

TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE

OBJECT A three-phase oil-immersed type power transformer

TYPE PTR 62500 /170G **SERIAL No.** 50003

Rated power	62,5 MVA
Rated voltage	154 kV $\pm$ 12 x 1,25% / 33,6 kV
Connection symbol	Yyn0
Rated frequency	50 Hz

MANUFACTURER Astor Transformer,
Ankara, Turkey

CLIENT Astor Transformer,
Ankara, Turkey

TESTED BY KEMA Nederland B.V.,
Arnhem, The Netherlands

DATE(S) OF TESTS 21 May 2015

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 60076-5 (2006)

This Type Test Certificate has been issued by KEMA following exclusively the STL Guides.

The results are shown in the record of Proving Tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above Standard with respect to the dynamic ability to withstand short-circuits.

This Certificate applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the manufacturer.

This Certificate consists of 88 pages in total.

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KEMA Nederland B.V.



S.A.M. Verhoeven
Director Testing, Inspections &
Certification The Netherlands

Arnhem, 23 October 2015

INFORMATION SHEET

1 Certificate

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 object having the same type references 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 fulfil 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. If the apparatus does not pass the tests such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on 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 Official and uncontrolled test documents

The official test documents of KEMA High-Power Laboratory are issued in bound form. Uncontrolled copies may be provided as loose sheets or as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

5 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.

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1 IDENTIFICATION OF THE OBJECT TESTED

1.1 Ratings/characteristics of the object tested

Voltage	154 kV $\pm$ 12 x 1,25% / 33,6 kV	
Power	62,5 MVA	
Current	234,3 A / 1073,9 A	
Short-circuit impedance	12,4 %	X
Connection symbol	Ynyn0	
Cooling method	ONAF	
Frequency	50 Hz	X
Category	II	
Apparent system power	Infinite	

X = This rating has been proved by the tests of this Certificate.

1.2 Description of the object tested

A three-phase oil-immersed type power transformer

1.3 List of drawings

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following drawings and/or documents. KEMA has verified that these drawings and/or documents adequately represent the object tested. The manufacturer is responsible for the correctness of these drawings and/or documents and the technical data presented.

The following drawings and/or documents have been included in this Certificate:

Drawing no./document no.	Revision
14 124 78 06 00	0
14 124 78 01 00	0

The following drawings and/or documents are only listed for reference and are kept in KEMA's files:

Drawing no./document no.	Revision
14 124 74 03 00	0
14 124 74 02 00	0
14 124 73 01 00	0
14 124 72 02 00	0
14 124 72 03 00	0
14 124 72 04 00	0
14 124 71 03 00	0
14 124 71 04 00	0

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Ünsal, H. Demir, M. Arslan, E.	Astor Transformer, Ankara, Turkey
Acarlıoğlu, G. Çetindağ, S. Çelik, L.	TEIAS, Ankara, Turkey.
Keskin, M.	HGFIA Deutschland Consulting GmbH & Co. KG, Hamburg, Germany

2.2 The tests were observed by

Routine tests carried out before the short-circuit tests

The routine tests carried out before the short-circuit tests were not witnessed by a KEMA inspector.

Short-circuit tests

Name	Company
Aditya, J.	KEMA Nederland B.V., Arnhem, The Netherlands

Routine tests carried out after the short-circuit tests

Name	Company
Houtepen, R.	KEMA Nederland B.V., Arnhem, The Netherlands

2.3 The transformer was inspected by

Name	Company
Houtepen, R.	KEMA Nederland B.V., Arnhem, The Netherlands

3 LEGEND

Phase indications

If more than one phase is recorded on oscillogram, the phases are indicated by the digits 1, 2 and 3. These phases 1, 2 and 3 correspond to the phase values in the columns of the accompanying table, respectively from left to right.

Explanation of the letter symbols and abbreviations on the oscillograms

pu	Per unit (the reference length of one unit is represented by the black bar on the oscillogram)
Buch	Signal Buchholz relay
I1pri	Primary current transformer
I1sec	Secondary current transformer
I2pri	Primary current transformer
I2sec	Secondary current transformer
I3pri	Primary current transformer
I3sec	Secondary current transformer
Itank	Tank current test object
U1S	Supply voltage
U2S	Supply voltage
U3S	Supply voltage

4 REACTANCE MEASUREMENT OVERVIEW

Tap position 25

Test number	Reactance								
	Measured between the phases			Calculated per leg			Change per leg		
	Ω			Ω			%		
	U-V	U-W	V-W	U	V	W	U	V	W
Before tests	133,22	132,54	132,57	66,63	66,59	65,94	-	-	-
AT 150521-4007	133,23	132,53	132,56	66,63	66,60	65,93	0,0	0,0	0,0
AT 150521-4010	133,23	132,53	132,56	66,63	66,60	65,93	0,0	0,0	0,0
AT 150521-4013	133,24	132,54	132,56	66,63	66,61	65,93	0,0	0,0	0,0
After tests	133,32	132,64	132,65	66,67	66,66	65,98	0,1	0,1	0,1

Tap position 13

Test number	Reactance								
	Measured between the phases			Calculated per leg			Change per leg		
	Ω			Ω			%		
	U-V	U-W	V-W	U	V	W	U	V	W
Before tests	94,36	93,91	93,96	47,20	47,16	46,76	-	-	-
AT 150521-4017	94,41	93,93	93,98	47,23	47,18	46,75	0,1	0,0	0,0
AT 150521-4020	94,41	93,94	93,98	47,23	47,18	46,76	0,1	0,0	0,0
AT 150521-4023	94,41	93,95	93,99	47,22	47,18	46,76	0,1	0,1	0,0
After tests	94,45	94,00	94,02	47,23	47,21	46,78	0,1	0,1	0,1

Tap position 1

Test number	Reactance								
	Measured between the phases			Calculated per leg			Change per leg		
	Ω			Ω			%		
	U-V	U-W	V-W	U	V	W	U	V	W
Before tests	62,71	62,39	62,55	31,44	31,28	31,11	-	-	-
AT 150521-4027	62,77	62,44	62,59	31,46	31,31	31,13	0,1	0,1	0,1
AT 150521-4030	62,77	62,45	62,60	31,46	31,31	31,14	0,1	0,1	0,1
AT 150521-4033	62,78	62,46	62,59	31,46	31,32	31,14	0,1	0,1	0,1
After tests	62,78	62,46	62,59	31,46	31,32	31,14	0,1	0,1	0,1

Maximum deviation

The maximum deviation in reactance per leg was 0,1%.

The maximum deviation allowed in accordance with the IEC 60076-5 is 1,0%.

5 SUMMARY OF TESTS

Short-circuit tests								
Test no.			150521 4007	150521 4010	150521 4013	150521 4017	150521 4020	150521 4023
Tap position			25	25	25	13	13	13
	U	kV	99,3	99,2	99,1	84,6	85,3	85,0
Voltage, phase value, beginning	V	kV	98,6	98,3	98,7	84,1	84,5	84,3
	W	kV	101	100	101	85,8	86,1	85,7
	U	kV	98,3	98,1	98,4	83,7	84,4	83,9
Voltage, phase value, end	V	kV	97,9	97,8	98,1	83,2	83,3	83,1
	W	kV	100	99,8	100	84,7	85,0	84,8
	U	kA	3,921	-3,892	3,867	-4,403	4,439	-4,416
Current HV-winding, peak value	V	kA	-3,616	3,626	-3,654	-2,830	2,821	-2,790
	W	kA	-2,321	2,275	-2,228	4,779	-4,808	4,750
	U	kA	1,430	1,413	1,414	1,738	1,725	1,721
Current HV-winding, phase value, beginning	V	kA	1,418	1,404	1,406	1,725	1,714	1,709
	W	kA	1,442	1,421	1,423	1,745	1,735	1,730
	U	kA	1,418	1,415	1,414	1,712	1,717	1,713
Current HV-winding, phase value, end	V	kA	1,409	1,405	1,406	1,704	1,708	1,703
	W	kA	1,426	1,423	1,424	1,723	1,727	1,722
	U	kA	1,420	1,414	1,416	1,719	1,724	1,720
Current HV-winding, phase value, average	V	kA	1,410	1,406	1,408	1,709	1,713	1,709
	W	kA	1,427	1,423	1,425	1,728	1,733	1,729
	U	kA	21,1	-21,0	20,9	-20,5	20,7	-20,5
Current LV-winding, peak value	V	kA	-19,4	19,4	-19,6	-13,2	13,1	-13,0
	W	kA	-12,9	12,6	-12,4	22,5	-22,6	22,4
	U	kA	7,76	7,73	7,75	8,10	8,12	8,10
Current LV-winding, phase value, beginning	V	kA	7,64	7,62	7,63	7,97	8,00	7,98
	W	kA	7,93	7,91	7,92	8,27	8,30	8,27
	U	kA	7,76	7,74	7,75	8,06	8,08	8,06
Current LV-winding, phase value, end	V	kA	7,64	7,62	7,62	7,94	7,97	7,94
	W	kA	7,94	7,91	7,92	8,23	8,25	8,23
	U	kA	7,77	7,74	7,75	8,10	8,12	8,10
Current LV-winding, phase value, average	V	kA	7,65	7,40	7,64	7,97	8,00	7,98
	W	kA	7,94	7,92	7,93	8,26	8,29	8,27
	U	s	0,513	0,512	0,512	0,512	0,512	0,513
Current duration	V	s	0,513	0,512	0,512	0,513	0,513	0,513
	W	s	0,514	0,513	0,513	0,513	0,513	0,513

REMARKS	
150521-4007	No visible disturbance.
150521-4010	No visible disturbance.
150521-4013	No visible disturbance.
150521-4017	No visible disturbance.
150521-4020	No visible disturbance.
150521-4023	No visible disturbance.

