

REPORT OF PERFORMANCE

486-91

CLIENT National Switchgears,
Ambattur, Madras, India
MANUFACTURER National Switchgears,
Ambattur, Madras, India
APPARATUS Punched stainless steel resistor
SERIAL No. K/072

RATINGS ASSIGNED BY THE MANUFACTURER

Resistance	0.018	Ω
Voltage	11	kV
Thermal current	2000	A
Duration	10	s
Frequency	50	Hz

The tests have been carried out in accordance with the client's instructions.
Test procedure and test parameters were based on ANSI/IEEE Std. 32.

Date of tests 14th and 15th November 1991

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

THIS REPORT CONSISTS OF:

Sheets	5
Circuit diagrams	1
Electromagnetic oscillograms	1
Photographs	2
Report no.	1430-91
Classification sheet	B70E

© Copyright: Publication or reproduction of the contents of this report in any other form than a complete copy to the letter, is not allowed without our written consent.

N.V. KEMA

H.W. Kempen

Arnhem, 9th December 1991

TYPE OF TEST	LOCATION	TEST DATE	OBSERVER	SHEET
Dielectric tests	High-Voltage Laboratory	14th November 1991	W.J.W.M. Sloot	Report 1430-91
10 s temperature-rise test	De Zoeten Laboratorium	15th November 1991	M. Lusing	3 and 4

The tests were witnessed by :

Name

Samy, R. P.

CompanyNational Switchgears,
Ambattur, Madras, India*Photographs*141305
141306

TABLE WITH TEST RESULTS

REPORT **406-91** TYPE OF TESTS REQUESTED: Short-time withstand current test TEST CIRCUIT **S01** SHEET **3**

Condition before tests: Resistor new. Photograph 141305.
 Top connections made by means of flexible connectors.
 Ambient temperature: 8 °C.

Before the temperature-rise test a power-frequency voltage withstand test and a lightning-impulse voltage withstand test was carried out at our High-Voltage Laboratory.
 See report no. 1430-91 (included).

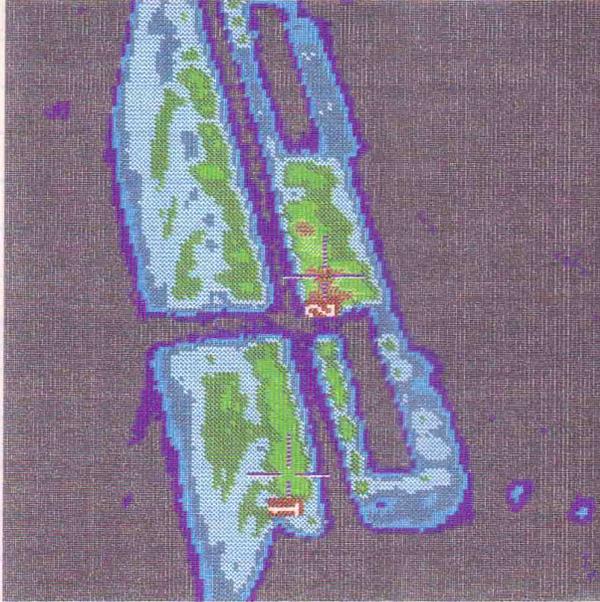
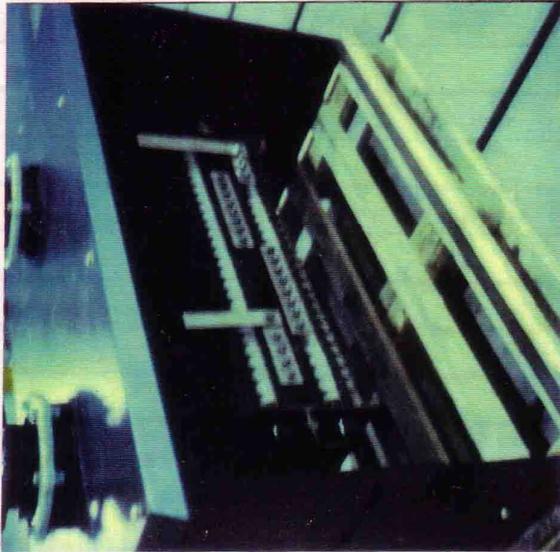
Date and test	Peak value of current A	Symmetrical current				Duration s	Voltage			Maximum temperature (1) °C	Physical behaviour		Remarks
		Beginning A	Middle A	End A	Average A		Beginning kV	Middle kV	End kV		Flame	Emission of Gas	
911115 5011	A	2090	2090	2090	2090	10.1	49	57	63	532	none	none	No visible disturbance.

