

Withdrawable circuit-breakers for ZS8.4 switchgear

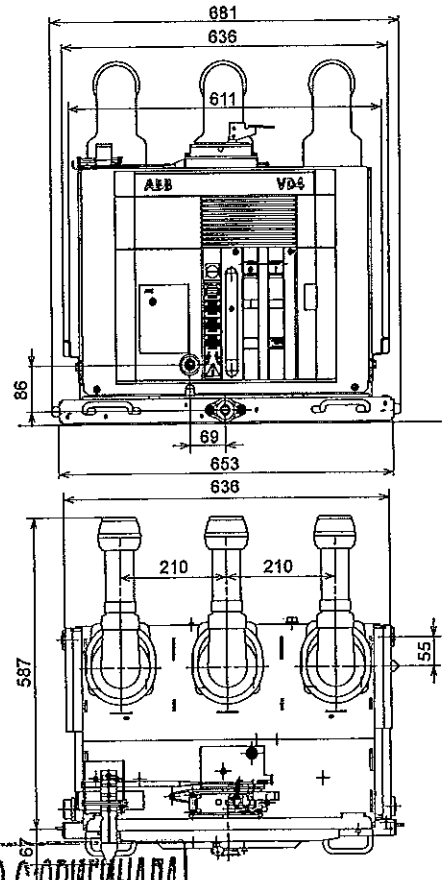
VD4/ZT8		
TN	1VCD000136	
Ur	24	kV
Ir	1250	A
Isc	16	kA
	20	kA
	25	kA

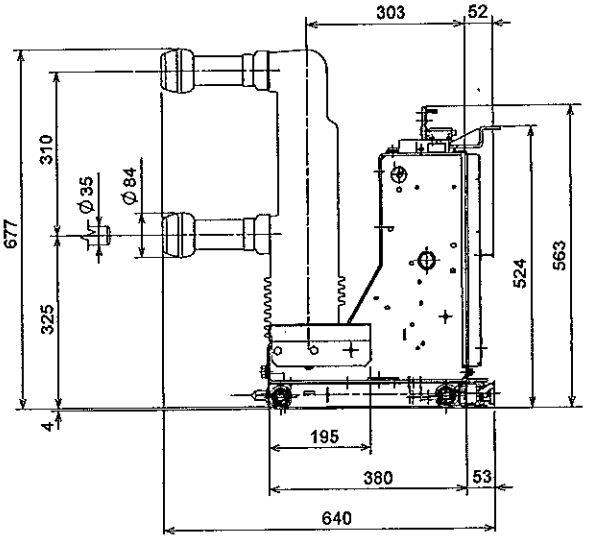




Withdrawable circuit-breakers for ZS8.4 switchgear

VD4/ZS8		
TN	1VCD000135	
Ur	24	kV
Ir	1250	A
Isc	16	kA
	20	kA
	25	kA

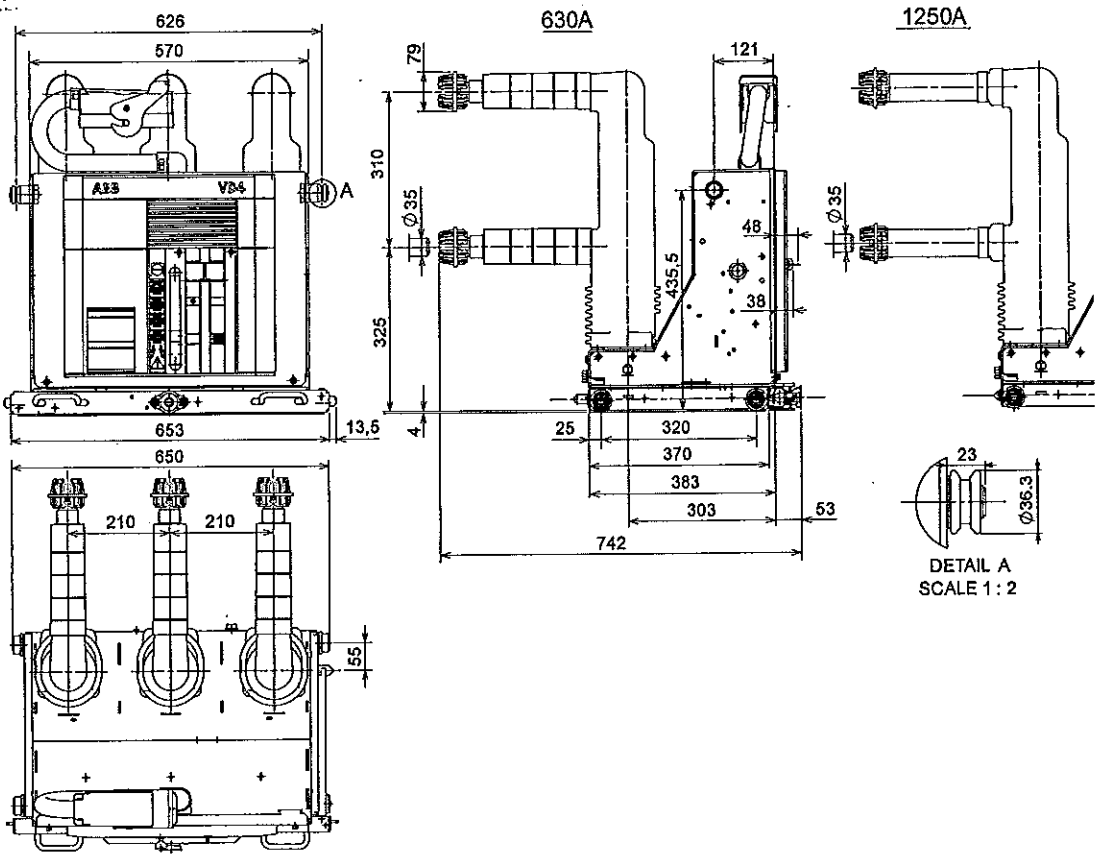




ВЯРНО С ОРИГИНАЛА

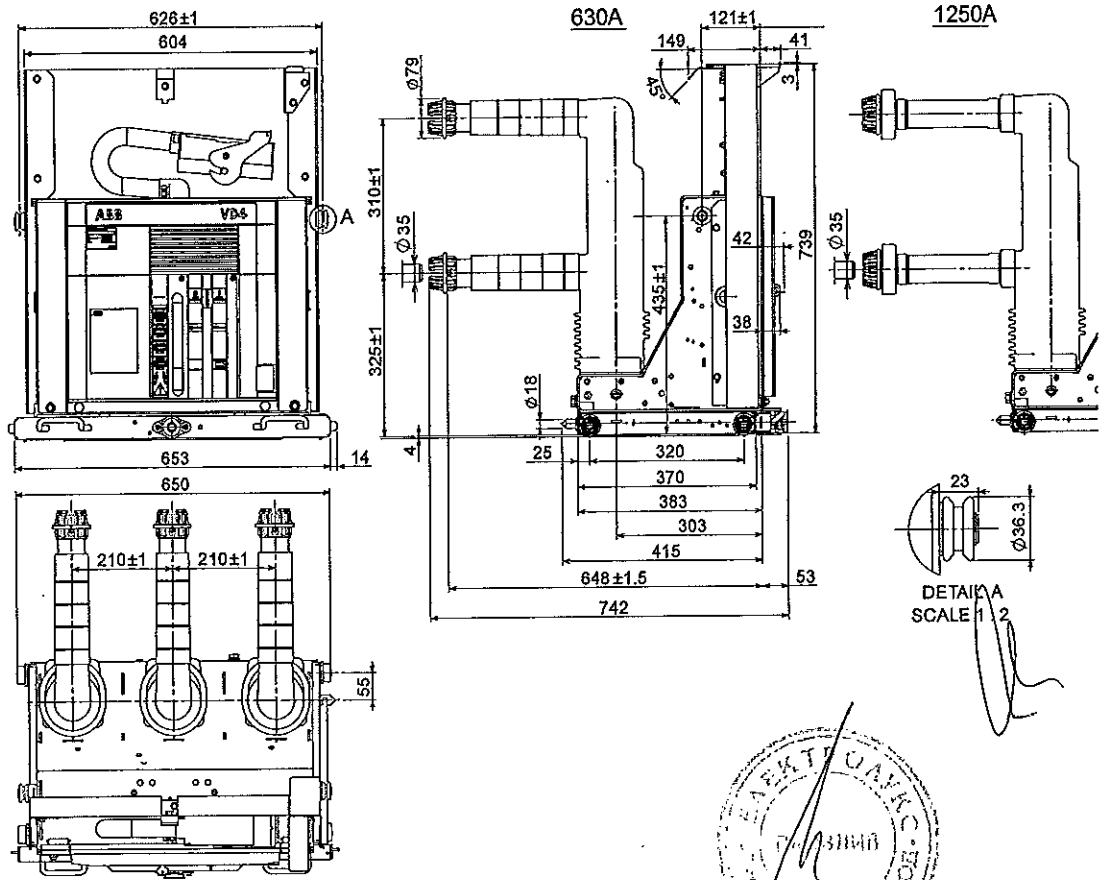
Withdrawable circuit-breakers for UniSwitch / UniMix switchgears

VD4/US		
TN	1VCD000047	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA



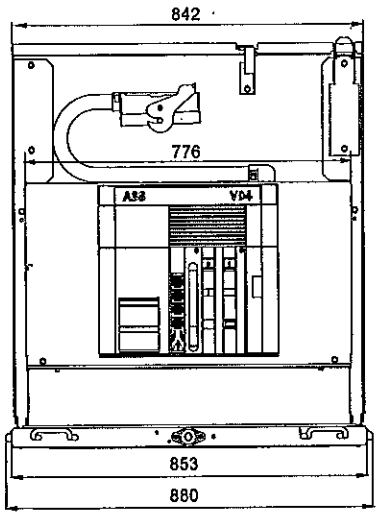
Withdrawable circuit-breakers for UniSec switchgears

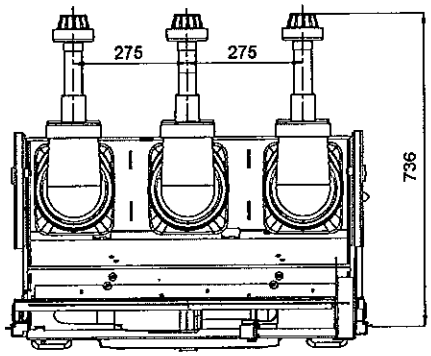
VD4/SEC		
TN	1VCD000190	
Ur	24	kV
Ir	630	A
	1250	A
Isc	16	kA
	20	kA
	25	kA

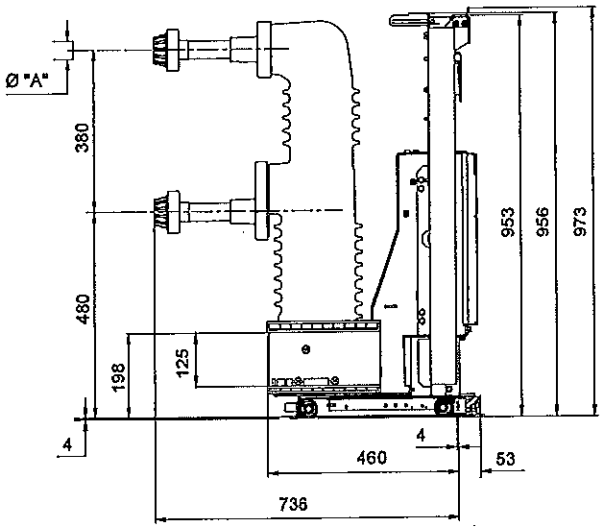


ВЯРНО С ОРИГИНАЛА

VD4		
TN	1VYN300901-KG	
Ur	36	kV
Ir	1250	A
	1600	A
	2000	A
Isc	31.5	kA







Breaker type	Ø A mm
VD4 36.12.32	35
VD4 36.16.32 - VD4 36.20.32	79

ВЯРНО С ОРИГИНАЛА

14. Product quality and environmental protection

The apparatus are produced in compliance with the requirements of international standards for the quality management system and environmental management system. In these fields, the excellent level is proved by quality certificates according to ISO 9001 and by the EMS according to ISO 14 001.

End of life of product

The ABB company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14 001 standard.
The duty of company is to facilitate subsequent recycling or disposal at the end of product life. During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

Methods of disposal

Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

RAW MATERIAL	RECOMMENDED METHOD OF DISPOSAL
Metal material (Fe, Cu, Al, Ag, Zn, W, others)	Separation and recycling
Thermoplasts	Recycling or disposal
Epoxy resin	Separation of metal material and the disposal of rest
Rubber	Disposal
Oil as dielectric (transformer oil)	Draining from equipment and further recycling or disposal
Packing material – wood	Recycling or disposal
Packing material – foil	Recycling or disposal

ВЯРНО С ОРИГИНАЛА

For more information please contact:

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www.abb.com

The data and illustrations are not binding. We reserve the right to make changes without notice in the course of technical development of the product.

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647654/011 - Rev. Y, en - Instruction Manual - 2014.03 (VD4 up to 36 kV; up to 50 kA) (gs)(b)

ВЯРНО С ОРИГИНАЛА

Power and productivity
for a better world™

Приложение 1.2 - Типови_изпитания

ВЯРНО С ОРИГИНАЛА

Deutscher Akkreditierungs Rat
DAR
Reg.-Nr.
DAT-P-032/93

ABB Calor Emag Laboratories

ABB

TEST REPORT No. HZ 235 F 01

Sheet 1

Issued by an Accredited Laboratory corresponding to EN 45001

Copy-No. 1e

Test Object

One feeder panel (1000 mm width) of metal-clad, air-insulated switchgear type ZS1.2 equipped with a circuit-breaker type VD4P 2420-25 and an earthing switch type EK6-ZS1-2406-275

Rated voltage	U_r	24 kV
Rated normal current busbar / tee-off	I_r	2500/1600 A
Rated frequency	f_r	50/60 Hz
Rated peak withstand current	I_p	63 kA
Rated short-time withstand current	I_k	25 kA
Rated duration of short-circuit current	t_k	3 s
Rated short-circuit breaking capacity at 24 kV	I_{sc}	25 kA

Manufacturer

ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen

Tests performed

Three-phase peak withstand and short-time withstand current tests of the main circuit and the earthing switch.
For further details see sheet-no. 2.

Test Specification

The tests have been carried out in accordance with the client's instructions.
Test procedure and test parameters were based on:
IEC 60694/2nd Ed./1996-05/Clause 6.6,
IEC 60298/3rd Ed./1990-12/Clause 6.5,
IEC 60129/3rd Ed./1984/Clause 6.5,
IEC 60056/4th Ed./1987/Clause 6.5.

Test Results

The switchgear, the vacuum circuit-breaker and the earthing switch passed the above mentioned peak withstand and short-time withstand current tests successfully.

