

# TYPE TEST REPORT

Test document No.: 482.407.6.314

Client: SIMKO Tic. ve San. A.S.  
Enerji İletim ve Dağıtım Tesisleri  
Yakacık Yolu No.111  
TR-81430 Istanbul

Manufacturer: SIMKO Tic. ve San. A.S.

Equipment under test: Low-voltage switchgear assembly  
Capacitor unit

Type: C unit 8 PU.152

Manufacturing No.: 36045870

Rated characteristics:	Rated operational voltage	400	V
	Rated insulation voltage	1000	V
	Rated impulse withstand voltage	-	kV
	Rated operational current	577	A
	Rated power	400	kVAr
	Rated peak withstand current	50	kA
	Rated short-time withstand current (1 s)	24	kA
	Rated frequency	50	Hz
	Degree of protection	IP 40	

Normative document: IEC 439-1: 1992 + Corrigendum 1993  
DIN EN 60439 Teil 1 VDE 0660 Teil 500: 1994-04

Test performed: Tests for the verification of  
• short-circuit withstand strength  
• dielectric properties

Date of test: 12 to 19 December 1996

Test result: The equipment under test has passed the tests.



Berlin, 9 April 1997

*min*  
Prof. Dr.-Ing. H. Hänisch  
Managing director

*Fiebig*  
Dr.-Ing. R. Fiebig  
Test engineer in charge

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This test document contains 22 sheets.

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SIMKO Tic. ve San. A.S.

**1. Participants in the test**

Dr. Fiebig	IPH test engineer in charge
Mr. Borchert, Ronald	IPH test engineer
Mr. Wittwer	IPH test engineer
Mr. Bayrak	SIMKO Tic. ve San. A.S.
Mr. Kulacoglu	SIMKO Tic. ve San. A.S.

**2. Test performed**

Tests for the verification of

- short-circuit withstand strength
- dielectric properties

**3. Identity of the equipment under test (EUT)**

**3.1 Technical data and characteristics**

EUT: Low-voltage switchgear assembly, capacitor unit  
 Type: C unit 8 PU.152  
 Manufacturer: SIMKO - Siemens AG  
 Serial No.: 36045870  
 Year of manufacture: 1996

**Rated characteristics**

Rated operational voltage		400 V
Rated insulation voltage		1000 V
Rated impulse withstand voltage		- kV
Rated operational current		577 A
Rated power		400 kVAr
Rated peak withstand current	main busbar	50 kA
	PE and PN conductors	120kA
Rated short-time withstand current	main busbar	24 kA
	PE and PN conductors	55 kA
Rated duration of short-circuit		1 s
Rated frequency		50 Hz
IP degree of protection		IP 40
Maximum ambient air temperature		35 °C

**Characteristics:**

Main dimensions		W/H/D	600 mm x 2200 mm x 600 mm
Switch cabinet	manufacturer	SIMKO	Metal sheet, varnished
Internal enclosures			None
Air ventilation lattice on front side	side	below	Ventilation slots 385 cm <sup>2</sup>
		above	Roof opening 423 cm <sup>2</sup>
Type of mounting			In series, wall distance at least 10 cm
Kind of connection			Cable

Equipment:	pc	Type	Manufacturer	Rated values
Fuse	24	3NH30	SIMKO	160 A
Fuse-link	24	3NA38	SIMKO	125 A
Capacitor	16	4RB525	SIEMENS	25 kVAr
Contactore	8	3TF48	SIMKO	
Discharge reactor	8	4AJ99	SIMKO	Up to 50kVAr
Controller	1	4RY83	SIEMENS	Up to 5 outputs
Distribution bar for both sides			-	20 mm x 10 mm each
N bar		E-Cu	-	40 mm x 10 mm
PE bar		E-Cu	-	40 mm x 10 mm

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**3.2 Identity documents**

The identity of the EUT is fixed by the following drawings and data submitted by the client:

Name of Drawing	Drawing No.	Date of drawing	Author	Note
Test Panel 400 kVAr Capacitor Group	(4)G77552- S202	18.11.96	SIMKO	Sheet 20
Test Anlage C Feld Frontansicht	(3)G77552-IPH- A 2	27.11.96	SIMKO	Sheet 21
Test Anlage C Feld Frontansicht	(3)G77552-IPH- A 4	27.11.96	SIMKO	Sheet 22

EUT entry at IPH: 10 December 1996

#### 4. Verification of short-circuit withstand strength

Due to the identical design, the verifications of the short-circuit withstand strength of the neutral bar and of the effectiveness of the protective circuit are given by the type tests made on other components of this switchgear assembly. Cf. IPH Type Test Report No. 482.407.6.349.

##### 4.1 Test laboratory

Low-voltage high-power test laboratory, test room 2

##### 4.2 Normative document

IEC 439-1:1992 + Corrigendum 1993  
DIN EN 60439 Teil 1 VDE 0660 Teil 500: 1994-04

