ОФЕРТА

за участие в процедура от вида
„договаряне без предварителна покана за участие“,
за сключване на рамково споразумение, с предмет:

„Доставка на триполюсни товарови прекъсвачи за монтиране на закрито“, реф. № PPD 18-118

ПАПКА № 3

Кандидат: **“ИНТЕРКОМПЛЕКС ООД”**

Report No.: 1143 Page No.: 1

REPORT OF PERFORMANCE

Apparatus: High-voltage switch disconnector

Designation: NAL 24 with type A mechanism

Client: ABB Distribusjon AS, Skien, Norway

Manufacturer: ABB Distribusjon AS, Skien, Norway

Date(s) of test: 20. and 23. of October 1995

The test has been in accordance with:

The clients instruction based on IEC Publication 265-1, Second edition 1983, § 6.101. Making and breaking tests, Test duty no. 4.

The performance of the apparatus tested and the observations made during the test have been recorded in tables with test results and hardcopies from data acquisition system. The documents of this report are:

Ratings of the test object:	Page No.:
Technical Data of Test Circuit:	Page No.: 8
Test result(s) / Conclusion:	Page No.: 3
Table(s) with test results:	Page No.: 4 to 7
Circuit diagram(s):	Page No.: 9
Drawing(s):	Page No.: 10 and 11
Photo(s):	Page No.: 12
Client's observer(s)	Page No.:
Data acquisition (Oscillograms)	Rec. No.: 18871, 34971 and 34972, 34974 to 34993, 34996 to 35007

Skien, 25. of Oct. 1995

на основание чл. 36а, ал. 3 от ЗОП

Bjørn Kamperhaug
(Test Engineer)

на основание чл. 36а, ал. 3 от ЗОП

Tor Bratsberg
(Technical Manager)

Test object

The test object was a high-voltage switch disconnector type NAL 24 with a stored energy, independent manually spring operated mechanism type A.

The test object was marked with serial no. N 27720.

Publication

The client's instruction based on IEC Publication 265-1, Second edition 1983, § 6.101, Test duty no. 4.

Test procedure

The purpose of the test was to verify a breaking capacity with a capacitive load of 80 A at a test voltage of 24 kV.

The test was performed with breaking operations only. The switch disconnector was operated by means of the 220 V DC trip coil.

The switch disconnector was mounted in a test rack in vertical position.

A rotating potmeter was fastened to the rotating centre of the main contact knife in phase R, in order to control the condition of the switch disconnector and to calculate the arcing times.

Tests performed

A No load test, closing operation, rec no. 34971

B No load test, opening operation, rec no. 34972

C Resistance measurement at 100 A DC, between the termination contacts of each pole

D 20 breaking operations with capacitive load, with the supply circuit connected to the upper side of the switch disconnector, rec. no. 34974 to 34993

E 10 breaking operations with capacitive load, with the supply circuit connected to the lower side of the switch disconnector, rec. no. 34996 to 35005

F No load test, closing operation, rec no. 35006

G No load test, opening operation, rec no. 35007

H Resistance measurement at 100 A DC, between the termination contacts of each pole

Test result

The values obtained during the test are listed in tables on page no. 4 to 7.

The test object fulfilled the requirement for the test. It was no sign of any burning marks on the main contacts.

No reignitions or restrikes occurred during the breaking operations.

The over-voltages during the breaking operations were far below the permitted limit.

NEFI Kortslutningslaboratorium
P. O. Box 108, Sentrum, 3701 SKIEN | Stubenvegen 71, 3721 SKIEN, Norway - Tel.: +47 35590330 - Fax.: +47 35590615

NOLOAD

Performance under No-Load condition

Values recorded

Type of apparatus: High-voltage switch disconnector with a two spring mechanism

Travel recorder: Rotating potmeter linear to the rotation of the main contact knife in phase R

Closing device: Manually by means of the handle

Opening device: By means of the 220 V DC trip coil

Total travel closing contacts: 334 mm (circle sector)

Total travel opening contacts: 406 mm (circle sector)

Test Number		A	B	C		F	G	H
Oscillogram, Record Number		34971	34972	None		35006	35007	None
Operation		C	O	None		C	O	None
Time from current initiation closing coil to contact touch		-	-			-	-	
Time from current initiation opening coil to contact sep.		-	-			-	-	
Travel after contact touch (Last phase to touch)		31 mm	-			32,7 mm	-	
Travel to contact separation (First phase to separate)		-	80,4 mm			-	80,4 mm	
Speed measuring	Closing: Closing speed	7,5 m/s	-			6,9 m/s	-	
	Closing: First cursor reference (before contact touch)	10,3 mm	-			10,3 mm	-	
	Closing: Last cursor reference (after first cursor ref.)	6,0 ms	-			6,0 ms	-	
	Opening: Opening speed	-	6,0 m/s			-	5,8 m/s	
	Opening: First cursor (after contact sep.)	-	0 ms			-	0 ms	
	Opening: Last cursor reference (after first cursor ref.)	-	16,1 mm			-	16,3 mm	
Resistance measurement between termination contacts at 100 A DC. (micro ohm)				R phase: 76 S phase: 80 T phase: 77				R phase: 81 S phase: 84 T phase: 81
Ambient temperature		22,5 Deg. C	22,5 Deg. C	22,5 Deg. C		21,5 Deg. C	21,5 deg. C	21,5 deg. C
Signature		BKA	BKA	BKA		BKA	BKA	BKA
Date		19.10.95	19.10.95.	19.10.95.		23.10.95.	23.10.95	23.10.95

Remarks

Test D

Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 22 Deg. C
Test date: 20.10.95.
Signature: BKA

Test requirement: IEC 265-1 TD 4

Type of test circuit:

Operating sequence: 20 x Open

Connections to apparatus tested:
Supply from the upper side

Condition og apparatus before test: New and clean

Test-No.		TRV	1	2	3	4	5	6	7	8	9	10	
Oscillogram No.		18871	34974	34975	34976	34977	34978	34979	34980	34981	34982	34983	
Operation			0	0	0	0	0	0	0	0	0	0	
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R		81,3										
	S		79,8										
	T		81,0										
	Average		80,7										
Recovery voltage	R		24,2										
	kV S		24,2										
	T		24,2										
	Average between phases		24,2										
Closing-/Opening time	ms												
	R		8,0					8,0					
Arcing time	ms S		8,0					8,0					
	T		3,0					3,0					

Remarks: Cont. next page

Condition of apparatus after Test:

NEFI Kortslutningslaboratorium

Page No.: 5
Report No.: 1143

Test D

Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 22 Deg.C
Test date: 20.10.95.
Signature: BKA

Test requirement: Cont. from previous page

Type of test circuit:

Operating sequence:

Connections to apparatus tested:

Condition og apparatus before test:

Supply from the upper side

Test-No.		11	12	13	14	15	16	17	18	19	20		
Oscillogram No.		34984	34985	34986	34987	34988	34989	34990	34991	34992	34993		
Operation		0	0	0	0	0	0	0	0	0	0		
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R										80,8		
	A S										79,4		
	T										80,4		
	Average										80,2		
Recovery voltage	R										24,1		
	kV S										24,1		
	T										24,1		
	Average between phases										24,1		
Closing-/Opening time	ms												
Arcing time	R	8,0					7,5				7,5		
	ms S	8,0					7,5				7,5		
	T	3,0					3,0				2,5		

Remarks: Cont. next page

Condition of apparatus after Test:

Test E — Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 21,5 Deg. C
Test date: 23.10.95.
Signature: BKA

Test requirement: IEC 265-1 TD 4

Type of test circuit:

Operating sequence: 10 x Open

Connections to apparatus tested: Supply from the lower side

Condition og apparatus before test: Pretested during test D

Test-No.		21	22	23	24	25	26	27	28	29	30		
Oscillogram No.		34996	34997	34998	34999	35000	35001	35002	35003	35004	35005		
Operation		0	0	0	0	0	0	0	0	0	0		
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R	81,6									80,9		
	S	80,1									79,8		
	T	81,1									80,7		
	Average	80,9									80,5		
Recovery voltage	R	24,2									24,2		
	kV S	24,3									24,1		
	T	24,3									24,2		
	Average between phases	24,3									24,2		
Closing-/Opening time	ms												
	R	8,5					7,5				8,5		
Arcing time	ms S	8,5					7,5				8,5		
	T	3,5					3,0				3,5		

Remarks:

Condition of apparatus after Test: See page no. 3

Report No.: 1143 Page No.: 8

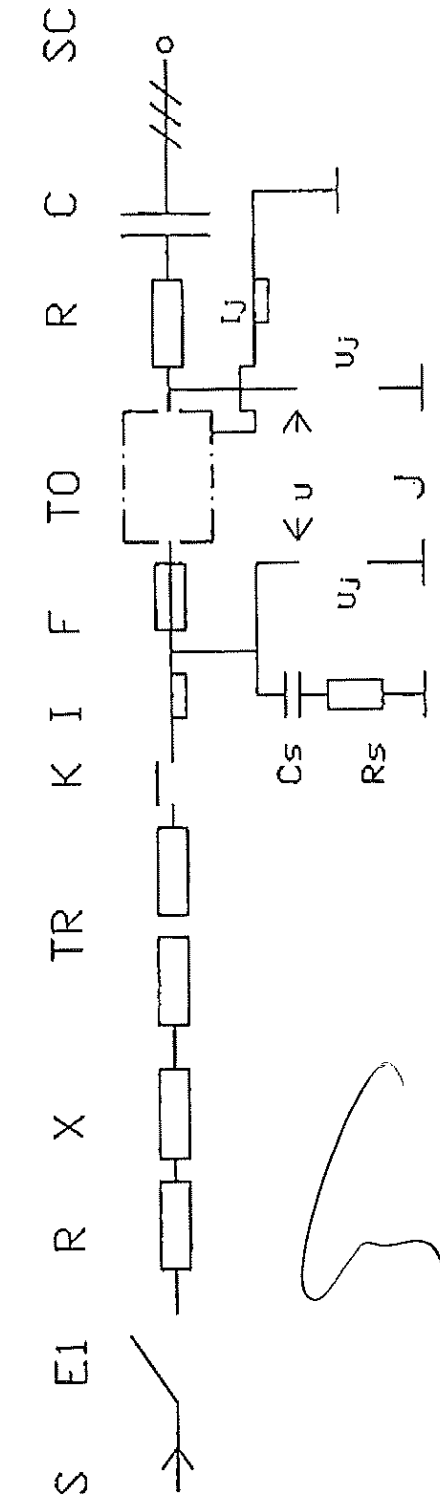
Technical Data of Test Circuit

Test Number		1 - 20	21 - 30		
Record Number		34974-34993	34996-35005		
Number of phases	(test circuit)	3	3		
Operating frequency	(Hz)	50	50		
Power factor source side		0,1 1)	0,1 1)		
Power factor load side		0,088 2)	0,088 2)		
Load before test object	(% of total)				
Transformer connection symbol		Dyn	Dyn		
Transformer star point		Earthed	Earthed		
Short circuit point		Isolated	Isolated		
TRV Source side	Uc/t3 (kV/uS)	44/86,6	44/86,6		
TRV Load side	Uc/t3 (kV/uS)				
Res. frequency load side	(kHz)				
Damping factor	(j)				
Circuit diagram	(Page No.)	9	9		
Supply side		Upper	Lower		

Remarks:

1) The supply circuit is, according to the IEC 265-1 publication, as during a test with the mainly active load
2) Capacitive load

Make / Break test, IEC 265-1, Test duty 4

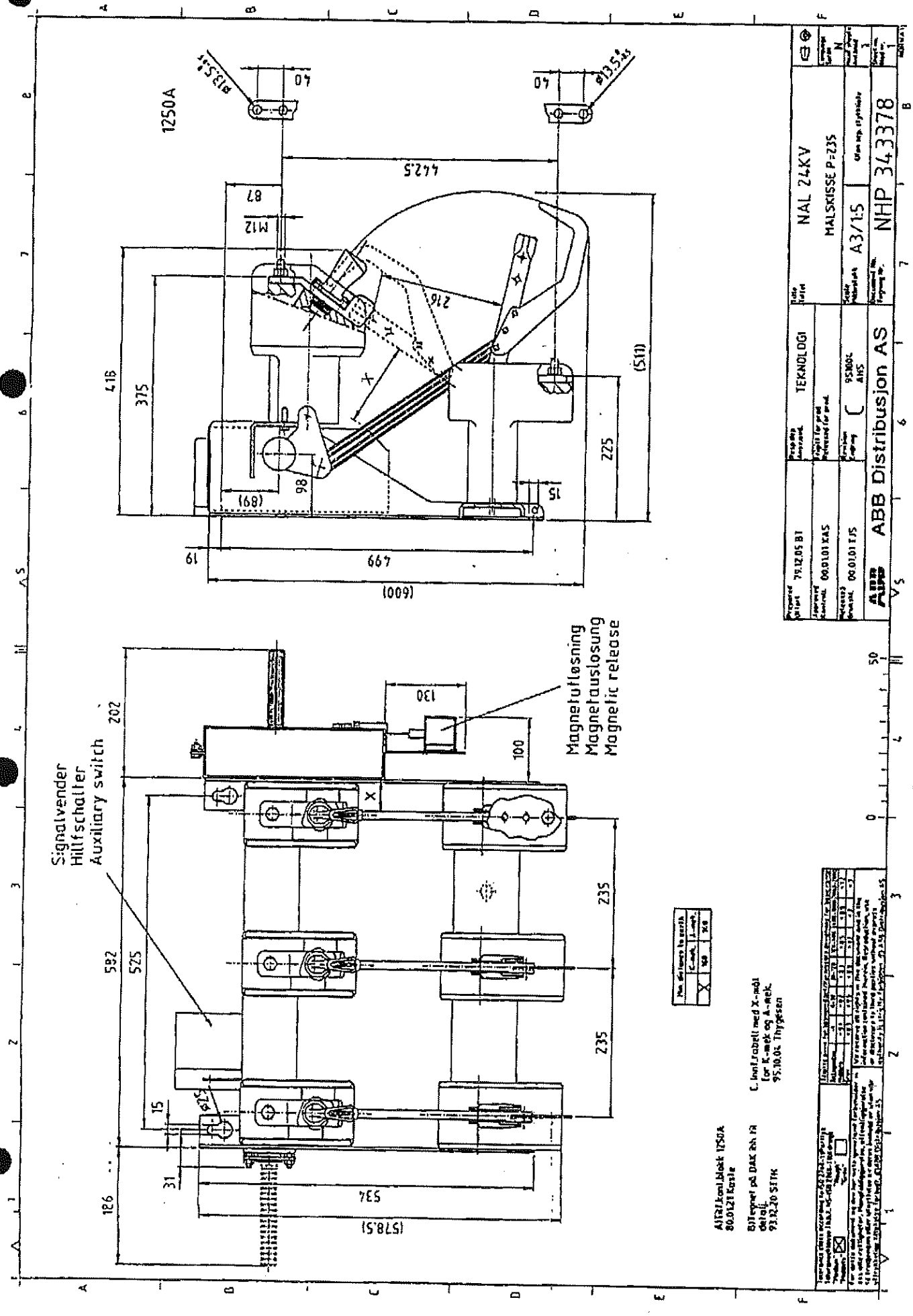


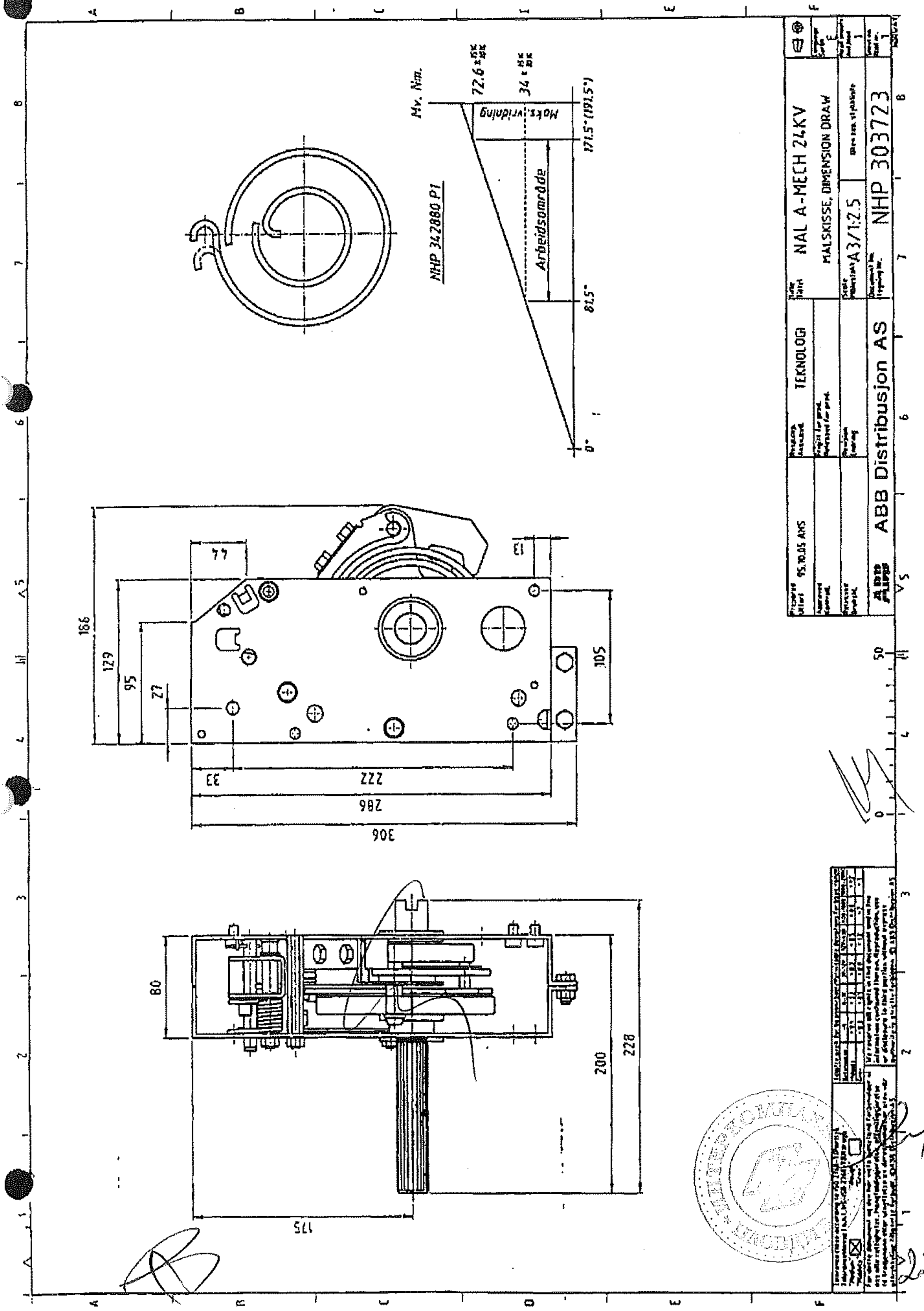
S = 17 kV supply voltage
E1= Safety switch
R = Resistance
X = Reactance
TR= Transformer
I = Current measuring
Ij= Current meas. to earth (option)
U = Phase voltage
Uj= Voltage measuring
C = Capacitive load

K = Making switch
TO= Test object
SC= Short circuit point
J = Earth connection
F = Protection fuses
Cs/Rs= Resonance freq. adj.

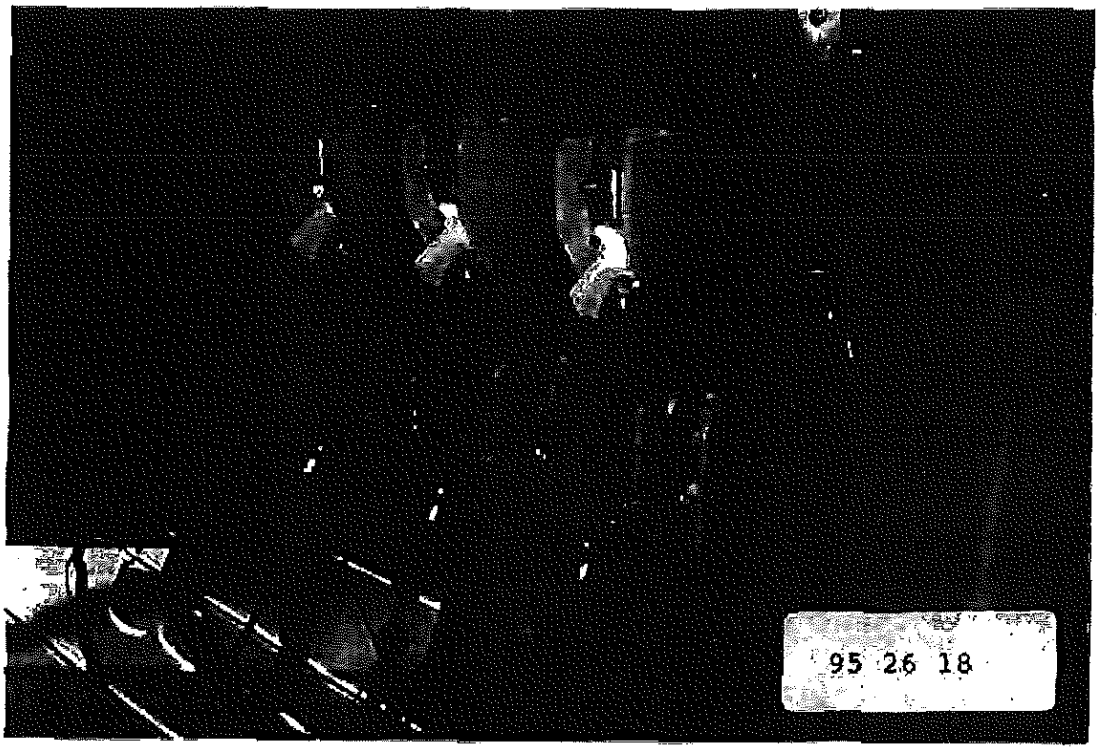
FILE:CAPLOAD

Postboks 108, N-3701 SKIEN Stulenvegen 71, N-3721 SKIEN Tlf.: (03) 590338 Fax.: (03) 590615


1250A
Signalvender
Hilfschalter
Auxiliary switch
Magnetutløsning
Magnetauslösung
Magnetic release
NAL 24KV
MALSKISSE P=235
ABB Distribusjon AS
NHP 343378
A3/1:5
TEKNOLOGI


NAL A-MECH 24KV
MÅLSKISSE, DIMENSION DRAW
TEKNOLOGI
A3/1:2,5
NHP 303723
ABB Distribusjon AS
95.10.05 AMS
NHP 342880 P1
Mv. Nm.
72,6
34
Maks. vridning
Arbeidsområde
171,5° (191,5°)
81,5°
0°
186
129
95
27
44
13
105
33
222
286
306
80
200
228
175

Test object



SATS

Scandinavian Association for Testing Switchgear

c/o EFI - Norwegian Electric Power Research Institute

Sem Sælandsv. 11 7034 Trondheim NORWAY

Telephone: + 47-7-597200 Telex: 55 513 efi n Telefax: + 47-7-597250

REPORT OF PERFORMANCE No. 96-B04

TITLE:

Dielectric tests on high-voltage switch disconnector with integrated earthing switch type NALE 24 and switch-fuse combination type NALF 24.

Trondheim 1996-01-09

на основание чл. 36а, ал. 3 от ЗОП

SATS Secretariat Approval

22

SATS Scandinavian Association for Testing Switchgear

c/o EFI – The Norwegian Research Institute of Electricity Supply
Sem Sælandsv. 11 7034 Trondheim–NTH NORWAY
Tel. (07)597200 Telex 55513 efi n

REPORT OF PERFORMANCE No. 96-B04

APPARATUS: High-voltage switch disconnector with integrated earthing switch and high-voltage switch-fuse combination

DESIGNATION: NALE 24 and NALF 24

MANUFACTURER: ABB Distribusjon AS, Skien, Norway

DATE(S) OF TESTS: 3. to 6. of November 1992

RATINGS ASSIGNED BY THE MANUFACTURER

Rated 1 min. power-frequency withstand voltage; (rms value):
50 kV to earth, between poles and across open switching device
60 kV across isolating distance

Rated lightning impulse withstand voltage; (peak value):
125 kV to earth, between poles and across open switching device
145 kV across isolating distance

THE TESTS HAVE BEEN MADE IN ACCORDANCE WITH
See page no. 5.

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with test results and oscillograms.

THE DOCUMENTS FORMING PART OF THIS REPORT ARE

Table with test results	Nos.:	Page No.: 7 to 14
Oscillogram	Nos.:	Page No.: 20
Drawing	Nos.:	Page No.: 15 to 19
Diagram	Nos.:	
Photograph	Nos.:	

Skien, 4. of January 1996
Place and Date

на основание чл. 36а, ал. 3 от ЗОП
SATS Observer

на основание чл. 36а, ал. 3 от ЗОП
Laboratory manager

Contents

- Front sheet ..... Page No.: 1
- Information sheet (SATS)..... Page No.: 2
- Contents ..... Page No.: 3 (This page)
- Preface, Chapter 1..... Page No.: 4
- Test object, Chapter 2..... Page No.: 4
- Conclusion, Chapter 3 ..... Page No.: 4
- Dielectric tests, Chapter 4..... Page No.: 5
- Tables with test results ..... Page No.: 7 to 14
- Drawings..... Page No.: 15 to 19
- Oscillograms..... Page No.: 20

1. Preface

The tests were witnessed by SATS observer, Mr. Arne Nesse, EFI (Norwegian Electric Power Research Institute).

Parts of the tests were also witnessed by:

Mr. Sten Thygesen, ABB Distribusjon, Skien, Norway

The tests have been performed at ABB Distribusjon AS, Electrotechnical and Mechanical Laboratory, Skien, Norway.

2. Test objects

- High-voltage switch disconnector type NAL 24.
- High-voltage earthing switch type E 24.
- High-voltage switch-fuse combination type NALF 24.

The high-voltage earthing switch type 24 was mounted on the lower side, (hinge side), of the high-voltage switch type NAL 24. The high-voltage earthing switch is then an integrated part of the high-voltage switch and in this combination called NALE 24.

The test objects were manufactured by ABB Distribusjon AS, Skien, Norway.

All fuses used during tests were manufactured by ABB Distribusjon AS, Skien, Norway.

3. Conclusion

The test objects passed the lighting impulse withstand voltage and the power-frequency withstand voltage tests successfully according to IEC Publication 265-1 (1983), IEC Publication 420 (1990-11), IEC Publication 60-1 (1989-11) and IEC Publication 694 (1980).

4. Dielectric tests

4.1 Test objects

- High-voltage switch disconnector (with earthing switch) type NALE 24, with type K-mechanism, serial no. 238222.
- High-voltage switch-fuse combination type NALF 24, equipped with fuses type CEF 24 kV, 40 A, serial no. 238221.

4.2 Lightning impulse withstand voltage tests

4.2.1 Publication

IEC Publication 265-1, Second edition 1983, IEC Publication 420, Second edition 1990-11, IEC Publication 60-1, Second edition 1989-11 and IEC Publication 694, First edition 1980, § 6.1.6. Lightning impulse voltage tests.

4.2.2 Test procedure

15 consecutive lightning impulses with both polarities applied on each configuration from 1 to 9, on all phases in succession.
Configuration no. is equal to test condition no. as given in table VIII,
IEC Publication 694 (1980).

4.2.3 Technical data of test equipment

Lightning impulse generator:
Voltage range: 0 - 400 kV
Max energy: 10 kJ

Wave form: 1,2/50 10^{-6} s.

4.2.4 Test result

The number of disruptive discharges on self-restoring insulation did not excees twa for each series of 15 impulses and no disruptive discharges on non-self-restoring insulation occured.
The test voltage was 125 kV to earth, between poles and across open switching device and 145 kV across isolating distance.
For detailed test results, ref. to page no. 7, 8, 9 and 11, 12 and 13.

4.3 Power frequency voltage tests

4.3.1 Publication

IEC Publication 265-1, Second edition 1983, IEC Publication 420, Second edition 1990-11, IEC Publication 60-1, Second edition 1989-11 and IEC Publication 694, First edition 1980, § 6.1.7. Power frequency voltage withstand tests.

4.3.2 Test procedure

Voltage applied on each configuration from 1 to 9, on all phases in succession.
Configuration no. is equal to test condition no. as given in table VIII, IEC Publication 694 (1980).
Duration of each test was 1 minute.

4.3.3 Technical data of test equipment

Power frequency transformer, single phase:
Voltage range: 0 - 60 kV, 50 Hz
Output short-time: 50 kVA
Short-circuit current, load side: 1A

4.3.4 Test result

No disruptive discharges occurred, on the test.

The test voltage was 50 kV to earth, between poles and across open switching device, and 60 kV across the isolating distance.

For detailed test results, ref. to page no. 10 and 14.

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 1 of 3
Test object : Switch-fuse com. NALF 24		Date: 05.11.92

Climatic conditions
Temperature: 22 °C
Humidity: 11 g/m^3
Atmospheric pressure: 760 mm Hg

Applied correction factor: 0.994
Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U [kV]	No. of impulses		Wave-form T_f/T_h [µs]	Record no.	Remarks
				Total	No. of discharges			
1	L1	-	90	5	0	1.2 / 50		
1	L1	-	126	15	0	1.2 / 50		
1	L1	+	90	5	0	1.2 / 50		
1	L1	+	126.5	15	0	1.2 / 50		
2	L2	-	90	5	0	1.2 / 50		
2	L2	-	126	15	0	1.2 / 50		
2	L2	+	90	5	0	1.2 / 50		
2	L2	+	126	15	0	1.2 / 50		
3	L3	-	90	5	0	1.2 / 50		
3	L3	-	126	15	0	1.2 / 50		
3	L3	+	90	5	0	1.2 / 50		
3	L3	+	126	15	1	1.2 / 50		
4	L1	-	90	5	0	1.2 / 50		
4	L1	-	126	15	0	1.2 / 50		
4	L1	+	90	5	0	1.2 / 50		
4	L1	+	126	15	0	1.2 / 50		
5	L2	-	90	5	0	1.2 / 50		
5	L2	-	126	15	0	1.2 / 50		
5	L2	+	90	5	0	1.2 / 50		
5	L2	+	126	15	1	1.2 / 50		
6	L3	-	90	5	0	1.2 / 50		
6	L3	-	126	15	0	1.2 / 50		
8	L3	+	90	5	0	1.2 / 50		
6	L3	+	126	15	0	1.2 / 50		

Notes:

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 2 of 3
Test object : Switch-fuse comb. NALF 24		Date: 05.11.92

Climatic conditions
Temperature: 22 °C
Humidity: 11 g/m^3
Atmospheric pressure: 760 mm Hg

Applied correction factor: 0.994
Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U [kV]	No. of impulses		Wave-form T_f/T_n (µs)	Record no.	Remarks
				Total	No. of discharges			
7	L1	-	90	5	0	1.2 / 50		
7	L1	-	126	15	0	1.2 / 50		
7	L1	+	90	5	0	1.2 / 50		
7	L1	+	126	15	0	1.2 / 50		
8	L2	-	90	5	0	1.2 / 50		
8	L2	-	126	15	0	1.2 / 50		
8	L2	+	90	5	0	1.2 / 50		
8	L2	+	126	15	0	1.2 / 50		
9	L3	-	90	5	0	1.2 / 50		
9	L3	-	126	15	0	1.2 / 50		
9	L3	+	90	5	0	1.2 / 50		
9	L3	+	126	15	0	1.2 / 50		

Notes:

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 3 of 3
Test object : Switch-fuse comb. NALF 24		Date: 06.11.92

Climatic conditions
Temperature: 21.5 °C
Humidity: 11 g/m^3
Atmospheric pressure: 754 mm Hg

Applied correction factor: 0.988
Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U [kV]	No. of impulses		Wave-form T/T_n [µs]	Record no.	Remarks
				Total	No. of discharges			
4*	L1	-	112	5	0	1.2 / 50		
4*	L1	-	146	15	0	1.2 / 50		
4*	L1	+	111	5	0	1.2 / 50		
4*	L1	+	146	15	0	1.2 / 50		
5*	L2	-	111	5	0	1.2 / 50		
5*	L2	-	146	15	0	1.2 / 50		
5*	L2	+	111	5	0	1.2 / 50		
5*	L2	+	146	15	0	1.2 / 50		
6*	L3	-	111	5	0	1.2 / 50		
6*	L3	-	146	15	0	1.2 / 50		
6*	L3	+	111	5	0	1.2 / 50		
6*	L3	+	146	15	0	1.2 / 50		
7*	L1	-	111	5	0	1.2 / 50		
7*	L1	-	146	15	0	1.2 / 50		
7*	L1	+	111	5	0	1.2 / 50		
7*	L1	+	146	15	0	1.2 / 50		
8*	L2	-	111	5	0	1.2 / 50		
8*	L2	-	146	15	0	1.2 / 50		
8*	L2	+	111	5	0	1.2 / 50		
8*	L2	+	146	15	0	1.2 / 50		
9*	L3	-	111	5	0	1.2 / 50		
9*	L3	-	146	15	0	1.2 / 50		
9*	L3	+	111	5	0	1.2 / 50		
9*	L3	+	146	15	0	1.2 / 50		

Notes:
Ref. to note table VIII, IEC Publication 694 (1980). The base F and the terminals of the switching device except the terminal opposite the energized terminals were insulated from earth.

POWER FREQUENCY VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 1 of 1
Test object : Switch-fuse comb. NALF 24		Date: 05.11.92
Climatic conditions Temperature: 22 °C Humidity: 11 g/m^3 Atmospheric pressure: 760 mm Hg		Applied correction factor: 0.994 Tank filling pressure :

Configuration	Phase (s)	Freq. [Hz]	Voltage [kV]	Duration [min]	Disruptive discharge after time (min:sec)	Remarks
1	L1	50	50	1	-	
2	L2	50	50	1	-	
3	L3	50	50	1	-	
					-	
7	L1	50	50	1	-	
8	L2	50	50	1	-	
9	L3	50	50	1	-	
					-	
4	L1	50	50	1	-	
5	L2	50	50	1	-	
6	L3	50	50	1	-	
					-	
4*	L1	50	60	1	-	
5*	L2	50	60	1	-	
6*	L3	50	60	1	-	
					-	
7*	L1	50	60	1	-	
8*	L2	50	60	1	-	
9*	L3	50	60	1	-	

Notes:

Ref. to note table VIII, IEC Publication 694 (1980). The base F and the terminals of the switching device except the terminal opposite the energized terminals were insulated from earth.

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 1 of 3
Test object : NALE 24		Date: 03.11.92

Climatic conditions
Temperature: 21 °C
Humidity: 11 g/m^3
Atmospheric pressure: 735 mm Hg

Applied correction factor: 0.965
Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U (kV)	No. of impulses		Wave-form T_r/T_n [µs]	Record no.	Remarks
				Total	No. of discharges			
1	L1	-	90	5	0	1.2 / 50		
1	L1	-	126	15	0	1.2 / 50		
1	L1	+	90	5	0	1.2 / 50		
1	L1	+	126	15	0	1.2 / 50		
2	L2	-	90	5	0	1.2 / 50		
2	L2	-	126	15	0	1.2 / 50		
2	L2	+	90	5	0	1.2 / 50		
2	L2	+	126	15	0	1.2 / 50		
3	L3	-	90	5	0	1.2 / 50		
3	L3	-	126	15	0	1.2 / 50		
3	L3	+	90	5	0	1.2 / 50		
3	L1	+	126	15	0	1.2 / 50		
4	L1	-	90	5	0	1.2 / 50		
4	L1	-	126	15	0	1.2 / 50		
4	L1	+	90	5	0	1.2 / 50		
4	L1	+	126	15	0	1.2 / 50		
5	L2	-	90	5	0	1.2 / 50		
5	L2	-	126	15	0	1.2 / 50		
5	L2	+	90	5	0	1.2 / 50		
5	L2	+	126	15	0	1.2 / 50		
6	L3	-	90	5	0	1.2 / 50		
6	L3	-	126	15	0	1.2 / 50		
6	L3	+	90	5	0	1.2 / 50		
6	L3	+	126	15	0	1.2 / 50		

Notes:

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 2 of 3
Test object : NALE 24		Date: 03.11.92

Climatic conditions
Temperature: 21 °C
Humidity: 11 g/m^3
Atmospheric pressure: 735 mm Hg

Applied correction factor: 0.965
Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U [kV]	No. of impulses		Wave-form T_f/T_n [µs]	Record no.	Remarks
				Total	No. of discharges			
7	L1	-	90	5	0	1.2 / 50		
7	L1	-	126	15	0	1.2 / 50		
7	L1	+	90	5	0	1.2 / 50		
7	L1	+	126	15	0	1.2 / 50		
8	L2	-	90	5	0	1.2 / 50		
8	L2	-	126	15	0	1.2 / 50		
8	L2	+	90	5	0	1.2 / 50		
8	L2	+	126	15	0	1.2 / 50		
9	L3	-	90	5	0	1.2 / 50		
9	L3	-	126	15	0	1.2 / 50		
9	L3	+	90	5	0	1.2 / 50		
9	L3	+	126	15	0	1.2 / 50		

Notes:

LIGHTNING IMPULSE VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 3 of 3
Test object : NALE 24		Date: 03.11.92
Climatic conditions Temperature: 21 °C Humidity: 11 g/m^3 Atmospheric pressure: 735 mm Hg		Applied correction factor: 0.965 Tank filling pressure :

Configuration	Phase(s)	Polarity +/-	Minimum applied Voltage U [kV]	No. of impulses		Wave-form T_f/T_h [µs]	Record no.	Remarks
				Total	No. of discharges			
4*	L1	-	110	5	0	1.2 / 50		
4*	L1	-	146	15	0	1.2 / 50		
4*	L1	+	110	5	0	1.2 / 50		
4*	L1	+	145.5	15	0	1.2 / 50		
5*	L2	-	110	5	0	1.2 / 50		
5*	L2	-	146	15	0	1.2 / 50		
5*	L2	+	110	5	0	1.2 / 50		
5*	L2	+	145.5	15	0	1.2 / 50		
6*	L3	-	110	5	0	1.2 / 50		
6*	L3	-	146	15	0	1.2 / 50		
6*	L3	+	110	5	0	1.2 / 50		
6*	L3	+	145.5	15	0	1.2 / 50		
7*	L1	-	110	5	0	1.2 / 50		
7*	L1	-	146	15	0	1.2 / 50		
7*	L1	+	110	5	0	1.2 / 50		
7*	L1	+	146	15	1	1.2 / 50		
8*	L2	-	110	5	0	1.2 / 50		
8*	L2	-	146	1	0	1.2 / 50		
8*	L2	+	110	5	0	1.2 / 50		
8*	L2	+	145.3	15	1	1.2 / 50		
9*	L3	-	112	5	0	1.2 / 50		
9*	L3	-	146	15	0	1.2 / 50		
9*	L3	+	110	5	0	1.2 / 50		
9*	L3	+	146	15	0	1.2 / 50		
9*	L3	+	145.2	15	0	1.2 / 50		

Notes:
Ref. to note table VIII, IEC Publication 694 (1980). The base F and the terminals of the switching device except the terminal opposite the energized terminals were insulated from earth.

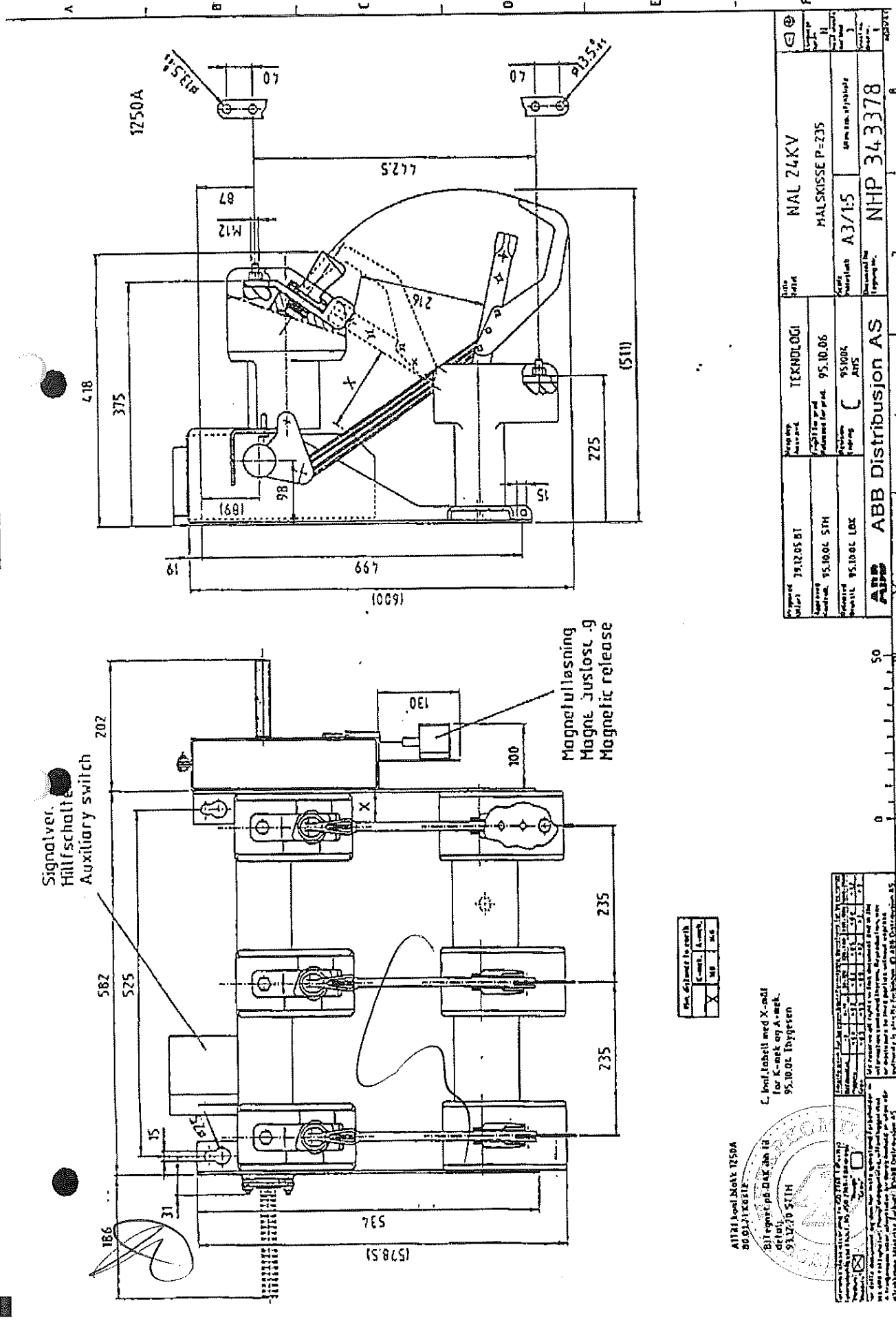
POWER FREQUENCY VOLTAGE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B04	Test no.:	Sheet no.: 1 of 1
Test object : NALE 24		Date: 05.11.92

Climatic conditions	Applied correction factor: 0.965
Temperature: 21 °C	Tank filling pressure :
Humidity: 11 g/m^3	
Atmospheric pressure: 735 mm Hg	

Configuration	Phase (s)	Freq. [Hz]	Voltage [kV]	Duration [min]	Disruptive discharge after time [min:sec]	Remarks
1	L1	50	50	1	-	
2	L2	50	50	1	-	
3	L3	50	50	1	-	
7	L1	50	50	1	-	
8	L2	50	50	1	-	
9	L3	50	50	1	-	
4	L1	50	50	1	-	
5	L2	50	50	1	-	
6	L3	50	50	1	-	
4*	L1	50	60	1	-	
5*	L2	50	60	1	-	
6*	L3	50	60	1	-	
7*	L1	50	60	1	-	
8*	L2	50	60	1	-	
9*	L3	50	60	1	-	

Notes:
Ref. to note table VIII, IEC Publication 694 (1980). The base F and the terminals of the switching device except the terminal opposite the energized terminals were insulated from earth.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Hilfschalter
Auxiliary switch
Magnetutlasning
Magnet Justost.g
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ABB Distribusjon AS
NAL 24KV
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A3/1:5
NHP 343378
TEKNOLOGI

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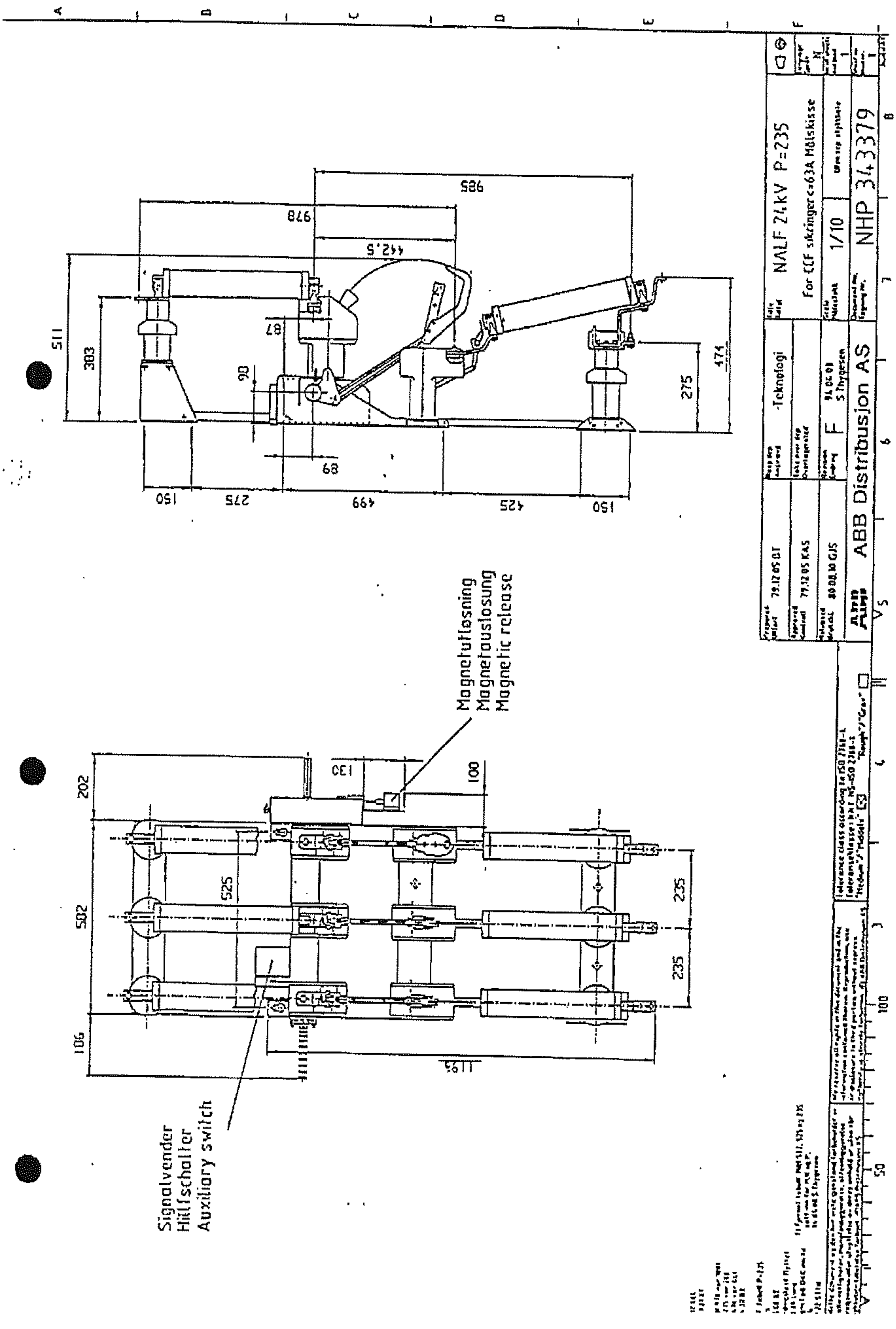
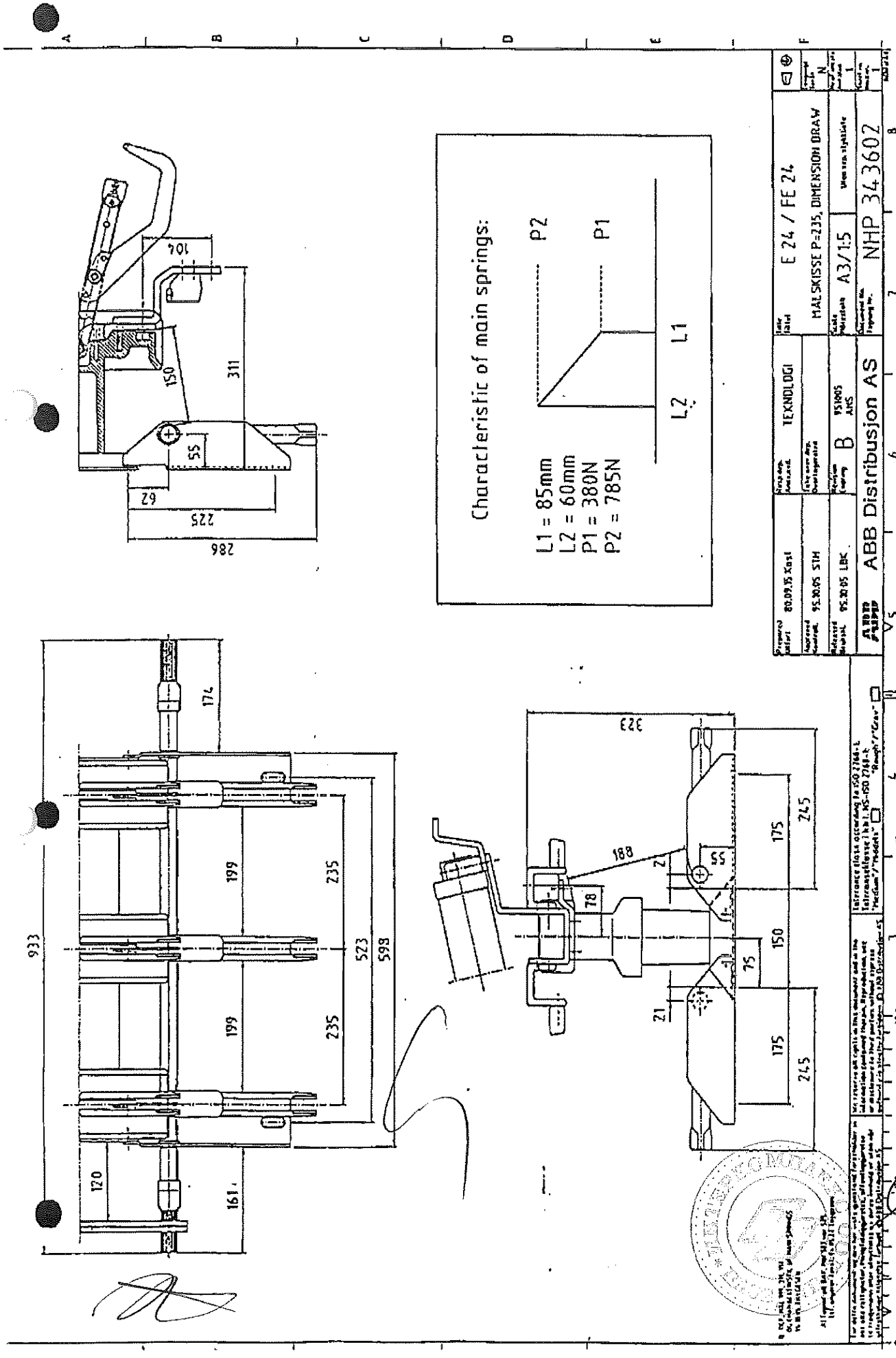

Magnetutløsning
Magnetauslösung
Magnetic release
Signalvender
Hilfschalter
Auxiliary switch
NALF 24kV P=235
For CCF sikringer ≤63A Mölskisse
1/10
-Teknologi
ABB Distribusjon AS
NHP 343379


Characteristic of main springs:
P2
P1
L2
L1
L1 = 85mm
L2 = 60mm
P1 = 380N
P2 = 785N
E 24 / FE 24
MALSKISSE P=235, DIMENSION DRAW
A3/1:5
NHP 343602
ABB Distribusjon AS
TEKNOLOGI
B
104
311
150
55
62
225
286
174
199
235
523
598
933
120
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323
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78
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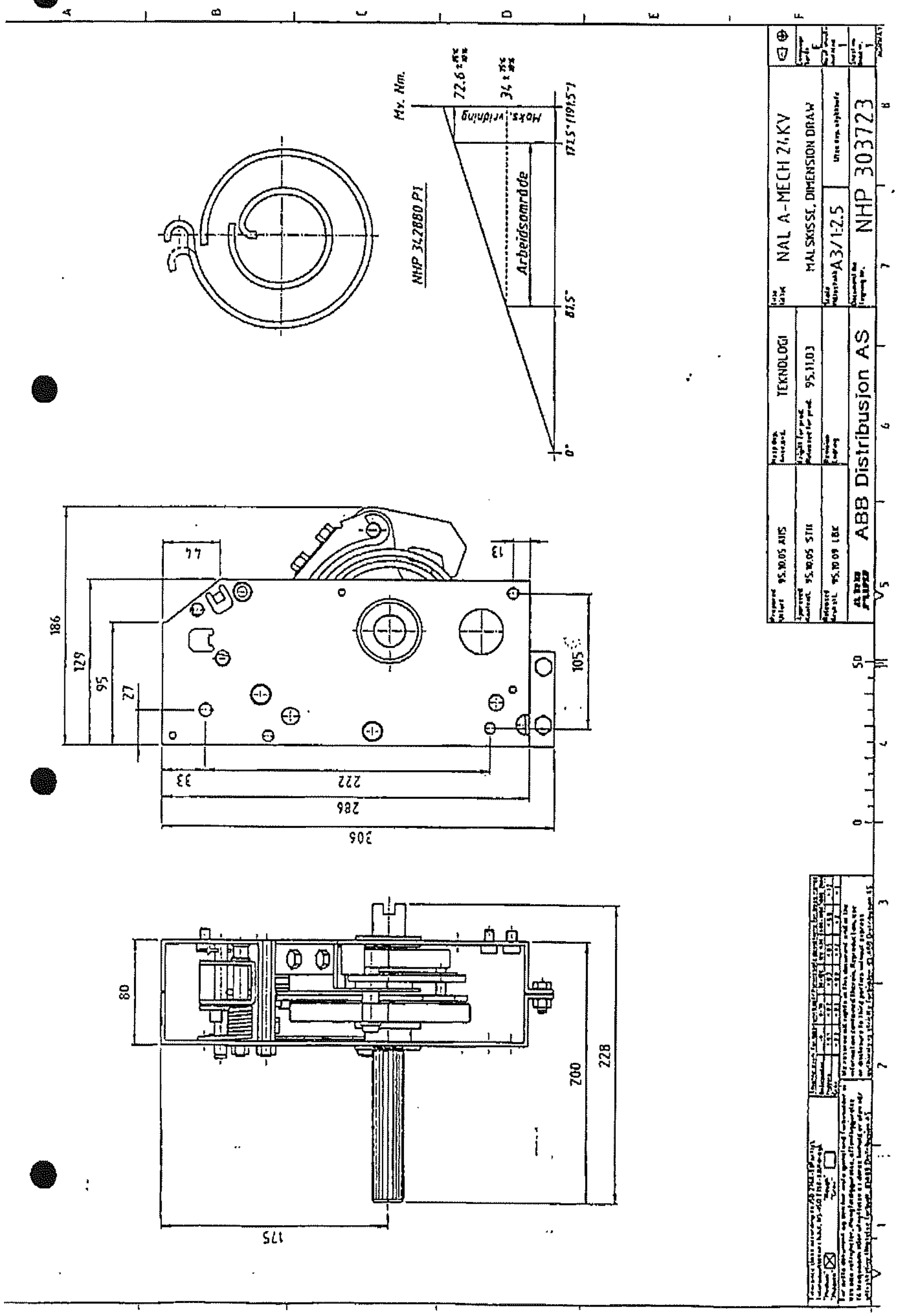
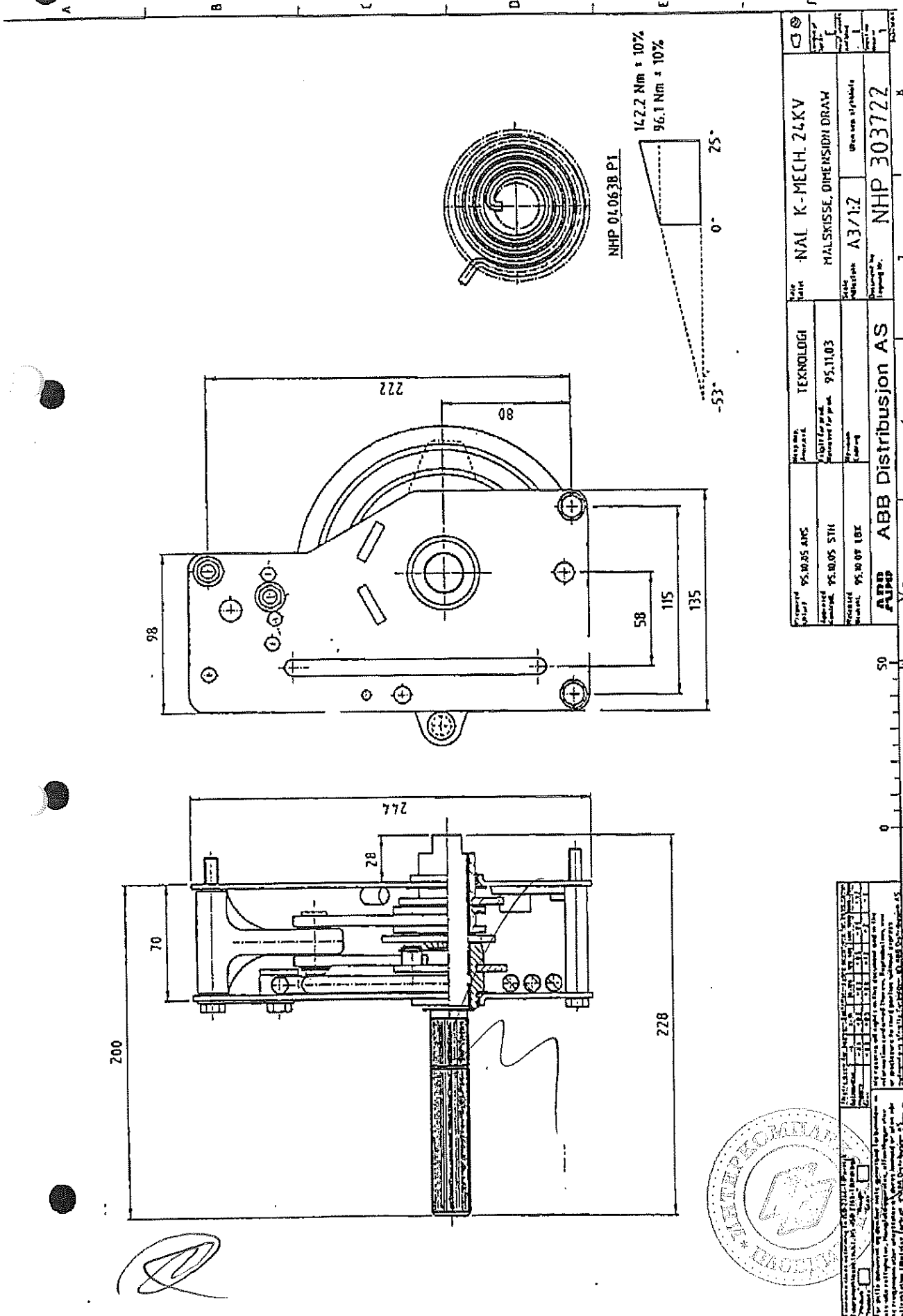
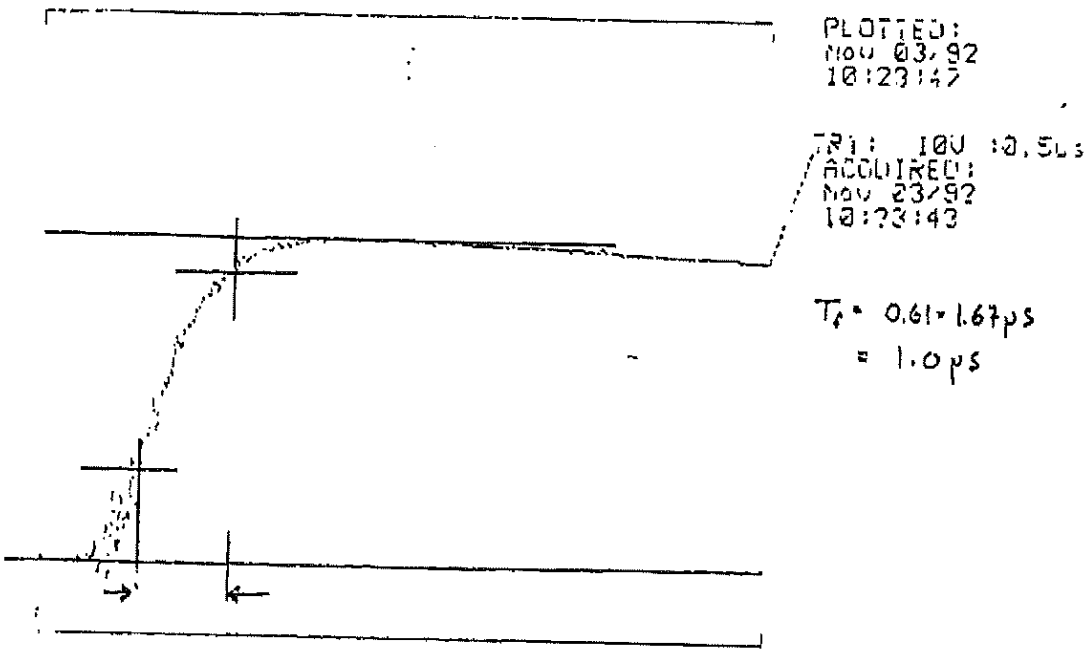
150
75
21


NAL A-MECH 24 KV
MALSKISSE, DIMENSION DRAW
A3/1:2.5
NHP 303723
TEKNOLOGI
ABB Distribusjon AS
NHP 342880 P1
Arbeidsområde
Maks. vridning
Mv. Nm.
72.6
34
171.5°(191.5°)
81.5°
0°
186
129
95
27
44
13
105
33
222
286
306
80
200
228
175


142.2 Nm ± 10%
96.1 Nm ± 10%
25°
0°
-53°
NHP 040638 P1
222
80
98
58
115
135
244
28
70
200
228
NAL K-MECH 24KV
MÅLSKISSE, DIMENSJON DRAW
A3/1:2
NHP 303722
TEKNOLOGI
95.11.03
95.10.05 ANS
95.10.05 STH
95.10.05 LBE
ABB Distribusjon AS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Nov 03/92
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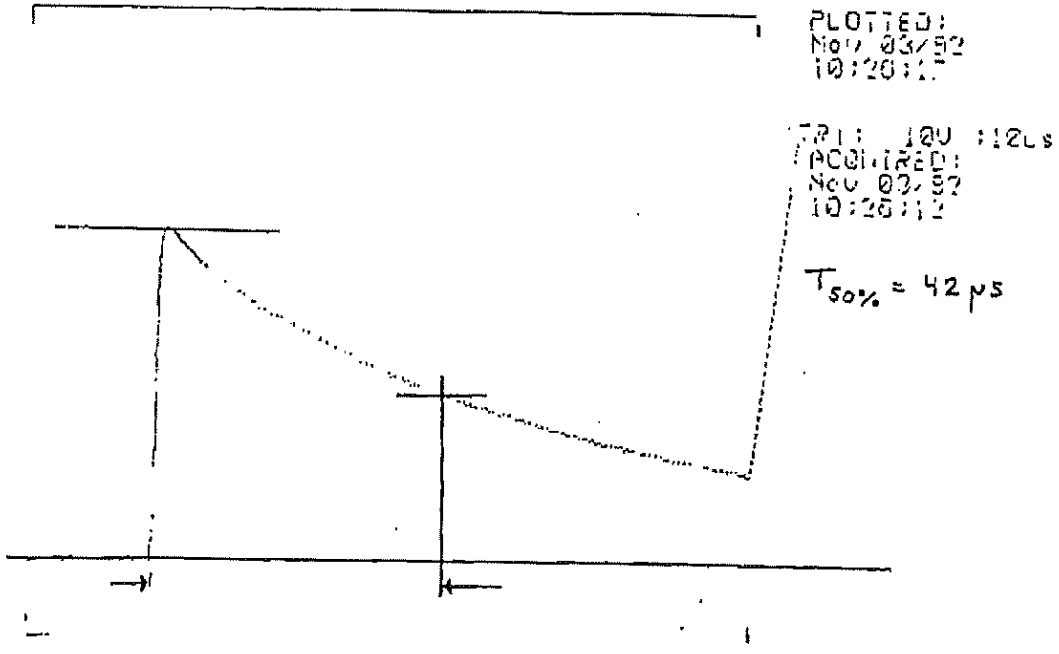
ACQUIRED:
Nov 23/92
10:23:43
T_f = 0.61 - 1.67 µs
= 1.0 µs


PLOTTED:
Nov 03/92
10:20:12
TR1: 10U :2us
ACQUIRED:
Nov 03/92
10:20:12
$T_{50\%}$ = 42 µs

SATS Scandinavian Association for Testing Switchgear

c/o EFI – The Norwegian Research Institute of Electricity Supply
Sem Sælandsv. 11 7034 Trondheim–NTH NORWAY
Tel. (07)597200 Telex 55513 efi n

REPORT OF PERFORMANCE No. 96-B03

APPARATUS: High-voltage switch disconnector and high-voltage switch-fuse combination
DESIGNATION: NAL 24 and NALF 24
MANUFACTURER: ABB Distribusjon AS, Skien, Norway
DATE(S) OF TESTS: 24. of November to 3. of December 1992

RATINGS ASSIGNED BY THE MANUFACTURER

NAL 24 : rated current : 630 A

NALF 24 : rated current with CEF 63 A

h.v.fuse : 63 A.

THE TESTS HAVE BEEN MADE IN ACCORDANCE WITH

See page no. 5 and 7.

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with test results and oscillograms.

THE DOCUMENTS FORMING PART OF THIS REPORT ARE

Table with test results	Nos.:	Page No.: 8 to 11
Oscillogram	Nos.:	
Drawing	Nos.:	Page No.: 12 to 16
Diagram	Nos.:	Page No.: 17 to 20
Photograph	Nos.:	

Skien, 4. of January 1996
Place and Date

на основание чл. 36а, ал. 3 от ЗОП
SATS Observer

на основание чл. 36а, ал. 3 от ЗОП
Laboratory manager

SATS

Scandinavian Association for Testing Switchgear
c/o EFI - Norwegian Electric Power Research Institute
Sem Sælandsv. 11 7034 Trondheim NORWAY
Telephone: + 47-7-597200 Telex: 55 513 efi n Telefax: + 47-7-597250

REPORT OF PERFORMANCE No. 96-B03

TITLE:

Temperature rise test on high-voltage switch disconnector type NAL 24 and switch-fuse combination type NALF 24.

Trondheim 1996-01-09
Place and Date

на основание чл. 36а, ал. 3 от ЗОП

SATS Secretariat Approval

Contents

- Front sheet ..... Page No.: 1
- Information sheet (SATS) ..... Page No.: 2
- Contents ..... Page No.: 3 (This page)
- Preface, Chapter 1 ..... Page No.: 4
- Test object, Chapter 2 ..... Page No.: 4
- Conclusion, Chapter 3 ..... Page No.: 4
- Temperature rise tests, Chapter 4 ..... Page No.: 5
- Measurement of the resistance of the main circuit, Chapter 5 ..... Page No.: 7
- Tables with test results ..... Page No.: 8 to 11
- Drawings ..... Page No.: 12 to 16
- drawings with added informations by the test laboratory ..... Page No.: 17 to 20

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1. Preface

The tests were witnessed by SATS observer, Mr. Arne Nesse, EFI (Norwegian Electric Power Research Institute).

Parts of the tests were also witnessed by:

Mr. Sten Thygesen, ABB Distribusjon, Skien, Norway

The tests have been performed at ABB Distribusjon AS, Electrotechnical and Mechanical Laboratory, Skien, Norway.

2. Test objects

- High-voltage switch disconnector type NAL 24, serial no. 238222.
- High-voltage earthing switch type E 24, serial no. 238222.
- High-voltage switch-fuse combination type NALF 24, serial no. 238218.

The high-voltage earthing switch type E 24 was mounted on the lower side, (hinge side), of the high-voltage switch type NAL 24. The high-voltage earthing switch is then an integrated part of the high-voltage switch and in this combination called NALE 24. However the temperature rise test is not relevant for earthing switches and no temperature rise test has been carried out on the E 24.

The test objects were manufactured by ABB Distribusjon AS, Skien, Norway.

All fuses used during tests are manufactured by ABB Distribusjon AS, Skien, Norway.

3. Conclusion

The test object passed the temperature rise tests successfully according to the IEC Publication 265-1 (1983), IEC Publication 420 (1990-11) and IEC Publication 694 (1980).

4. Temperature-rise tests

4.1 Test object

The test object was a high-voltage switch disconnector type NAL 24. See Chapter 5.4 for serial numbers.

4.1.1 Publication

IEC Publication 265-1, Second edition 1983, § 6.3, with reference to
IEC Publication 694, First edition 1980, § 6.3.

4.1.2 Test procedure

The test object was mounted in vertical (normal service) position in the test rack.
The three phases of the test object were connected in series with an AC single phase power supply.
The connections were made by means of Cu bars 2 // 5 x 40 mm.
The test was running until the steady state of the temperature was achieved, i.e. temperature less than 1 K per hour.
The test was performed with a test current of 630 A.
The ambient temperature was measured at the same height as the test object, and 1 meter from the test object with three equally distributed TC's type K.

4.1.3 Test results

The test object passed the test successfully with temperature rise below the limit given in table V of IEC Publication 694, see page no. 8 and 9.

4.2 Test object

The test object was a high-voltage switch-fuse combination type NALF 24, with fuses type CEF 24 kV, 63 A inserted.

4.2.1 Publication

IEC Publication 420, Second edition 1990-11, § 6.3, with reference to
IEC Publication 694, First edition 1980, § 6.3.

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4.2.2 Test procedure

The test object was mounted in vertical (normal service) position in the test rack.
The three phases of the test object were connected in series with an AC single phase power supply.
The connections were made by means of 50 mm^2 Copper uninsulated PN cable.The test was carried out with a test current of 63 A, corresponding to a nominal power loss of 147 W in each of the fuses according to the datasheet from the manufacturer.

4.2.3 Test results

The test object passed the test successfully with temperature rise below the limit given in table V of IEC Publication 694, see page no. 10 and 11.

5. Measurement of the resistance of the main circuit

5.1 Test objects

The test objects were a high-voltage switch disconnector type NAL 24 and a high-voltage switch-fuse combination type NALF 24, with fuses CEF 24 kV, 63 A inserted.
The test objects were mounted in vertical position in the test rack.

5.2 Publication

IEC Publication 694, First edition 1980. § 6.4.

5.3 Test procedure

The resistance was measured between terminals of each phase before and after the temperature rise test, see Chapter 4.
Voltage drop was measured at 50 A DC.
The measurement of NALF 24 also includes a measurement of the resistance of the fuse in each phase.
Measuring point, see page no. 19 and 20.