Test Date

14th September 2000

Client

ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen

ABB Calor Emag Laboratories ABB Ratingen

07th February 2002
Date of Issue

Dr. Stefan Göttlich
Laboratory Manager

Karl-Hermann Diergardt
Test Engineer

Total Number of Sheets: 20 Sheets (Test Report) + 6 Sheets (Oscillograms)

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

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

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

ABB Calor Emag Mittelspannung GmbH Ratingen
Oberhausener Str. 33
D - 40472 Ratingen
Phone + 49 (0) 21 02 12-1736
Fax + 49 (0) 21 02 12-1713

ВЯРНО С ОРИГИНАЛА

Tests performed:

Main circuit with vacuum circuit-breaker type VD4P 2420-25

Infeed by means of copper conductors to the cable terminals of the panel. Short-circuit bridge mounted on the bushings of busbar system outside the panel.

Three-phase peak withstand current tests up to 65.8 kA and short-time withstand current tests up to 25.5 kA - 3.03 s equivalent to 25.6 kA – 3 s.

(Oscillograms HZ 235 F 01 / 04 and 05)

Earthing switch type EK6-ZS1-2406-275

Infeed by means of copper conductors to the cable terminals of the panel. Short-circuit made by the earthing switch.

Three-phase peak withstand current tests up to 66.5 kA and short-time withstand current tests up to 25.1 kA – 3.03 s equivalent to 25.2 kA – 3 s.

(Oscillograms HZ 235 F 01 / 08 and 09)

ВЯРНО С ОРИГИНАЛА

Contents

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switchgear

Test Object: Metal-clad, air-insulated switchgear

Type: ZS1.2 (1000 mm width)

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

Serial-No.: 07550027/2015/00 **Year of manufacture:** 2000

Drawing No's.: See sheet-no. 7

Rated voltage	24	kV
Rated lightning impulse withstand voltage	125	kV
Rated power frequency withstand voltage	50	kV
Rated frequency	50/60	Hz
Rated current busbar	2500	A
Rated current tee-off	1600	A
Rated short-circuit peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated short-circuit duration	3	s
Insulating medium	air	
Rated filling pressure (abs., 20° C)	-	kPa
Prospective values under internal-arc conditions:		
Peak withstand current	63	kA
Short-time withstand current	25	kA
Short-circuit duration	1	s

Additional specifications and data:

- Current transformers 1600 / 5 / 5 A in cable compartment

Type	Serial-no. of the transformers		
	L1	L2	L3
ABB / TPU 65.11	058243	058244	058245

Date of receipt of test object: 12th September 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switching device

Test Object: Vacuum circuit-breaker

Type: VD4P 2420-25

Vacuum interrupter: VG4S series no.: L1: G4 01196, L2: G4 01192, L3: G4 01194

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

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

Drawing No's.: See sheet-no. 7

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	35	%
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-0.3 s-CO-3 min-CO	
Rated times of circuit-breaker:		
- opening time	≤ 40	ms
- closing time	≈ 60	ms
Number of poles	3	
Number of units per pole	1	
Rated auxiliary voltages:		
- voltage of trip coil	220	V-DC
- voltage of closing coil	220	V-DC
- voltage of motor	220	V-DC

Additional specifications and data: -

Date of receipt of test object: 12th September 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

(Ratings assigned by the manufacturer)

Switching device

Test Object: Earthing switch

Type: EK6-ZS1-2406-275

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

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

Drawing No's.: See sheet-no. 7

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	-	A
Rated short-circuit breaking current	-	kA
Rated short-circuit making current	63	kA
DC-component	-	%
Pole factor	-	
Rated peak withstand current	63	kA
Rated short-time withstand current	25	kA
Rated duration of short-circuit	3	s
Rated operating sequence	-	
Rated times of earthing switch:		
- opening time	-	ms
- closing time	-	ms
Number of poles	3	
Number of units per pole	1	
Rated auxiliary voltages:		
- voltage of trip coil	-	V-DC
- voltage of closing coil	-	V-DC
- voltage of motor	-	V-DC

Additional specifications and data: -

Date of receipt of test object: 12th September 2000

ВЯРНО С ОРИГИНАЛА

Table of Drawings of Test Objects

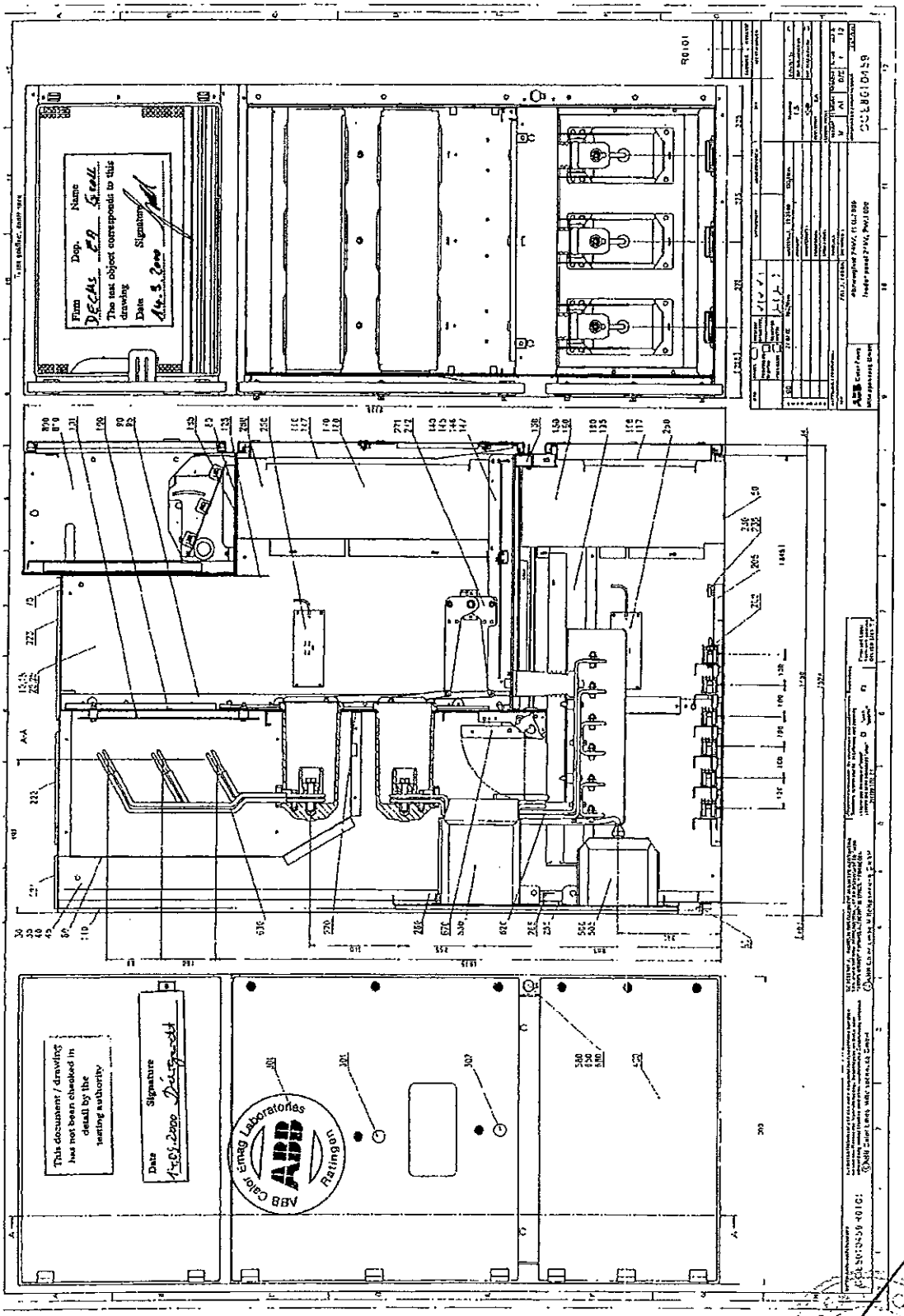
The drawings submitted for identification of the test object were stamped and signed by the test engineer.

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

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

1. Panel ZS1.2, 24 kV, PW 1000	manufacturing type GCE8010459R0101 according to drawing-no. GCE8010459R0101, sheet-no. 1, index 00
2. Withdrawable circuit-breaker VD4P 2420-25	manufacturing type GCE7000162R1104 according to drawing-no. GCE7000162R1104, sheet-no. 5, index 02
3. Pole part	manufacturing type GCE7005757R0122 according to drawing-no. GCE7005757R0122, sheet-no. 221, index 00
4. Mechanism	manufacturing type GCE7179610R0104 according to drawing-no. GCE7179610R0104, sheet-no. 4, index 36
5. Earthing switch EK6-ZS1-2406-275	manufacturing type GCE7169312R0118 according to drawing-no. GCE7169312R0121, sheet-no. 1, index 24

ВЯРНО С ОРИГИНАЛА



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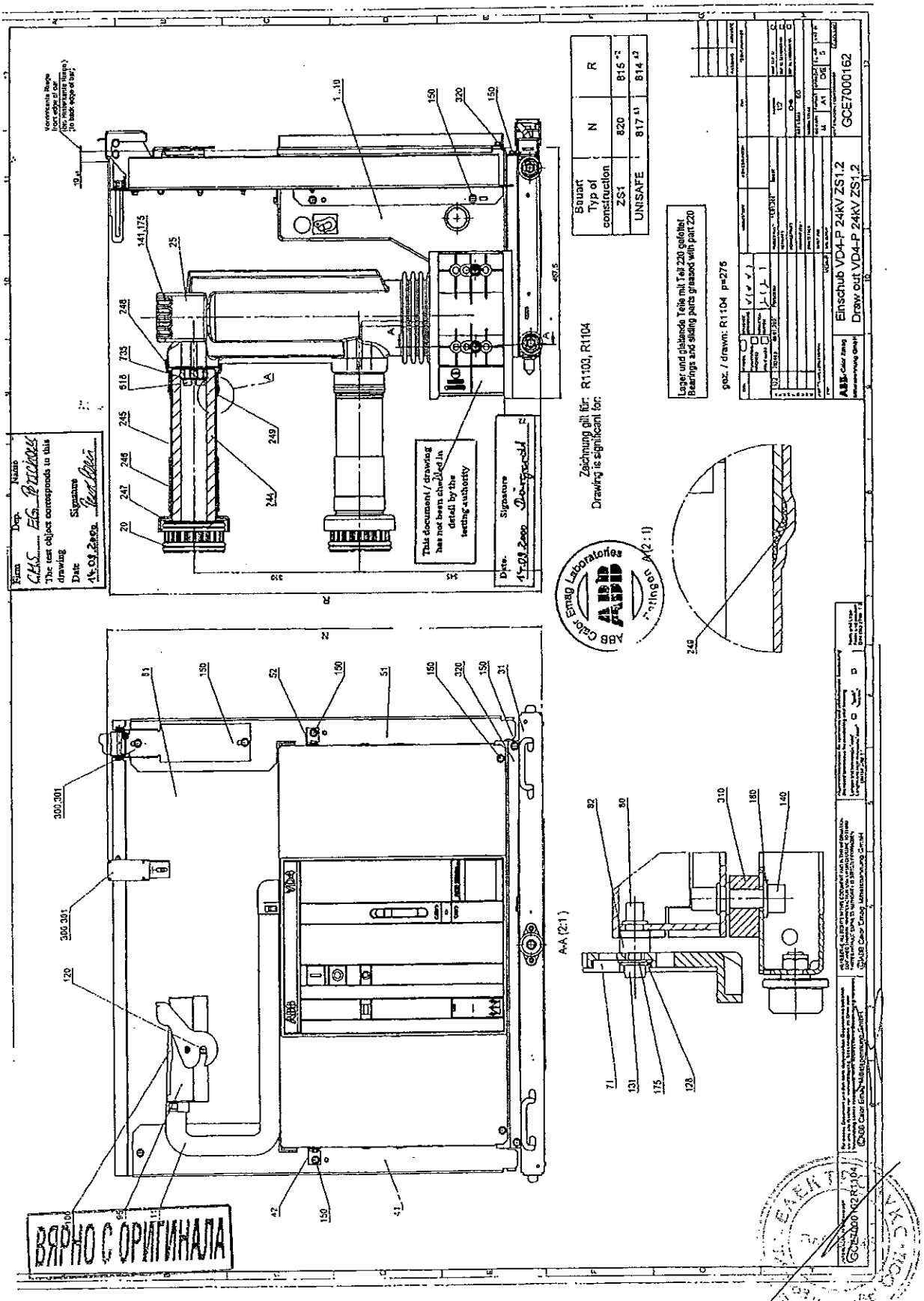
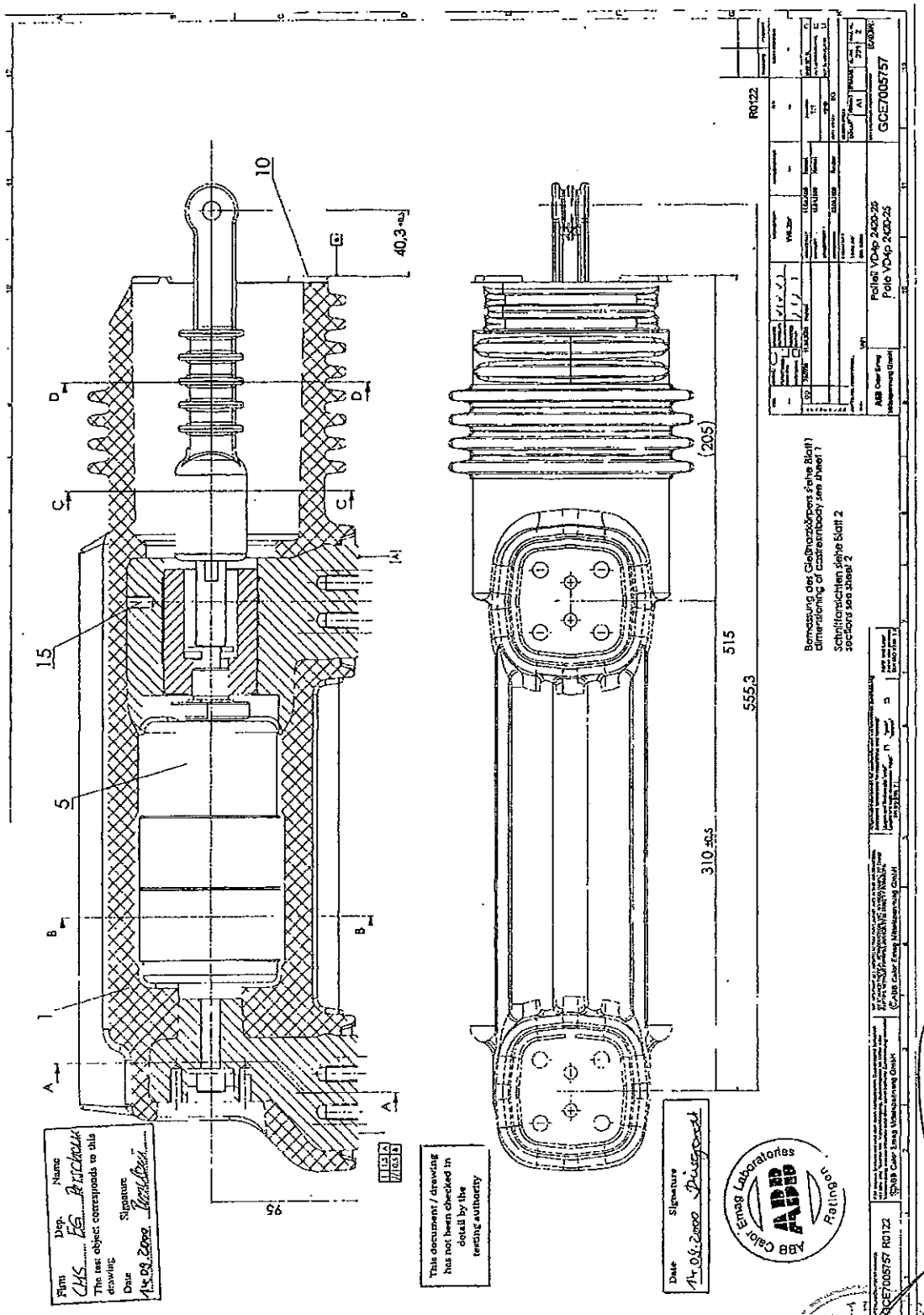