##### 4.3 Required test parameters

- Prospective short-circuit values

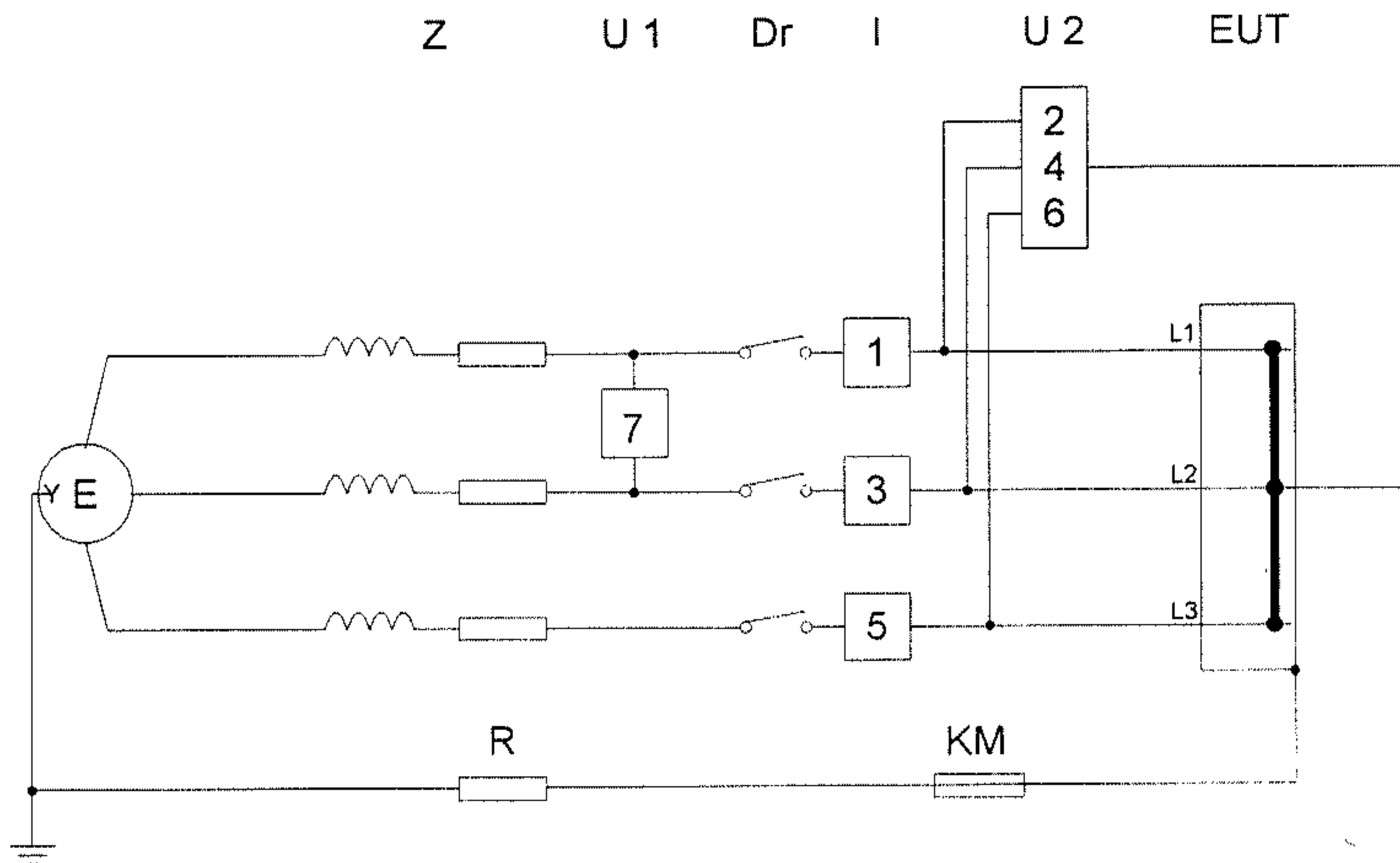
Test current	24 kA, 50 Hz, three-phase
Peak current	50 kA
Power factor	$\cos \varphi = 0.25$
Duration of short-circuit	1 s

##### 4.4 Test arrangement

Power was supplied via flexible single-core cables of 240 mm<sup>2</sup> cross-section per phase. The short-circuit was at the upper end of the main busbar.

See Figures 3 and 4, Sheets 16 and 17: EUT with test arrangement

4.5 Test and measuring circuits



- |       |  |     |  |
|-------|--|-----|--|
| E     | Power supply $S_k'' = 300 \text{ MVA}$ | U 1 | Test voltage measurement                       |
| Dr    | Making switch                          | U 2 | Voltage drop measurement                       |
| Z     | Test circuit impedance                 | I   | Current measurement                            |
| R     | Fault current limiting resistance      | KM  | Fault current indicator on frame and enclosure |
| 1 - 7 | Measuring points                       |     |  |

Figure 1: Test circuit

Technical data of measuring circuits

Osc. No.	Measuring point	Measuring quantity	Measuring sensor / device	Technical parameters
297 0093 and 296 2153	1 3 5	Current L1 L2 L3	Shunt	R = 51.66 $\mu\Omega$ R = 53.17 $\mu\Omega$ R = 50.45 $\mu\Omega$
	2 4 6	Voltage L1 L2 L3	RC divider	Ratio 400 : 1 Ratio 400 : 1 Ratio 399 : 1
	7	Test voltage	Current transformer Voltmeter	Ratio 10/0.1 kV Class 0.5
	KM	Indicator for fault current	Fuse element (Cu wire)	d = 0.8 mm l = 50 mm

Recording instrument:

Transient recorder "Bakker" with digital optical links



**4.6 Test results**

Main busbar HSS of the compensation unit

Type of test circuit: Direct  
 Test requirement: Rated short-time withstand current  
 Condition of EUT before test: New  
 Connection of EUT: By cables at the lower terminals of the compensation unit  
 Ambient air temperature: 20 °C

		297 0093	296 2153
Operating sequence		Current setting	I <sub>cw</sub>
Voltage applied	V	425	425
Prospective short-circuit current, peak value	kA	L1	53.5
		L2	41.3
		L3	46.4
Prospective symmetrical short-circuit current, r.m.s. value	kA	L1	26.0
		L2	25.5
		L3	25.9
	Average	25.8	25.8
Power factor cos φ		0.26	0.26
Short-time current	kA	L1	-
		L2	23.3
		L3	24.0
I <sub>t</sub>	(kA) <sup>2</sup> s	L1	-
		L2	562
		L3	586
Fault current	A	-	521
Duration of current flow	ms	-	0
Notes		-	1013
Evaluation		-	-
		-	o.k.

Notes:

o.k. The busbar system is capable of properly carrying the rated short-time withstand current. The detection device at the enclosure did not indicate any fault current.

Condition of EUT after test:

The EUT does not show any visible damage. There was no unpermissible deformation of the enclosure and no significant deformation of the busbars so that the clearances were not reduced to values less than those specified. There was no separation or loosening of conductors or outgoing terminals. The insulation of the conductors or the supporting insulating parts was not deteriorated either.

See Figure 5, Sheet 18



#### 4.7 Evaluation of test

The main busbar system of the switchgear assembly is capable of carrying the prospective peak withstand current of 53.5 kA and the prospective short-time withstand current of 25.8 kA at a test voltage of 425 V at the rated duration of short-circuit of 1 s.