5.4 Test results

After the test objects had cooled down to the ambient temperature, the differences between the measurements were negligible:

Test object	Resistance in mΩ before temperature rise test			Resistance in mΩ after temperature rise test		
	Phase L1	Phase L2	Phase L3	Phase L1	Phase L2	Phase L3
NAL 24 No. 238222 See page no. 19 (c)	0.07	0.09	0.10	0.08	0.09	0.10
NALF 24 No. 238218 See page no. 20 (a)	24.0	25.0	25.0	24.0	25.0	24.0
Fuses only See page no. 20 (b)	23.9	24.9	24.9	23.9	24.9	24.9

TEMPERATURE RISE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B03	Test no.:		Sheet no.: 1 of 2
Test object : Switch-disconnector NAL 24			Date: 24.11.92
Temporary connections Type : 2 // Cu Bars 5 x 40 mm Length between terminals : 2 m Length of source connections : 1,2 m		Fuse type:	
		Power loss: W (At rated current)	
		Total test duration: 5 hrs	
		Amb. temperature Before test: 22.7 °C	
		After test: 22.8 °C	
Location of measuring points: See page no. 17			
Test current: 630 A			

Measuring Point no.:	Identification of measuring point		Temp. rise limit acc. to standard [K]	Temp. rise at steady state cond. [K]	Remarks
1	Conn.terminal	L1	65	42.5	
2	Hinge, cont..knife	L1	65	44.8	
3	Contact knife	L1	65	46.3	
4	Peak contact	L1	65	45.2	
5	Conn.terminal	L1		40.8	
6	Conn.bars	L2	+/- 5	40.6	
7	1 m from terminal	L2	65	37.1	
8	Conn.terminal	L2	65	43.2	
9	Hinge, cont. knife	L2	65	47.9	
10	Cont.knife	L2	65	44.6	
11	Peak contact	L2		45.6	
12	Conn.terminal	L2	65	44.2	
13	Conn.terminal	L3	65	44.1	
14	Hinge, cont. knife	L3	65	48.1	
15	Cont.knife	L3	65	45.9	
16	Peak contact	L3		45.7	
17	Conn.terminal	L3		40.4	
18	Conn.bar	L3		38.0	
19	1 m from terminal	L3	+/- 5	41.9	
20	Conn.bar	L1		41.4	

Notes:

TC : Type K

TEMPERATURE RISE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B03	Test no.:	Sheet no.: 2 of 2
Test object : Switch disconnector		Date: 24.11.92

Temporary connections Type : 2 // Cu Bars 5 x 40 mm Length between terminals : 2 m Length of source connections : 1.2 m	Fuse type:		
	Power loss:	W (At rated current)	
	Total test duration:	5	hrs
	Amb. temperature Before test:	22.7	°C
	After test:	22.8	°C
Location of measuring points: See page no. 17			
Test current: 630 A			

Measuring Point no.:	Identification of measuring point		Temp. rise limit acc. to standard [K]	Temp. rise at steady state cond. [K]	Remarks
21	1 m from terminal	L1	+/- 5	38.0	
22	Conn.bar	L2		41.5	
23	1 m out on conn.bar	L2	+/- 5	40.0	
24	Conn.bar	L3		42.5	
25	1 m out on conn.bar	L3	+/- 5	41.1	
26	Conn.bar	L1		39.3	
27	1 m out on conn.bar	L1	+/- 5	37.6	

Notes:

TC : Type K

TEMPERATURE RISE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B03	Test no.:	Sheet no.: 1 of 2
Test object : Switch-fuse comb. NALF 24		Date: 03.12.92

Temporary connections	Fuse type: CEF 24, 63 A			
Type : 50 mm2 Cu PN	Power loss: 147 W (At rated current)			
Length between terminals : 2 m	Total test duration:	6	hrs	
Length of source connections : 1.2 m	Amb. temperature	Before test:	23.8	°C
Location of measuring points: See page no. 18		After test:	24.0	°C
Test current: 63 A				

Measuring Point no.:	Identification of measuring point		Temp. rise limit acc. to standard [K]	Temp. rise at steady state cond. [K]	Remarks
1	Conn.terminal	L1	65	15.0	
2	Spring cont.	L1	65	37.4	
3	Spring cont.	L1	65	59.7	
4	Conn.bar	L1		25.4	
5	Hinge, cont. knife	L1	65	11.6	
6	Cont.knife	L1	65	9.5	
7	Conn.terminal	L1	65	8.4	
8	Conn.terminal	L2	65	16.1	
9	Spring cont.	L2	65	38.2	
10	Spring cont.	L2	65	61.2	
11	Conn.bar	L2		26.2	
12	Hinge, cont. knife	L2	65	12.5	
13	Cont.knife	L2	65	10.0	
14	Conn.terminal	L2	65	8.8	
15	Conn.terminal	L3	65	15.6	
16	Spring cont.	L3	65	32.1	
17	Spring cont.	L3	65	60.9	
18	Conn.bar	L3		26.8	
19	Hinge, cont. knife	L3	65	13.1	
20	Cont.knife	L3	65	11.1	

Notes:

TC : Type K

TEMPERATURE RISE TEST
TABLE WITH TEST RESULTS

Report no.: 96-B03	Test no.:	Sheet no.: 2 of 2
Test object : Switch-fuse comb. NALF 24		Date: 03.12.92

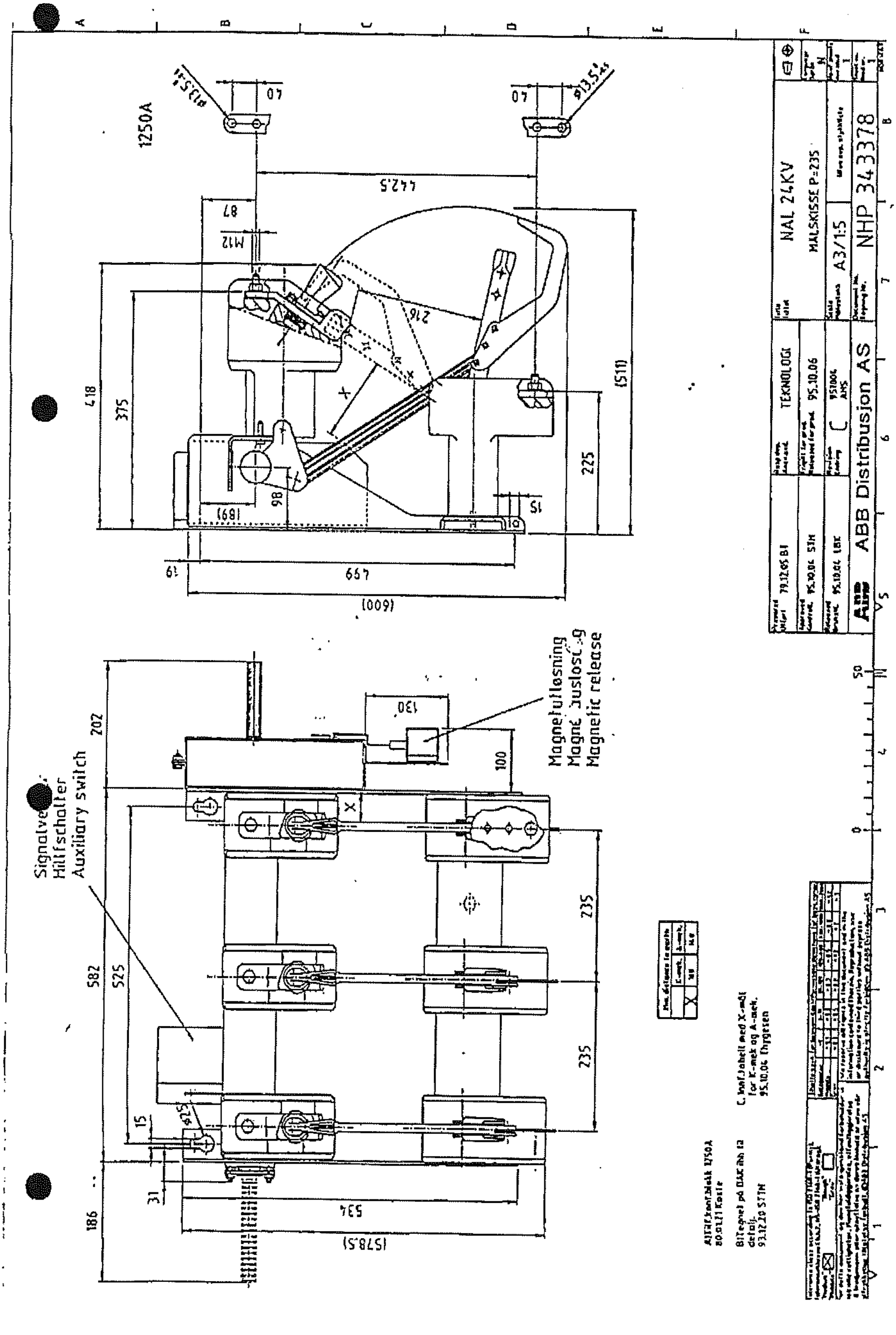
Temporary connections	Fuse type: CEF 24, 63 A		
Type : 50 mm2 Cu PN	Power loss: 147 W (At rated current)		
Length between terminals : 2 m	Total test duration:	6	hrs
Length of source connections : 1.2 m	Amb. temperature Before test:	23.8	°C
Location of measuring points: See page no. 18	After test:	24.0	°C

Test current: 63 A

Measuring Point no.:	Identification of measuring point		Temp. rise limit acc. to standard [K]	Temp. rise at steady state cond. [K]	Remarks
21	Conn.terminal	L3	65	10.3	
22	1 m from terminal	L3	+/- 5	6.8	
23	1 m from terminal	L1	+/- 5	9.6	
24	1 m from terminal	L2/L3	+/- 5	11.2	
25	1 m from terminal	L1/L2	+/- 5	9.1	
26	Fuse	L1		90.2	
27	Fuse	L2		96.9	

Notes:

TC : Type K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TEKNOLOGI
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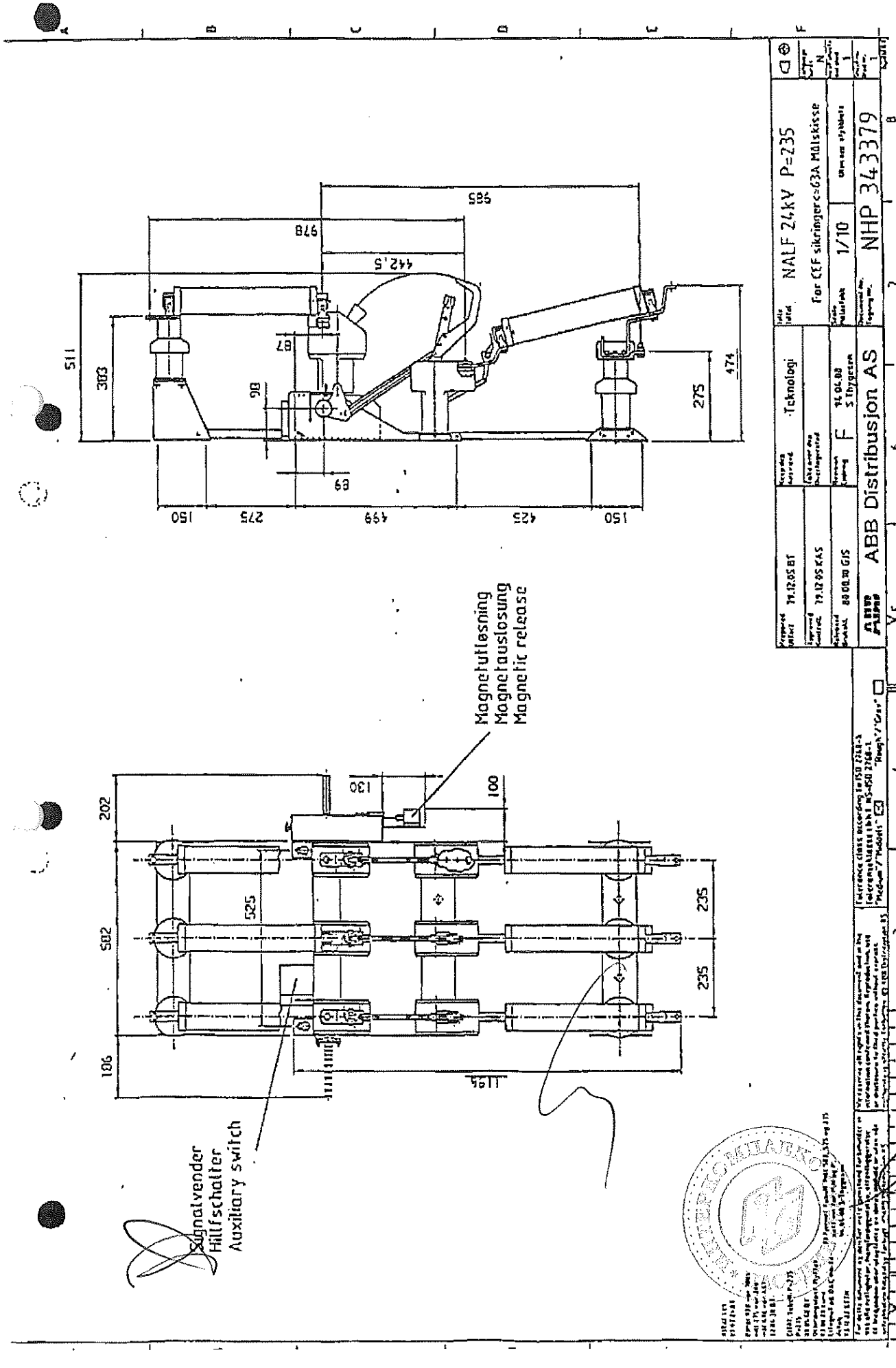
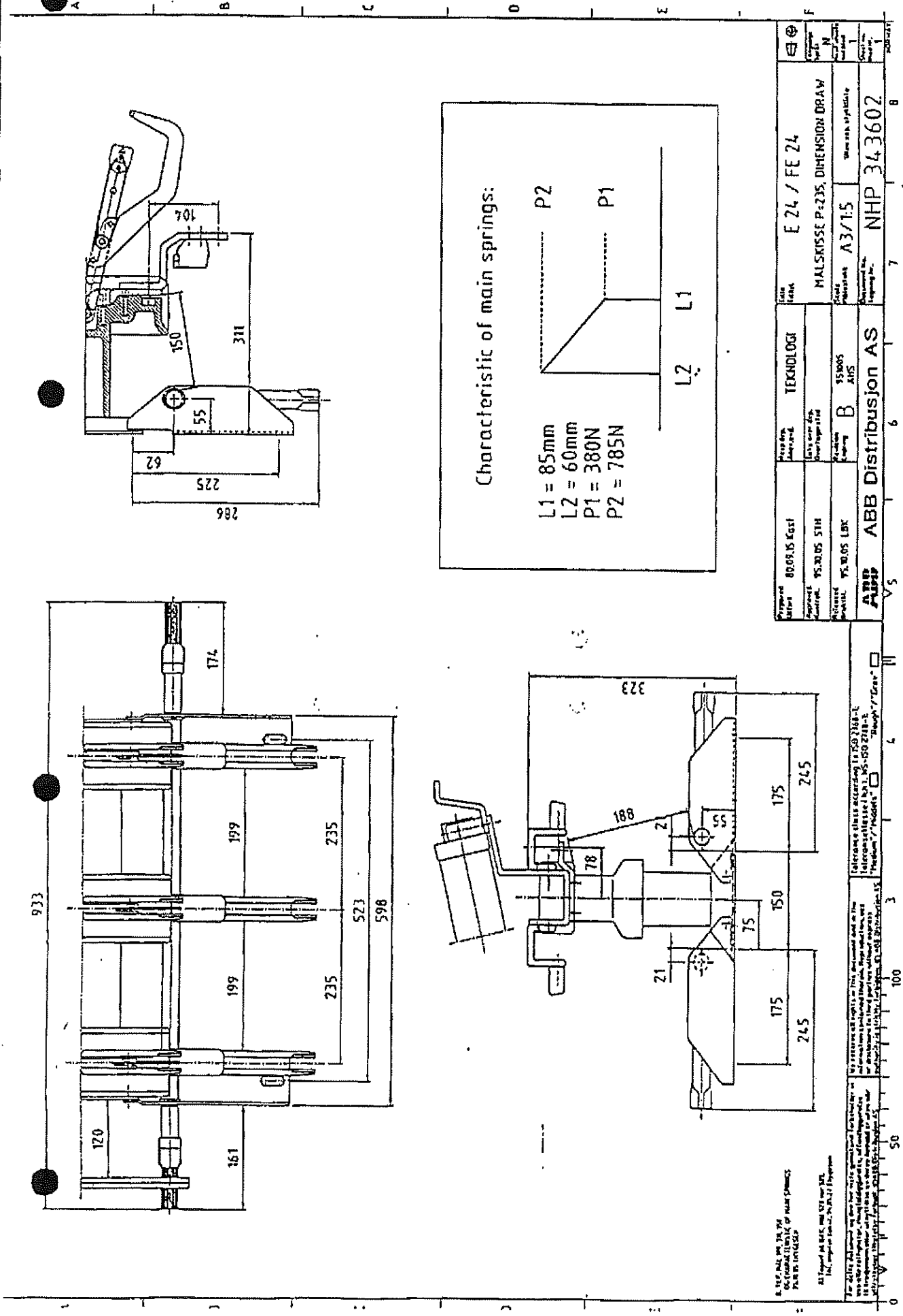
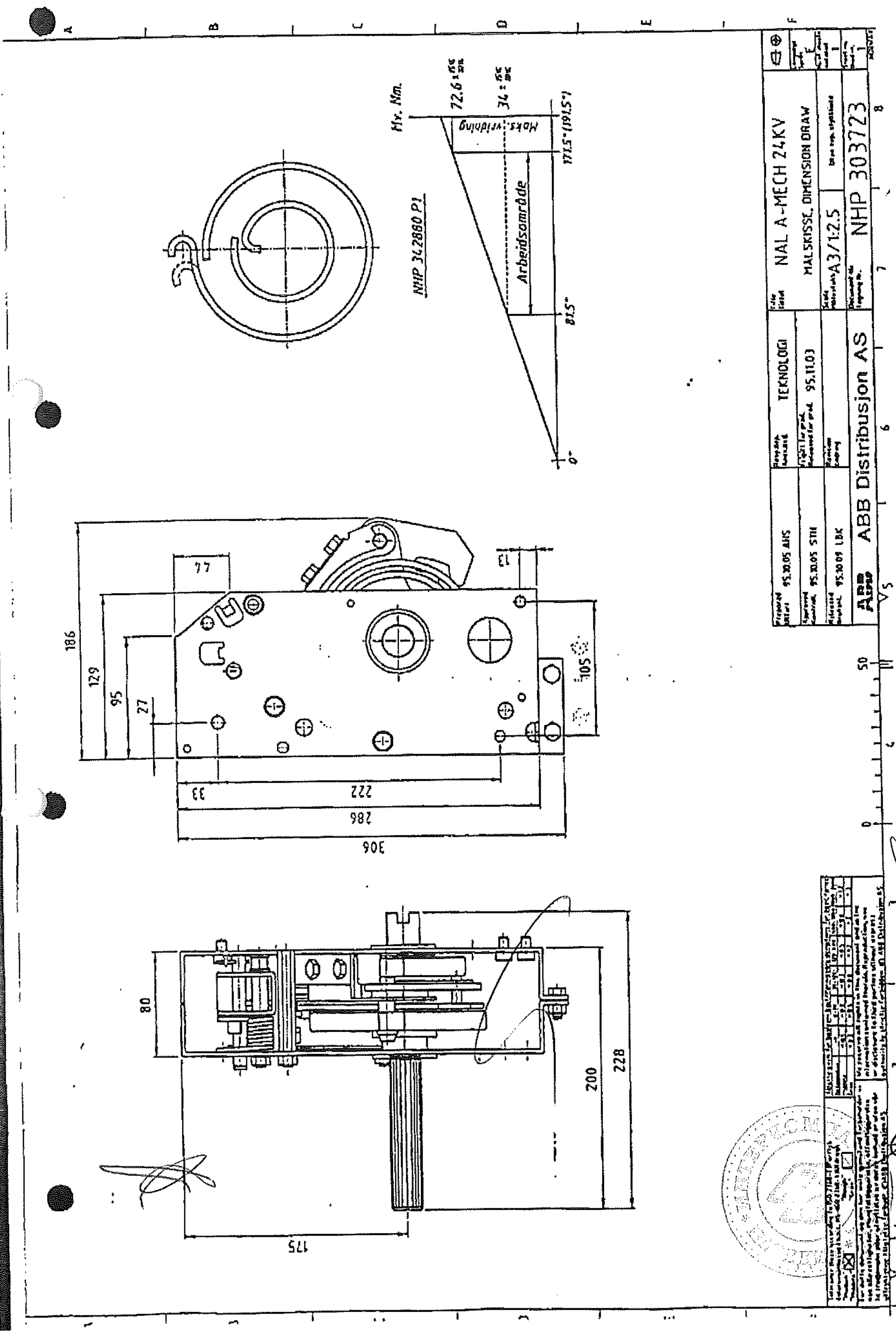
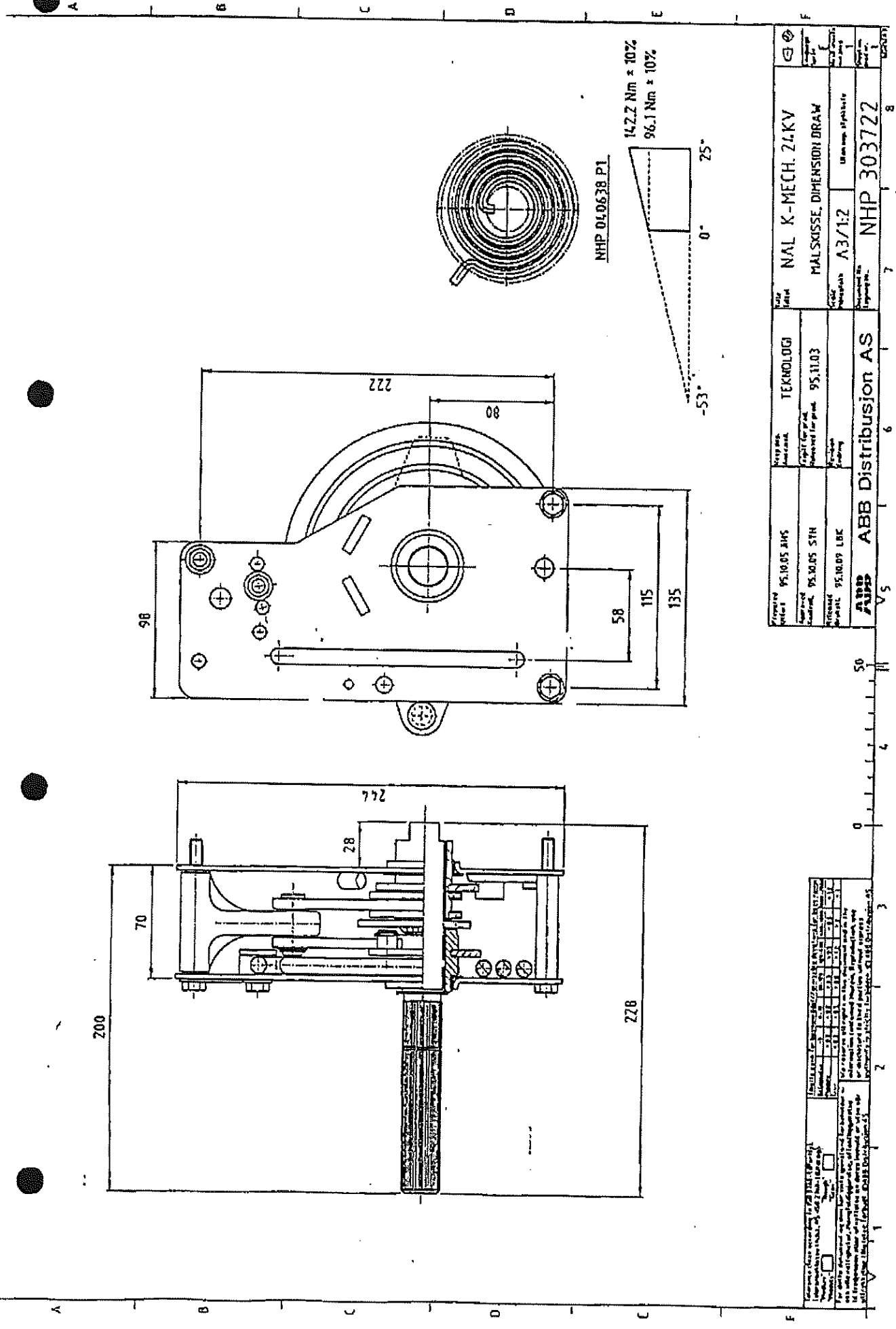
NHP 343378
ABB Distribusjon AS
Magnetic release
Hilfschalter
Auxiliary switch


585
978
442,5
511
383
87
98
89
474
275
150
275
499
425
150
Magnetutlösning
Magnetauslösung
Magnetic release
202
582
186
130
100
525
235
235
1194
Signalvender
Hilfschalter
Auxiliary switch
NALF 24kV P=235
For CEF sikringgere≤63A Målskisse
1/10
NHP 343379
ABB Distribusjon AS
Teknologi

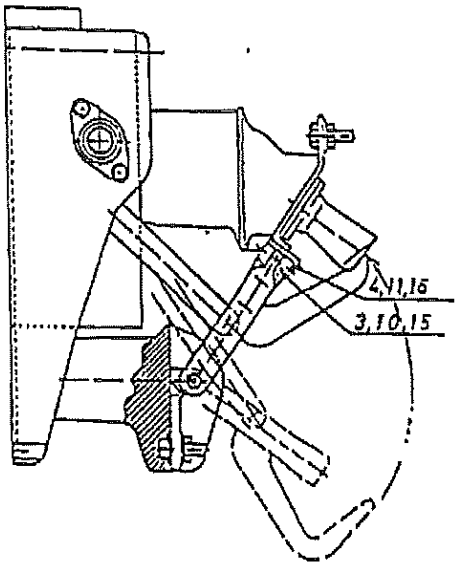
238

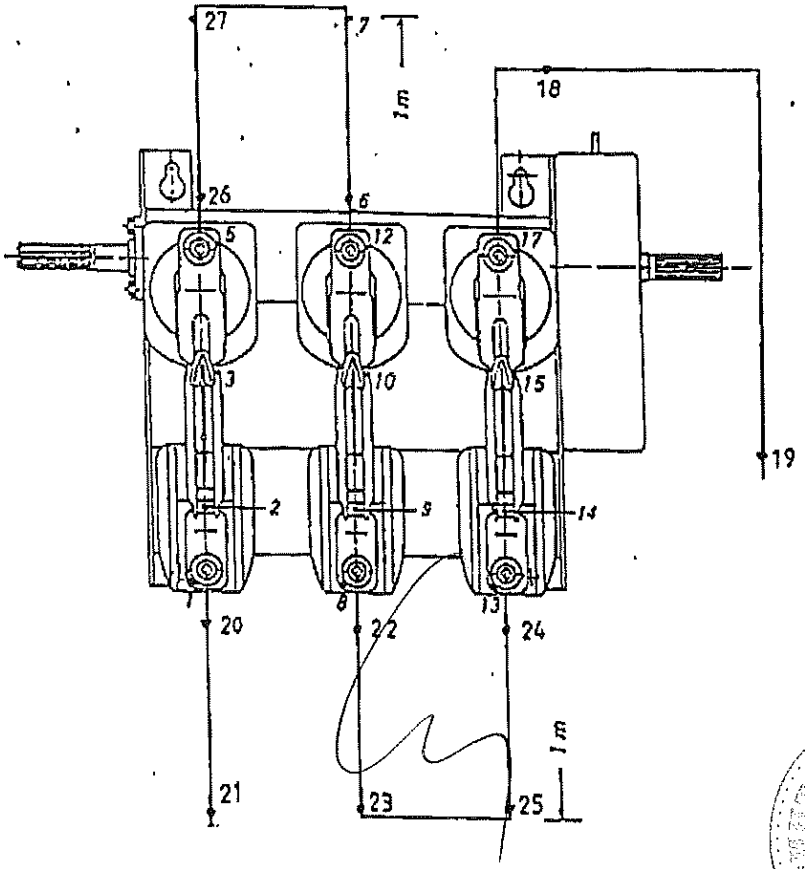

Characteristic of main springs:
P2
P1
L2
L1
L1 = 85mm
L2 = 60mm
P1 = 380N
P2 = 785N
E 24 / FE 24
MALSKISSE P=235, DIMENSION DRAW
NHP 343602
ABB Distribusjon AS
TEKNOLOGI
A3/1:5
104
150
311
55
62
225
286
174
199
235
523
598
933
120
161
323
188
78
175
245
75
150
21


NAL A-MECH 24KV
MÅLSKISSE, DIMENSION DRAW
A3/1:2,5
NHP 303723
TEKNOLOGI
95.11.03
ABB Distribusjon AS
NHP 342880 P1
Mv. Nm.
72,6
34
Maks. vridning
Arbeidsområde
171,5° (191,5°)
81,5°
0°
186
129
95
27
77
13
105
33
222
286
306
80
200
228
175


142.2 Nm ± 10%
96.1 Nm ± 10%
25°
0°
-53°
NHP 04.0638 P1
222
80
98
58
115
135
244
28
70
200
228
NAL K-MECH. 24KV
MALSKISSE, DIMENSJON DRAW
A3/1:2
NHP 303722
ABB Distribusjon AS
TEKNOLOGI
95.10.05 AHS
95.10.05 STH
95.10.09 LBK
95.11.03

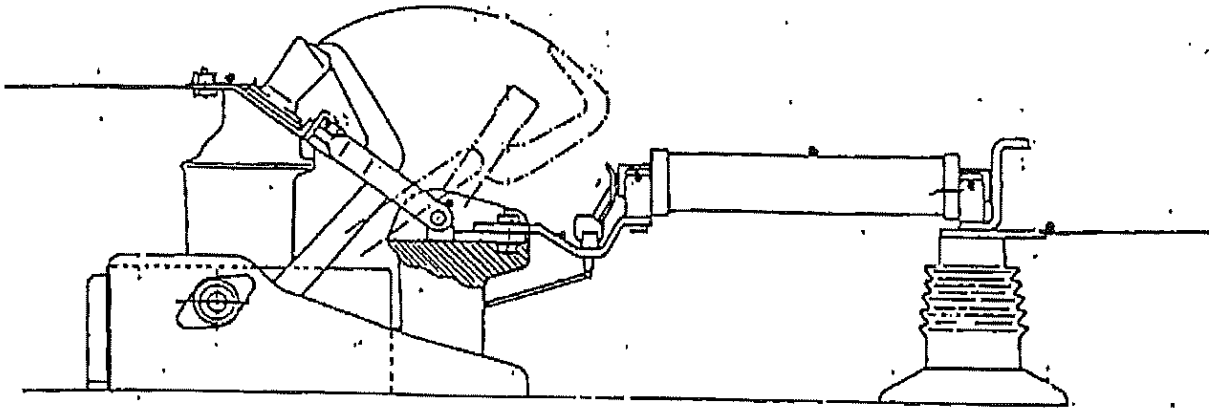
Location of measuring points

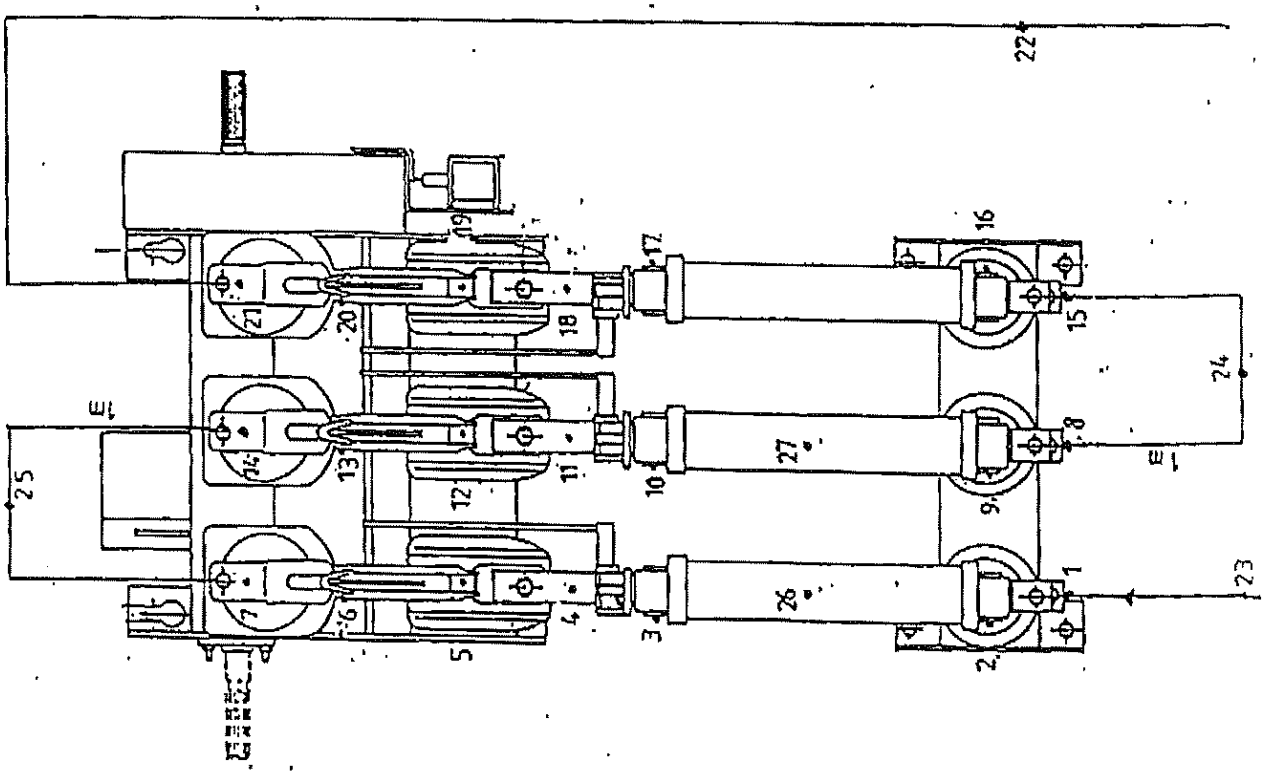


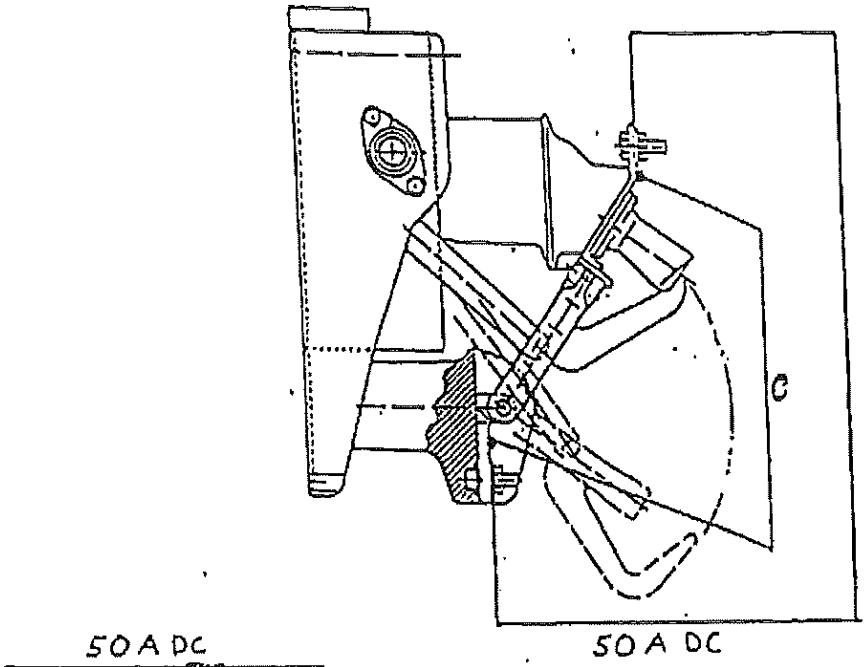


240

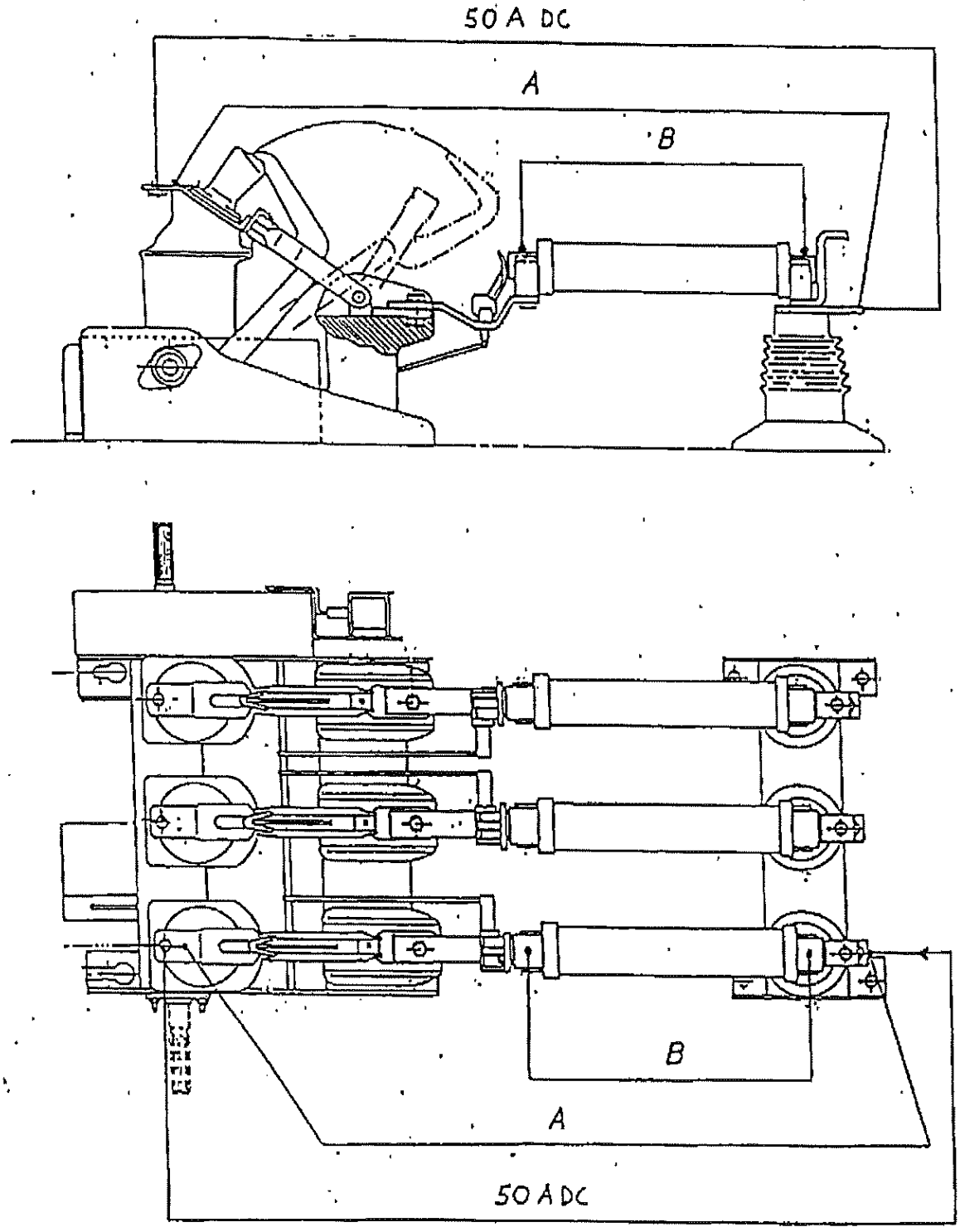
Location of measuring point



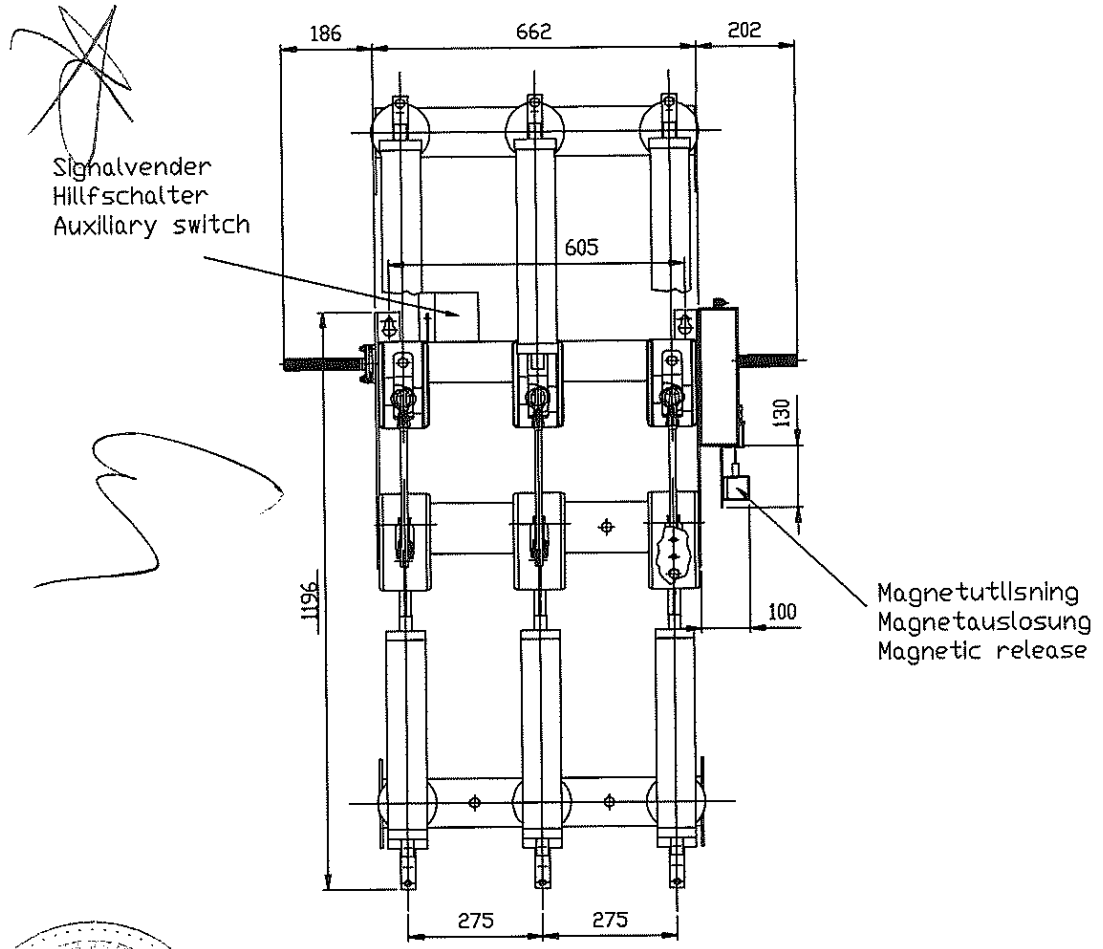


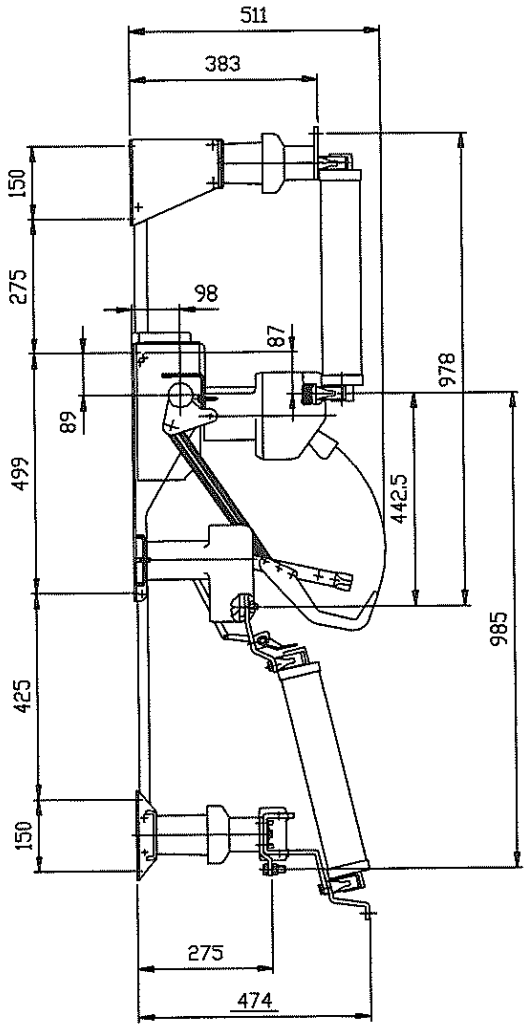


Measurement of the resistance (NALE)



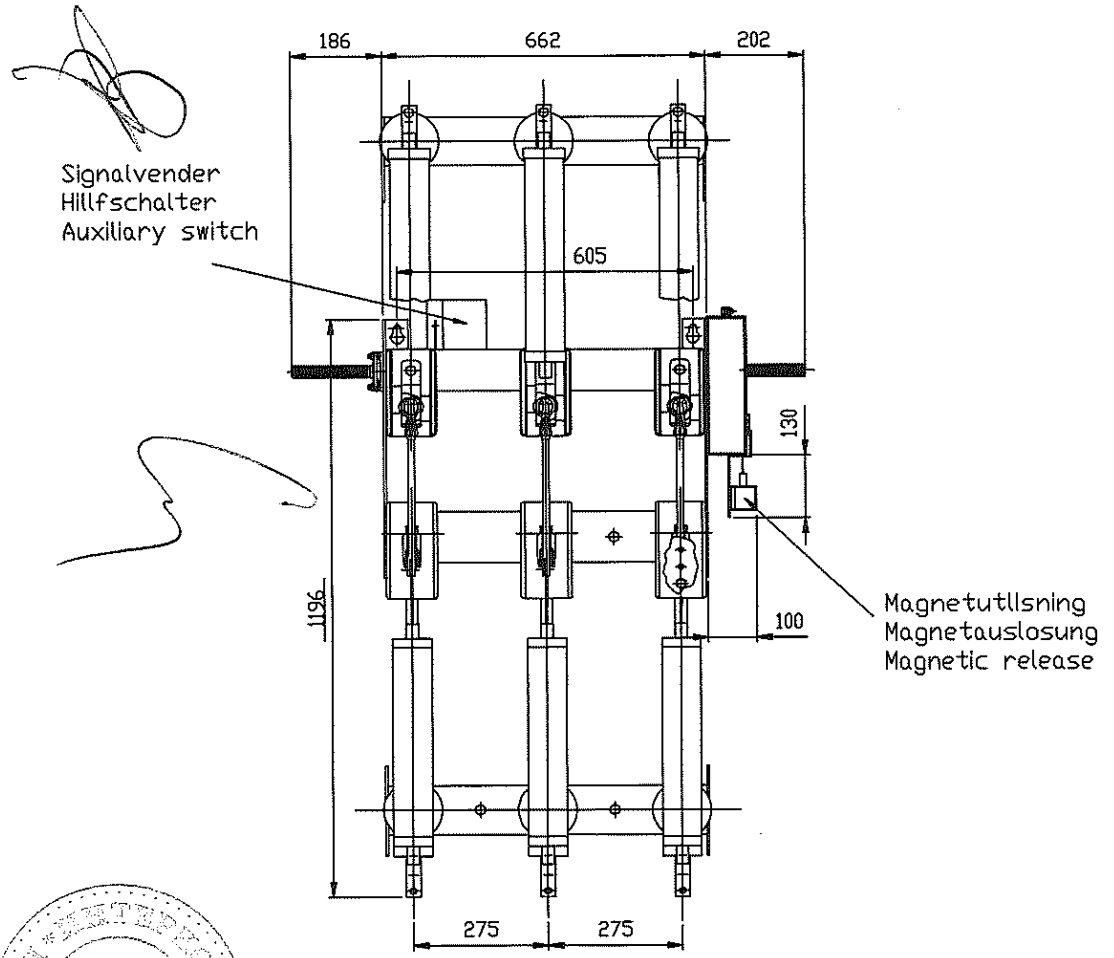
Measurement of the resistance (NALF)

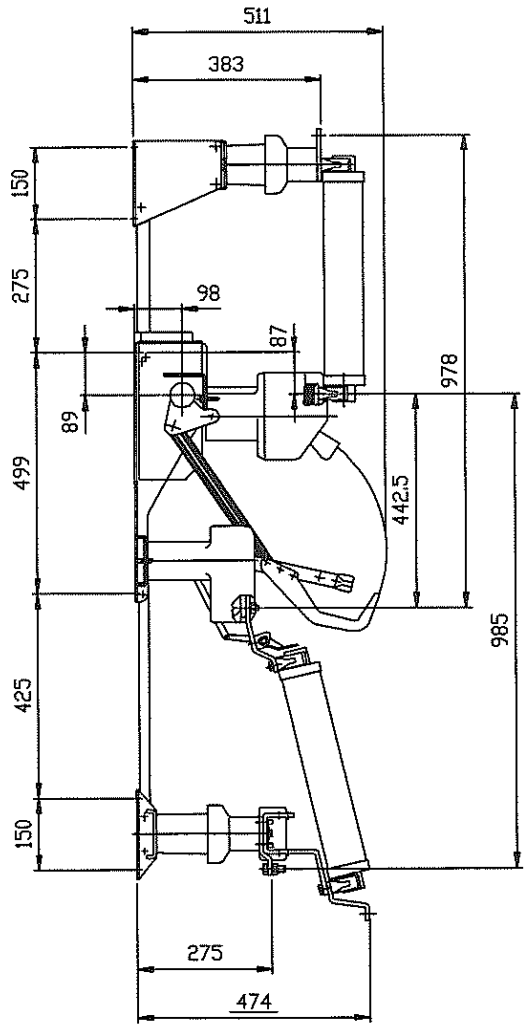




Prepared / Utført: 94.04.08 S.Thygesen	Resp.dep. / Ansv.avd.: Teknologi	Title / Tittel: NALF 24kV P=275	Language / Språk: N
Approved / Kontroll.	Take over dep. / Overtagerssted	For CEF sikringer<=63A M)lsklsse	Num.sheets / Ant.blad: 1
Released / Brukskl.	Revision / Endring	Scale / Målestokk: 1/10 — Uten sep. stykkliste	Sheet no. / Blad nr.: 1
ABB Distribusjon AS		Document No. / Tegning nr.: NHP 303220	NORWAY

Tolerance class according to ISO 2768-1
Toleranseklasse i h.h.t. NS-ISO 2768-1
"Medium"/"Middels" ☒ "Rough"/"Grov" ☐





Prepared / Utført: 94.04.08 S.Thygesen	Resp.dep. / Ansv.avd.: Teknologi	Title / Tittel: NALF 24kV P=275	Language / Språk: N
Approved / Kontrollt.	Take over dep. / Overtagerstad	For CEF sikringer<=63A M)lskisse	
Released / Brukskl.	Revision / Endring	Scale / Målestokk: 1/10 — Uten sep. styliddiste	Num of sheets / Antblad: 1
ABB Distribusjon AS		Document No. / Tegning Nr.: NHP 303220	Sheet no. / Blad nr.: 1

NORWAY

Tolerance class according to ISO 2768-1i
Toleranseklasse i h.h.t. NS-ISO 2768-1i
"Medium"/"Middels" ☒ "Rough"/"Grov" ☐

SPRAWOZDANIE Nr / TEST REPORT No. 6957/LAR/05

ZAKŁAD WIELKICH MOCY
HIGH POWER DEPARTMENT
INSTYTUT ELEKTROTECHNIKI – ELECTROTECHNICAL INSTITUTE
04-703 WARSZAWA; ul. M. Pożaryskiego 28
tel./fax.: (0-22) 812 04 07; tel.: (0-22) 812 23 38; e-mail: nwr@iel.waw.pl
Certyfikat Akredytacji / Certificate Accreditation PCA Nr AB 074

SPRAWOZDANIE Z PRÓB W WARUNKACH ZWARCIA DOZIEMNEGO
TEST REPORT OF TESTS UNDER EARTH FAULT CONDITIONS

BADANY APARAT
APPARATUS

ROZŁĄCZNIK
SWICH DISCONNECTOR

TYP
DESIGNATION

NAL 24-6

Nr seryjny
Serial No. **14667/205**

Napięcie znamionowe
Rated Voltage 24 kV

Częstotliwość
Rated Frequency 50 Hz

PRODUCENT
MANUFACTURER

ABB Sp. z o.o.
ul. Bitwy Warszawskiej 1920 r. nr 18, 02-366 Warszawa
Oddział w Przasnyszu, ul. Leszno 59, 06-300 Przasnysz

ZLECENIODAWCA
TESTED FOR

ABB Sp. z o.o.

DATA BADAŃ
DATE(S) OF TESTS

25.05.2005, 31.05.2005

WYKONAWCA BADAŃ
TESTED BY

Laboratorium Badawcze Aparatury Rozdzielczej
Switchgear and Controlgear Testing Laboratory
04-703 Warszawa; ul. Pożaryskiego 28, Certyfikat Akredytacji PCA Nr AB 074

Przedmiot badań, wykonany zgodnie z dokumentacją, rysunkami konstrukcyjnymi i fotografiami, stanowiącymi załącznik do niniejszego sprawozdania, poddany został próbom zgodnie z normą
The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this report has been subjected to the series of proving tests in accordance with
PN-EN 60265-1:2001

Niniejsze Sprawozdanie odnosi się wyłącznie do badanego obiektu.
Producent ponosi odpowiedzialność za każdy egzemplarz wyrobu oznakowany identycznie jak wyrób badany.
The Test Report applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designators with that tested rests with the Manufacturer.

Kierownik Laboratorium / Head of Laboratory

Ph. D. Eng. Albert Gmitrzak

Warszawa 07.06.2005

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PARAMETRY TECHNICZNE DEKLAROWANE PRZEZ PRODUCENTA I POTWIERDZONE BADANIAMI
RATINGS ASSIGNED BY THE MANUFACTURER AND PROVED BY TESTS

Napięcie znamionowe Voltage	24 kV
Prąd wyłączeniowy zwarcia doziemnego Earth fault current	55 A
Prąd wyłączeniowy ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego Cable charging switching current under earth fault conditions	31,5 A
Częstotliwość Frequency	50 Hz

WYKAZ PRÓB / SUMMARY OF TESTS

	STRONA PAGE
Łączenie prądu zwarcia doziemnego (szereg probierczy 6a) Earth fault off-load switching current test (test duty 6a)	5
Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b) Cable charging switching current under earth fault conditions (test duty 6b)	6

PN-EN 60265-1:2001 Rozłączniki wysokonapięciowe.
Część 1: Rozłączniki na napięcia znamionowe wyższe niż 1 kV i niższe niż 52 kV.

W badaniach uczestniczył / The tests were observed by:

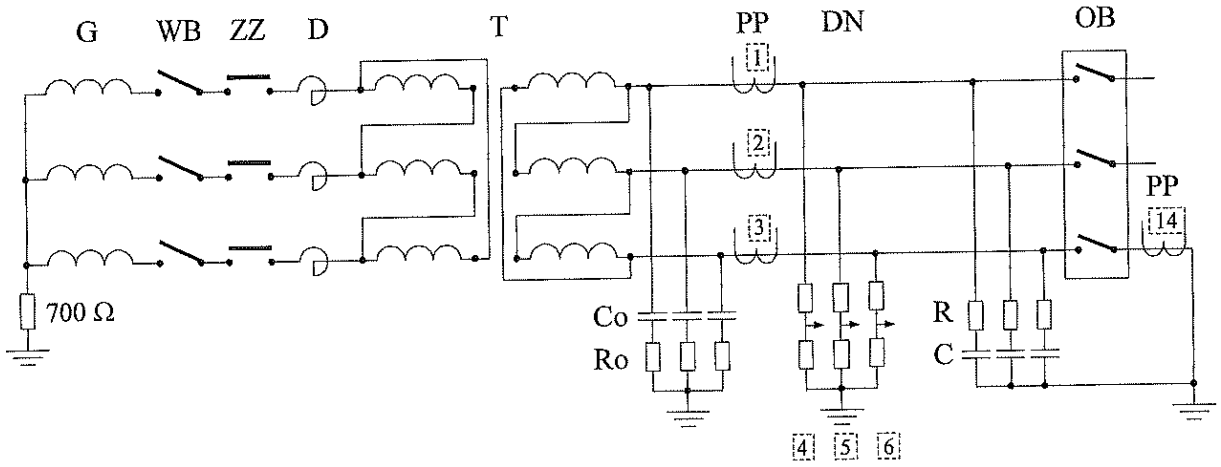
mgr inż. Tomasz Sinkiewicz — ABB Sp. z o. o.
Oddział w Przasnyszu, ul. Leszno 59, 06-300 Przasnysz

Dokumenty identyfikacyjne / Identification of the apparatus

Wymiary obiektu są zgodne z dołączonymi rysunkami wymiarowymi.
The apparatus is constructed in accordance with the drawings incorporated in this report.

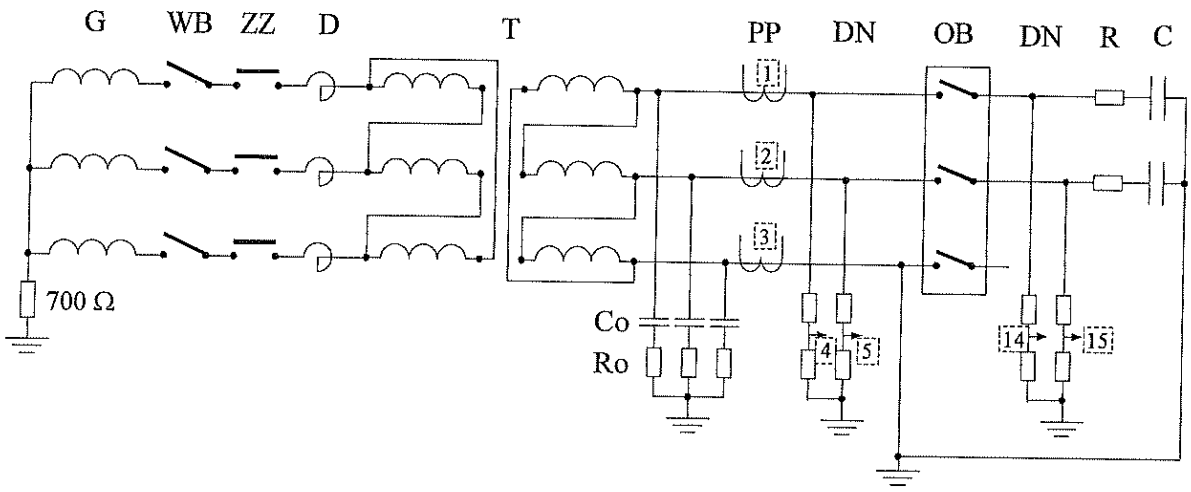
Rysunek / Drawing: NHP 343070

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądu zwarcia doziemnego (szereg probierczy 6a)** Earth fault off-load switching current test (test duty 6a)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP1



G	**Generator TJ 100**
WB	**Wyłącznik bezpieczeństwa** Master breaker
ZZ	**Załącznik zwarciowy** Making switch
D	**Dławiki** Inductance
T	**Transformator** Transformer
DN	**Dzielnik napięcia** Voltage divider
PP	**Przekładnik prądowy** Current transformer
OB	**Obiekt badany** Tested object

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)** Cable charging switching current under earth fault conditions (test duty 6b)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP2



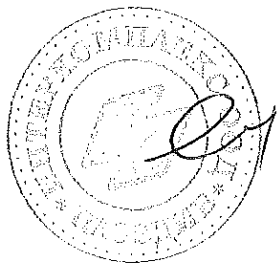
G	**Generator TJ 100**
WB	**Wyłącznik bezpieczeństwa** Master breaker
ZZ	**Załącznik zwarciowy** Making switch
D	**Dlawiki** Inductance
T	**Transformator** Transformer
DN	**Dzielnik napięcia** Voltage divider
PP	**Przekladnik prądowy** Current transformer
OB	**Obiekt badany** Tested object

TESTS RESULTS

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądu zwarcia doziemnego (szereg probierczy 6a)** Earth fault off-load switching current test (test duty 6a)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP1

Typ napędu / Operating mechanism:
Typ: NMMD1 220V AC/DC
Art: 5DLN 527601-F

Numer oscylogramu Oscillogram no.	**Napięcie probiercze** Test voltage (kV)	**Prąd probierczy I_{6a}** Test current I_{6a} (A)	**Uwagi** Remarks
80719	24.0	55.0	
80722	24.4	58.6	
80723	24.4	58.5	
80724	24.3	57.9	
80725	24.5	58.8	
80726	24.5	58.8	
80727	24.3	57.6	
80728	24.3	57.8	
80729	24.2	57.6	
80730	24.5	58.8	

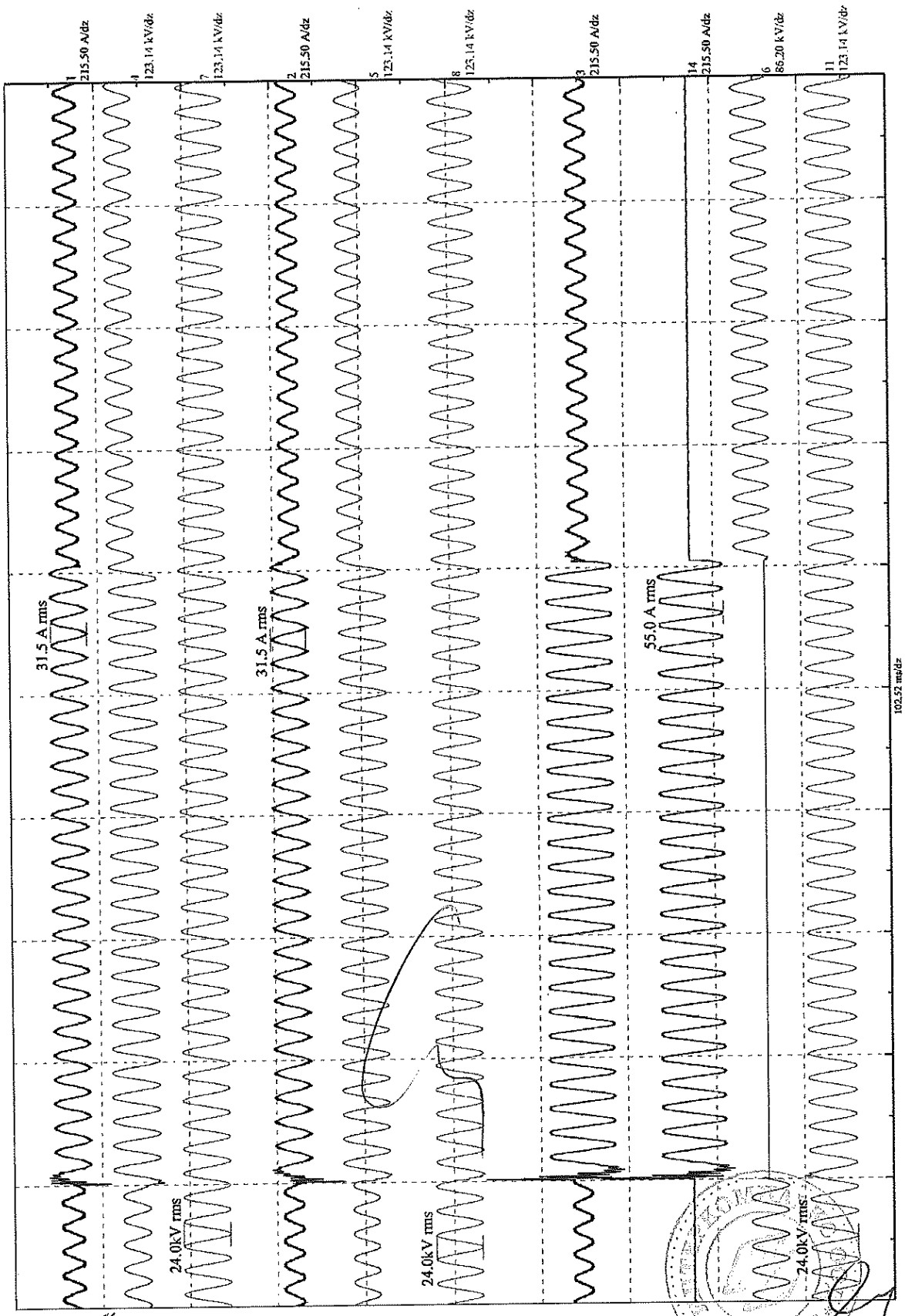


RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)** Cable charging switching current under earth fault conditions (test duty 6b)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP2

Wartości prądów i napięć są podawane kolejno dla fazy L1 i L2
Current and voltage values are given for L1 and L2.