Bauart
Typ of construction
N
R
ZS1
820
815 +2
UNISAFE
817 +1
814 +2
Einschub VD4-P 24kV ZS1.2
Draw out VD4-P 24kV ZS1.2
GCE7000162
Zeichnung gilt für: R1103, R1104
Drawing is significant for:
ABB Calor Emag Laboratories
Ludwigshafen
A-A (2:1)
ВЯРНО С ОРИГИНАЛА



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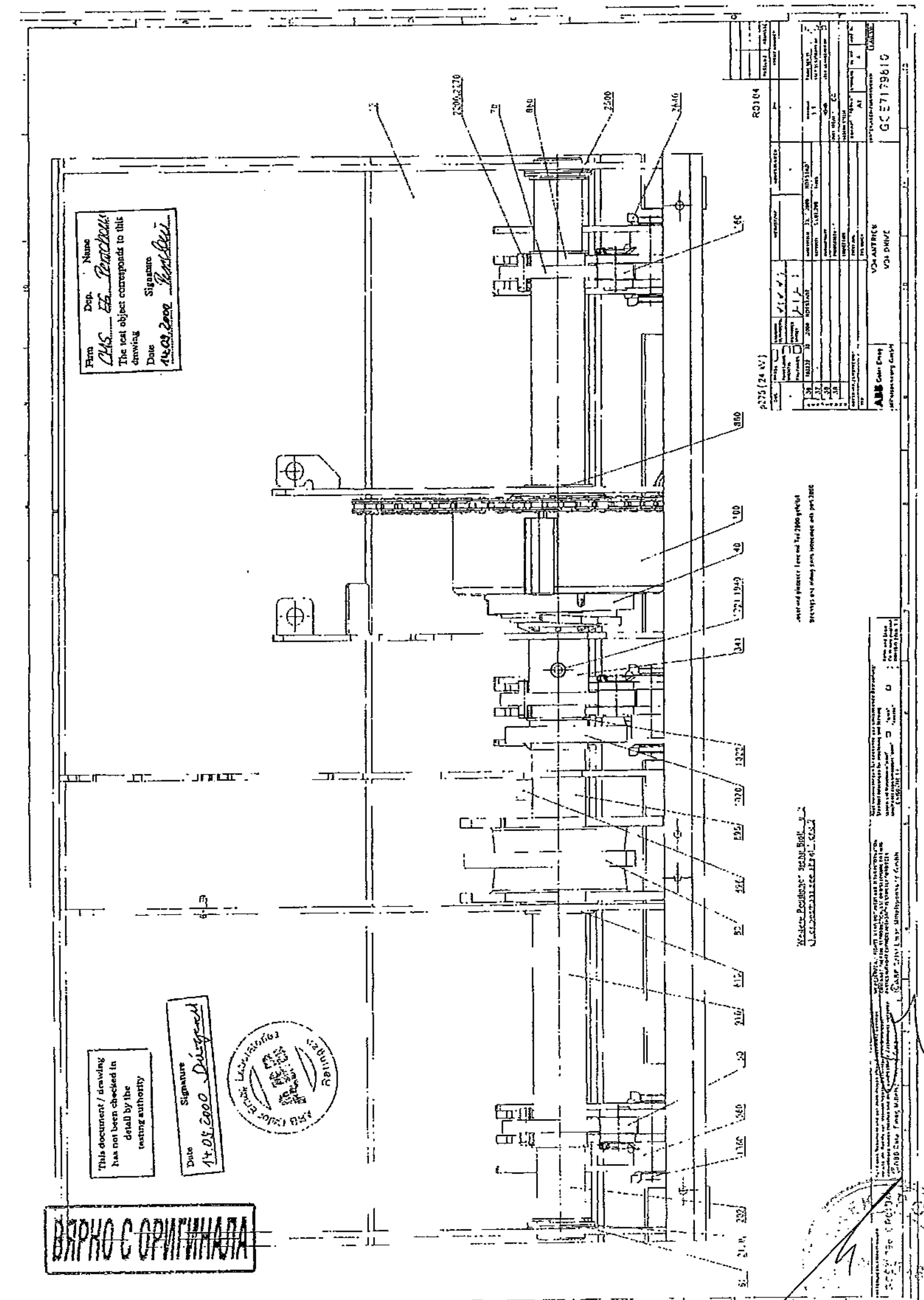
The test object corresponds to this drawing
This document / drawing has not been checked in detail by the testing authority
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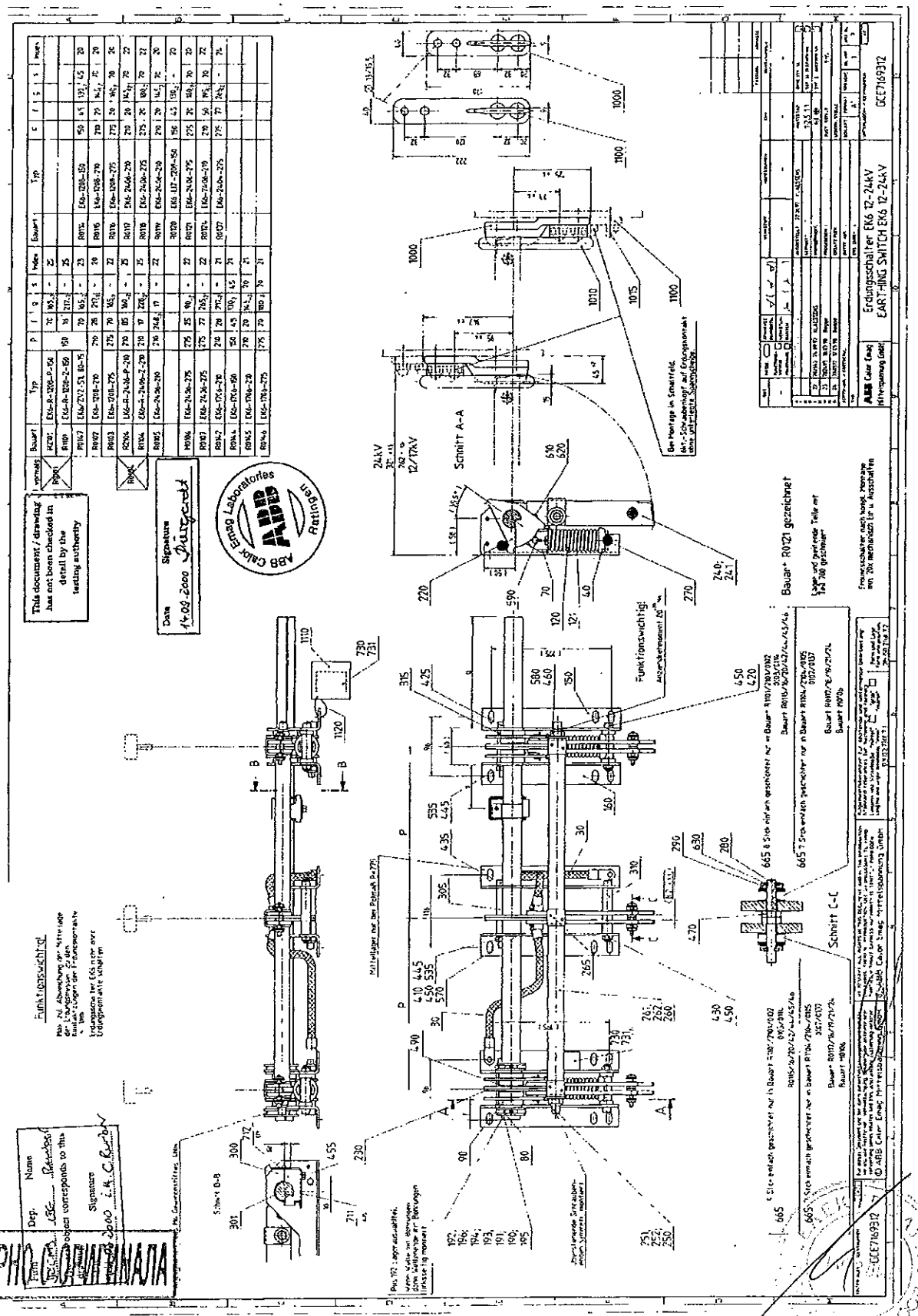

Schnitt A-A
Schnitt B-B
Schnitt C-C
Funktionswichtig!
Bauart R0121 gezeichnet
ABB Calor Emag Laboratories
This document / drawing has not been checked in detail by the testing authority
Data 14.09.2000
Signature

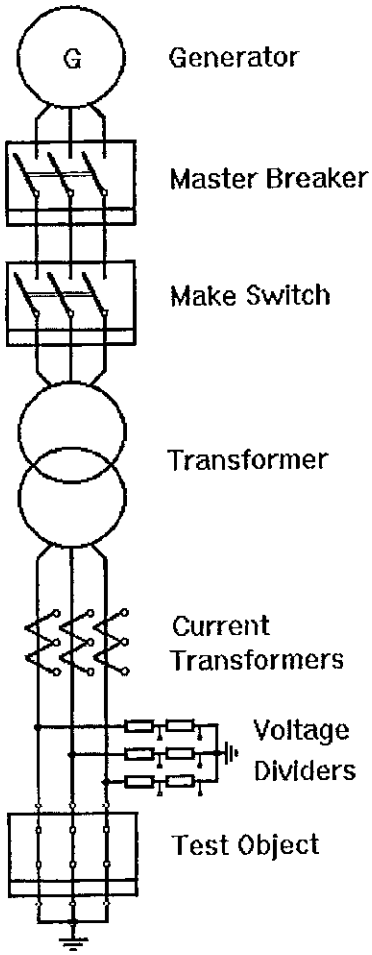
Technical Data of Test Circuit

Test		STC	--	--	--
Oscillogram-No. HZ 235 F 01		02 - 09	--	--	--
Number of phases	(circuit)	3	--	--	--
Number of poles/phases	(test object)	3	--	--	--
Power frequency	Hz	50	--	--	--
Power factor	cos φ	≤ 0.15	--	--	--
Earthing Generator		earthed via 5 kΩ	--	--	--
Earthing Transformer		not earthed	--	--	--
Earthing Short-circuit point		earthed	--	--	--
Circuit diagram	Sheet no.:	14	--	--	--
Circuit impedance	mΩ	≈ 5	--	--	--
	--	--	--	--	--
TRV control elements		--	--	--	--
Capacitance in parallel	µF	--	--	--	--
Resistance in series	Ω	--	--	--	--
	-	--	--	--	--
	-	--	--	--	--
Prospective TRV	-	--	--	--	--
TRV peak value u_c	kV	--	--	--	--
Time co-ordinate t_3	µs	--	--	--	--
Time delay t_d	µs	--	--	--	--
Based on	kV	--	--	--	--
Rate-of-rise	kV/µs	--	--	--	--
	-	--	--	--	--
	-	--	--	--	--
Voltage measurements		Divider 75 kΩ / 1.1 kΩ	--	--	--
Current measurements		Transformer 50 kA / 5 A	--	--	--

Remarks: -

ВЯРНО С ОРИГИНАЛА

Principle Diagram of Test Circuit



ВЯРНО С ОРИГИНАЛА

Peak and Short-Time Withstand Current Tests

Actual values
(Main circuit)

Condition of test object before test: Switchgear and equipment new.

Connection to test object: By means of copper conductors to the cable terminals of the panel. Short-circuit bridge mounted on the bushings of busbar outside the panel. The circuit breaker closed.

Oscillogram-No. HZ 235 F 01				04	05	--	--
Peak short-circuit current		L1	kA	65.8	29.8	--	--
		L2	kA	53.6	28.1	--	--
		L3	kA	19.0	32.5	--	--
Short-circuit current	first cycle	L1	kA	27.8	26.2	--	--
		L2	kA	28.6	25.9	--	--
		L3	kA	26.3	25.2	--	--
	last cycle	L1	kA	26.2	25.9	--	--
		L2	kA	27.1	26.9	--	--
		L3	kA	25.3	25.0	--	--
Equivalent r.m.s. value		L1	kA	26.3	25.5	--	--
		L2	kA	27.3	26.4	--	--
		L3	kA	25.4	24.6	--	--
Average value			kA	26.3	25.5	--	--
Duration of short-circuit current			s	0.304	3.03	--	--
Short-time current	1 s	L1	kA	--	--	--	--
		L2	kA	--	--	--	--
		L3	kA	--	--	--	--
Average value			kA	--	--	--	--
Short-time current	3 s	L1	kA	--	25.6	--	--
		L2	kA	--	26.5	--	--
		L3	kA	--	24.7	--	--
Average value			kA	--	25.6	--	--

Remarks:
HZ 235 F 01 / 01: Current calibration
HZ 235 F 01 / 02: No-load operation
HZ 235 F 01 / 03: Test with reduced values
HZ 235 F 01 / 06: No-load operation

Condition of test object after test:
HZ 235 F 01 / 05: No visible change or damage. Circuit-breaker opened by its own mechanism at the first attempt.

ВЯРНО С ОРИГИНАЛА

Peak and Short-Time Withstand Current Tests

Actual values
(Earthing switch)

Condition of test object before test: Switchgear and equipment as after test 06.

Connection to test object: By means of copper conductors to the cable terminals. Short-circuit made by means of the closed earthing switch inside the panel. Circuit-breaker open in test position.

Oscillogram-No. HZ 235 F 01				08	09	--	--
Peak short-circuit current		L1	kA	66.5	34.1	--	--
		L2	kA	52.9	30.2	--	--
		L3	kA	19.1	36.2	--	--
Short-circuit current	first cycle	L1	kA	27.9	26.9	--	--
		L2	kA	27.9	26.3	--	--
		L3	kA	26.2	25.8	--	--
	last cycle	L1	kA	25.8	25.3	--	--
		L2	kA	26.0	25.6	--	--
		L3	kA	24.8	24.4	--	--
Equivalent r.m.s. value		L1	kA	26.1	25.4	--	--
		L2	kA	26.4	25.6	--	--
		L3	kA	25.1	24.4	--	--
Average value			kA	25.8	25.1	--	--
Duration of short-circuit current			s	0.302	3.03	--	--
Short-time current	1 s	L1	kA	--	--	--	--
		L2	kA	--	--	--	--
		L3	kA	--	--	--	--
Average value			kA	--	--	--	--
Short-time current	3 s	L1	kA	--	25.5	--	--
		L2	kA	--	25.7	--	--
		L3	kA	--	24.5	--	--
Average value			kA	--	25.2	--	--

Remarks:
HZ 235 F 01 / 07: Test with reduced values

Condition of test object after test:
HZ 235 F 01 / 09: No visible change or damage. Earthing switch could be opened easily by its own mechanism.