Condition after tests: Externally no visible change.
 Porcelain intact.
 Photograph 141306.
 (1) During the test an infra-red temperature measurement was carried out to detect the hottest spot in the resistor.
 (See next sheet).



PLOT WITH TEST RESULTS

Infra-red temperature measurement



FUNC	RESULT	°C	X/Y
SP1	379		29/ 73
SP2	532		75/ 65
ARI		19600	WHOLE
EXT	*110	*532	

- 751
- 711
- 670
- 631
- 590
- 550
- 511
- 468
- 429
- 391
- 348
- 306
- 264
- 227
- 187
- 146
- 110

NORM 40.0 °C
FREEZE

E 0.34 Ea 0.34

CRT Heat and Flow Dept SHQ-P784
Hans Galenkamp tel (040-7)33106

K071.012 91-NOV-15 11:05:20 Resistor K/071, 10 sec.

K/071 on plot is not correct, please read K/072.

REPORT 486-91		CALIBRATION OF ELECTROMAGNETIC OSCILLOGRAM				SHEET 5	
Time marking ▶		100 ms	ms	ms	ms	ms	
Trace ▼	Phase ▼	Test	Test	Test	Test	Test	
		911115 5011					
CURRENT OPENING COIL momentary A/mm							
CURRENT CLOSING COIL momentary A/mm							
VOLTAGE momentary kV/mm							
1		0.87					
CURRENT momentary A/mm							
2		160					
AMPLIFIED VOLTAGE momentary V/mm							
AMPLIFIED CURRENT momentary A/mm							
$i^2 t$ $10^3 \times A^2 \text{ s/mm}$							
POWER MW/mm							
ENERGY MJ/mm							
PRESSURE bar/mm							

Trace No. 1 is indicated on each oscillogram. Traces are numbered from top to bottom except for travel recorders. For practical reasons travel recorder traces bear no number.

CIRCUIT COMPONENTS

- G = GENERATOR
- MB = MASTER BREAKER
- MS = MAKE SWITCH
- PT = POWER TRANSFORMER
- R = RESISTOR
- C = CAPACITOR
- L = INDUCTANCE

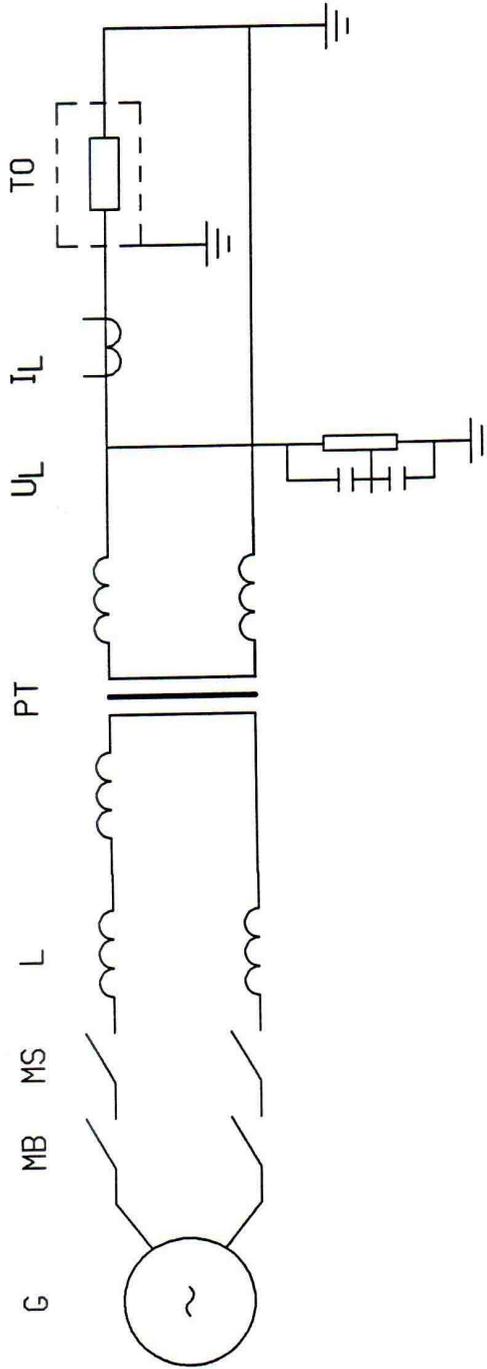
- TO = TEST OBJECT
- AL = ARTIFICIAL LINE
- AB = AUXILIARY BREAKER
- OP = OVERVOLTAGE PROTECTION