Typ napędu / Operating mechanism:
Typ: NMMD1 220V AC/DC
Art: 5DLN 527601-F

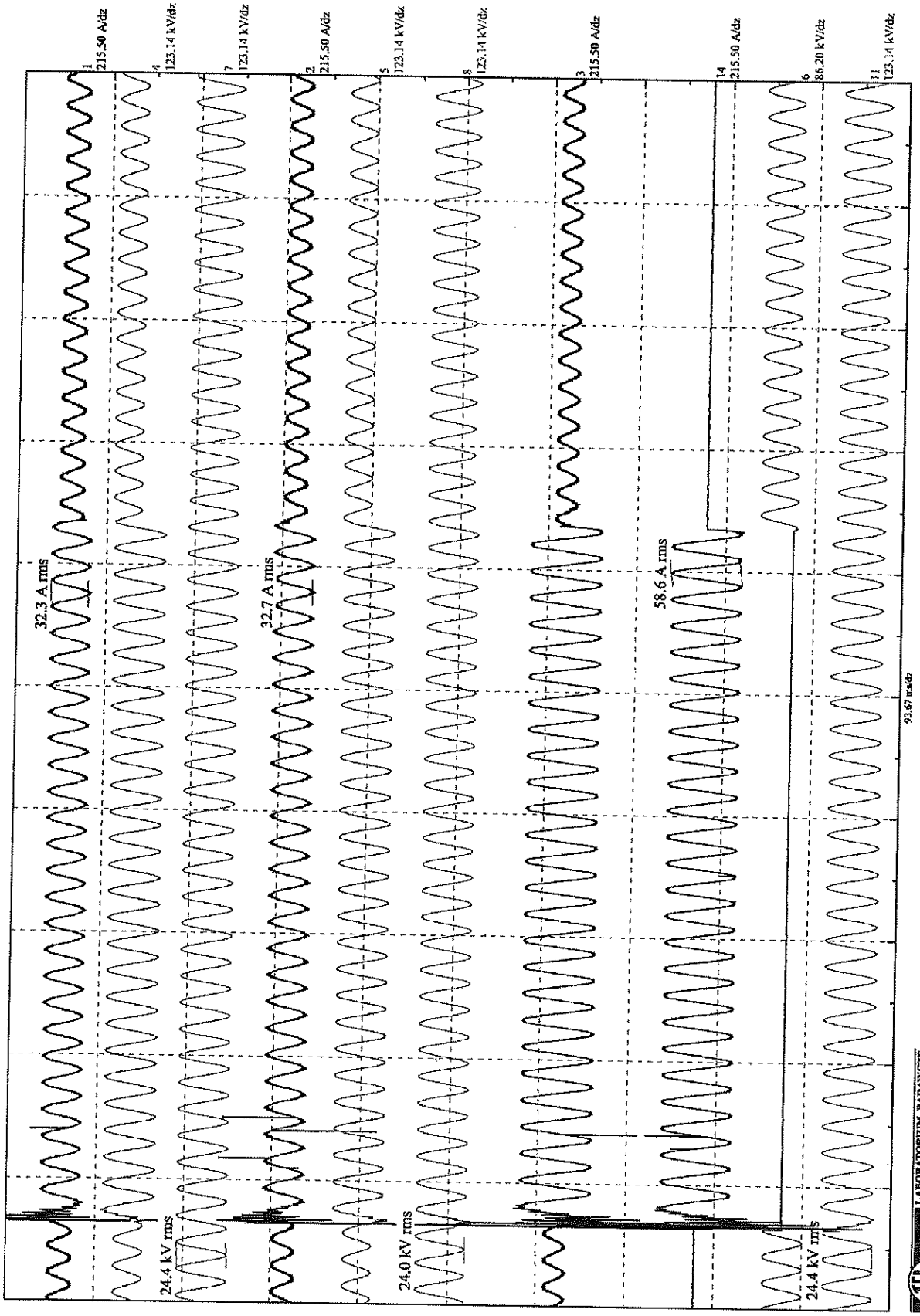
Numer oscylogramu Oscillogram no.	**Napięcie probiercze** Test voltage (kV)	**Prąd probierczy I_{6b}** Test current I_{6b} (A)	**Uwagi** Remarks
80704	24.9 24.6	33.2 31.5	
80709	25.3 24.7	32.4 32.9	
80710	25.3 24.8	32.4 32.5	
80711	24.7 24.2	31.7 31.5	
80712	25.0 24.7	32.4 32.3	
80713	24.6 24.3	32.1 32.1	
80714	25.1 24.8	32.5 33.1	
80715	24.5 24.1	32.3 32.4	
80717	24.9 24.7	32.7 32.5	
80718	25.0 24.5	32.3 31.9	

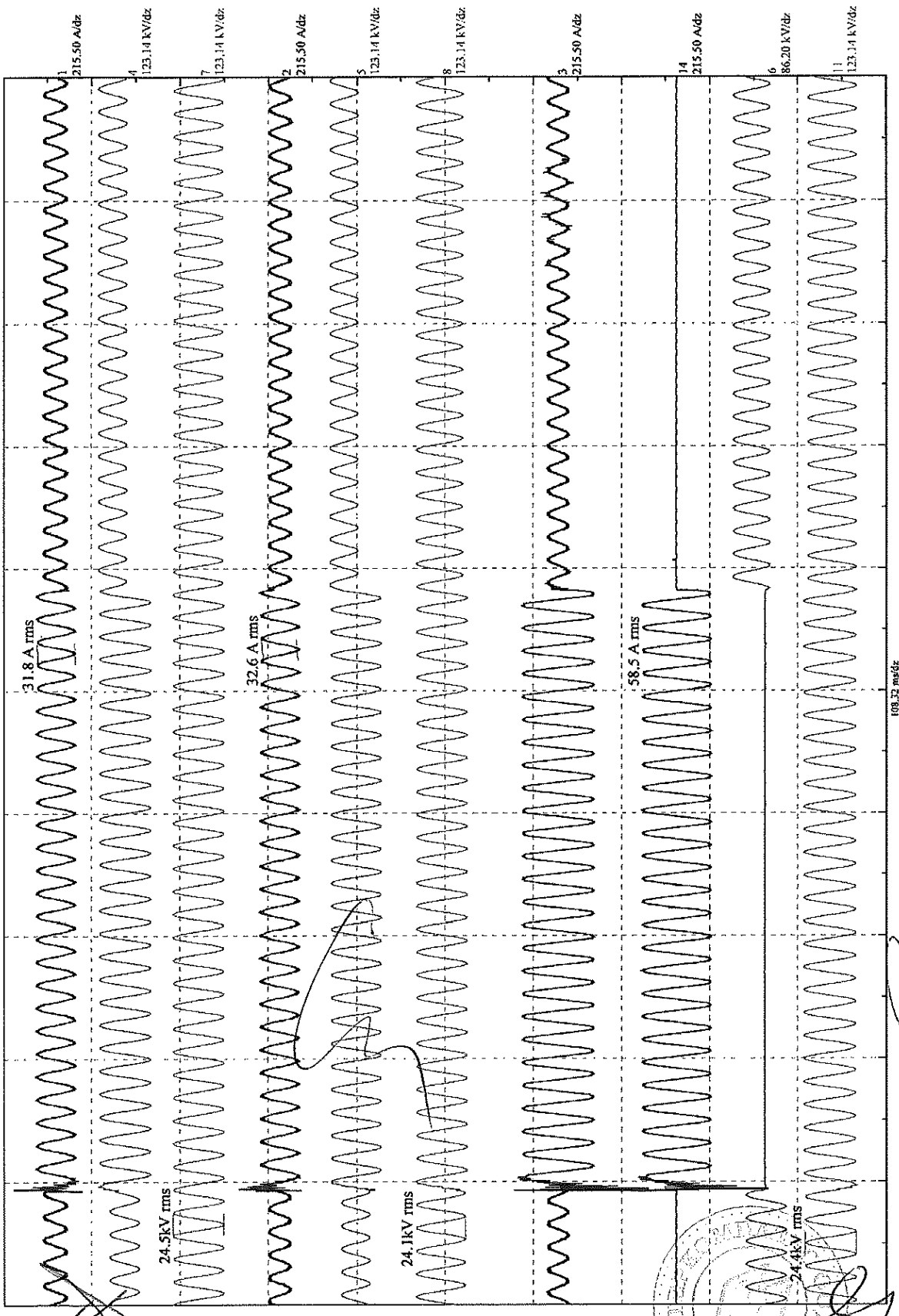


Data: 2005-05-30 16:18:20 Oscylogram Nr: 80719

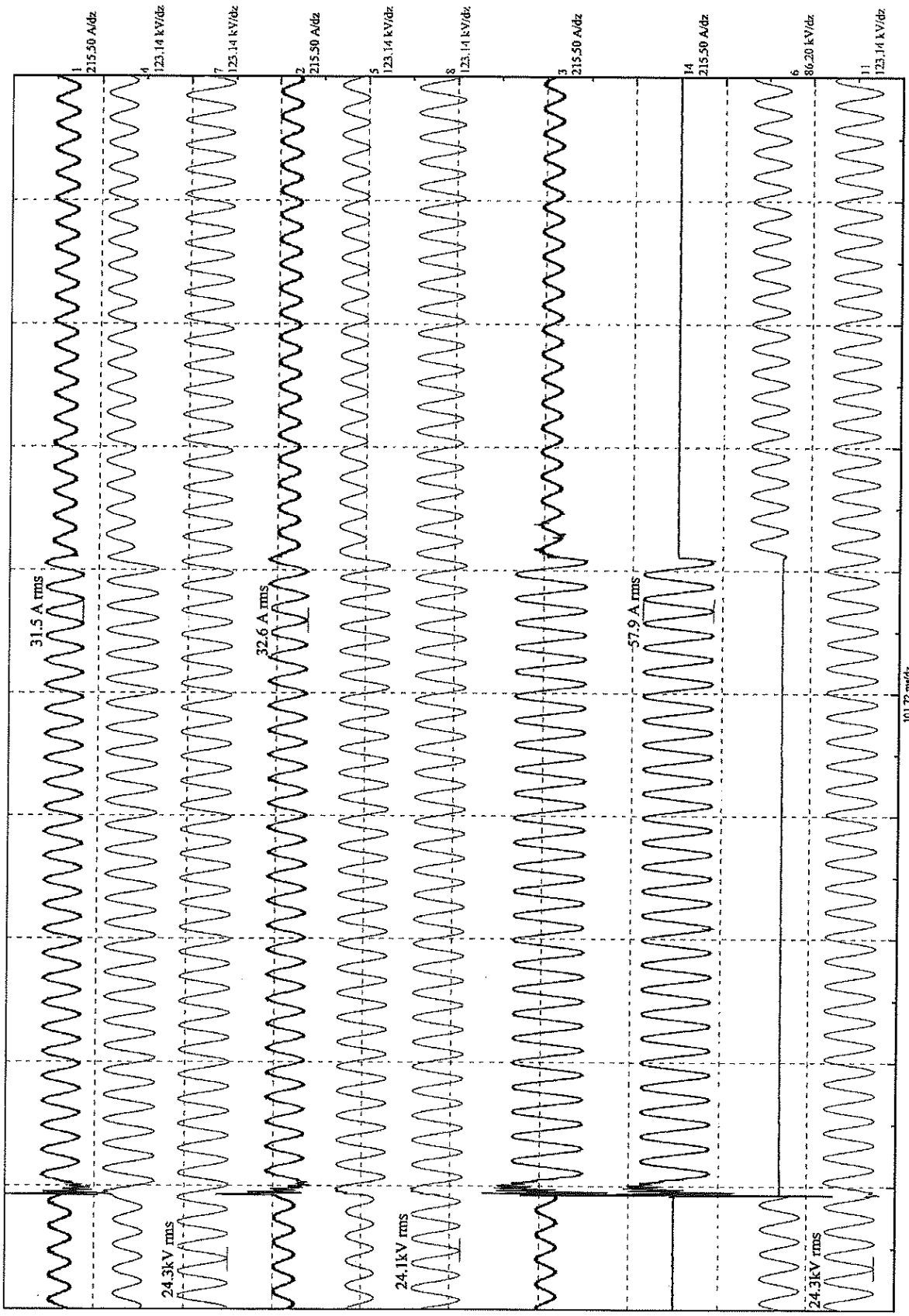
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

247


1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
12 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
32.3 A rms
32.7 A rms
58.6 A rms
24.4 kV rms
24.0 kV rms
24.4 kV rms
93.67 ms/dz
Data: 2005-05-31 10:19:42
Oscylogram Nr: 80722
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

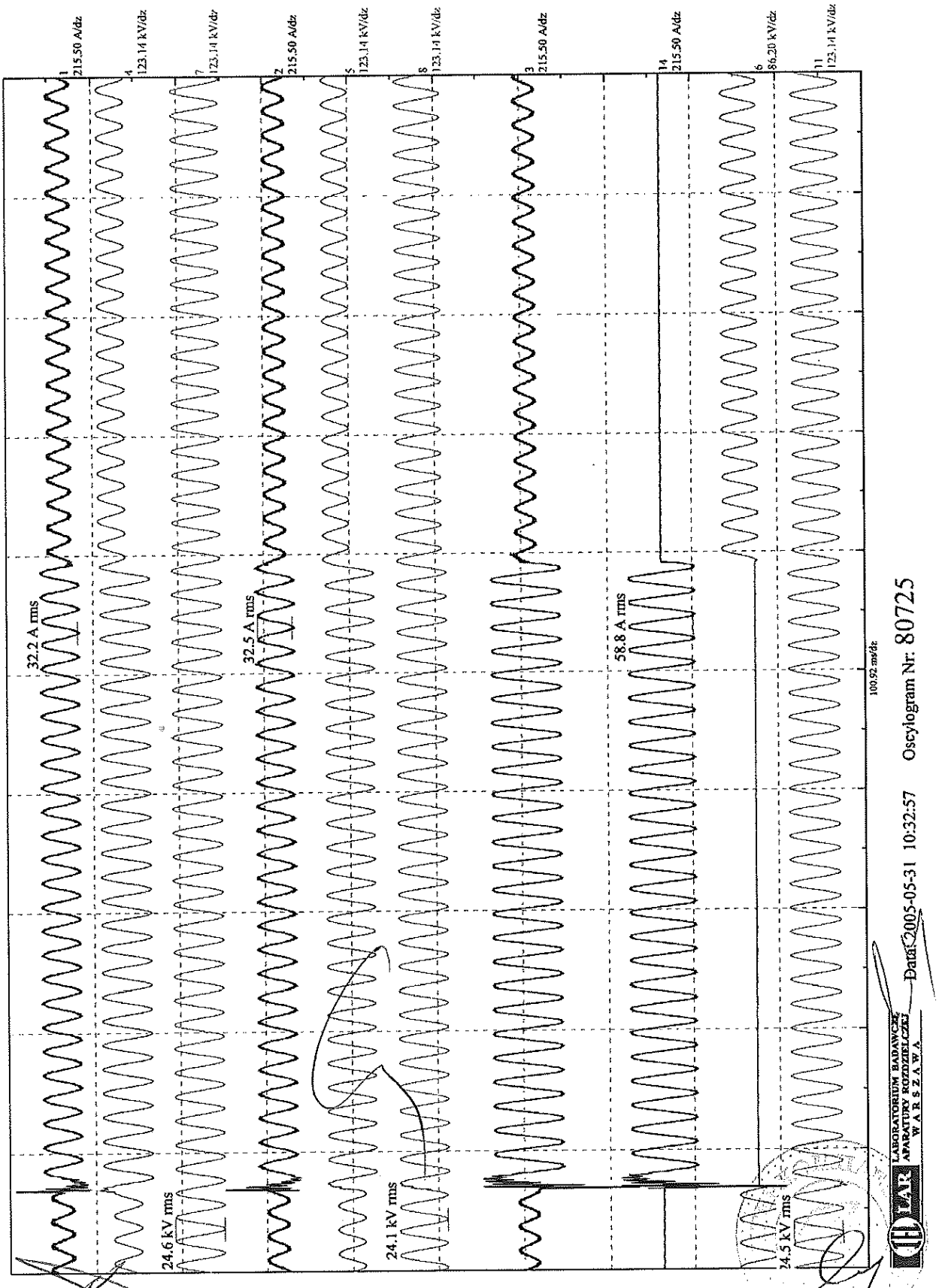

1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
31.8 A rms
32.6 A rms
58.5 A rms
24.5kV rms
24.1kV rms
24.4kV rms
108.32 ms/dz
Data: 2005-05-31 10:23:43
Oscylogram Nr: 80723
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

248

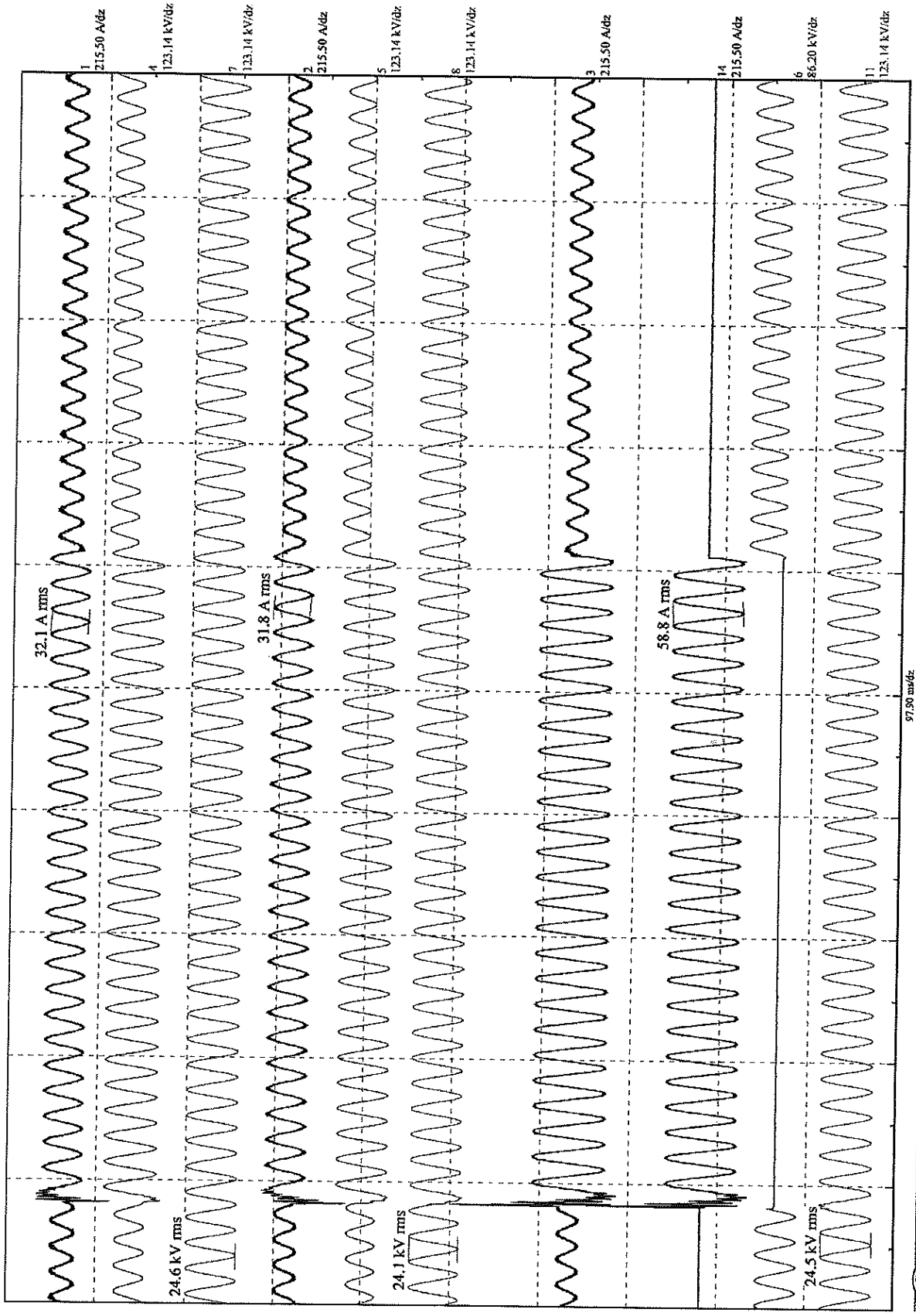


Data: 2005-05-31 10:29:35 Oscylogram Nr: 80724

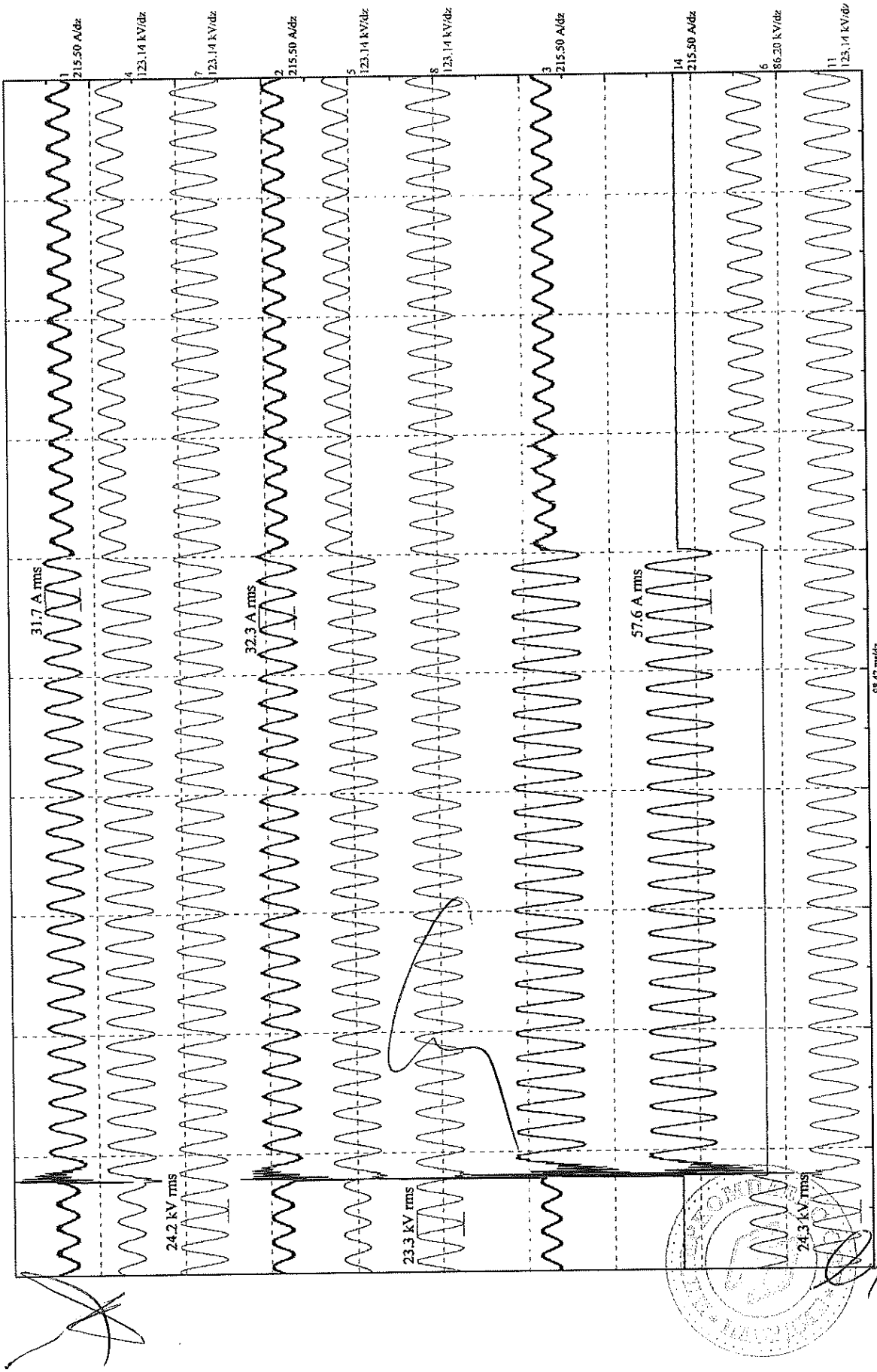
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A


1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
32.2 A rms
32.5 A rms
58.8 A rms
24.6 kV rms
24.1 kV rms
24.5 kV rms
100.92 ms/dz
Data: 2005-05-31 10:32:57
Oscylogram Nr: 80725
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

249



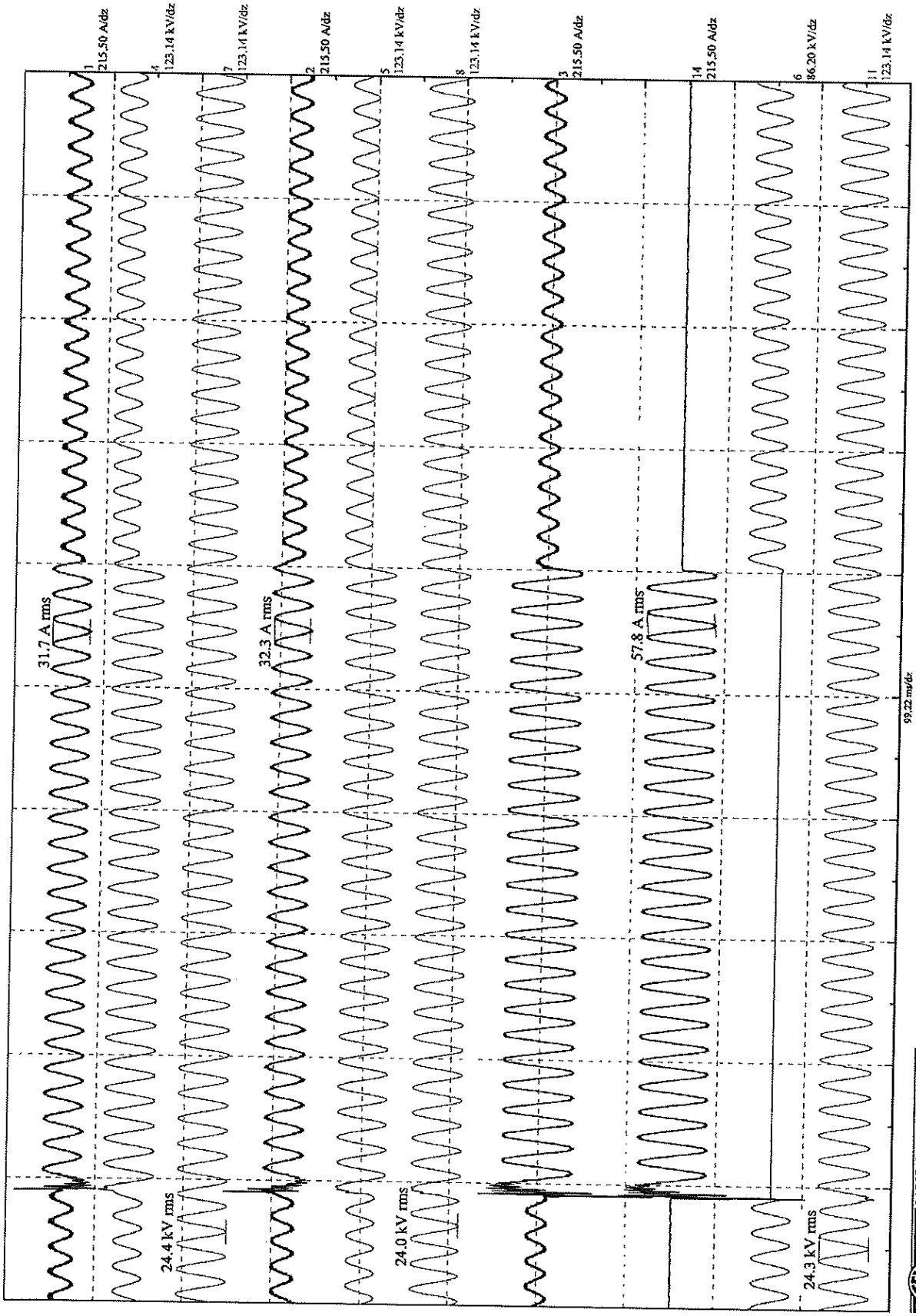
Data: 2005-05-31 10:36:38 Oscylogram Nr: 80726



Data: 2005-05-31 10:40:19 Oscylogram Nr: 80727

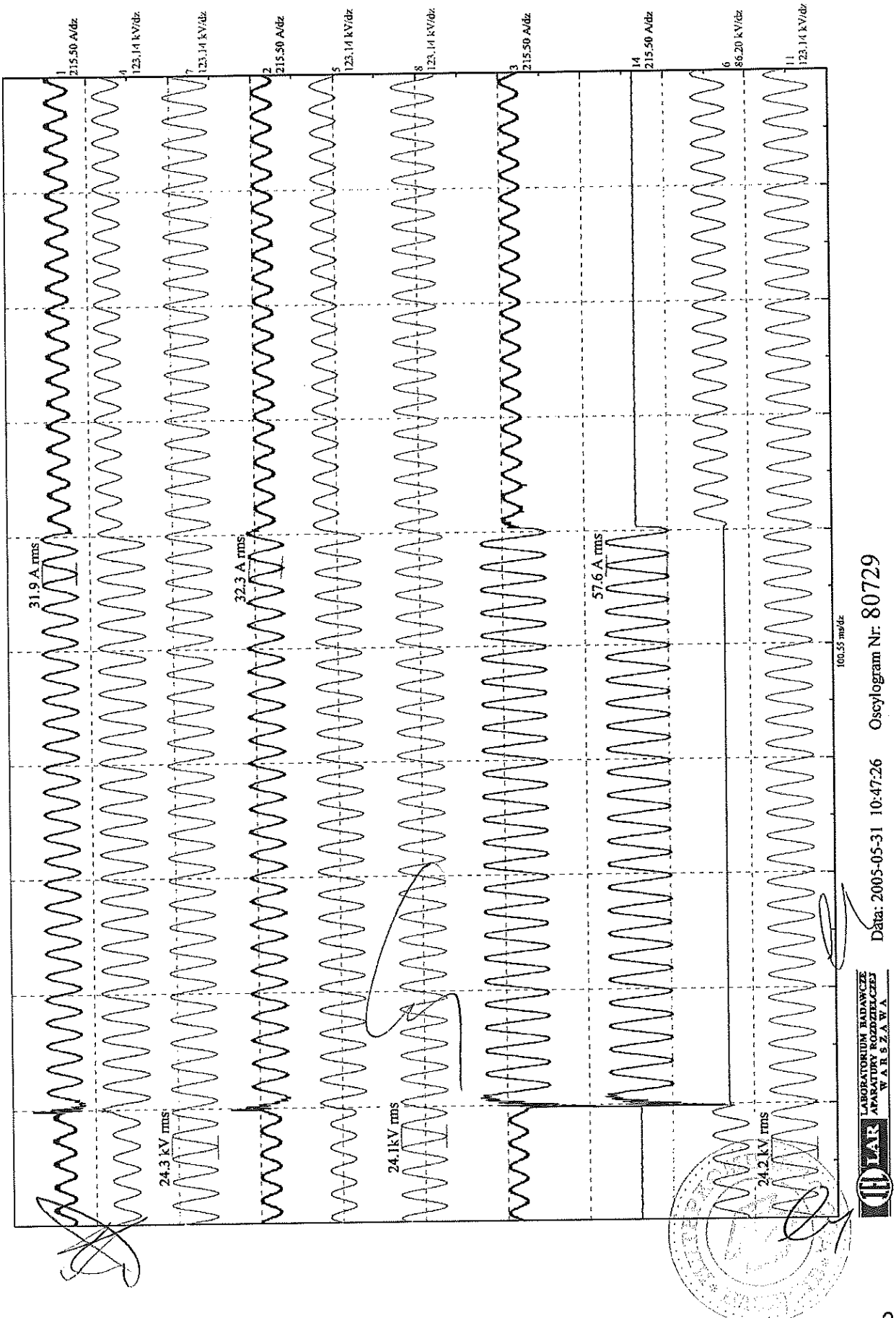
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ WARSZAWA

280

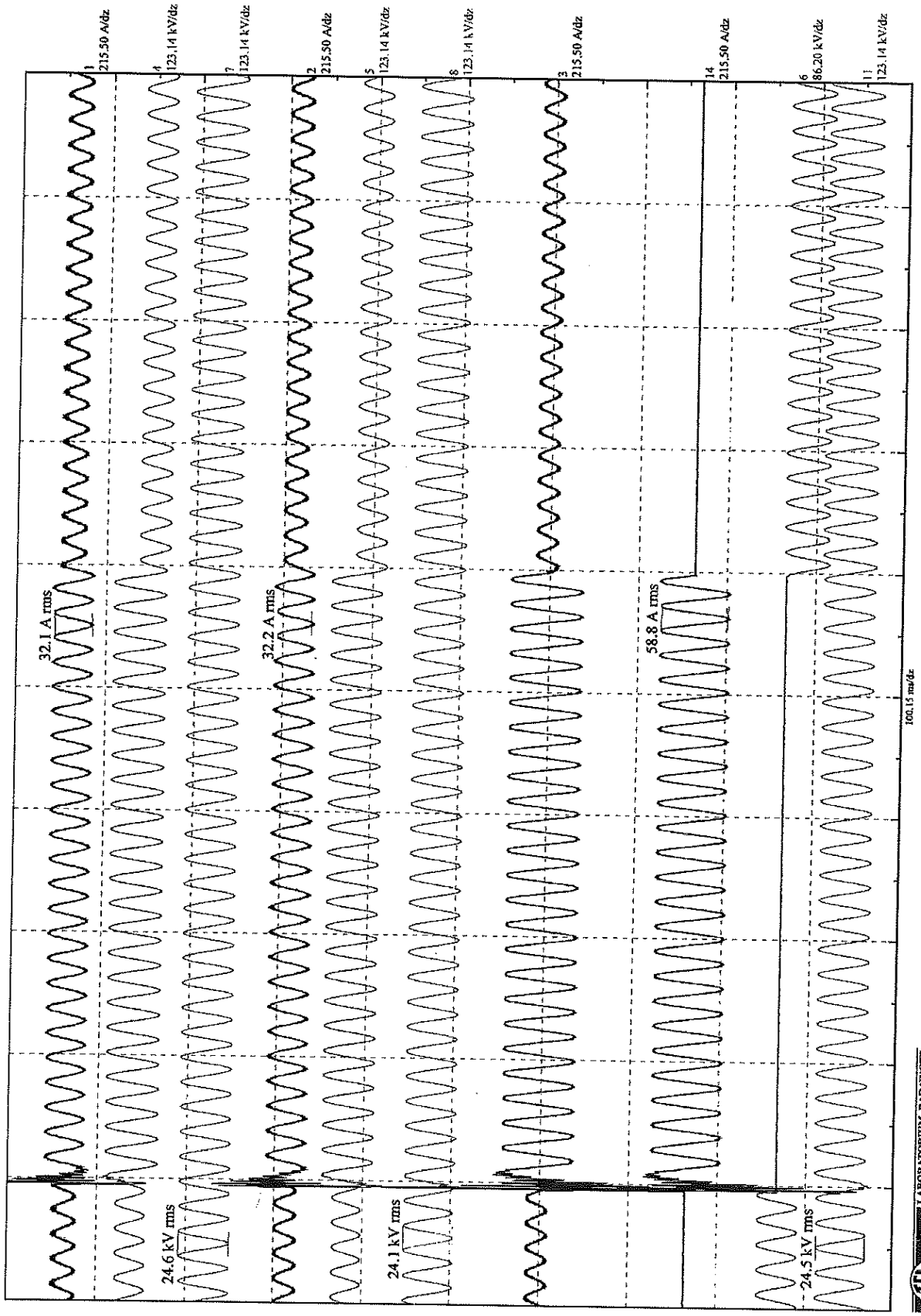


Data: 2005-05-31 10:43:58 Oscylogram Nr: 80728

LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ WARSZAWA


1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
31.9 A rms
32.3 A rms
57.6 A rms
24.3 kV rms
24.1kV rms
24.2 kV rms
100.55 ms/dz
Data: 2005-05-31 10:47:26
Oscylogram Nr: 80729
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

257



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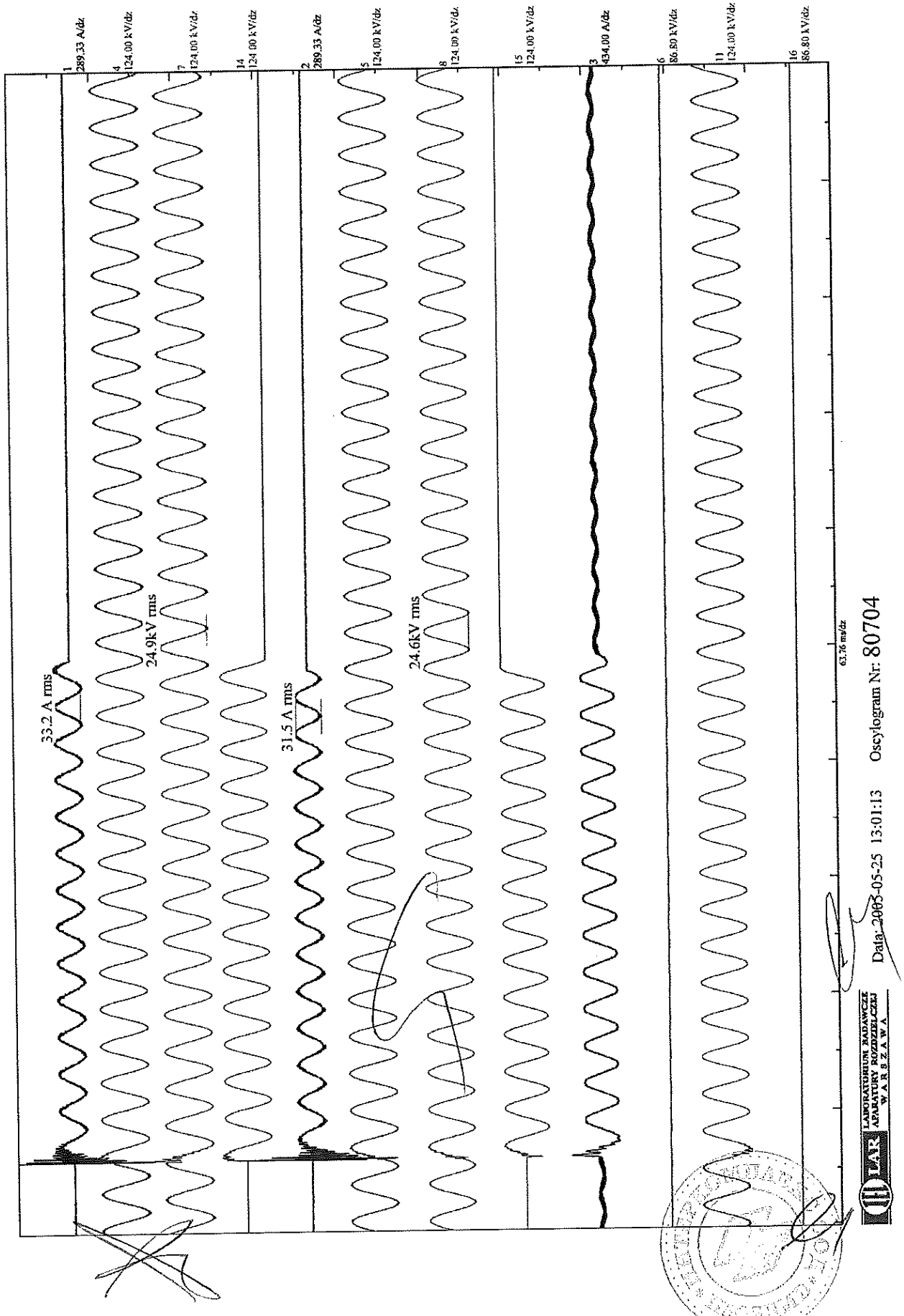
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4 124.00 kV/dz
7 124.00 kV/dz
14 124.00 kV/dz
2 289.33 A/dz
5 124.00 kV/dz
8 124.00 kV/dz
15 124.00 kV/dz
3 434.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
33.2 A rms
24.9kV rms
31.5 A rms
24.6kV rms
63.76 ms/dz
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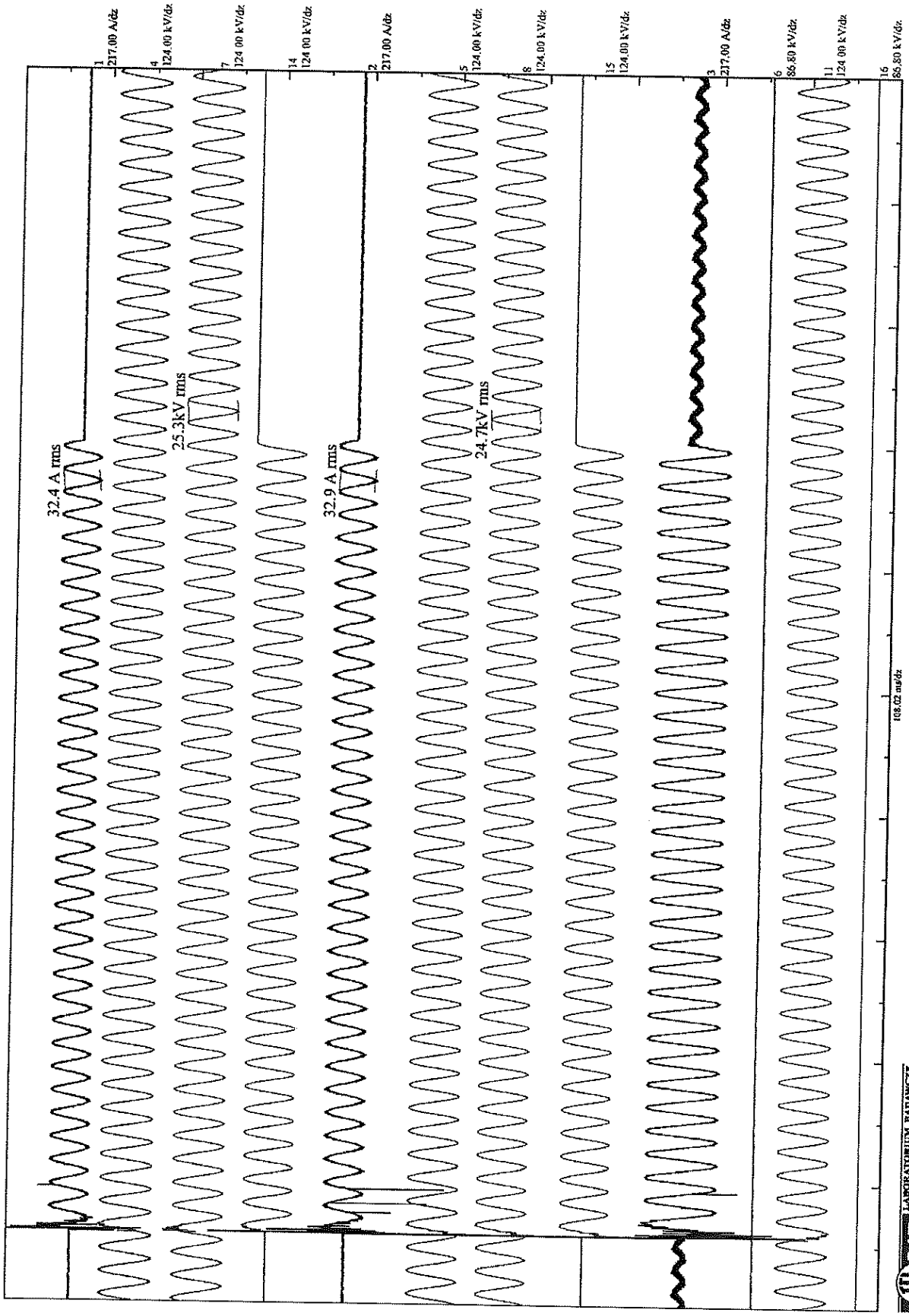
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

257


32.4 A rms
25.3kV rms
32.9 A rms
24.7kV rms
106.02 ms/dz
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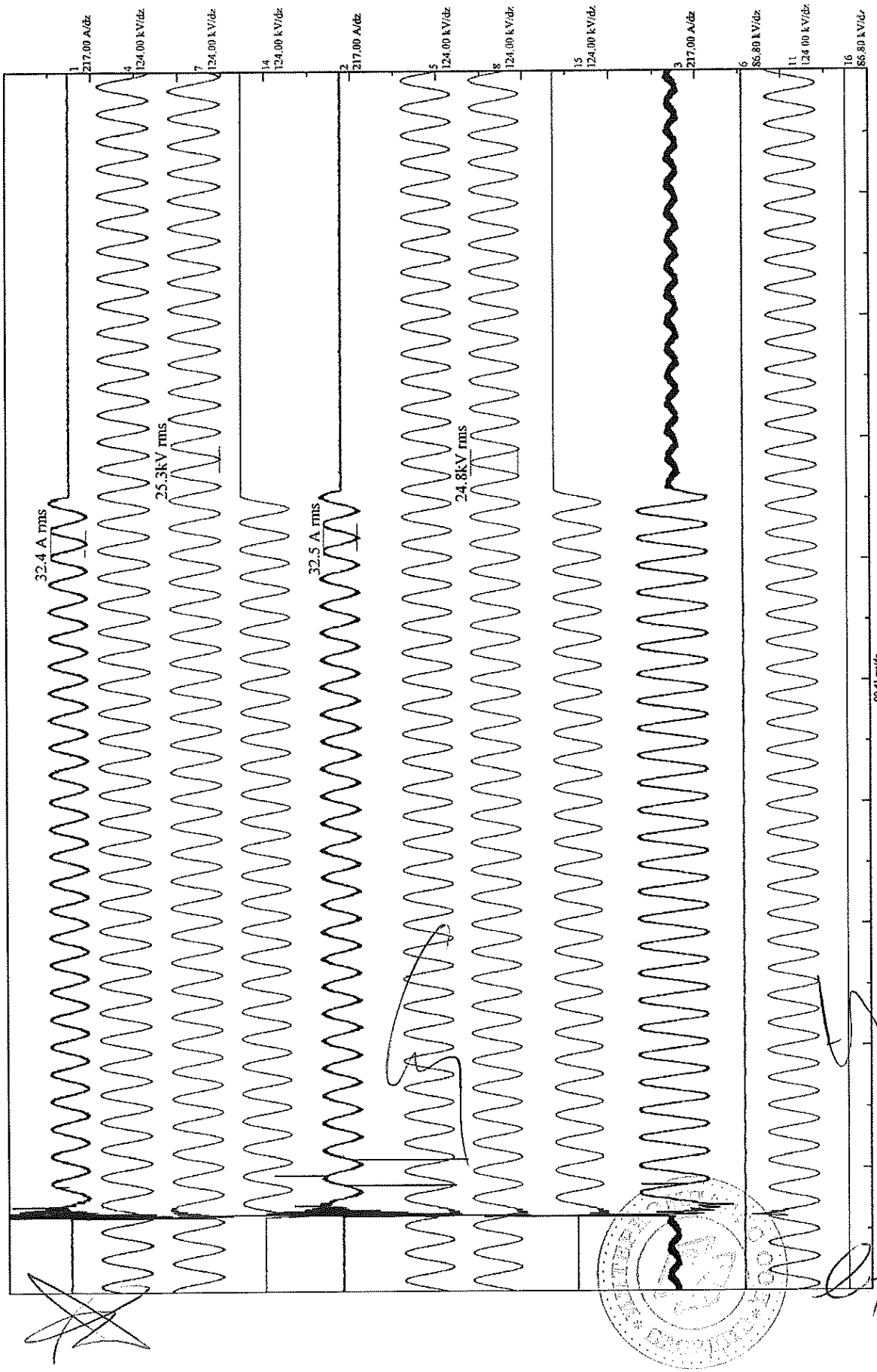
Oscylogram Nr: 80709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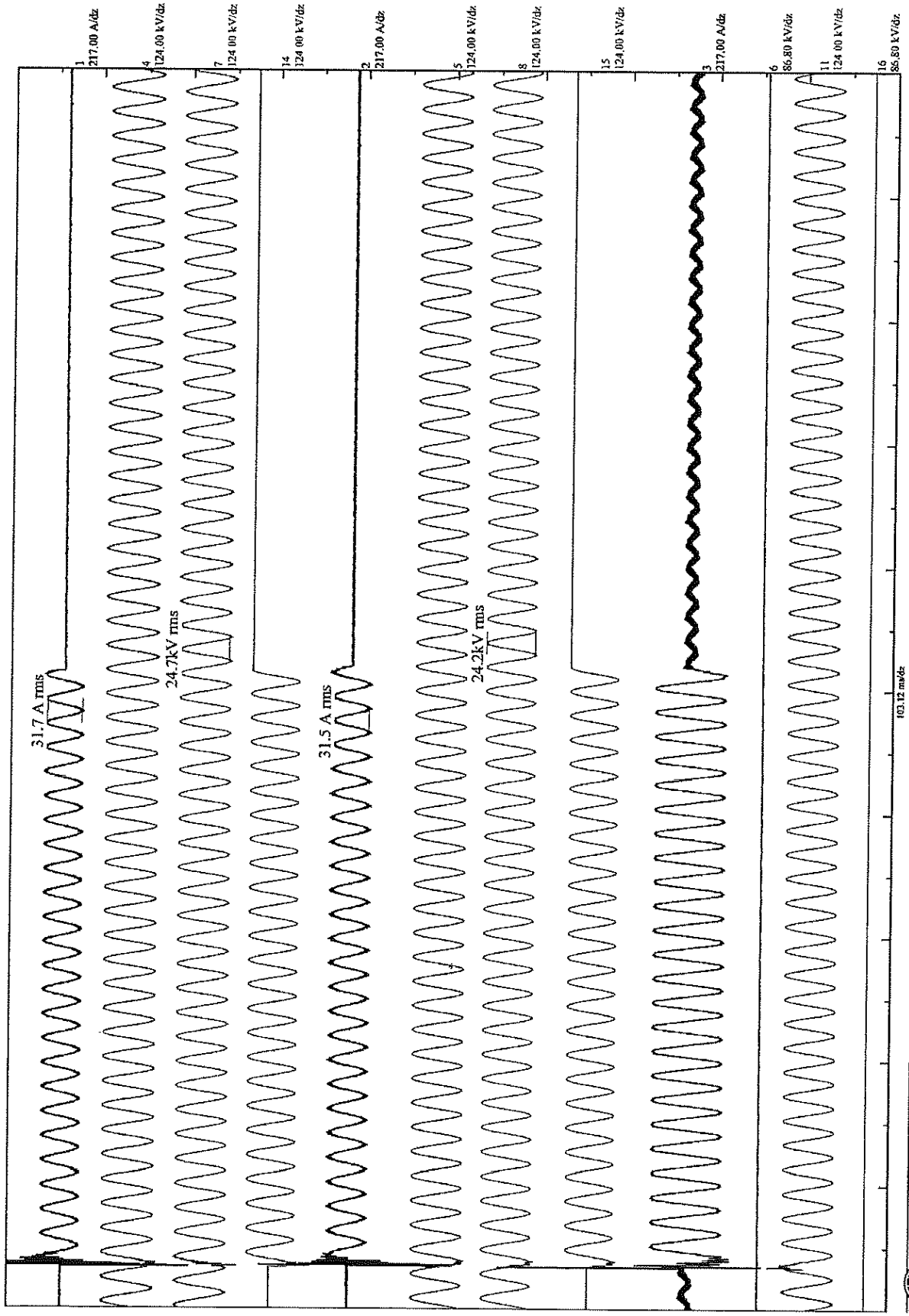
15 124.00 kV/dz
3 217.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
32.4 A rms
25.3kV rms
32.5 A rms
24.8kV rms
90.41 ms/dz
Data: 2005-05-30 13:37:08
Oscylogram Nr: 80710
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

252



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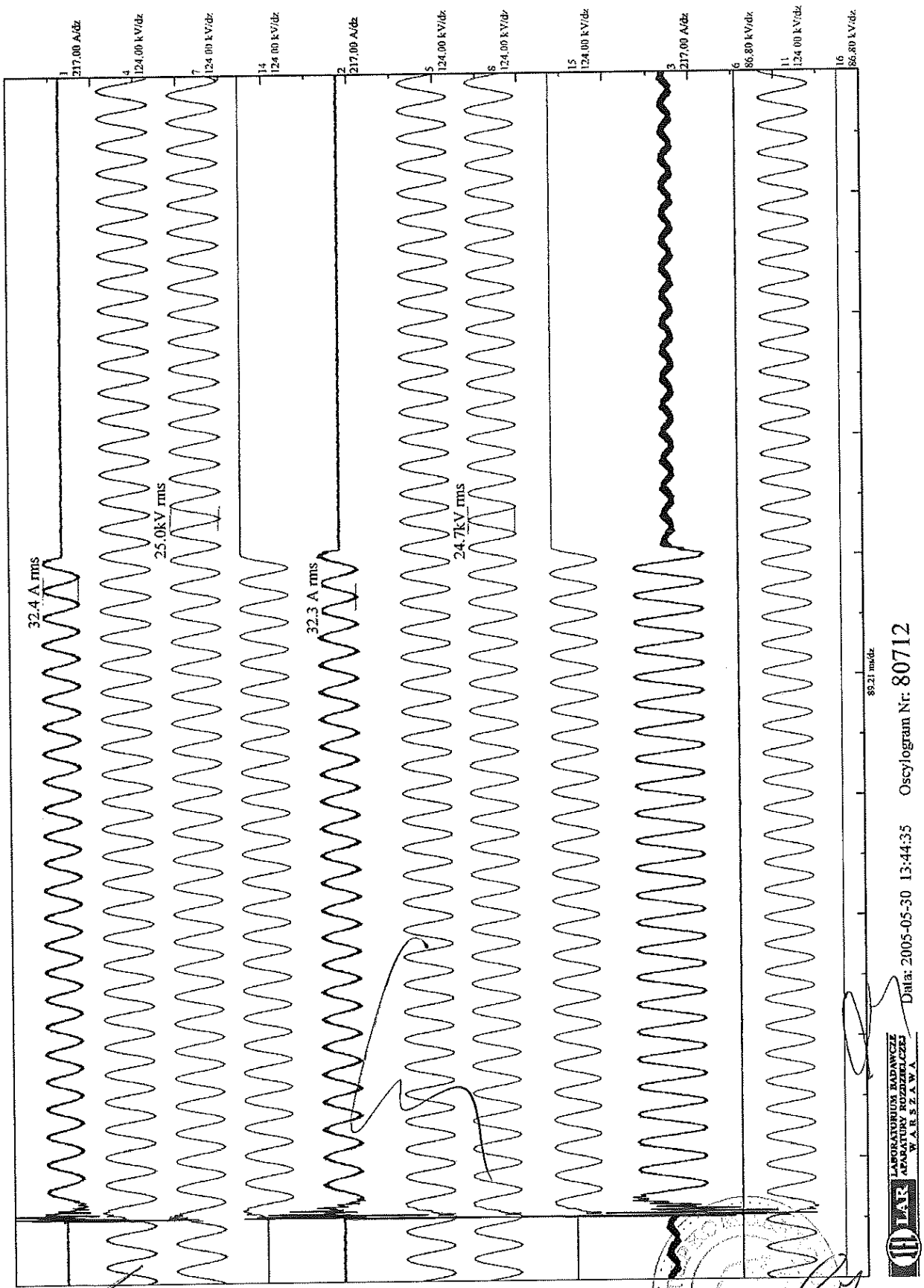
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15 124.00 kV/dz
3 217.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
32.4 A rms
25.0kV rms
32.3 A rms
24.7kV rms
89.21 ms/dz
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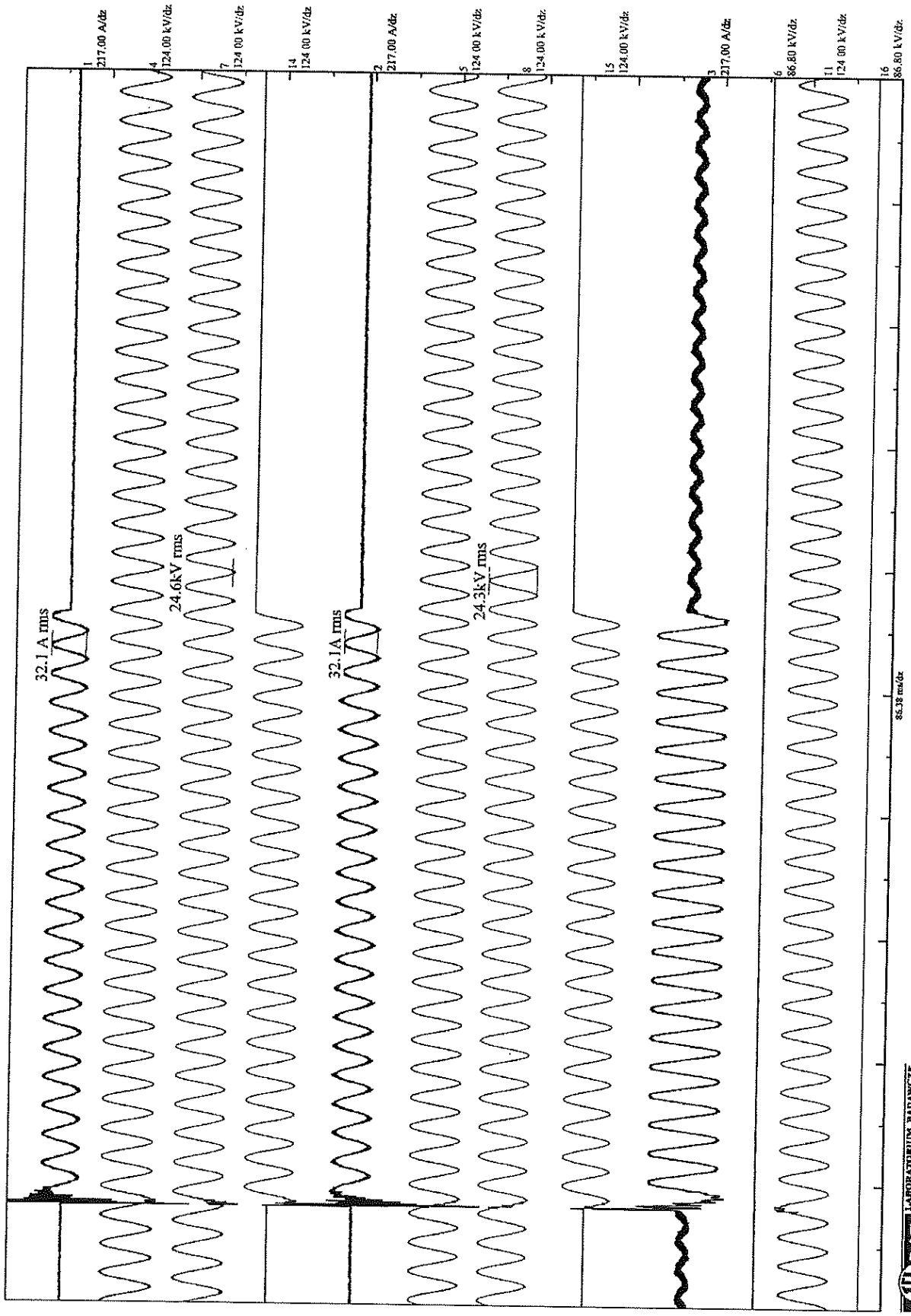
Data: 2005-05-30 13:44:35
Oscylogram Nr: 80712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2 217.00 A/dz
5 124.00 kV/dz
8 124.00 kV/dz
15 124.00 kV/dz
3 217.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
32.1 A rms
24.6kV rms
32.1A rms
24.3kV rms
86.38 ms/dz
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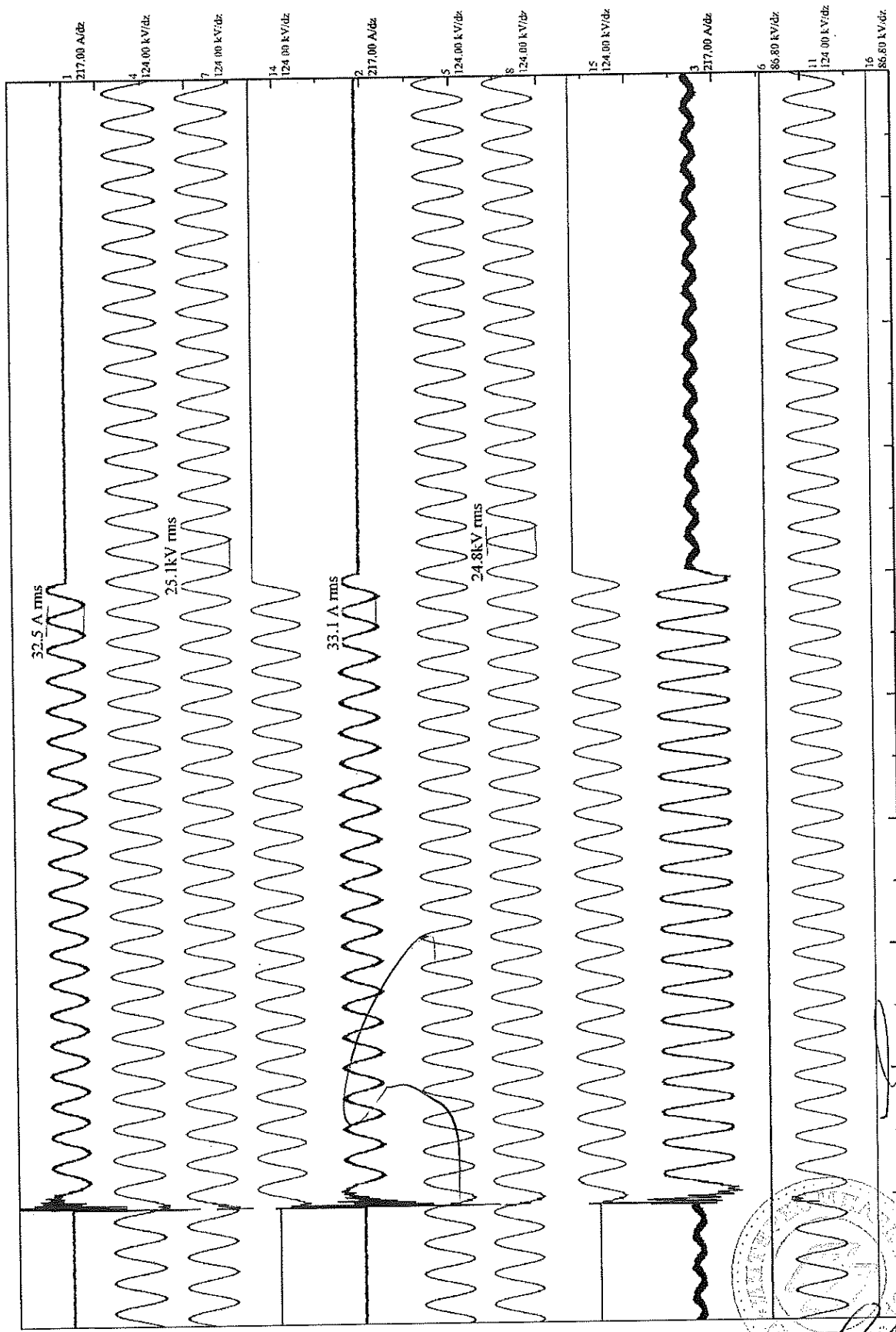
Data: 2005-05-30 13:47:37
Oscylogram Nr: 80713



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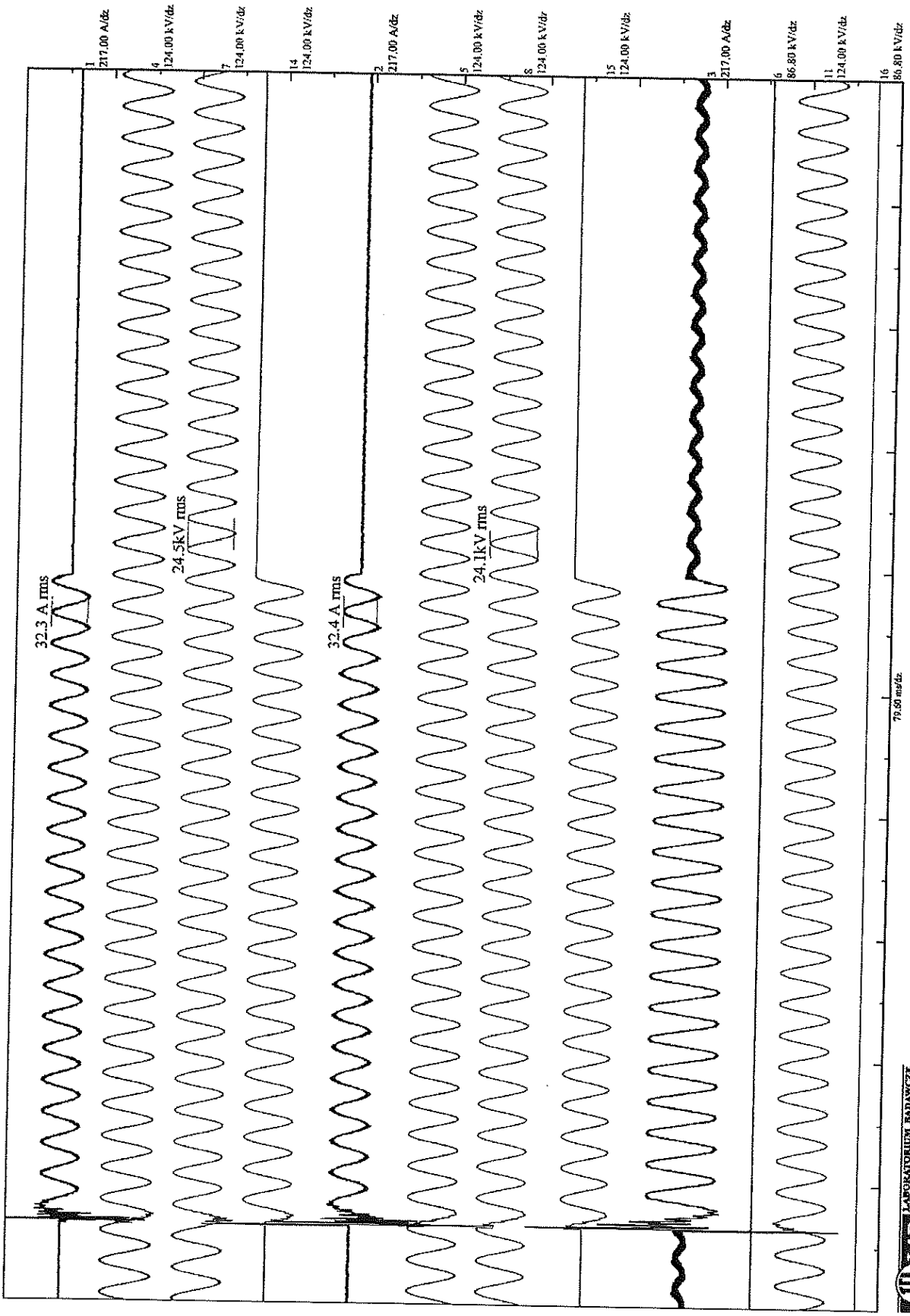
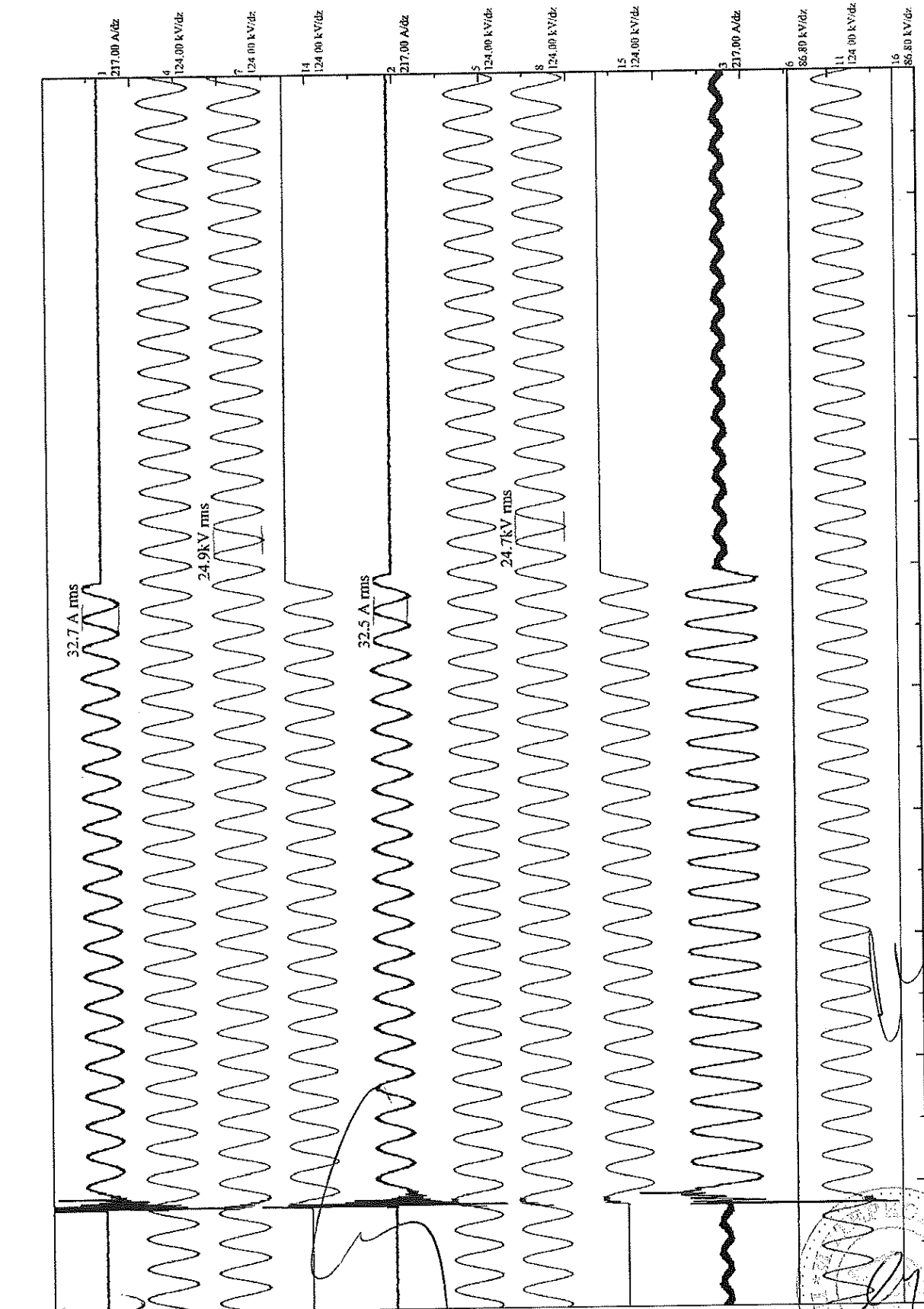
254


1
217.00 A/dz.
4
124.00 kV/dz.
7
124.00 kV/dz.
14
124.00 kV/dz.
2
217.00 A/dz.
5
124.00 kV/dz.
8
124.00 kV/dz.
15
124.00 kV/dz.
3
217.00 A/dz.
6
86.80 kV/dz.
11
124.00 kV/dz.
16
86.80 kV/dz.
32.3 A rms
24.5kV rms
32.4 A rms
24.1kV rms
79.60 ms/dz.
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ
W A R S Z A W A
Data: 2005-05-30 13:53:45
Oscylogram Nr: 80715



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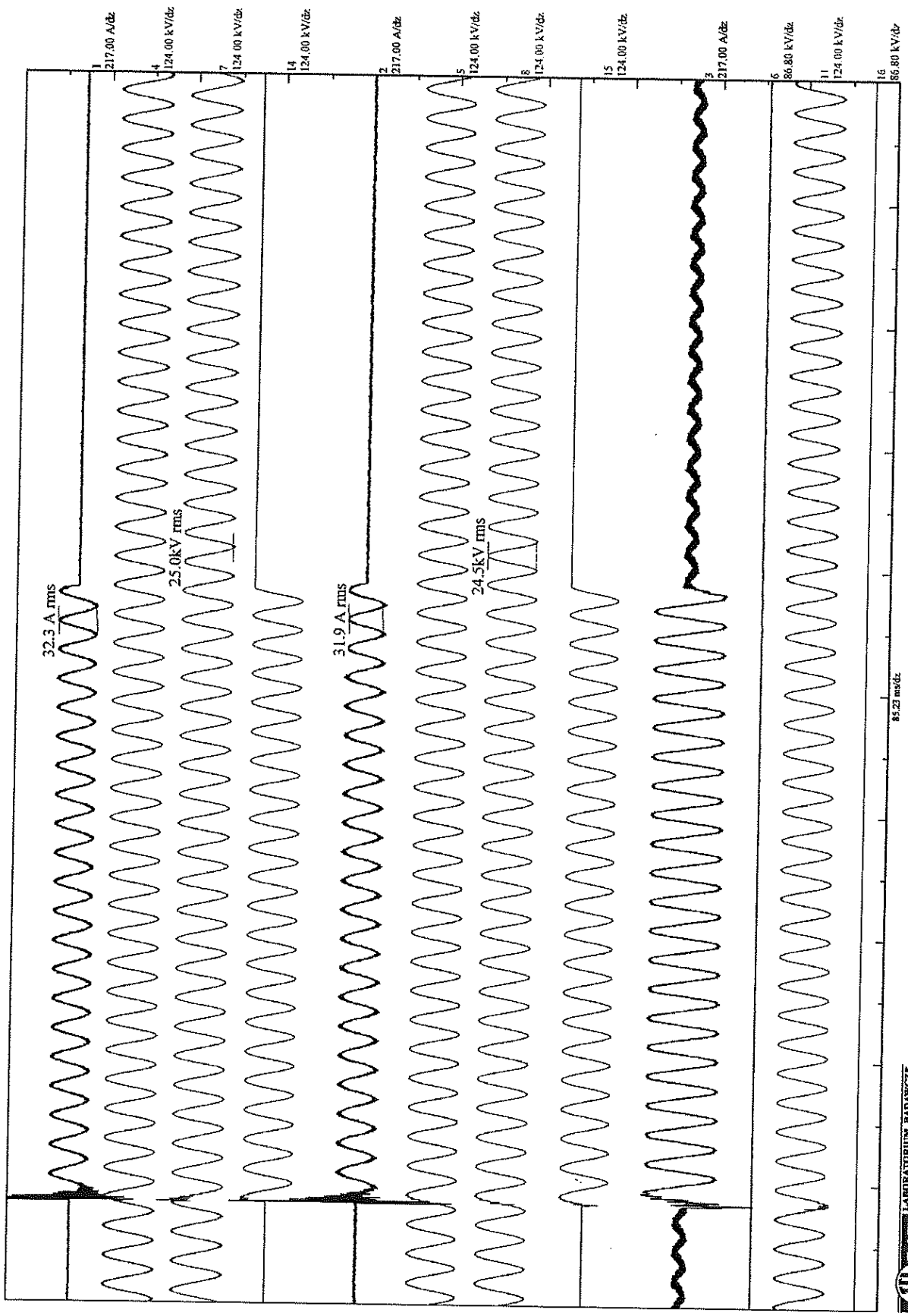
255



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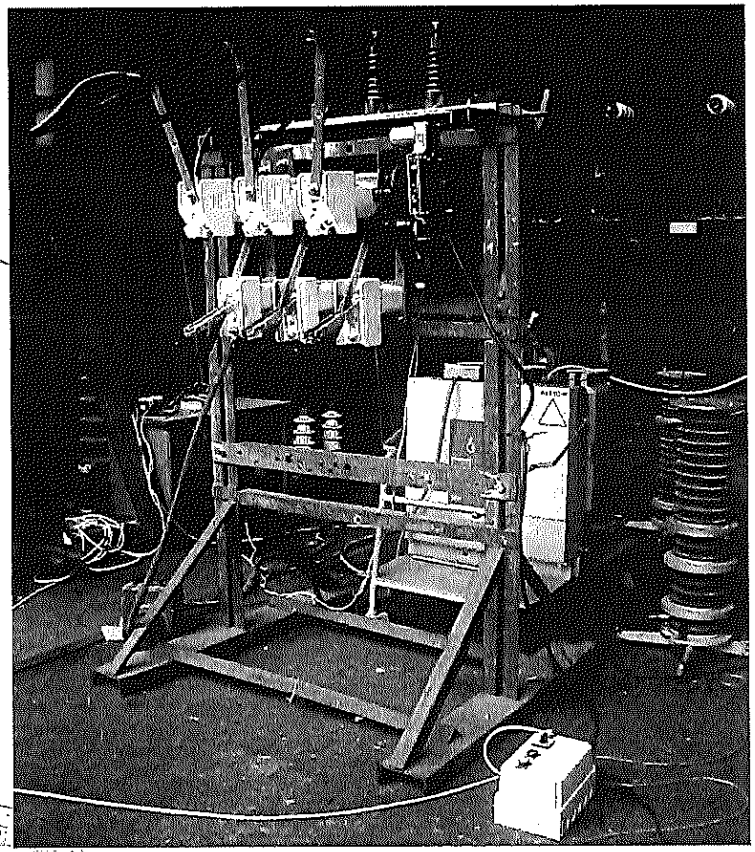
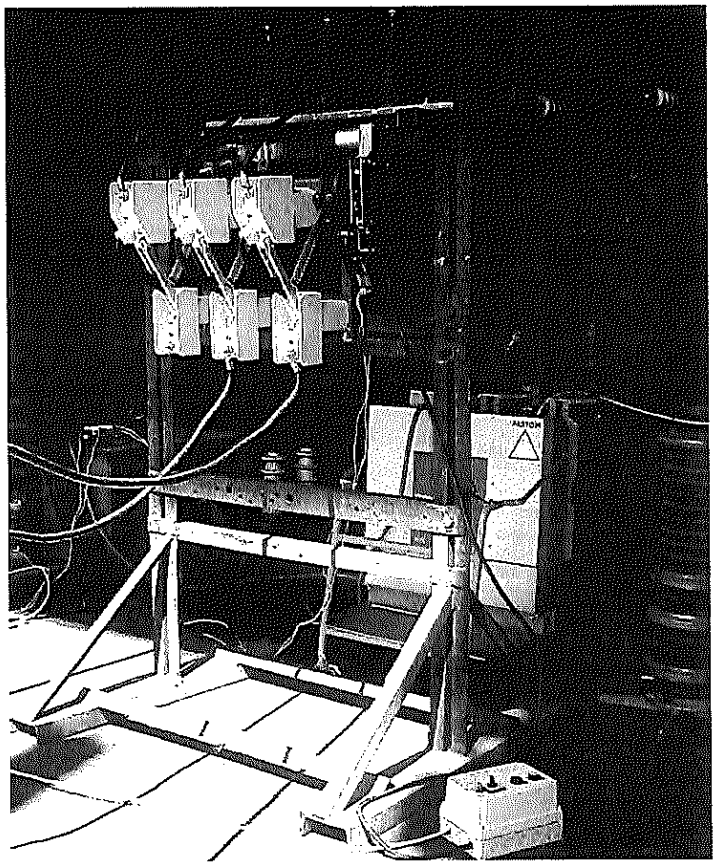
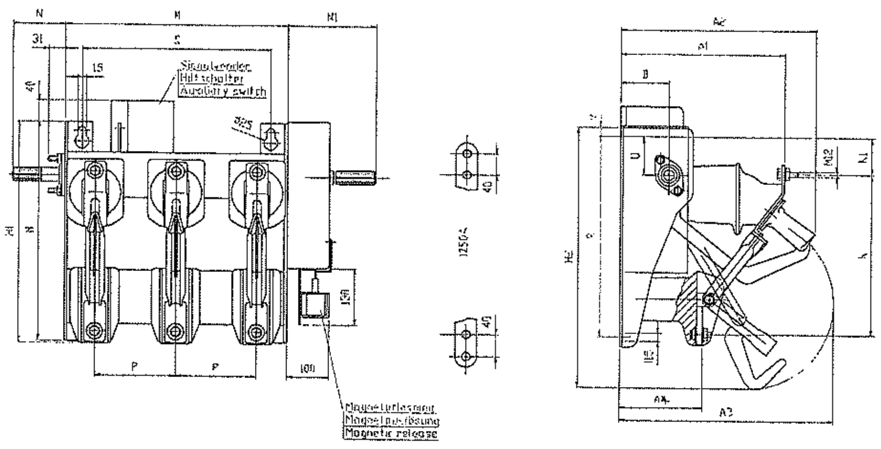


Obiekt badany przed próbą łączenia prądu zwarcia doziemnego (szereg probierczy 6a)
Test object before Earth fault off-load switching current test (test duty 6a)



Obiekt badany przed próbą łączenia prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)
Test object before cable charging switching current under earth fault conditions (test duty 6b)



Type	A	A1	A2	A3	B	H	H1	H2	K	K1	M	N	N1	P	R	S	U	V
NAL 12-A/K/KS P=150	166	320	362	394	90	422	428	510	310	63	412	122	164	150	375	350	75	33
NAL 12-A/K/KS. P=210	166	320	362	394	90	422	428	510	310	63	532	122	164	210	375	470	75	33
NAL 17,5-A/K/KS. P=170	225	375	418	511	98	534	577	600	441	87	452	122	164	170	500	395	90	18
NAL 17,5-A/K/KS. P=210	225	375	418	511	99	534	577	600	441	82	532	122	164	210	500	470	90	19
NAL 24-A/K/KS P=235	225	375	418	511	98	534	577	600	441	87	582	186	202	225	500	525	90	18
NAL 24-A/K/KS. P=275	225	375	418	511	98	534	577	600	441	87	662	186	202	275	500	605	90	16

* 1250A A mål + 2mm

Fremstilt / Utført: 91.05.08 STTH	Godkjent / Anmeldt: Teknologi	Tittel / Titel: NAL 12-24	
Kontroll: 91.11.01 STTH		Dimension Drawing	Versjon: D
	Revisjon: D 94.09.07 S.Thygesen	Skala / Målestokk:	Uten sep. stykkliste
ABB	ABB Distribusjon AS	Tegning Nr.: NHP 343070	Blad nr.: 1

SPRAWOZDANIE Nr / TEST REPORT No. 6957/LAR/05

ZAKŁAD WIELKICH MOCY
HIGH POWER DEPARTMENT

INSTYTUT ELEKTROTECHNIKI – ELECTROTECHNICAL INSTITUTE
04-703 WARSZAWA; ul. M. Pożaryskiego 28
tel./fax.: (0-22) 812 04 07; tel.: (0-22) 812 23 38; e-mail: nwr@iel.waw.pl
Certyfikat Akredytacji / Certificate Accreditation PCA Nr AB 074

SPRAWOZDANIE Z PRÓB W WARUNKACH ZWARCIA DOZIEMNEGO
TEST REPORT OF TESTS UNDER EARTH FAULT CONDITIONS

BADANY APARAT
APPARATUS: **ROZŁĄCZNIK**
SWICH DISCONNECTOR

TYP
DESIGNATION: **NAL 24-6**

Nr seryjny
Serial No.: **14667/205**

Napięcie znamionowe
Rated Voltage: 24 kV

Częstotliwość
Rated Frequency: 50 Hz

PRODUCENT
MANUFACTURER: **ABB Sp. z o.o.**
ul. Bitwy Warszawskiej 1920 r. nr 18, 02-366 Warszawa
Oddział w Przasnyszu, ul. Leszno 59, 06-300 Przasnysz

ZLECENIODAWCA
TESTED FOR: **ABB Sp. z o.o.**

DATA BADAŃ
DATE(S) OF TESTS: **25.05.2005, 31.05.2005**

WYKONAWCA BADAŃ
TESTED BY: **Laboratorium Badawcze Aparatury Rozdzielczej**
Switchgear and Controlgear Testing Laboratory
04-703 Warszawa; ul. Pożaryskiego 28, Certyfikat Akredytacji PCA Nr AB 074

Przedmiot badań, wykonany zgodnie z dokumentacją, rysunkami konstrukcyjnymi i fotografiami, stanowiącymi załącznik do niniejszego sprawozdania, poddany został próbom zgodnie z normą
The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this report has been subjected to the series of proving tests in accordance with
PN-EN 60265-1:2001

Niniejsze Sprawozdanie odnosi się wyłącznie do badanego obiektu.
Producent ponosi odpowiedzialność za każdy egzemplarz wyrobu oznakowany identycznie jak wyrób badany.
The Test Report applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designators with that tested rests with the Manufacturer.