During the verification of short-circuit withstand strength,

- the conductors and busbars did not show any unpermissible deformations,
- there were no signs of deterioration of supporting insulating parts,
- there was no unpermissible loosening of parts used for the connection of conductors and no separation of conductors from the outgoing terminals,
- the frame of the assembly was not unpermissibly distorted,
- the detection device did not indicate any fault current.

The criteria of assessment according to IEC 439-1 were fulfilled for test Osc. No. 296 2153.

The test has been  **p a s s e d .**



**5. Verification of dielectric properties****5.1 Test laboratory**

Low-voltage test laboratory, test room 2

**5.2 Normative documents**

IEC 439-1: 1992 + Corrigendum 1993  
DIN EN 60439 Teil 1 VDE 0660 Teil 500: 1994-04, Sub-clause 8.2.2

**5.3 Required test parameters**

Power-frequency voltage 50 Hz      3.5 kV/1 min

**5.4 Test arrangement**

During the power-frequency voltage withstand test all contactors were closed and all capacitors for overvoltage protection were disconnected. The control and measuring circuits were also disconnected by the removal of the D-type fuses.



5.5 Test and measuring circuits

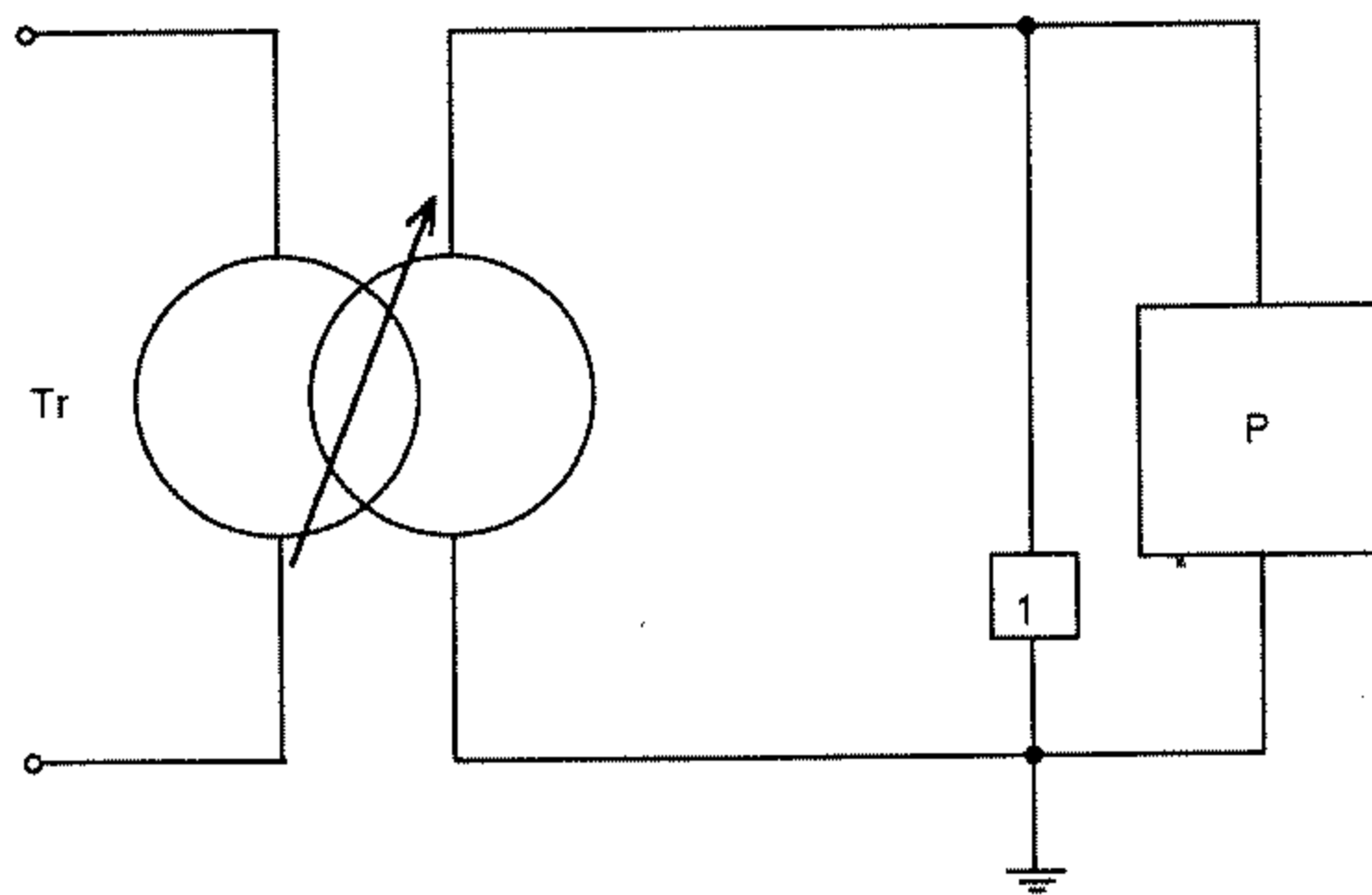
Power-frequency voltage withstand test

Technical data of the high-voltage testing device SIP 010

Transformer:      Rated voltage                      5 kV  
                          Rated power                         150 VA  
                          Frequency                                     50 Hz

Technical data of the measuring circuit

Meas. point	Measuring quantity	Measuring sensor/device	Technical parameters
1	Test voltage	Internal measuring facility of the testing device with digital display	r.m.s. value indication



Tr Transformer

P EUT

Figure 2: Test circuit for the power-frequency voltage withstand test



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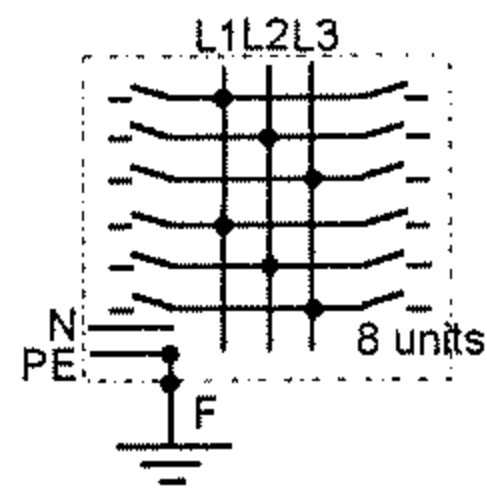
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**5.6 Test results**

**Power-frequency voltage withstand test**

Test frequency:	50 Hz
Testing time after reaching full voltage:	1 min
Atmospheric conditions during test:	Air temperature 20 °C Air humidity 50 % Air pressure 1010 mbar
Correction factors	Atmospheric correction of test voltage not necessary

Simplified test arrangement



Power-frequency test voltage

Result

Voltage applied to	Earthed	kV	Disruptive discharges
L1	L2, L3, PE, F	3.5	0
L2	L1, L3, PE, F	3.5	0
L3	L1, L2, PE, F	3.5	0
L1	L2	3.5	0
L2	L3	3.5	0
L3	L1	3.5	0
N	L1, L2, L3, PE, F	3.5	0

F Earthed enclosure



**5.7 Evaluation of test**

During the test with 50 Hz power-frequency voltage 3.5 kV/1 min there occurred no disruptive discharges.