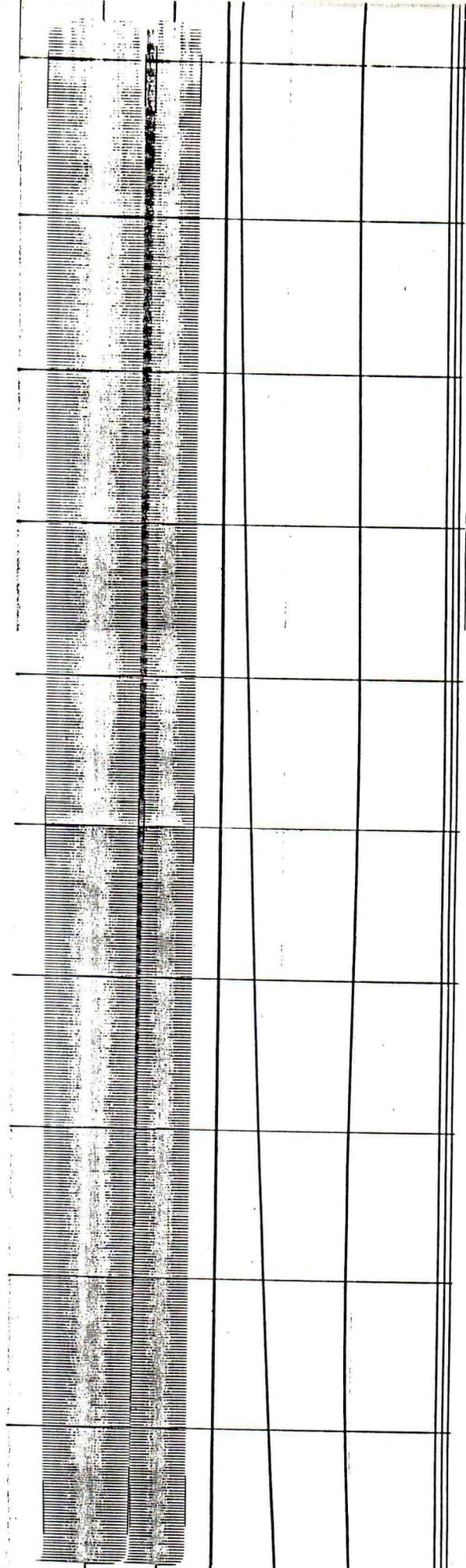
MEASUREMENTS

- U = VOLTAGE MEASUREMENT
- I = CURRENT MEASUREMENT

SUFFIX OF U AND I

- L = LOW-FREQUENCY RECORDING INSTRUMENT
- H = HIGH-FREQUENCY RECORDING INSTRUMENT
- LD = DIFFERENTIAL MEASUREMENT WITH L
- HD = DIFFERENTIAL MEASUREMENT WITH H





50 mm
For calibration values see calibration sheet
TEST 911115-0011
KEMAR



KEMA

BEFORE TEST
911115-5010

KEMA

AFTER TEST
911115-5011



CLIENT
National Switchgears, Madras, India

Order no. 1366500

Client's reference: Mr. R.P. Samy

Report no. 1430-91

Test report concerning a power frequency voltage withstand test and a lightning impulse voltage withstand test on a neutral grounding resistor unit with serial number K/072

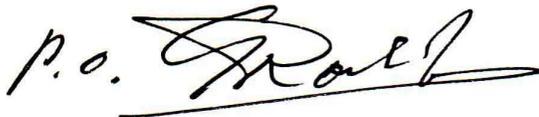
Date and place of test:
November 14, 1991, in the High-Voltage Laboratory of N.V. KEMA, Arnhem, the Netherlands

Author: W.J.W.M. Slood

SUMMARY AND CONCLUSION

The test programme was specified by the client.
The tests were passed successfully.