Short-circuit tests (continued)							
Test no.			150521 4027	150521 4030	150521 4033		
Tap position			1	1	1		
	U	kV	73,2	72,8	73,2		
Voltage, phase value, beginning	V	kV	73,0	72,7	73,2		
	W	kV	74,3	73,9	74,2		
	U	kV	72,1	71,5	72,2		
Voltage, phase value, end	V	kV	71,4	71,2	71,4		
	W	kV	72,5	72,1	72,4		
	U	kA	-3,715	3,707	-3,819		
Current HV-winding, peak value	V	kA	6,291	-6,279	6,331		
	W	kA	-5,904	5,889	-5,847		
	U	kA	2,254	2,242	2,253		
Current HV-winding, phase value, beginning	V	kA	2,247	2,235	2,246		
	W	kA	2,275	2,264	2,274		
	U	kA	2,229	2,218	2,227		
Current HV-winding, phase value, end	V	kA	2,218	2,208	2,216		
	W	kA	2,244	2,234	2,242		
	U	kA	2,248	2,237	2,247		
Current HV-winding, phase value, average	V	kA	2,238	2,227	2,237		
	W	kA	2,267	2,257	2,266		
	U	kA	-14,8	14,8	-15,2		
Current LV-winding, peak value	V	kA	24,6	-24,6	24,8		
	W	kA	-23,5	23,5	-23,3		
	U	kA	8,93	8,89	8,93		
Current LV-winding, phase value, beginning	V	kA	8,83	8,78	8,82		
	W	kA	9,16	9,11	9,15		
	U	kA	8,83	8,79	8,82		
Current LV-winding, phase value, end	V	kA	8,71	8,67	8,71		
	W	kA	9,03	8,99	9,02		
	U	kA	8,91	8,87	8,91		
Current LV-winding, phase value, average	V	kA	8,79	8,75	8,79		
	W	kA	9,13	9,08	9,12		
	U	s	0,515	0,514	0,514		
Current duration	V	s	0,514	0,514	0,514		
	W	s	0,515	0,514	0,514		

REMARKS	
150521-4027	No visible disturbance.
150521-4030	No visible disturbance.
150521-4033	No visible disturbance.

6 SHORT-CIRCUIT TESTS

Standard and date

Standard	IEC 60076
Test date	21 May 2015

6.1 Condition before test

Transformer previously subjected to routine tests, carried out at the factory of the manufacturer.

Supply to HV windings.

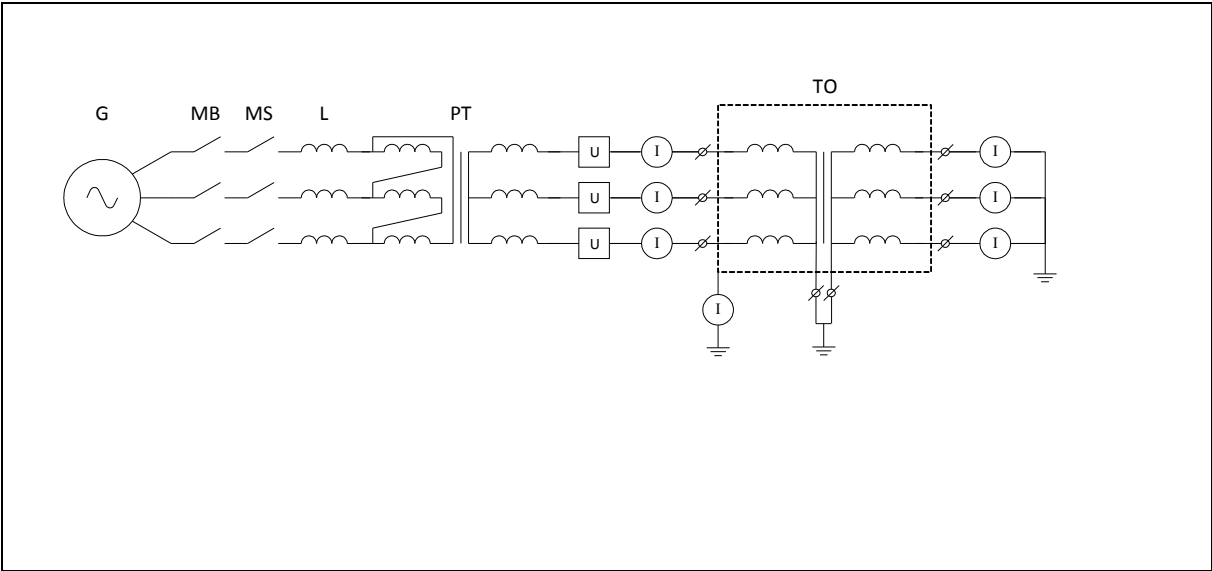
HV neutral terminal earthed.

LV windings pre-set short-circuited by means of shunts and earthed.

LV neutral terminal earthed.

Tank earthed via an earth fault current indicating CT.

6.2 **Test circuit S01**



G	= Generator	TO	= Test Object	U	= Voltage Measurement to earth
MB	= Master Breaker	L	= Reactor	I	= Current Measurement
MS	= Make Switch				
PT	= Power Transformer				

Supply		
Power	MVA	3214
Frequency	Hz	50
Phase(s)		3
Voltage	kV	216
Current	kA	8,59
Impedance	Ω	14,5
Power factor		< 0,1
Neutral		not earthed

Load	
Short-circuit point	earthed

Remarks: -

6.3 Calculation sheet short-circuit current

System power of: Infinite

System voltage of: 154 kV

Tap position	25 Max.	13 Nom.	1 Min.
Tap voltage	177,10 kV	154,00 kV	130,90 kV
Impedance voltage	13,24%	12,41%	11,42%
Resistance (75 °C)	0,37%	0,40%	0,41%

Tap position 25 Max.

Supply voltage: 177,10 kV

Terminal voltage: 177,09 kV

Short-circuit current	Minimum value	Rated	Maximum value
HV current	1385,0 A	1538,9 A	1692,7 A
HV peak current	3,73 kA	3,92 kA	4,12 kA
LV current	7,30 kA	8,11 kA	8,92 kA
LV peak current	19,65 kA	20,68 kA	21,72 kA

HV reactance: 66,42 Ω

HV inductance: 211,41 mH

Tap position 13 Nom.

Supply voltage: 154,00 kV

Terminal voltage: 153,99 kV

Short-circuit current	Minimum value	Rated	Maximum value
HV current	1699,2 A	1888,0 A	2076,8 A
HV peak current	4,57 kA	4,81 kA	5,06 kA
LV current	7,79 kA	8,65 kA	9,52 kA
LV peak current	20,96 kA	22,07 kA	23,17 kA

HV reactance: 47,07 Ω

HV inductance: 149,82 mH

Tap position 1 Min.

Supply voltage: 130,90 kV

Terminal voltage: 130,89 kV

Short-circuit current	Minimum value	Rated	Maximum value
HV current	2172,3 A	2413,7 A	2655,1 A
HV peak current	5,85 kA	6,15 kA	6,46 kA
LV current	8,46 kA	9,40 kA	10,34 kA
LV peak current	22,78 kA	23,98 kA	25,18 kA