The EUT has **passed** the verification of dielectric properties according to DIN EN 60439 Teil 1 VDE 0660 Teil 500: 1994-04 and according to IEC 439-1: 1992 + Corrigendum 1993.



## 6. Appendices



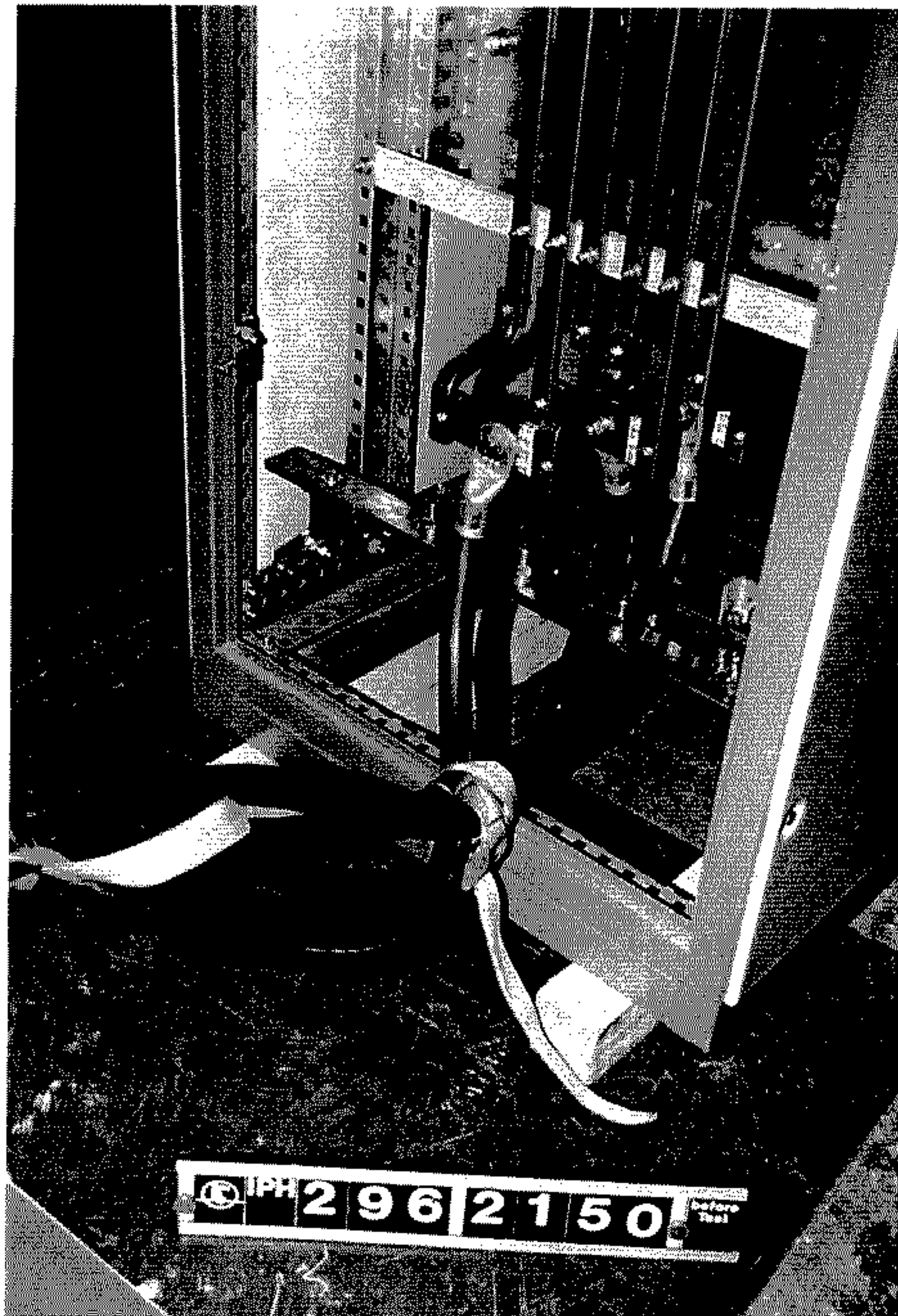


Figure 3: View of the EUT with power supply for the short-circuit test



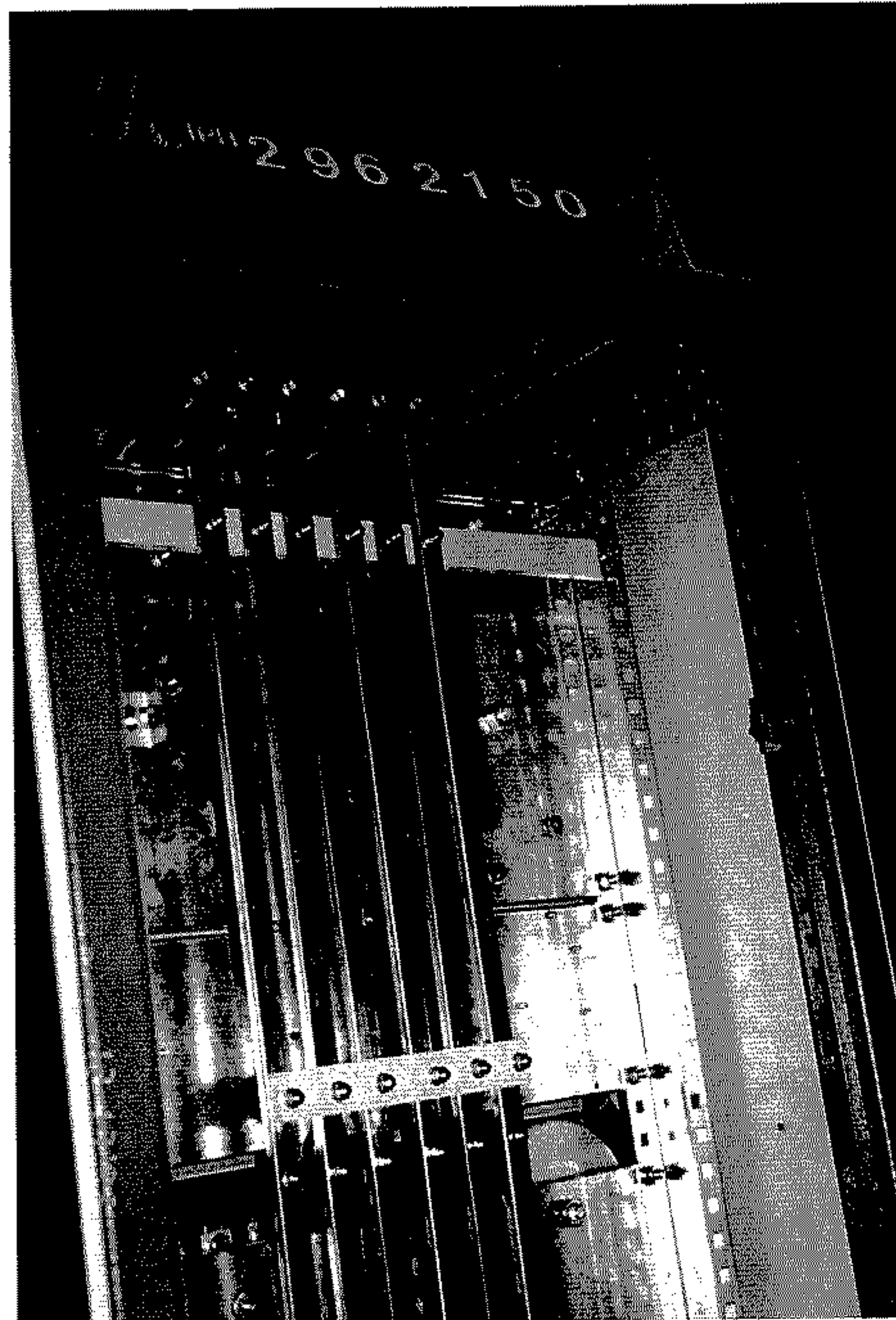


Figure 4: View of the EUT with short-circuit point at the upper end of the main busbar for the short-circuit test