N.V. KEMA
KEMA HIGH-POWER/HIGH-VOLTAGE LABORATORIES
High-Voltage Laboratory



N. van Schaik

To this report belong:

- 4 pages
- 2 appendices
- 7 oscillograms
- 1 drawing

© Publication in total or in part and/or reproduction in whatever way of the contents of this report is not allowed unless permission has been explicitly given either in this report or by previous letter.

- 5 DEC 1991

MATERIAL TESTEDNeutral grounding resistor unit

Manufacture : National Switchgears,
Madras, India

Quantity : 1

Serial number : K/072

Year of construction : 1991

System voltage : 11000 V, 50 Hz

Fault current : 2000 A

Duration : 10 s

Total resistance : $0.018 \Omega \pm 10\%$ (20°)

Material of element : stainless steel (punched)

See also drawing no. 1 for construction and dimensions.

PURPOSE OF THE TESTS

Purpose of the testing was to verify whether the material complies with the requirements set by the client.

TEST PROGRAMME

The test programme was specified by the client and was as follows:

- 1 power frequency voltage withstand test with reference to IEC 694, clause 6.1.7
requirement: no flashover
no breakdown
- 2 lightning impulse voltage withstand test with reference to IEC 694, clause 6.1.6
requirement: no flashover
no breakdown.

DATE AND PLACE OF THE TESTS

November 14, 1991, in the High-Voltage Laboratory of KEMA, Arnhem, the Netherlands.

PERSONS ATTENDING THE TESTS

Mr. R.P. Samy (National Switchgears).

THE TESTS WERE CARRIED OUT BY

Mr. W.J.W.M. Sloot and Mr. J.F.W. Scheefhals.

DESCRIPTION AND RESULTS OF THE TESTS**1 Power frequency voltage withstand test**

The neutral grounding resistor unit was subjected to a power frequency voltage withstand test with the test voltage as per clause 4.2.1, table 1 of IEC 694.

The unit was placed on the laboratory floor.

A voltage of 20 kV was applied for 1 minute to the interconnected terminals of the unit, the enclosure being earthed. The voltage was measured by using a resistive divider.

The atmospheric conditions were taken into account according to clause 6.1.1 of IEC 694.

Neither flashover nor breakdown occurred.

The results are represented in appendix 1.

The results do not give rise to remarks.

2 Lightning impulse voltage withstand test

The neutral grounding resistor unit was subjected to a lightning impulse voltage withstand test with the test voltage as per clause 4.2.1, table 1, list 1 of IEC 694.

The unit was placed on the laboratory floor. A lightning impulse with a crest value of 40 kV was applied to the interconnected terminals of the unit, the enclosure being earthed.

The wave shape was determined at 50% of the test voltage and was 1.14/46 μ s.

The voltage was measured by using a resistive divider.

The atmospheric conditions were taken into account according to clause 6.1.1 of IEC 694.

Neither flashover nor breakdown occurred.

The results are represented in appendix 2.

The results do not give rise to remarks.

Report no.: 1430-91
 Test date : 1991-11-14

Appendix: 1
 Page no.: 1

Results of the power frequency voltage withstand test.
 Test object: neutral grounding resistor unit, serial no. K/072

Atmospheric conditions

Ambient temperature (t) : 19.5 °C Ambient air pressure (p) : 993 mbar
 Temperature of the test object : 19.5 °C Humidity (h) : 8.5 g H₂O/m³

number	voltage applied between	voltage and duration kV s	results	remarks
1	interconnected terminals and enclosure	20 60	no flashover no breakdown	none

Report no.: 1430-91

Appendix: 2

Page no.: 1

RESULTS OF THE LIGHTNING IMPULSE VOLTAGE TEST.