HV reactance: 31,29 Ω

HV inductance: 99,59 mH

Peak factor according to IEC = 2,55

 $Z_{\text{supply}} / Z_{\text{trafo}} = 0,01\%$

Peak factor according to X/R = 2,69

6.4 Photograph before test



6.5 Test results and oscillograms

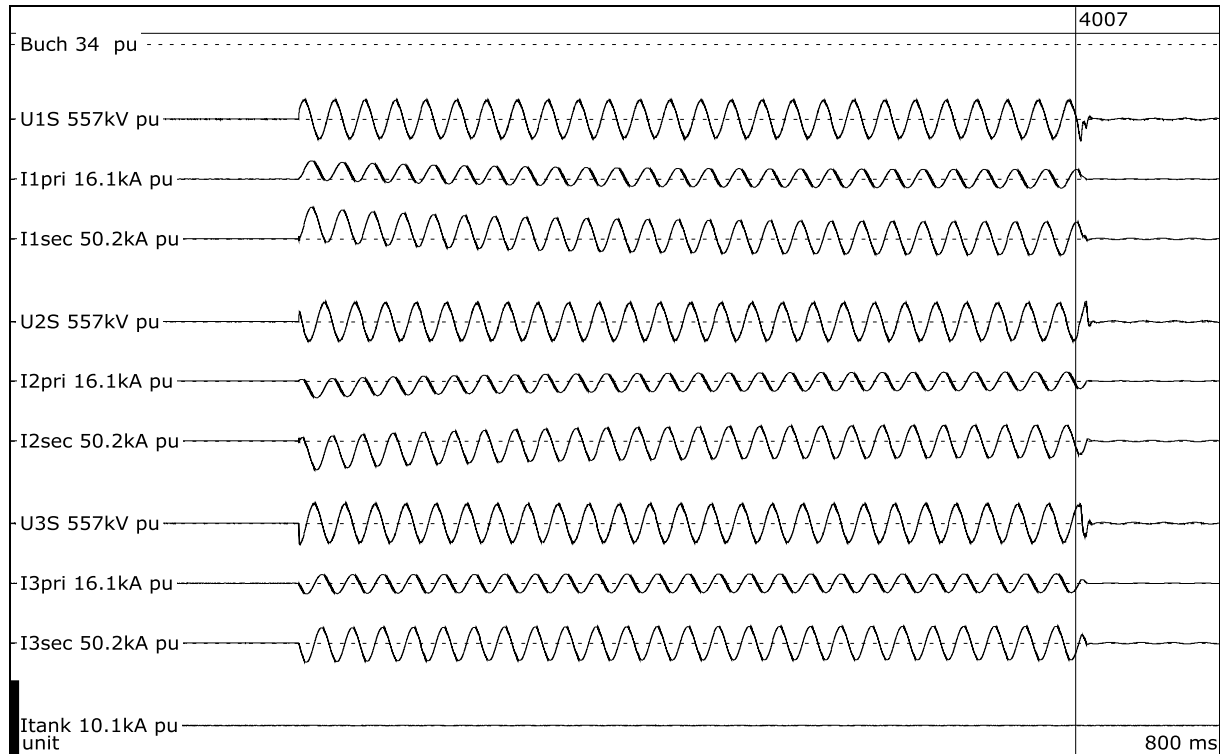
Overview of test numbers

150521-4007, 4010, 4013, 4017, 4020, 4023, 4027, 4030, 4033

Remarks

-

Short-circuit test

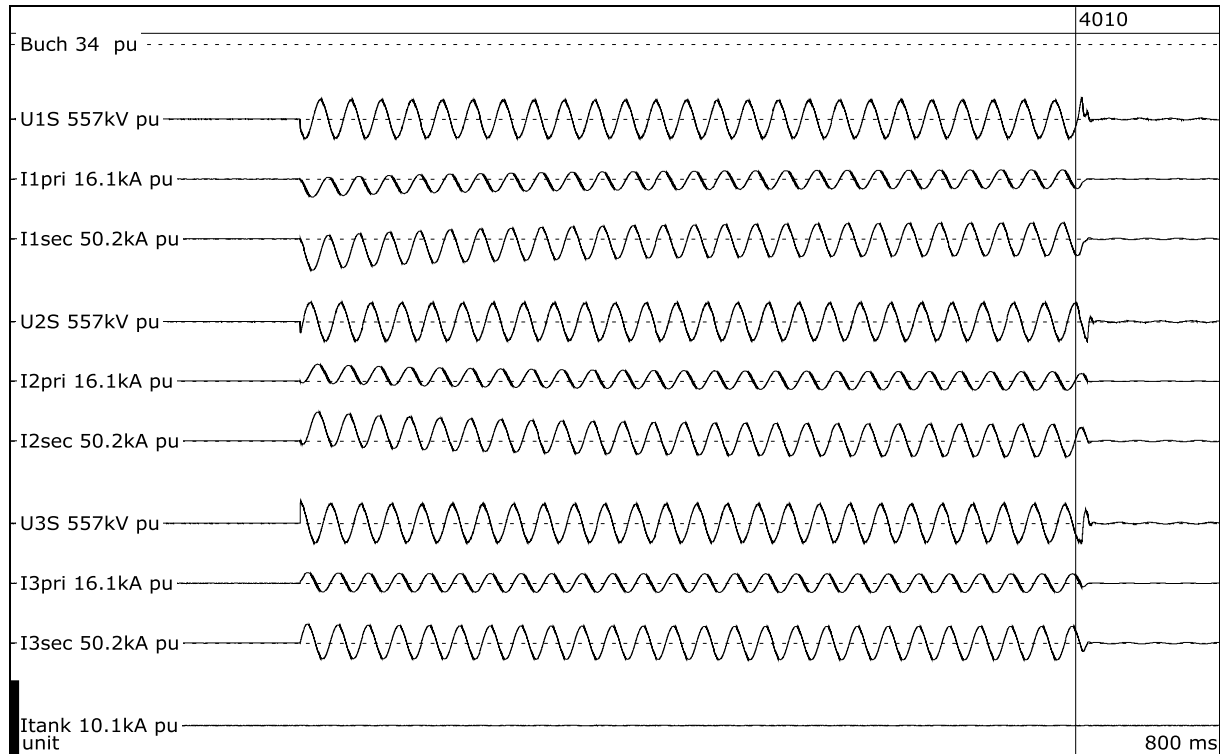


Test number: 150521-4007

Phase		U	V	W
Tap position		25		
Voltage, phase value, beginning	kV	99,3	98,6	101
Voltage, phase value, end	kV	98,3	97,9	100
Current HV-winding, peak value	kA	3,921	-3,616	-2,321
Current HV-winding, phase value, beginning	kA	1,430	1,418	1,442
Current HV-winding, phase value, end	kA	1,418	1,409	1,426
Current HV-winding, phase value, average	kA	1,420	1,410	1,427
Current LV-winding, peak value	kA	21,1	-19,4	-12,9
Current LV-winding, phase value, beginning	kA	7,76	7,64	7,93
Current LV-winding, phase value, end	kA	7,76	7,64	7,94
Current LV-winding, phase value, average	kA	7,77	7,65	7,94
Current duration	s	0,513	0,513	0,514

Remarks: No visible disturbance.

Short-circuit test

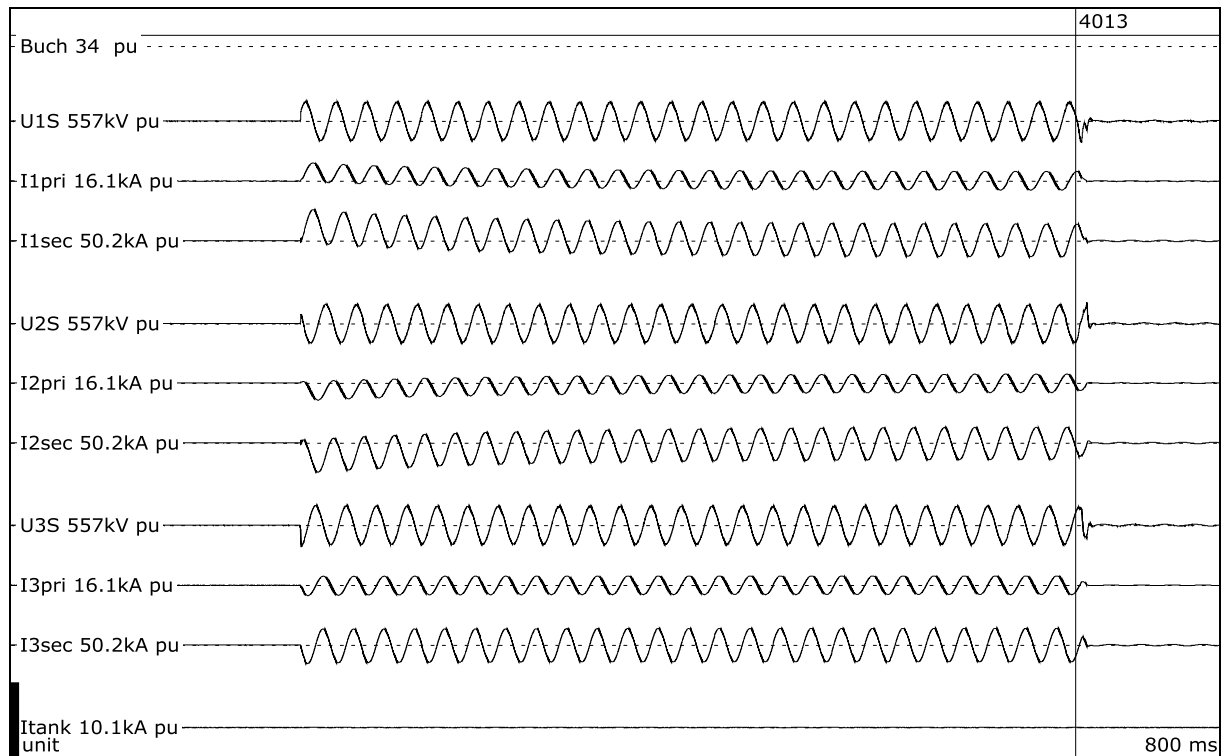


Test number: 150521-4010

Phase		U	V	W
Tap position		25		
Voltage, phase value, beginning	kV	99,2	98,3	100
Voltage, phase value, end	kV	98,1	97,8	99,8
Current HV-winding, peak value	kA	-3,892	3,626	2,275
Current HV-winding, phase value, beginning	kA	1,413	1,404	1,421
Current HV-winding, phase value, end	kA	1,415	1,405	1,423
Current HV-winding, phase value, average	kA	1,414	1,406	1,423
Current LV-winding, peak value	kA	-21,0	19,4	12,6
Current LV-winding, phase value, beginning	kA	7,73	7,62	7,91
Current LV-winding, phase value, end	kA	7,74	7,62	7,91
Current LV-winding, phase value, average	kA	7,74	7,40	7,92
Current duration	s	0,512	0,512	0,513

Remarks: No visible disturbance.