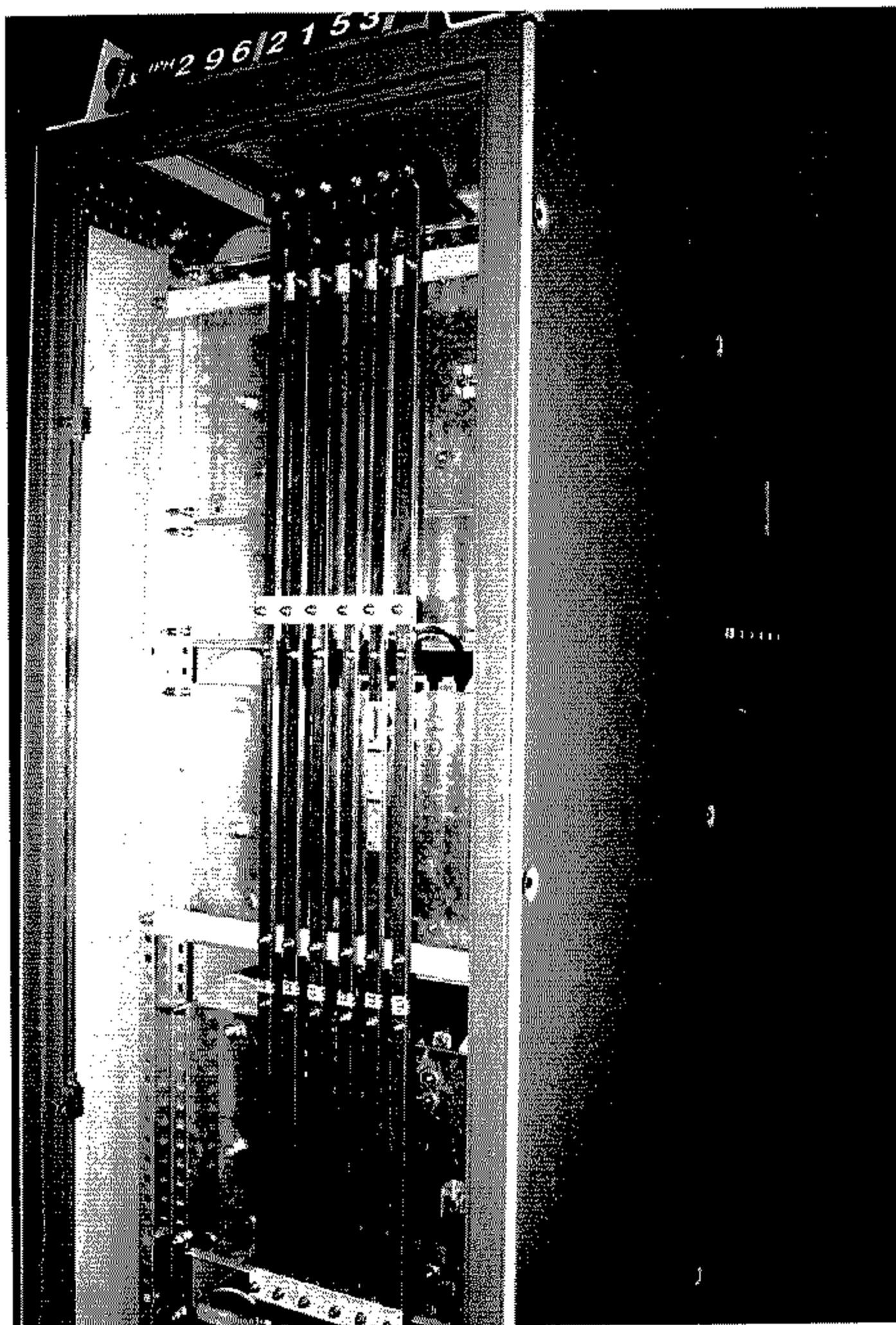
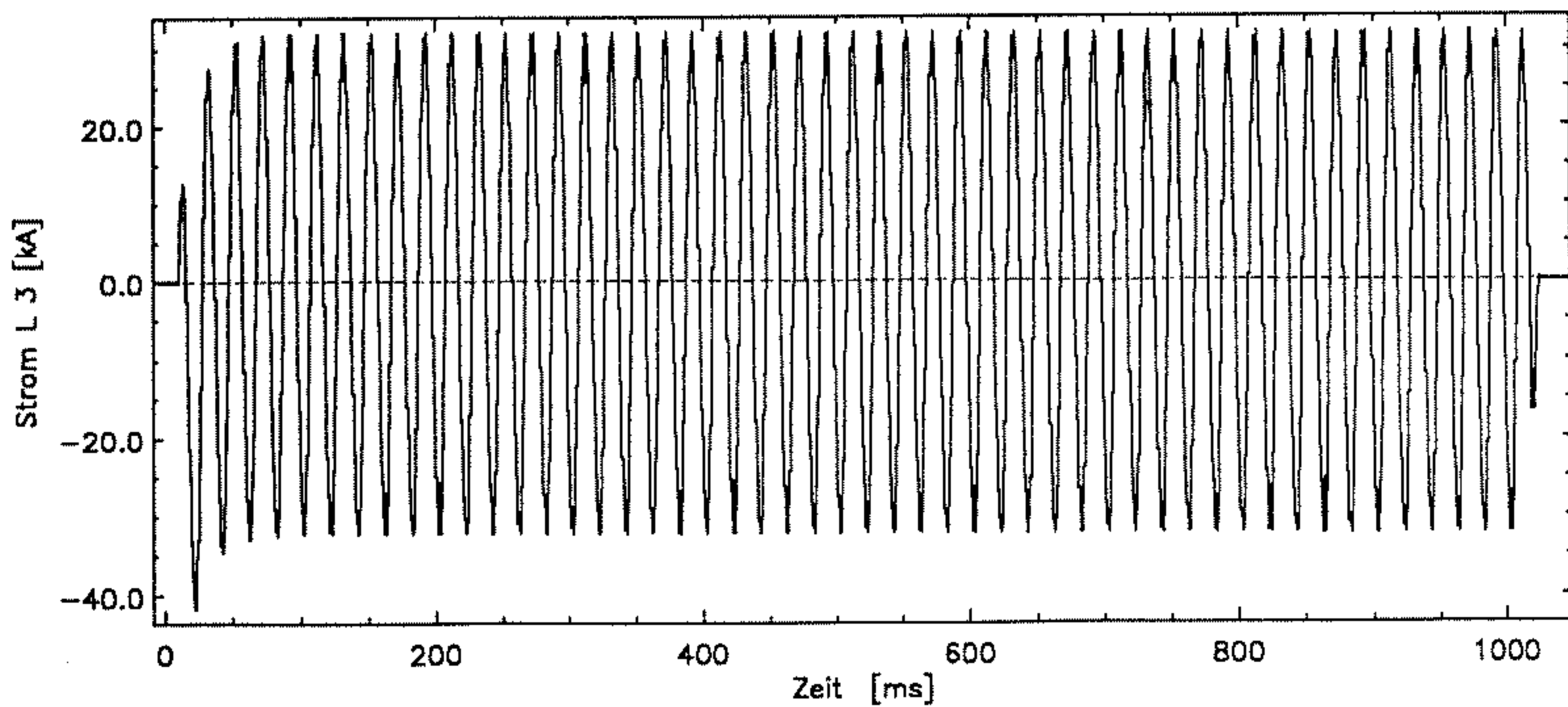