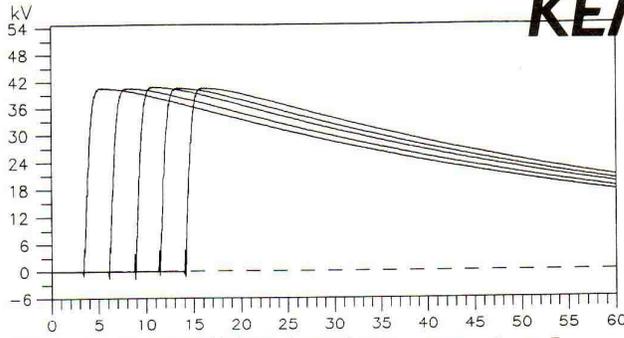
Testobject: Neutral Grounding Resistor Unit, serial no. K/072

Atmospheric conditions

Ambient temperature (T) : 19.5 °C
 Temperature of the testobject: 19.5 °C
 Ambient air pressure (b) : 993 mbar
 Humidity (h) : 8.5 g H₂O/m³

Requirement: IEC 694, clause 6.1.6, used as a guide

Fig. No.	Number of impulses	Remarks	Date	Time
1	1	Waveshape: 1.14/47 μs	911411	13:32
2	5	negative impulses nos. 1 - 5	911411	13:34
3	5	negative impulses nos. 6 - 10	911411	13:37
4	5	negative impulses nos. 11 - 15	911411	13:55
5	5	positive impulses nos. 1 - 5	911411	13:58
6	5	positive impulses nos. 6 - 10	911411	14:01
7	5	positive impulses nos. 11 - 15	911411	14:04



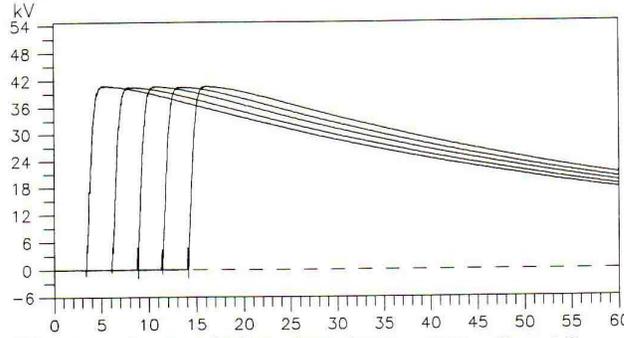
PEAKVALUES:

- 40.7 kV
- 40.6 kV
- 40.9 kV
- 40.7 kV
- 40.7 kV

Date: 91-14-11
Time: 13:58

μs

fig.no. 5 positive impulses nos. 1 - 5



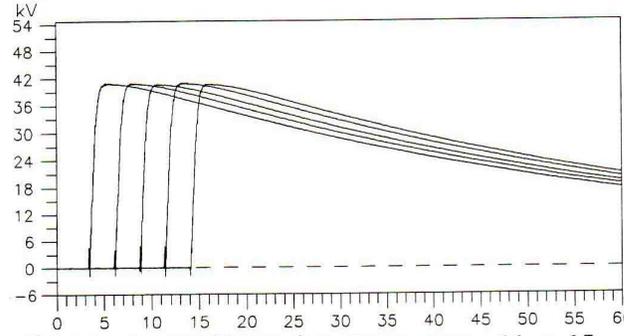
PEAKVALUES:

- 41.0 kV
- 40.7 kV
- 40.8 kV
- 40.7 kV
- 40.7 kV

Date: 91-14-11
Time: 14:01

μs

fig.no. 6 positive impulses nos. 6 - 10



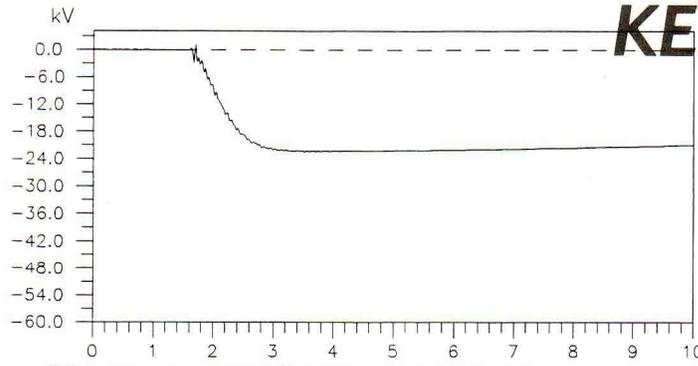
PEAKVALUES:

- 41.0 kV
- 41.0 kV
- 40.7 kV
- 41.1 kV
- 40.7 kV

Date: 91-14-11
Time: 14:04

μs

fig.no. 7 positive impulses nos. 11 - 15



PEAKVALUE:

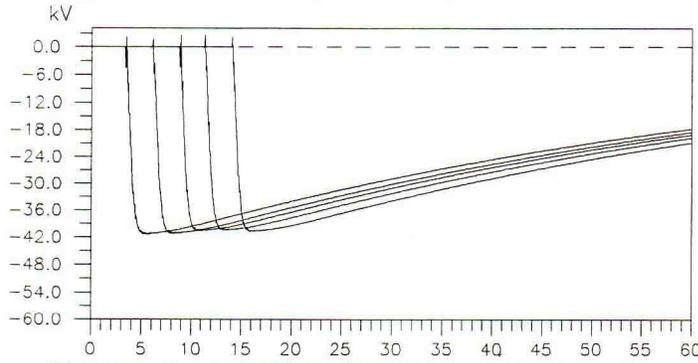
-22.4 kV

Date: 91-14-11

Time: 13:32

μs

fig.no. 1 Waveshape: 1.14/47 μs



PEAKVALUES:

-41.4 kV

-41.2 kV

-40.6 kV

-40.5 kV

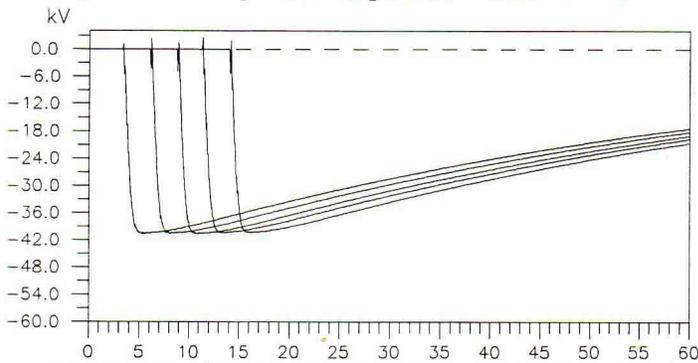
-40.8 kV

Date: 91-14-11

Time: 13:34

μs

fig.no. 2 negative impulses nos. 1 - 5



PEAKVALUES:

-40.7 kV

-40.7 kV

-40.7 kV

-40.5 kV

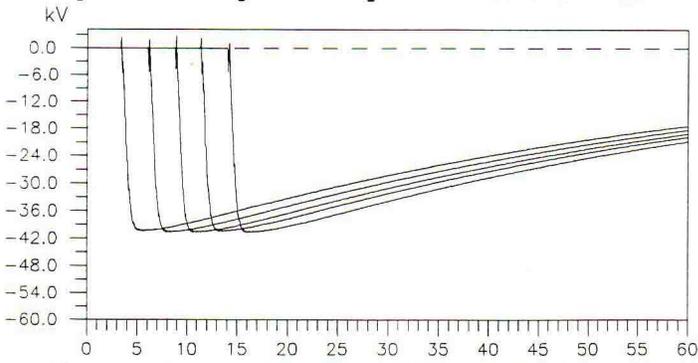
-40.4 kV

Date: 91-14-11

Time: 13:37

μs

fig.no. 3 negative impulses nos. 6 - 10



PEAKVALUES:

-40.4 kV

-40.7 kV

-40.7 kV

-40.5 kV

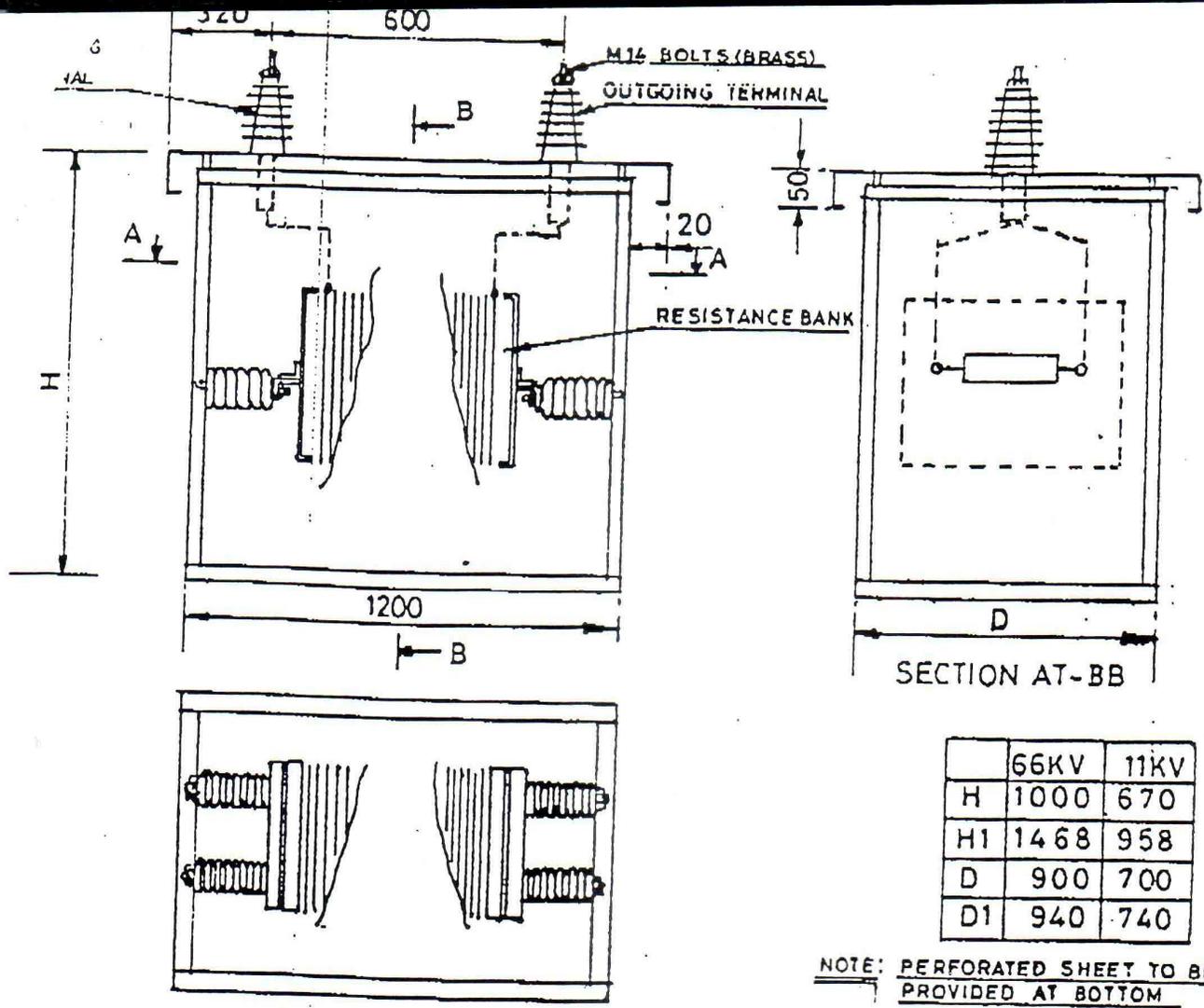
-40.7 kV

Date: 91-14-11

Time: 13:55

μs

fig.no. 4 negative impulses nos. 11 - 15

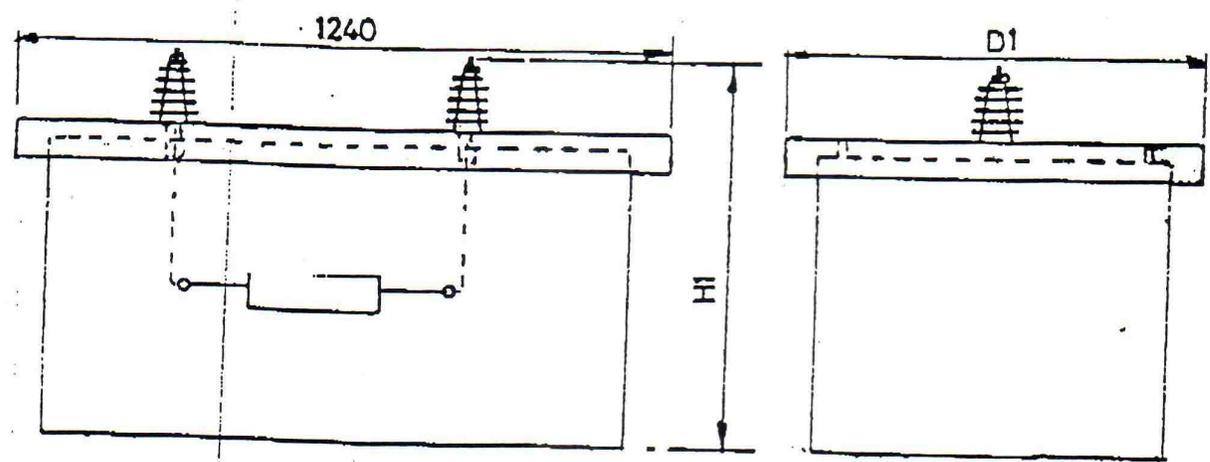


SECTION AT-AA

SECTION AT-BB

	66KV	11KV
H	1000	670
H1	1468	958
D	900	700
D1	940	740

NOTE: PERFORATED SHEET TO BE PROVIDED AT BOTTOM
RESISTANCE ELEMENT STAINLESS STEEL



NATIONAL SWITCHGEARS

CLIENT:

A G S N	TITLE: 11KV & 66KV RESISTANCE BOX	DRG NO:	
	SCALE: N.T.S	4-778	

1-1-91

pg 2 of 2

1 Certificate of Compliance

A Certificate contains a record of a series of type tests carried out strictly in accordance with a recognized standard. The equipment tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by KEMA. The Certificate is applicable only to the equipment tested. KEMA is responsible for the validity and the contents of the Certificate.

The responsibility for conformity of any apparatus having the same designation as the one tested rests with the manufacturer.

The Certificate contains the essential drawings and a description of the equipment tested. Detailed rules are given in KEMA's Certification procedure.

2 Report of Performance

A Report of Performance contains a record of one or more tests which have been carried out according to the client's instructions. These tests are not necessarily in accordance with a recognized standard. The test results do not verify ratings of the test object.

KEMA issues three types of Reports of Performance:

2.1 *The tests have been carried out strictly in accordance with The apparatus has complied with the relevant requirements.*

This sentence will appear on the front page of a Report of Performance if the tests have been performed in accordance with a recognized standard, but the series of tests does not completely fulfill the requirements for a Certificate of Compliance (for example, if the number of test duties is not a complete series of type tests).