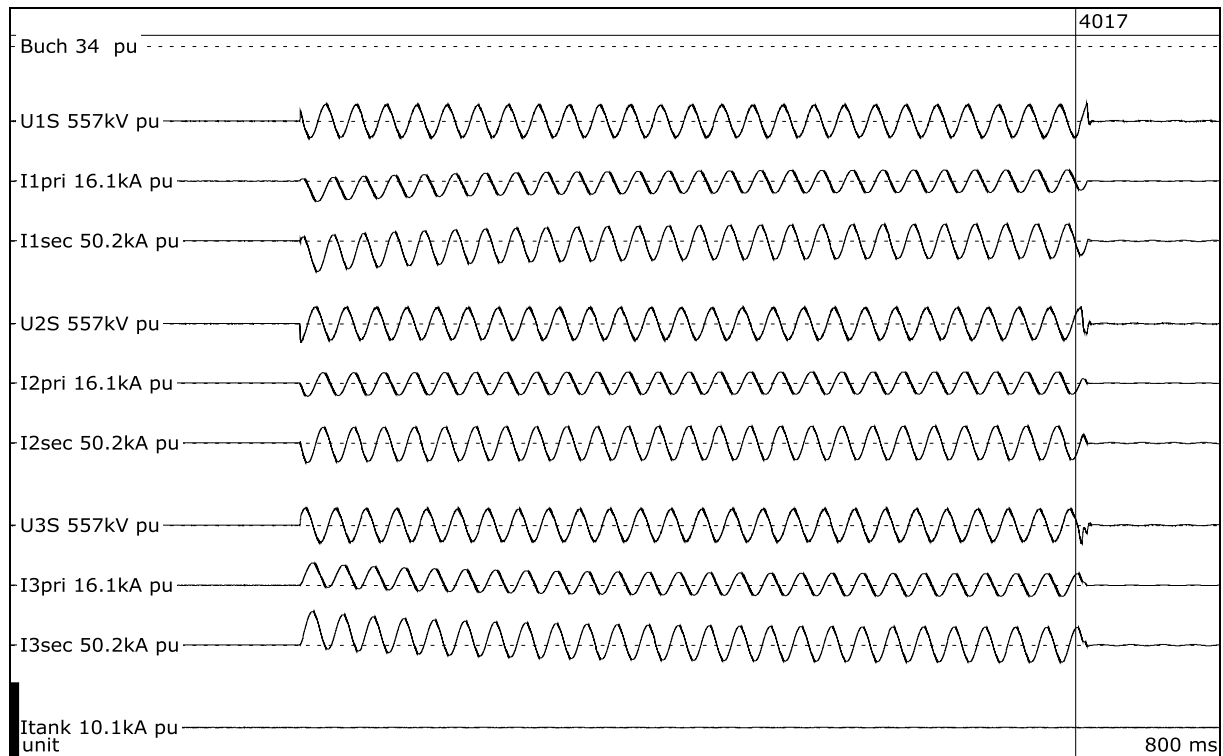
Short-circuit test



Test number: 150521-4013

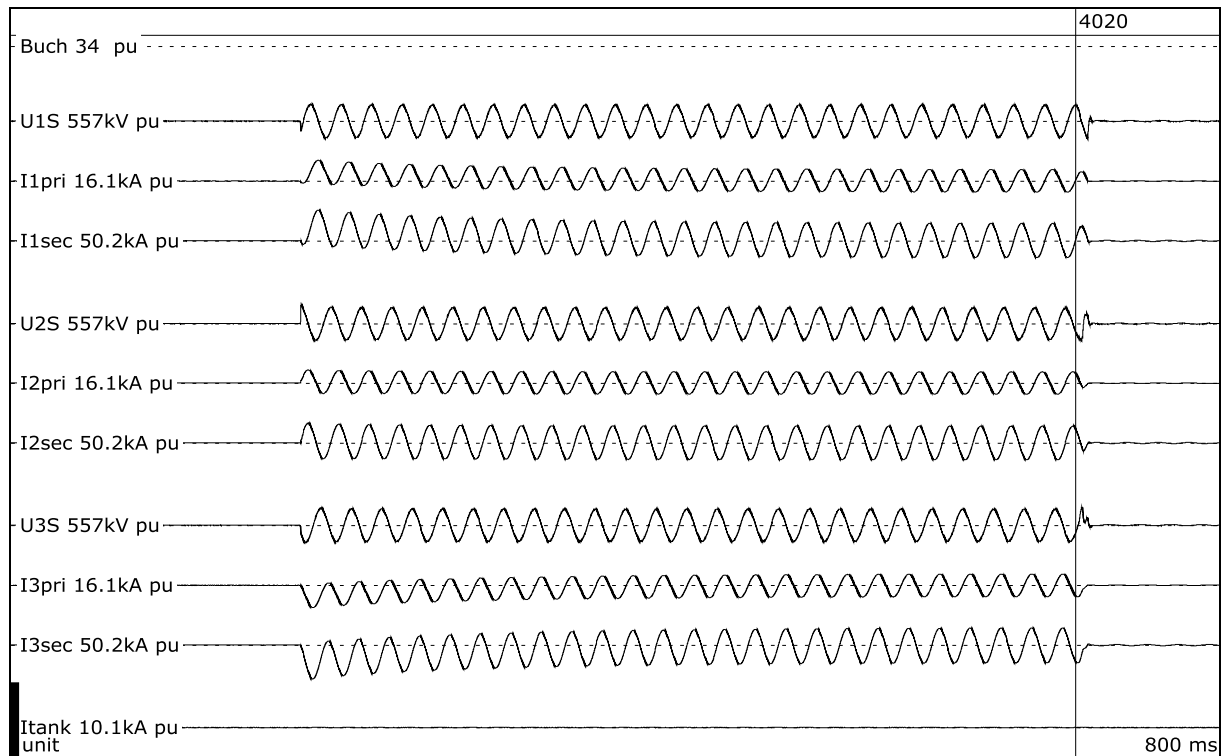
Phase		U	V	W
Tap position		25		
Voltage, phase value, beginning	kV	99,1	98,7	101
Voltage, phase value, end	kV	98,4	98,1	100
Current HV-winding, peak value	kA	3,867	-3,654	-2,228
Current HV-winding, phase value, beginning	kA	1,414	1,406	1,423
Current HV-winding, phase value, end	kA	1,414	1,406	1,424
Current HV-winding, phase value, average	kA	1,416	1,408	1,425
Current LV-winding, peak value	kA	20,9	-19,6	-12,4
Current LV-winding, phase value, beginning	kA	7,75	7,63	7,92
Current LV-winding, phase value, end	kA	7,75	7,62	7,92
Current LV-winding, phase value, average	kA	7,75	7,64	7,93
Current duration	s	0,512	0,512	0,513

Remarks: No visible disturbance.

Short-circuit test

Test number: 150521-4017

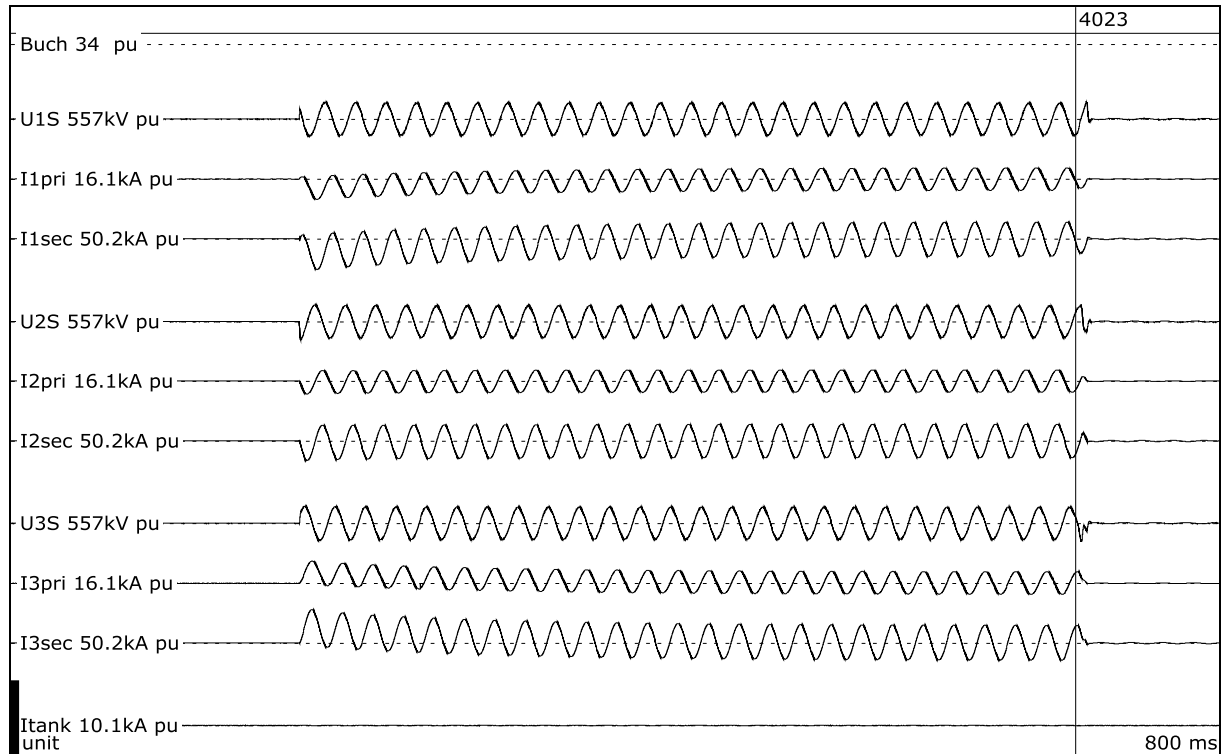
Phase		U	V	W
Tap position		13		
Voltage, phase value, beginning	kV	84,6	84,1	85,8
Voltage, phase value, end	kV	83,7	83,2	84,7
Current HV-winding, peak value	kA	-4,403	-2,830	4,779
Current HV-winding, phase value, beginning	kA	1,738	1,725	1,745
Current HV-winding, phase value, end	kA	1,712	1,704	1,723
Current HV-winding, phase value, average	kA	1,719	1,709	1,728
Current LV-winding, peak value	kA	-20,5	-13,2	22,5
Current LV-winding, phase value, beginning	kA	8,10	7,97	8,27
Current LV-winding, phase value, end	kA	8,06	7,94	8,23
Current LV-winding, phase value, average	kA	8,10	7,97	8,26
Current duration	s	0,512	0,513	0,513

Remarks: No visible disturbance.