Kierownik Laboratorium / Head of Laboratory

Ph. D. Eng. Albert Gmitrzak

Warszawa 07.06.2005

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PARAMETRY TECHNICZNE DEKLAROWANE PRZEZ PRODUCENTA I POTWIERDZONE BADANIAMI
RATINGS ASSIGNED BY THE MANUFACTURER AND PROVED BY TESTS

Napięcie znamionowe Voltage	24 kV
Prąd wyłączeniowy zwarcia doziemnego Earth fault current	55 A
Prąd wyłączeniowy ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego Cable charging switching current under earth fault conditions	31,5 A
Częstotliwość Frequency	50 Hz

WYKAZ PRÓB / SUMMARY OF TESTS

	STRONA PAGE
Łączenie prądu zwarcia doziemnego (szereg probierczy 6a) Earth fault off-load switching current test (test duty 6a)	5
Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b) Cable charging switching current under earth fault conditions (test duty 6b)	6

PN-EN 60265-1:2001 Rozłączniki wysokonapięciowe.
Część 1: Rozłączniki na napięcia znamionowe wyższe niż 1 kV i niższe niż 52 kV.

W badaniach uczestniczył / The tests were observed by:

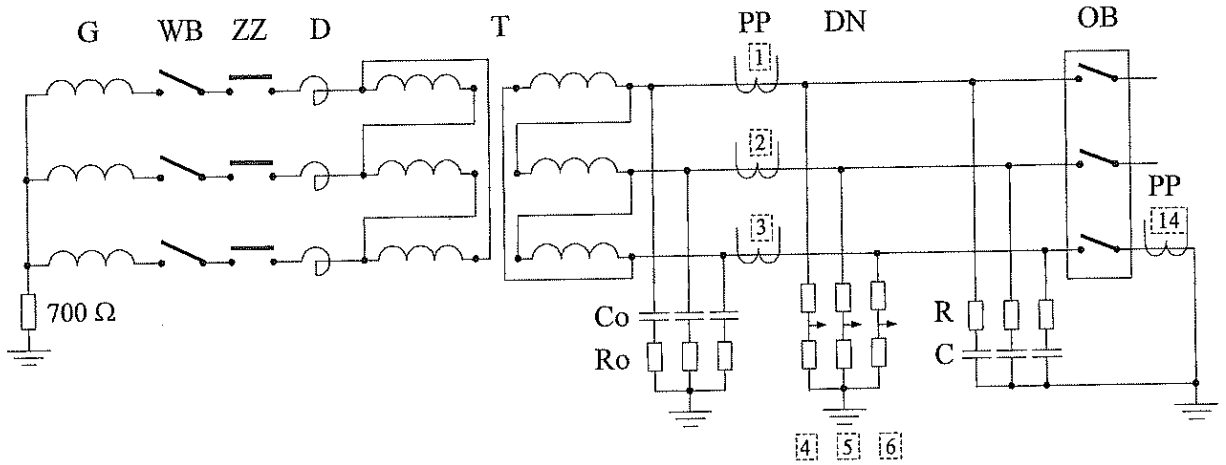
mgr inż. Tomasz Sinkiewicz — ABB Sp. z o. o.
Oddział w Przasnyszu, ul. Leszno 59, 06-300 Przasnysz

Dokumenty identyfikacyjne / Identification of the apparatus

Wymiary obiektu są zgodne z dołączonymi rysunkami wymiarowymi.
The apparatus is constructed in accordance with the drawings incorporated in this report.

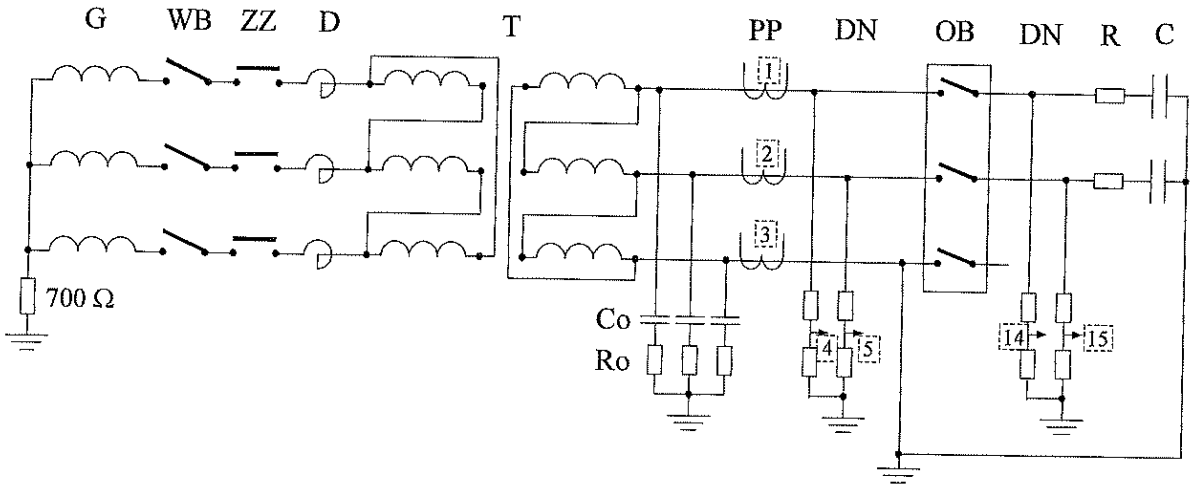
Rysunek / Drawing: NHP 343070

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądu zwarcia doziemnego (szereg probierczy 6a)** Earth fault off-load switching current test (test duty 6a)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP1



G	**Generator TJ 100**
WB	**Wyłącznik bezpieczeństwa** Master breaker
ZZ	**Załącznik zwarciowy** Making switch
D	**Dławiki** Inductance
T	**Transformator** Transformer
DN	**Dzielnik napięcia** Voltage divider
PP	**Przekładnik prądowy** Current transformer
OB	**Obiekt badany** Tested object

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)** Cable charging switching current under earth fault conditions (test duty 6b)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP2



G	**Generator TJ 100**
WB	**Wyłącznik bezpieczeństwa** Master breaker
ZZ	**Załącznik zwarciowy** Making switch
D	**Dławiki** Inductance
T	**Transformator** Transformer
DN	**Dzielnik napięcia** Voltage divider
PP	**Przekładnik prądowy** Current transformer
OB	**Obiekt badany** Tested object

TESTS RESULTS

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądu zwarcia doziemnego (szereg probierczy 6a)** Earth fault off-load switching current test (test duty 6a)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP1

Typ napędu / Operating mechanism:
Typ: NMMD1 220V AC/DC
Art: 5DLN 527601-F

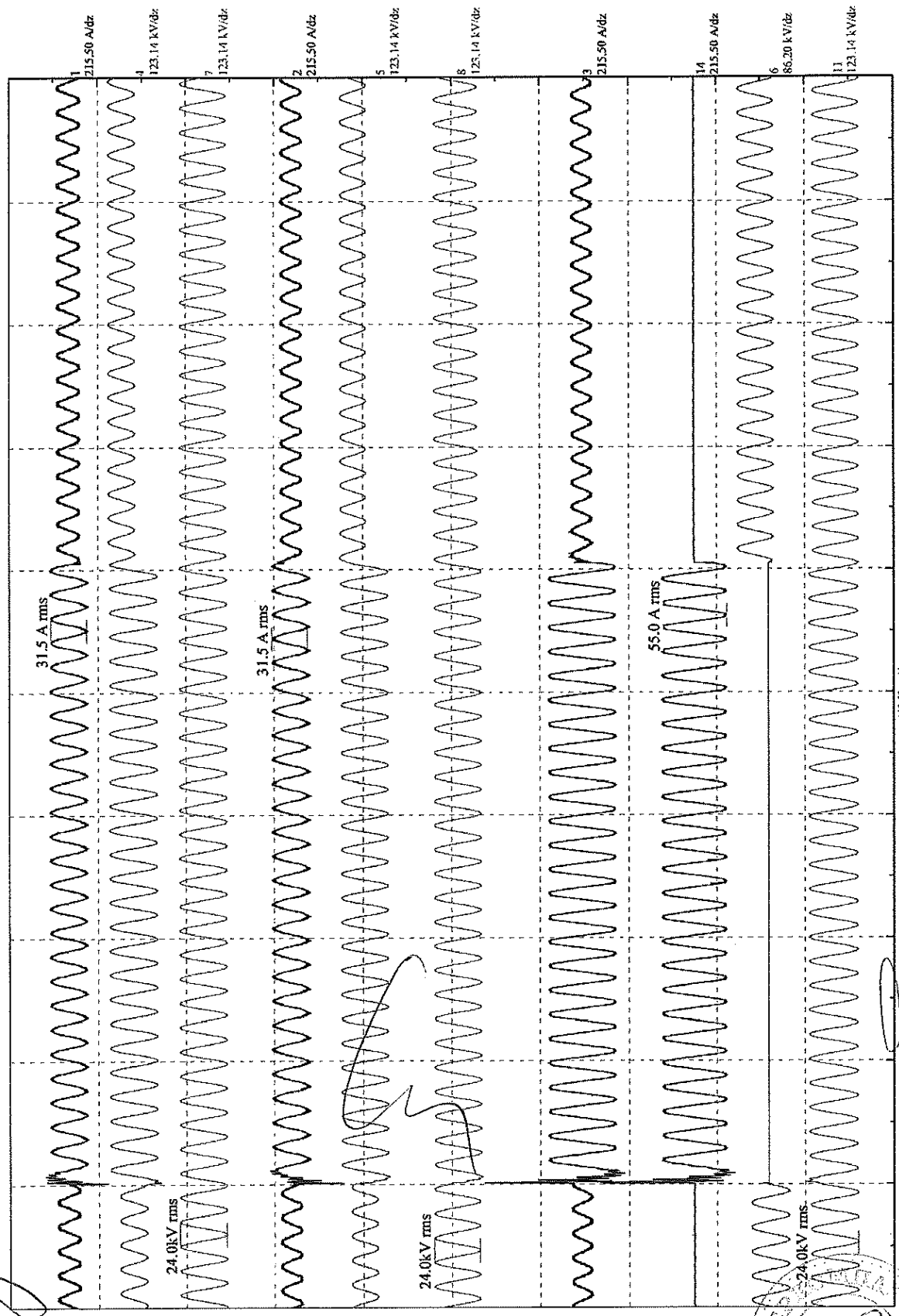
Numer oscylogramu Oscillogram no.	**Napięcie probiercze** Test voltage (kV)	**Prąd probierczy I_{6a}** Test current I_{6a} (A)	**Uwagi** Remarks
80719	24.0	55.0	
80722	24.4	58.6	
80723	24.4	58.5	
80724	24.3	57.9	
80725	24.5	58.8	
80726	24.5	58.8	
80727	24.3	57.6	
80728	24.3	57.8	
80729	24.2	57.6	
80730	24.5	58.8	

RODZAJ PRÓBY TYPE OF TEST	**Łączenie prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)** Cable charging switching current under earth fault conditions (test duty 6b)	**OBWÓD PROBIERCZY** TEST CIRCUIT	OP2

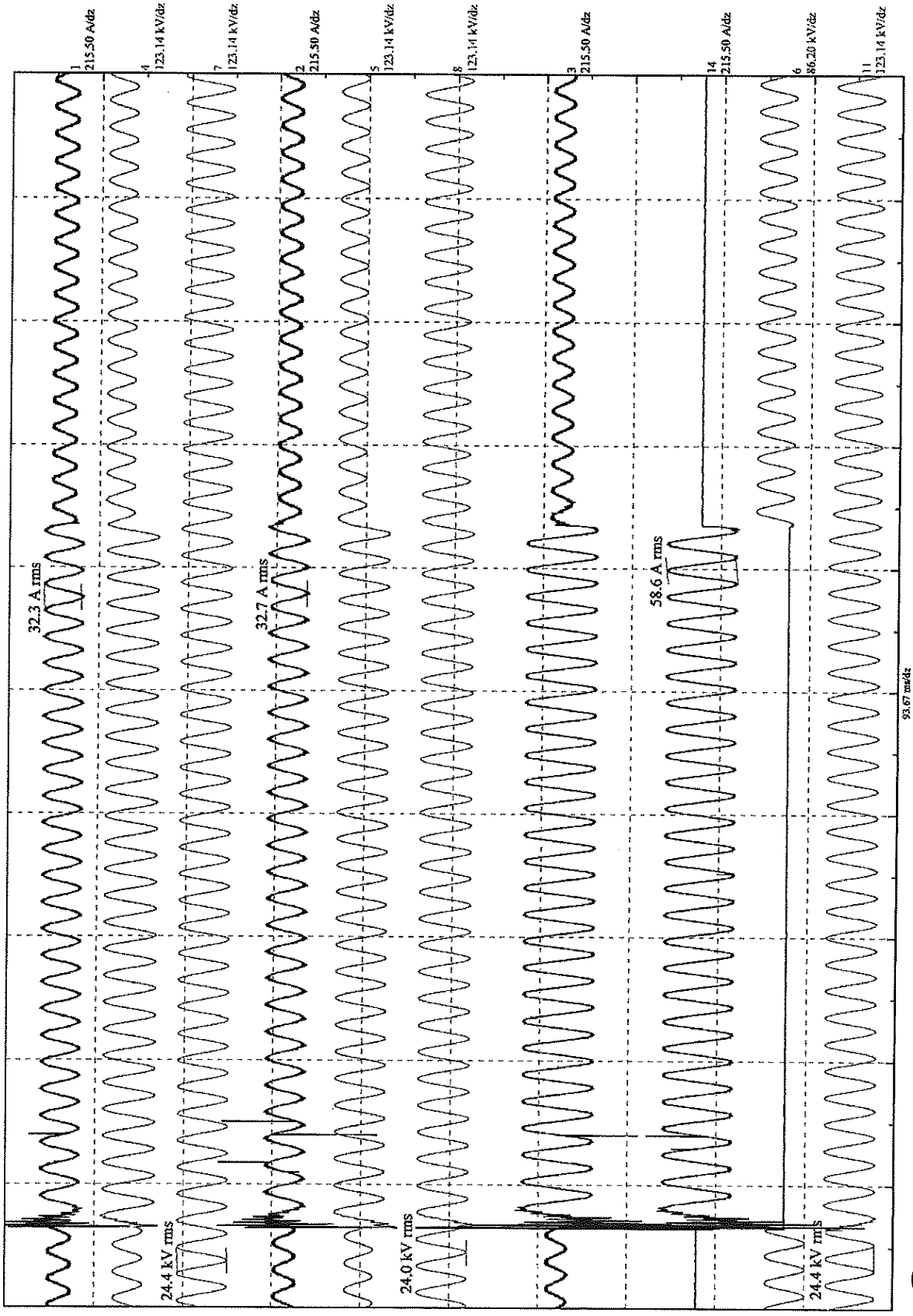
Wartości prądów i napięć są podawane kolejno dla fazy L1 i L2
Current and voltage values are given for L1 and L2.

Typ napędu / Operating mechanism:
Typ: NMMD1 220V AC/DC
Art: 5DLN 527601-F

Numer oscylogramu Oscillogram no.	**Napięcie probiercze** Test voltage (kV)	**Prąd probierczy I_{6b}** Test current I_{6b} (A)	**Uwagi** Remarks
80704	24.9 24.6	33.2 31.5	
80709	25.3 24.7	32.4 32.9	
80710	25.3 24.8	32.4 32.5	
80711	24.7 24.2	31.7 31.5	
80712	25.0 24.7	32.4 32.3	
80713	24.6 24.3	32.1 32.1	
80714	25.1 24.8	32.5 33.1	
80715	24.5 24.1	32.3 32.4	
80717	24.9 24.7	32.7 32.5	
80718	25.0 24.5	32.3 31.9	


1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 125.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
31.5 A rms
31.5 A rms
55.0 A rms
24.0kV rms
24.0kV rms
24.0kV rms
102.52 ms/dz
Data: 2005-05-30 16:18:20
Oscylogram Nr: 80719
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

260



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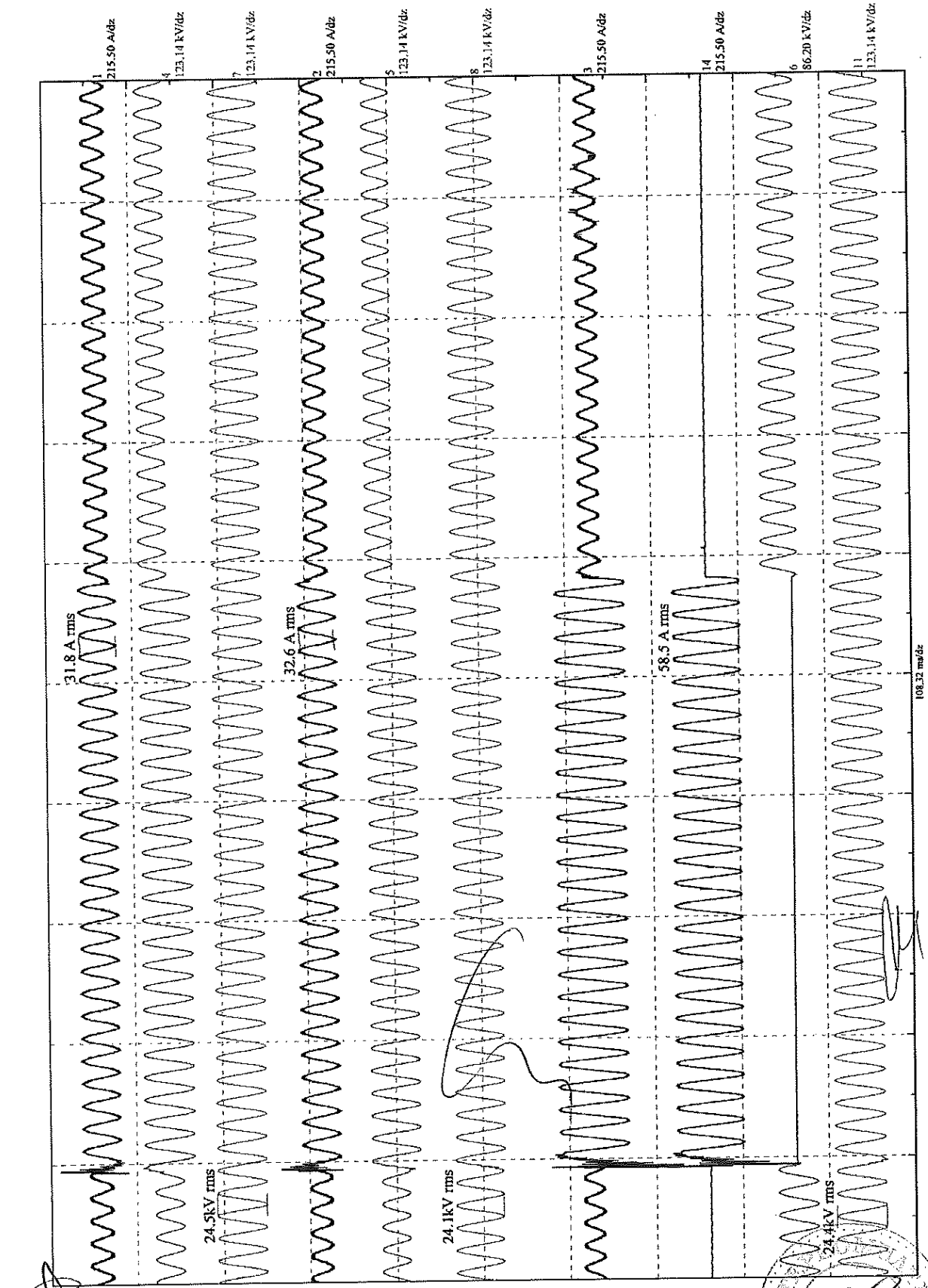

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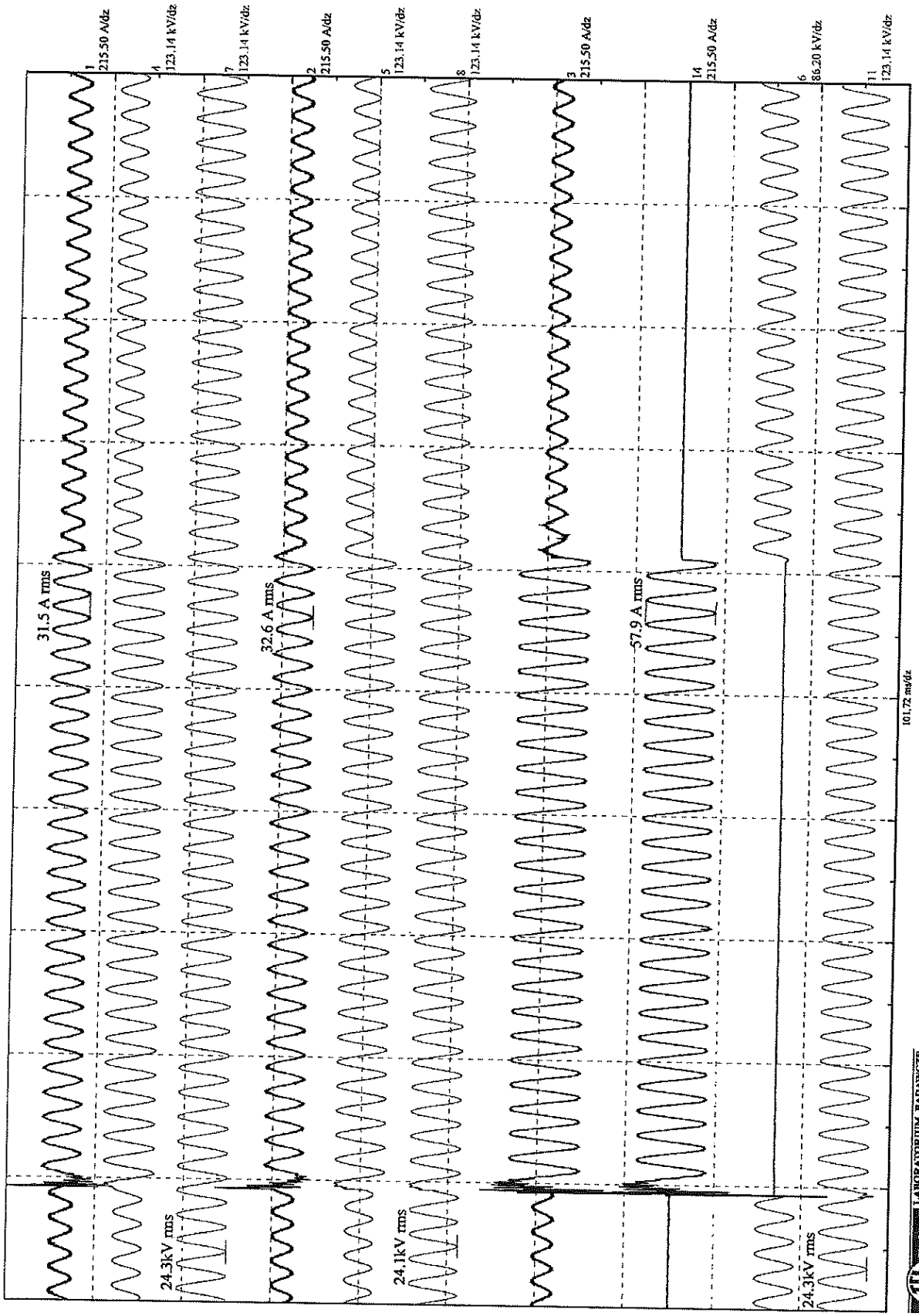
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

261



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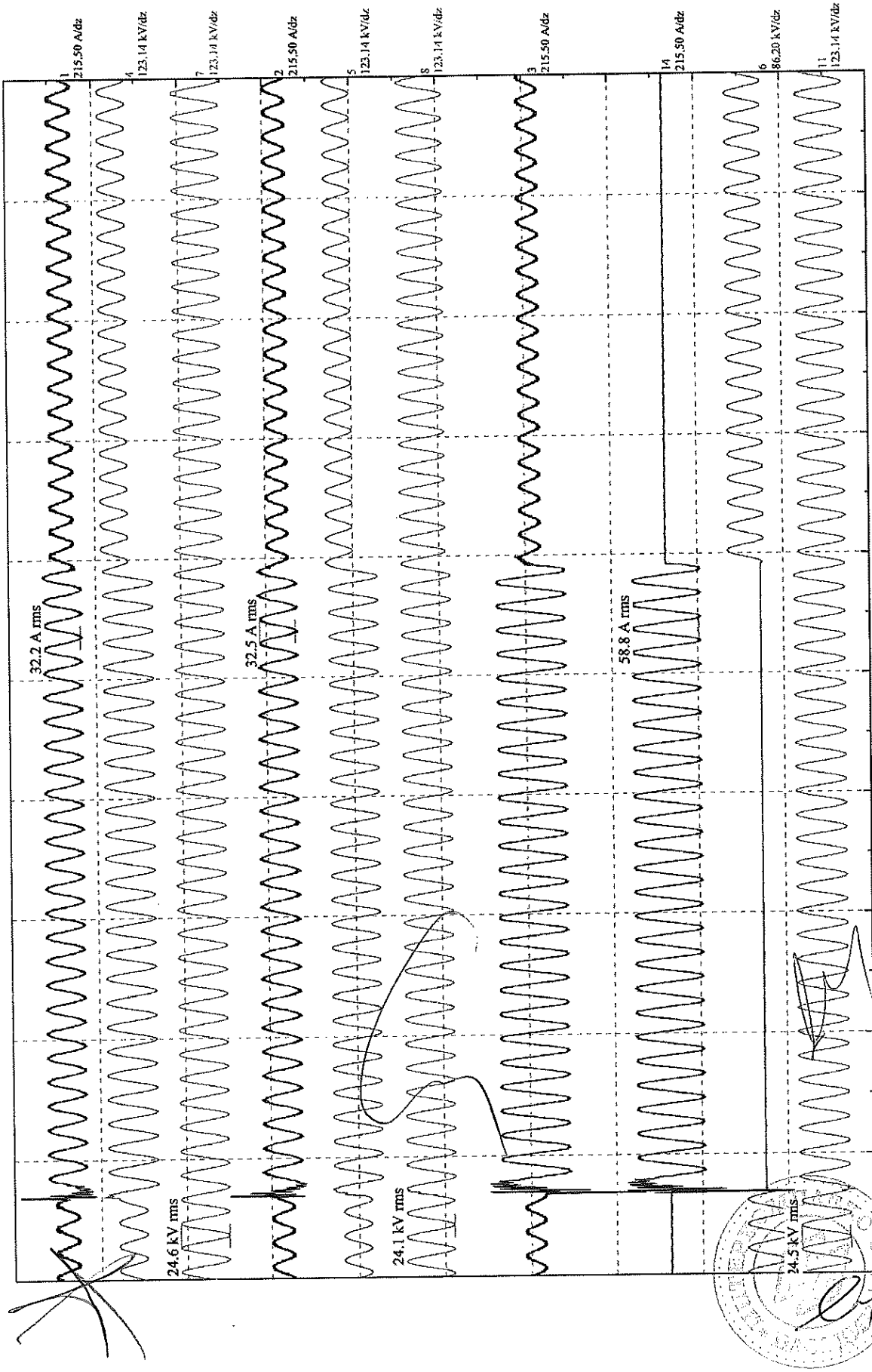
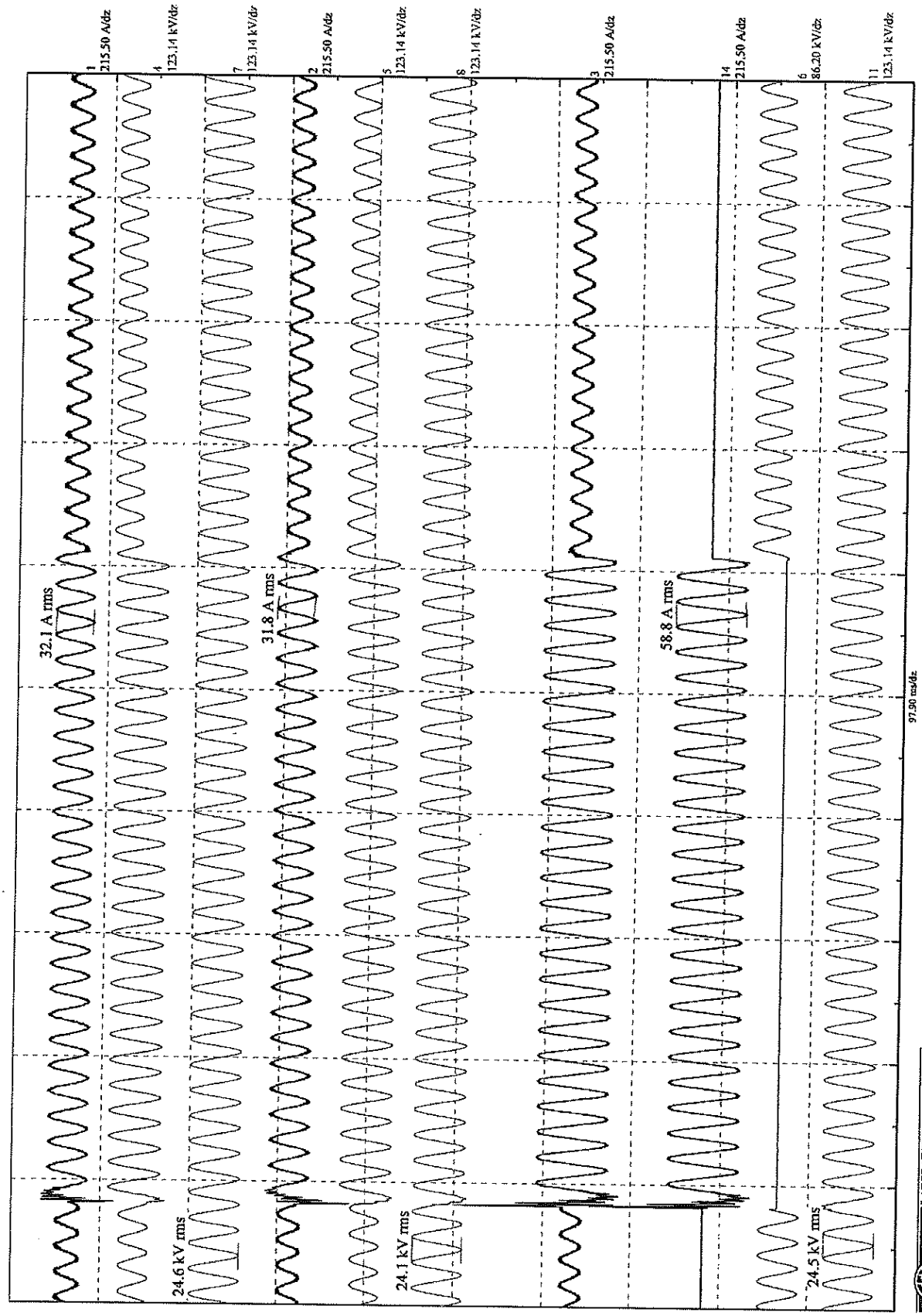
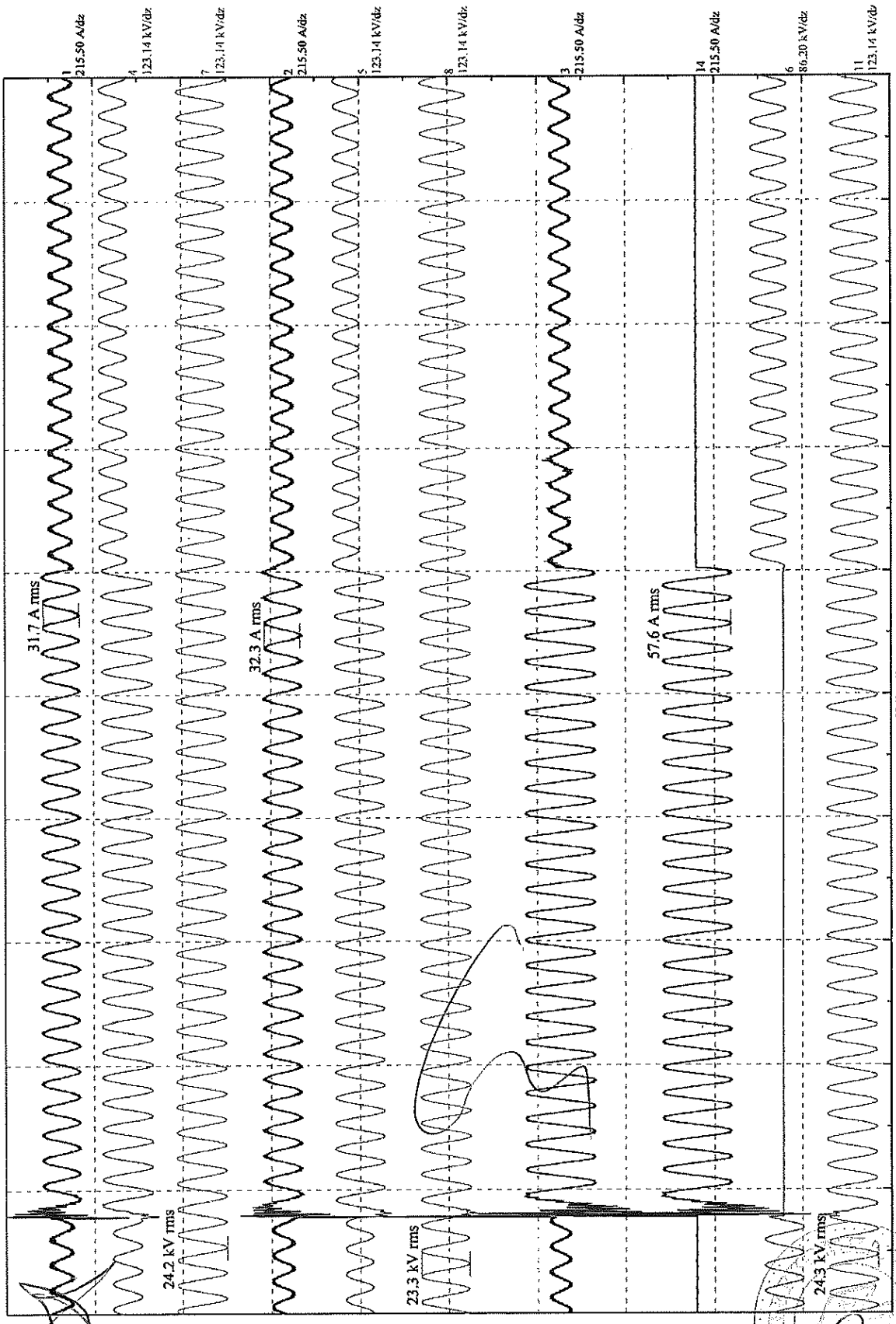

1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
32.2 A rms
32.5 A rms
58.8 A rms
24.6 kV rms
24.1 kV rms
24.5 kV rms
100.92 ms/dz
Data: 2005-05-31 10:32:57
Oscylogram Nr: 80725
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

262



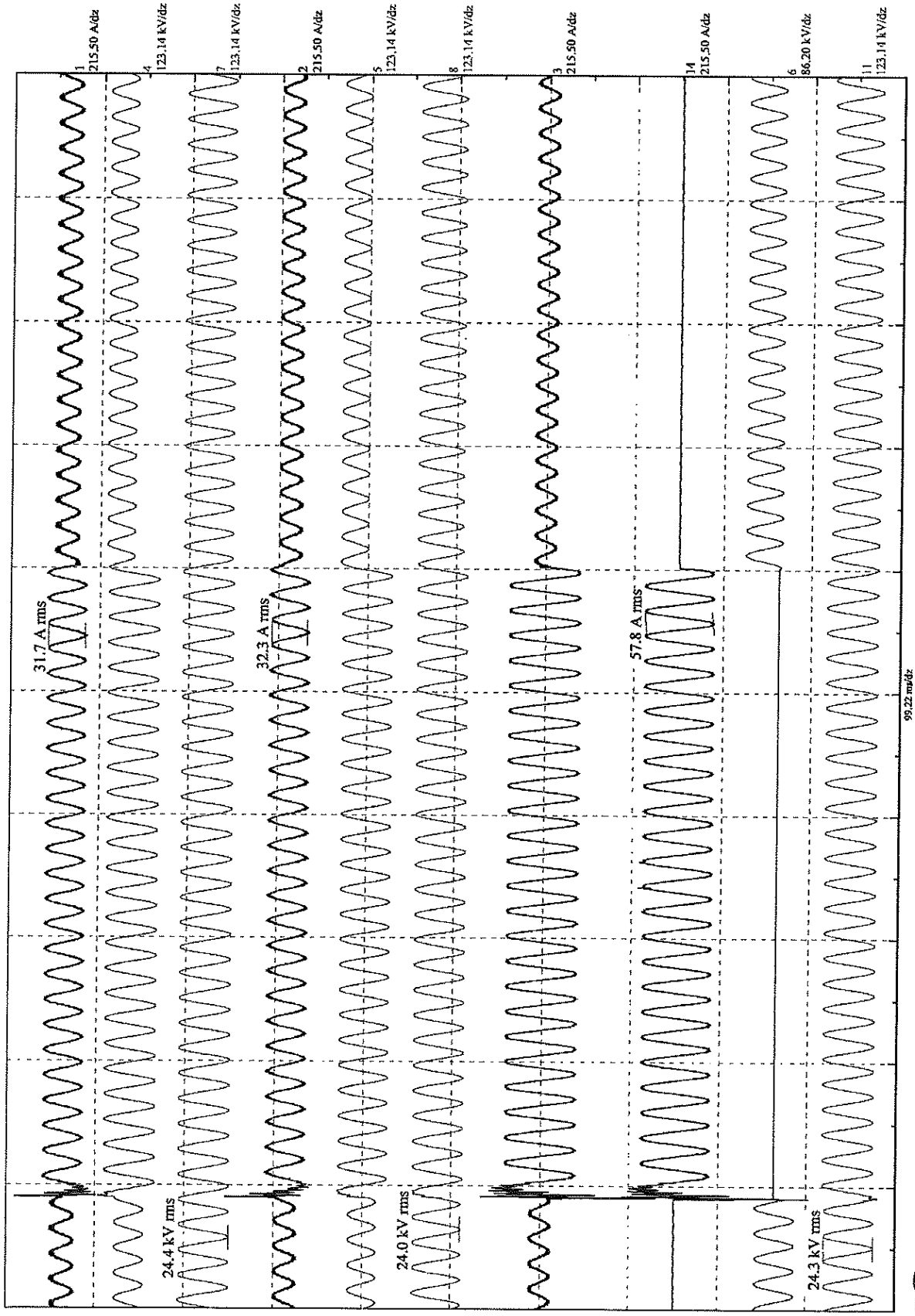
Data: 2005-05-31 10:36:38 Oscylogram Nr: 80726



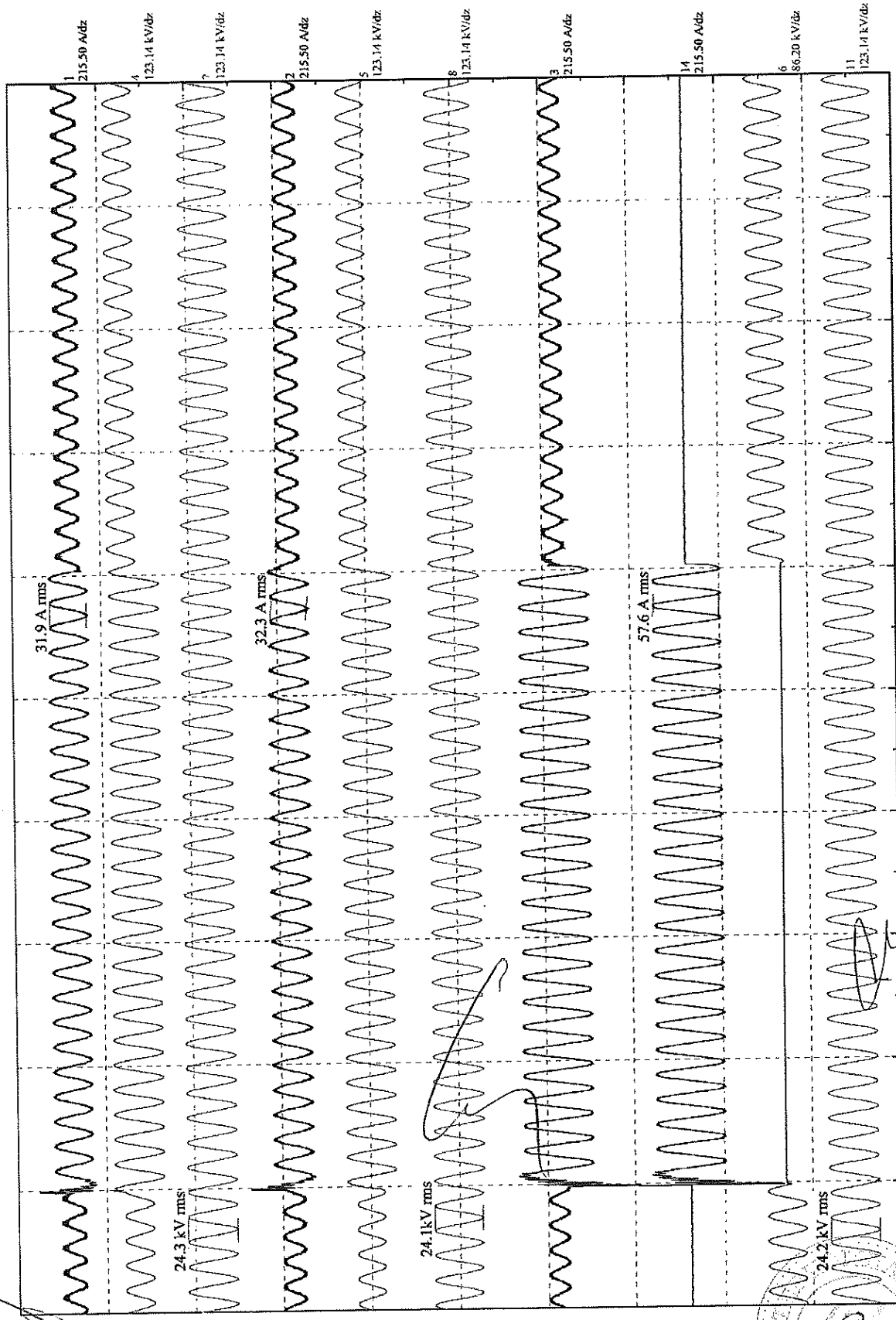
Data: 2005-05-31 10:40:19 Oscylogram Nr: 80727

LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

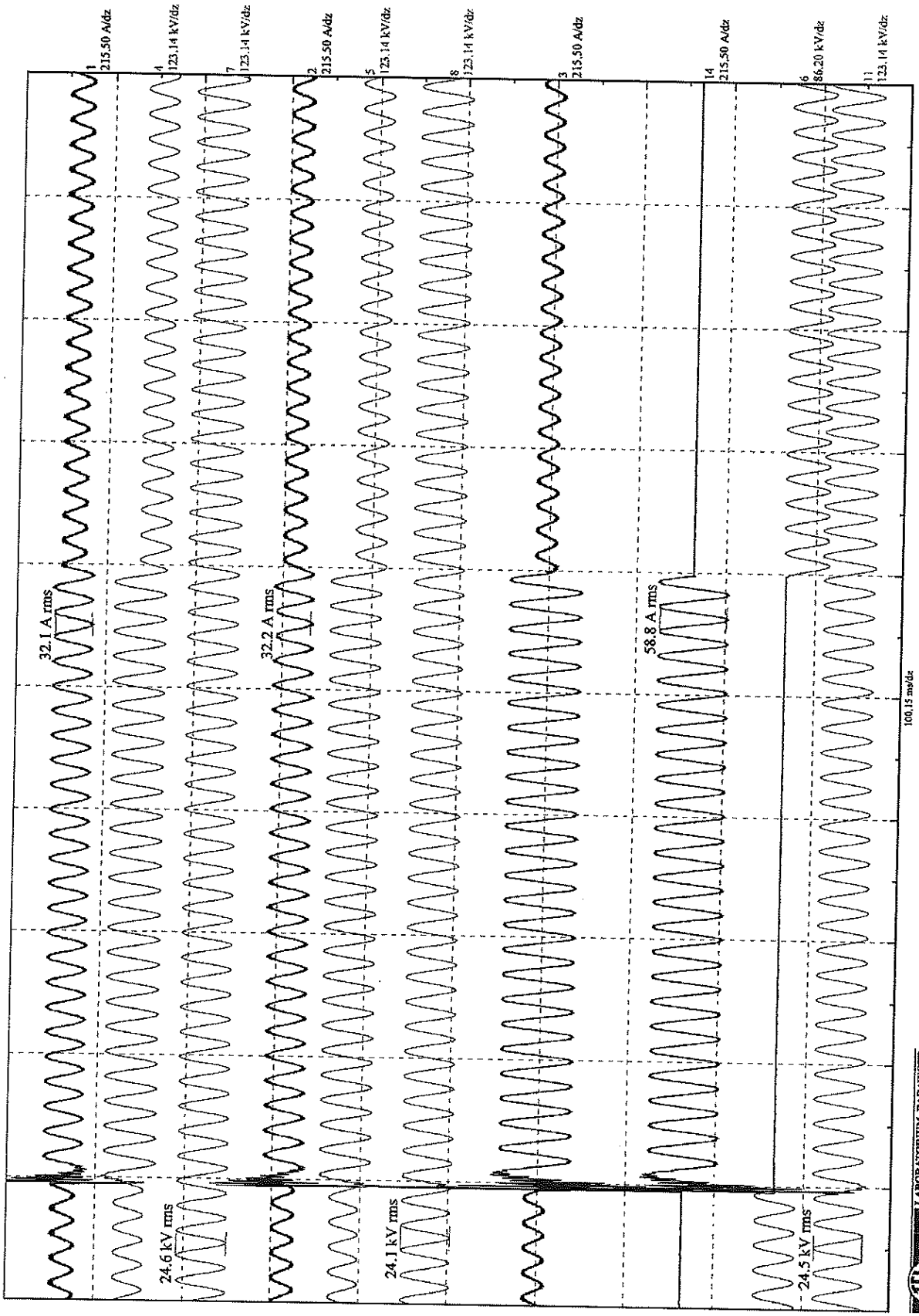
263

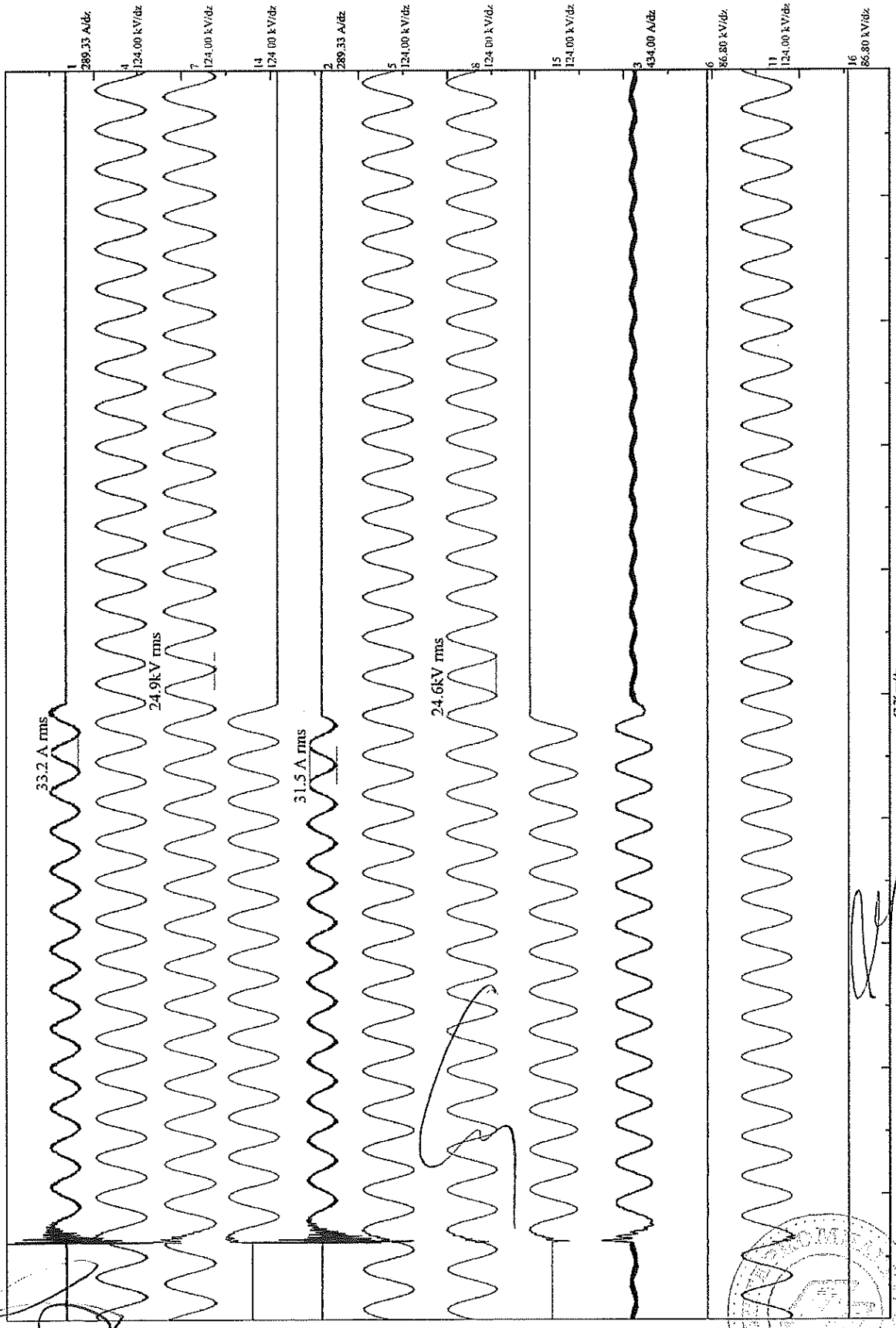


Data: 2005-05-31 10:43:58 Oscylogram Nr: 80728


1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
31.9 A rms
32.3 A rms
57.6 A rms
24.3 kV rms
24.1kV rms
24.2 kV rms
100.55 ms/dz
Data: 2005-05-31 10:47:26
Oscylogram Nr: 80729
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

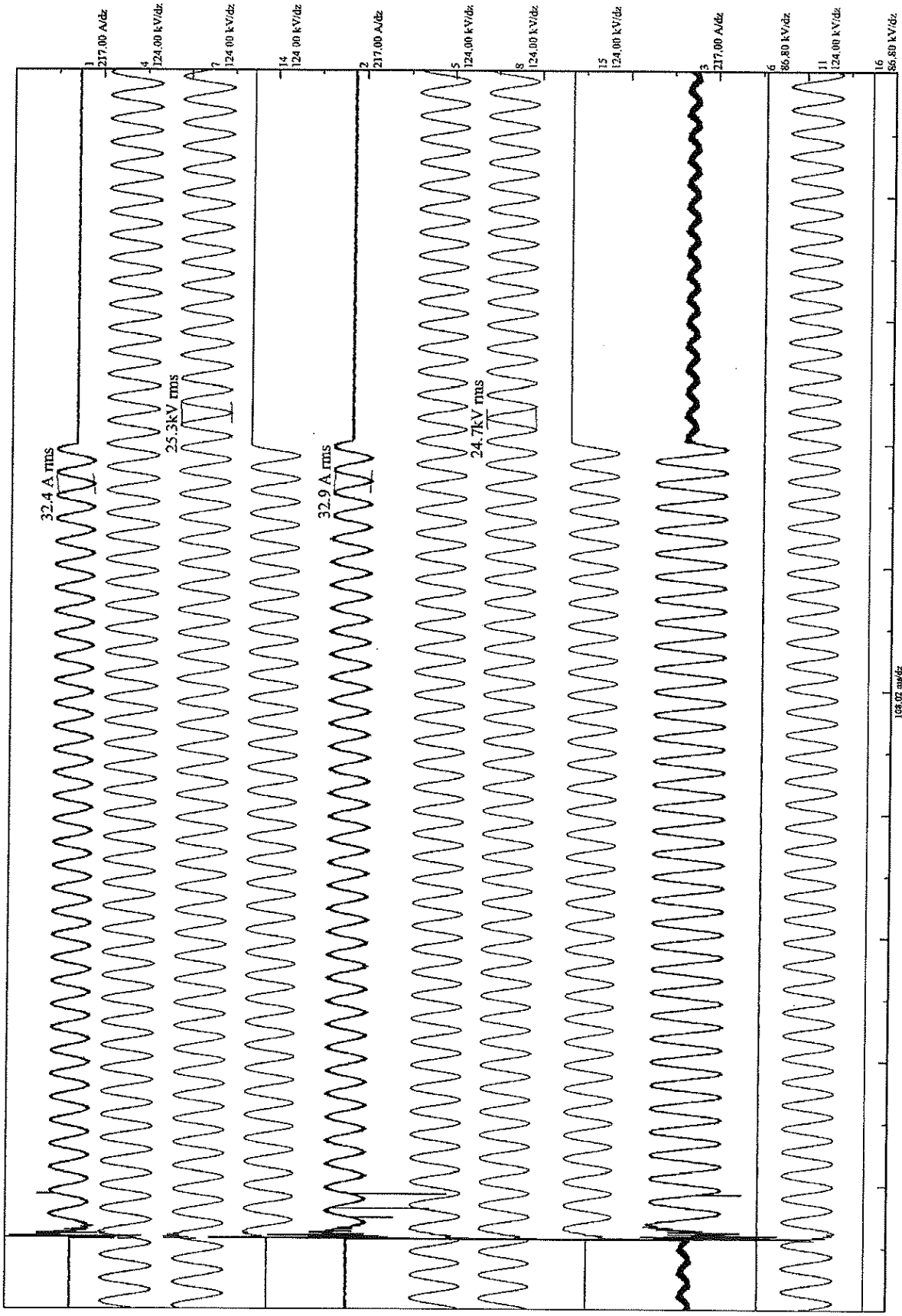
269

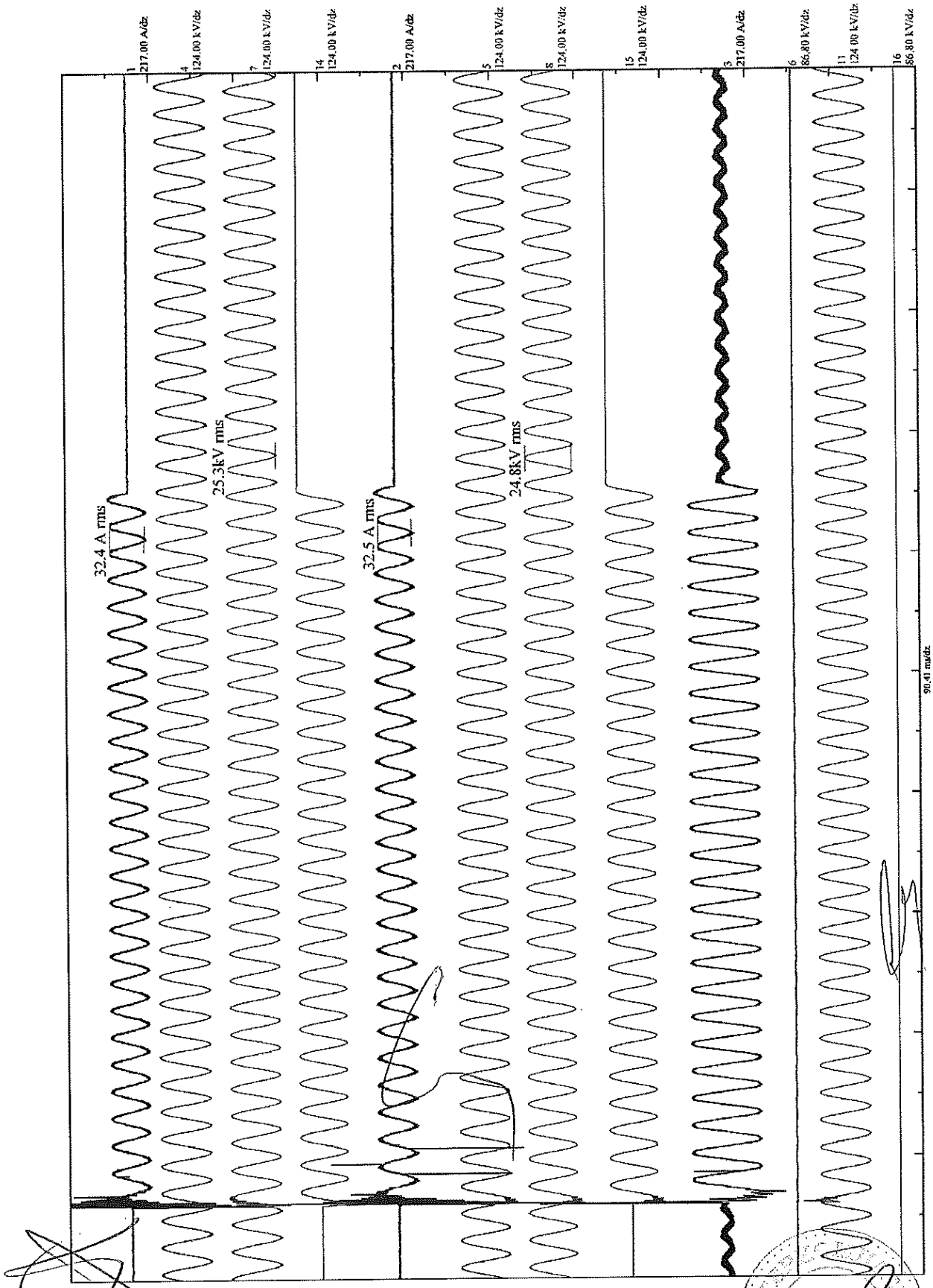

1 215.50 A/dz
4 123.14 kV/dz
7 123.14 kV/dz
2 215.50 A/dz
5 123.14 kV/dz
8 123.14 kV/dz
3 215.50 A/dz
14 215.50 A/dz
6 86.20 kV/dz
11 123.14 kV/dz
32.1 A rms
32.2 A rms
58.8 A rms
100.15 ms/dz
24.6 kV rms
24.1 kV rms
24.5 kV rms
Data: 2005-05-31 10:50:44
Oscylogram Nr: 80730
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ
W A R S Z A W A



Data: 2005-05-25 13:01:13 Oscylogram Nr: 80704

LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

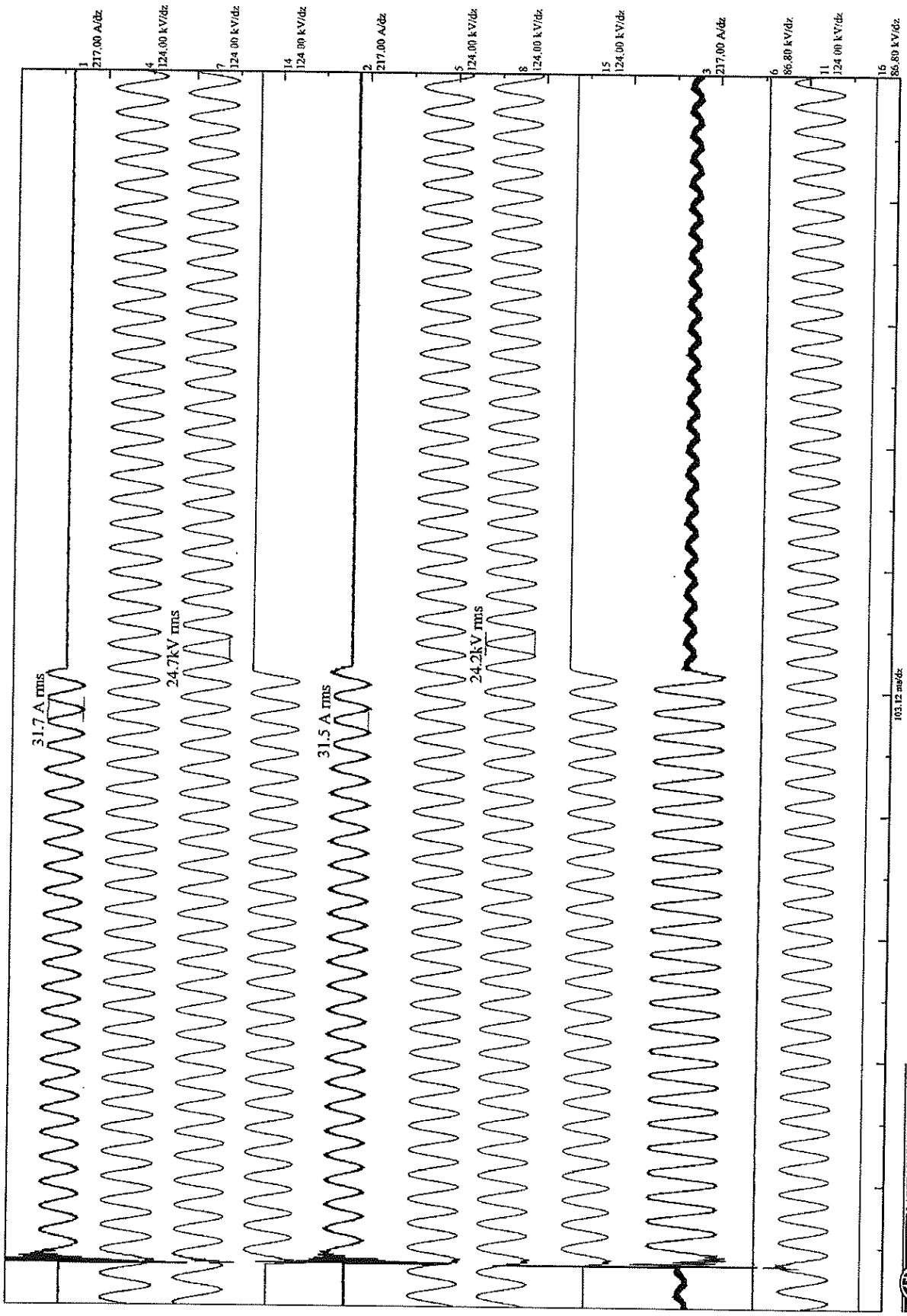

1 217.00 A/dz
4 124.00 kV/dz.
7 124.00 kV/dz.
14 124.00 kV/dz.
2 217.00 A/dz
5 124.00 kV/dz.
8 124.00 kV/dz.
15 124.00 kV/dz.
3 217.00 A/dz
6 86.80 kV/dz.
11 124.00 kV/dz.
16 86.80 kV/dz.
32.4 A rms
25.3kV rms
32.9 A rms
24.7kV rms
108.02 ms/dz
Data: 2005-05-30 13:33:38
Oscylogram Nr: 80709
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

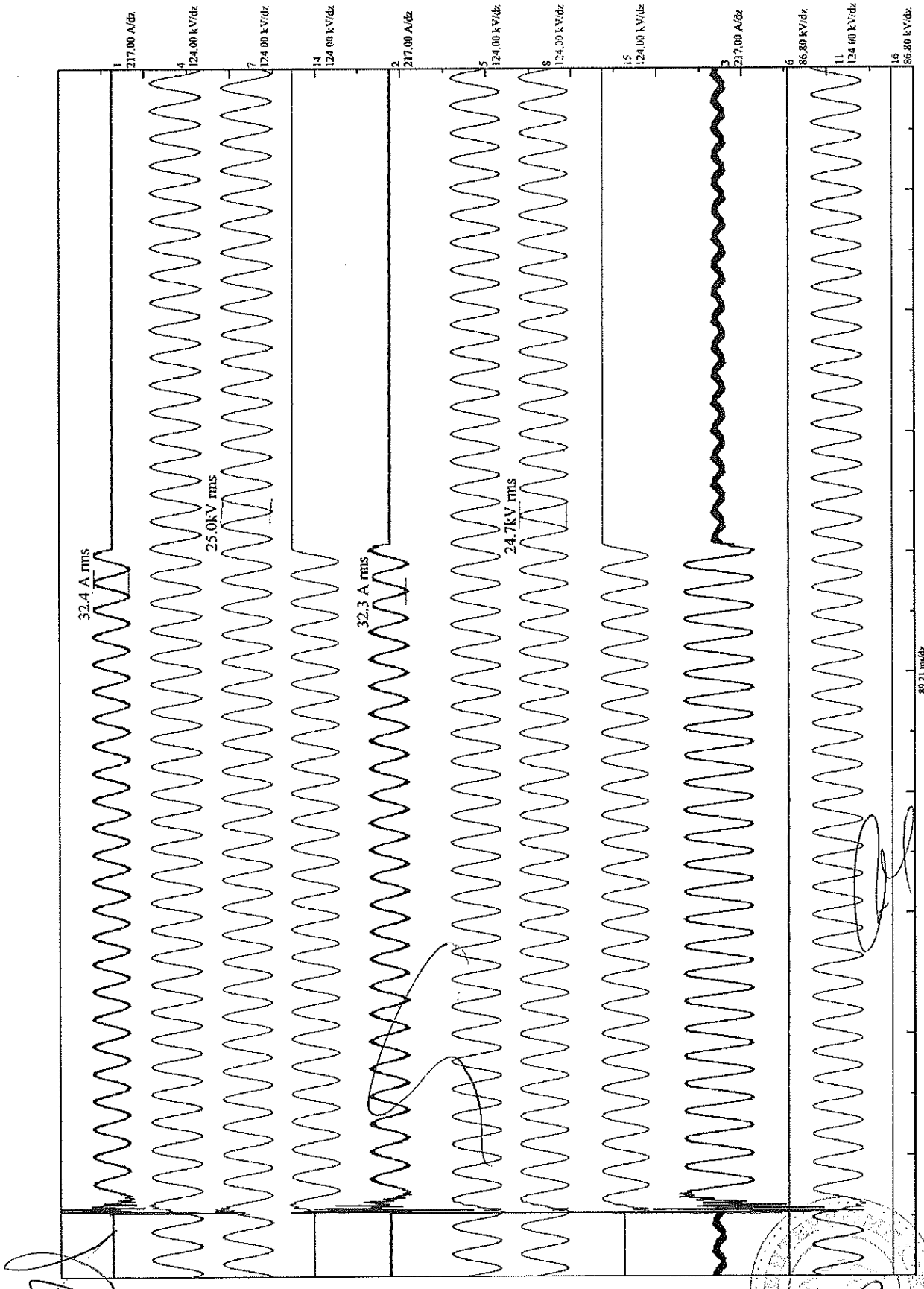


Data: 2005-05-30 13:37:08 Oscylogram Nr: 80710

LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

266

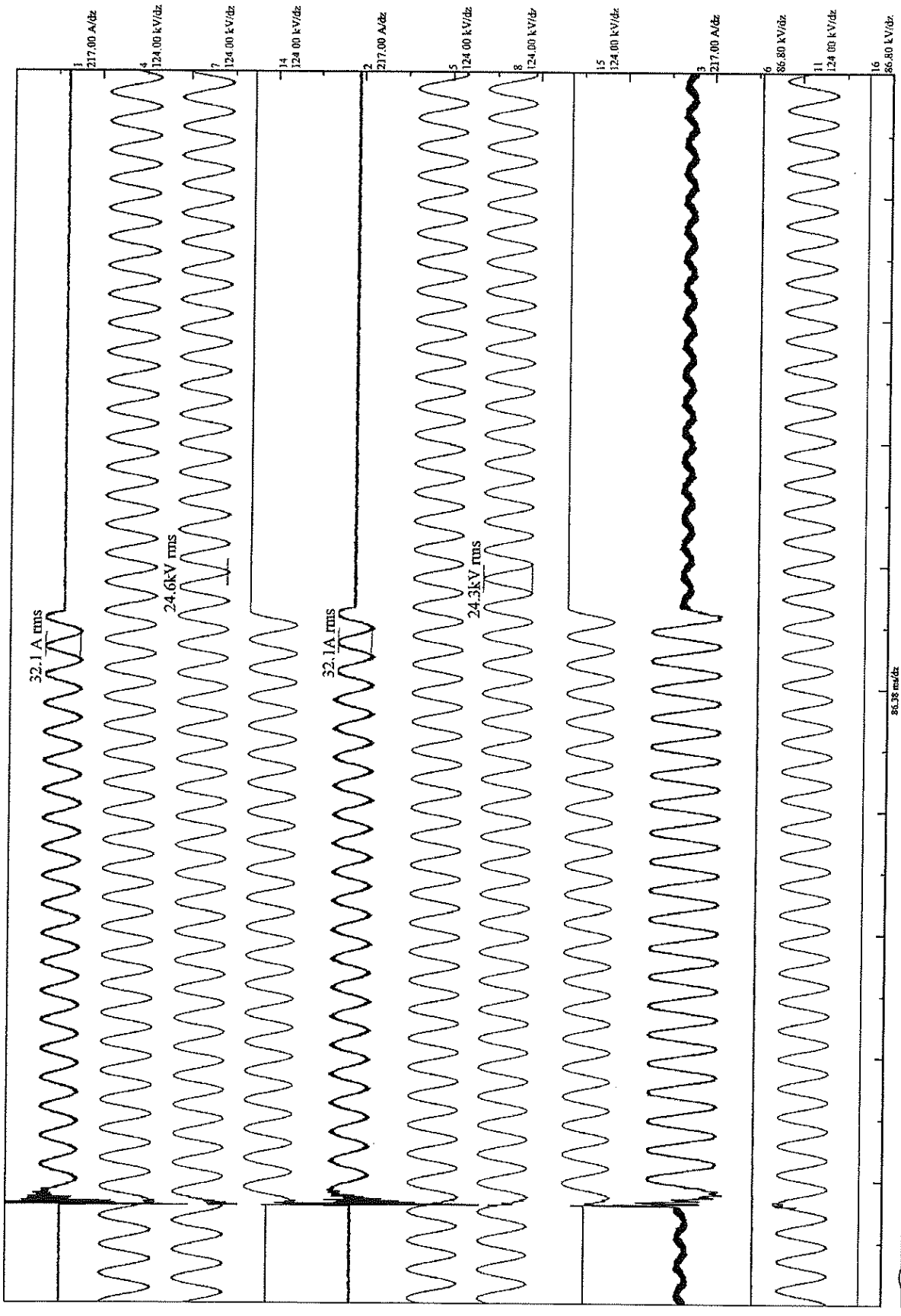

1
217.00 A/dz.
4
124.00 kV/dz.
7
124.00 kV/dz.
14
124.00 kV/dz.
2
217.00 A/dz.
5
124.00 kV/dz.
8
124.00 kV/dz.
15
124.00 kV/dz.
3
217.00 A/dz.
6
86.80 kV/dz.
11
124.00 kV/dz.
16
86.80 kV/dz.
31.7 A rms
24.7kV rms
31.5 A rms
24.2kV rms
103.12 ms/dz.
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A
Data: 2005-05-30 13:40:46
Oscylogram Nr: 80711