The Report contains verified drawings and a description of the equipment tested. Detailed rules are given in KEMA's Certification procedure. The condition of the test object after the tests is assessed and recorded in the Report.

2.2 *The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on*

This sentence will appear on the front page of a Report of Performance if the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer.

Verification of the drawings (if submitted) and assessment of the condition after the tests is only done at the client's request.

2.3 *The tests have been carried out according to the client's instructions.*

This sentence will appear on the front page of a Report of Performance if the tests, test procedure and/or test parameters are not in accordance with a recognized standard.

3 Standards

When reference is made to a standard, and the date of issue is not stated, this applies to the latest issue, including amendments which have been officially published prior to the date of the tests.

4 Accuracy of measurement

In the table of test results the measured quantities are given in three digits. This method of presentation does not indicate an accuracy. The guaranteed uncertainty in the figures mentioned, taking into account the total measuring system, is less than 5%, unless mentioned otherwise.

5 Qualified by STERLAB

The De Zoeten Laboratorium has been entered in the STERLAB register for laboratories under Nr. 20 for the testing services as defined in the Field of Accreditation.

The accreditation is applicable to tests performed in accordance with IEC, ANSI and European standards, recorded in test documents items 1 and 2.1 above.

The accreditation is carried out in accordance with European Standard 45001, based on ISO/IEC Guides 25 and 38.