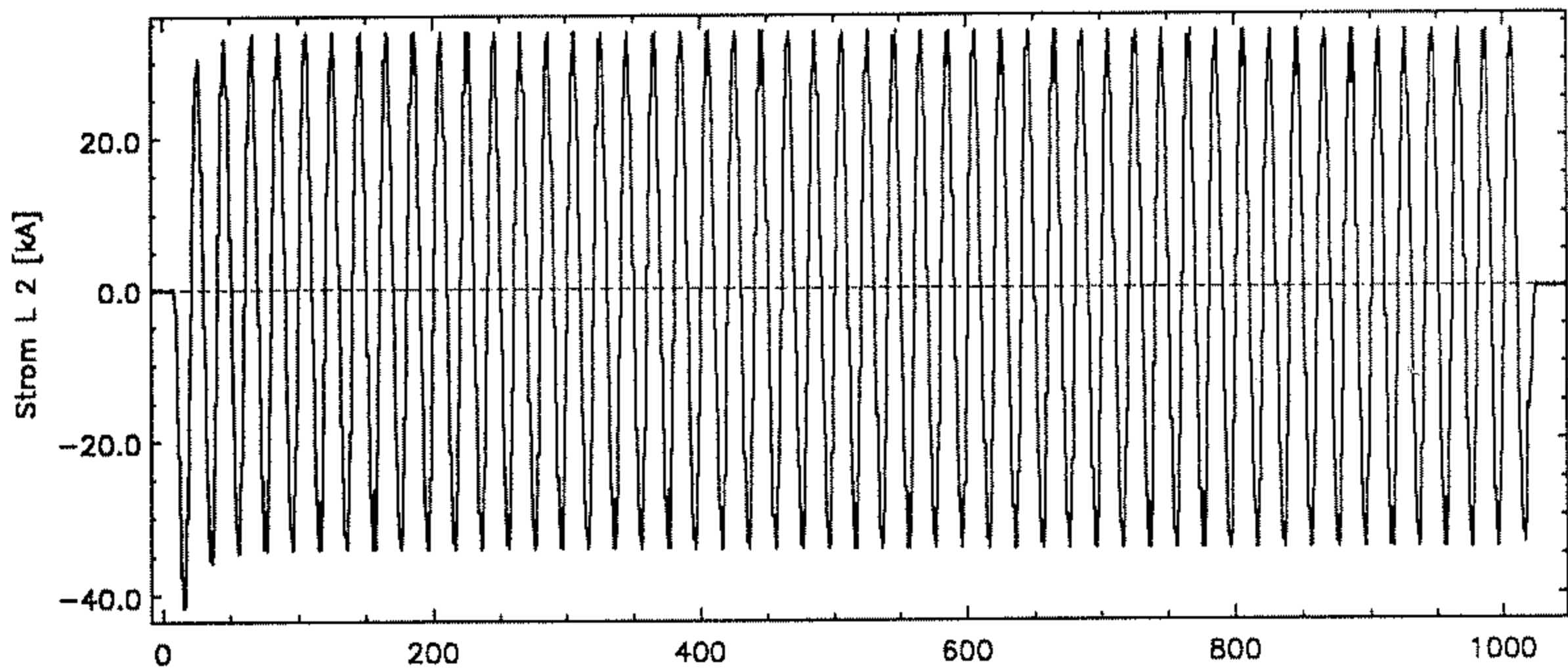
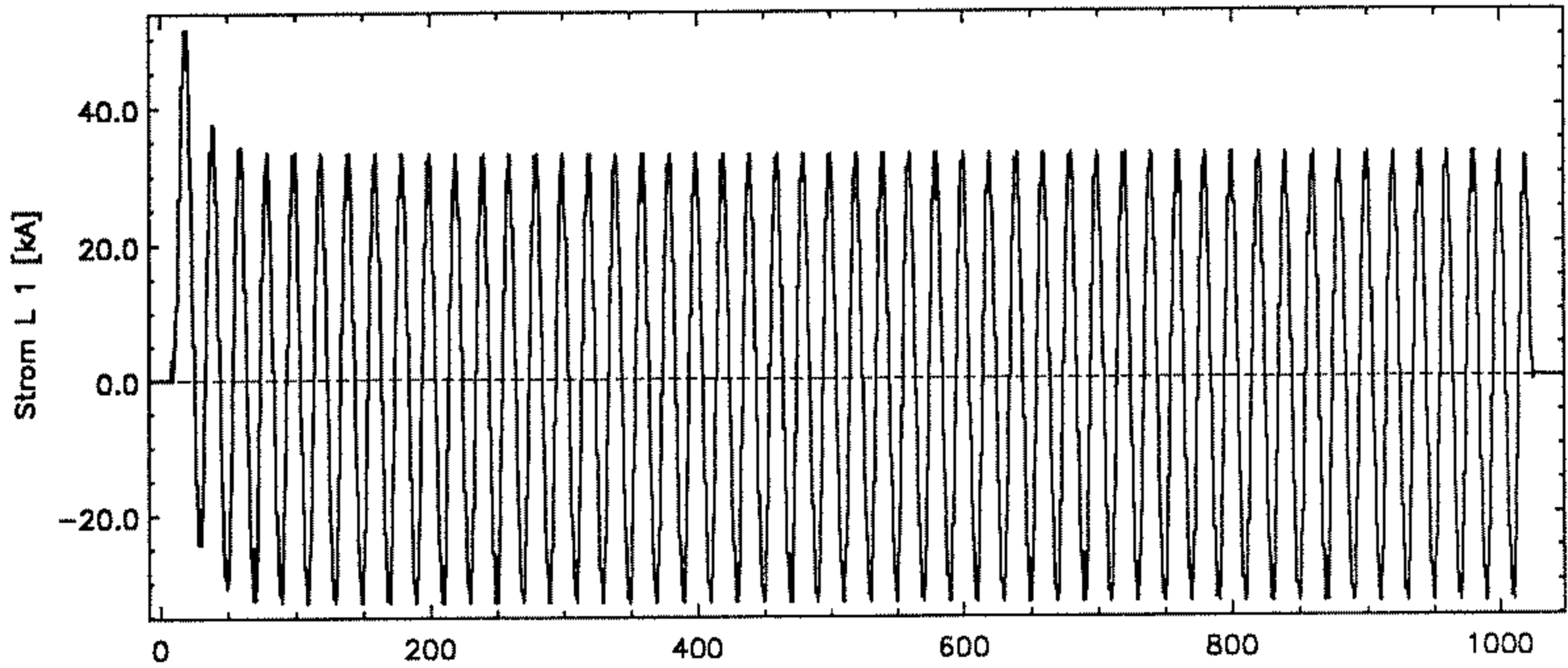