Short-circuit test

Test number: 150521-4020

Phase		U	V	W
Tap position		13		
Voltage, phase value, beginning	kV	85,3	84,5	86,1
Voltage, phase value, end	kV	84,4	83,3	85,0
Current HV-winding, peak value	kA	4,439	2,821	-4,808
Current HV-winding, phase value, beginning	kA	1,725	1,714	1,735
Current HV-winding, phase value, end	kA	1,717	1,708	1,727
Current HV-winding, phase value, average	kA	1,724	1,713	1,733
Current LV-winding, peak value	kA	20,7	13,1	-22,6
Current LV-winding, phase value, beginning	kA	8,12	8,00	8,30
Current LV-winding, phase value, end	kA	8,08	7,97	8,25
Current LV-winding, phase value, average	kA	8,12	8,00	8,29
Current duration	s	0,512	0,513	0,513

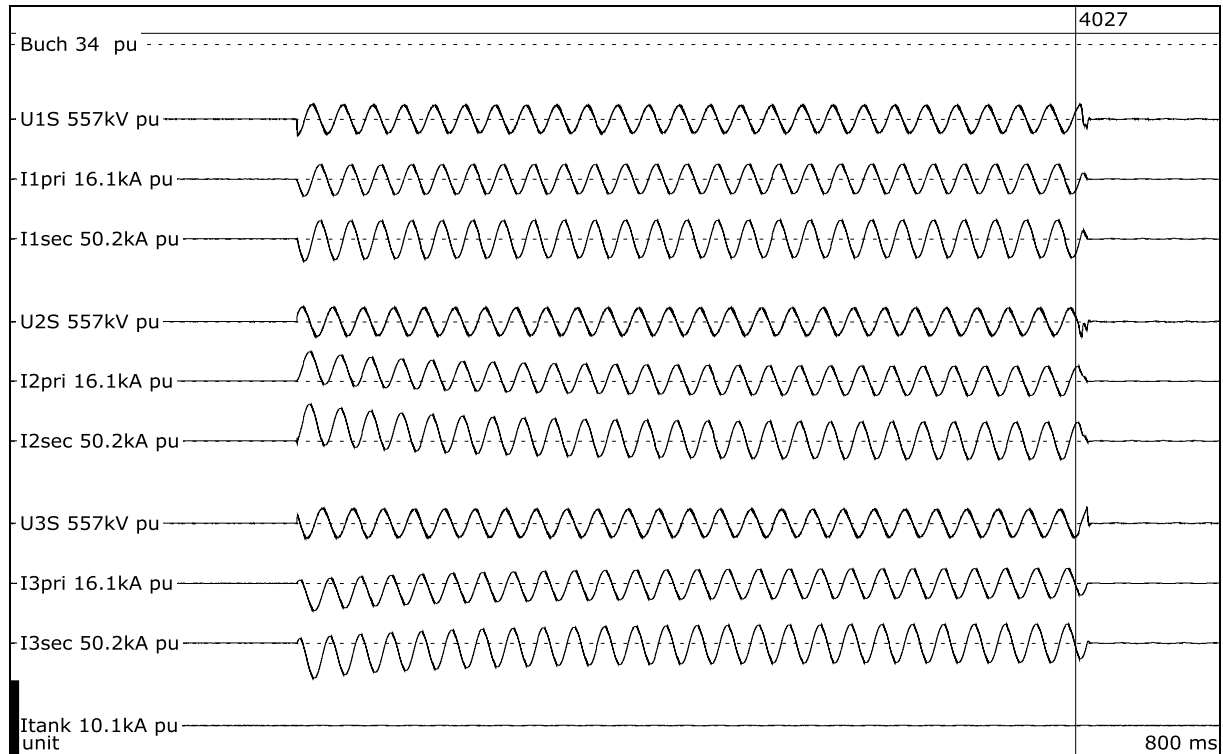
Remarks: No visible disturbance.

Short-circuit test

Test number: 150521-4023

Phase		U	V	W
Tap position		13		
Voltage, phase value, beginning	kV	85,0	84,3	85,7
Voltage, phase value, end	kV	83,9	83,1	84,8
Current HV-winding, peak value	kA	-4,416	-2,790	4,750
Current HV-winding, phase value, beginning	kA	1,721	1,709	1,730
Current HV-winding, phase value, end	kA	1,713	1,703	1,722
Current HV-winding, phase value, average	kA	1,720	1,709	1,729
Current LV-winding, peak value	kA	-20,5	-13,0	22,4
Current LV-winding, phase value, beginning	kA	8,10	7,98	8,27
Current LV-winding, phase value, end	kA	8,06	7,94	8,23
Current LV-winding, phase value, average	kA	8,10	7,98	8,27
Current duration	s	0,513	0,513	0,513

Remarks: No visible disturbance.

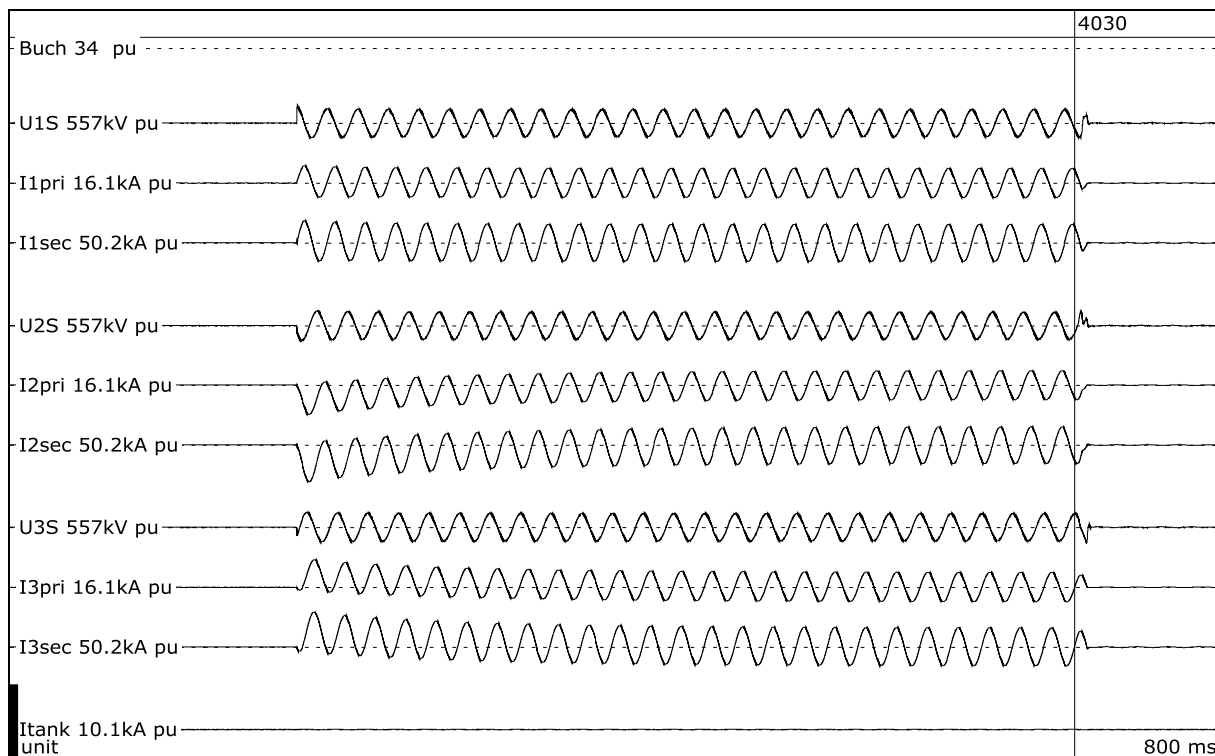
Short-circuit test



Test number: 150521-4027

Phase		U	V	W
Tap position		1		
Voltage, phase value, beginning	kV	73,2	73,0	74,3
Voltage, phase value, end	kV	72,1	71,4	72,5
Current HV-winding, peak value	kA	-3,715	6,291	-5,904
Current HV-winding, phase value, beginning	kA	2,254	2,247	2,275
Current HV-winding, phase value, end	kA	2,229	2,218	2,244
Current HV-winding, phase value, average	kA	2,248	2,238	2,267
Current LV-winding, peak value	kA	-14,8	24,6	-23,5
Current LV-winding, phase value, beginning	kA	8,93	8,83	9,16
Current LV-winding, phase value, end	kA	8,83	8,71	9,03
Current LV-winding, phase value, average	kA	8,91	8,79	9,13
Current duration	s	0,515	0,514	0,515