ВЯРНО С ОРИГИНАЛА

Actual Values of No-Load Operations

Rated supply voltage of closing coil 220 V dc
Rated supply voltage of opening coil 220 V dc

	Voltage of closing coil V	Closing time ms	Voltage of opening coil V	Opening time ms
Test HZ 235 F 01 / 02	--	--	220	36,4
Test HZ 235 F 01 / 06	--	--	220	37,4

Measurement of the Resistance of the Main-Circuit

Cable terminal against busbar outside the panel.

	Phase L 1	Phase L 2	Phase L 3
Before Test HZ 235 F 01 / 02	67.8 μΩ	60.4 μΩ	54.5 μΩ
After Test HZ 235 F 01 / 06	61.1 μΩ	60.0 μΩ	56.4 μΩ

ВЯРНО С ОРИГИНАЛА

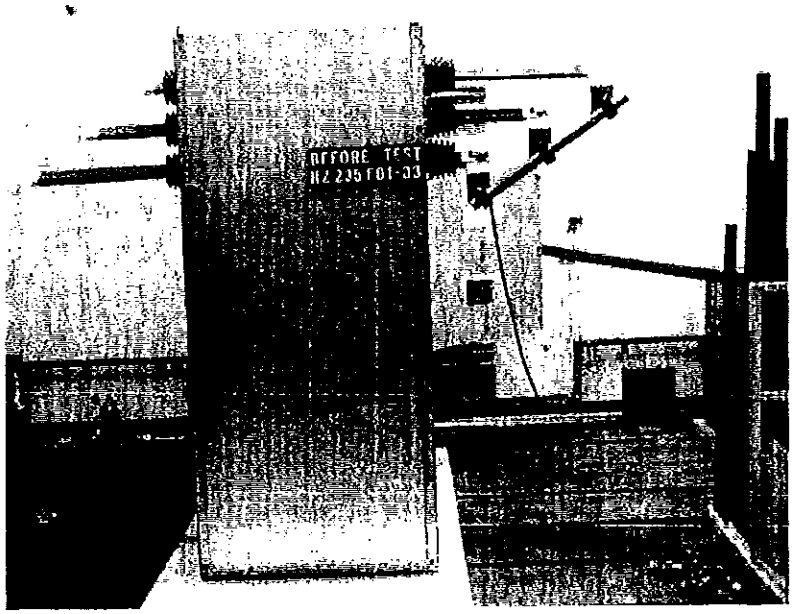


Photo no. 1
Before Test HZ 235 F 01 / 03

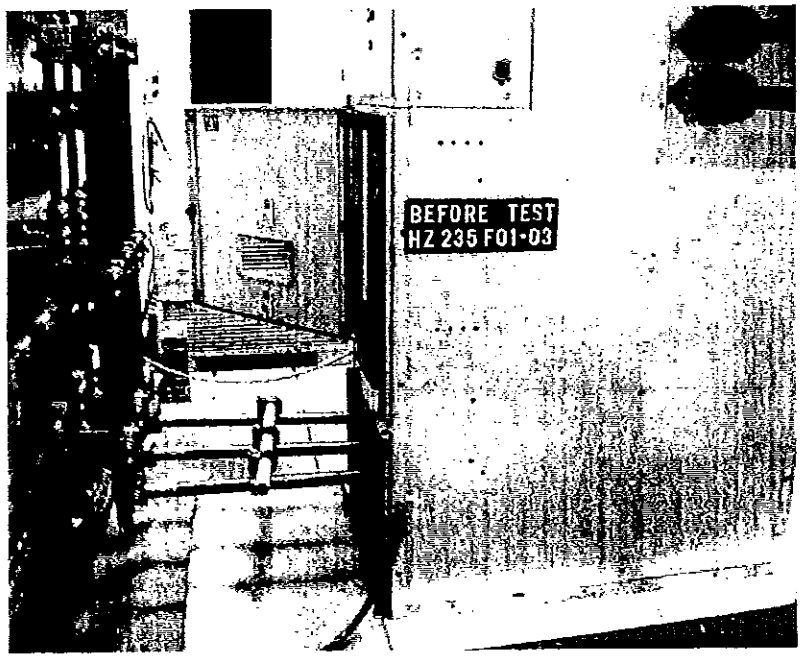


Photo no. 2
Before Test HZ 235 F 01 / 03

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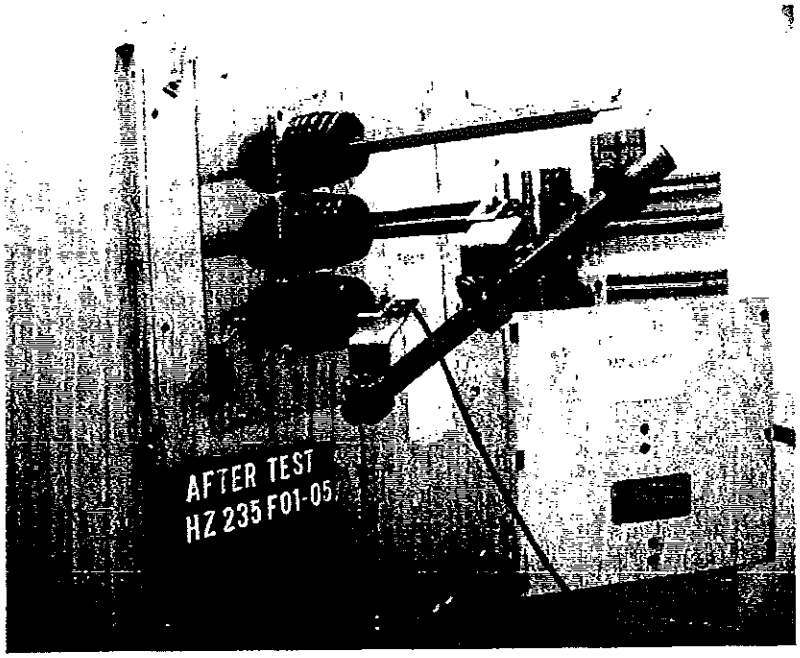

Photo no. 3
After Test HZ 235 F 01 / 05

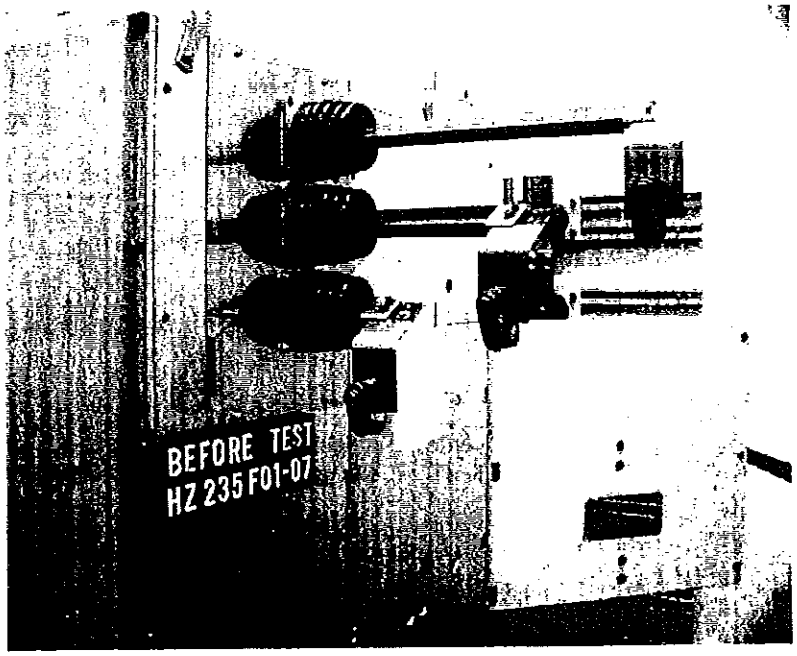

Photo no. 4
Before Test HZ 235 F 01 / 07

ВЯРНО С ОРИГИНАЛА

Photo no. 5
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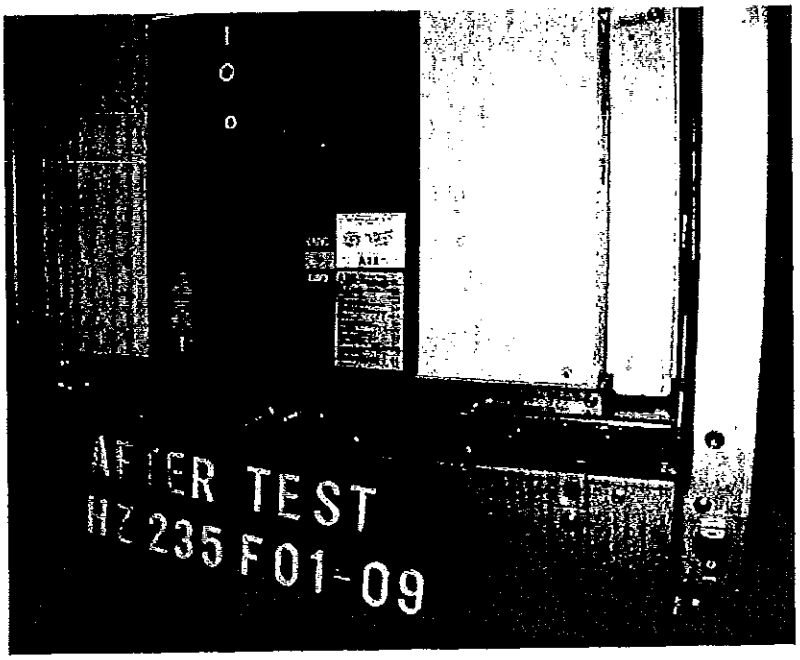

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After Test HZ 235 F 01 / 09

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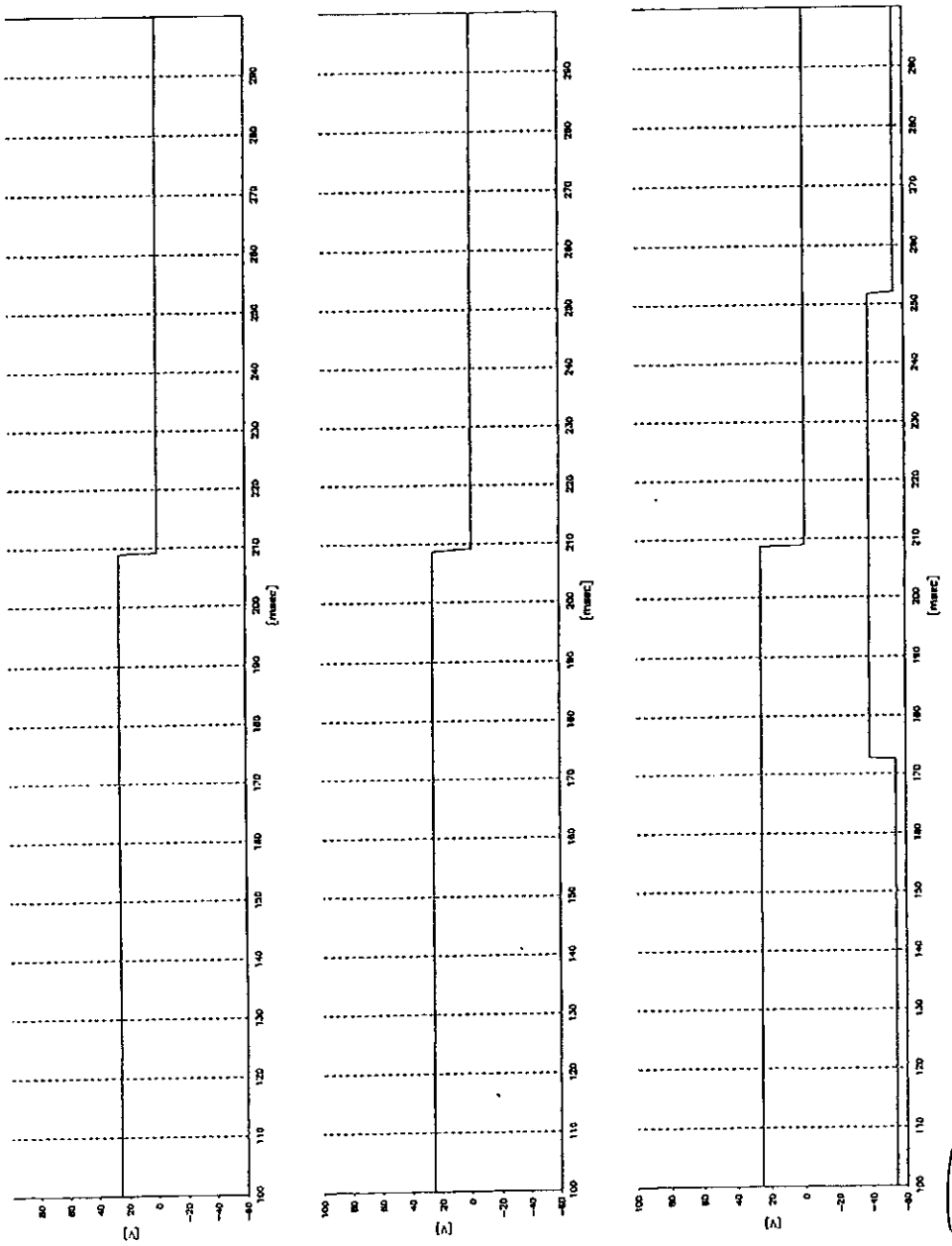