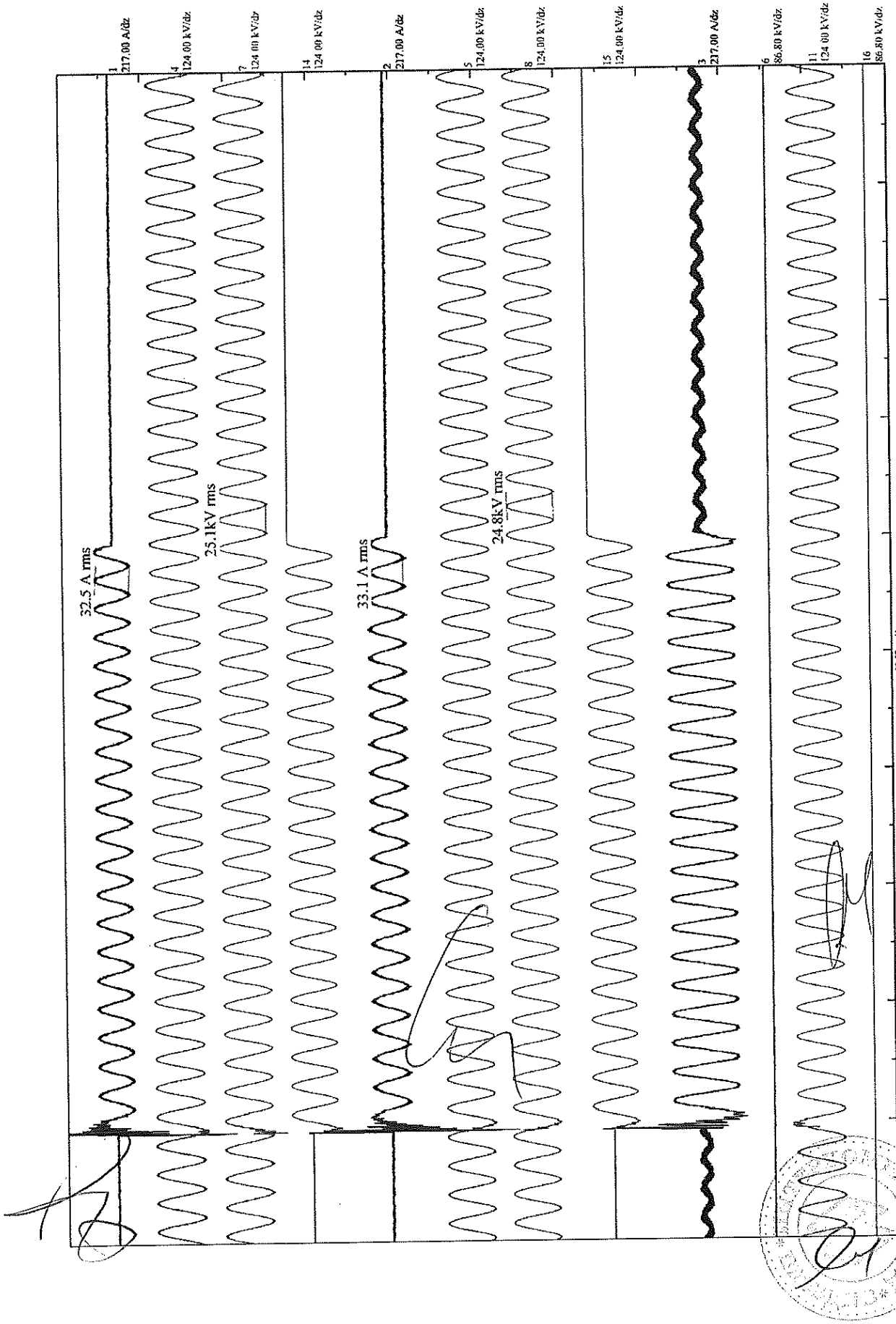


LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ WARSZAWA

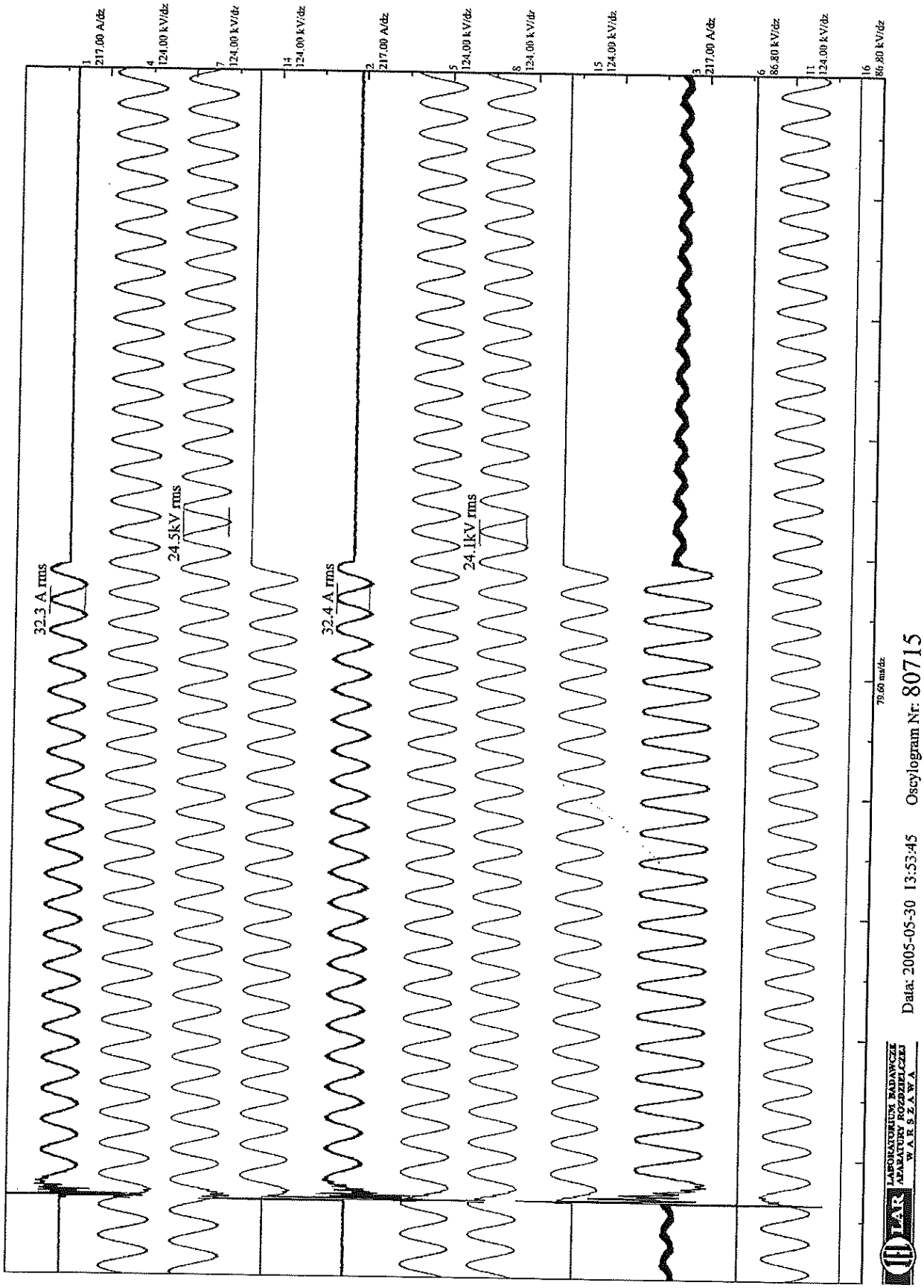
Data: 2005-05-30 13:44:35 Oscylogram Nr: 80712

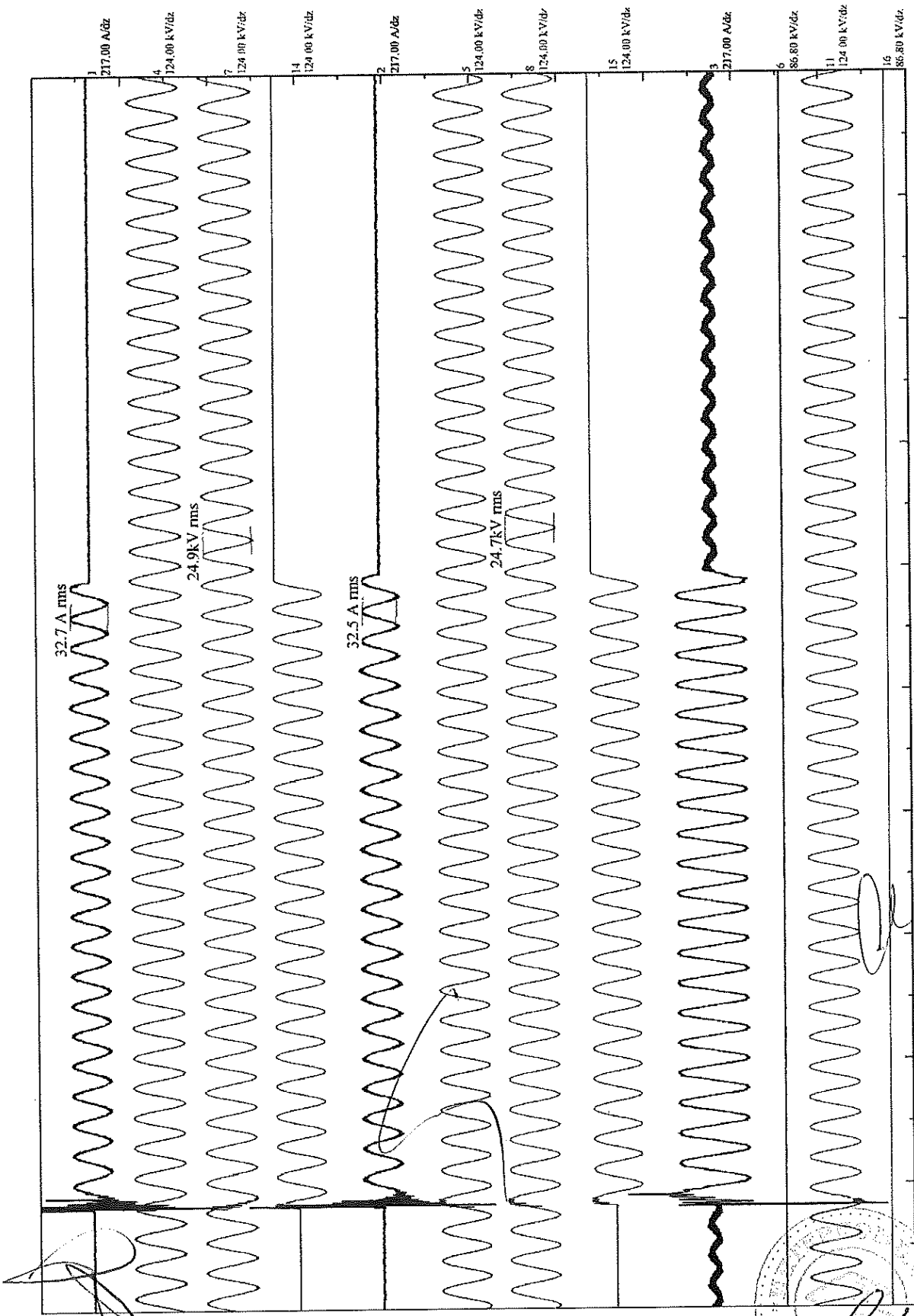
264


32.1 A rms
24.6kV rms
32.1A rms
24.3kV rms
Data: 2005-05-30 13:47:37
Oscylogram Nr: 80713


1 217.00 A/dz
4 124.00 kV/dz
7 124.00 kV/dz
14 124.00 kV/dz
2 217.00 A/dz
5 124.00 kV/dz
8 124.00 kV/dz
15 124.00 kV/dz
3 217.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
32.5 A rms
25.1kV rms
33.1 A rms
24.8kV rms
82.57 ms/dz
Data: 2005-05-30 13:50:22
Oscylogram Nr: 80714
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ
WARSZAWA

268

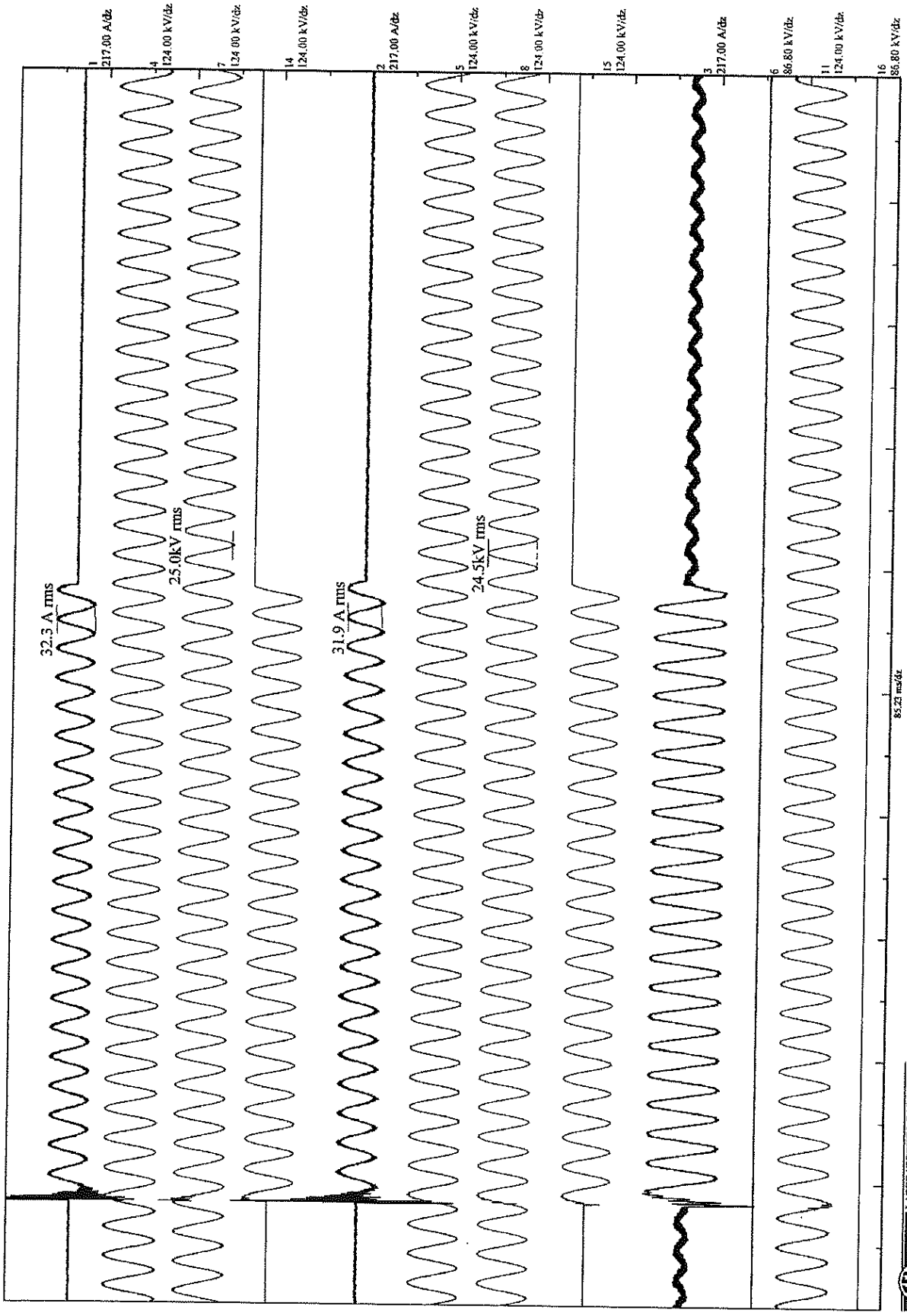

1 217.00 A/dz
4 124.00 kV/dz
7 124.00 kV/dz
14 124.00 kV/dz
2 217.00 A/dz
5 124.00 kV/dz
8 124.00 kV/dz
15 124.00 kV/dz
3 217.00 A/dz
6 86.80 kV/dz
11 124.00 kV/dz
16 86.80 kV/dz
32.3 A rms
24.5kV rms
32.4 A rms
24.1kV rms
70.00 ms/dz
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A
Data: 2005-05-30 13:53:45
Oscylogram Nr: 80715



Data: 2005-05-30 13:57:12 Oscylogram Nr: 80717

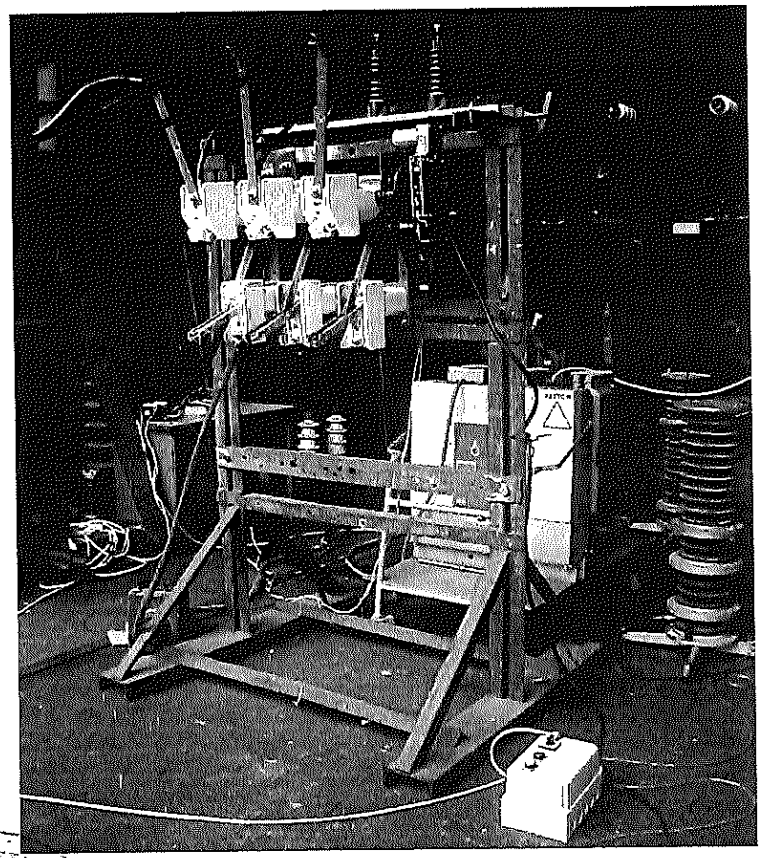
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A

269

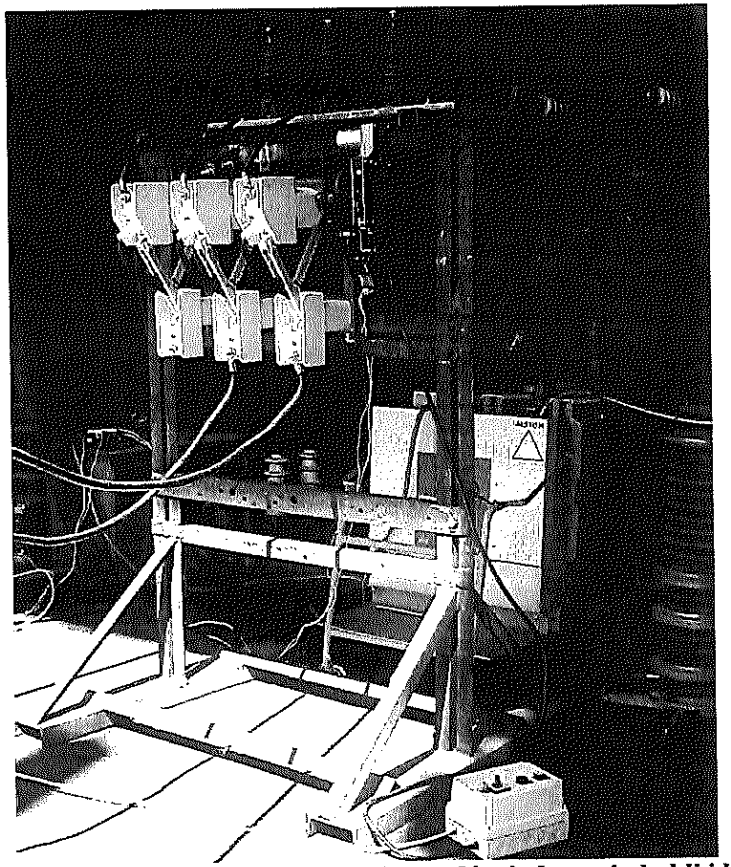


Data: 2005-05-30 14:00:22 Oscylogram Nr. 80718

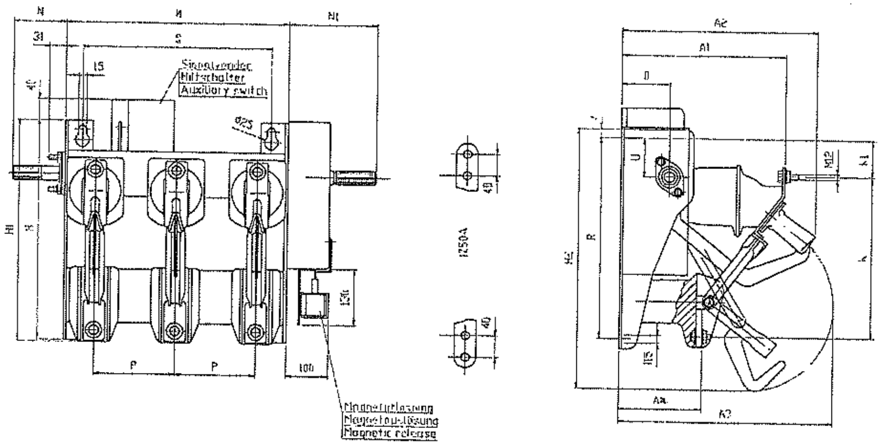
LABORATORIUM BADAWCZE APARATURY ROZDZIELCZEJ W A R S Z A W A



Obiekt badany przed próbą łączenia prądu zwarcia doziemnego (szereg probierczy 6a)
Test object before Earth fault off-load switching current test (test duty 6a)



Obiekt badany przed próbą łączenia prądów ładowania kabli i linii napowietrznych w warunkach zwarcia doziemnego (szereg probierczy 6b)
Test object before cable charging switching current under earth fault conditions (test duty 6b)



Type	A	A1	A2	A3	B	H	H1	H2	K	K1	M	N	N1	P	R	S	U	V
NAL 12-A/K/KS P=150	166	320	362	394	90	422	428	510	310	63	412	122	164	150	375	350	75	33
NAL 12-A/K/KS, P=210	166	320	362	394	90	427	428	510	310	63	532	122	164	210	375	470	75	33
NAL 17,5-A/K/KS, P=170	225	375	418	511	98	534	577	600	441	87	452	122	164	170	500	395	90	18
NAL 17,5-A/K/KS, P=210	225	375	418	511	98	534	577	600	441	82	532	122	164	210	500	470	90	19
NAL 24-A/K/KS P=235	225	375	418	511	98	534	577	600	441	87	582	186	202	235	500	525	90	18
NAL 24-A/K/KS, P=275	225	375	418	511	98	534	577	600	441	87	662	186	207	275	500	605	90	16

* 1250A A mål + 2mm

Preparert / Utført: 91.05.08 STTH	Overtatt / Ansvarl.: Teknologi	Tittel: NAL 12-24 / Dimension Drawing		
Kontroll: 91.11.01 STTH				
Godkjent / Bruksakt:	Revisjon / Endring: D 94.09.07 S.Thygesen	Skala:	Uten sola stykkliste	
ABB Distribusjon AS		Dokument nr.: NHP 343070		Blad nr.: 1

NEFI

Kortslutningslaboratorium SHORT–CIRCUIT TESTING STATION

Postboks 108, 3701 SKIEN Stufensvegen, 3700 SKIEN Telegr. NEBB Telex 21524 Telefax (03) 52 69 92 Tlf. *(03) 59 03 38

REPORT OF PERFORMANCE No. 67

APPARATUS: *High voltage switch-disconnector*

DESIGNATION: *NAL 24 kV, 1250 A*

MANUFACTURER: *A/S Norsk Elektrisk & Brown Boveri, Switchgear division Skien, Norway*

DATE(S) OF TESTS: *17.03.1987*

RATING ASSIGNED BY THE MANUFACTURER

Rated short-time withstand current : 25 kArms in 2,0 sec.

Rated peak withstand current : 67 kApeak

THE TESTS HAVE BEEN MADE IN ACCORDANCE WITH *IEC 265 § 6.5.*
Short-time withstand and peak withstand current test.

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with tests results and oscillograms.

THE DOCUMENTS FORMING PART OF THIS REPORT ARE

Table with test results	Nos.:	4
Oscillogram	Nos.:	117
Drawing	Nos.:	*See page 6 and 7*
Diagram	Nos.:	5
Photograph	Nos.:	

Skien, 16.02.1988
Place and Date

на основание чл. 36а, ал. 3 от ЗОП

Test Engineer

на основание чл. 36а, ал. 3 от ЗОП

Laboratory manager

NEFI Kortslutningslaboratorium

Report-No.: 67 Sheet-No.: 2

Technical Data of Switching Device

Switching device: High voltage switch-disconnector

Type: NAL 24 kV, 1250 A

Manufacturer: A/S Norsk Elektrisk & Brown Boveri, Switchgear divisi

Serial-No.: Year of manufacture 1987

Drawing-No.: See page 6 and 7

Rated voltage		24 kV
Rated lightning impulse withstand voltage to earth		kV
Rated frequency		50 Hz
Rated normal current		1250 A
Rated short-circuit breaking current		kA
D. C. component		%
Peak value of Transient Recovery Voltage		kV
Rate of rise of Transient Recovery Voltage		kV/µs
Rated short-circuit making current		kA
Rated operating sequence		
Rated peak withstand current		67 kA
Rated short-time withstand current	2,0 s	25 kA
Number of poles		
Number of units per pole		
Arc extinguishing medium		
Operating times		ms
		ms
Mechanism		type K
Release		

NEFI Kortslutningslaboratorium

Report-No.: 67 Sheet-No.: 3

Technical Data of Test Circuit

Test-no.:	1			
Number of phases (test circuit)	3			
Rec.No.:	117			
Operating frequency Hz	50			
Power factor source side / load side	< 0,1			
Transformer connection symbol	Dyn			
Transformer star point	Earthed			
Short-circuit point	Isolated			
Circuit diagram Sheet-No.	5			
TRV source side u_c/t_3 kV/μs				
TRV load side f_e kHz				

Remarks:

The test-arrangement is in accordance with IEC 129 Third edition 1984, figure 4 page 76.

NEFI Kortslutningslaboratorium

Report-No.: 67

Sheet-No.: 4

Testing of short circuit Capacity
Values recorded.

Test requirement: 67 kApeak, 25 kArms in 2,0 sec.

Condition of apparatus before test: New and clean

Test No.	Oscillos-cope record No.	Rated voltage before test kV	Opera-tion	Opera-tion time mS	Short-time withstand current kArms				Peak withstand current kA peak			Dur-ation S	I^2t A.²S.			Result + -	Behavour during test / Remarks
					R	S	T	Aver-age	R	S	T						
	117	0,55	None		24,9	25,4	25,2	25,2	63			1,0				+	Very small burning marks located to the contacts in S-phase at the interrupter side.

Remarks:

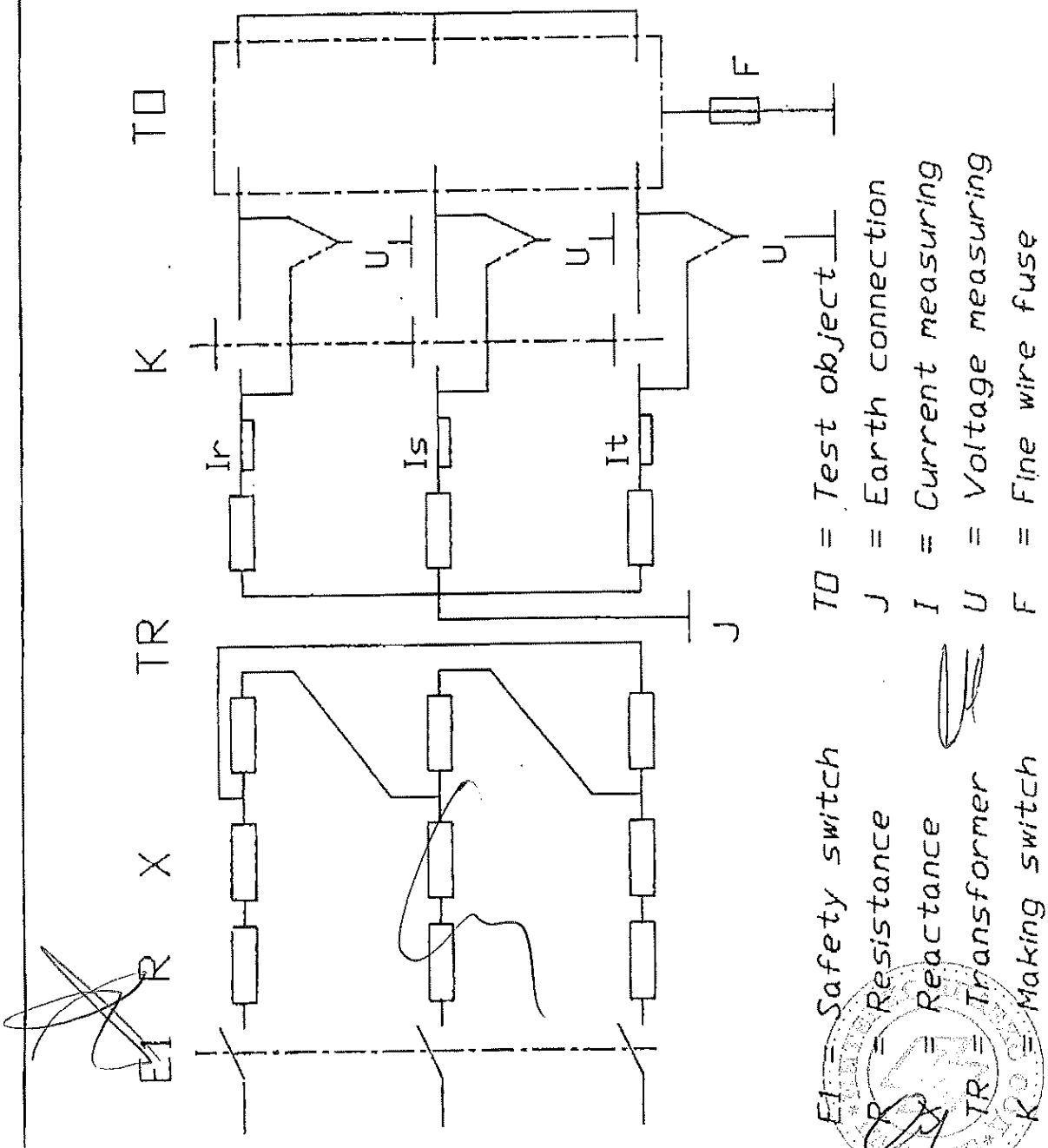
Condition of apparatus after test: The test passed successfully, but the test-values are not in accordance to the data-sheet.

NEFI Kortslutningslaboratorium

SHORT CIRCUIT TEST

Report-No.: 67

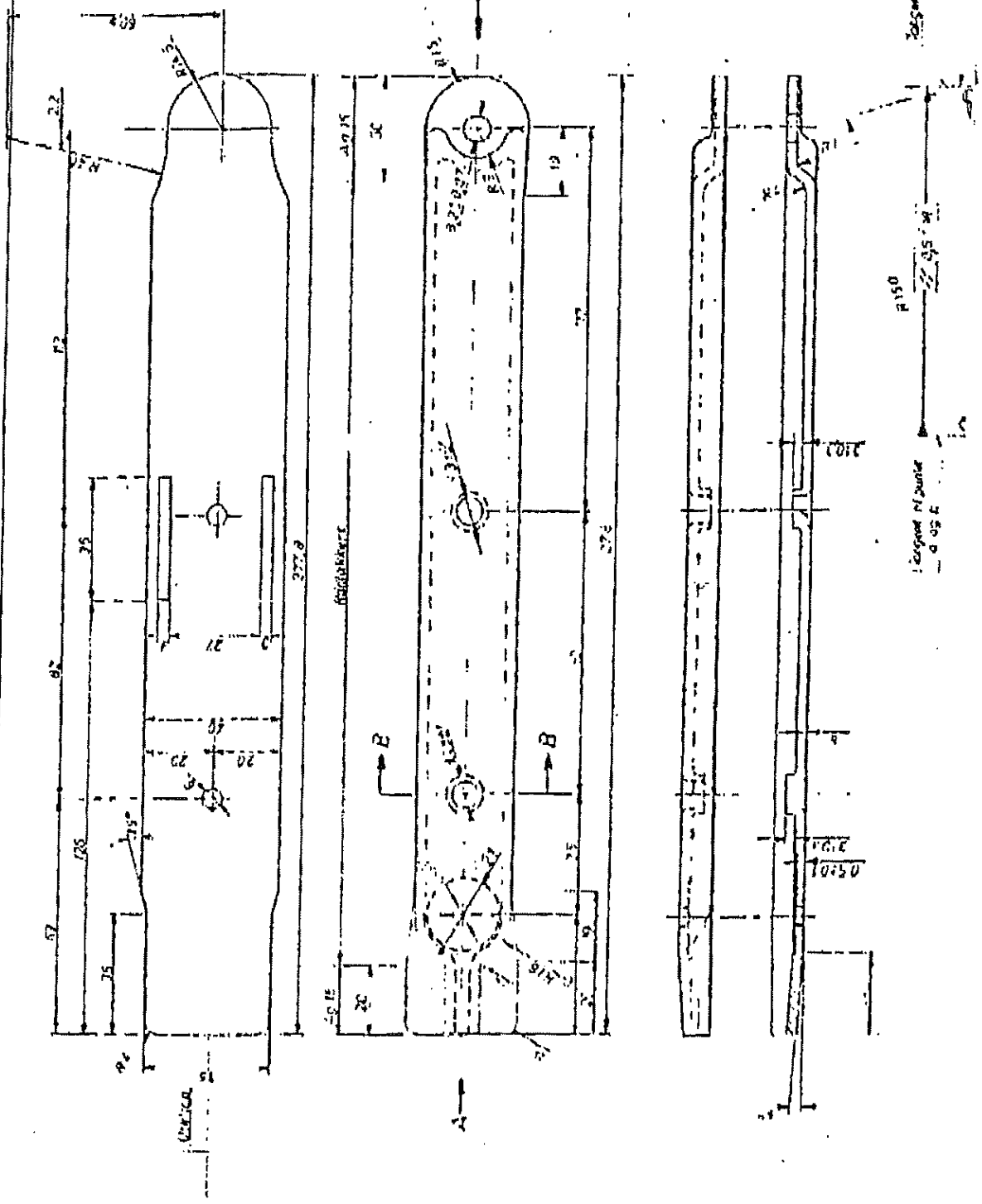
Sheet-No.: 5



NEFI Kortslutningslaboratorium

Report-No: 6-7.1

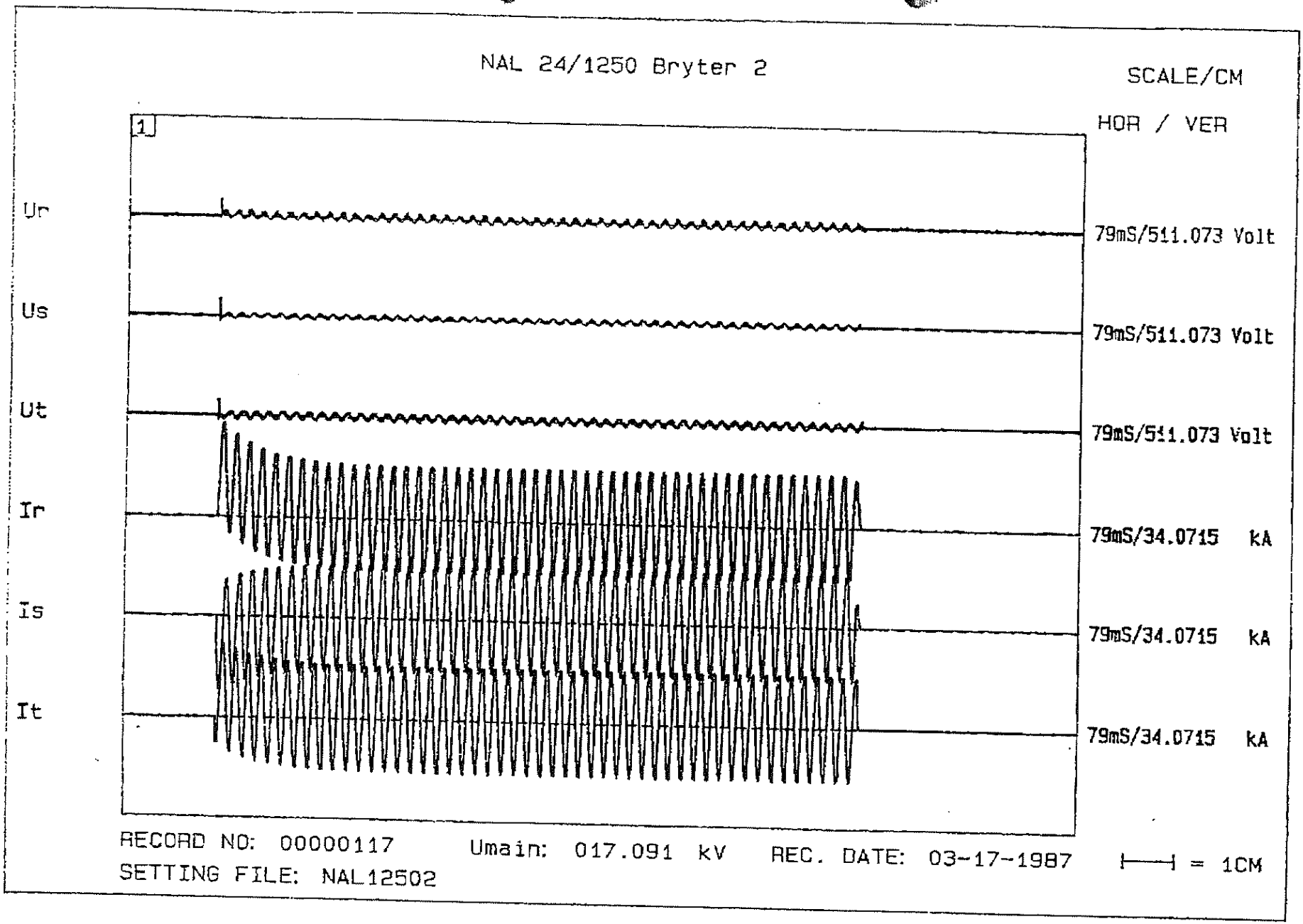
Sheet-No: 7



NEFI Kortslutningslaboratorium

Report-No.: 67

Sheet-No.: 6


NAL 24/1250 Bryter 2
SCALE/CM
HOR / VER
1
Ur
Us
Ut
Ir
Is
It
79mS/511.073 Volt
79mS/511.073 Volt
79mS/511.073 Volt
79mS/34.0715 kA
79mS/34.0715 kA
79mS/34.0715 kA
RECORD NO: 00000117
Umain: 017.091 kV
REC. DATE: 03-17-1987
SETTING FILE: NAL12502
= 1CM

English translation of Norwegian document.

NEBB Type of report: Test report Journal no. 2394. Report no. 870009

Temperature-rise test NAL 24 kV 1250 A with test current I = 1250 A

Occasion:

It is necessary to perform tests with the knifes painted red and without holes.

The requirement for the maximum temperature-rise is 65 K for the contact points of the switch and 75 K for the terminals (IEC 694).

Conclusion:

The requirement was fulfilled, but with only a small margin. The highest temperature was measured in the point of rotation of the knife with a temperature of 64.5 K.

Summary:

The test was performed with 2 parallel Cu bars 5 x 50 mm and length 1 m. The temperatures were measured at 25 different points as described on the attached drawing.
The following test equipment was used:

IBM PPC Mod. 5155
HP 3421 A, Control unit.
OKI Microline 192, Printer.

To fulfil the requirement of +/- 5 K as the maximum temperature difference from the terminals to a point 1 m from the terminals, it was necessary to insulate the bus bars thermally.

Test results:

See attached tables and curves.

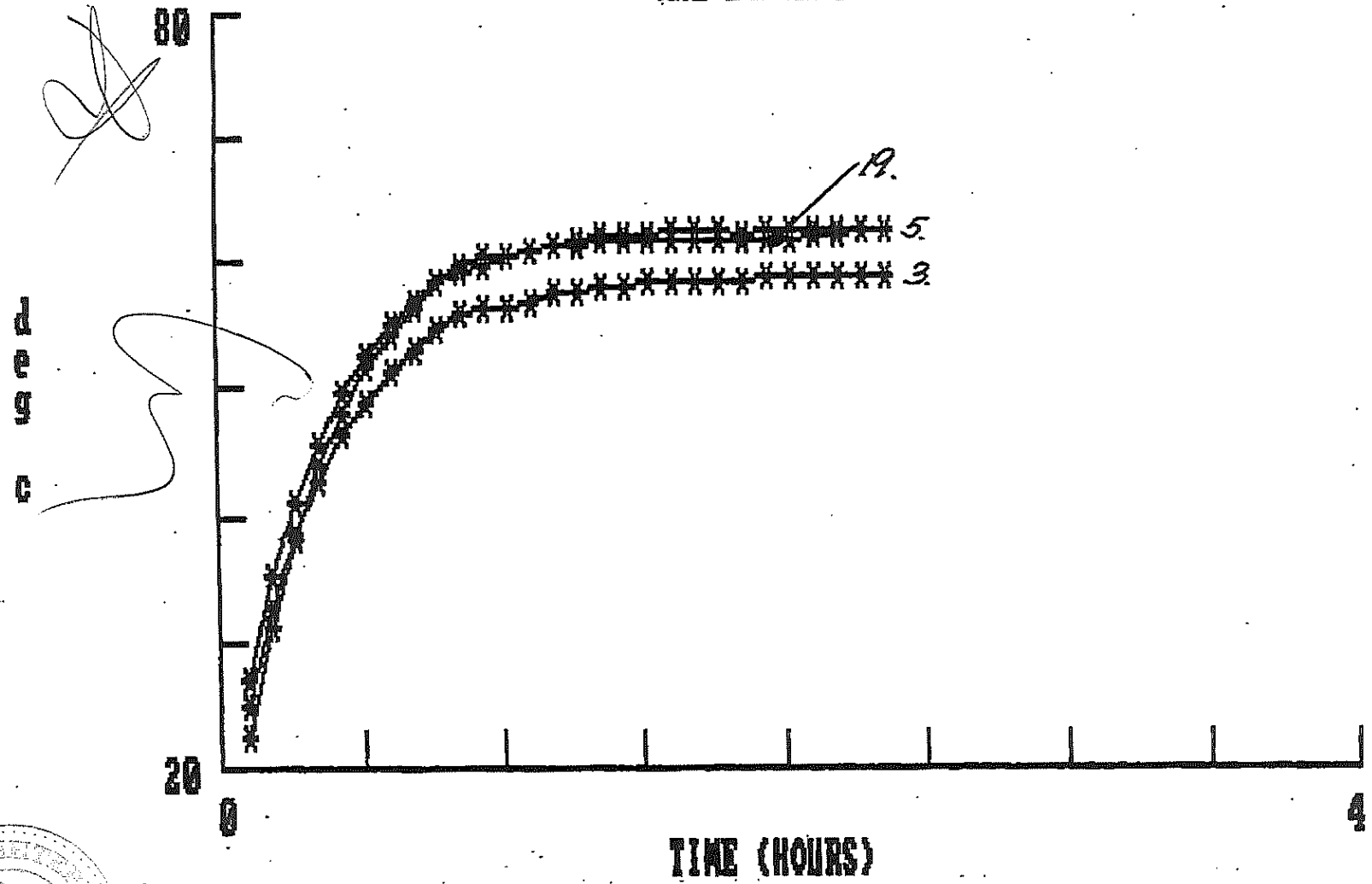
Skien, 24. February 1987
St.Th.
(Report date)

Skien, 5. July 2000
Pål Skryten
(Translation date)

Temperature-rise [K]

Measuring point	T [K]	Requirement [K]	Description	Phase
1	60.4	75	Terminal	L1
2	64.5	65	Rotating point	L1
3	58.9	65	Knife, rotating point	L1
4	57.9		Knife, middle point	L1
5	62.5	65	Knife, opening side	L1
6	61.3	65	Contact block	L1
7	57.1	75	Terminal	L1
8	58.8		Contact block / Material	L1
9	63.9		Bus bar1 m from terminal	L1
10	58.6		Bus bar1 m from terminal	L2
11	62.4		Contact block / Material	L2
12	61.0	75	Terminal	L2
13	62.1	65	Rotating point	L2
14	58.5	65	Knife, rotating point	L2
15	56.6		Knife, middle point	L2
16	58.0	65	Knife, opening side	L2
17	61.7	65	Contact block	L2
18	58.7	75	Terminal	L2
19	62.6	75	Terminal	L3
20	64.0	65	Rotating point	L3
21	59.8	65	Knife, rotating point	L3
22	57.8		Knife, middle point	L3
23	61.8	65	Knife, opening side	L3
24	64.3	65	Contact block	L3
25	58.4	75	Terminal	L3
0	24.0		Ambient air temperature	

Annex no. 1



Annex no. 2

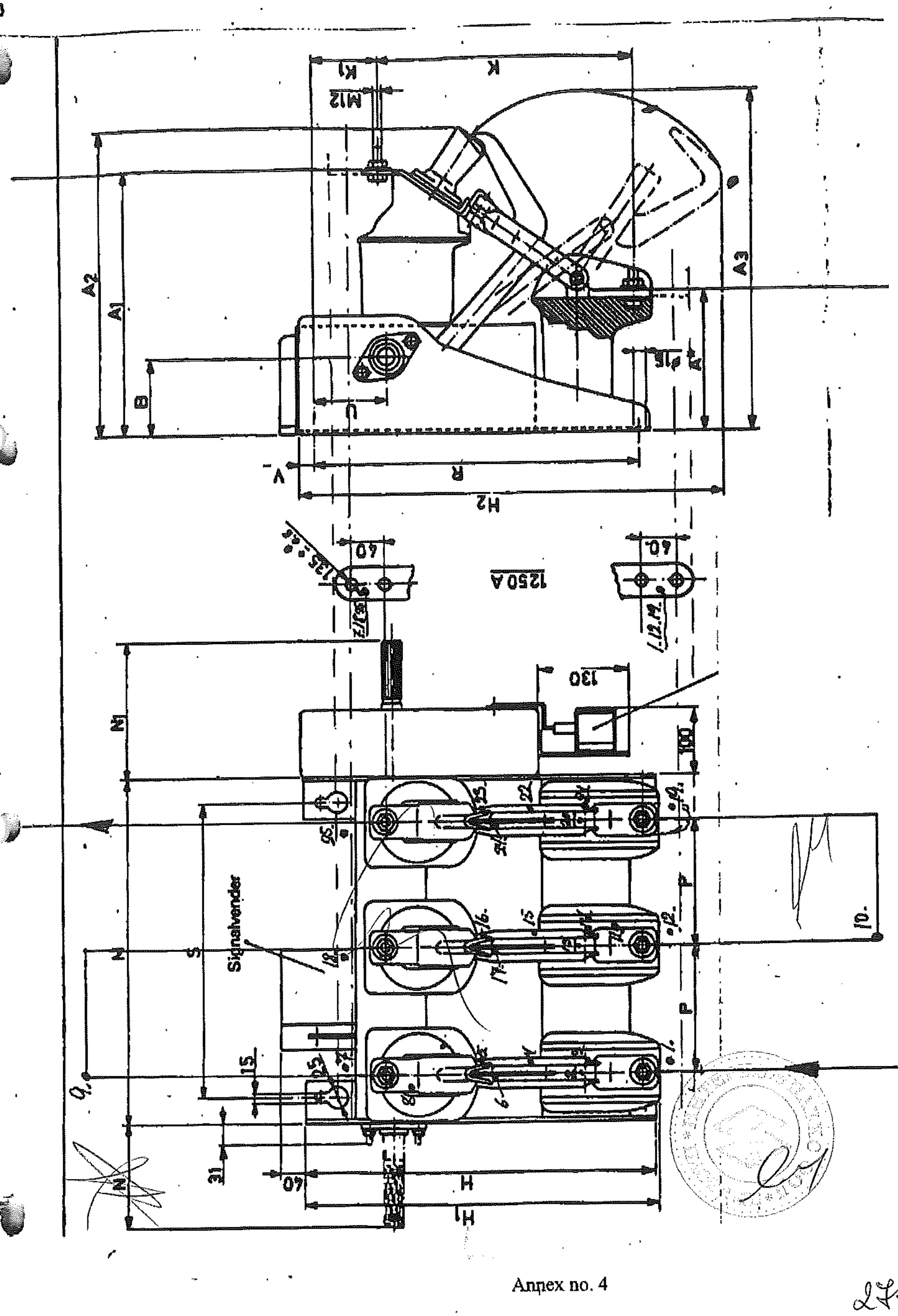
```
Channel 13      61.97502        DEG C
Channel 14      58.34572        DEG C
Channel 15      56.60539        DEG C
Channel 16      58.12812        DEG C
Channel 17      61.78134        DEG C
Channel 18      58.86939        DEG C
Channel 19      62.3541         DEG C
Channel 20      63.66201        DEG C
Channel 21      59.44986        DEG C
Channel 22      57.37042        DEG C
Channel 23      61.45829        DEG C
Channel 24      64.04966        DEG C
Channel 25      58.31322        DEG C

********** GROUP # 1 **********
   TEMP RISE TEST NEBB SKIEN
SCAN # 29  20:46:36 ø 08/01/87    18:24:39 ø 01-08-1987

CHANNEL READINGS:      DELTASTAB= .9127731
Channel 0      23.94623        DEG C
Channel 1      60.35636        DEG C
Channel 2      64.44888        DEG C
Channel 3      58.88069        DEG C
Channel 4      57.8893         DEG C
Channel 5      62.53505        DEG C
Channel 6      61.27605        DEG C
Channel 7      57.06744        DEG C
Channel 8      58.81769        DEG C
Channel 9      63.92536        DEG C
Channel 10      58.62422       DEG C
Channel 11      62.3751        DEG C
Channel 12      61.04355       DEG C
Channel 13      62.06031       DEG C
Channel 14      58.45494       DEG C
Channel 15      56.59366       DEG C
Channel 16      58.01972       DEG C
Channel 17      61.67293       DEG C
Channel 18      58.73694       DEG C
Channel 19      62.58484       DEG C
Channel 20      63.98983       DEG C
Channel 21      59.80122       DEG C
Channel 22      57.8423        DEG C
Channel 23      61.78577       DEG C
Channel 24      64.25637       DEG C
Channel 25      58.39839       DEG C


IX? 1250 IP? 15008.C? 3  20:47:29    20:50:26    243 IX 1250NYIN= 1254
********** GROUP # 1 **********
   TEMP RISE TEST NEBB SKIEN
SCAN # 29  08/01/87 ø 20:46:36    18:24:39 ø 01-08-1987
CHANNEL READINGS:      DELTASTAB= .9127731

Channel 0      23.94623        DEG C
Channel 1      60.35636        DEG C
Channel 2      64.44888        DEG C
Channel 3      58.88069        DEG C
Channel 4      57.8893         DEG C
Channel 5      62.53505        DEG C
Channel 6      61.27605        DEG C
Channel 7      57.06744        DEG C
Channel 8      58.81769        DEG C
Channel 9      63.92536        DEG C
Channel 10      58.62422       DEG C
Channel 11      62.3751        DEG C
Channel 12      61.04355       DEG C
Channel 13      62.06031       DEG C
Channel 14      58.45494       DEG C
Channel 15      56.59366       DEG C
Channel 16      58.01972       DEG C
Channel 17      61.67293       DEG C
Channel 18      58.73694       DEG C
Channel 19      62.58484       DEG C
Channel 20      63.98983       DEG C
Channel 21      59.80122       DEG C
Channel 22      57.8423        DEG C
Channel 23      61.78577       DEG C
Channel 24      64.25637       DEG C
Channel 25      58.39839       DEG C
```



A1
A2
A3
B
K
K1
M12
U
R
V
H2
40
1250 A
130
100
N1
N
S
P
Signalvender
15
31
H
H1

Annex no. 4

SATS

Scandinavian Association for Testing Switchgear

c/o EFI - Norwegian Electric Power Research Institute

Sem Sælandsv. 11 7034 Trondheim NORWAY

Telephone: + 47-7-597200 Telex: 55 513 efi n Telefax: + 47-7-597250

REPORT OF PERFORMANCE No. 96-B04

TITLE:

Dielectric tests on high-voltage switch disconnector with integrated earthing switch type NALE 24 and switch-fuse combination type NALF 24.

Trondheim 1996-01-09

Place and Date

SATS Secretariat Approval

278

SATS Scandinavian Association for Testing Switchgear

c/o EFI – The Norwegian Research Institute of Electricity Supply
Sem Sælandsv. 11 7034 Trondheim–NTH NORWAY
Tel. (07)597200 Telex 55513 efi n

REPORT OF PERFORMANCE No. 96-B04

APPARATUS: High-voltage switch disconnector with integrated earthing switch and high-voltage switch-fuse combination

DESIGNATION: NALE 24 and NALF 24

MANUFACTURER: ABB Distribusjon AS, Skien, Norway

DATE(S) OF TESTS: 3. to 6. of November 1992

RATINGS ASSIGNED BY THE MANUFACTURER

Rated 1 min. power-frequency withstand voltage; (rms value):
50 kV to earth, between poles and across open switching device
60 kV across isolating distance

Rated lightning impulse withstand voltage; (peak value):
125 kV to earth, between poles and across open switching device
145 kV across isolating distance

THE TESTS HAVE BEEN MADE IN ACCORDANCE WITH
See page no. 5.

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with test results and oscillograms.

THE DOCUMENTS FORMING PART OF THIS REPORT ARE

Table with test results	Nos.:	Page No.: 7 to 14
Oscillogram	Nos.:	Page No.: 20
Drawing	Nos.:	Page No.: 15 to 19
Diagram	Nos.:	
Photograph	Nos.:	

Skien, 4. of January 1996
Place and Date

на основание чл. 36а, ал. 3 от ЗОП

SATS Observer

на основание чл. 36а, ал. 3 от ЗОП

Laboratory manager

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- Information sheet (SATS) ..... Page No.: 2
- Contents ..... Page No.: 3 (This page)
- Preface, Chapter 1 ..... Page No.: 4
- Test object, Chapter 2 ..... Page No.: 4
- Conclusion, Chapter 3 ..... Page No.: 4
- Dielectric tests, Chapter 4 ..... Page No.: 5
- Tables with test results ..... Page No.: 7 to 14
- Drawings ..... Page No.: 15 to 19
- Oscillograms ..... Page No.: 20

1. Preface

The tests were witnessed by SATS observer, Mr. Arne Nesse, EFI (Norwegian Electric Power Research Institute).

Parts of the tests were also witnessed by:

Mr. Sten Thygesen, ABB Distribusjon, Skien, Norway

The tests have been performed at ABB Distribusjon AS, Electrotechnical and Mechanical Laboratory, Skien, Norway.

2. Test objects

- High-voltage switch disconnector type NAL 24.
- High-voltage earthing switch type E 24.
- High-voltage switch-fuse combination type NALF 24.

The high-voltage earthing switch type 24 was mounted on the lower side, (hinge side), of the high-voltage switch type NAL 24. The high-voltage earthing switch is then an integrated part of the high-voltage switch and in this combination called NALE 24.

The test objects were manufactured by ABB Distribusjon AS, Skien, Norway.

All fuses used during tests were manufactured by ABB Distribusjon AS, Skien, Norway.

3. Conclusion

The test objects passed the lighting impulse withstand voltage and the power-frequency withstand voltage tests successfully according to IEC Publication 265-1 (1983), IEC Publication 420 (1990-11), IEC Publication 60-1 (1989-11) and IEC Publication 694 (1980).

4. Dielectric tests

4.1 Test objects

- High-voltage switch disconnector (with earthing switch) type NALE 24, with type K-mechanism, serial no. 238222.
- High-voltage switch-fuse combination type NALF 24, equipped with fuses type CEF 24 kV, 40 A, serial no. 238221.

4.2 Lightning impulse withstand voltage tests

4.2.1 Publication

IEC Publication 265-1, Second edition 1983, IEC Publication 420, Second edition 1990-11, IEC Publication 60-1, Second edition 1989-11 and IEC Publication 694, First edition 1980, § 6.1.6. Lightning impulse voltage tests.

4.2.2 Test procedure

15 consecutive lightning impulses with both polarities applied on each configuration from 1 to 9, on all phases in succession.
Configuration no. is equal to test condition no. as given in table VIII,
IEC Publication 694 (1980).

4.2.3 Technical data of test equipment

Lightning impulse generator:
Voltage range: 0 - 400 kV
Max energy: 10 kJ

Wave form: 1,2/50 10^{-6} s.

4.2.4 Test result

The number of disruptive discharges on self-restoring insulation did not excees twa for each series of 15 impulses and no disruptive discharges on non-self-restoring insulation occured.
The test voltage was 125 kV to earth, between poles and across open switching device and 145 kV across isolating distance.
For detailed test results, ref. to page no. 7, 8, 9 and 11, 12 and 13.

4.3 Power frequency voltage tests

4.3.1 Publication

IEC Publication 265-1, Second edition 1983, IEC Publication 420, Second edition 1990-11, IEC Publication 60-1, Second edition 1989-11 and IEC Publication 694, First edition 1980, § 6.1.7. Power frequency voltage withstand tests.

4.3.2 Test procedure

Voltage applied on each configuration from 1 to 9, on all phases in succession.
Configuration no. is equal to test condition no. as given in table VIII,
IEC Publication 694 (1980).
Duration of each test was 1 minute.

4.3.3 Technical data of test equipment

Power frequency transformer, single phase:
Voltage range: 0 - 60 kV, 50 Hz
Output short-time: 50 kVA
Short-circuit current, load side: 1A

4.3.4 Test result

No disruptive discharges occurred, on the test.

The test voltage was 50 kV to earth, between poles and across open switching device, and 60 kV across the isolating distance.

For detailed test results, ref. to page no. 10 and 14.

SATS

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REPORT OF PERFORMANCE No. 95-B04

TITLE:

Making and breaking tests on high-voltage switch disconnector type NAL 24, according to IEC Publication 265-1 (1983), test duty no. 1 to 4

Trondheim 1996-01-02

Place and Date

на основание чл. 36а, ал. 3 от ЗОП

SATS Secretariat Approval

SATS Scandinavian Association for Testing Switchgear

c/o EFI – The Norwegian Research Institute of Electricity Supply
Sem Sælandsv. 11 7034 Trondheim-NTH NORWAY
Tel. (07)597200 Telex 55513 efi n

REPORT OF PERFORMANCE No. 95-B04

APPARATUS: High-voltage switch disconnector
DESIGNATION: NAL 24
MANUFACTURER: ABB Distribusjon AS, Skien, Norway
DATE(S) OF TESTS: 1. to 8. of June 1995

RATINGS ASSIGNED BY THE MANUFACTURER

See page no. 3 and 4

THE TESTS HAVE BEEN MADE IN ACCORDANCE WITH IEC Publication 265-1, Second edition 1983, § 6.101. Making and breaking tests, test duty no. 1 to 4.

The performance of the apparatus tested and the observations made during the tests have been recorded in the tables with test results and oscillograms.

THE DOCUMENTS FORMING PART OF THIS REPORT ARE

Table with test results	Nos.:	Page No.: 15 to 22
Oscillogram	Nos.:	Page No.: 23 to 65
Drawing	Nos.:	Page No.: 9 to 11
Diagram	Nos.:	Page No.: 13 and 14
Photograph	Nos.:	Page No.: 66

Skien, 12. of December 1995

Place and Date

на основание чл. 36а, ал. 3 от ЗОП

SATS Observer

на основание чл. 36а, ал. 3 от ЗОП

Laboratory manager

Report No.: 95-B04 Page No.: 3

Technical Data of Switching Device assigned by the manufacturer

Switching device: High-voltage switch disconnector
Type: NAL 24 (Part of NALE 24)
Serial No.: N 267232
Drawing No.: NHP 343378 and NHP 303722 Year of manufacture: 1995

Rated voltage:	24	kV
Rated lightning impulse withst. volt. to earth:	125	kV
Rated frequency:	50	Hz
Rated normal current:	630	A
Rated short circuit breaking current:	N/A	kA
D. C. component:	N/A	%
Peak value of Transient Recovery Voltage:	41	kV
Rate of rise of Transient Recovery Voltage:	0,47	kV/us
Rated short circuit making current:	50	kA
Rated operating sequence:	2 x C	
Rated peak withstand current:	50	kA
Rated short time withstand current:	2,0 s 20 1)	kA
Number of poles:	3	
Number of units per pole:	1	
Arc extinguishing medium:	Air	
Mechanism:	2)	
Release:	None	

Remarks:

1) 16 kA with a duration of 3,0 sec.
2) Independent manually spring operated mechanism type K.

Report No.: 95-B04 Page No.: 4

Technical Data of Switching Device assigned by the manufacturer

Switching device: High-voltage earthing switch
Type: E 24 (Part of NALE 24)
Serial No.: N 267232
Drawing No.: NHP 343602 Year of manufacture: 1995

Rated voltage:	24	kV
Rated lightning impulse withst. volt. to earth:	125	kV
Rated frequency:	50	Hz
Rated normal current:	N/A	A
Rated short circuit breaking current:	N/A	kA
D. C. component:	N/A	%
Peak value of Transient Recovery Voltage:	N/A	kV
Rate of rise of Transient Recovery Voltage:	N/A	kV/us
Rated short circuit making current:	50	kA
Rated operating sequence:	2 x C	
Rated peak withstand current:	50 1)	kA
Rated short time withstand current:	2 s 20 2)3)	kA
Number of poles:	3	
Number of units per pole:	1	
Arc extinguishing medium:	N/A	
Mechanism:	4)	
Release:	N/A	

Remarks:

1) 40 kA when fed through the switch disconnector
2) 16 kA with a duration of 3,0 sec.
3) 20 kA is not valid when fed through the switch disconnector.
4) Independent manually spring operated.

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- Technical Data of Switching Device ..... Page No.: 3 and 4
- Contents ..... Page No.: 5 (This page)
- Preface, Chapter 1 ..... Page No.: 6
- Test object, Chapter 2 ..... Page No.: 6
- Publication, Chapter 3 ..... Page No.: 6
- Test procedure, Chapter 4 ..... Page No.: 6
- Test results, Chapter 5 ..... Page No.: 8
- Drawings ..... Page No.: 9 to 11
- Technical Data of Test Circuits ..... Page No.: 12
- Circuit diagrams ..... Page No.: 13 and 14
- Tables with test results (values recorded) ..... Page No.: 15 to 22
- Oscillograms ..... Page No.: 23 to 65
- Photo ..... Page No.: 66

1. Preface

The tests were witnessed by SATS observer, Mr. Arne Nesse, EFI (Norwegian Electric Power Research Institute).

Parts of the tests were also witnessed by:

Mr. Sten Thygesen, ABB Distribusjon AS, Skien, Norway

The tests have been performed at NEFI High Power Laboratory, Skien, Norway. The scale of the drawings is changed by the test laboratory.

2. Test object

The test object was a high-voltage switch disconnector type NAL 24.

A high-voltage earthing switch type E 24 was mounted on the lower side, (hinge side), of the high-voltage switch type NAL 24. The high-voltage earthing switch is then an integrated part of the high-voltage switch and in this combination called NALE 24.

The test object was manufactured by ABB Distribusjon AS, Skien, Norway and marked with serial no. N 267232.

3. Publication

IEC Publication 265-1, Second edition 1983, § 6.101. Making and breaking tests, test duty no. 1 to 4.

4. Test procedure

The high-voltage switch disconnector type NAL 24 was freely mounted on a steel rack in vertical position. See photo on page no. 66. The spring operated mechanism was remotely operated by means of a pneumatic device.
The connections were made by means of XLPE 25 mm² Cu high-voltage cables.
Half of the operations were carried out with the supply circuit connected to the upper terminals and the other half of the operations were carried out with the supply circuit connected to the lower terminals for each test duty.

The trace marked «move» on the oscillograms was recorded from a potmeter connected to the rotating centre bolt of the main contact knife in phase R of the switch. The trace was used to control the condition of the switch during the tests, and to determine the contact separation in order to calculate the arcing times.

Prior to the tests the prospective transient recovery voltage was measured according to IEC Publication 265-1, § 6.101.8, rec. no. 18871, page no. 23.
See technical data of the test circuits on page no. 12.

4.1 No load tests

The close- and opening speeds were calculated from no load tests, rec.no. 34274 and 34275.

4.2 Resistance measurement

The resistance between the terminals of the switch disconnector in each phase was measured with 100 A DC.

4.3 Test duty no. 1

110 closing/opening operations, rec.no. 34276 to 34385, were performed with a rated current of 630 A.

4.4. Test duty no. 2.

This test is included in test duty 1. The impedance of the supply circuit was raised to 20 % of the total impedance of the test circuit.

4.5 Test duty no. 3.

20 closing/opening operations, rec.no. 34386 to 34405, were carried out with 5 % of the rated mainly active load breaking current.

4.6 Test duty no. 4.

20 closing/opening operations, rec.no. 34406 to 34425, were carried out with the rated line and cable charging breaking current of 45 A.

4.7 No load tests

The close- and opening speeds were calculated from no load tests, rec.no.34426 and 34427.

4.8 Resistance measurement

The resistance between the terminals of the switch disconnector in each phase was measured with 100 A DC.

All the tests during test duty 1 - 4 were carried out on the same apparatus without maintaince with a rated voltage of 24 kV.

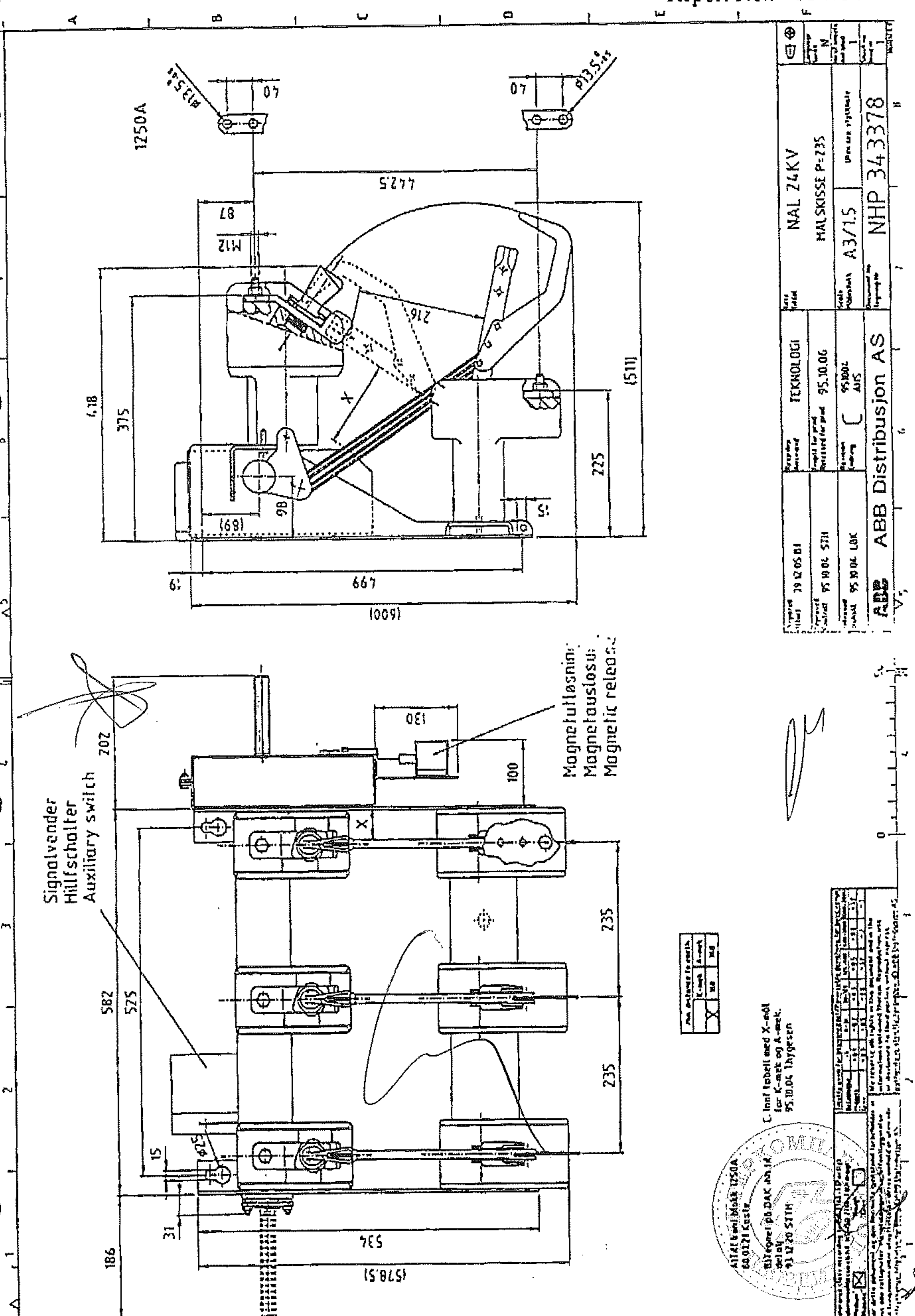
5. Test result

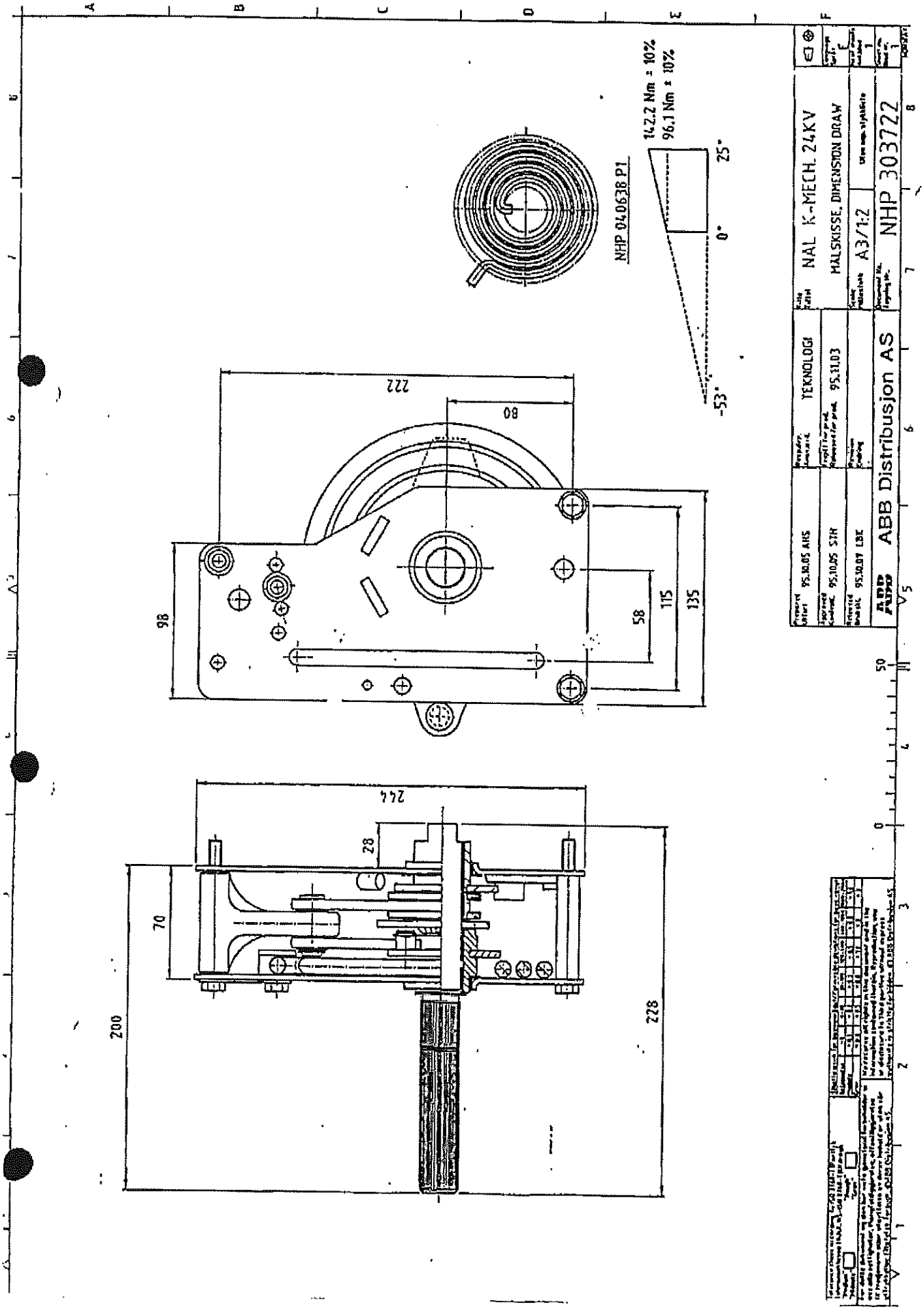
The test object passed the tests successfully and fulfilled the requirements in IEC Publication 265-1 for the test duties no.1, 2 and 3.