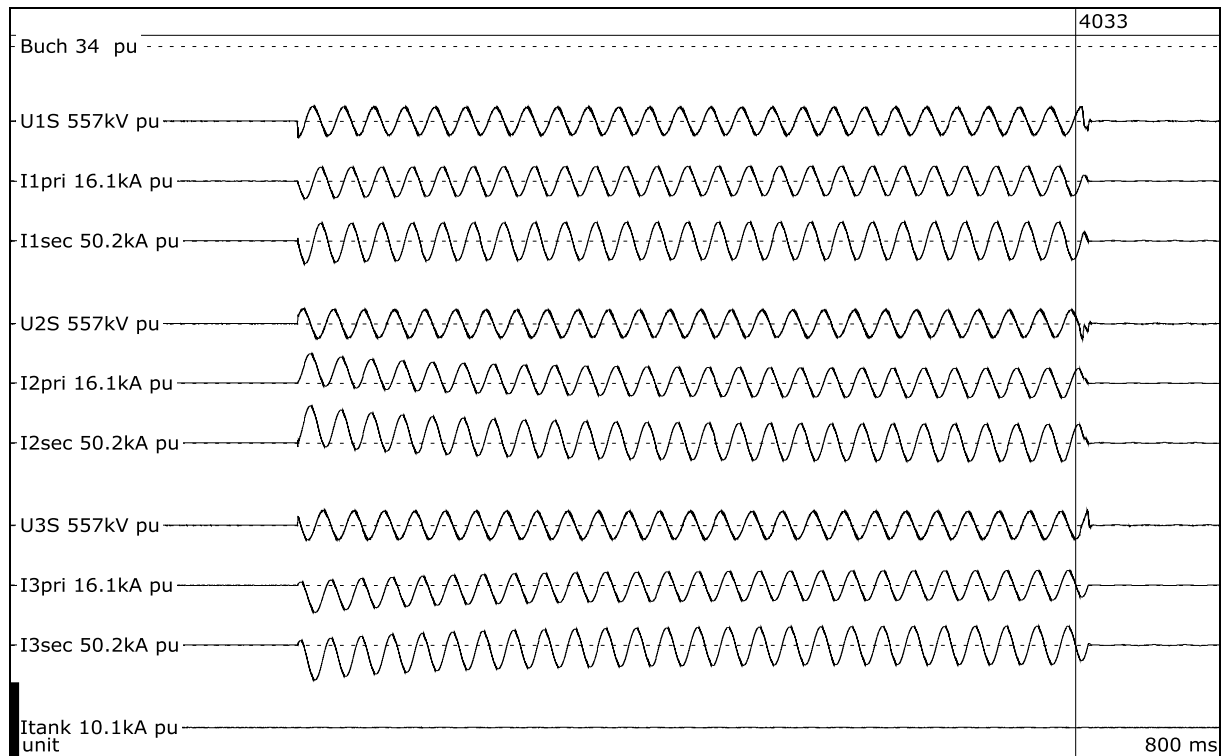
Remarks: No visible disturbance.

Short-circuit test

Test number: 150521-4030

Phase		U	V	W
Tap position		1		
Voltage, phase value, beginning	kV	72,8	72,7	73,9
Voltage, phase value, end	kV	71,5	71,2	72,1
Current HV-winding, peak value	kA	3,707	-6,279	5,889
Current HV-winding, phase value, beginning	kA	2,242	2,235	2,264
Current HV-winding, phase value, end	kA	2,218	2,208	2,234
Current HV-winding, phase value, average	kA	2,237	2,227	2,257
Current LV-winding, peak value	kA	14,8	-24,6	23,5
Current LV-winding, phase value, beginning	kA	8,89	8,78	9,11
Current LV-winding, phase value, end	kA	8,79	8,67	8,99
Current LV-winding, phase value, average	kA	8,87	8,75	9,08
Current duration	s	0,514	0,514	0,514

Remarks: No visible disturbance.

Short-circuit test



Test number: 150521-4033

Phase		U	V	W
Tap position		1		
Voltage, phase value, beginning	kV	73,2	73,2	74,2
Voltage, phase value, end	kV	72,2	71,4	72,4
Current HV-winding, peak value	kA	-3,819	6,331	-5,847
Current HV-winding, phase value, beginning	kA	2,253	2,246	2,274
Current HV-winding, phase value, end	kA	2,227	2,216	2,242
Current HV-winding, phase value, average	kA	2,247	2,237	2,266
Current LV-winding, peak value	kA	-15,2	24,8	-23,3
Current LV-winding, phase value, beginning	kA	8,93	8,82	9,15
Current LV-winding, phase value, end	kA	8,82	8,71	9,02
Current LV-winding, phase value, average	kA	8,91	8,79	9,12
Current duration	s	0,514	0,514	0,514

Remarks: No visible disturbance.

6.6 **Condition after test**

Externally no visible change.

6.7 Photographs after test





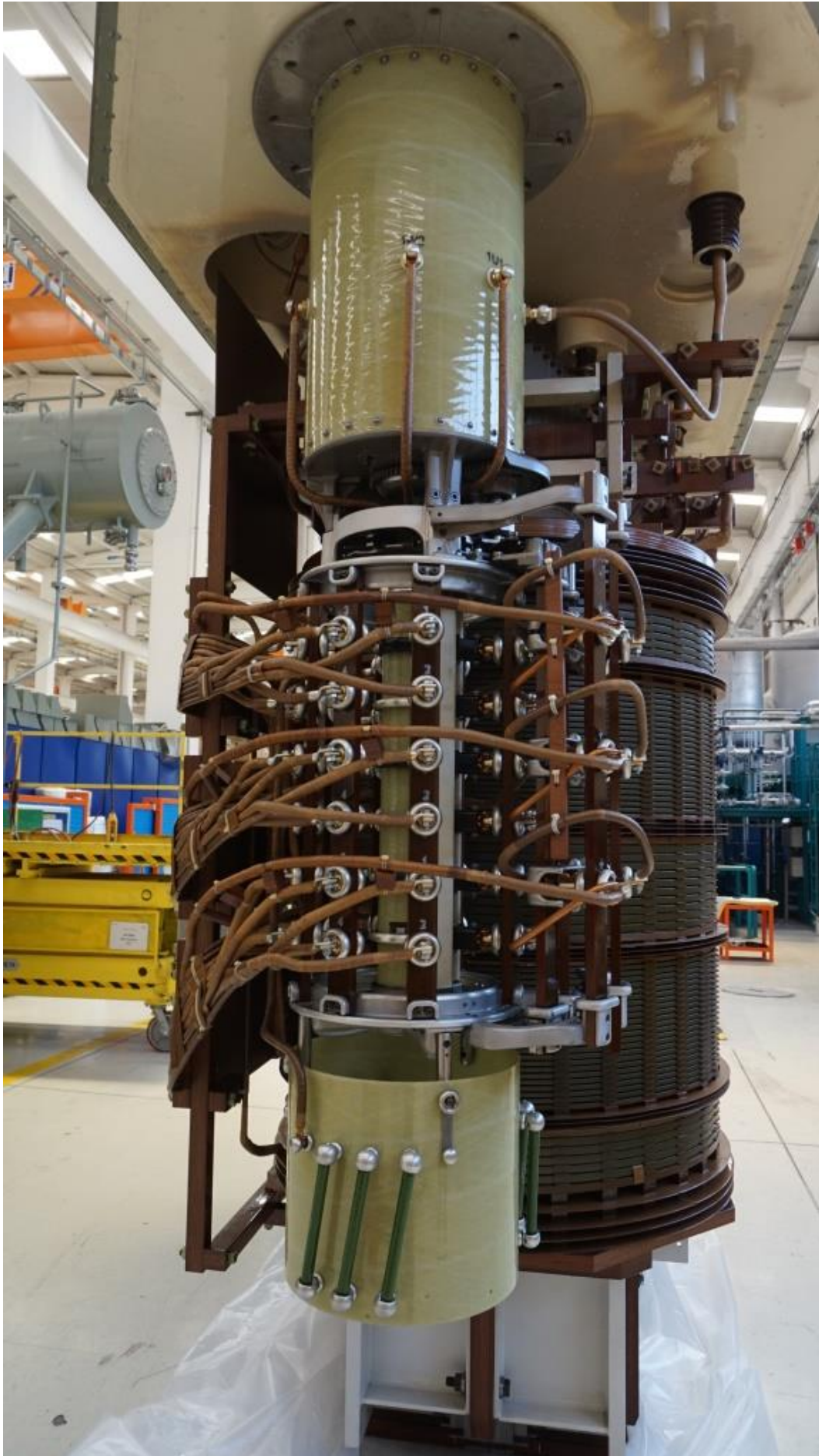
7 INSPECTION OF THE ACTIVE PART

On 14 Augustus 2015 the transformer was untanked and the active part was inspected by a KEMA inspector at the factory of the manufacturer.

The out-of-tank inspection with respect to displacements, deformations of core and windings, connections and supporting structures or traces of discharges did not reveal any apparent defects.