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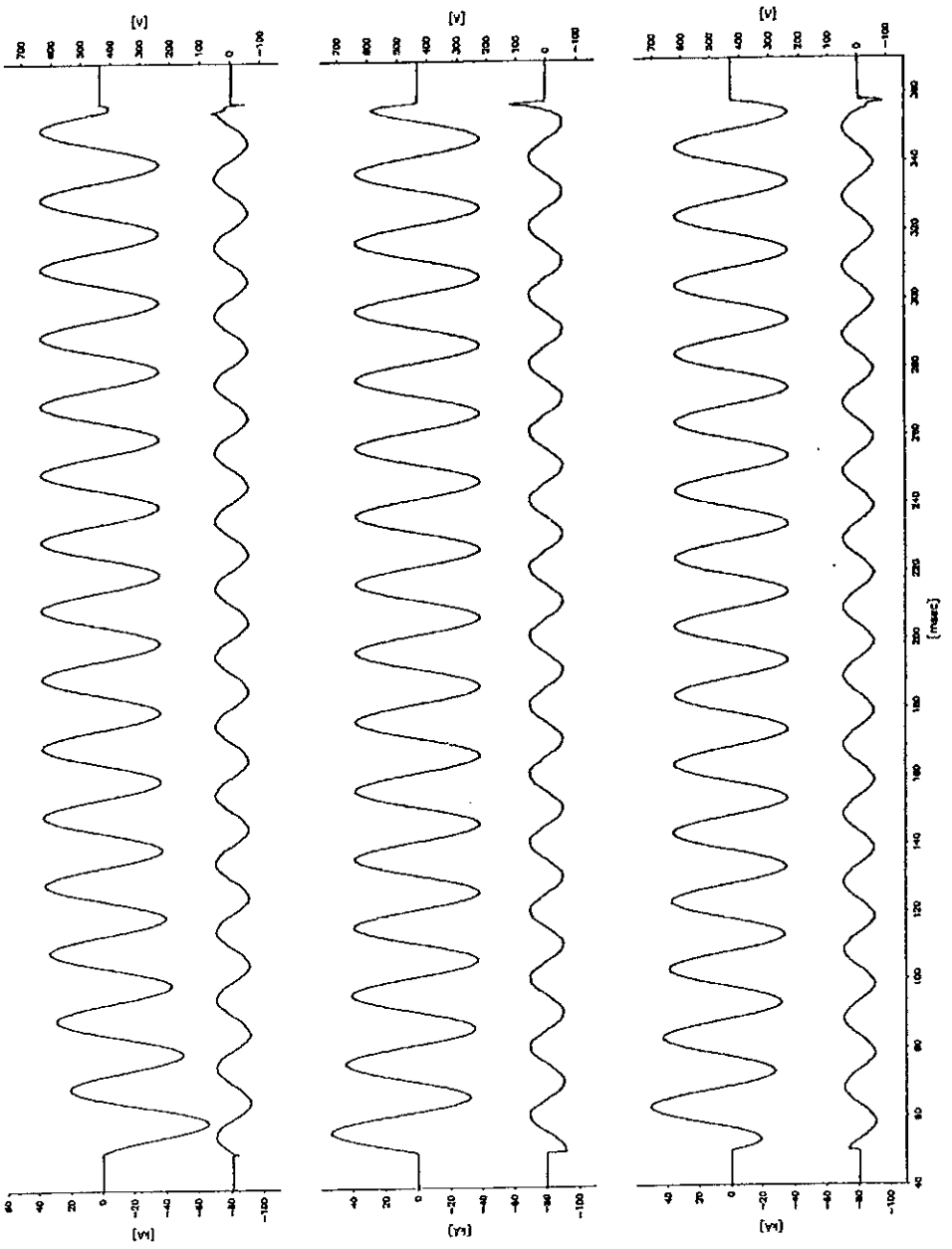
ВЯРНО С ОРИГИНАЛА



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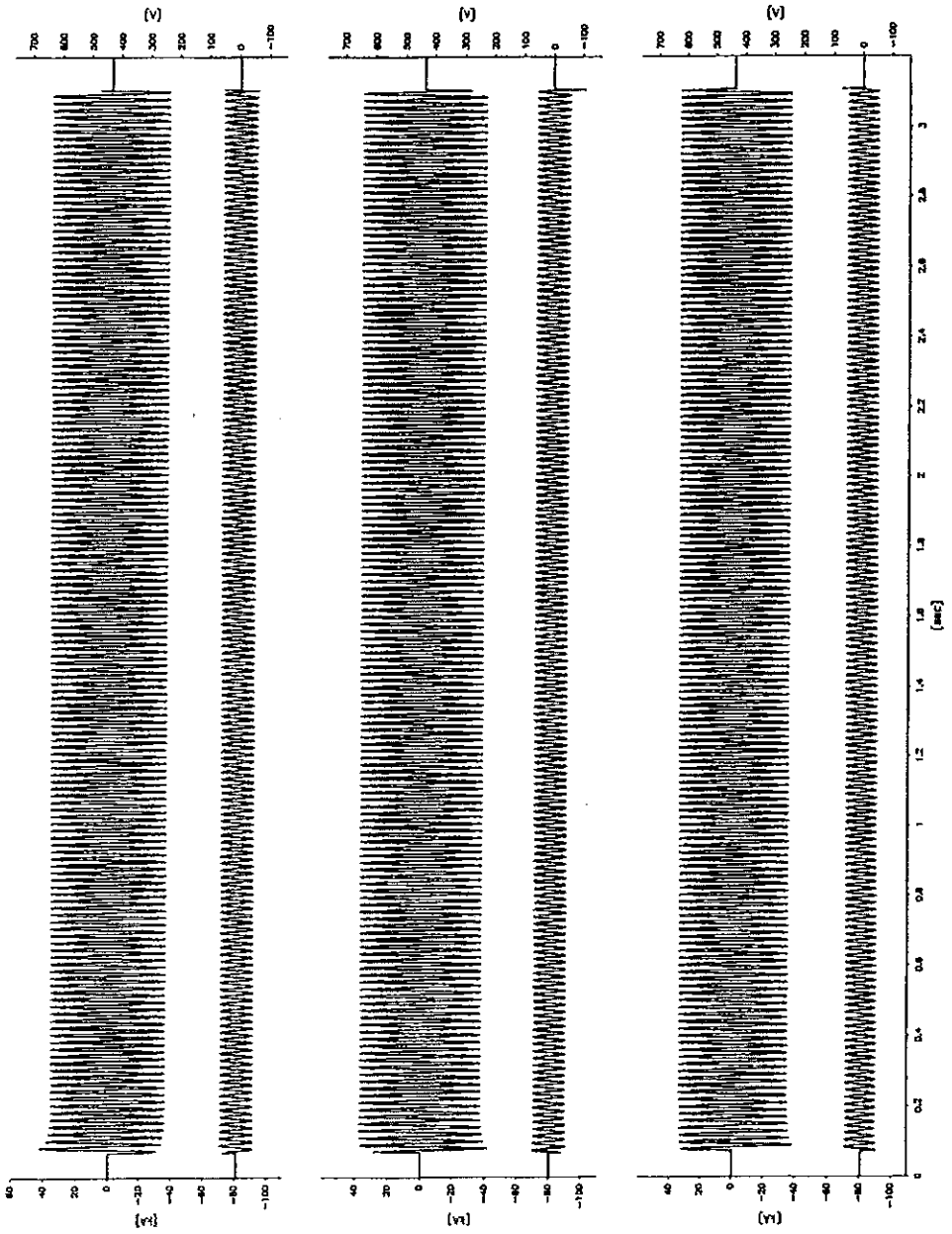

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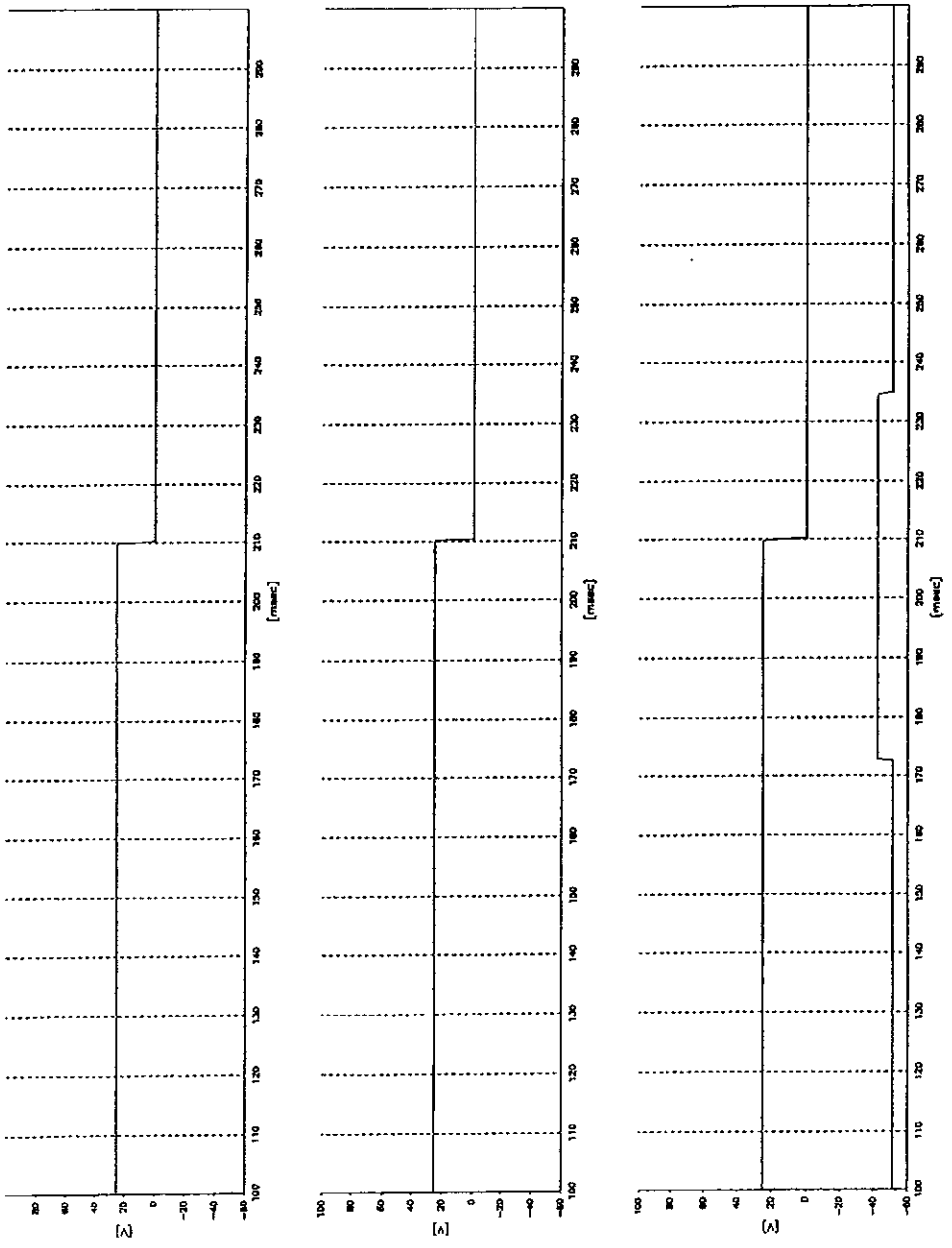
HZ235F01.005

ВЯРНО С ОРИГИНАЛА



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HZ235F01.006

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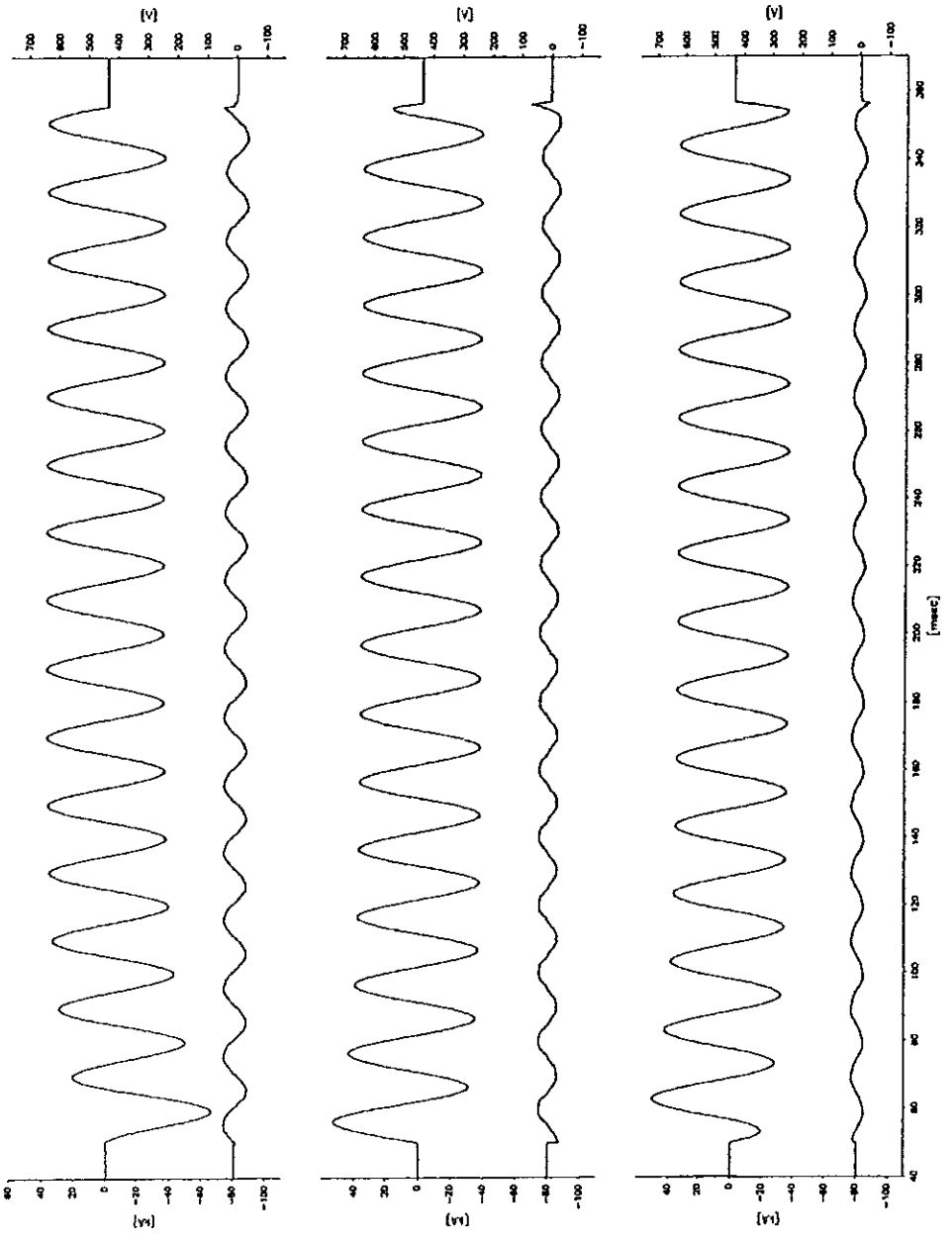