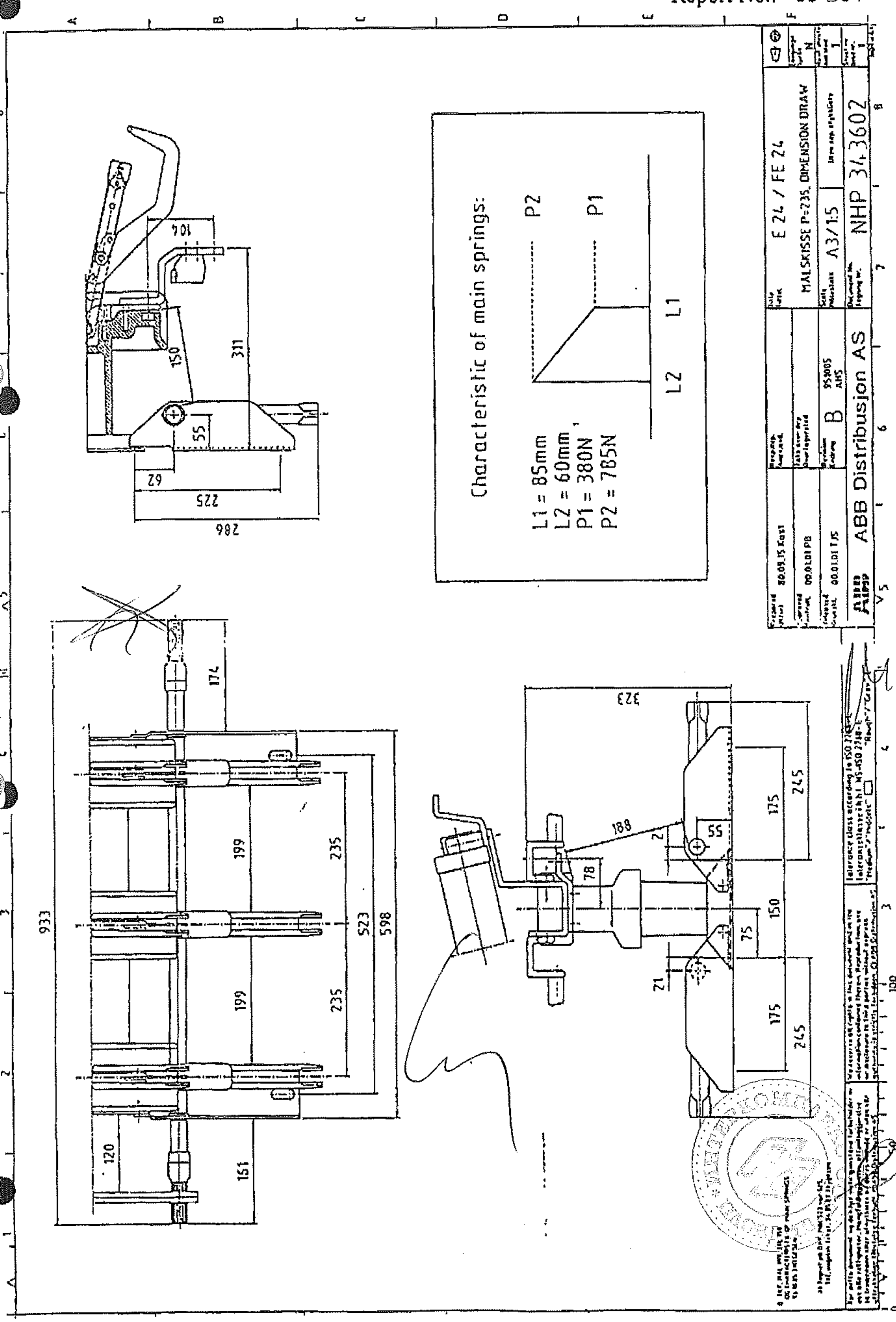
The test object in test duty no. 4 fulfilled the requirements in IEC Publication 56, table IX, column A (unloaded lines and cables) as the overvoltages to earth produced during the breaking operations were lower than 74 kV.

The overvoltages produced during the breaking operations are listed in a table on page no. 22.

After the tests the contacts were visually inspected and found to be in good condition.


1250A
NAL 24KV
MÅLSKISSE P-235
A3/1:5
NHP 343378
ABB Distribusjon AS
TEKNOLOGI
Magnetutløsning
Magnetauslösung
Magnetic release
Signalvender
Hilfschalter
Auxiliary switch
442,5
667
(600)
418
375
225
235
235
582
525
534
(578,5)
186
130
100
202


142.2 Nm ± 10%
96.1 Nm ± 10%
25°
0°
-53°
NHP 04.0638 P1
222
80
98
58
115
135
244
28
70
200
228
NAL K-MECH. 24KV
MÅLSKISSE, DIMENSJON DRAW
A3/1:2
NHP 303722
ABB Distribusjon AS
TEKNOLOGI
95.10.05 AHS
95.10.05 STR
95.10.07 LBE
95.11.03


Characteristic of main springs:
P2
P1
L1
L2
L1 = 85mm
L2 = 60mm
P1 = 380N
P2 = 785N
E 24 / FE 24
MALSKISSE P=235, DIMENSION DRAW
A3/1:5
NHP 343602
ABB Distribusjon AS
933
523
598
199
235
174
151
120
323
245
175
150
188
78
75
55
311
150
104
62
225
286

Report No.: 95-B04 Page No.: 12

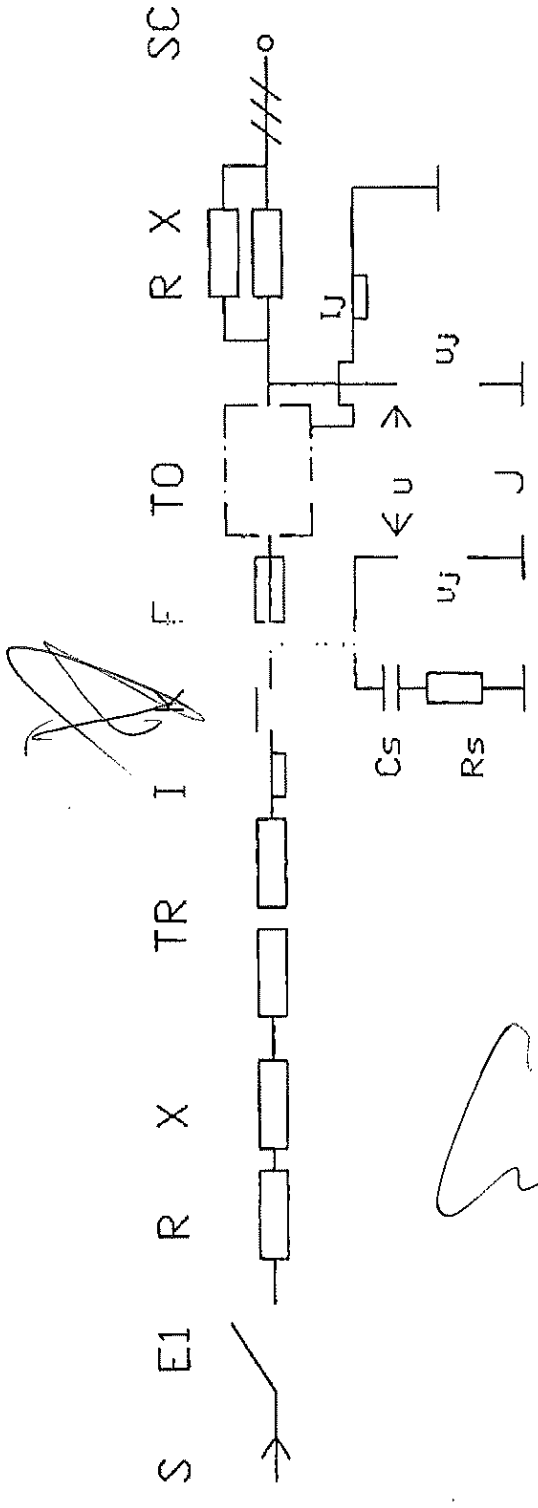
Technical Data of Test Circuit

Test Number	1 - 110	111 - 130	131 - 150	
Record Number	34276-34385	34386-34405	34406-34425	
Number of phases (test circuit)	3	3	3	
Operating frequency (Hz)	50	50	50	
Power factor source side	0.1	0.1	0.1	
Power factor load side	0.7	0.7	0.067 1)	
Load before test object (% of total)	20	2)	2)	
Transformer connection symbol	Dyn	Dyn	Dyn	
Transformer star point	Earthed	Earthed	Earthed	
Short circuit point	Isolated	Isolated	Isolated	
TRV Source side Uc/t3 (kV/uS)	44/86.6	44/86.6	44/86.6	
TRV Load side Uc/t3 (kV/uS)				
Res. frequency load side (kHz)				
Damping factor (j)				
Circuit diagram (Page No.)	13	13	14	
Transformer ratio	17/24 kV	17/24 kV	17/24 kV	
Test duty no.:	1 - 2	3	4	

Remarks:

1) Capacitive load
2) The same supply circuit as for TD 1 - 2.

Make / Break test, IEC 265-1, Test duty 1-3

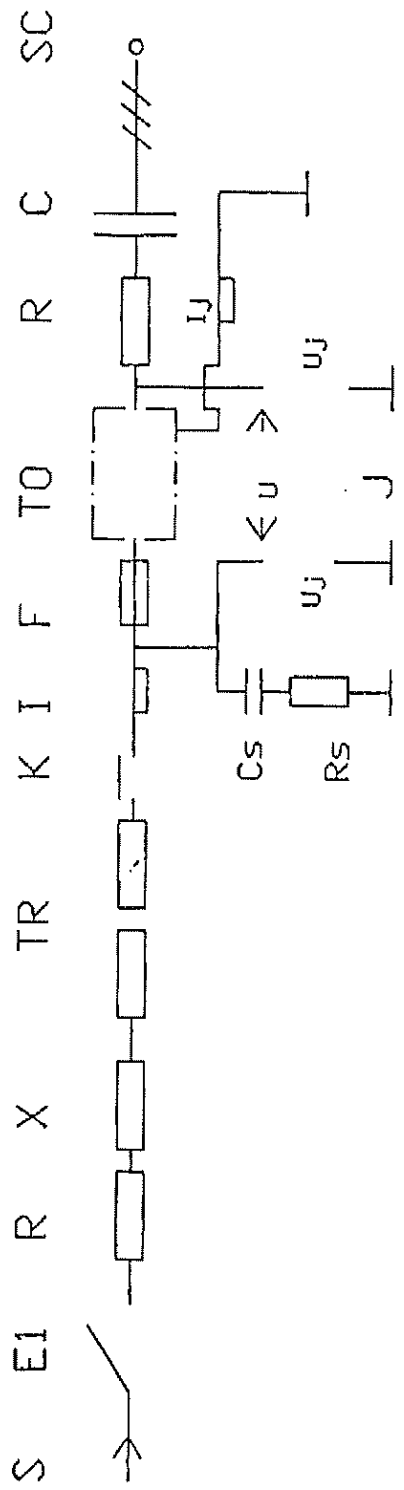


S = 17 kV supply voltage
E1= Safety switch
R = Resistance
X = Reactance
TR= Transformer
I = Current measuring
Ij= Current meas. to earth (option)
U = Phase voltage
Uj= Voltage measuring

K = Making switch
TO= Test object
SC= Short circuit point
J = Earth connection
F = Protection fuses
Cs/Rs= Resonance freq. adj.

FILE: IEC265TDI

Make / Break test, IEC 265-1, Test duty 4



S = 17 kV supply voltage
E1= Safety switch
R = Resistance
X = Reactance
TR= Transformer
I = Current measuring
Ij= Current meas. to earth (option)
U = Phase voltage
Uj= Voltage measuring
C = Capacitive load

K = Making switch
TO= Test object
SC= Short circuit point
J = Earth connection
F = Protection fuses
Cs/Rs= Resonance freq. adj.

FILE:CAPLOAD

NOLOAD

Performance under No-Load condition

Values recorded

Type of apparatus: High-voltage switch disconnector type NAL 24, serial no. N 267232

Travel recorder: Rotating potmeter linear to the rotation of the centre bolt of the main contact knife in phase R

Closing device: By means of a pneumatic device

Opening device: By means of a pneumatic device

Total travel closing contacts: 255 mm length of main contact knives, 334 mm circle sector. (75 deg.)

Total travel opening contacts: 310 mm length of aux. contact knives, 406 mm circle sector. (75 deg.)

Test Number			4.1	4.1	4.2		4.7	4.7	4.8
Oscillogram, Record Number			34274	34275	None		34426	34427	None
Operation			C	O	None		C	O	None
Time from current initiation closing coil to contact touch			-	-			-	-	
Time from current initiation opening coil to contact sep.			-	-			-	-	
Travel after contact touch (Last phase to touch)			31.9 mm	-			75.5 mm	-	
Travel to contact separation (First phase to separate)			-	79.9 mm			-	73.8 mm	
Speed Measuring	Closing	Closing speed	6.7 m/s	-			7.7 m/s	-	
		First cursor reference (before contact touch)	13.4 mm	-			13.4 mm	-	
		Last cursor reference (after first cursor ref.)	6 ms	-			6.1 ms	-	
	Opening	Opening speed	-	5.1 m/s			-	5.4 m/s	
		First cursor (after contact sep.)	-	0 ms			-	0 ms	
		Last cursor reference (after first cursor ref.)	-	15.2 ms			-	15.1 ms	
Resistance measurement between terminals of each phase with 100 A DC (uohm)					R: 96.3 S: 94.4 T: 89.2				R: 85.3 S: 101.1 T: 95.2
Ambient temperature			23.5 deg. C	23.5 deg. C	23.5 deg. C		23.5 deg. C	23.5 deg. C	23.5 deg. C
Signature			TB	TB	TB		BKA	BKA	BKA
Date			01.06.95	01.06.95	01.06.95		08.06.95	08.06.95	08.06.95

Remarks: Test no. 4.1 and 4.2 are performed before the 150 c/o operations.
Test no. 4.7 and 4.8 are performed after the 150 c/o operations.

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Test no. 4.3 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 22 / 24 Deg.C.
Test date: 06.06.95.
Signature: BKA

Test requirement: IEC 265-1 TD 1-2

Type of test circuit:

Operating sequence: 110 c/o

Connections to apparatus tested:
Supply from the upper side

Condition og apparatus before test: New and clean

Test-No.		TRV	1	11	21	31	41	51	55				
Oscillogram No.		18871	34276	34286	34296	34306	34316	34326	34330				
Operation			c/o	c/o	c/o	c/o	c/o	c/o	c/o				
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R		659						659				
	A S		664						661				
	T		668						668				
	Average		664						663				
Recovery voltage	R		24.2						24.1				
	kV S		24.2						24.1				
	T		24.3						24.3				
	Average between phases		24.2						24.2				
Closing-/Opening time	ms												
Arcing time	R		7.0	11.5	13.0	11.5	13.0	5.5	11.5				
	ms S		7.0	11.5	8.0	16.5	8.0	10.5	6.5				
	T		2.0	6.5	13.0	16.5	13.0	10.5	11.5				

Remarks: The scale of trace "Move" is valid for the breaking operations only.

Condition of apparatus after Test:

Cont. next page

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Test no. 4.3 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 22 / 24 Deg. C
Test date: 06.06. / 07.06.95.
Signature: BKA

Test requirement: Cont.from the previous page

Type of test circuit:

Operating sequence:

Connections to apparatus tested:
Supply from the lower side

Condition og apparatus before test:

Test-No.		56	61	71	81	91	101	110					
Oscillogram No.		34331	34336	34346	34356	34366	34376	34385					
Operation		c/o	c/o	c/o	c/o	c/o	c/o	c/o					
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R	657						656					
	S	663						662					
	T	669						666					
	Average	663						661					
Recovery voltage	R	24.1						24.3					
	kV S	24.1						24.2					
	T	24.3						24.3					
	Average between phases	24.2						24.3					
Closing-/Opening time	ms												
	R	9.5	1.5	12.5	1.5	8.0	19.0	12.0					
Arcing time	ms S	14.5	6.5	17.5	6.5	3.0	14.0	12.0					
	T	14.5	6.5	17.5	6.5	8.0	19.0	7.0					

Remarks: The scale of trace "Move" is valid for the breaking operations only.

Condition of apparatus after Test:

P. O. Box 108, Sentrum, 3701 SKIEN | Stulenvegen 71, 3721 SKIEN, Norway - Tel.: +47 35590338 - Fax.: +47 35590615

Test no. 4.4 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 24 Deg. C
Test date: 07.06.95.
Signature: BKA

Test requirement: IEC 265-1 TD 3

Type of test circuit:

Operating sequence: 20 c/o

Connections to apparatus tested: Supply from the upper side

Condition og apparatus before test: Pretested during TD 1-2

Test-No.		111		120										
Oscillogram No.		34386		34395										
Operation		c/o		c/o										
Voltage before test	kV													
Making current (Max. value)	A													
Breaking current	R	33.3		33.2										
	A S	33.4		33.3										
	T	33.9		33.8										
	Average	33.5		33.4										
Recovery voltage	R	24.3		24.3										
	kV S	24.2		24.2										
	T	24.3		24.3										
	Average between phases	24.3		24.3										
Closing-/Opening time	ms													
Arcing time	R	1.0		7.5										
	ms S	6.0		3.5										
	T	6.0		7.5										

Remarks: The scale of trace "Move" is valid for the breaking operations only.

Condition of apparatus after Test:

Cont. next page

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Test no. 4.4 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 24 Deg. C
Tost date: 07.06.95.
Signature: BKA

Test requirement: Cont. from the previous page

Type of test circuit:

Operating sequence:

Connections to apparatus tested:

Condition og apparatus before test:

Supply from the lower side

Test-No.		121		130									
Oscillogram No.		34396		34405									
Operation		c/o		c/o									
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R	33.3		33.2									
	S	33.3		33.3									
	T	33.9		33.8									
	Average	33.5		33.4									
Recovery voltage	R	24.2		24.2									
	kV S	24.2		24.2									
	T	24.3		24.3									
	Average between phases	24.2		24.2									
Closing-/Opening time	ms												
Arcing time	R	7.0		5.0									
	ms S	2.5		0.0									
	T	7.0		5.0									

Remarks: The scale of trace "Move" is valid for the breaking operations only.

Condition of apparatus after Test:

P. O. Box 108, Sentrum, 3701 SKIEN | Stulenvegen 71, 3721 SKIEN, Norway - Tel.: +47 35590338 - Fax.: +47 35590615

Test no. 4.5 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 23.5 Deg. C
Test date: 07.06.95.
Signature: BKA

Test requirement: IEC 265-1 TD 4

Type of test circuit:

Operating sequence: 20 c/o

Connections to apparatus tested:

Condition og apparatus before test: Pretested during TD 1-3

Supply from the upper side

Test-No.		131	132	133	134	135	136	137	138	139	140		
Oscillogram No.		34406	34407	34408	34409	34410	34411	34412	34413	34414	34415		
Operation		c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o		
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R	45.5									45.6		
	A S	45.5									45.4		
	T	45.7									45.7		
	Average	45.6									45.6		
Recovery voltage	R	24.4									24.2		
	kV S	24.3									24.2		
	T	24.3									24.4		
	Average between phases	24.3									24.3		
Closing-/Opening time	ms												
Arcing time	R	0.0									5.0		
	ms S	4.5									5.0		
	T	4.5									0.5		

Remarks: The scale of trace "Move" is valid for the breaking operations only.

Condition of apparatus after Test:

Cont. next page

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Test no. 4.5 Testing of Making- and Breaking-Capacity

Values recorded

Ambient temperature: 23.5 Deg. C
Test date: 08.06.95.
Signature: BKA

Test requirement: Cont. from the previous page

Type of test circuit:

Operating sequence:

Connections to apparatus tested: Supply from the lower side

Condition og apparatus before test:

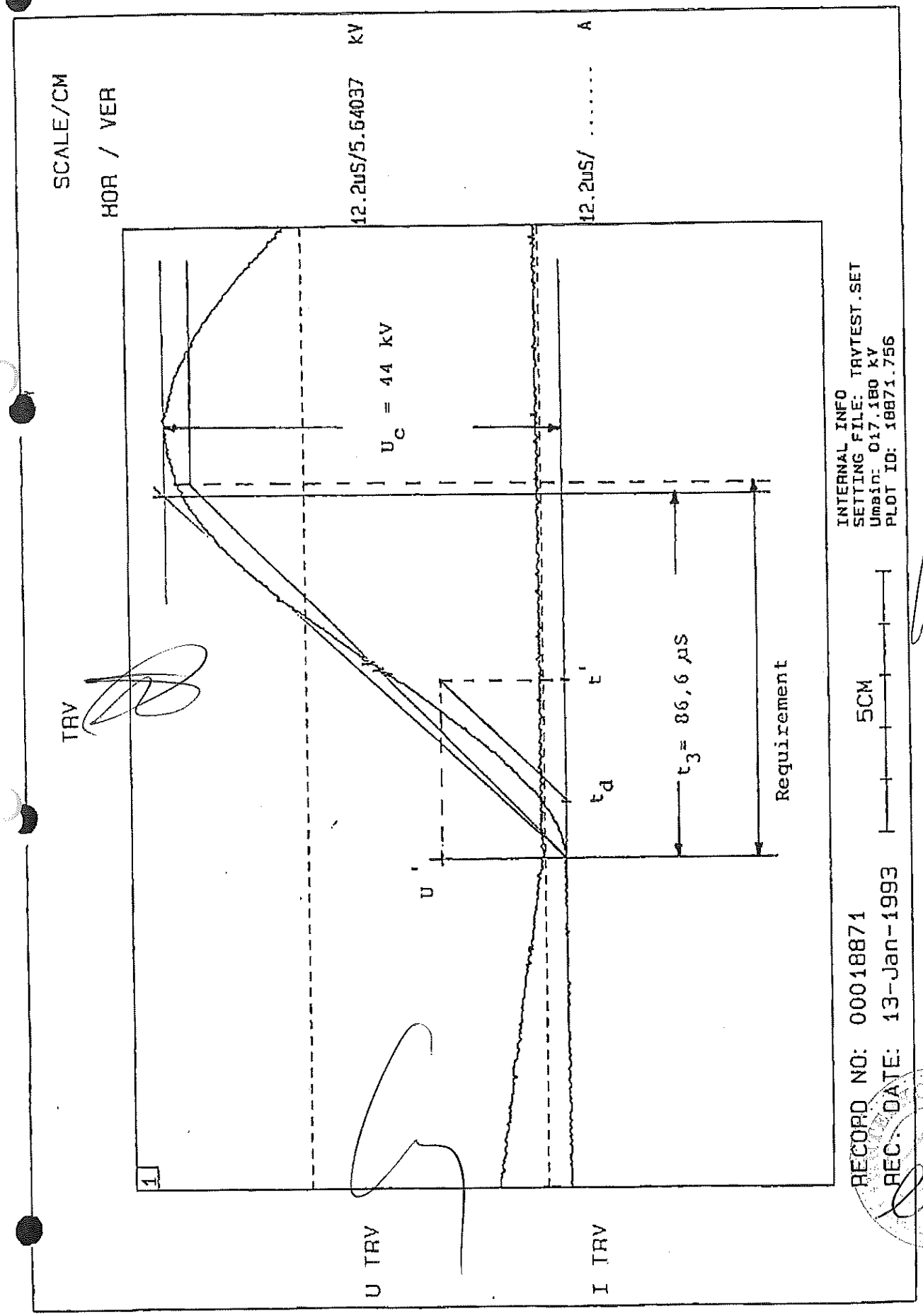
Test-No.		141	142	143	144	145	146	147	148	149	150		
Oscillogram No.		34416	34417	34418	34419	34420	34421	34422	34423	34424	34425		
Operation		c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o	c/o		
Voltage before test	kV												
Making current (Max. value)	A												
Breaking current	R	45.5									45.3		
	S	45.4									45.3		
	T	45.6									45.5		
	Average	45.5									45.4		
Recovery voltage	R	24.2									24.2		
	kV S	24.2									24.1		
	T	24.3									24.3		
	Average between phases	24.2									24.2		
Closing-/Opening time	ms												
Arcing time	R	0.5									0.5		
	ms S	5.0									5.0		
	T	5.0									5.0		

Remarks: The scale of trace "Move" is valid for the breaking operations only.

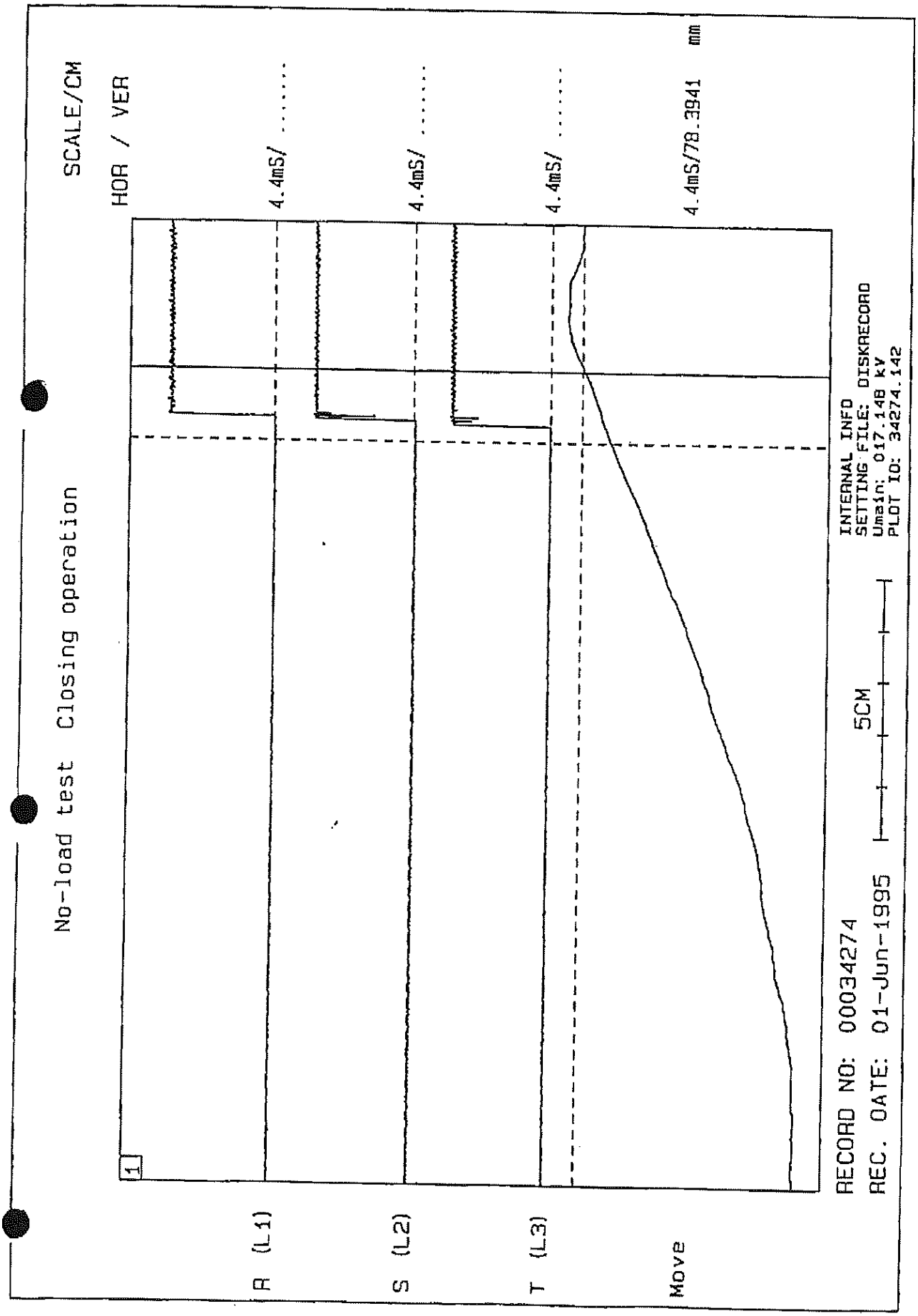
Condition of apparatus after Test: See page no. 8.

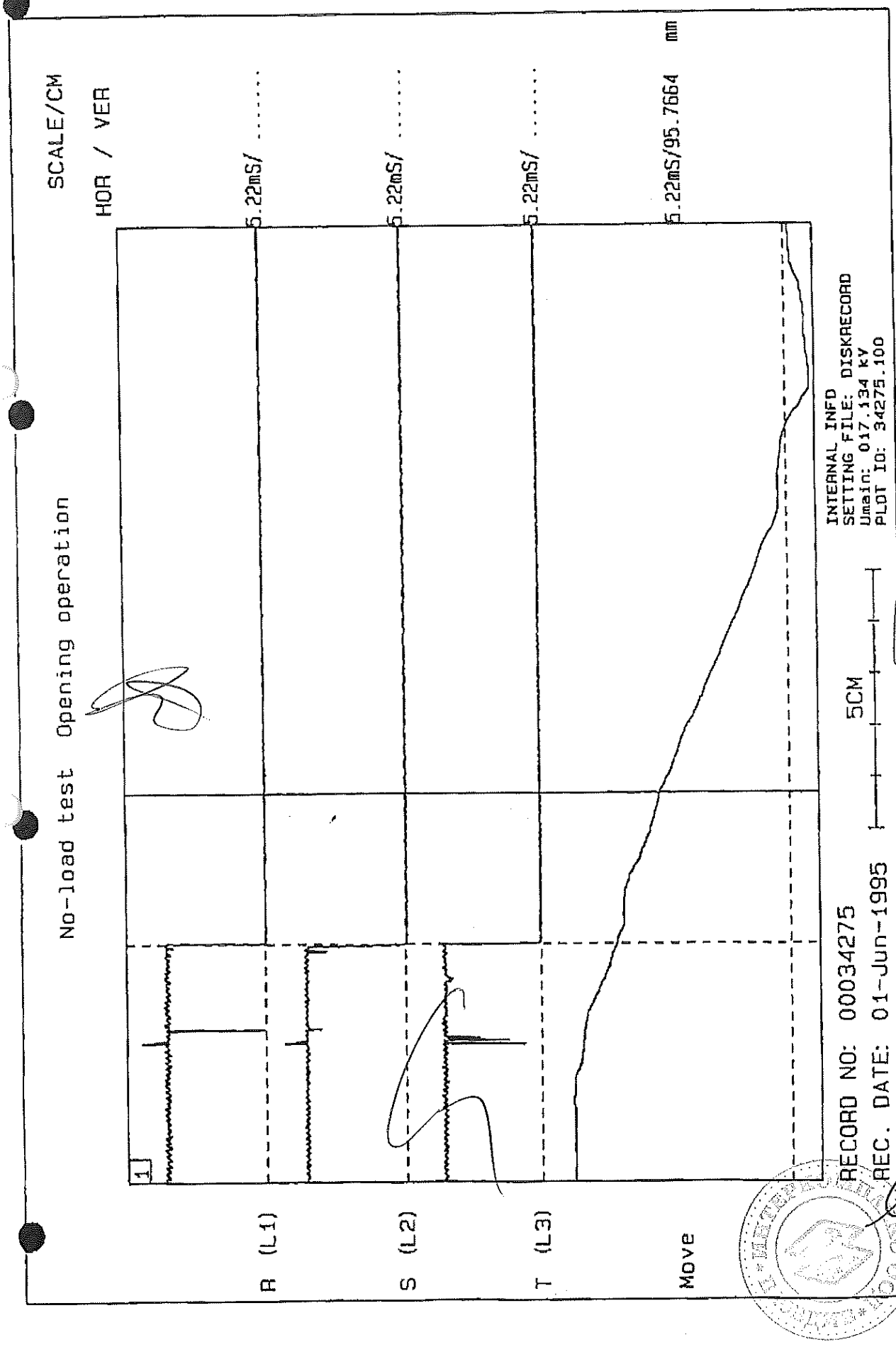
Switching overvoltages to earth - Breaking operation
IEC 265-1 TD4

Rec.no.	Ur supply	Ur load	Us supply	Us load	Ut supply	Ut load
34406	< 20	30.6	32.3	< 20	37.2	52.5
34407	22.4	22.4	26.8	27.4	< 20	27.9
34408	35.6	45.4	< 20	29.5	24.6	30.6
34409	< 20	25.2	< 20	29.5	< 20	< 20
34410	26.3	25.7	21.9	53.6	21.9	29.0
34411	< 20	30.1	< 20	< 20	< 20	26.3
34412	21.9	21.3	26.8	27.4	< 20	29.5
34413	27.4	27.4	< 20	29.0	23.5	22.4
34414	< 20	29.5	< 20	< 20	< 20	25.2
34415	21.9	22.4	26.8	27.4	< 20	28.4
34416	< 20	30.1	< 20	< 20	< 20	25.7
34417	21.9	21.3	26.8	27.4	< 20	29.0
34418	< 20	29.0	< 20	< 20	< 20	25.2
34419	< 20	29.5	30.6	< 20	36.6	47.6
34420	< 20	25.7	< 20	29.5	< 20	< 20
34421	24.1	24.6	28.4	51.4	< 20	29.0
34422	< 20	25.2	< 20	29.5	< 20	< 20
34423	< 20	29.5	< 20	< 20	< 20	25.7
34424	< 20	24.6	< 20	29.0	< 20	< 20
34425	< 20	29.0	31.2	< 20	38.3	49.2

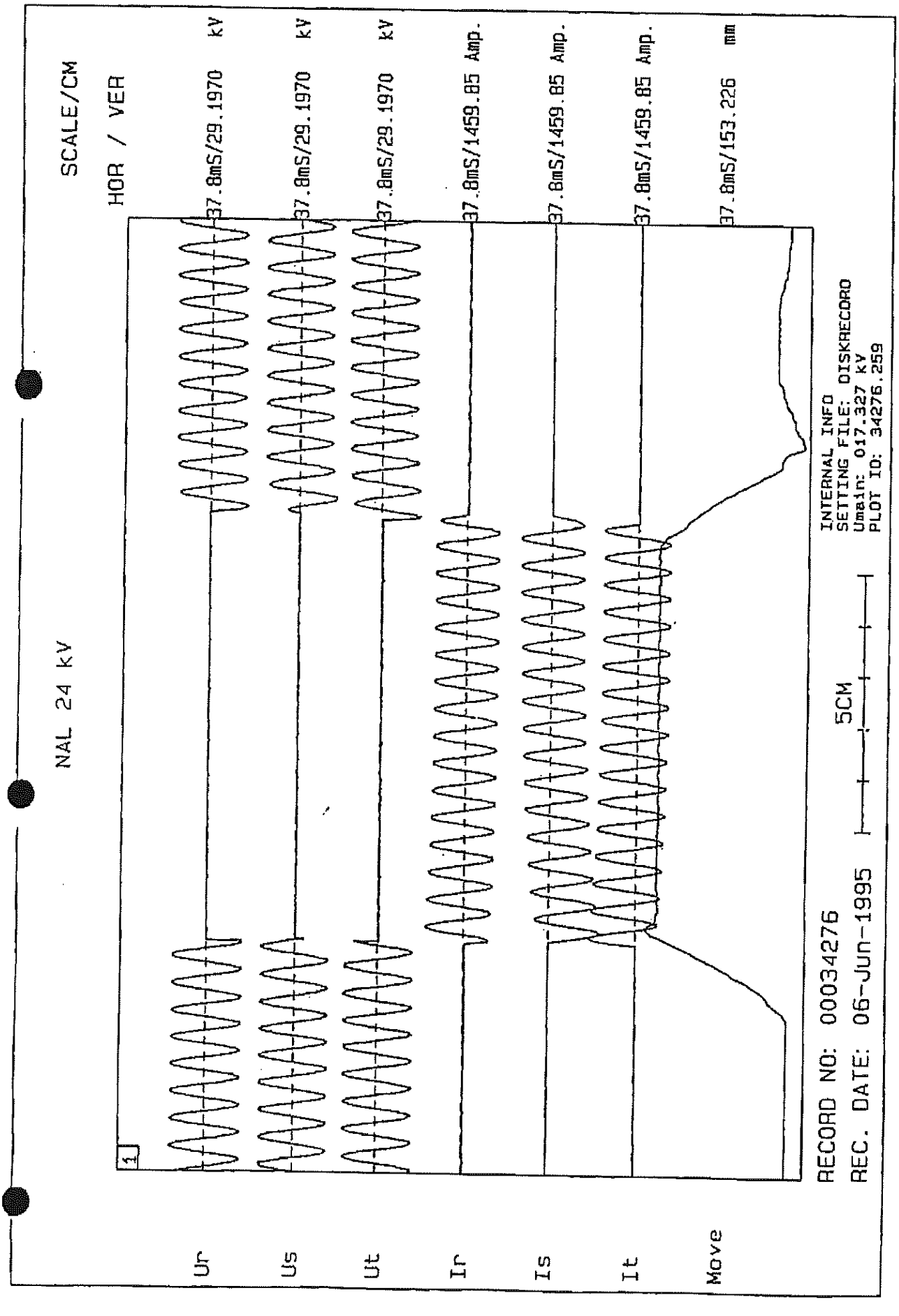

SCALE/CM
HOR / VER
12.2uS/5.64037 kV
12.2uS/ ..... A
U_c = 44 kV
t_3= 86,6 µS
t_d
t'
U'
Requirement
TRV
5CM
INTERNAL INFO
SETTING FILE: TRVTEST.SET
Umain: 017.180 kV
PLOT ID: 18871.756
RECORD NO: 00018871
REC. DATE: 13-Jan-1993
U TRV
I TRV
1

292


No-load test Closing operation
SCALE/CM
HOR / VER
4.4mS/ .....
4.4mS/ .....
4.4mS/ .....
4.4mS/78.3941 mm
1
R (L1)
S (L2)
T (L3)
Move
5CM
RECORD NO: 00034274
REC. DATE: 01-Jun-1995
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.148 kV
PLOT ID: 34274.142


No-load test Opening operation
SCALE/CM
HOR / VER
5.22mS/ .....
5.22mS/ .....
5.22mS/ .....
5.22mS/95.7664 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.134 kV
PLOT ID: 34275.100
5CM
RECORD NO: 00034275
REC. DATE: 01-Jun-1995
R (L1)
S (L2)
T (L3)
Move
1

293


SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.327 kV
PLOT ID: 34276.259
5CM
RECORD NO: 00034276
REC. DATE: 06-Jun-1995
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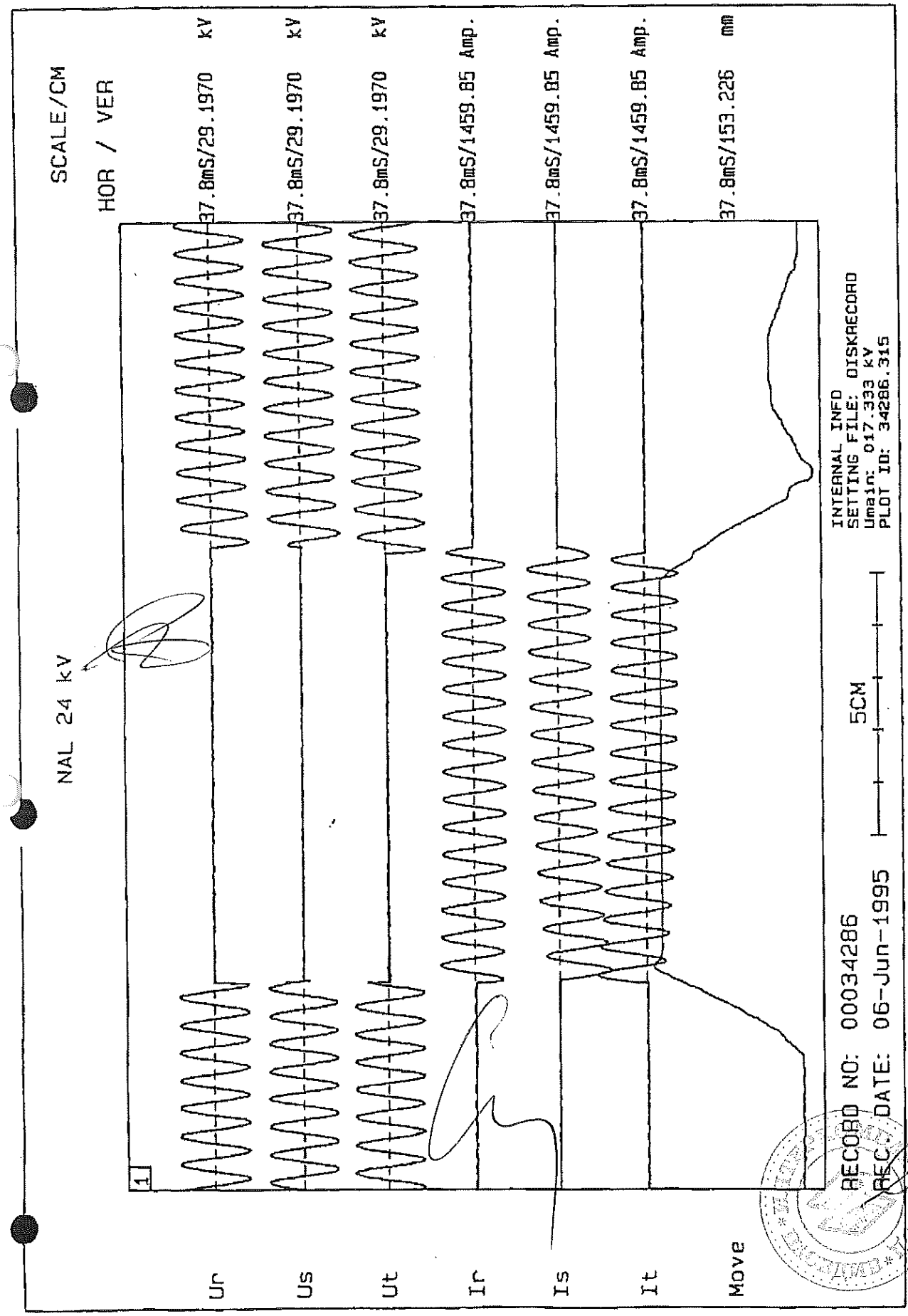
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.333 kV
PLOT ID: 34286.315
5CM
RECORD NO: 00034286
REC. DATE: 06-Jun-1995
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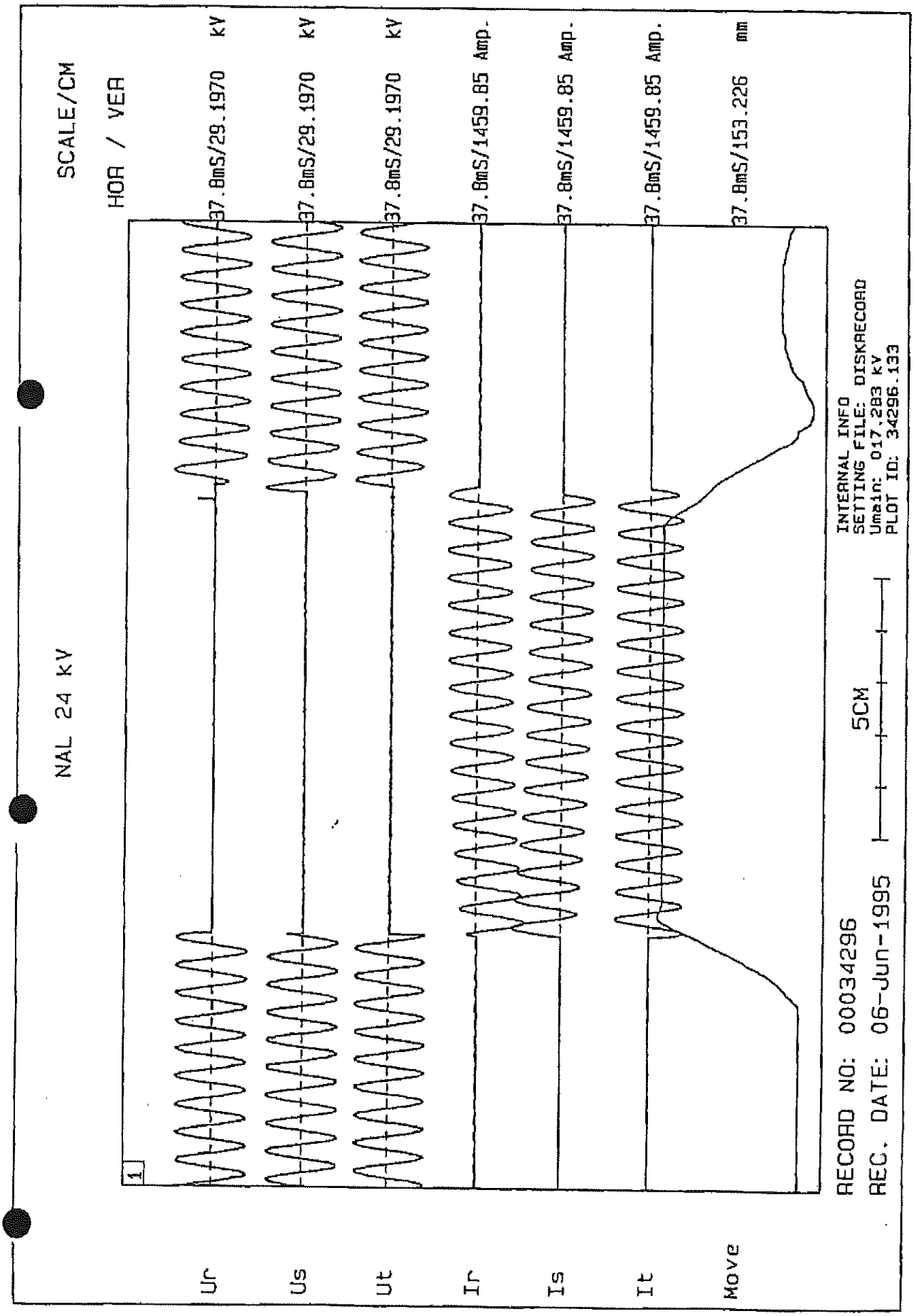
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
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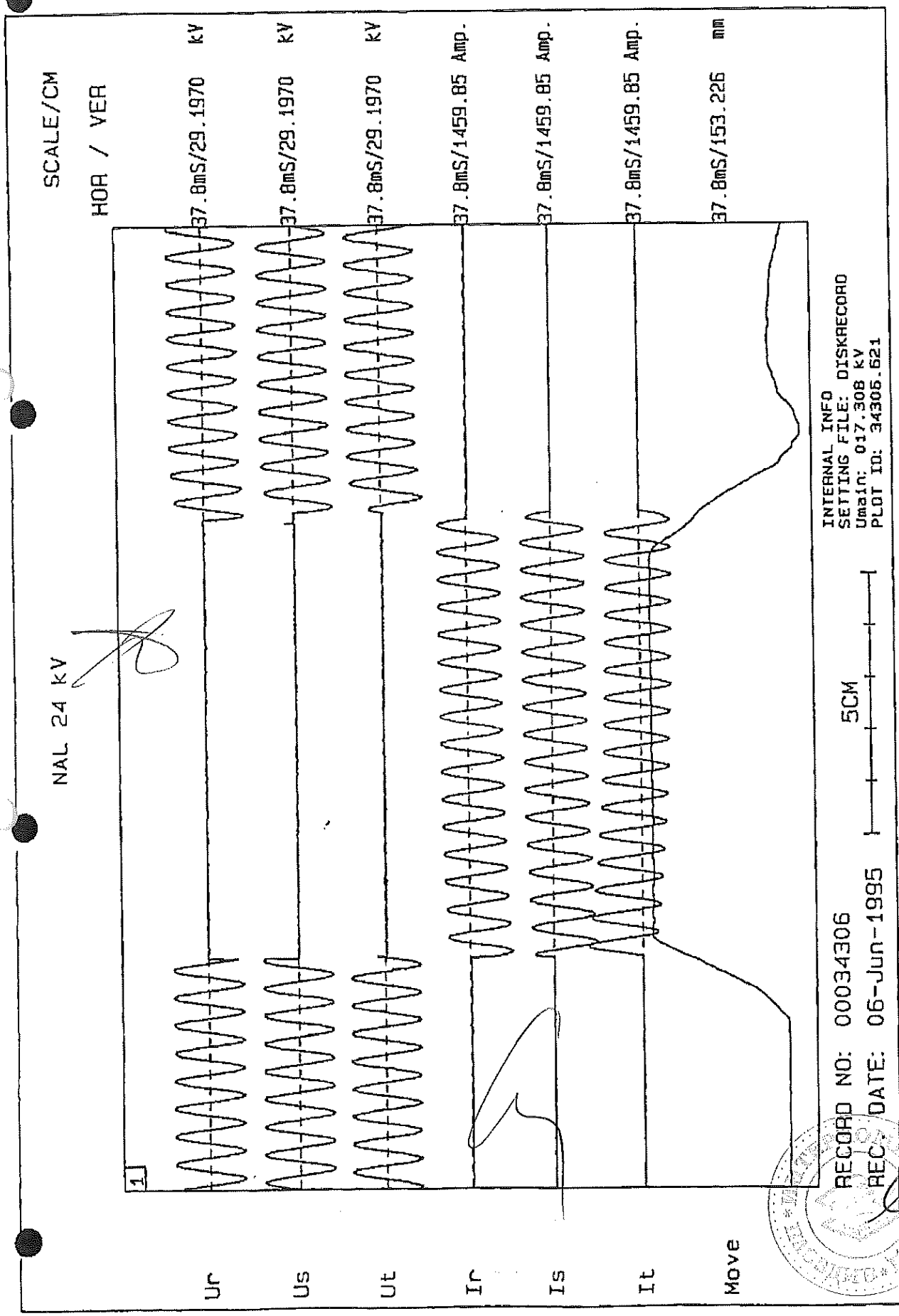
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.283 kV
PLOT ID: 34296.133
RECORD NO: 00034296
REC. DATE: 06-Jun-1995


SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.308 kV
PLOT ID: 34306.621
5CM
RECORD NO: 00034306
REC. DATE: 06-Jun-1995
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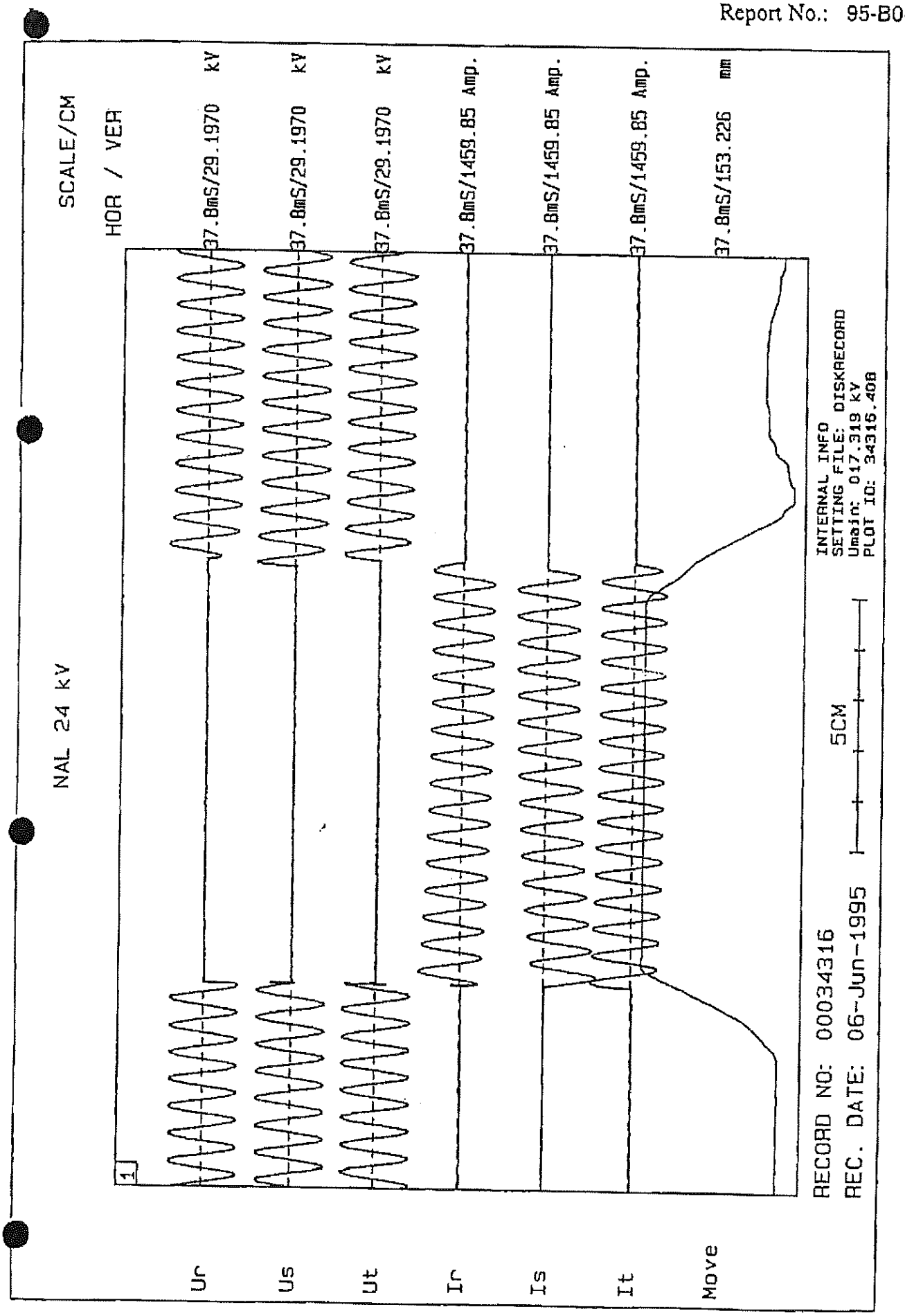
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
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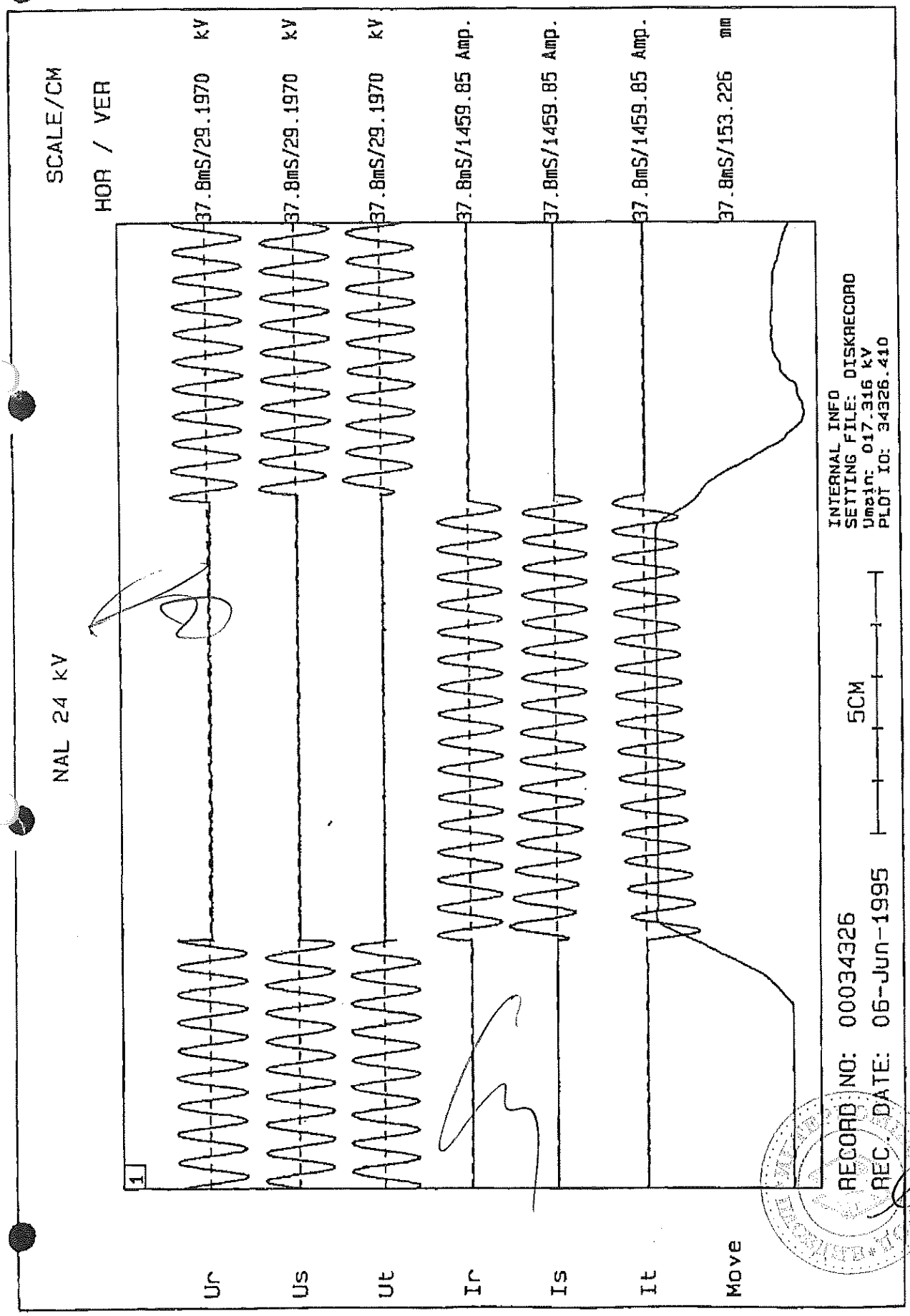
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.319 kV
PLOT ID: 34316.408
RECORD NO: 00034316
REC. DATE: 06-Jun-1995


SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.316 kV
PLOT IO: 34326.410
5CM
RECORD NO: 00034326
REC. DATE: 06-Jun-1995
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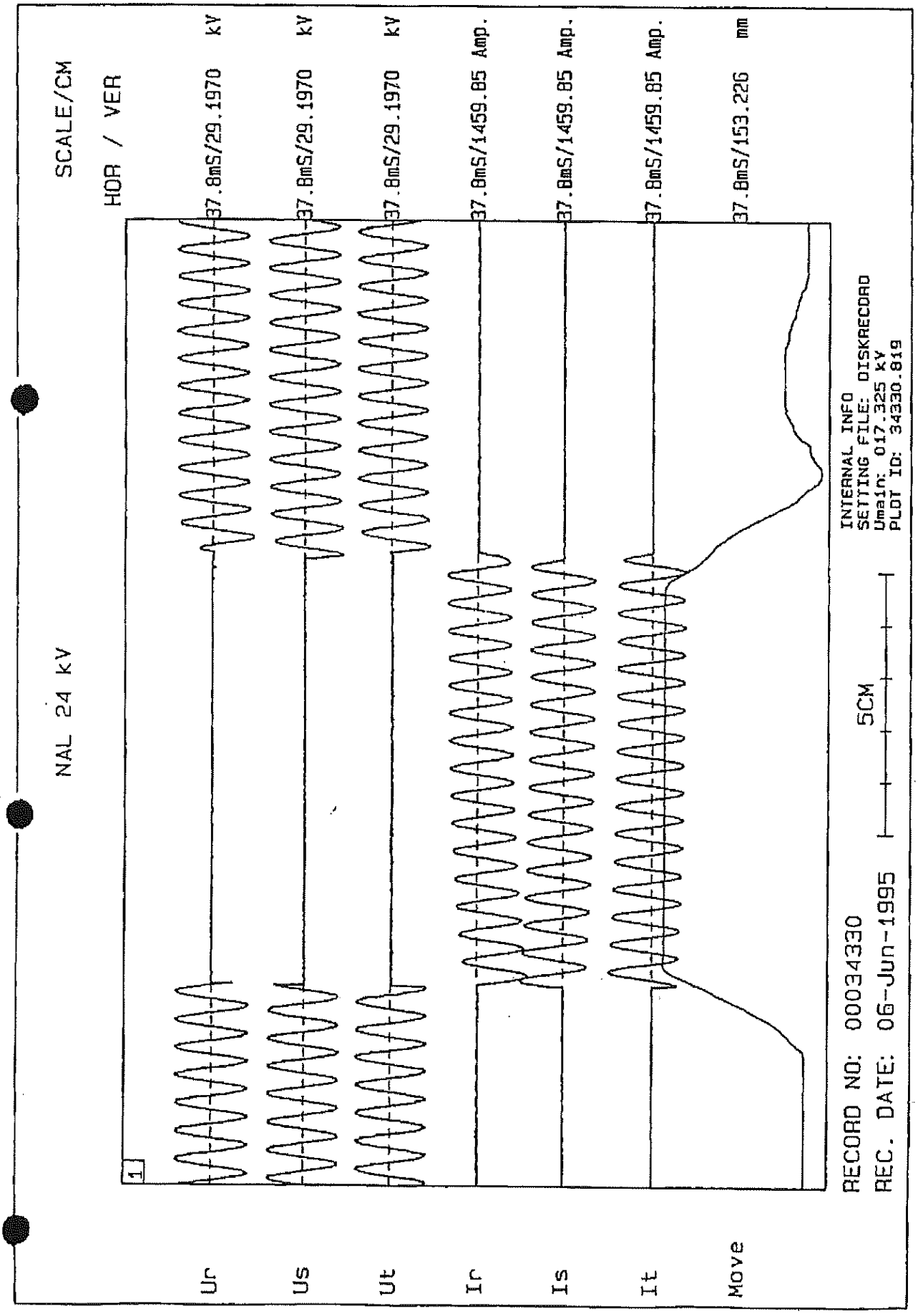
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
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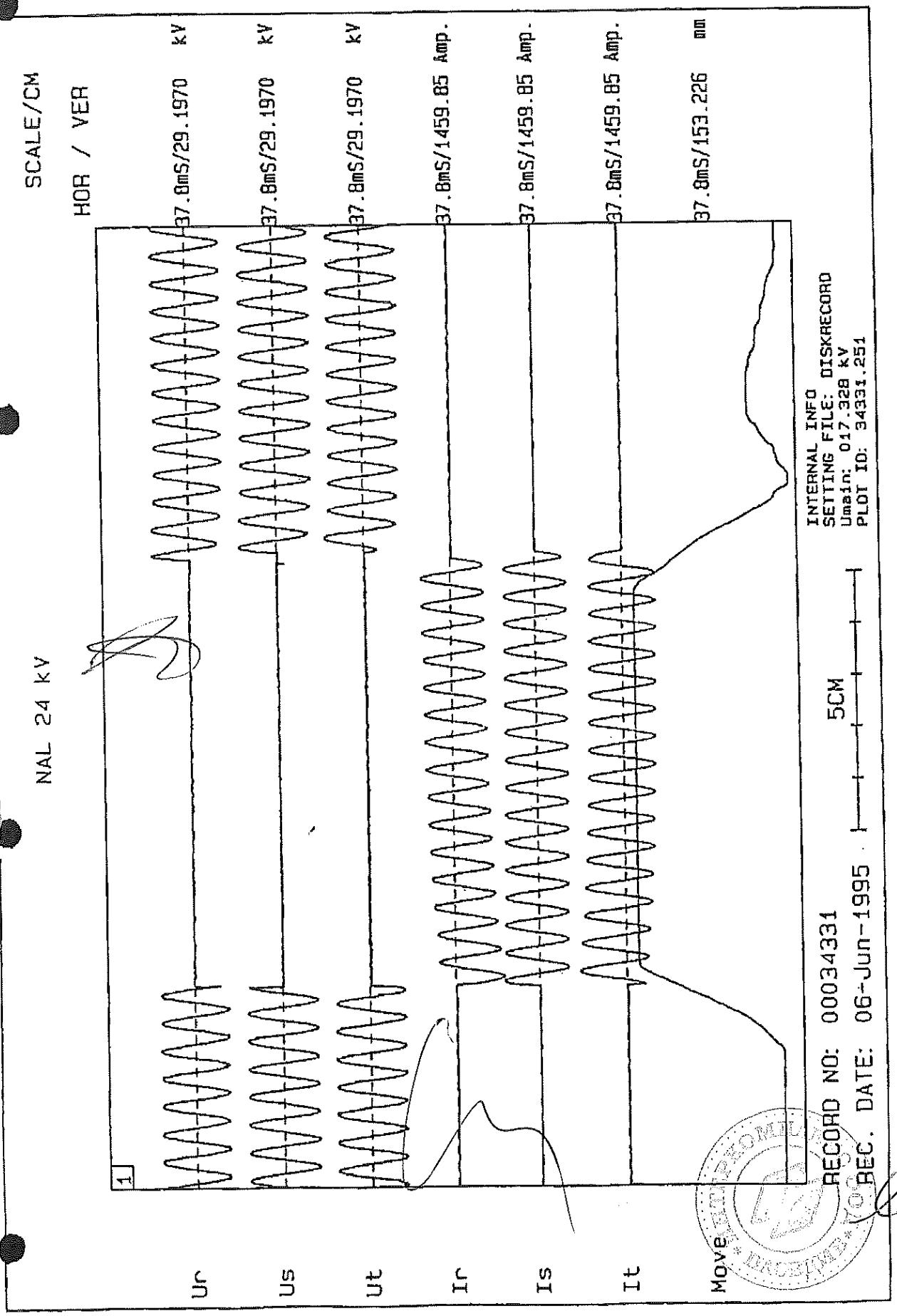
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.325 kV
PLOT ID: 34330.819
RECORD NO: 00034330
REC. DATE: 06-Jun-1995


SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.328 kV
PLOT ID: 34331.251
NAL 24 kV
5CM
RECORD NO: 00034331
REC. DATE: 06-Jun-1995
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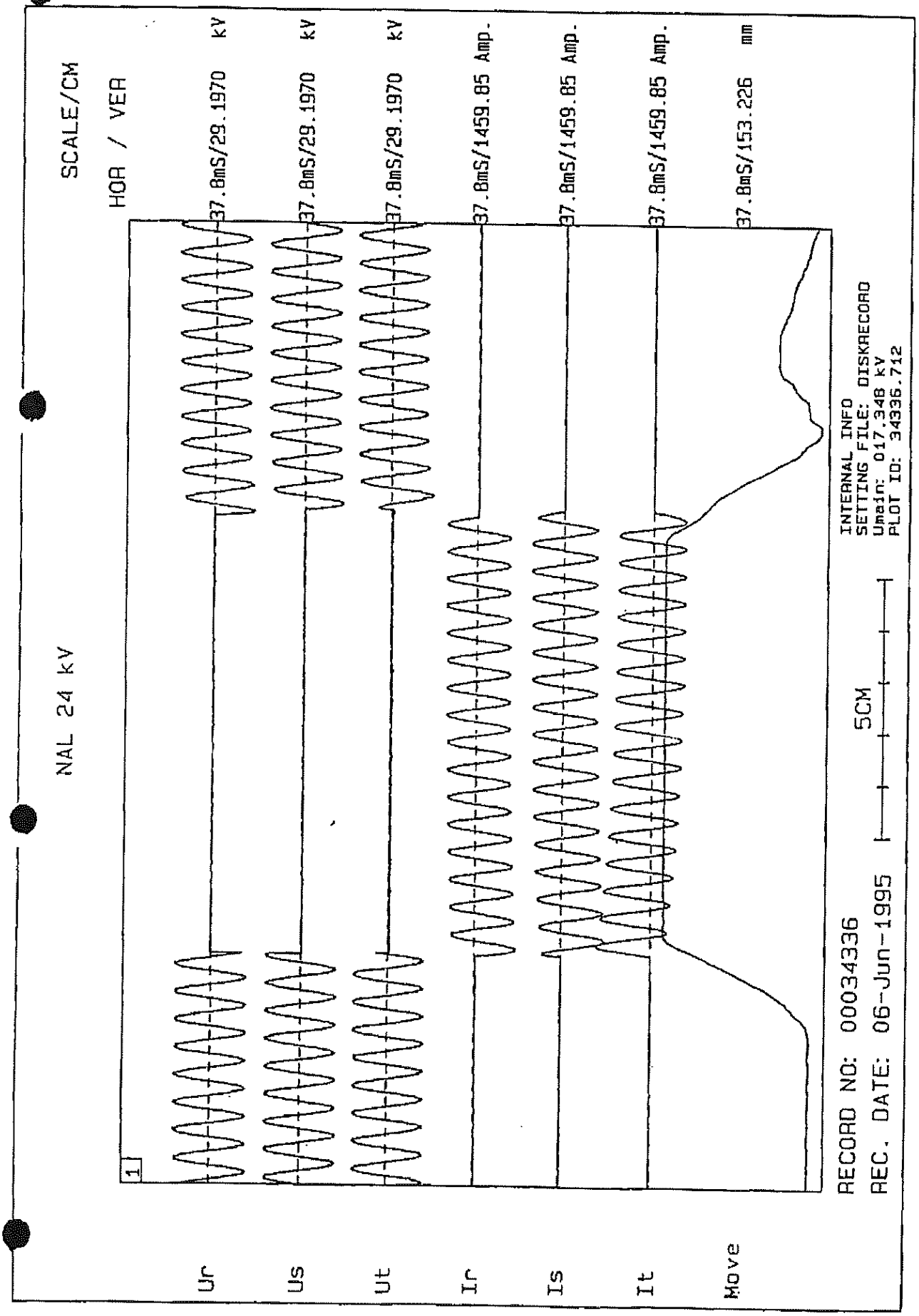
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
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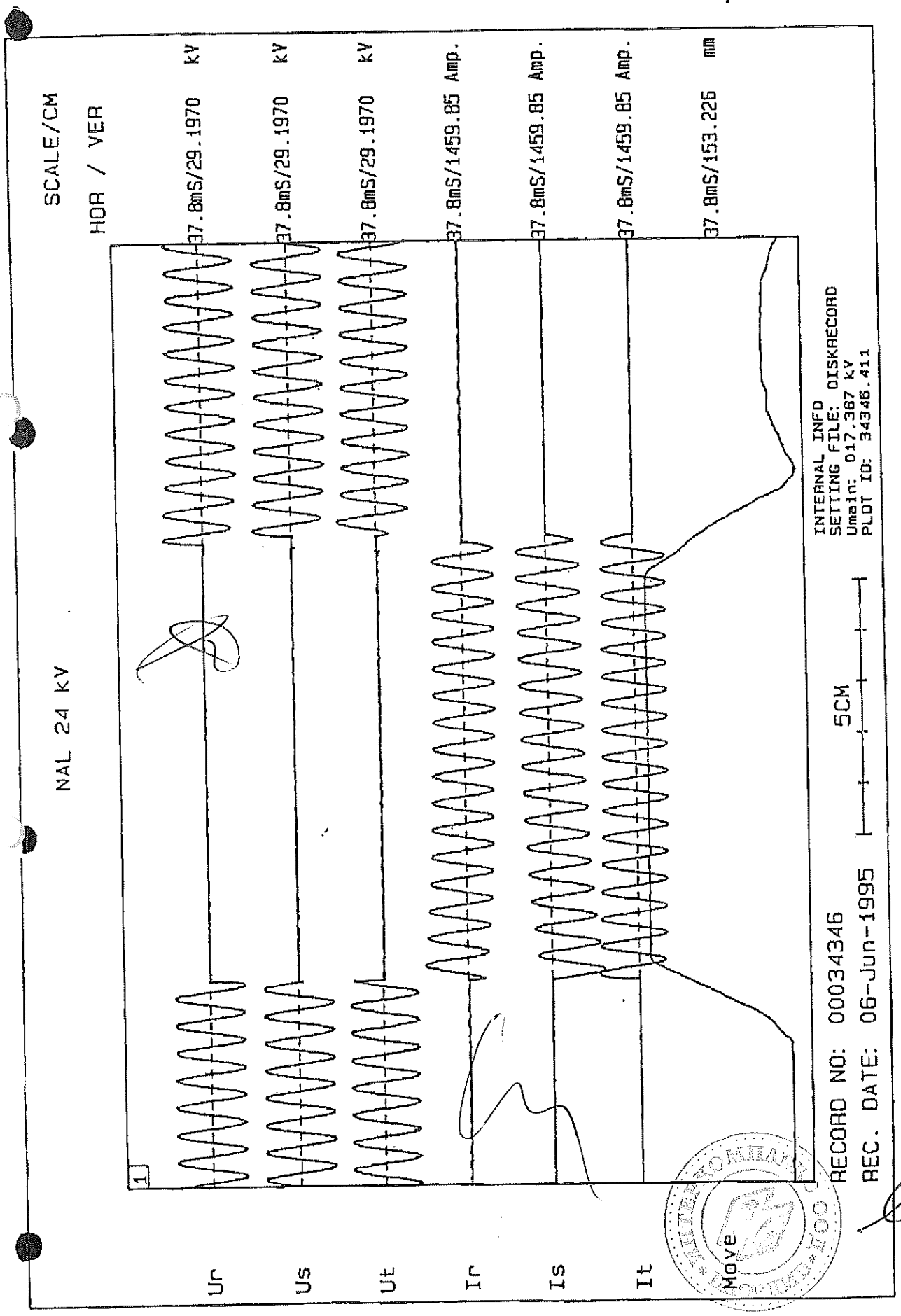
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.348 kV
PLOT ID: 34336.712
RECORD NO: 00034336
REC. DATE: 06-Jun-1995


SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.387 kV
PLOT ID: 34346.411
5CM
NAL 24 kV
RECORD NO: 00034346
REC. DATE: 06-Jun-1995
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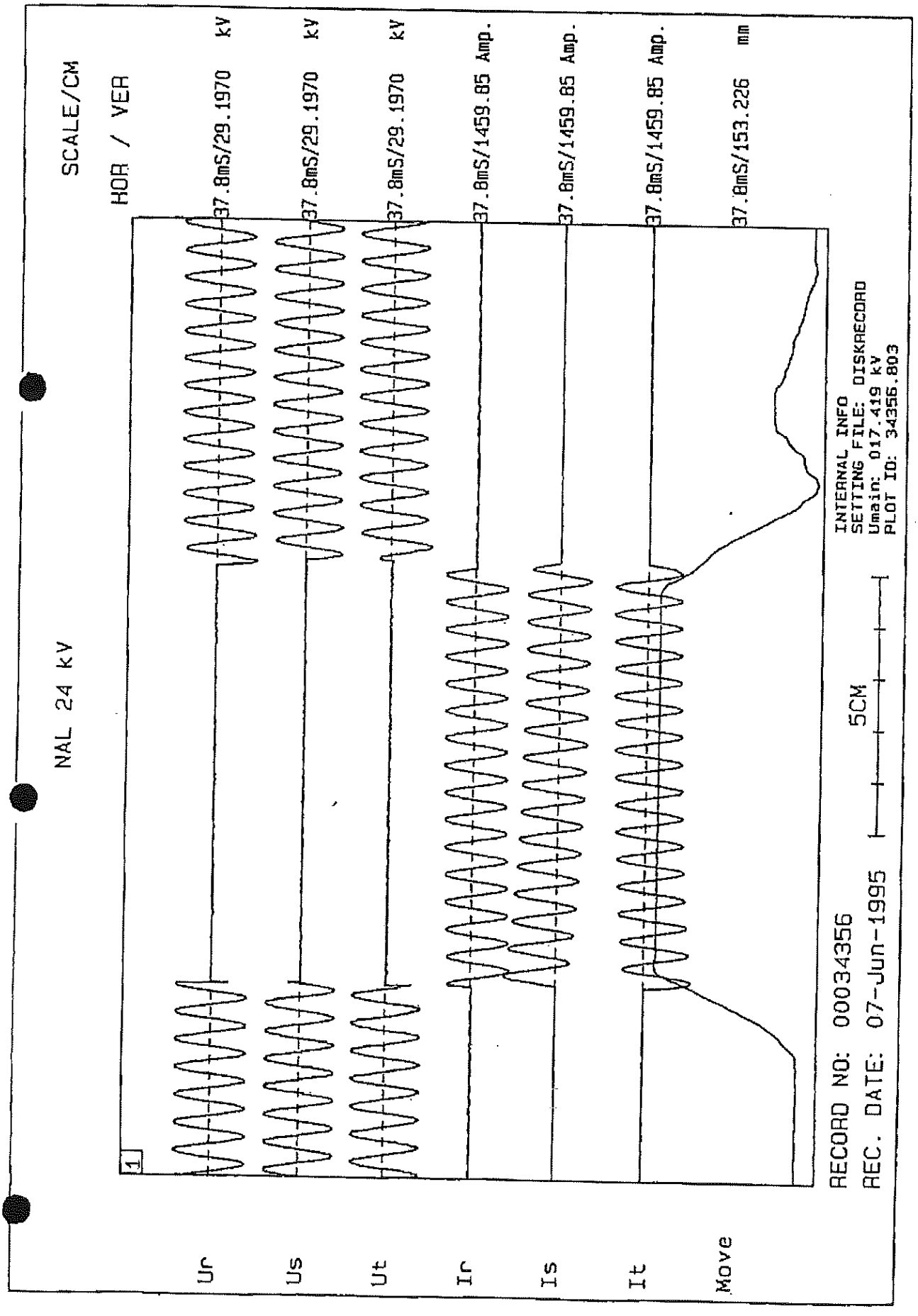
SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.419 kV
PLOT ID: 34356.803
5CM
RECORD NO: 00034356
REC. DATE: 07-Jun-1995
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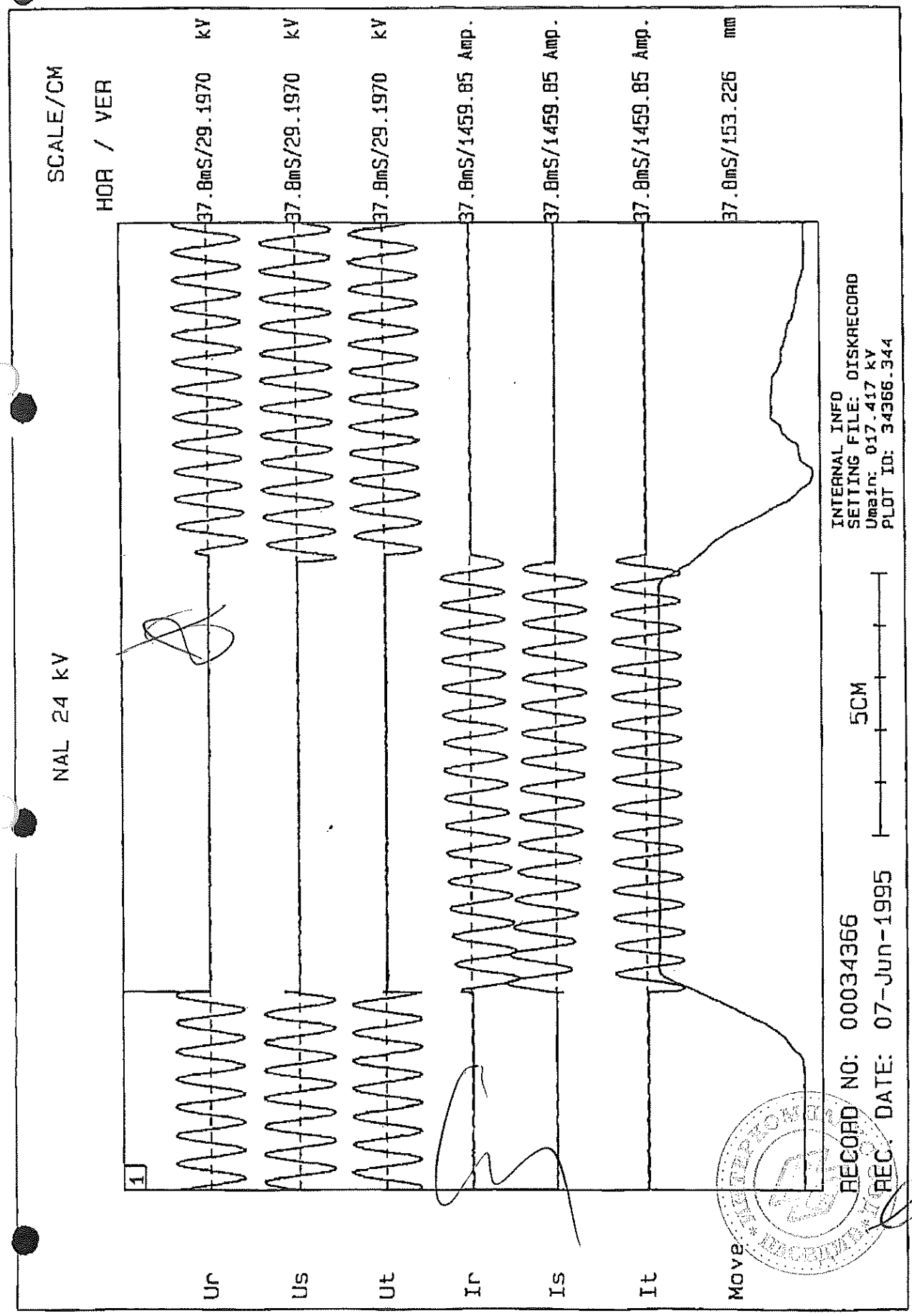
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.417 kV
PLOT ID: 34366.344
5CM
RECORD NO: 00034366
REC. DATE: 07-Jun-1995
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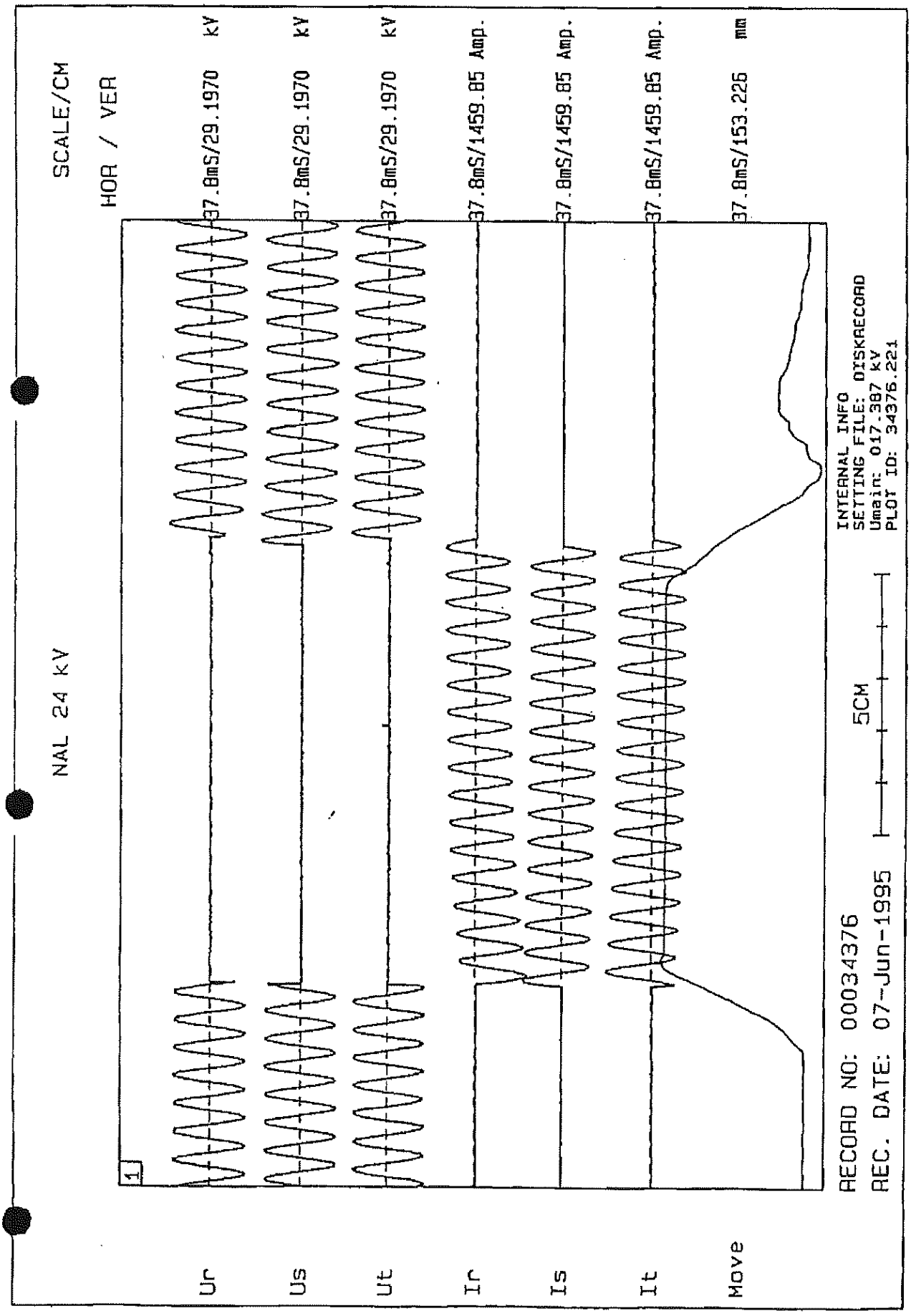
299


SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
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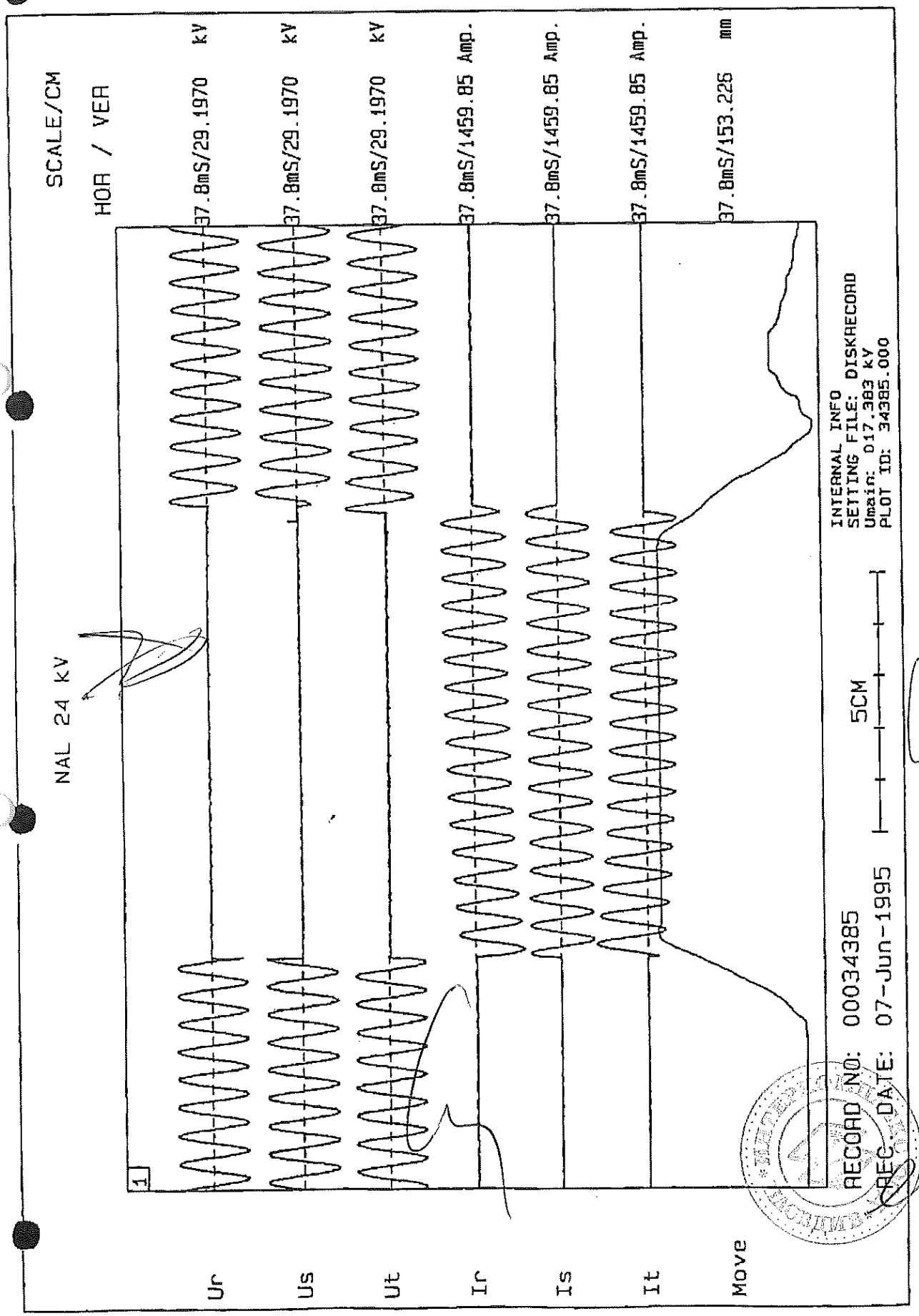
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.387 kV
PLOT ID: 34376.221
RECORD NO: 00034376
REC. DATE: 07-Jun-1995


SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/1459.85 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.383 kV
PLOT ID: 34385.000
5CM
RECORD NO: 00034385
REC. DATE: 07-Jun-1995
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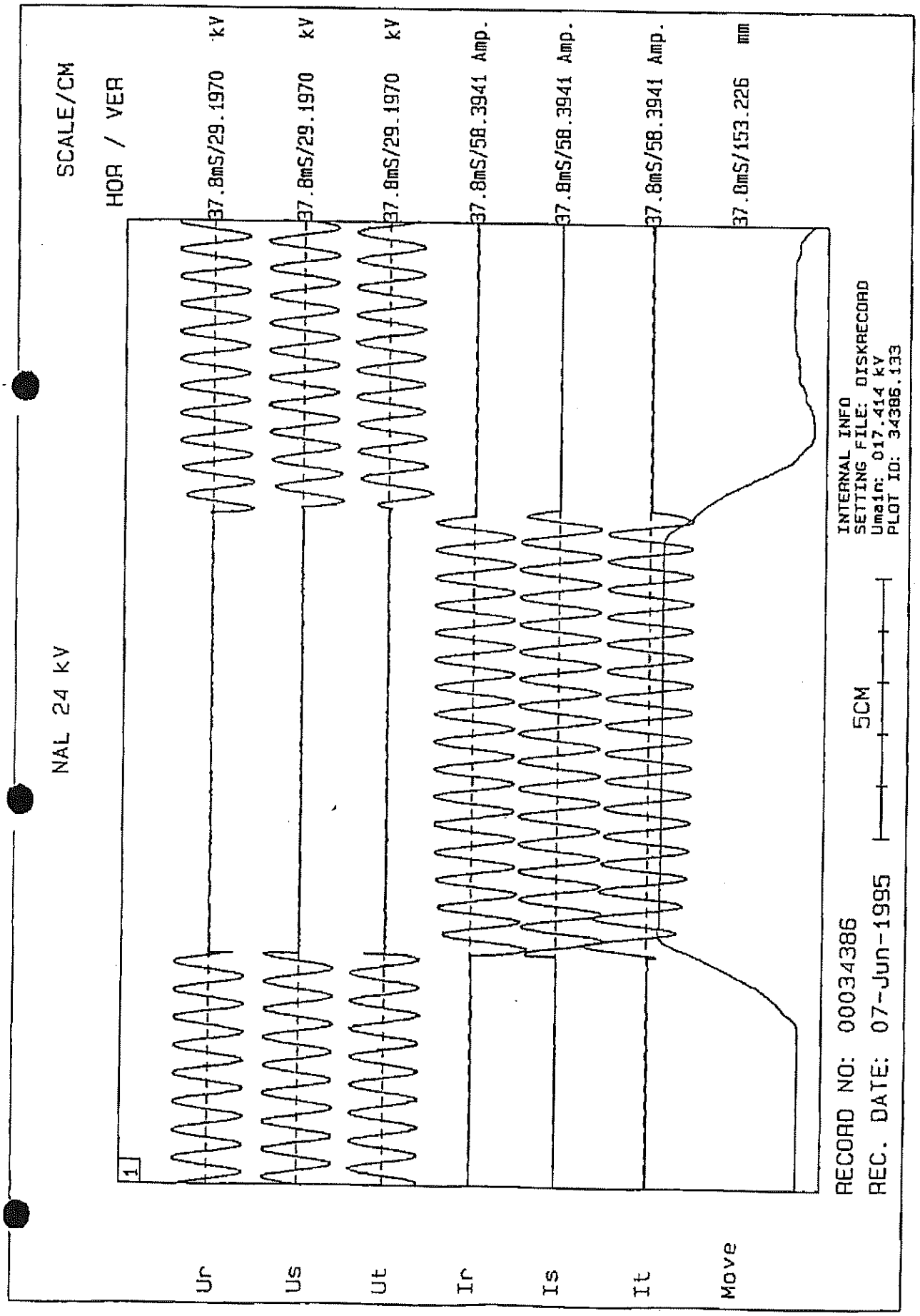
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.414 kV
PLOT ID: 34386.133
5CM
RECORD NO: 00034386
REC. DATE: 07-Jun-1995
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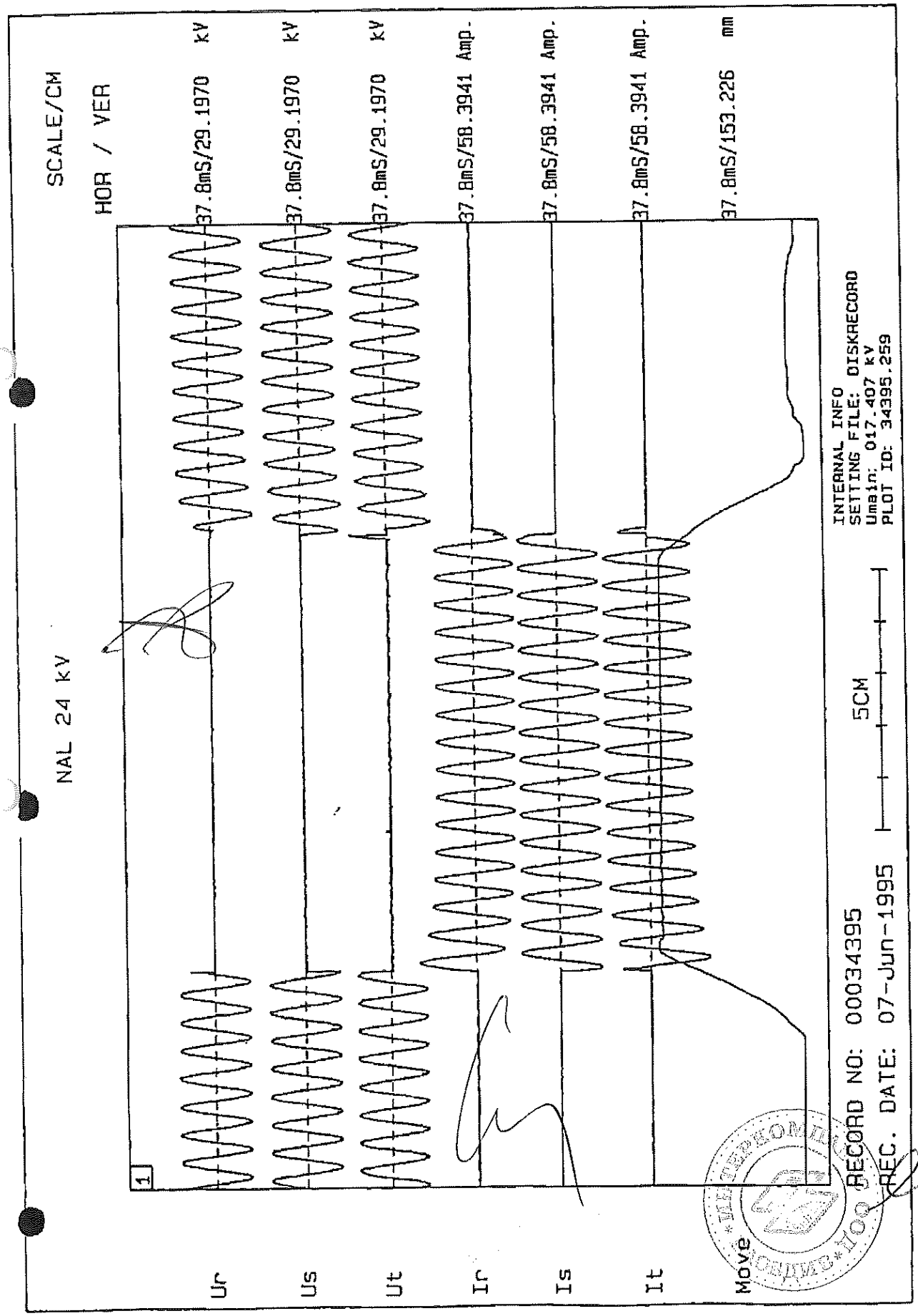
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.407 kV
PLOT ID: 34395.259
5CM
RECORD NO: 00034395
REC. DATE: 07-Jun-1995
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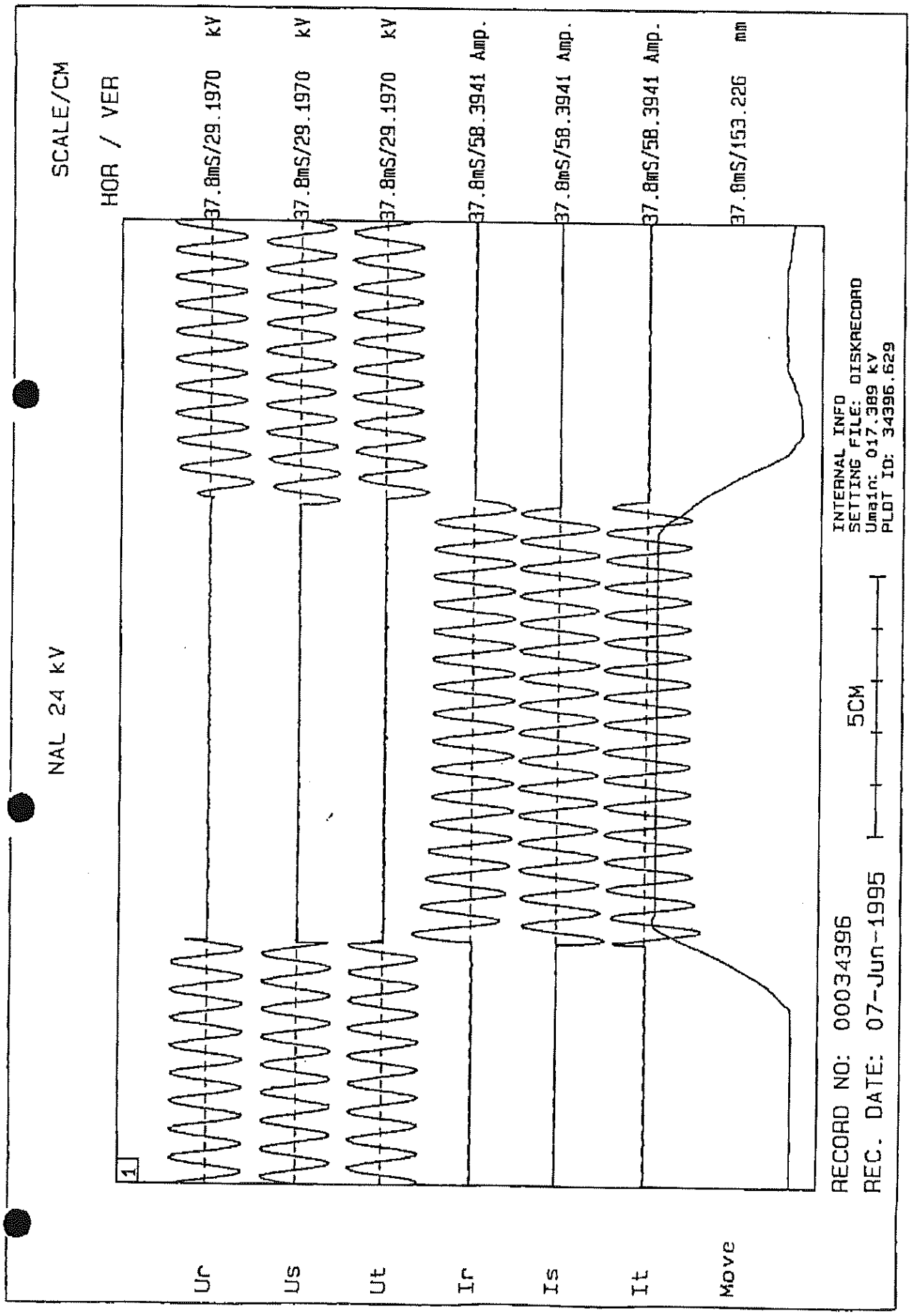
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.389 kV
PLOT ID: 34396.629
5CM
RECORD NO: 00034396
REC. DATE: 07-Jun-1995
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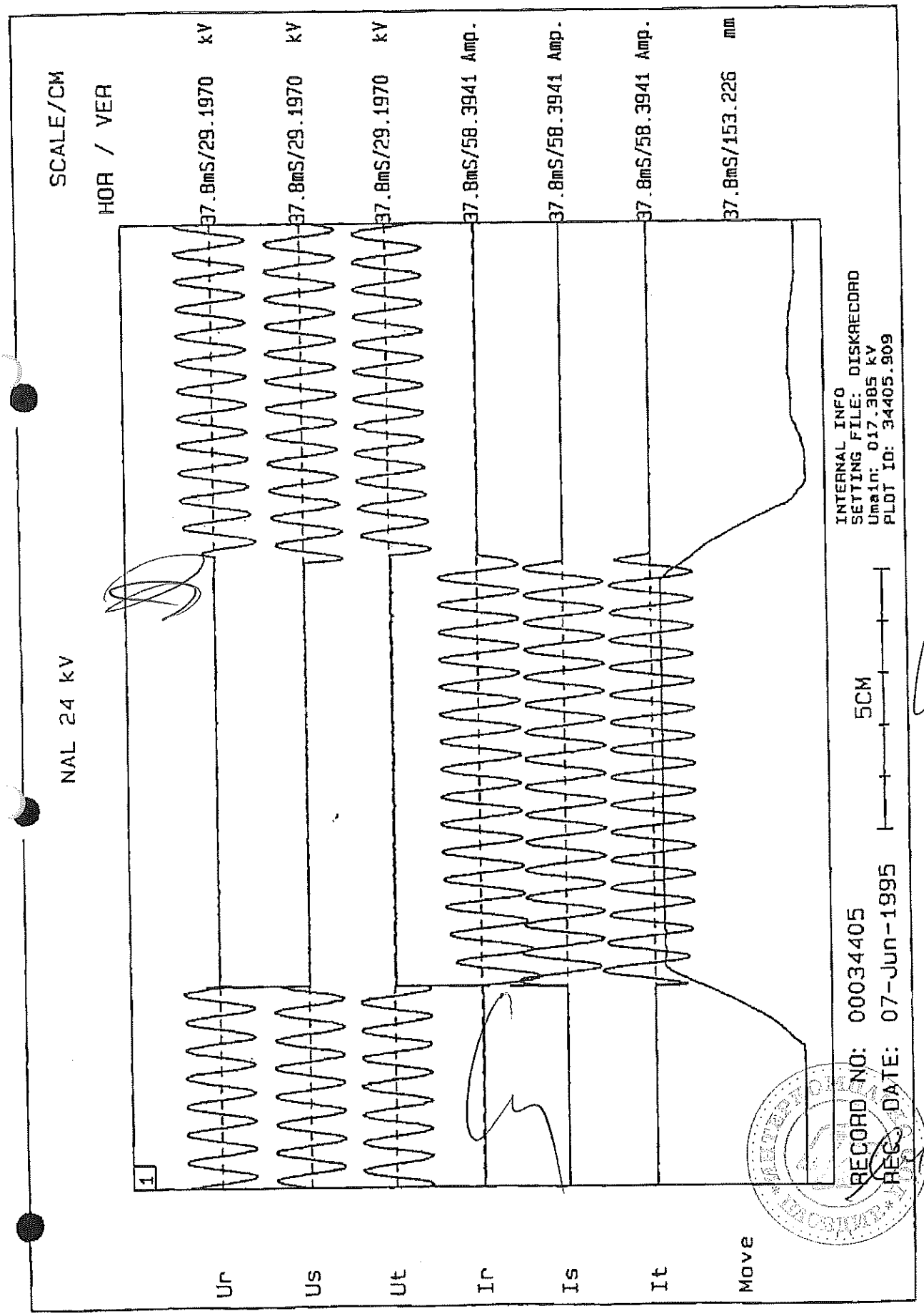
SCALE/CM
HOR / VER
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/29.1970 kV
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/58.3941 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.385 kV
PLOT ID: 34405.909
5CM
RECORD NO: 00034405
REC. DATE: 07-Jun-1995
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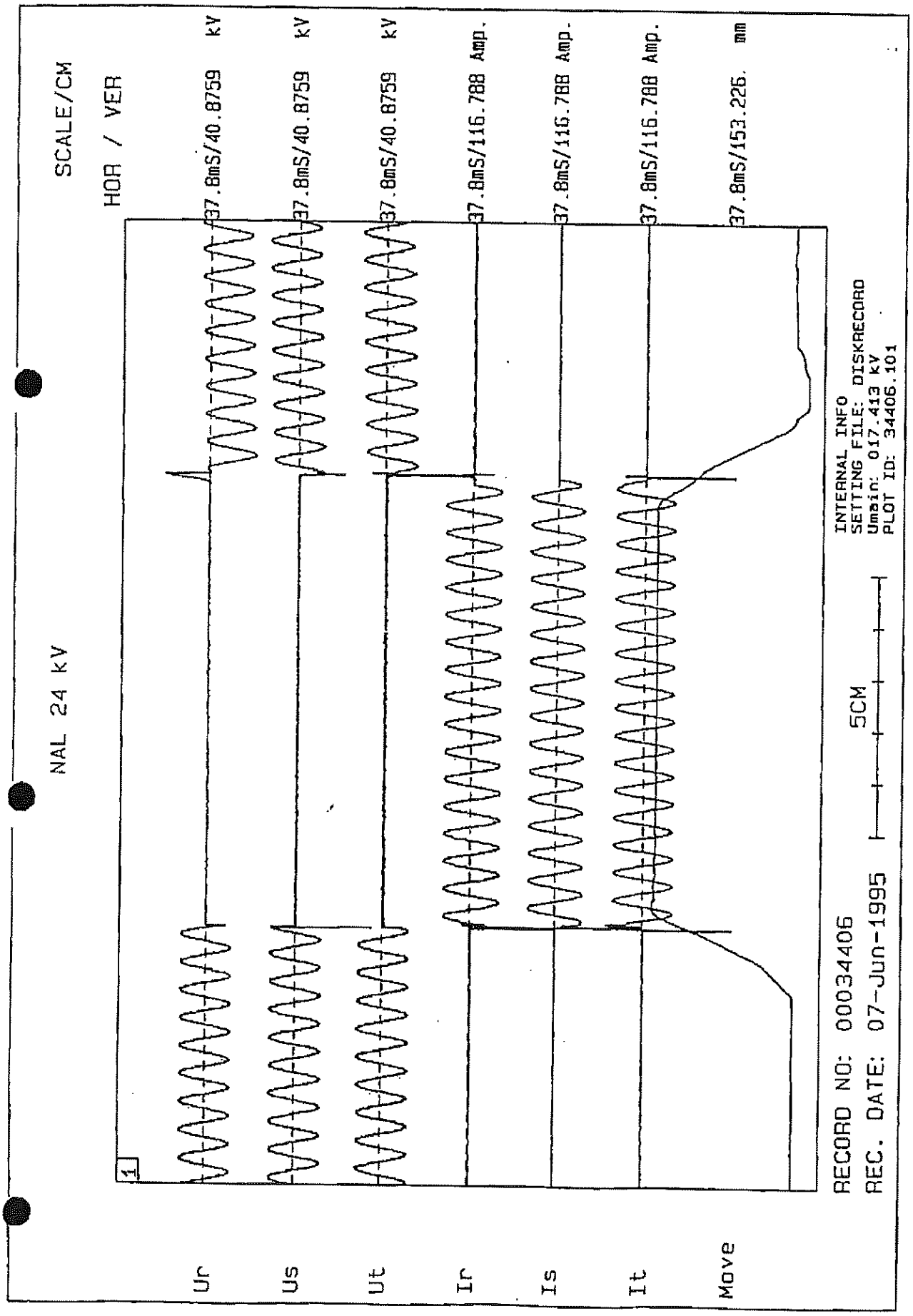
NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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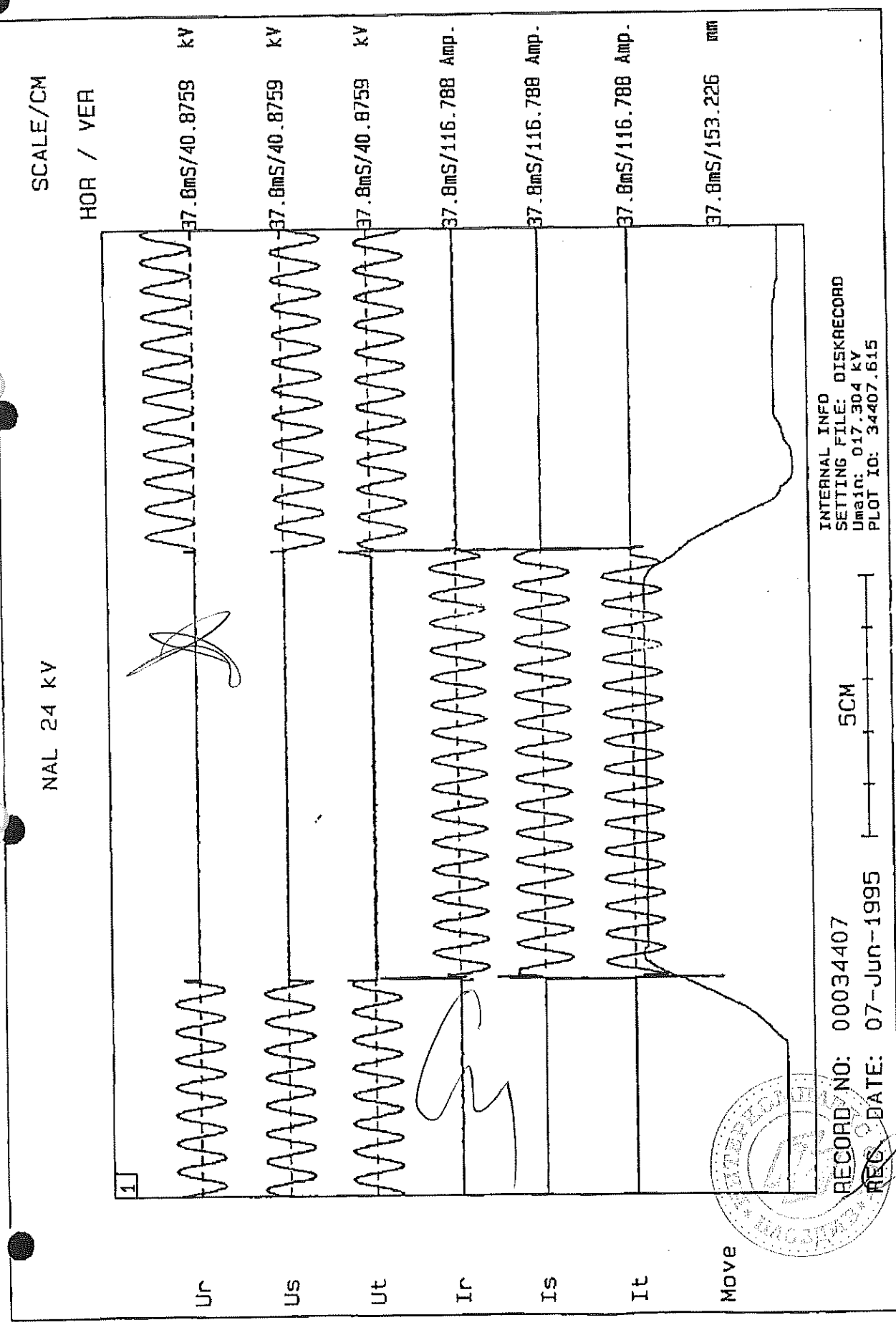
5CM
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.413 kV
PLOT ID: 34406.101
RECORD NO: 00034406
REC. DATE: 07-Jun-1995


NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.304 kV
PLOT IO: 34407.615
5CM
RECORD NO: 00034407
REC. DATE: 07-Jun-1995
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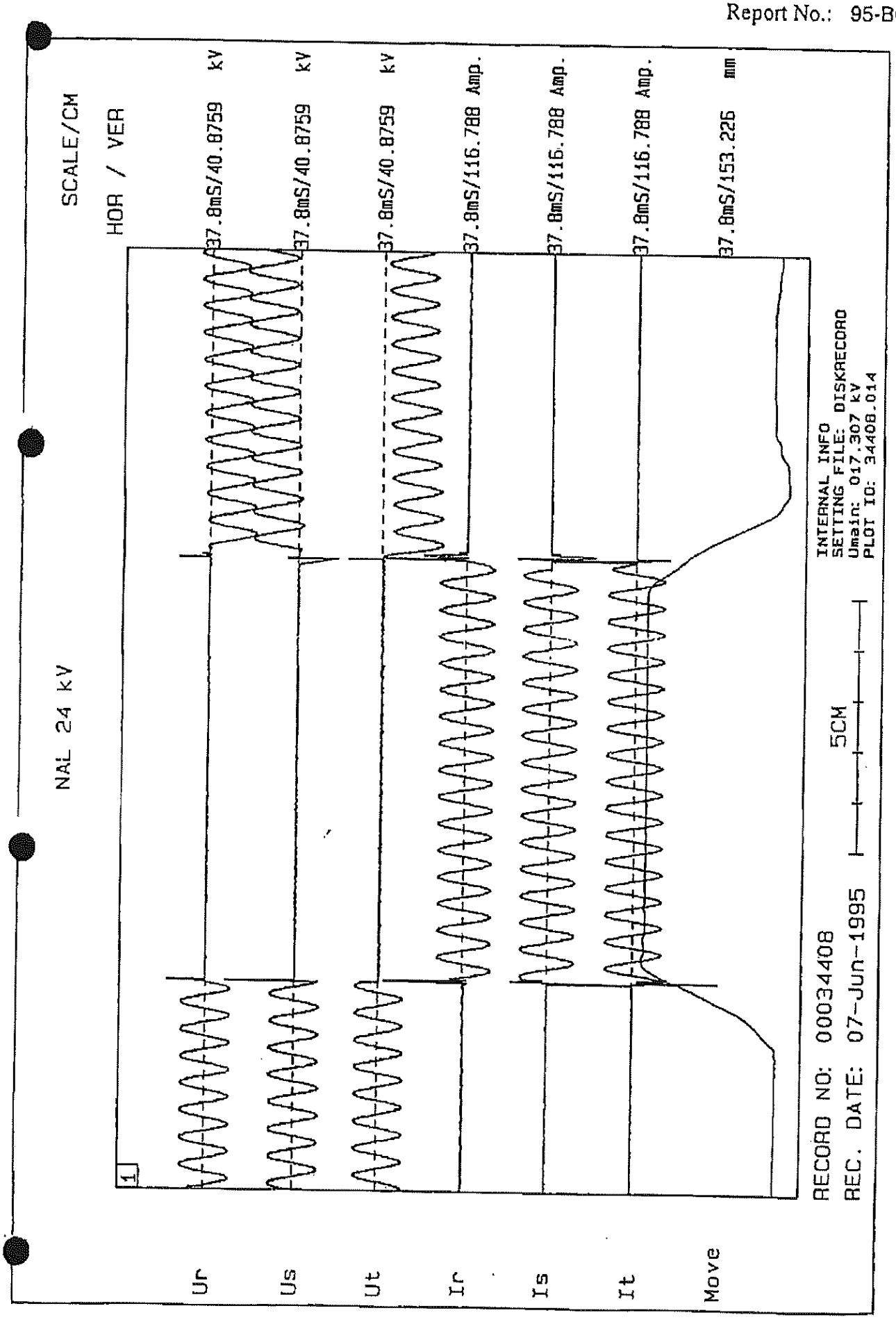
NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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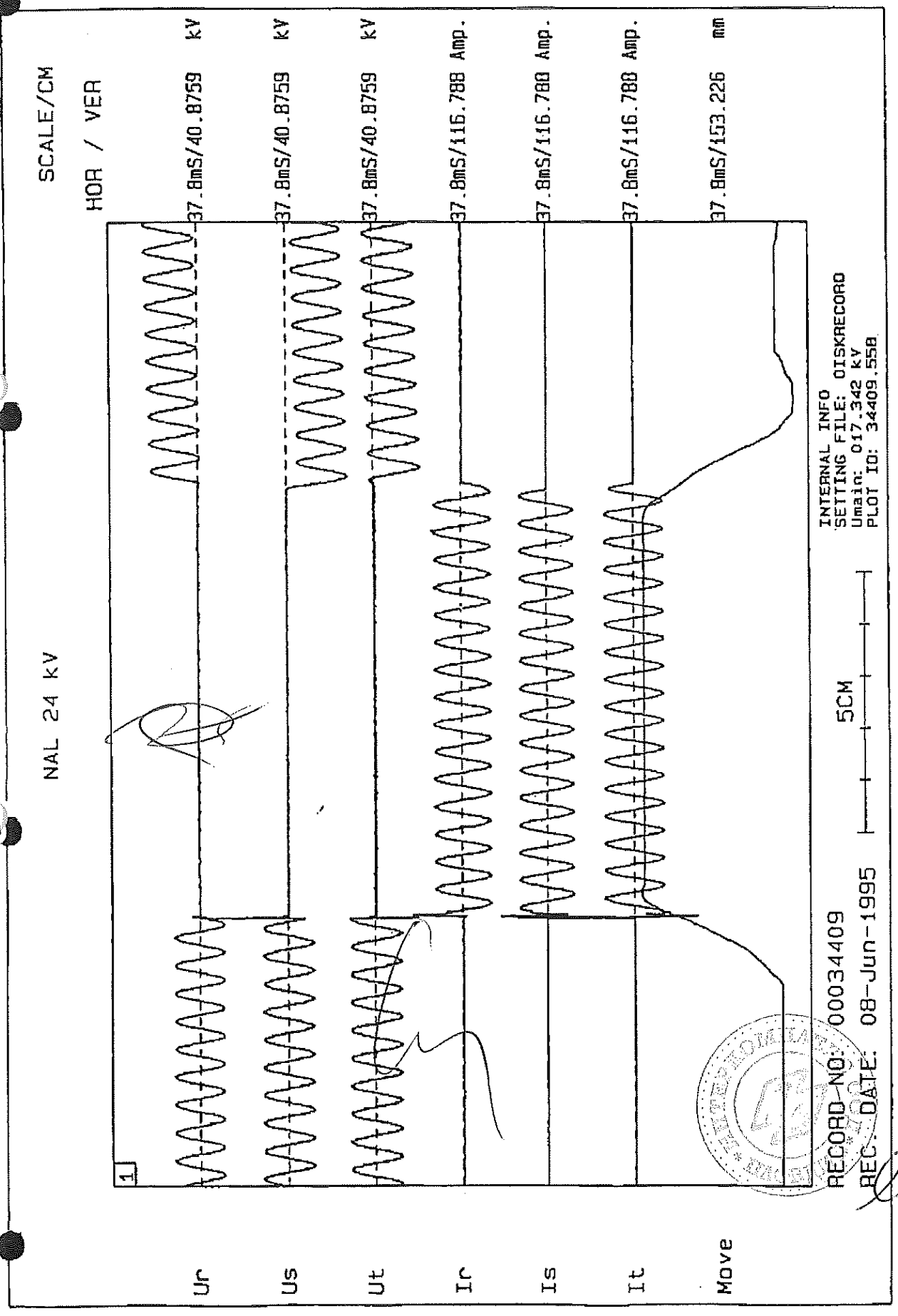
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.307 kV
PLOT ID: 34408.014
RECORD NO: 00034408
REC. DATE: 07-Jun-1995


NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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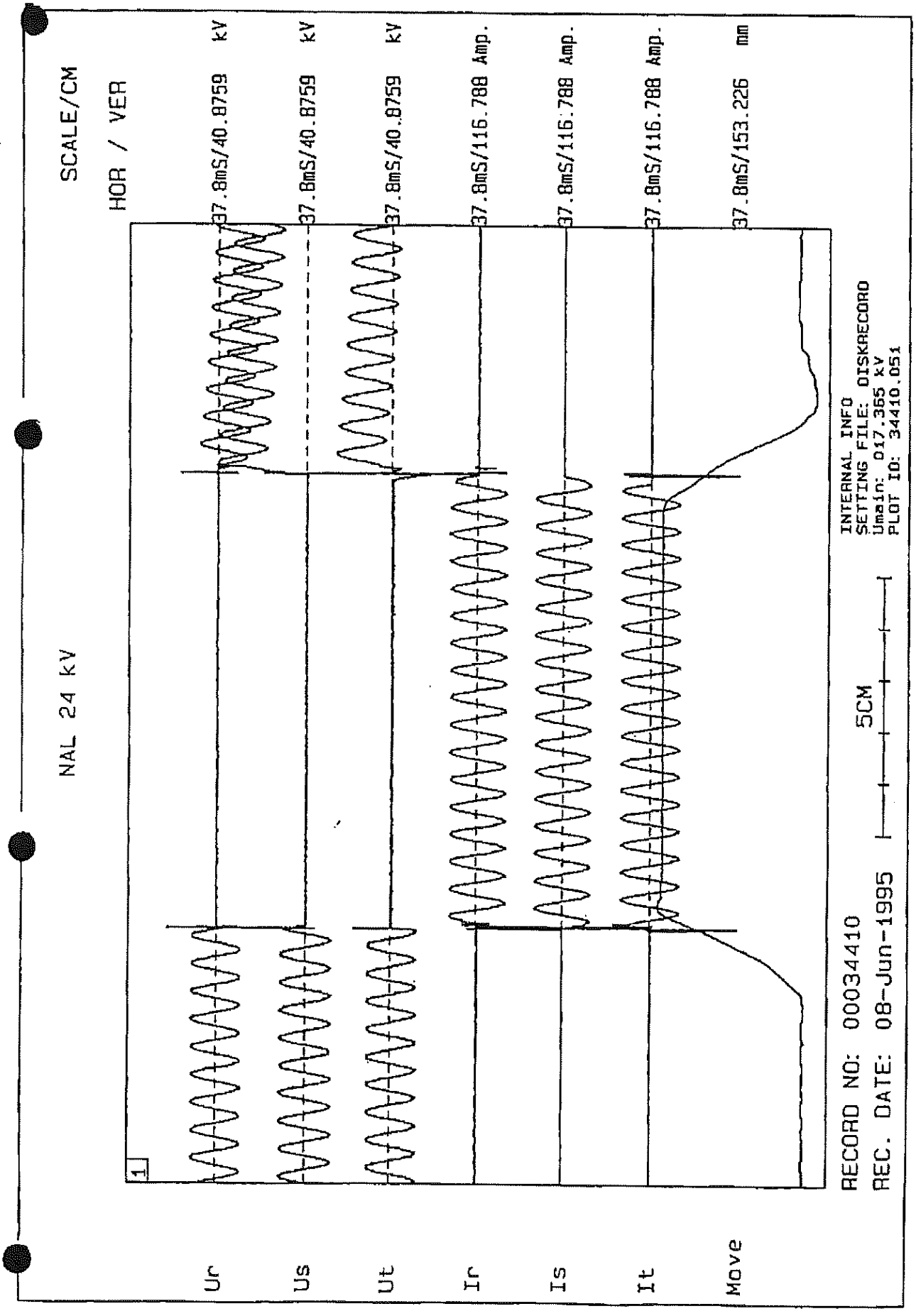
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.342 kV
PLOT ID: 34409.558
5CM
RECORD NO: 00034409
REC. DATE: 08-Jun-1995


SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: OISKRECORD
Umain: 017.365 kV
PLOT ID: 34410.051
5CM
RECORD NO: 00034410
REC. DATE: 08-Jun-1995
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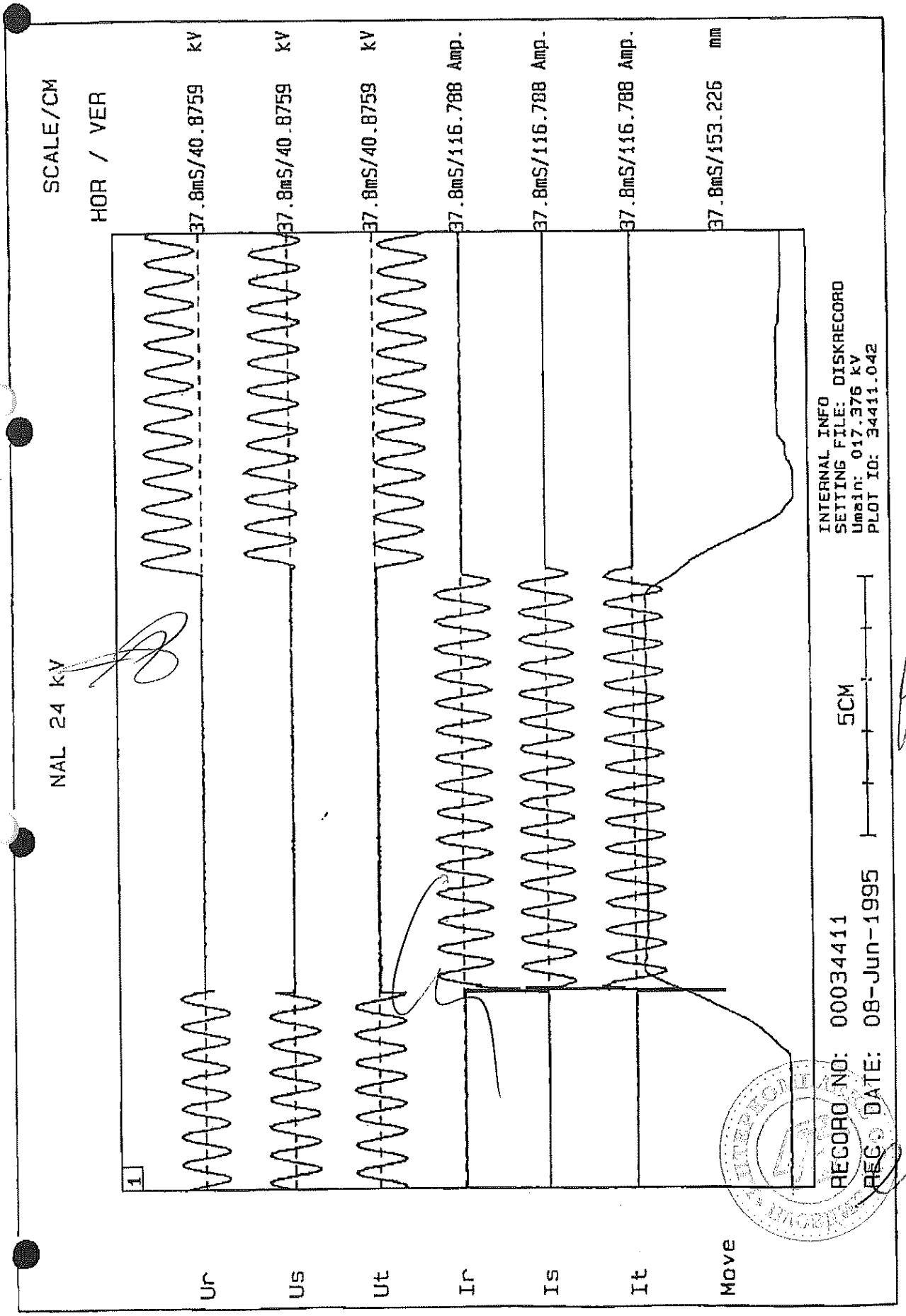
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.376 kV
PLOT ID: 34411.042
5CM
RECORD NO: 00034411
REC. DATE: 08-Jun-1995
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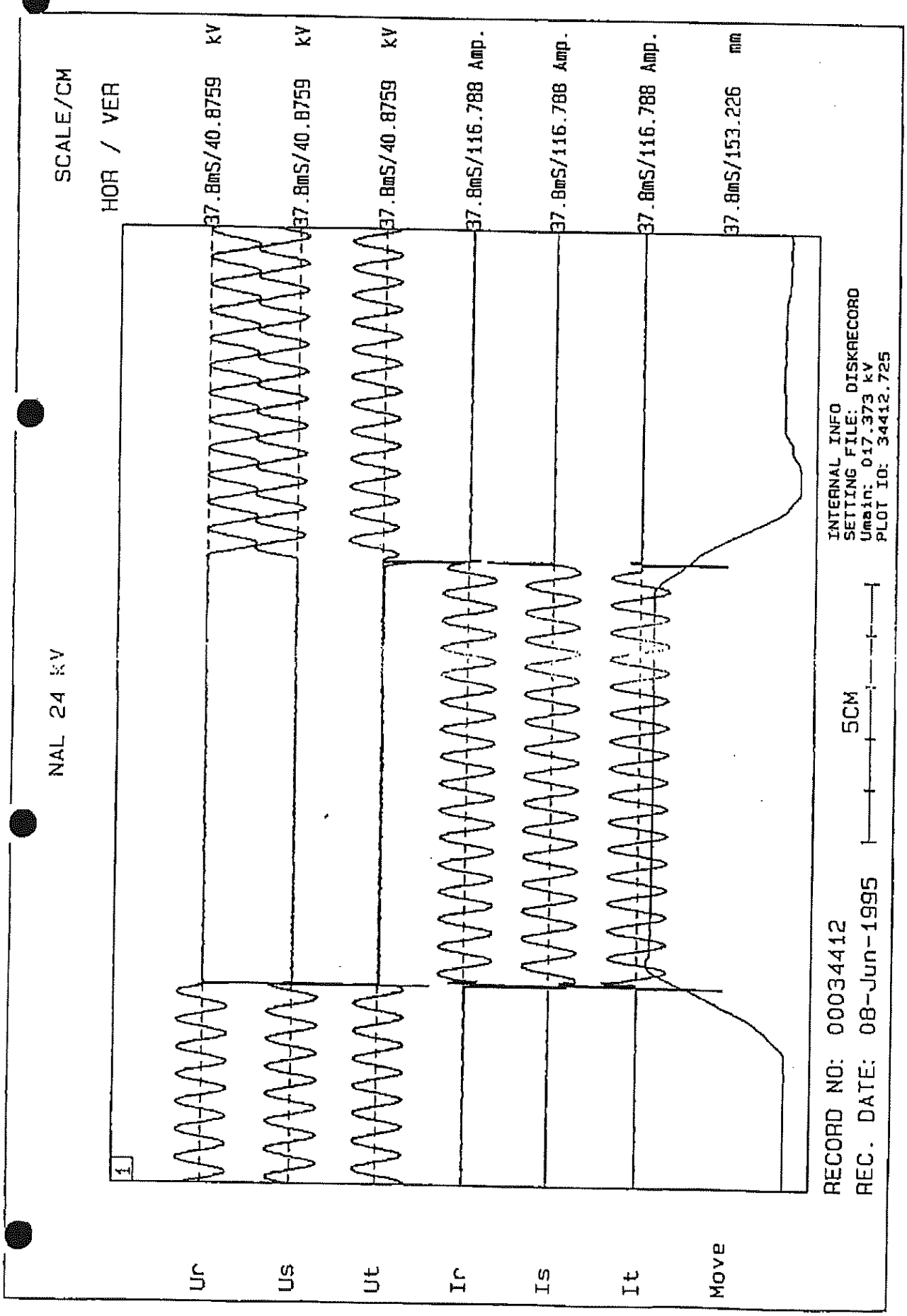
SCALE/CM
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37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
NAL 24 KV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.373 kV
PLOT ID: 34412.725
5CM
RECORD NO: 00034412
REC. DATE: 08-Jun-1995
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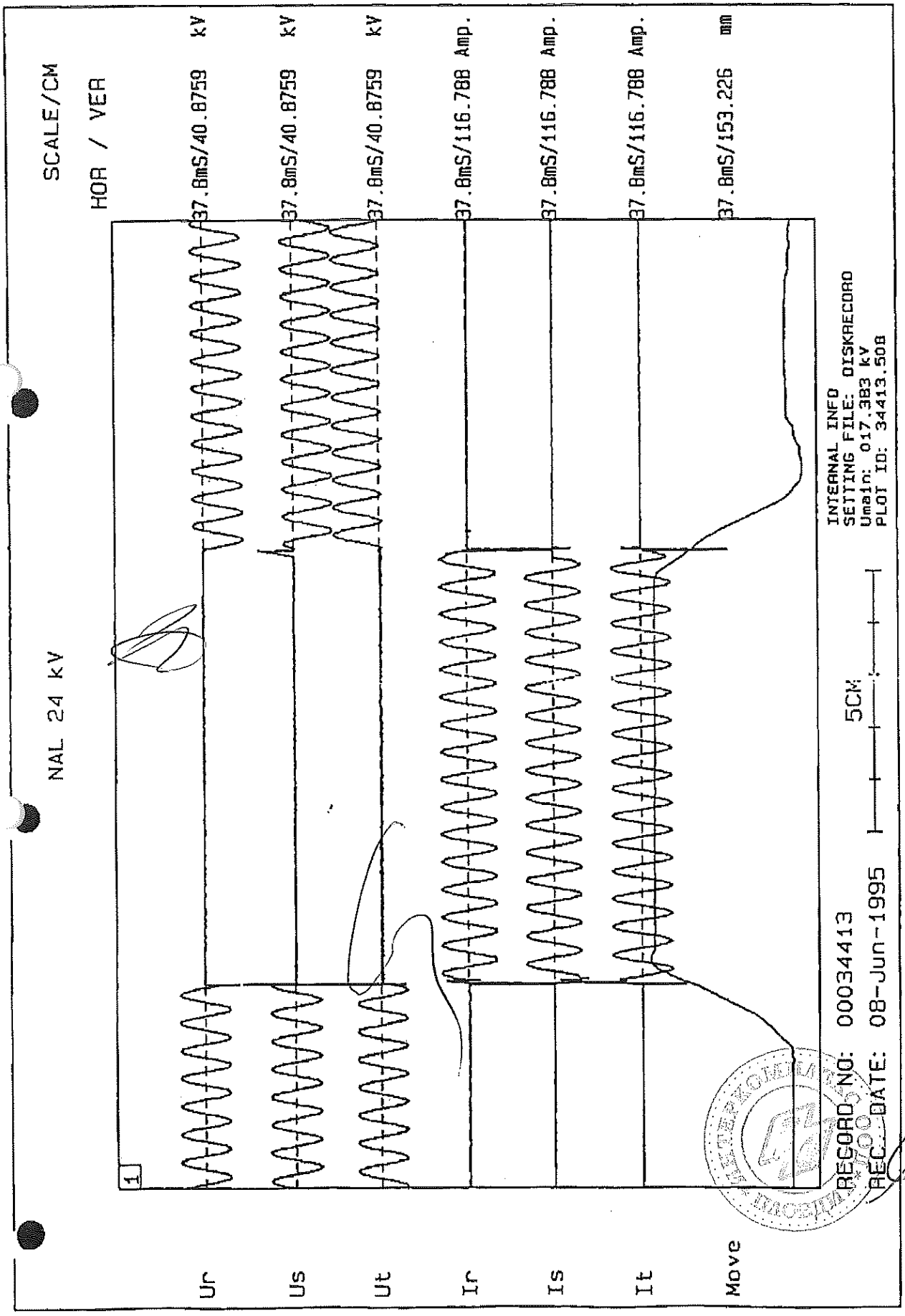
NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.383 kV
PLOT ID: 34413.508
5CM
RECORD NO: 00034413
REC. DATE: 08-Jun-1995
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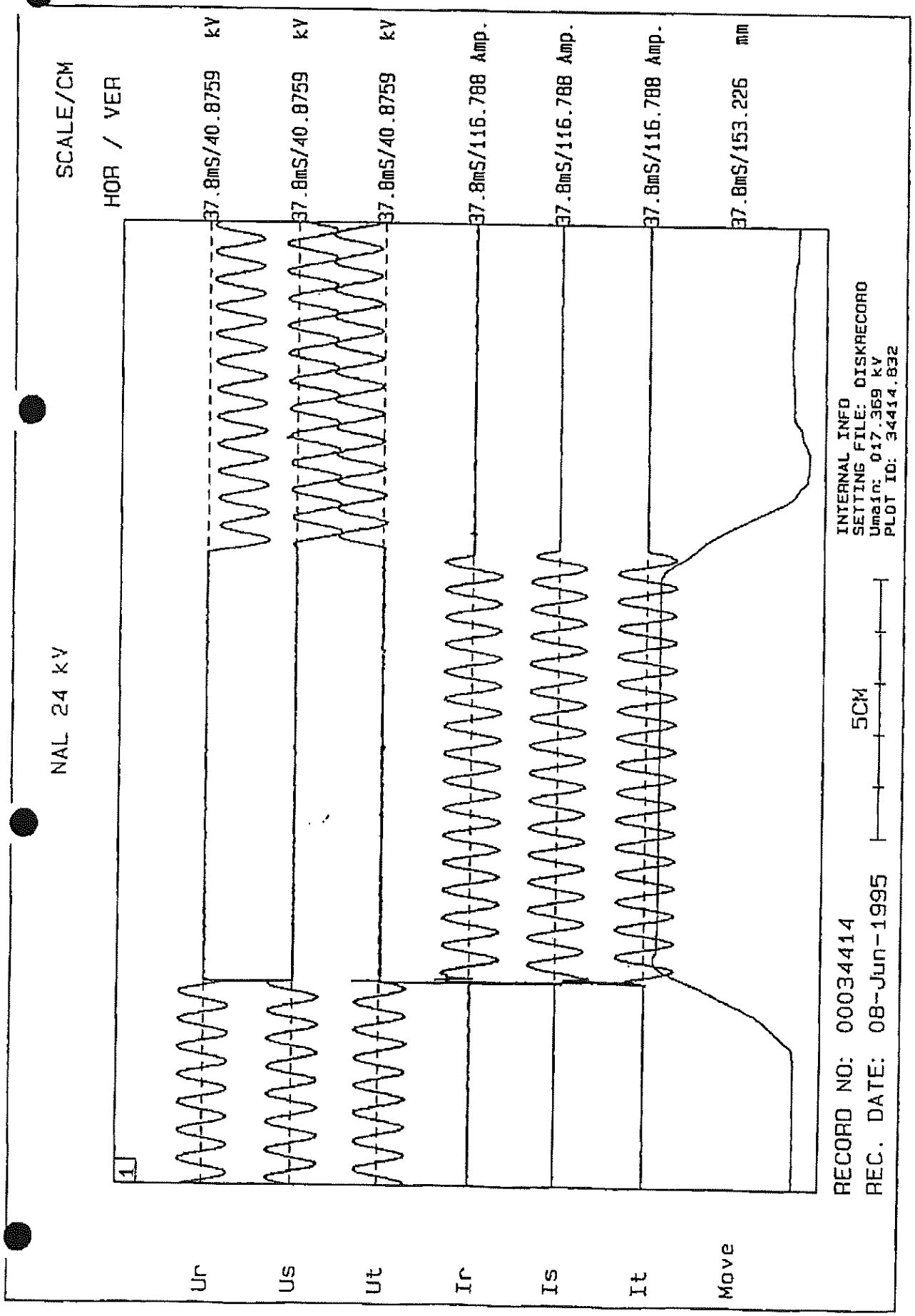
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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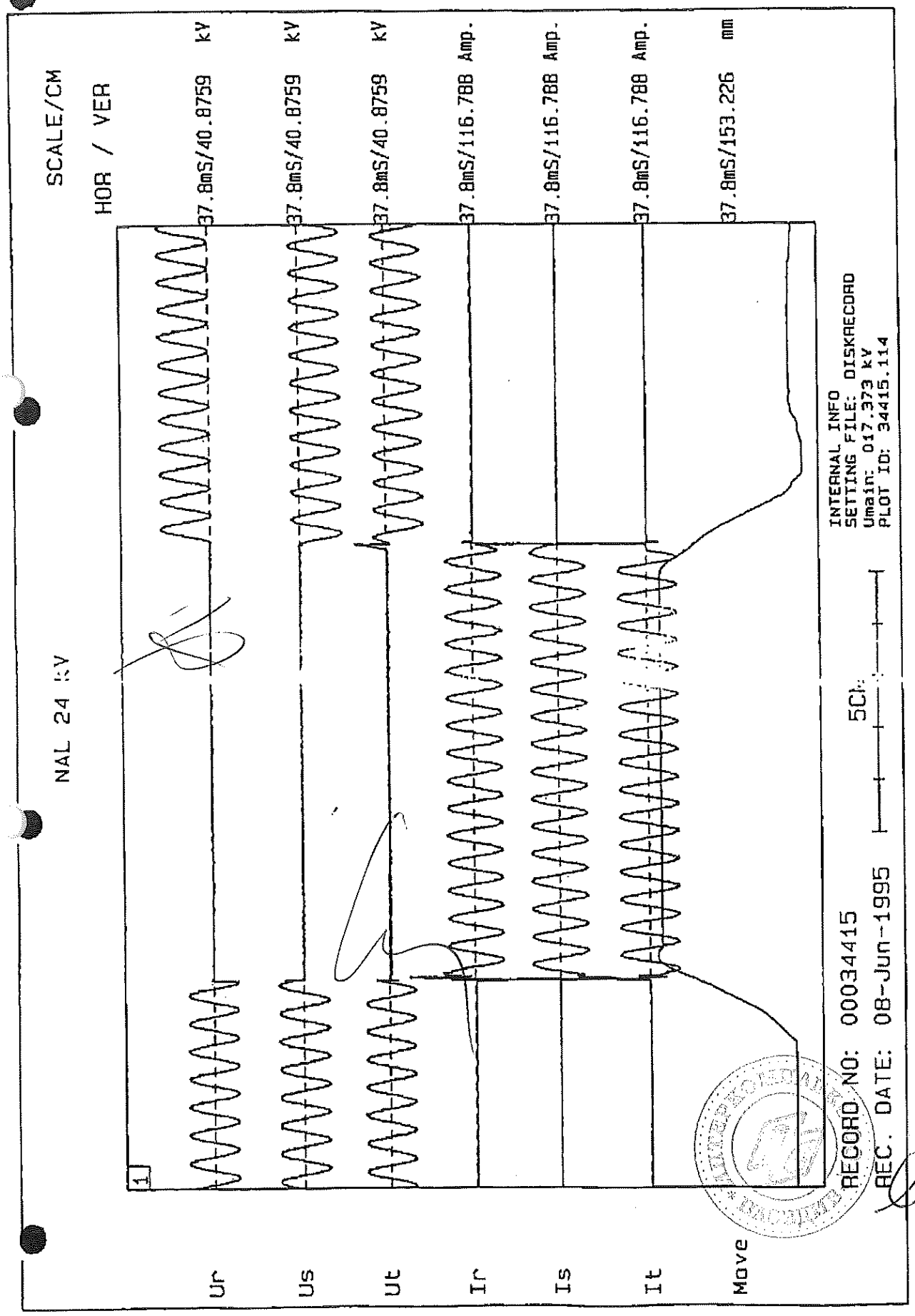
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.369 kV
PLOT ID: 34414.832
RECORD NO: 00034414
REC. DATE: 08-Jun-1995


SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.373 kV
PLOT ID: 34415.114
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RECORD NO: 00034415
REC. DATE: 08-Jun-1995
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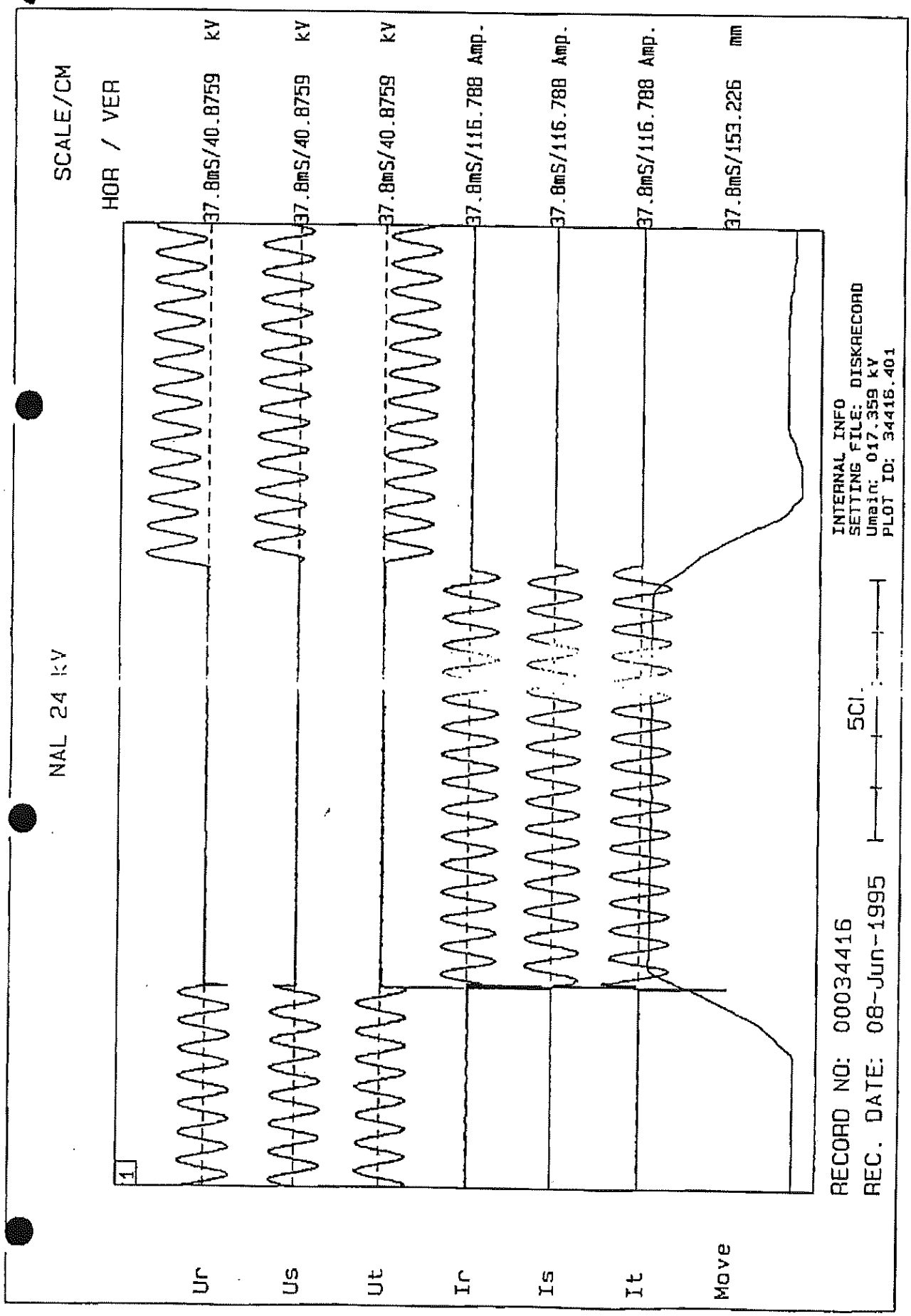
SCALE/CM
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NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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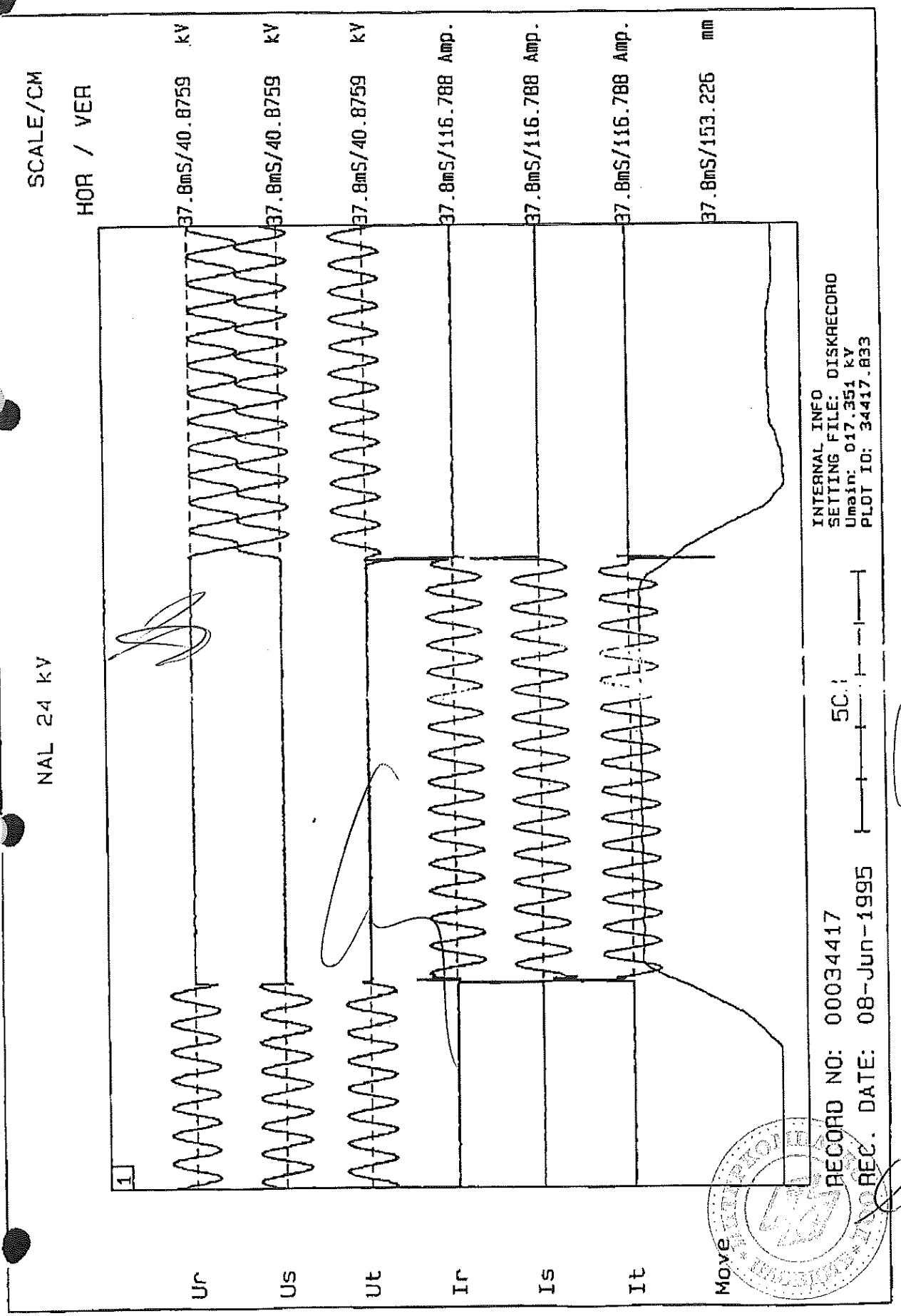
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.359 kV
PLOT ID: 34416.401
RECORD NO: 00034416
REC. DATE: 08-Jun-1995


SCALE/CM
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37.8mS/40.8759 kV
37.8mS/40.8759 kV
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37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.351 kV
PLOT ID: 34417.833
RECORD NO: 00034417
REC. DATE: 08-Jun-1995
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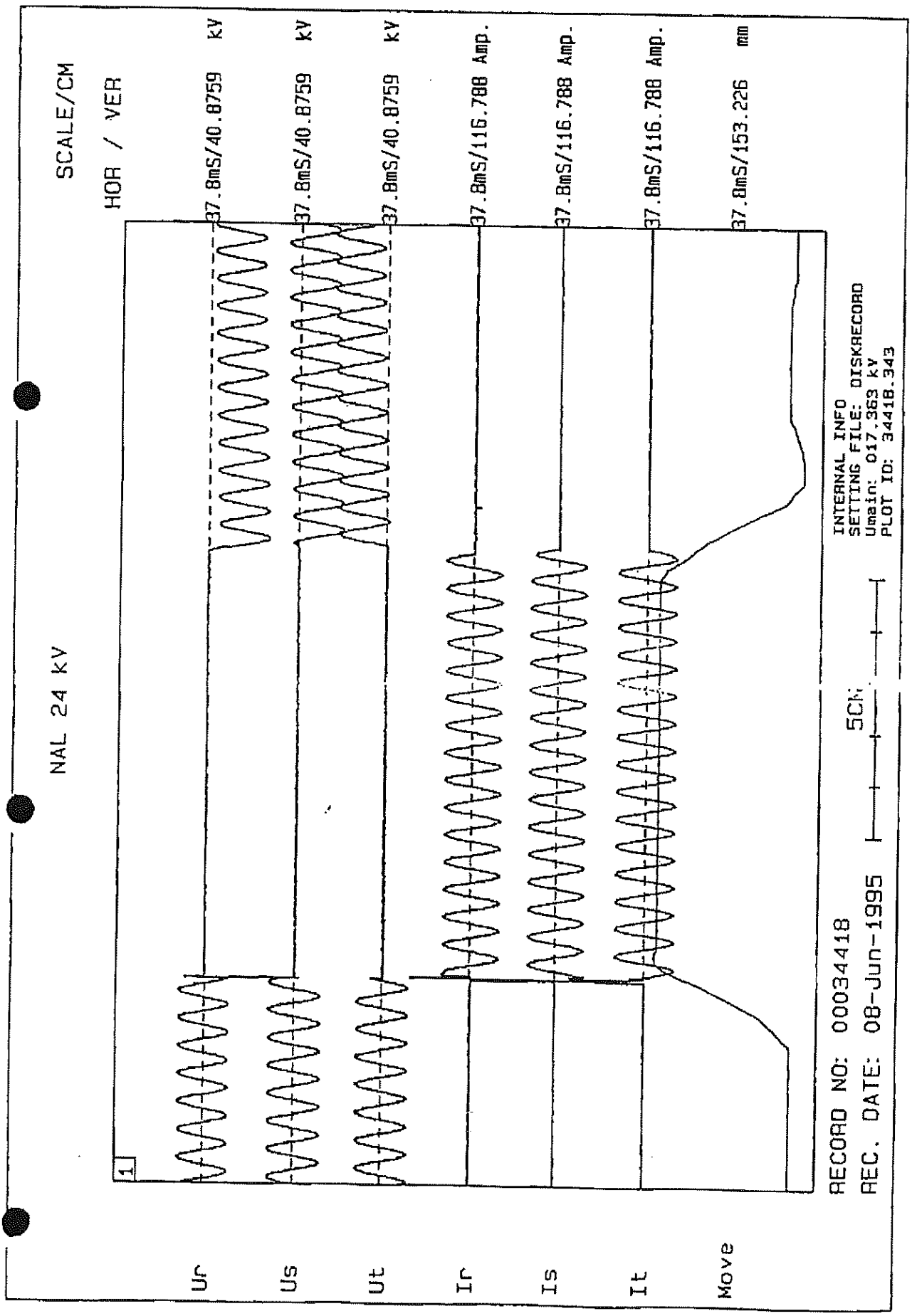
NAL 24 kV
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
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37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.363 kV
PLOT ID: 34418.343
RECORD NO: 00034418
REC. DATE: 08-Jun-1995
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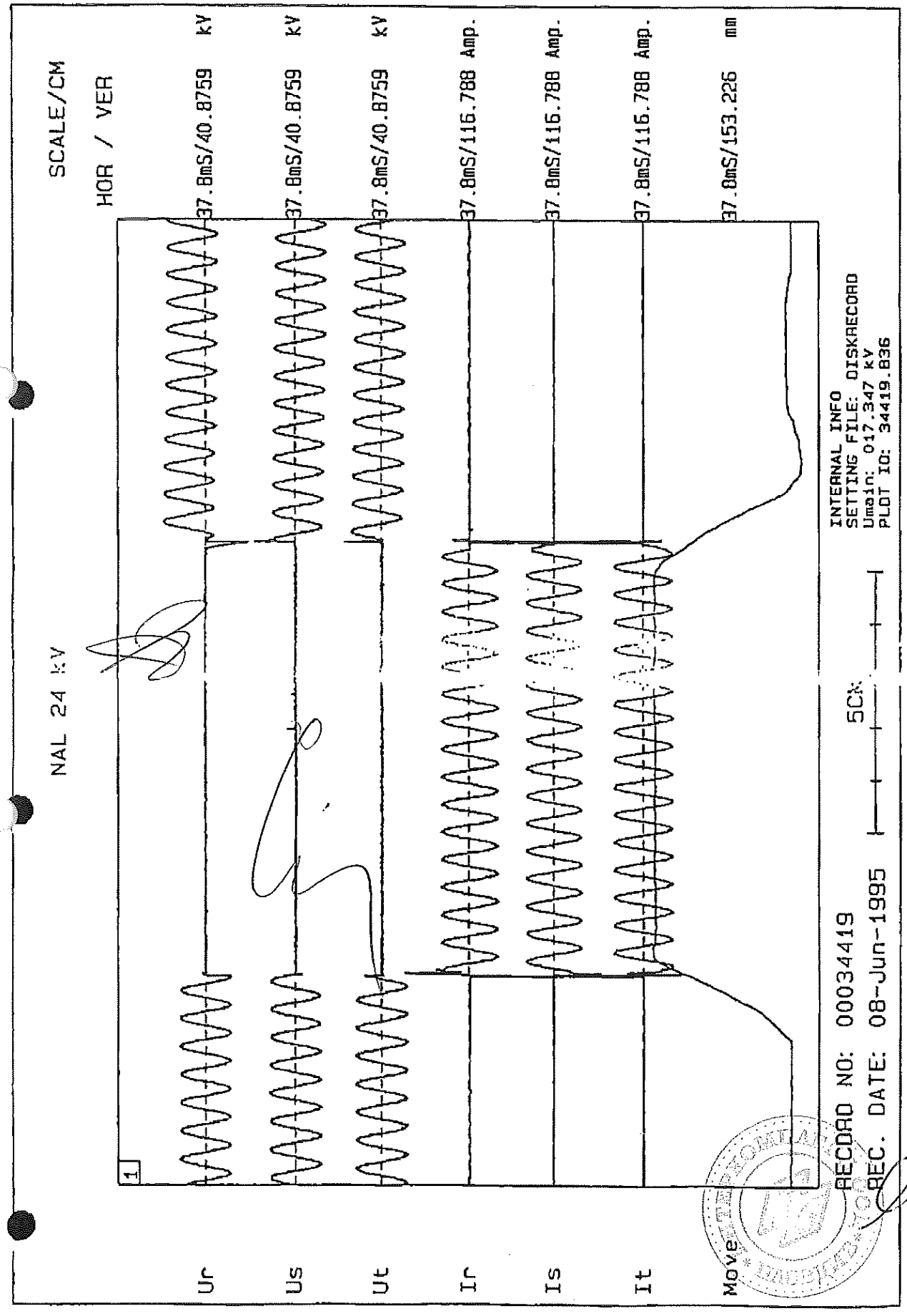
SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.347 kV
PLOT IO: 34419.836
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RECORD NO: 00034419
REC. DATE: 08-Jun-1995
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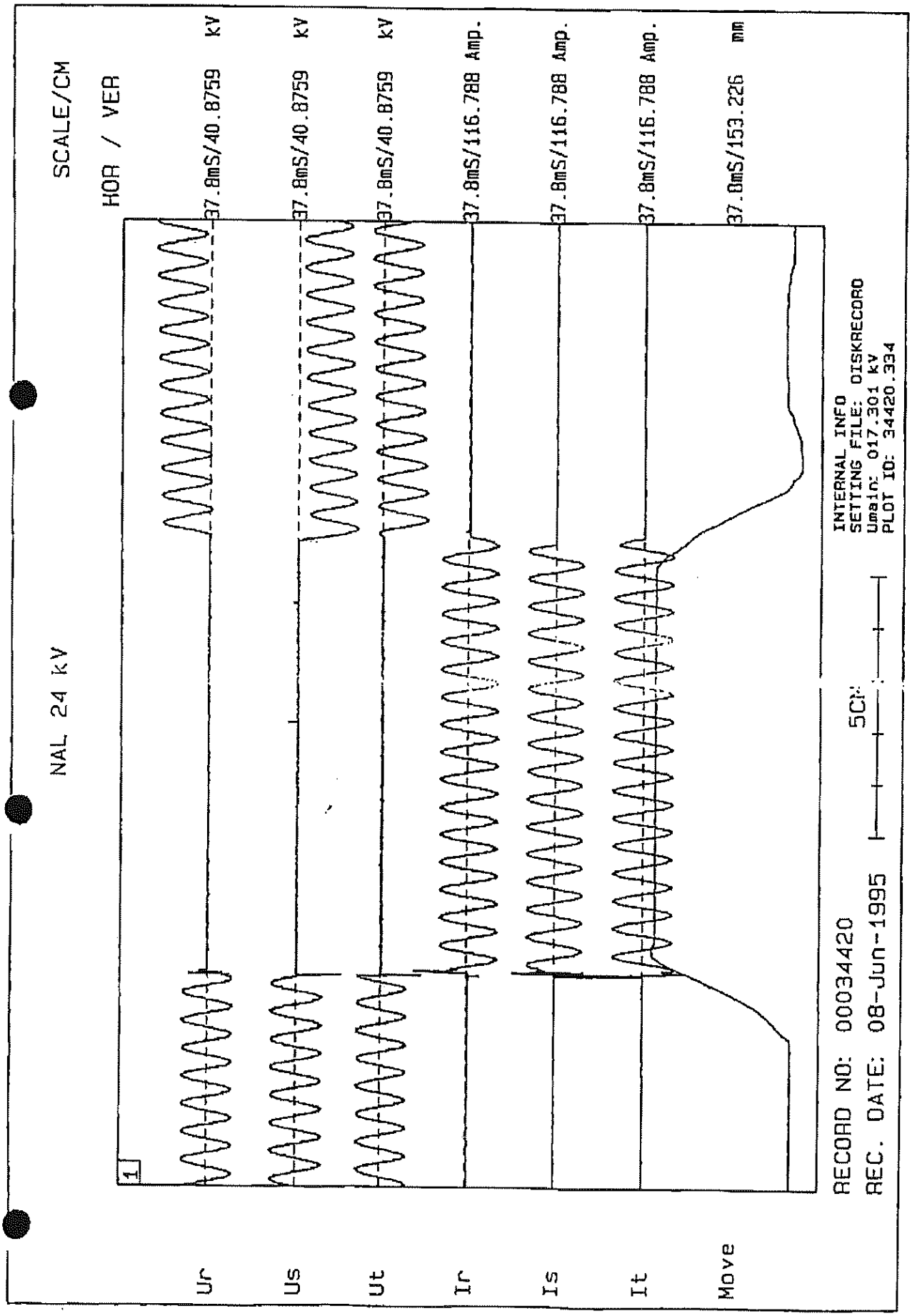
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
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37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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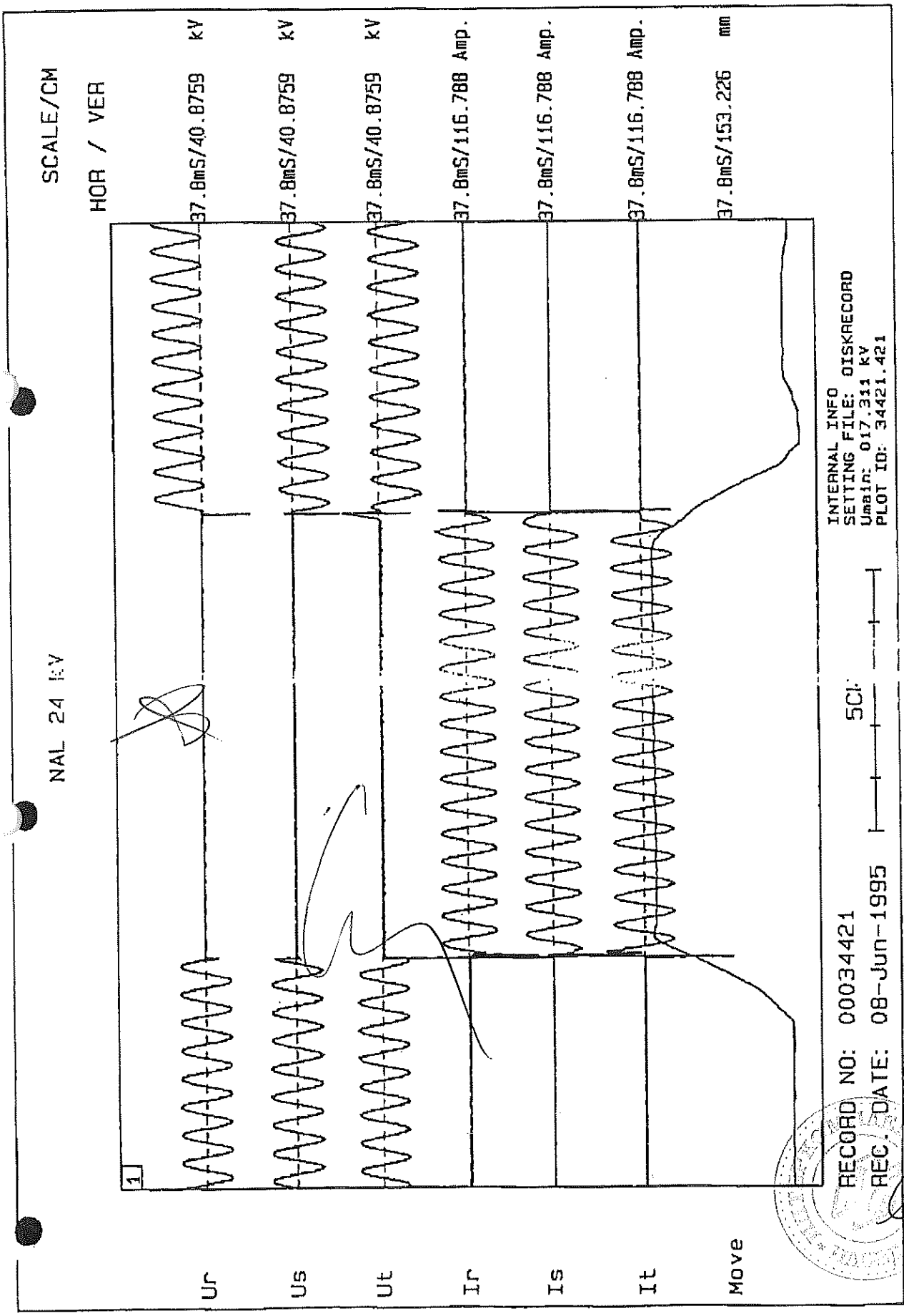
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.301 kV
PLOT ID: 34420.334
RECORD NO: 00034420
REC. DATE: 08-Jun-1995


SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: OISKRECORD
Umain: 017.311 kV
PLOT ID: 34421.421
RECORD NO: 00034421
REC. DATE: 08-Jun-1995
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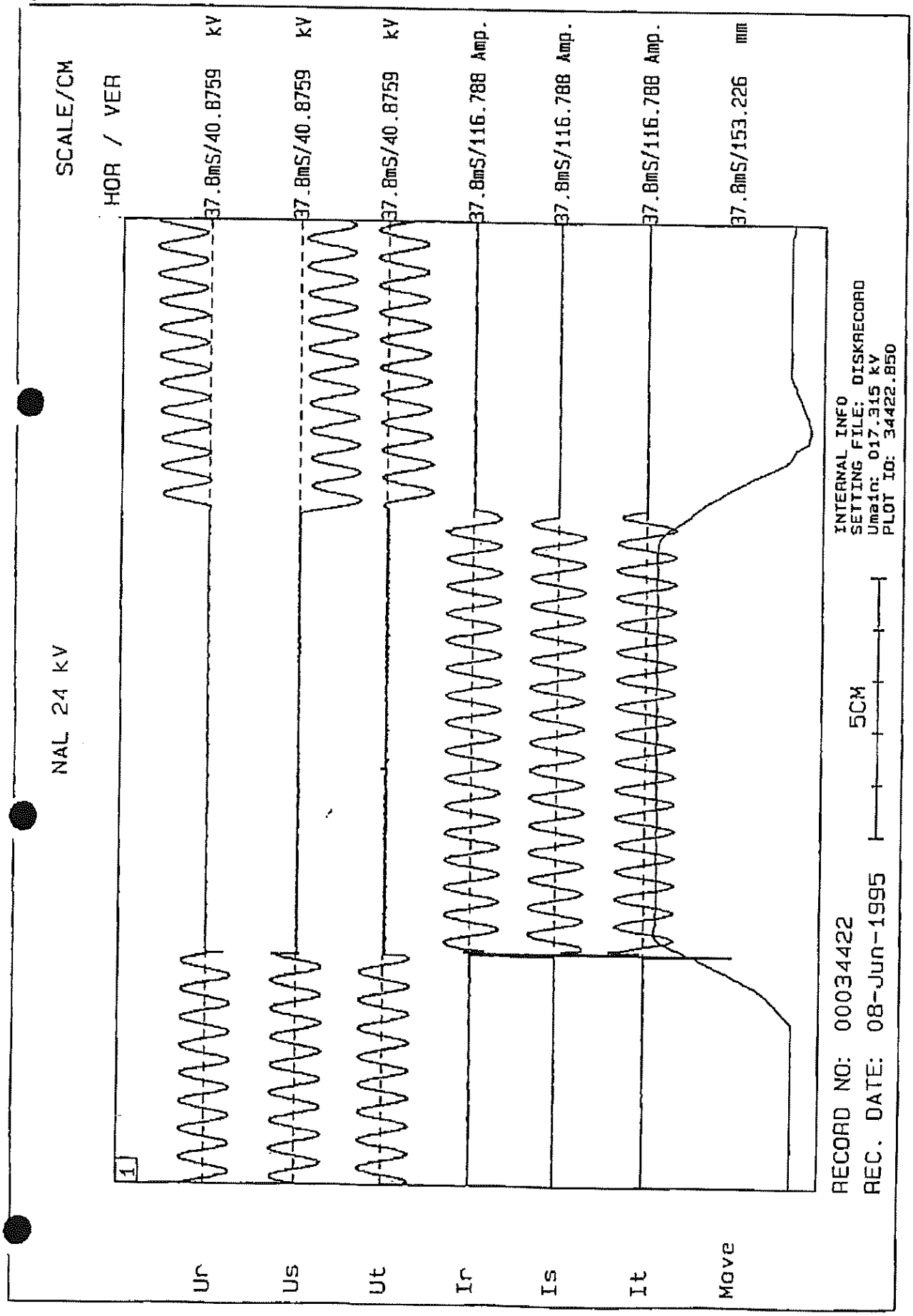
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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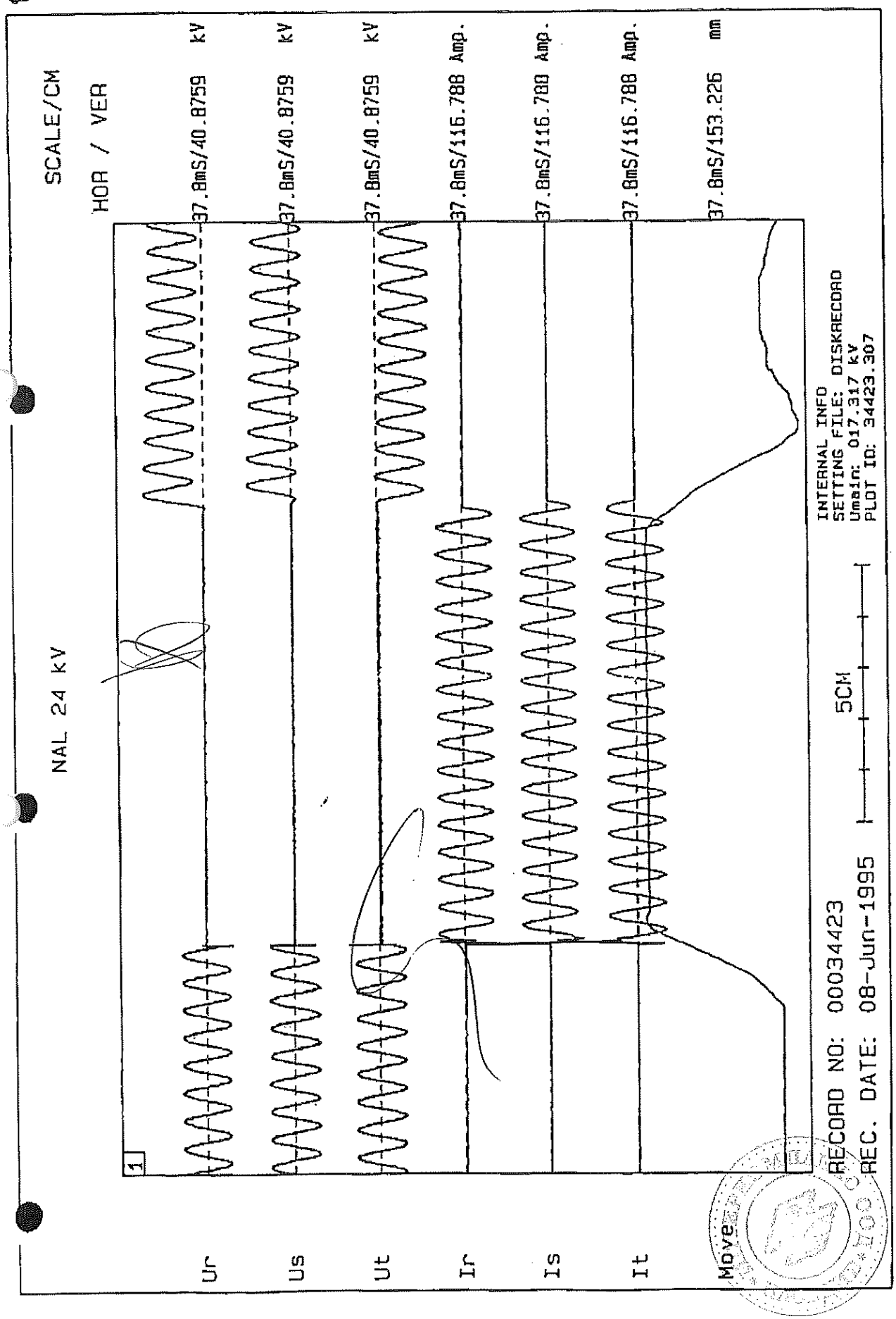
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.315 kV
PLOT ID: 34422.850
RECORD NO: 00034422
REC. DATE: 08-Jun-1995


SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.317 kV
PLOT ID: 34423.307
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RECORD NO: 00034423
REC. DATE: 08-Jun-1995
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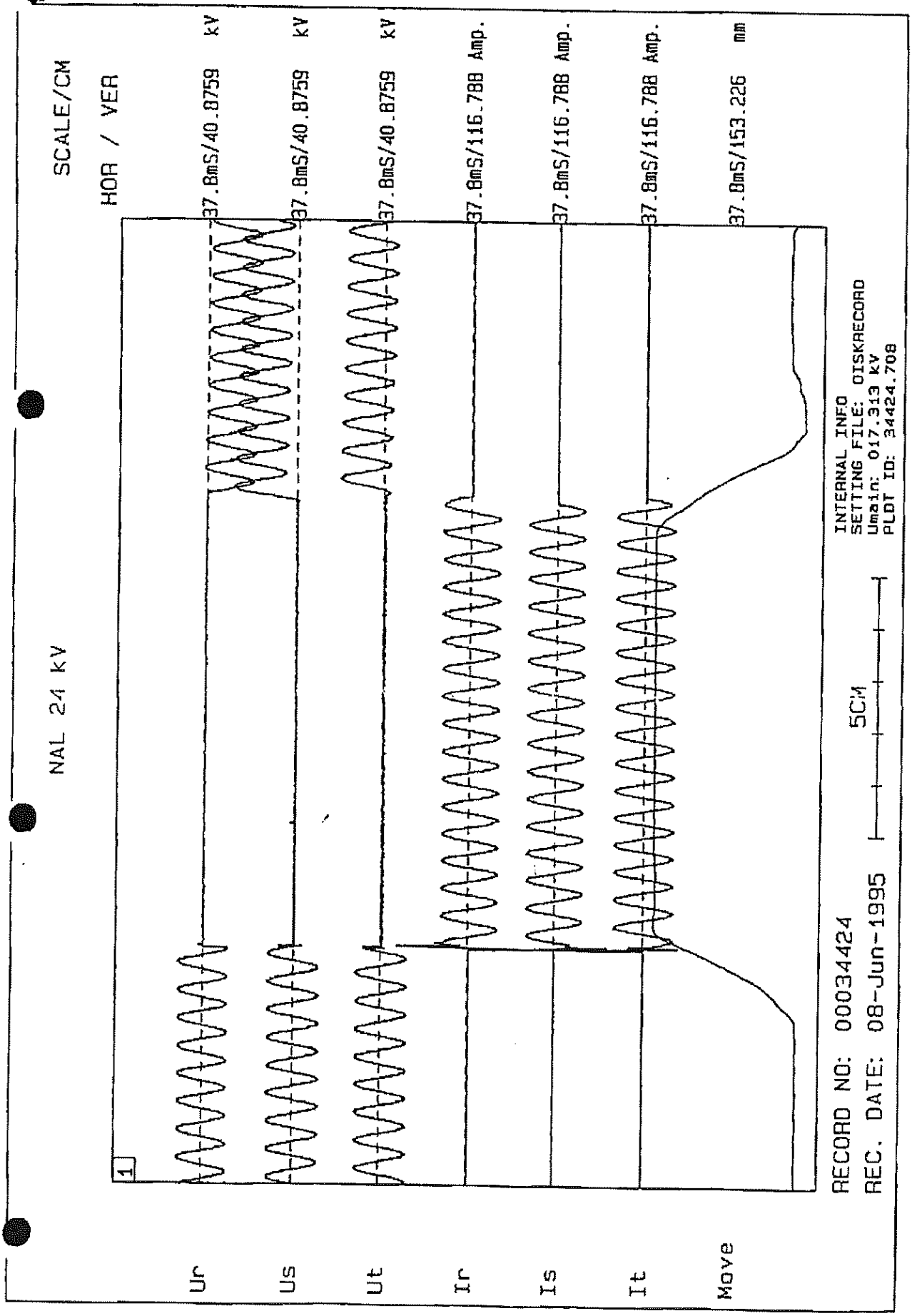
SCALE/CM
HOR / VER
NAL 24 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
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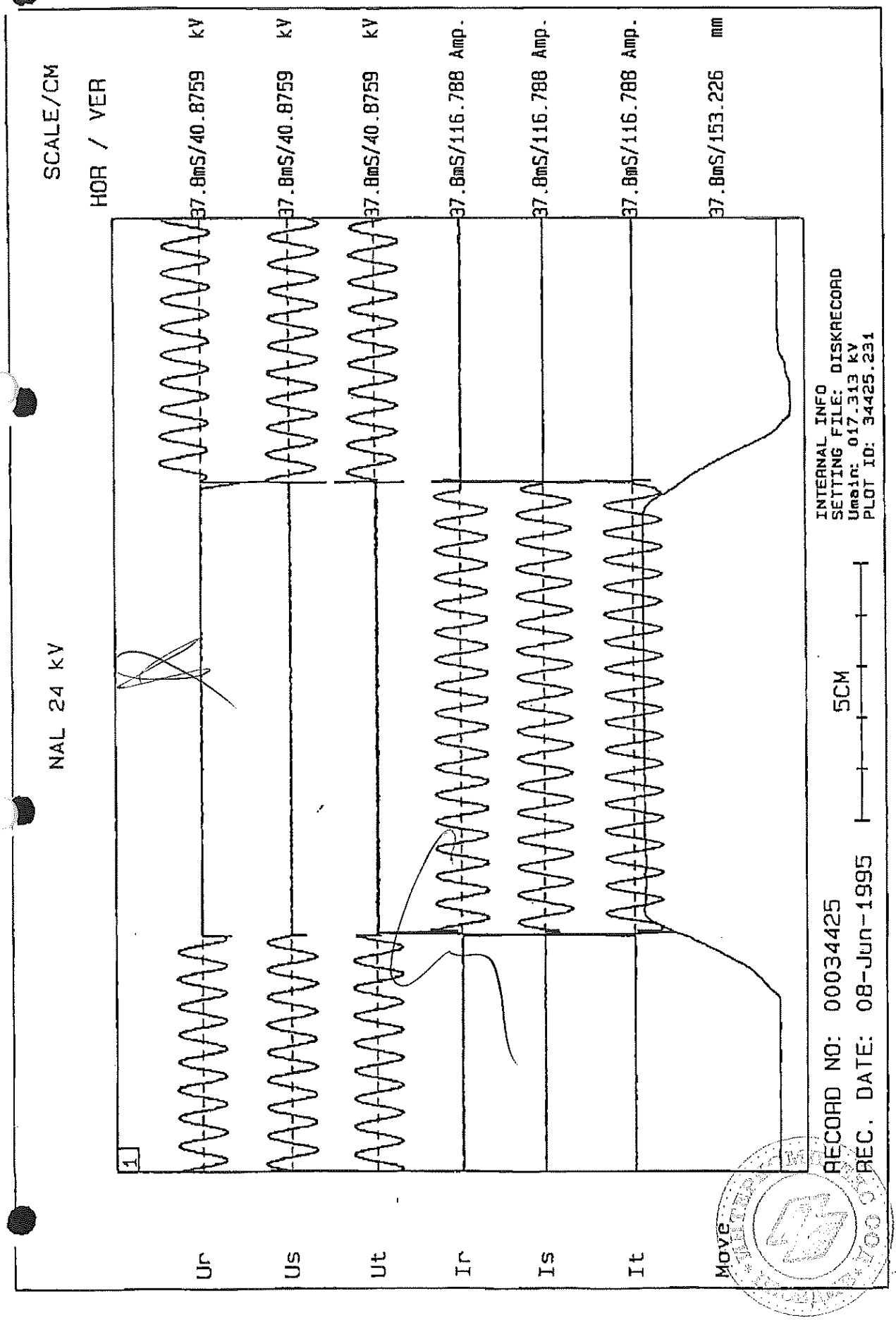
INTERNAL INFO
SETTING FILE: OISKRECORD
Umain: 017.313 kV
PLOT ID: 34424.708
RECORD NO: 00034424
REC. DATE: 08-Jun-1995


SCALE/CM
HOR / VER
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/40.8759 kV
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/116.788 Amp.
37.8mS/153.226 mm
NAL 24 kV
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.313 kV
PLOT ID: 34425.231
5CM
RECORD NO: 00034425
REC. DATE: 08-Jun-1995
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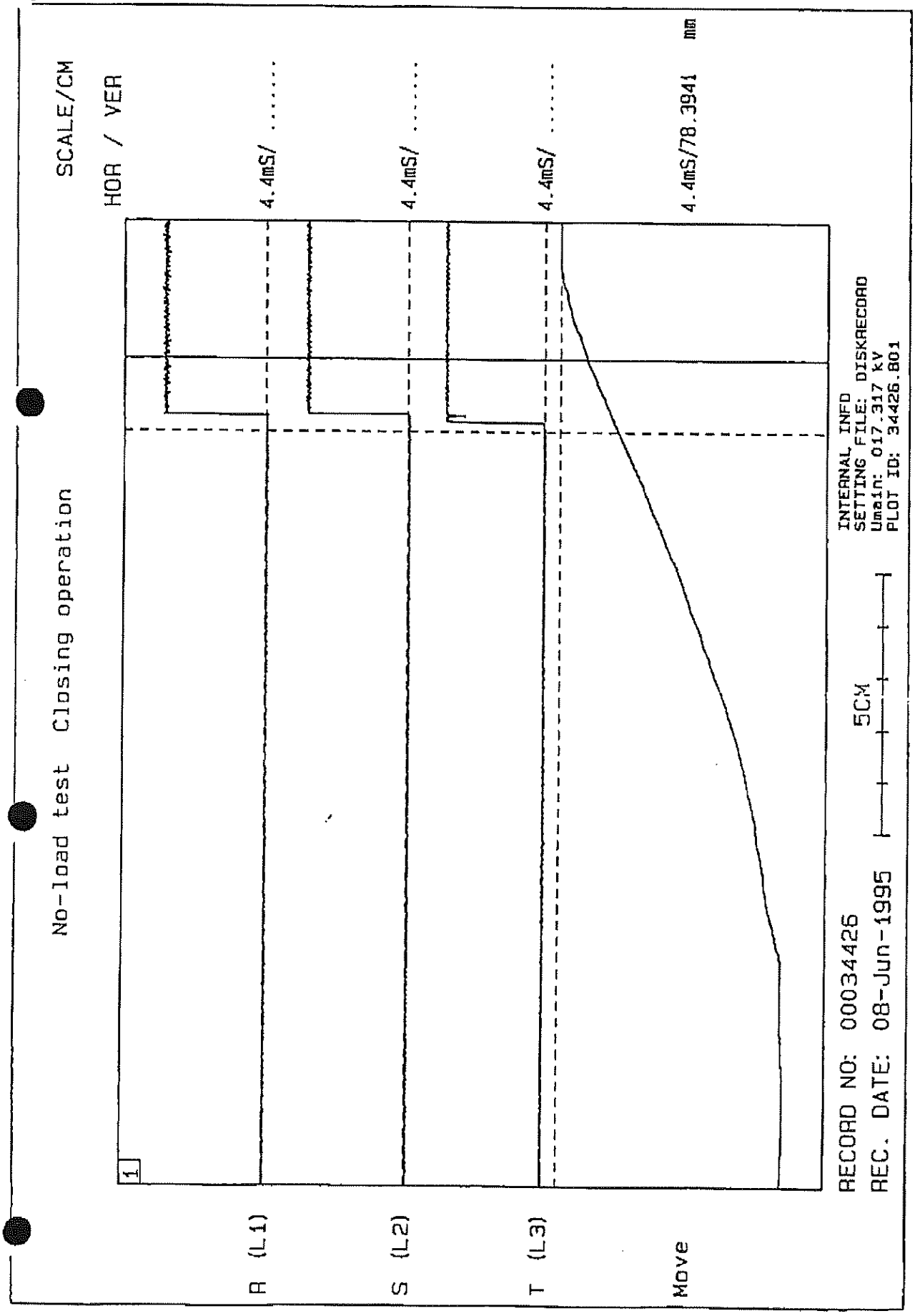
No-load test Closing operation
SCALE/CM
HOR / VER
4.4mS/ .....
4.4mS/ .....
4.4mS/ .....
4.4mS/78.3941 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.317 kV
PLOT ID: 34426.801
5CM
RECORD NO: 00034426
REC. DATE: 08-Jun-1995
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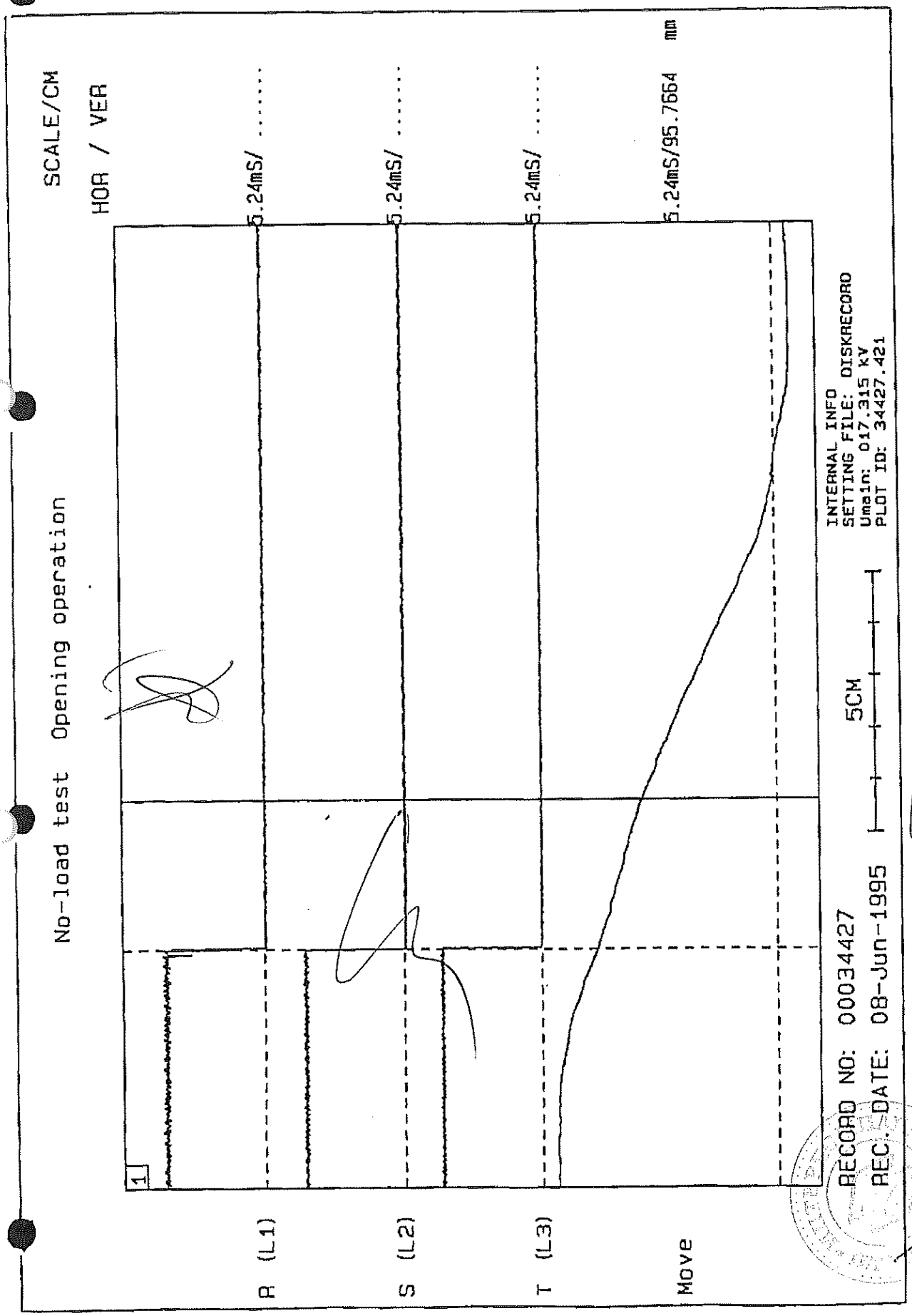
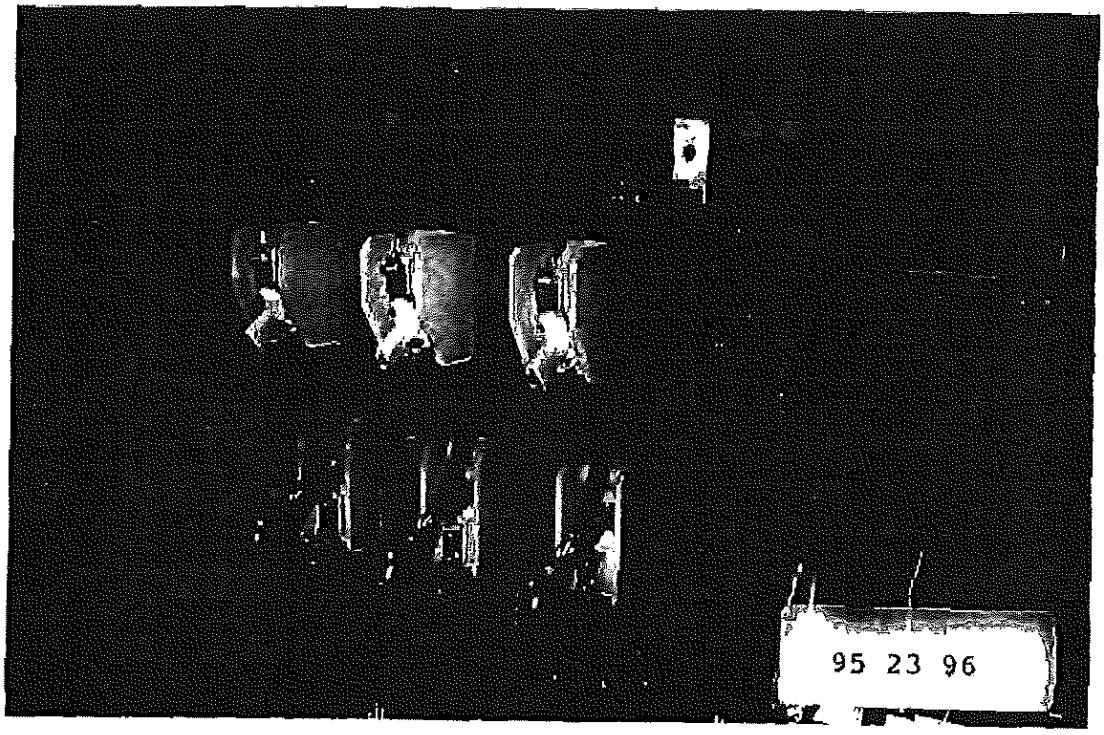
S (L2)
T (L3)
Move


No-load test Opening operation
SCALE/CM
HOR / VER
5.24mS/ .....
5.24mS/ .....
5.24mS/ .....
5.24mS/95.7664 mm
INTERNAL INFO
SETTING FILE: DISKRECORD
Umain: 017.315 kV
PLOT ID: 34427.421
5CM
RECORD NO: 00034427
REC. DATE: 08-Jun-1995
R (L1)
S (L2)
T (L3)
Move

Test object



Приложение ТС 15

NORSK
AKKREDITERING

ACCREDITATION DOCUMENT

Accreditation no PROD 016

SINTEF Energi AS, SATS Certification

Sem Sælands vei 11
7465 Trondheim

The accreditation includes certification of products within the scope specified on the following page(s) in this document.

Accreditation in accordance with NS-EN ISO/IEC 17065 (2012) is granted with the reference to Parlamentary Proposition no. 106 (1989/90) and Norwegian Accreditation's statues laid down in Royal Decree of 7 october 1993. The accreditation was initially granted 05.11.2004.

The accreditation requires regular surveillance, and is valid until 27.10.2019.

The decision of accreditation made by Norwegian Accreditation implies that the organisation fulfils the requirements for accreditation within the scope. The certification body itself is responsible for certifications performed.

NORWEGIAN ACCREDITATION

на основание чл. 36а, ал. 3 от ЗОП

29.09.2016
Date

Norwegian Accreditation

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NORSK AKKREDITERING

Accreditation document
Accreditation no. PROD 016
Scope of accreditation

The administrative/geographic unit:

SINTEF Energy AS
Sem Sælands vei 11
7465 Trondheim

is accredited for certification of the following products:

Products/ Normative doc.	Area of competence / description	Sert system ISO Guide 67	Remarks
STL General Guide	High voltage electrical power transmission and distribution equipment		QA SATS-011 Certification Procedure for Type Test Certificates and Reports of Performance QA SATS-030 Type Conformity Certification Procedure

29.09.2016
Date

на основание чл. 36а, ал. 3 от ЗОП

Norwegian Accreditation

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Laboratoria badawcze

AB 007

Akredytacja: AB 007

Data ważności certyfikatu: 15-04-2019

Akredytacja od: 31-12-1993

Dane organizacji:

Instytut Elektrotechniki

ul. Pożaryskiego 28; 04-703 Warszawa

Dane laboratorium:

Laboratorium Badawcze

ul. Narwicka 1; 80-557 Gdańsk

Kontakt:

Telefon: 58 343-12-91 wew.: brak

Komórka: brak

Fax: 58 343-12-95

Email: laboratorium@iel.gda.pl

www: laboratorium.iel.gda.pl

Zakres akredytacji:

AB 007

Dziedziny badań:

- Badania elektryczne i elektroniczne (E)
- Badania kompatybilności elektromagnetycznej (EMC) (F)
- Badania ogniowe (H)
- Badania mechaniczne, badania metalograficzne (J)
- Badania właściwości fizycznych (N)

Obiekty:

- Wyroby i wyposażenie elektryczne, telekomunikacyjne i elektroniczne

NEFI High Power Laboratory

Quality

NEFI High Power Laboratory is accredited by Norwegian Accreditation (http://www.akkreditert.no/en/akkrediterte-organisasjoner/akkrediteringsomfang/?AkkId=119) according to NS-EN ISO/IEC 17025.

The scope of accreditation is P05 Electrical testing in accordance with the specifications in the Accreditation Document for TEST 040.

The different parts of the quality system is described in the quality-manual for NEFI High Power Laboratory.
The measurement system is calibrated by external calibration laboratories with traceability to International standards.

Uncertainty of measurement is calculated in accordance with publication EA-4/02.

The accreditation requires regular surveillance.

This guarantees the optimal quality of the laboratory including strict regulations for integrity issues and procedures for calibration and traceability of measurements.

Check out our client reference list: Reference list1 – NEFI (002) (https://nefilab.com/wp-content/uploads/2018/11/Reference-list1-NEFI-002-3.pdf)

NORSK AKKREDITERING TEST 040 (http://www.akkreditert.no/en/akkrediterte-

SATS

Skien, Norway
(https://www.google.no/maps/place/NEFI+Laboratorium/data=!

NORSK
AKKREDITERING

ACCREDITATION DOCUMENT

TEST 040

ABB Laboratories, Skien, ABB AS, NEFI High Power Laboratory
Stulenvegen 71
N-3721 SKIEN
Norway

The scope of accreditation is in accordance with the specifications on the following pages in this document.

The accreditation was initially granted 10.07.1995. The accreditation is given according to "Law on the free exchange of goods in the European Economic Area" of 14.04.2013.
The organisation complies with the requirements in NS-EN ISO/IEC 17025 (2005)

The accreditation requires regular surveillance, and is valid until 01.03.2017.
The decision of accreditation made by Norwegian Accreditation implies that the organisation has been found to fulfil the requirements for accreditation within the scope.
The organisation itself is responsible for the results of performed measurements.

NORWEGIAN ACCREDITATION

16.01.2015
Date

Norwegian Accreditation

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NORSK AKKREDITERING

Accreditation document
Accreditation no. TEST 040

Administrative/geographical unit:
NEFI High Power Laboratory
Stulenvegen 71
N-3721 SKIEN; Norway

Permanent facility

P05 Electrical testing

Object	Parameter	Reference standard	Identity of internal method	Comments
Electrical equipment	Current-measurement RMS: 1A - 100kA Peak: 2,5A - 300 kA	Internal method	NEFI Dok. 8-21	
Electrical equipment	Voltage measurement AC: 10V-100kV peak DC: 10V-100kV	Internal method	NEFI Dok. 8-22	
High-voltages fuses: Current limiting fuses	Breaking tests	IEC 60282-1	NEFI Dok. 8-61	§ 6.6
Low-voltage switchgear and controlgear: General rules	General rules for IEC 60947 series. See IEC 60947-3 for testing parameters.	IEC 60947-1	NEFI Dok. 8-62	
Low-voltage switchgear and controlgear: Switches, disconnectors, switch-disconnectors and fuse-combination units	Testing of dielectric properties. Making and breaking capacities Dielectric verification. Leakage current. Operational performance test. Short-time withstand current test. Short-circuit making capacity test. Fuse protected short-circuit withstand.	IEC 60947-3	NEFI Dok. 8-63	8.3.3.2, 8.3.3.3, 8.3.3.4, 8.3.3.5, 8.3.4.1, 8.3.5.1, 8.3.5.2, 8.3.6.2
Low-voltage switchgear and controlgear assemblies: General rules	General rules for IEC 61439 series. Power-frequency withstand voltage. Testing of main circuit. Testing of the protective circuit	IEC 61439-1	NEFI Dok. 8-64	§10.9.2, §10.11.5.3, §10.11.5.6
Low-voltage switchgear and controlgear assemblies: Power switchgear and controlgear assemblies	See IEC 61439-1 for testing parameters.	IEC 61439-2	NEFI Dok. 8-65	

16.01.2015
Date

на основание чл. 36а, ал. 3 от ЗОП

Norwegian Accreditation

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NORSK AKKREDITERING

Accreditation document
Accreditation no. TEST 040

Administrative/geographical unit:
NEFI High Power Laboratory
Stulenvegen 71
N-3721 SKIEN; Norway

Permanent facility

P05 Electrical testing

Object	Parameter	Reference standard	Identity of internal method	Comments
High-voltage switchgear and controlgear: Common specifications	Common specifications for IEC 62271 series. Power-frequency voltage tests. Voltage test as condition check. Measuring the resistance of circuits. Short-time withstand current and peak withstand current tests.	IEC 62271-1	NEFI Dok. 8-67	§6.2.6.1 §6.2.11 §6.4 §6.6
High-voltage switchgear and controlgear: High-voltage alternating-current circuit-breakers	Dielectric tests. (See IEC 62271-1 for testing parameters). Measurement of the resistance of the main circuit. Short-time withstand current and peak withstand current tests.	IEC 62271-100	NEFI Dok. 8-68	§6.2 §6.4 §6.6
High-voltage switchgear and controlgear: Alternating current disconnectors and earthing switches	Dielectric tests. (See IEC 62271-1 for testing parameters). Measuring of the resistance of circuits. Short-time withstand current and peak withstand current tests. Tests to prove the short-circuit making performance of earthing switches. (Limited to 250 MVA)	IEC 62271-102	NEFI Dok. 8-69	§6.2 §6.4 §6.6 §6.101
High-voltage switchgear and controlgear: Switches for rated voltages above 1 kV up to and including 52 kV	Dielectric tests. (See IEC 62271-1 for testing parameters). Measurement of the resistance of circuits Short- time withstand current and peak withstand current tests Making and breaking tests.	IEC 62271-103	NEFI Dok. 8-70	§6.2 §6.4. §6.6. §6.101

16.01.2015
Date

на основание чл. 36а, ал. 3 от ЗОП

Norwegian Accreditation

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NORSK AKKREDITERING

Accreditation document
Accreditation no. TEST 040

Administrative/geographical unit:
NEFI High Power Laboratory
Stulenvegen 71
N-3721 SKIEN; Norway

Permanent facility

P05 Electrical testing

Object	Parameter	Reference standard	Identity of internal method	Comments
High-voltage switchgear and controlgear: High-voltage alternating current switch-fuse combinations for rated voltages above 1kV and up to and including 52kV	Dielectric tests. (See IEC 62271-1 for testing parameters). Measurement of the resistance of circuits. Making and breaking tests. Thermal test with long prearcing time of fuse	IEC 62271-105	NEFI Dok. 8-71	§6.2 §6.4, §6.101, §6.104
High-voltage switchgear and controlgear: AC metal-enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV	Dielectric tests. (See IEC 62271-1 for testing parameters). Measuring of the resistance of circuits. Short-time withstand current and peak withstand current tests. Verification of making and breaking capacities Internal arcing test Annex AA: Method for verify the internal arc classification	IEC 62271-200	NEFI Dok. 8-72	§6.2 §6.4, §6.6, §6.101, §6.106
High-voltage switchgear and controlgear: High-voltage / low-voltage prefabricated substations	Short-time withstand current and peak withstand current tests. Internal arcing test Annex AA: Internal arc fault - Method to verify the internal arc classification (IAC)	IEC 62271-202	NEFI Dok. 8-73	§6.6 §6.102

16.01.2015
Date

на основание чл. 36а, ал. 3 от ЗОП

Norwegian Accreditation

NORSK
AKKREDITERING

ACCREDITATION DOCUMENT

Accreditation no PROD 016

SINTEF Energi AS, SATS Certification

Sem Sælands vei 11
7465 Trondheim

The accreditation includes certification of products within the scope specified on the following page(s) in this document.

Accreditation in accordance with NS-EN ISO/IEC 17065 (2012) is granted with the reference to Parlamentary Proposition no. 106 (1989/90) and Norwegian Accreditation's statues laid down in Royal Decree of 7 october 1993. The accreditation was initially granted 05.11.2004.

The accreditation requires regular surveillance, and is valid until 27.10.2019.

The decision of accreditation made by Norwegian Accreditation implies that the organisation fulfils the requirements for accreditation within the scope. The certification body itself is responsible for certifications performed.

NORWEGIAN ACCREDITATION

7/10-14

Date

на основание чл. 36а, ал. 3 от ЗОП

Norwegian Accreditation

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Accreditation document
Accreditation no. PROD 016
Scope of accreditation

The administrative/geographic unit:

SINTEF Energy AS
Sem Sælands vei 11
7465 Trondheim

is accredited for certification of the following products.

Products: Normative doc.	Area of competence / description	Conf. system ISO Guide 65	Remarks
STL General Guide	Short-Circuit Testing Liaison General Guide		QA SATS 011 Type Test Certification Procedure, QA SATS 020 Type Conformity Certification Procedure. Accreditation scope: Version 7 of the STL-Guide regarding performing reports and certificates listed in paragraph 5.

The accreditation is limited to product certification of high voltage electrical transmission and distribution power equipment.
SATS Certification is a member of STL (Short-Circuit Testing Liason)

на основание чл. 36а, ал. 3 от ЗОП

27/10-14
Date

Norwegian Accreditation

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Intercomplex Ltd.®
4002 Пловдив, бул. "Пещерско шосе" № 201, тел. (032) 241 415, тел./факс: (032) 241 414, e-mail: office@intercomplex.bg
1113 София, ул. "Акад. Г. Бончев" № 20, тел. (02) 971 70 41, факс: (02) 971 71 41, e-mail: office.sf@intercomplex.bg

Приложение ТС 16
към Технически спецификации
от процедура PPD 18-118

ДЕКЛАРАЦИЯ
за доставка на резервни части

Долуподписаният ***Ехиязар Гарабед Узунян***, в качеството ми на ***управител*** на ***ИНТЕРКОМПЛЕКС ООД***, със седалище и адрес на управление: ***гр. Пловдив бул. Пещерско шосе 201***, вписано в Търговския регистър към Агенцията по вписванията с ЕИК ***115096057***, във връзка с обявената от ***ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ АД***, процедура от вида „договаряне без предварителна покана за участие", за сключване на рамково споразумение с предмет: ***„Доставка на триполюсни товарови прекъсвачи за монтиране на закрито", реф. № 18-118***

ДЕКЛАРИРАМ:

1. Производителят, „ABB" – Полша, гарантира, че ще осигурява резервни части за товаровите прекъсвачи, съгласно приложения списък за период не по-малък от 20 години.

2. Правя настоящата декларация на основание предоставените ми документи от производителя - „ABB" – Полша, приложени към настоящата документация.

Известно ми е, че при деклариране на неверни данни, нося наказателна отговорност по чл. 313 от НК.

на основание чл. 36а, ал. 3 от ЗОП

08.03.2019 година

Декларатор: .....

Ехиязар Узунян

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Превод от английски

ABB (лого)

Декларация на производител

Дата: 12.02.2019

До АББ България

бул. Христофор Колумб № 8, ет. 3

Ние, ABB Sp. z. o. o. , разположени на ул. Зеганска № 1, 04-713 Варшава, производител на товарови прекъсвачи за вътрешен монтаж тип NAL(F), с настоящото декларираме доставката на резервни части за период от 20 години.

Adam Durski

Подпис: не се чете

Специалист производство

Artur Cwalina

Подпис: не се чете

Регионален производствен управител

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Manufacturer's Declaration

Date: 12.02.2019

To: **ABB Bulgaria EOOD**
9 Christofor Columbus Blvd. fl.3
1592, Sofia, Bulgaria

We, ABB Sp. z o. o., located in Zeganska Str. 04-713 Warszawa, producer of indoor switch disconnector NAL(F) type do hereby confirm guaranteed delivery of the spare parts for period of 20 years.

Adam Durski

на основание чл. 36а, ал. 3 от ЗОП

Product specialist

Artur Cwalina

на основание чл. 36а, ал. 3 от ЗОП

Local Product Group Manager

25 years in Poland

www.abb.pl

ABB Sp. z o.o.
Headquarters
1 Żegańska Str.
04-713 Warszawa
tel.: + 48 22 22 37 000
fax: +48 22 22 37 222

Branch Office
in Przasnysz
59 Leszno Str.
06-300 Przasnysz, Poland
tel.: +48 22 22 38 900
fax: +48 22 22 38 953

District Court for the Capital City of Warsaw, XIII Economic Department, Polish Court Register under the KRS No. 0000004745

NIP (taxpayer identification no.): 526-030-44-84, PL 5260304484
GIOŚ (environmental identification no.): E0008536WBW
Share capital: 350 655 734,00 PLN

ABB Contact Center: +48 2222 3 7777

intercomplex Ltd.®
4002 Пловдив, бул. "Пещерско шосе" № 201, тел. (032) 241 415, тел./факс: (032) 241 414, e-mail: office@intercomplex.bg
1113 София, ул. "Акад. Г. Бончев" № 20, тел. (02) 971 70 41, факс: (02) 971 71 41, e-mail: office.sf@intercomplex.bg

Приложение 3
към Техническо предложение
по процедура реф.№ PPD 18-118

СРОКОВЕ ЗА ДОСТАВКА

№	Наименование	Мярка	Количество със срок на доставка до 7 кал. дни	Количество със срок на доставка до 30 кал. дни
1	2	3	4	5
1	Триполюсен товаров прекъсвач за монтиране на закрито, комбиниран със заземителни ножове 12kV/16kA за 630A	бр.	5	20
2	Триполюсен товаров прекъсвач за монтиране на закрито, комбиниран със заземителни ножове 24kV/16kA за 630A	бр.	10	30
3	Триполюсен товаров прекъсвач за монтиране на закрито, комбиниран с предпазители и заземителни ножове 12kV/16kA за 400A	бр.	5	20
4	Триполюсен товаров прекъсвач за монтиране на закрито, комбиниран с предпазители и заземителни ножове 24kV/16kA за 400A	бр.	5	20

Забележки:

1/ Срокът на доставките започва да тече от датата на изпращане на поръчката.

2/ Количествата в колона 4, със срок на доставка до 7 /седем/ календарни дни, се доставят след SAP поръчка до посочените в обявлението складове на Възложителя за покриване на спешни нужди на Възложителя.

Възложителят може до поръчва посоченото спешно количество веднъж месечно.

3/ В случай, че крайният срок на доставката съвпада с празничен или неработен ден, то доставката се извършва не по-късно от първия работен ден след изтичането на срока.

4/ При поръчки на Възложителя на количества в рамките на потвърдените от Изпълнителя и недоставени в посочените срокове, ще бъдат налагани неустойки, съгласно условията на договора.

5/ Възложителят може да поръча количества по-малки от посочените в колони 4 и 5.

6/ Възложителят може да поръчва количества по-високи от посочените в колони 4 и 5, като това обстоятелство ще бъде посочено текстово в съответната поръчка изпратена към Изпълнителя. С потвърждението на поръчката, Изпълнителят вписва в същата очаквана дата за доставка на количествата надвишаващи посочените в колони 4 и 5.

7/ Количествата за доставка в колони 4 и 5 са отделни и независими едно от друго.

8/ Количествата за доставка в колона 5 не включват в себе си количествата за доставка в колона 4.

9/ Възложителят има право да направи едновременно поръчки за доставка на количества от колони 4 и 5.

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08.03.2019 г.

Участник: ИНТЕРКОМПЛЕКС ООД

на основание чл. 36а, ал. 3 от ЗОП

Ехиязар Узунян - управител

intercomplex Ltd.®
4002 Пловдив, бул. "Пещерско шосе" № 201, тел. (032) 241 415, тел./факс: (032) 241 414, e-mail: office@intercomplex.bg
1113 София, ул. "Акад. Г. Бончев" № 20, тел. (02) 971 70 41, факс: (02) 971 71 41, e-mail: office.sf@intercomplex.bg

ДЕКЛАРАЦИЯ

за приемане на условията в проекта на рамково споразумение и проекта на конкретен договор, неразделна част от рамковото споразумение

Долуподписаният ***Ехиязар Гарабед Узунян***, в качеството ми на ***управител*** представляващ ***ИНТЕРКОМПЛЕКС ООД***, участник в процедура от вида „договаряне без предварителна покана за участие", за сключване на рамково споразумение, с предмет **„Доставка на триполюсни товарови прекъсвачи за монтиране на закрито", реф. № PPD 18-118**

ДЕКЛАРИРАМ, ЧЕ:

1. Приемам условията в проекта на рамково споразумение, приложен в документацията за участие.

2. Приемам условията в проекта на конкретен договор, неразделна част от рамковото споразумение, приложен в документацията за участие.

на основание чл. 36а, ал. 3 от ЗОП

08.03.2019 г.

Декларатор: .....

Ехиязар Гарабед Узунян

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intercomplex Ltd.®

4002 Пловдив, бул. "Пещерско шосе" № 201, тел. (032) 241 415, тел./факс: (032) 241 414, e-mail: office@intercomplex.bg
1113 София, ул. "Акад. Г. Бончев" № 20, тел. (02) 971 70 41, факс: (02) 971 71 41, e-mail: office.sf@intercomplex.bg

ДЕКЛАРАЦИЯ

за срока на валидност на офертата

Долуподписаният **Ехиязар Гарабед Узунян**, притежаващ лична к[на основание чл. 36а, ал. 3 от ЗОП] на [на основание чл. 36а, ал. 3 от ЗОП] [illegible] управител на „ИНТЕРКОМПЛЕКС" ООД, участник в процедура от вида „договаряне без предварителна покана за участие", за сключване на рамково споразумение, **„Доставка на триполюсни товарови прекъсвачи за монтиране на закрито", реф. № PPD 18-118**

ДЕКЛАРИРАМ, ЧЕ:

С подаване на настоящата оферта, направените от нас предложения и поети ангажименти са валидни за срок от **6 (шест)** месеца, считано от крайния срок за подаване на офертите.

[на основание чл. 36а, ал. 3 от ЗОП]

08.03.2019 г.

Декларатор: .....

Ехиязар Гарабед Узунян

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