7.1 Photographs during inspection

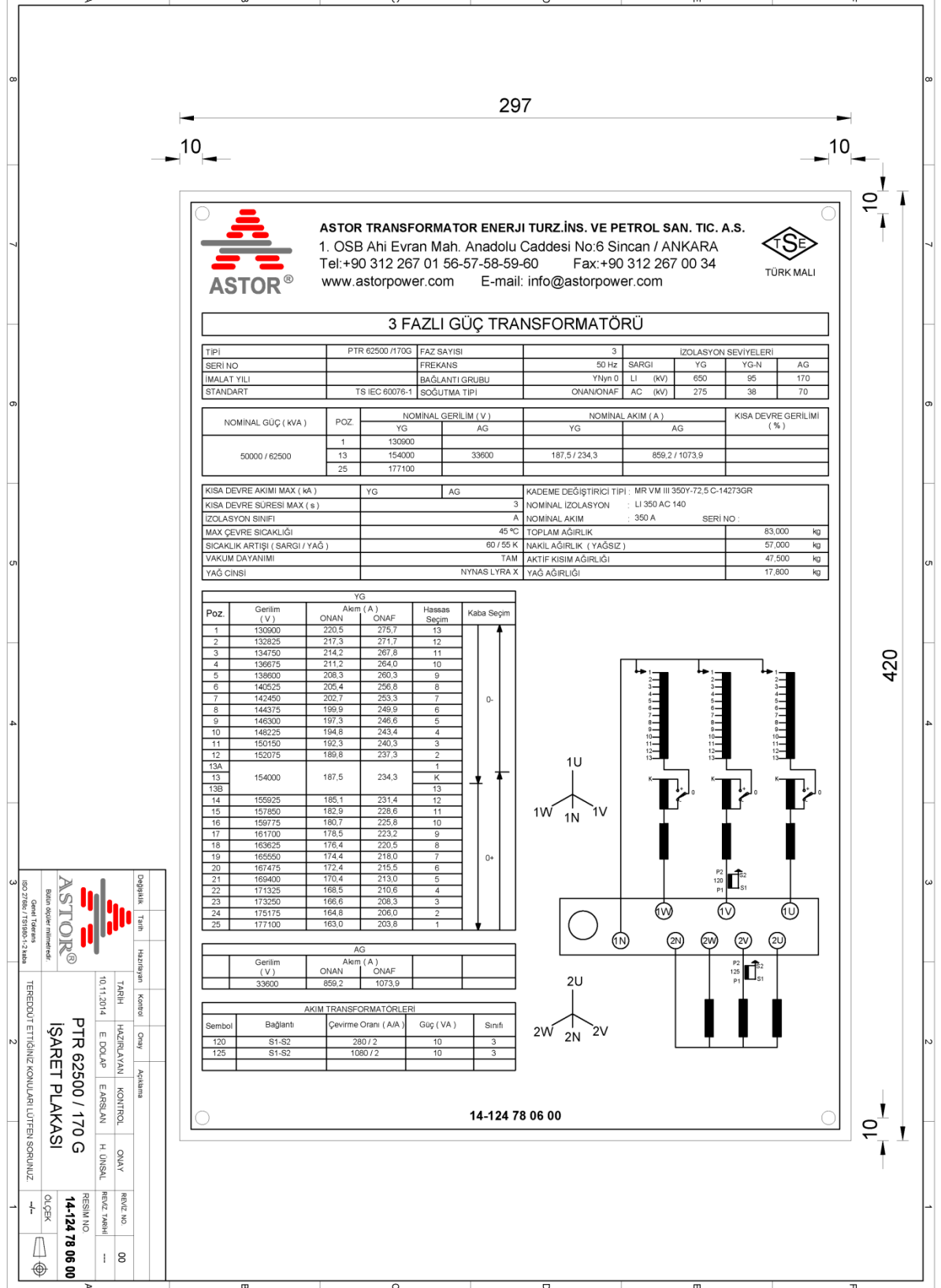


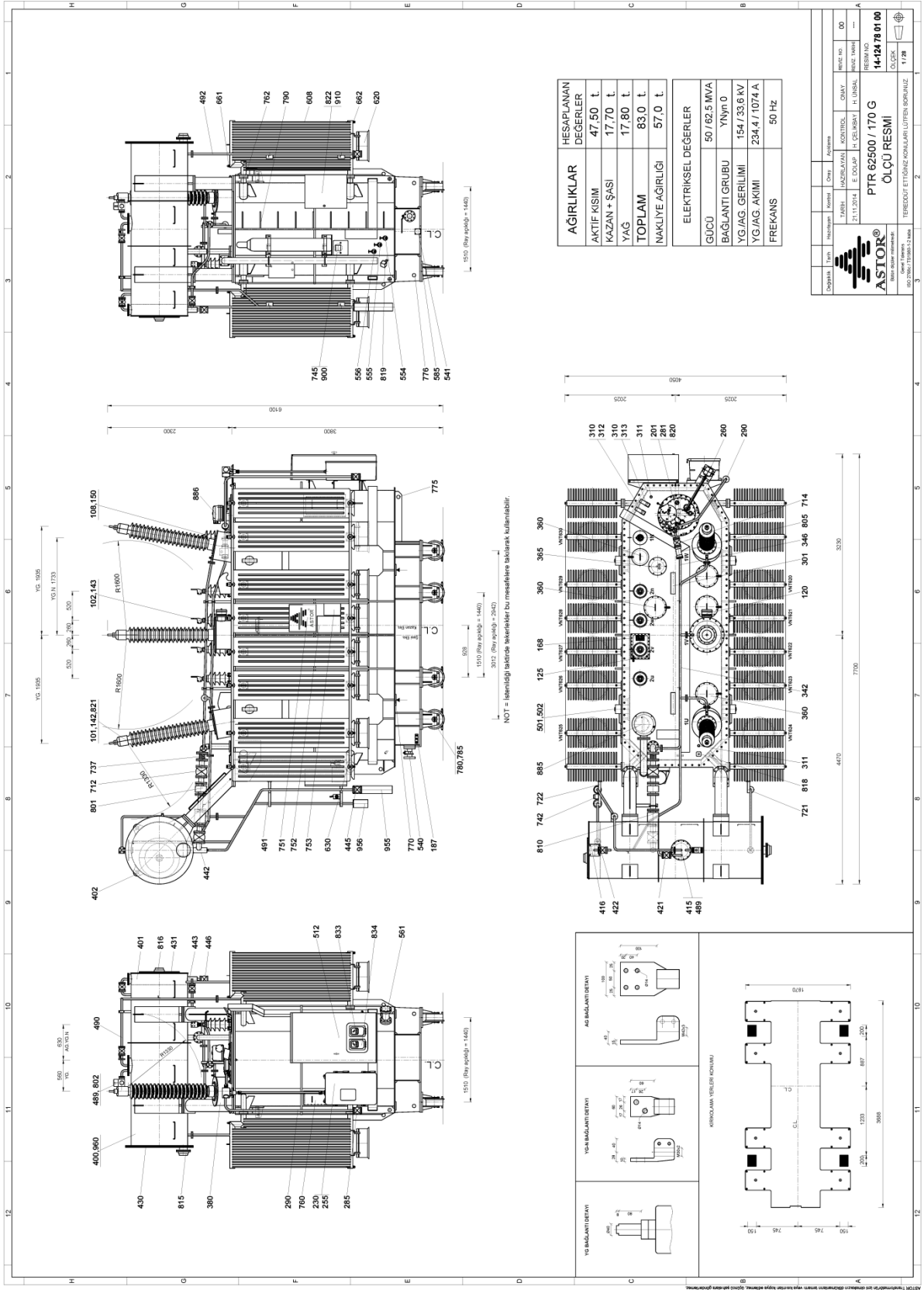






ASTOR Transformatör'ün izni olmaksızın diğer firmaların tamamı veya kısmen kopya edilemez, üçüncü şahıslara gönderilemez.





Annex I **ROUTINE TESTS BEFORE SHORT-CIRCUIT TESTS**

Routine tests before the short-circuit tests were carried out at the factory of the manufacturer on 20 April 2015 without the presence of a KEMA inspector. See enclosed report on the following pages. The responsibility for the content of this report rests with the manufacturer.



TRANSFORMER ROUTINE TEST REPORT

1. Organize Sanayii Bölgesi Ahi Evran Mah.
Anadolu Cad. No:6 Sincan, ANKARA / TURKEY
Phone: +90 312 267 01 56 (57-58-59-60)
Fax: +90 312 267 00 34

Date	20.4.2015
Serial No.	50003
Brand	ASTOR
Vector Group	YNyn0
Project No.	14-124
Cooling	ONAN/ONAF
Type	Conservator Tank

Customer

POWER	62,5 MVA	PHASE	3	FREQ.	50 Hz	Temp. Rise (°K)	55 / 60
-------	----------	-------	---	-------	-------	-----------------	---------

Winding (HV / LV)	Cu / Cu
-------------------	---------

Tab	Primary Voltage (V)	Secondary Voltage (V)	Nominal Values	TURN RATIO			DEVIATION ($\leq \%0,5$)		
				1U1V/2U2N	1V1W/2V2N	1W1U/2W2N	1U1V/2U2N	1V1W/2V2N	1W1U/2W2N
1	130900		3,896	3,8966	3,8985	3,8968	0,020	0,068	0,025
2	132825		3,953	3,9539	3,9559	3,9542	0,020	0,070	0,027
3	134750		4,010	4,0115	4,0135	4,0117	0,027	0,077	0,032
4	136675		4,068	4,0690	4,0709	4,0692	0,032	0,078	0,037
5	138600		4,125	4,1265	4,1283	4,1267	0,036	0,080	0,041
6	140525		4,182	4,1840	4,1859	4,1842	0,041	0,086	0,046
7	142450		4,240	4,2415	4,2433	4,2416	0,045	0,088	0,048
8	144375		4,297	4,2990	4,3007	4,2991	0,049	0,089	0,052
9	146300		4,354	4,3564	4,3583	4,3566	0,051	0,095	0,056
10	148225		4,411	4,4140	4,4159	4,4141	0,058	0,101	0,060
11	150150		4,469	4,4715	4,4738	4,4718	0,062	0,113	0,068
12	152075		4,526	4,5298	4,5327	4,5292	0,083	0,147	0,070
13	154000	33600	4,583	4,5864	4,5895	4,5867	0,067	0,135	0,073
14	155925		4,641	4,6437	4,6458	4,6439	0,066	0,112	0,071
15	157850		4,698	4,7012	4,7032	4,7013	0,070	0,112	0,072
16	159775		4,755	4,7587	4,7608	4,7588	0,073	0,118	0,076
17	161700		4,813	4,8161	4,8181	4,8163	0,075	0,116	0,079
18	163625		4,870	4,8734	4,8757	4,8739	0,074	0,121	0,084
19	165550		4,927	4,9312	4,9333	4,9314	0,084	0,126	0,088
20	167475		4,984	4,9886	4,9907	4,9887	0,085	0,127	0,087
21	169400		5,042	5,0459	5,0483	5,0463	0,084	0,132	0,092
22	171325		5,099	5,1035	5,1062	5,1038	0,089	0,142	0,095
23	173250		5,156	5,1612	5,1636	5,1614	0,096	0,143	0,100
24	175175		5,214	5,2186	5,2208	5,2187	0,097	0,139	0,099
25	177100		5,271	5,2760	5,2784	5,2763	0,098	0,144	0,104