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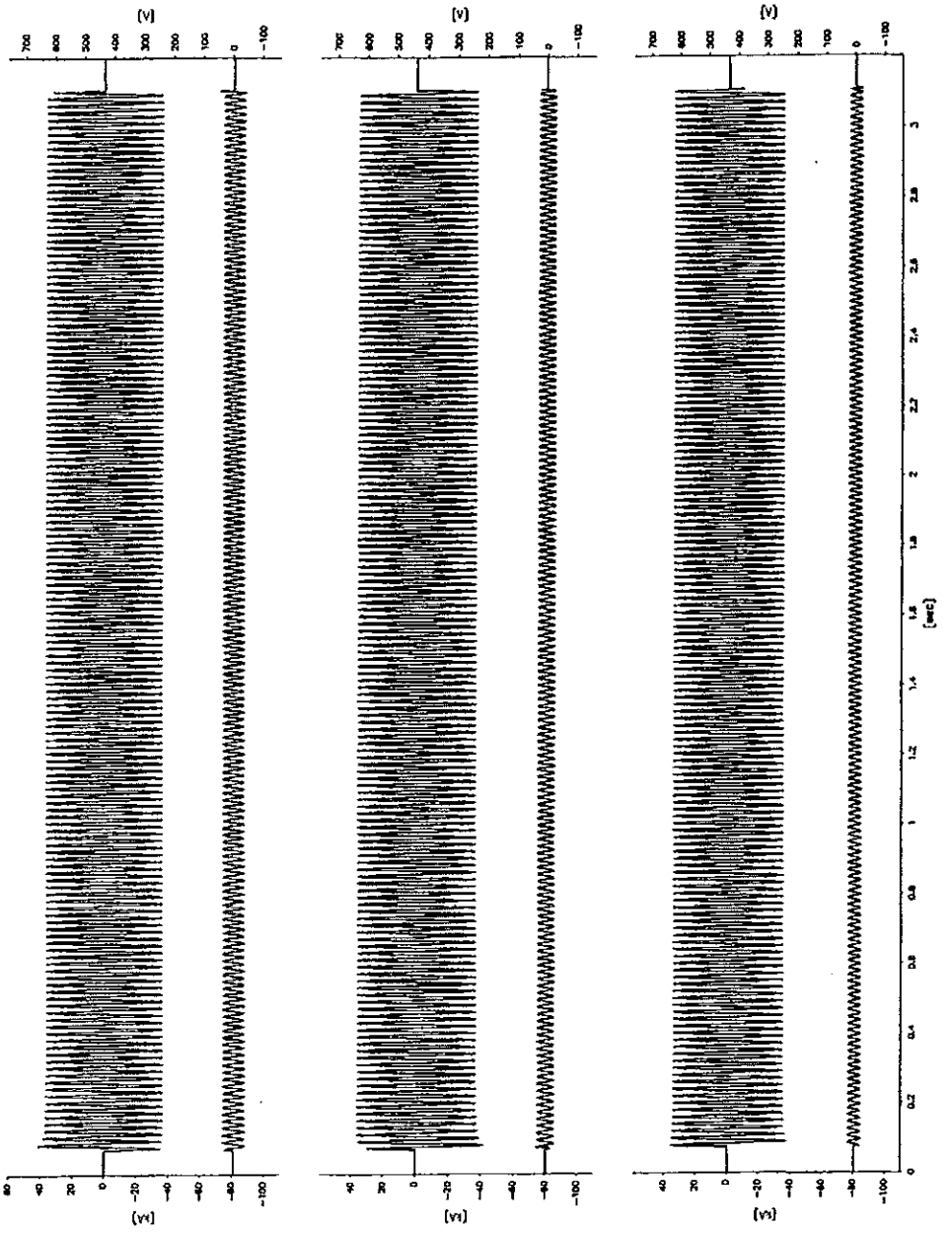

HZ235F01.009

ВЯРНО С ОРИГИНАЛА

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ABB Calor Emag Laboratories

ABB

TEST REPORT No. HZ 236 E 06 Sheet 1

Issued by an Accredited Laboratory corresponding to EN 45001

Copy-No. 02e

Test Object

2-panel metal-clad air-insulated switchgear type ZS1.2 – 24 kV consisting of
- feeder panel 2000 A with vacuum circuit-breaker type VM1 2420-25, natural ventilated
- feeder panel 1250 A with vacuum circuit-breaker type VM1 2412-25

max. ambient temperature ϑ_{umax} = 40 °C,

Rated voltage	U_n	24	kV
Rated normal current panel	I_n	2000 / 1250	A
Rated frequency	f	50	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
Max. ambient temperature	ϑ_u	40	°C

Manufacturer

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

Tests performed

Three-phase temperature-rise test at the rated current of 2000 A / 1250 A at a power frequency of 50 Hz.
Measurement of the resistance of the main circuit before and after the temperature rise test.

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 2-panel ZS1.2-type switchgear passed the above mentioned tests successsfully. The respective requirements are met. The test results are tabulated on sheets 19 to 24.

Test Date

November 11th - November 12th, 2000

Client

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

ABB Calor Emag Laboratories Ratingen

November 16th, 2000
Date of Issue

Laboratory Manager

Test Engineer

Total Number of Sheets: 29 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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ABB Calor Emag Mittelspannung GmbH Ratingen
High-Power Testing Laboratory

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ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switchgear – Panel 1

Ratings assigned by the manufacturer

Test Object: Metal-clad air insulated switchgear, incoming panel with vacuum circuit-breaker type VM1
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.: 7550027/2016/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010459R0102

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 of busbar	2000	A
Rated normal current of tee-offs	2000	A
Rated peak withstand current	63	kA
Rated short-time withstand current	25	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	63	kA
Short-time current	25	kA
Duration of short-circuit	1	s
Max. ambient air temperature	40	°C

The above mentioned switchgear panel is fully described in 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 Transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
Wirges GmbH	TPU66.11	2000	E
Voltages	**Frequency**	**Sort-time withst. current**	**Peak withstand current**
24/50/125 kV	50 Hz	25 kA / 3 s	63 kA
Serial Nos.	**L1** 058249, **L2** 058250; **L3** 058251		
Core 1	2000 / 5 A; 15 VA, accuracy class 0.5		
Core 2	2000 / 5 A; 15 VA, accuracy class 5P15		

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switchgear – Panel 2

Ratings assigned by the manufacturer

Test Object: Metal-clad air insulated switchgear, incoming panel with vacuum circuit-breaker type VM1
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.: 7550027/2014/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010457R0102

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 of busbar	2000	A
Rated normal current of tee-offs	1250	A
Rated peak withstand current	63	kA
Rated short-time withstand current	25	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	63	kA
Short-time current	25	kA
Duration of short-circuit	1	s
Max. ambient air temperature	40	°C

The above mentioned switchgear panel is fully described in 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 Transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
Wirges GmbH	TPU63.11	2000	E
Voltages	**Frequency**	**Sort-time withst. current**	**Peak withstand current**
24/50/125 kV	50 Hz	25 kA / 3 s	63 kA
Serial Nos.	**L1** 058240, **L2** 058241; **L3** 058242		
Core 1	1250 / 5 A; 10 VA, accuracy class 0.5		
Core 2	1250 / 5 A; 10 VA, accuracy class 5P15		

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switching Device – Circuit-Breaker of Panel 1

Ratings assigned by the manufacturer

Test Object:	Vacuum circuit-breaker
Type:	VM1 2420-25
Manufacturer:	ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.:	7550030/4006/00 **Year of manufacture:** 2000
Drawing No.:	GCE7004924R0136 (circuit-breaker)
Vacuum interrupter:	Type: VG4-S L1: No. 00/061190, L2: No. 00/061193, L3: No. 00/061195
Drawing No.:	GCE7005757R0102 (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 / 60 Hz
Rated normal current	2000 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	25 kA
D.C. component	40 %
Rated short-circuit making current	63 kA
Rated transient recovery voltage:	
Peak value	41 kV
Rate of rise	0.47 kV/µs
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	35...45 ms
Rated closing time	50...60 ms
Rated voltage of trip coil	230 V
Rated voltage of closing coil	230 V
Rated supply voltage	230 V
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:
-

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switching Device – Circuit-Breaker of Panel 2

Ratings assigned by the manufacturer

Test Object:	Vacuum circuit-breaker
Type:	VM1 2412-25
Manufacturer:	ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.:	7550027/4004/00 **Year of manufacture:** 2000
Drawing No.:	GCE7004924R0121 (circuit-breaker)
Vacuum interrupter:	Type: VG4-S L1: No. 01936, L2: No. 00678, L3: No. 02130
Drawing No.:	GCE7004730R0102 (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 / 60 Hz
Rated normal current	1250 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	25 kA
D.C. component	40 %
Rated short-circuit making current	63 kA
Rated transient recovery voltage:	
Peak value	41 kV
Rate of rise	0.47 kV/µs
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	35...45 ms
Rated closing time	50...60 ms
Rated voltage of trip coil	230 V
Rated voltage of closing coil	230 V
Rated supply voltage	230 V
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:

-

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

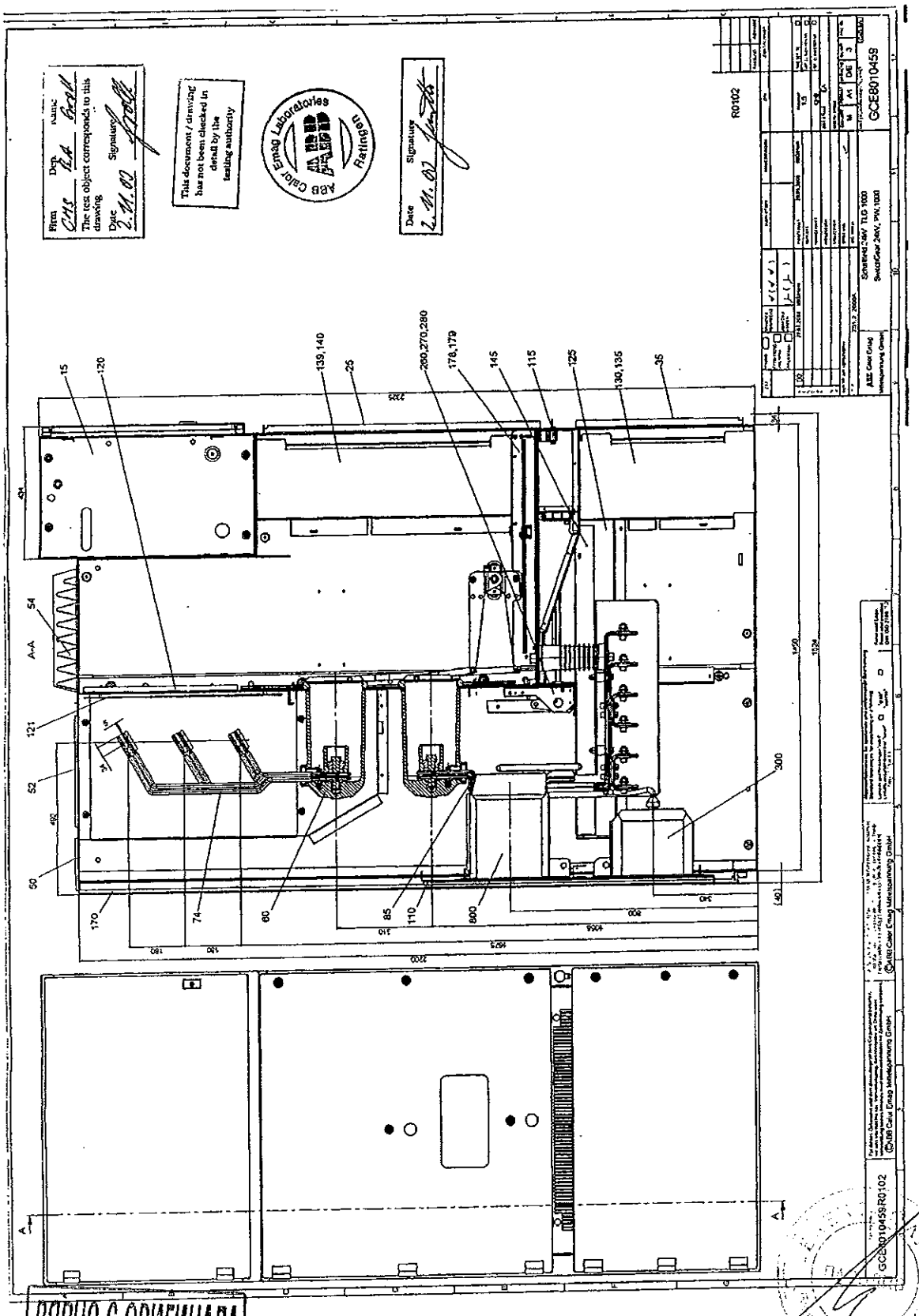
List of Drawings

The manufacturer has guaranteed, that the equipment submitted for test has been manufactured in full accordance with the following drawings. 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.	Title
GCE8010459R0102 index 00	Switchgear, 24 kV, PW. 1000
GCE8010457R0102 index 00	Switchgear, 24 kV, PW. 800
GCE7004924R0136 index 00	Draw out VM1 24 kV in ZS1.2
GCE7004924R0121 index 06	Draw out VM1 24 kV in ZS1
GCE7005757R0102 index 00	Pole part VD4p 2420-25
GCE7004730R0102 index 09	pole part VD4 24 kV 1250 A

ВЯРНО С ОРИГИНАЛА



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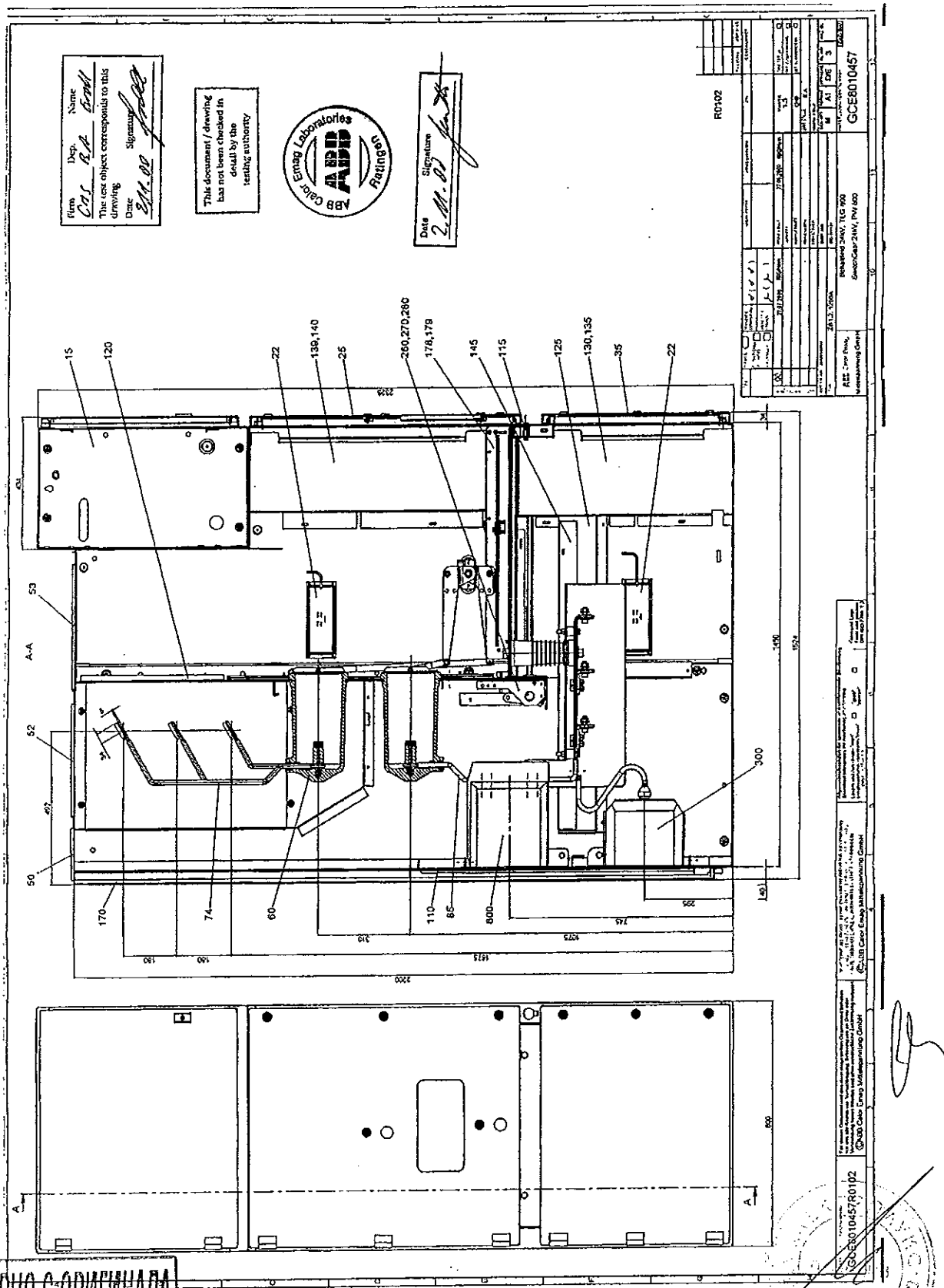