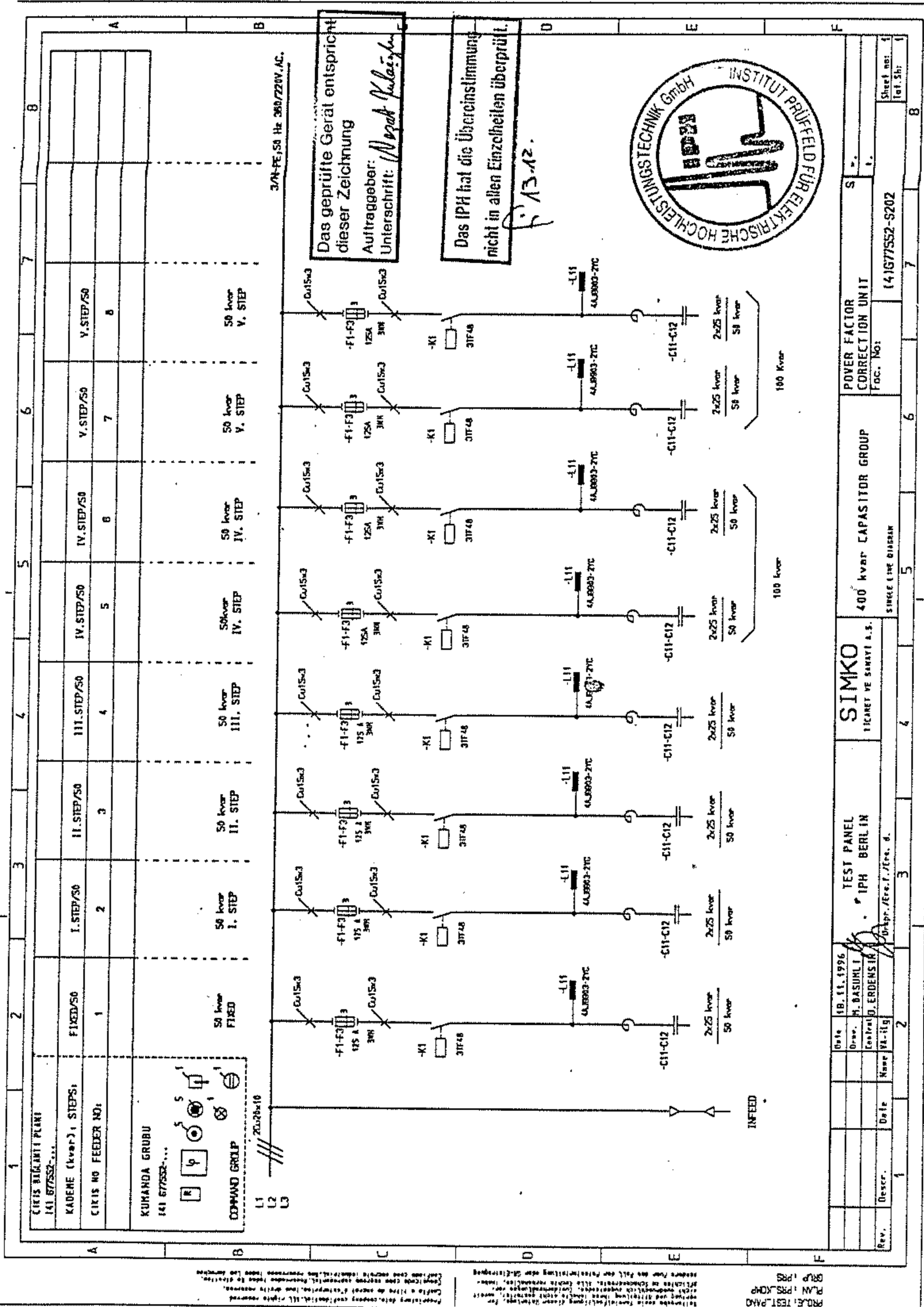
Figure 5: View of the EUT after test No. 296 2153



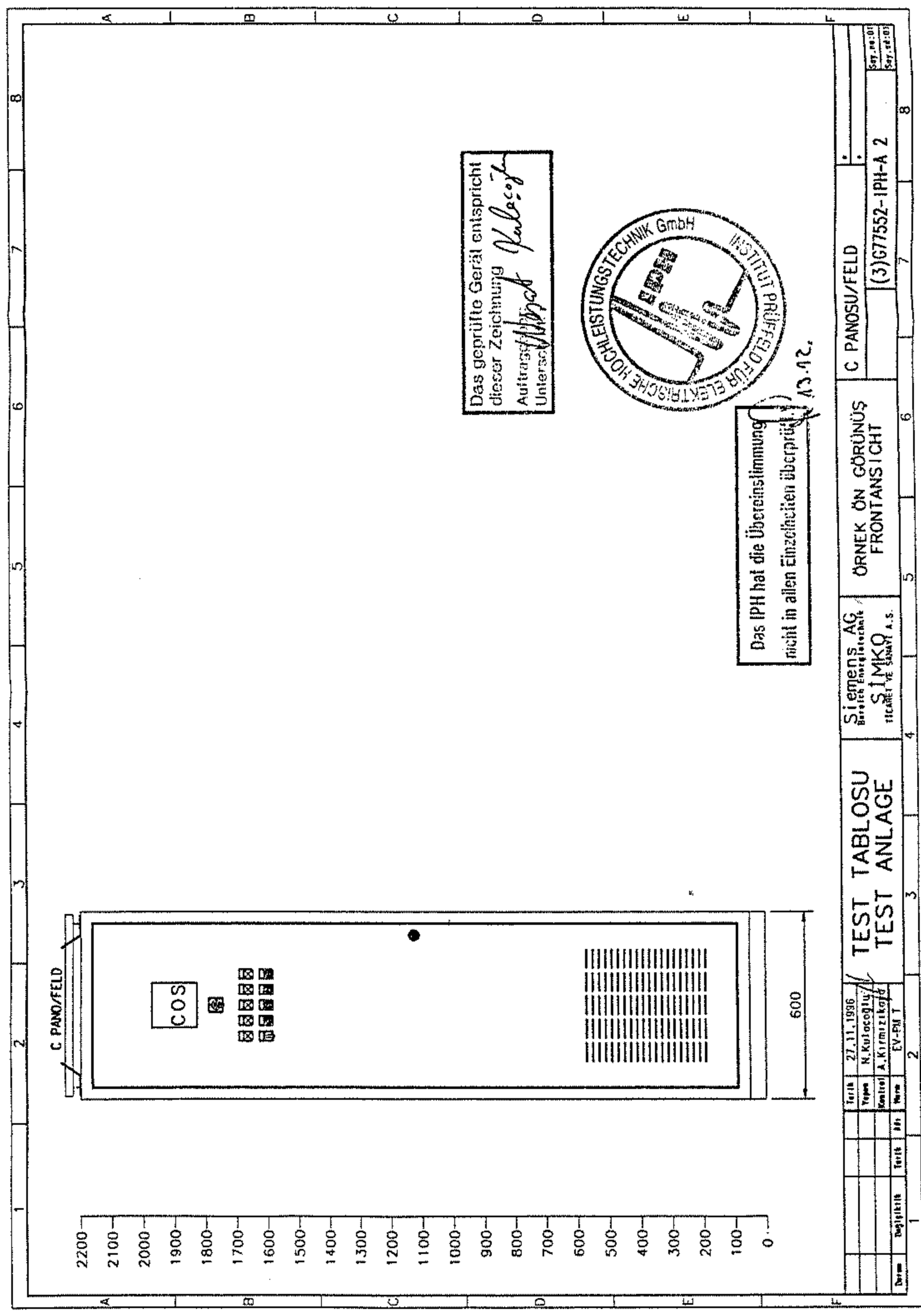


Osz.-Nr. 2962153  
 Osc.-No. 2962153









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