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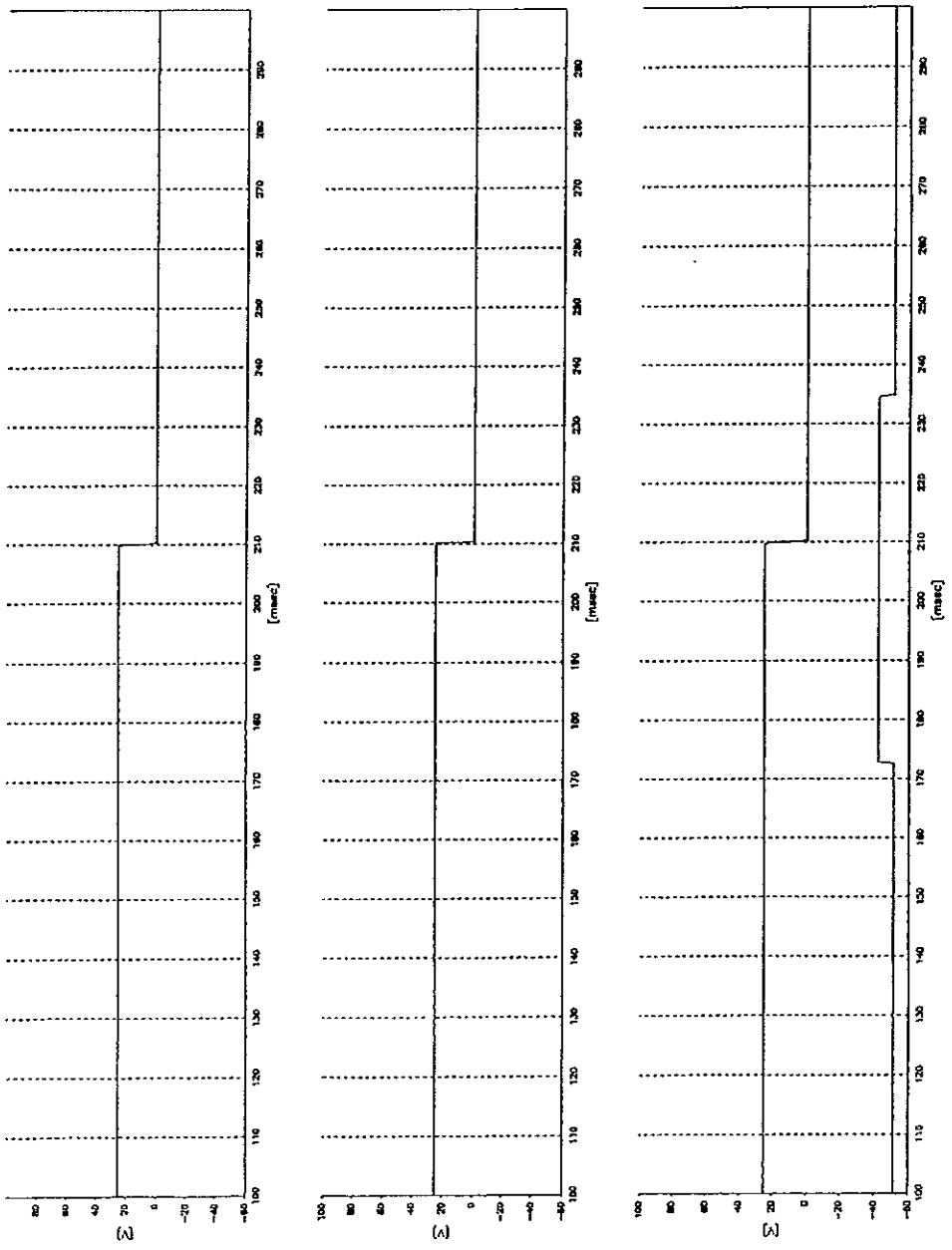

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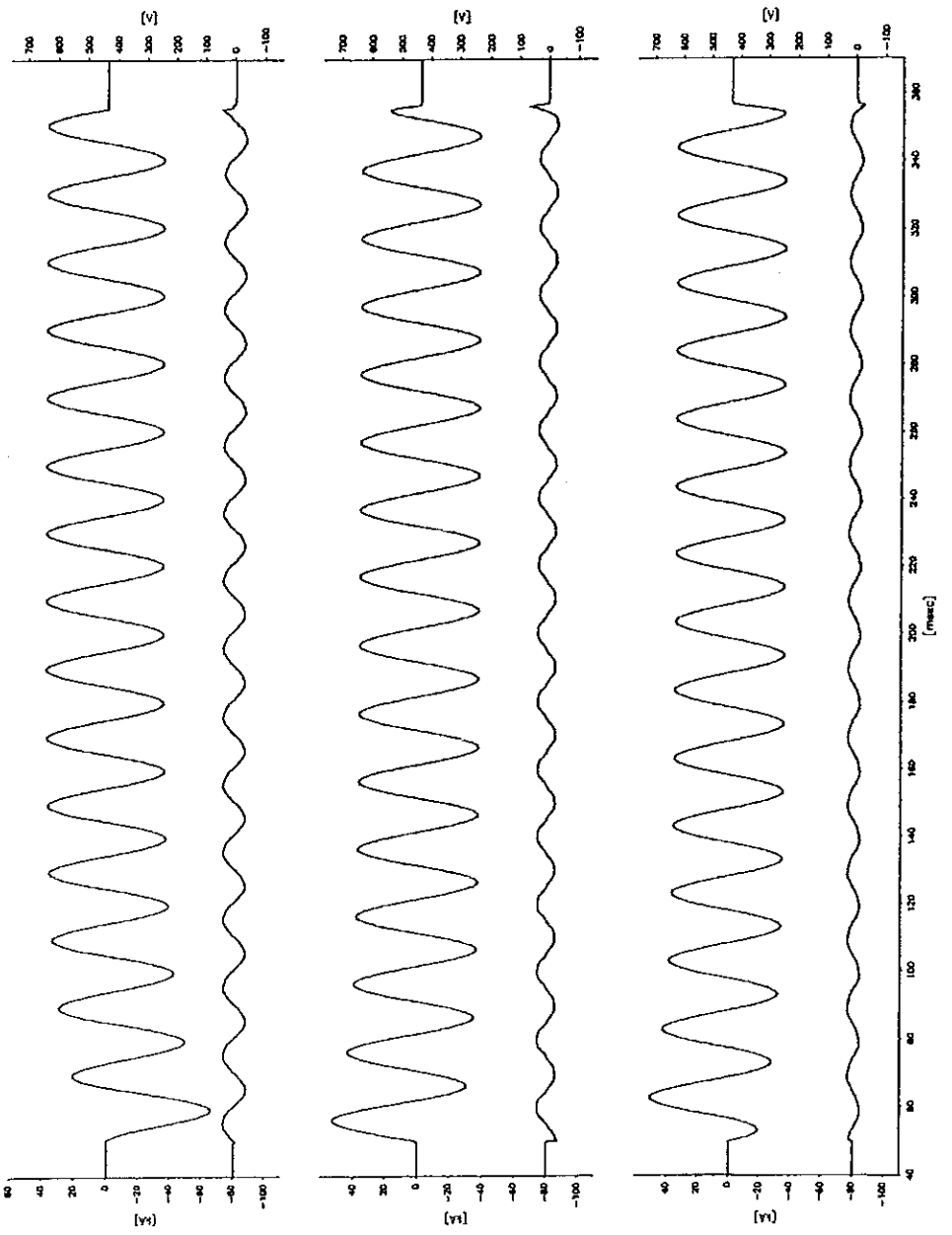

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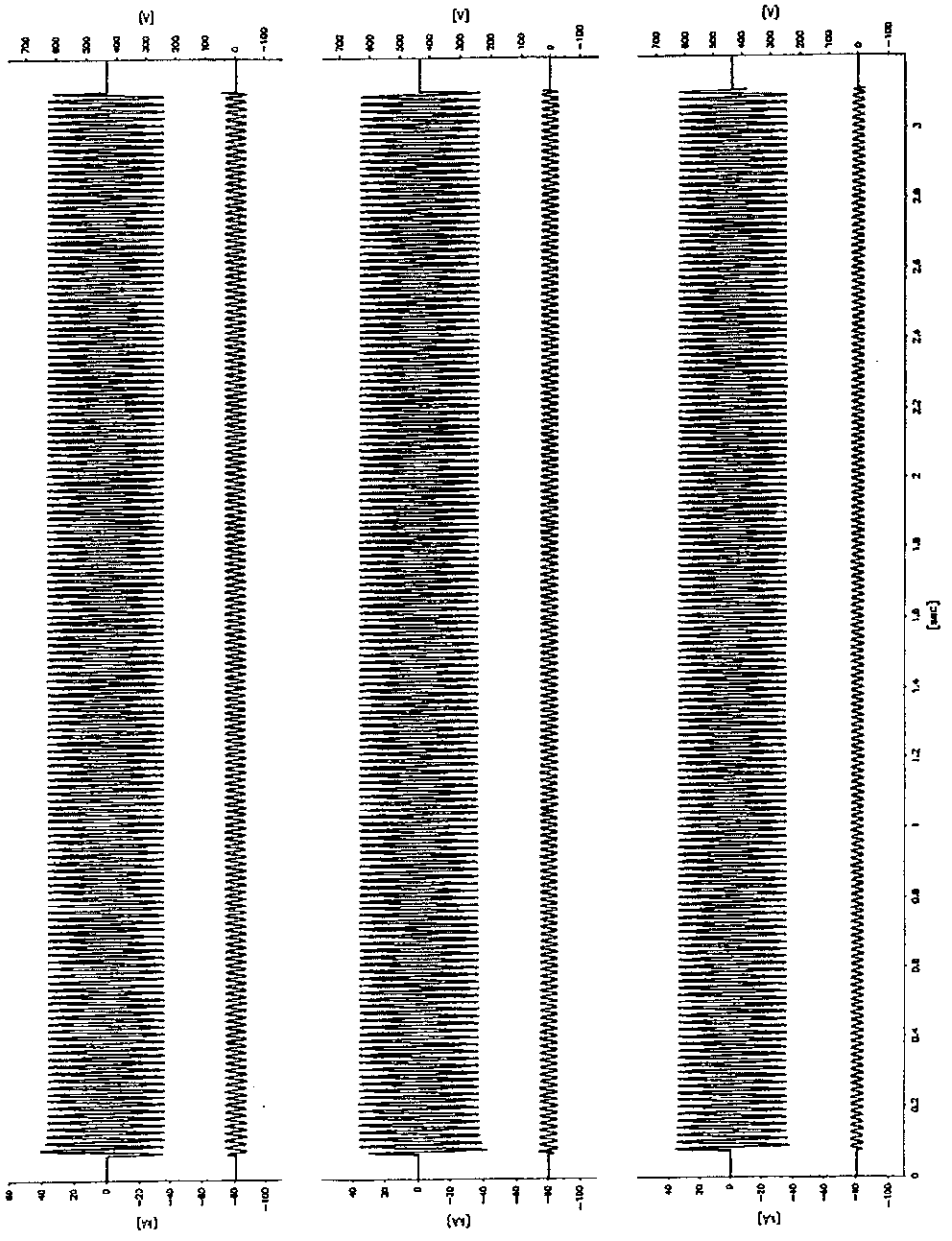

HZ235F01.009

ВЯРНО С ОРИГИНАЛА

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ABB Calor Emag Laboratories

ABB

TEST REPORT No. HZ 236 E 06

Issued by an Accredited Laboratory corresponding to EN 45001

Copy-No. 02e

Test Object

2-panel metal-clad air-insulated switchgear type ZS1.2 – 24 kV consisting of
- feeder panel 2000 A with vacuum circuit-breaker type VM1 2420-25, natural ventilated
- feeder panel 1250 A with vacuum circuit-breaker type VM1 2412-25

max. ambient temperature ϑ_{umax} = 40 °C,

Rated voltage	U_n	24	kV
Rated normal current panel	I_n	2000 / 1250	A
Rated frequency	f	50	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
Max. ambient temperature	ϑ_u	40	°C

Manufacturer

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

Tests performed

Three-phase temperature-rise test at the rated current of 2000 A / 1250 A at a power frequency of 50 Hz.
Measurement of the resistance of the main circuit before and after the temperature rise test.

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 2-panel ZS1.2-type switchgear passed the above mentioned tests successsfully. The respective requirements are met. The test results are tabulated on sheets 19 to 24.

Test Date

November 11th - November 12th, 2000

Client

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

ABB Calor Emag Laboratories ABB Ratingen

November 16th, 2000
Date of Issue

Laboratory Manager

Test Engineer

Total Number of Sheets: 29 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

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ВЯРНО С ОРИГИНАЛА

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ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switchgear – Panel 1

Ratings assigned by the manufacturer

Test Object: Metal-clad air insulated switchgear, incoming panel with vacuum circuit-breaker type VM1
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.: 7550027/2016/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010459R0102

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 of busbar	2000 A
Rated normal current of tee-offs	2000 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 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	63 kA
Short-time current	25 kA
Duration of short-circuit	1 s
Max. ambient air temperature	40 °C

The above mentioned switchgear panel is fully described in 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 Transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
Wirges GmbH	TPU66.11	2000	E
Voltages	**Frequency**	**Sort-time withst. current**	**Peak withstand current**
24/50/125 kV	50 Hz	25 kA / 3 s	63 kA
Serial Nos.	**L1** 058249, **L2** 058250; **L3** 058251		
Core 1	2000 / 5 A; 15 VA, accuracy class 0.5		
Core 2	2000 / 5 A; 15 VA, accuracy class 5P15		

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switchgear – Panel 2

Ratings assigned by the manufacturer

Test Object: Metal-clad air insulated switchgear, incoming panel with vacuum circuit-breaker type VM1
Type: ZS1.2
Manufacturer: ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.: 7550027/2014/00 (switchgear) **Year of manufacture:** 2000
Drawing No.: GCE8010457R0102

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 of busbar	2000 A
Rated normal current of tee-offs	1250 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 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	63 kA
Short-time current	25 kA
Duration of short-circuit	1 s
Max. ambient air temperature	40 °C

The above mentioned switchgear panel is fully described in 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 Transformers:

Manufacturer	**Type**	**Year of manufacture**	**Insulation class**
Wirges GmbH	TPU63.11	2000	E
Voltages	**Frequency**	**Sort-time withst. current**	**Peak withstand current**
24/50/125 kV	50 Hz	25 kA / 3 s	63 kA
Serial Nos.	**L1** 058240, **L2** 058241; **L3** 058242		
Core 1	1250 / 5 A; 10 VA, accuracy class 0.5		
Core 2	1250 / 5 A; 10 VA, accuracy class 5P15		

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switching Device – Circuit-Breaker of Panel 1

Ratings assigned by the manufacturer

Test Object:	Vacuum circuit-breaker
Type:	VM1 2420-25
Manufacturer:	ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.:	7550030/4006/00 **Year of manufacture:** 2000
Drawing No.:	GCE7004924R0136 (circuit-breaker)
Vacuum interrupter:	Type: VG4-S L1: No. 00/061190, L2: No. 00/061193, L3: No. 00/061195
Drawing No.:	GCE7005757R0102 (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 / 60 Hz
Rated normal current	2000 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	25 kA
D.C. component	40 %
Rated short-circuit making current	63 kA
Rated transient recovery voltage:	
Peak value	41 kV
Rate of rise	0.47 kV/µs
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	35...45 ms
Rated closing time	50...60 ms
Rated voltage of trip coil	230 V
Rated voltage of closing coil	230 V
Rated supply voltage	230 V
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:
-

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

Technical Data of Test Object

Switching Device – Circuit-Breaker of Panel 2

Ratings assigned by the manufacturer

Test Object:	Vacuum circuit-breaker
Type:	VM1 2412-25
Manufacturer:	ABB Calor Emag Mittelspannung GmbH, D-40472 Ratingen; Germany
Serial-No.:	7550027/4004/00 **Year of manufacture:** 2000
Drawing No.:	GCE7004924R0121 (circuit-breaker)
Vacuum interrupter:	Type: VG4-S L1: No. 01936, L2: No. 00678, L3: No. 02130
Drawing No.:	GCE7004730R0102 (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 / 60 Hz
Rated normal current	1250 A
Rated peak withstand current	63 kA
Rated short-time withstand current	25 kA
Rated duration of short-circuit	3 s
Rated short-circuit breaking current	25 kA
D.C. component	40 %
Rated short-circuit making current	63 kA
Rated transient recovery voltage:	
Peak value	41 kV
Rate of rise	0.47 kV/µs
First-pole-to-clear-factor	1.5
Rated operating sequence	O-0.3 s –CO-3 min-CO
Arc extinguishing medium	vacuum
Number of poles	3
Number of units per pole	1
Rated opening time	35...45 ms
Rated closing time	50...60 ms
Rated voltage of trip coil	230 V
Rated voltage of closing coil	230 V
Rated supply voltage	230 V
Rated frequency of supply voltage	- Hz
Further specifications:	
Max. ambient air temperature	40 °C

Essential characteristics:
-

Date of receipt of test object: 30th October 2000

ВЯРНО С ОРИГИНАЛА

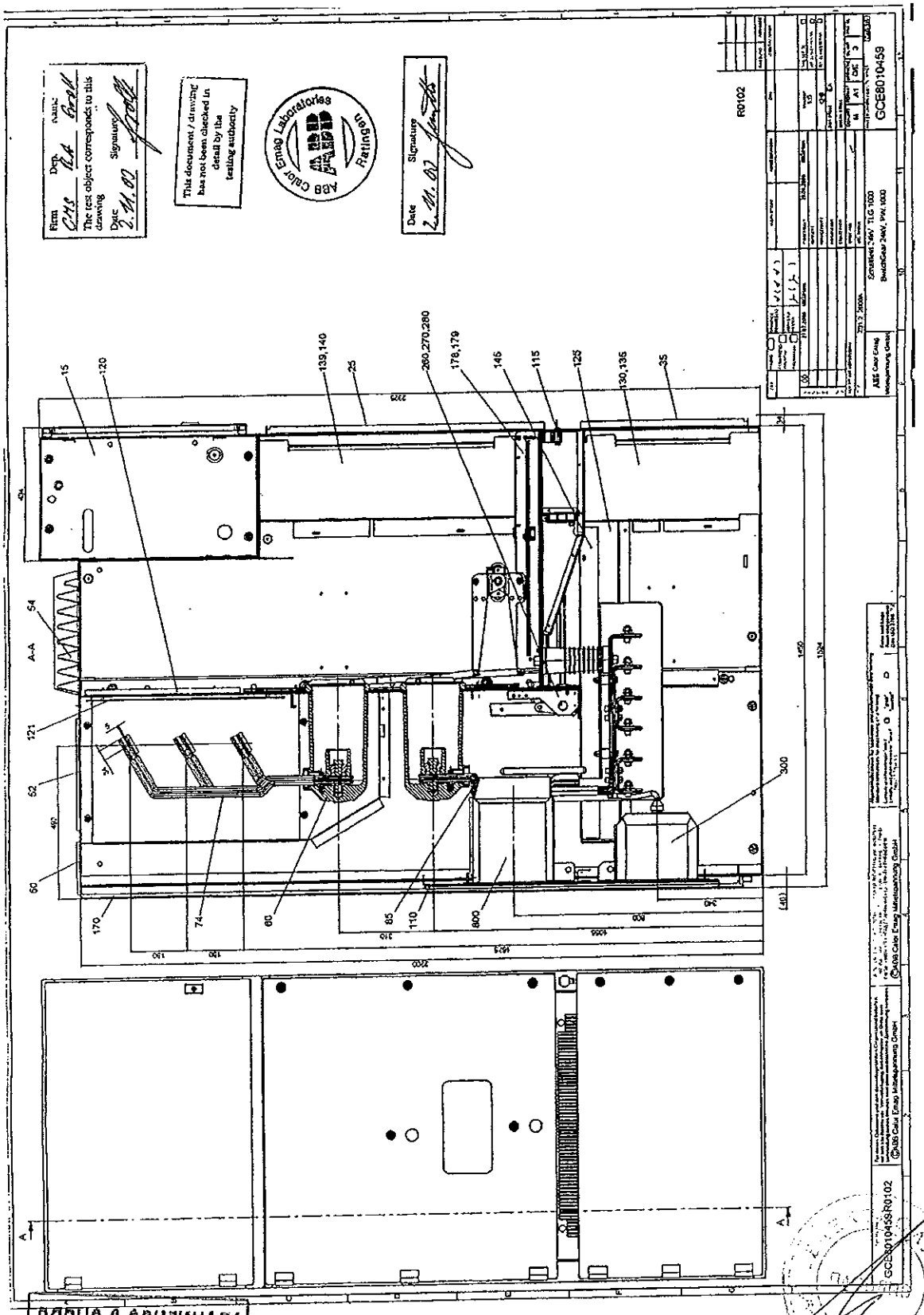
List of Drawings

The manufacturer has guaranteed, that the equipment submitted for test has been manufactured in full accordance with the following drawings. 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.	Title
GCE8010459R0102 index 00	Switchgear, 24 kV, PW. 1000
GCE8010457R0102 index 00	Switchgear, 24 kV, PW. 800
GCE7004924R0136 index 00	Draw out VM1 24 kV in ZS1.2
GCE7004924R0121 index 06	Draw out VM1 24 kV in ZS1
GCE7005757R0102 index 00	Pole part VD4p 2420-25
GCE7004730R0102 index 09	pole part VD4 24 kV 1250 A

ВЯРНО С ОРИГИНАЛА



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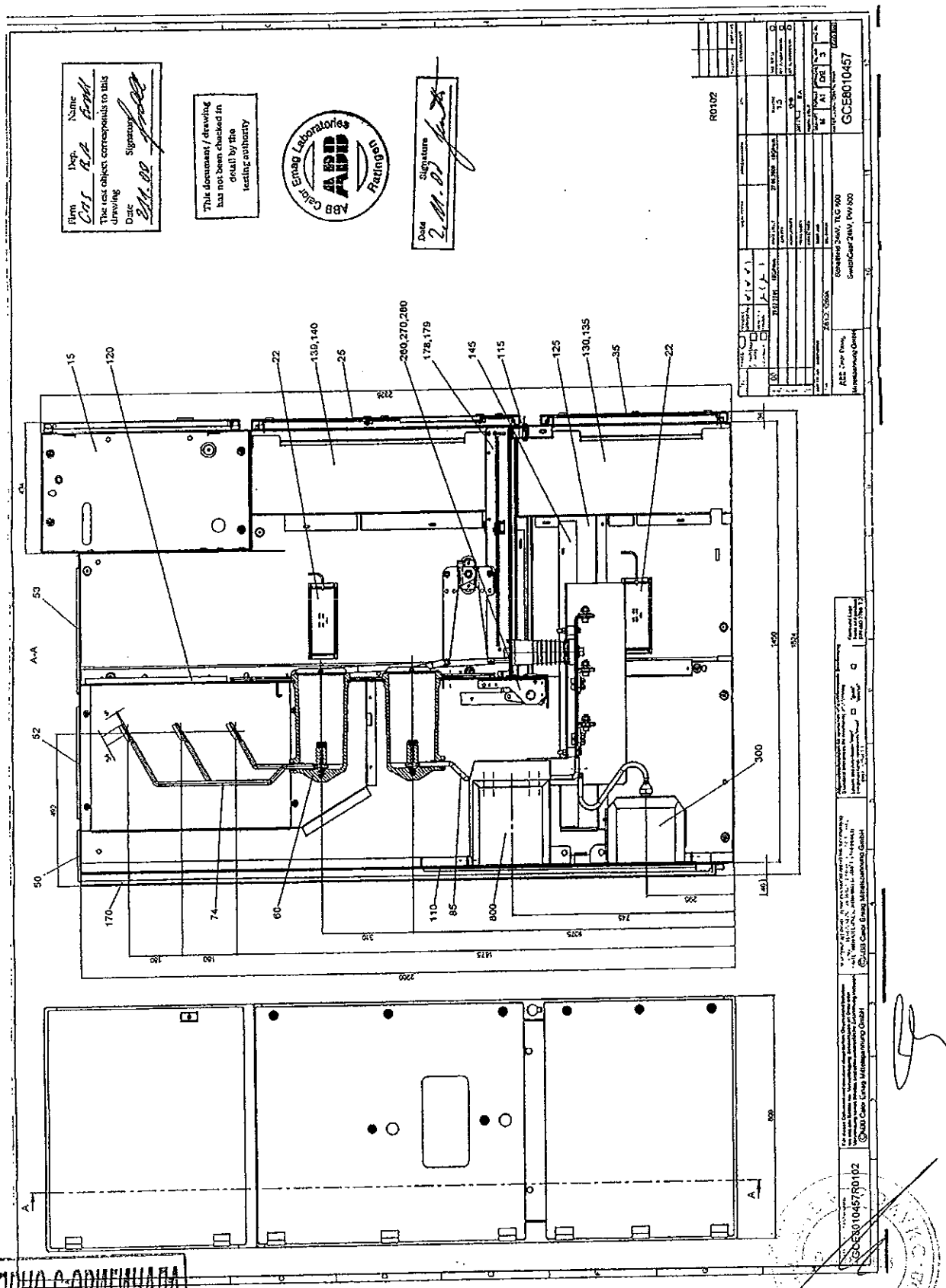
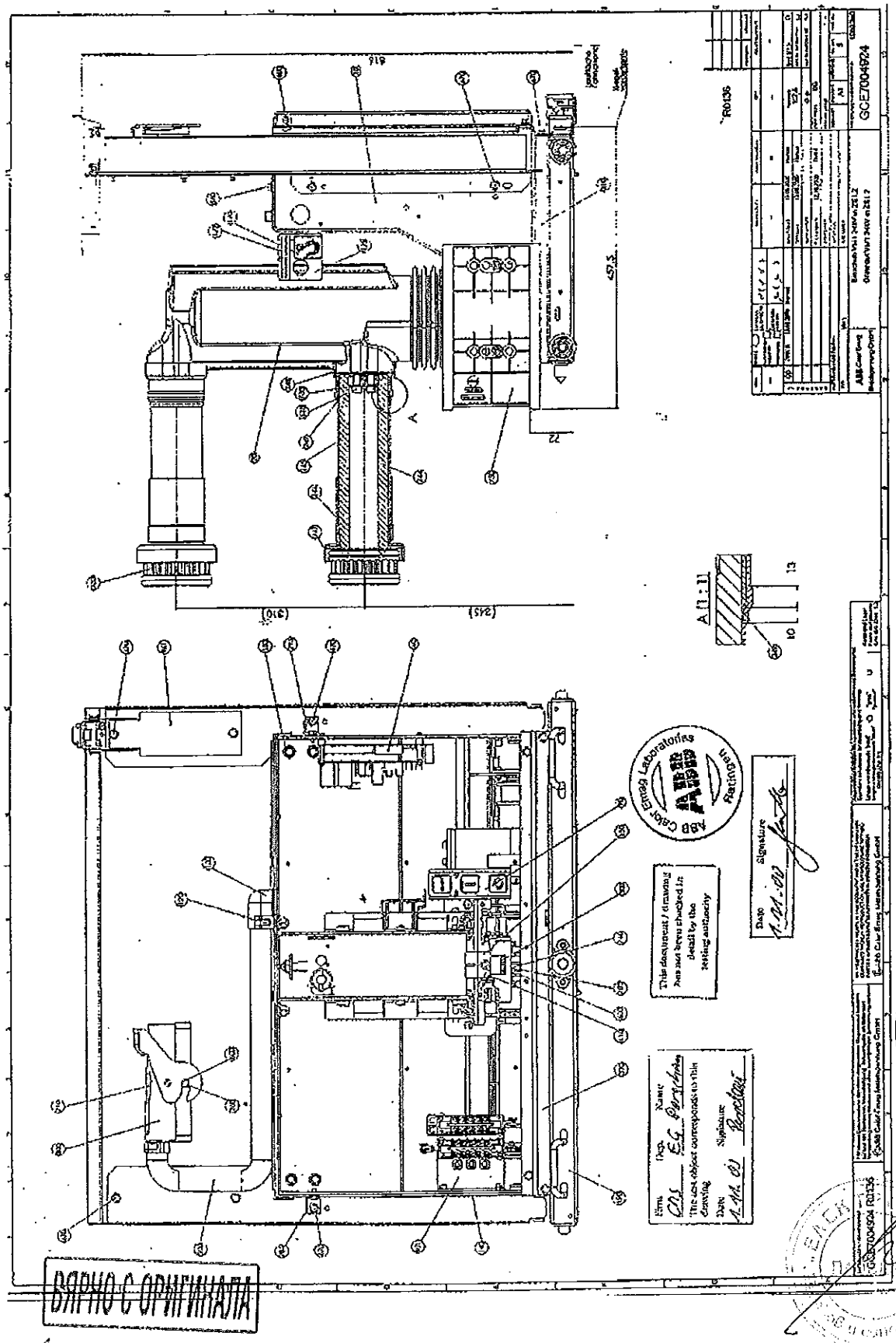


ВЯРНО С ОРИГИНАЛА



ВЯРНО С ОРИГИНАЛА

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