DC WINDING RESISTANCES $t(^{\circ}\text{C}) = 16,7$

Tab	HV Winding (Ω)					LV Windings (m Ω)				
	R _{1U1V}	R _{1V1W}	R _{1W1U}	R _{1MEAN}	Deviation	R _{2U2V}	R _{2V2W}	R _{2W2U}	R _{2MEAN}	Deviation
1	0,9795	0,9793	0,9777	0,9788	0,184%					
2	0,9991	0,9994	0,9964	0,9983	0,301%					
3	1,0148	1,0147	1,012	1,0138	0,277%					
4	1,0313	1,0314	1,0285	1,0304	0,282%					
5	1,0469	1,047	1,0439	1,0459	0,297%					
6	1,0632	1,0639	1,0606	1,0626	0,311%					
7	1,0789	1,0793	1,076	1,0781	0,307%					
8	1,0956	1,0965	1,0926	1,0949	0,357%					
9	1,1112	1,1116	1,1081	1,1103	0,316%					
10	1,1279	1,1287	1,1248	1,1271	0,347%					
11	1,1433	1,144	1,1403	1,1425	0,324%	44,912	45,008	44,996	44,9720	0,214%
12	1,1598	1,161	1,1569	1,1592	0,354%					
13	1,1926	1,194	1,1909	1,1925	0,260%					
14	1,2123	1,2136	1,2094	1,2118	0,347%					
15	1,2278	1,2288	1,225	1,2272	0,310%					
16	1,2442	1,2458	1,2416	1,2439	0,338%					
17	1,2598	1,2612	1,2568	1,2593	0,350%					
18	1,2764	1,2781	1,2734	1,2760	0,369%					
19	1,2919	1,2934	1,289	1,2914	0,341%					
20	1,3087	1,3104	1,3057	1,3083	0,360%					
21	1,324	1,3259	1,3212	1,3237	0,356%					
22	1,3407	1,3428	1,3378	1,3404	0,374%					
23	1,3561	1,3583	1,3532	1,3559	0,377%					
24	1,3727	1,3754	1,3699	1,3727	0,401%					
25	1,3879	1,3907	1,3853	1,3880	0,390%					

ASTOR TRANSFORMATÖR ENERJİ TUR.
İNŞ. ve PETROL SAN. TİC. A.Ş.
Ramazanoğlu Yolu, Transtek Cad. No: 18
Pendik / İSTANBUL
Anadolu Kurumlar V.D. No: 859 005 5899

		TRANSFORMER ROUTINE TEST REPORT 1. Organize Sanayii Bölgesi Ahi Evran Mah. Anadolu Cad. No:6 Sincan, ANKARA / TURKEY Phone: +90 312 267 01 56 (57-58-59-60) Fax: +90 312 267 00 34		Date	20.4.2015
				Serial No.	50003
Customer		POWER 62,5 MVA PHASE 3 FREQ. 50 Hz Temp. Rise (°K) 55 / 60		Brand	ASTOR
				Vector Group	YNyn0
Type		Winding (HV / LV)		Project No.	14-124
				Cooling	ONAN/ONAF
				Conservator Tank	Cu / Cu

INSULATION RESISTANCES (GΩ)						@ 20 °C	
Time	15 s	30 s	45 s	60s	30 s	60 s	
Prim. - Tank (5 kVdc)	31,7	33,5	34,4	35,2	30,8	32,4	
Prim. - Sec. (5 kVdc)	223	231	235	241	212,2	221,3	
Sec. - Tank (5 kVdc)	82,4	122	153	178	112,5	163,9	

DIELECTRIC TESTS			
TEST NAME	Voltage	Frequency	Time
APPLIED VOLTAGE TEST (HV-N)	38 kV	50 Hz	60 s
APPLIED VOLTAGE TEST (LV)	70 kV	50 Hz	60 s
INDUCED AC WITHSTAND	275,0 kV	200 Hz	30 s

MEASUREMENT OF SHORT CIRCUIT IMPEDANCE & LOAD LOSSES @18,7°C										
Tab	Nominal Current (A)	Applied Current (A)	Measured Values					Calculated Values		
			S.C.Voltage (Uk)	P _U (W)	P _V (W)	P _W (W)	ΣP @ 18,7	%Uk	ΣP @ 18,7	Pk @75°C
1	275,6638	275,210	14922	77062,0	66423,0	77569,0	221054,0	11,42	221783,6	258532
13	234,3142	234,590	19130	78262,0	64252,0	73590,0	216104,0	12,41	215596,2	248032
25	203,7515	203,810	23459	75545,0	58746,0	69257,0	203548,0	13,24	203431,2	233284

MEASUREMENT OF NO-LOAD LOSSES & CURRENTS											
Terminal	Voltage (V)	Freq. (Hz)	Nom. Cur. (A)	Currents (A)				No-load Losses (W)			
				I _{OU}	I _{OV}	I _{OW}	ΣI ₀	P _{OU}	P _{OV}	P _{OW}	P ₀
2U2V2W	30251	50	1073,94	0,663	0,49388	0,50103	0,553	8720,22	5349,28	7579,21	21648,7
2U2V2W	33637	50	1073,94	0,7501	0,5177	0,582	0,617	11327	6693,02	10083,8	28103,9
2U2V2W	37176	50	1073,94	1,0564	0,76869	1,0936	0,973	17278,2	9133,2	12594,6	39006

TESTS ON ON-LOAD TAP-CHANGERS – OPERATION TEST			
1	With the transformer de-energized, eight complete cycles of operation.		PASS
2	With the transformer de-energized, and with the auxiliary voltage reduced to 85 % of its rated value, one complete cycle of operation.		PASS
3	With the transformer energized at rated voltage and frequency at no load, one complete cycle of operation.		PASS
4	With one winding short-circuited and, as far as practicable, rated current in the tapped winding, 10 cycles of tap-change operations across the range of two steps on each side from where a coarse or reversing changeover selector operates.		PASS

CALCULATED VALUES	NO-LOAD LOSSES (P ₀)	NO LOAD CURRENT (I ₀)	LOAD LOSSES @ 75°C (P _k)	S.C. IMPEDANCE @ 75°C (U _k)	VOLTAGE REGULATION @ 4/4 LOAD	EFFICIENCY @ 4/4 LOAD (η)
	Tol.=+%-15 (W)	Tol.=+%-30 (%)	Tol.=+%-10 (W)	Tol.=±%7,5 (%)	cosØ = 1 (%)	cosØ = 1 (%)
GUARANTEED	30000	0,25	250000	12		
RESULTS	28076	0,06	248032	12,41	1,17	99,56

Oil Type	Oil Weight(kg)	Active Part Weight (kg)	Total Weight (kg)
Nynas Lyra X	17800	47500	83000

This test report doesn't include the all tests performed on transformer.

All values in this test report is preliminary work results, and given for informational purposes only.

This transformer meets requirements provided by IEC standards.

CUSTOMER

Approved

ASTOR TRANSFORMATÖR ENERJİ TİC. A.Ş.
İNŞ. VE PETROL SAN. TİC. A.Ş.
Ramazanoğlu Mah. Transtek Cad. No: 18
Bendik / İSTANBUL
Anadolu Kurumlar V.D. No: 859 005 5899

Annex II

ROUTINE TESTS AFTER SHORT-CIRCUIT TESTS

Routine tests after the short-circuit tests were carried out at the factory of the manufacturer on 10 and 11 August 2015 in presence of a KEMA inspector.

See enclosed report on the following pages.

ÖZGÜNEY ELEKTRİK TEST LABORATUVARI
TEST RAPORU / TEST REPORT

ÖZGÜNEY ELEKTRİK İNŞ. NAK. TAŞ. MOB. SAN. VE TİC. LTD. ŞTİ.
1. Organize Sanayii Bölgesi Ahi Evran Mah. Anadolu Cad. No:6 Sincan / ANKARA
Tel / Phone: +90 312 267 01 56, Fax: +90 312 267 00 34
web: http://www.ozguney.com.tr

AB-0650-T

15080007

08.15

DENEYİN TANIMI

TEST DEFINITION

Transformatör Rutin Testleri
Transformer Routine Tests

MÜŞTERİ ADI VE ADRESİ

CUSTOMER NAME AND ADDRESS

ASTOR A.Ş.
1. Organize Sanayi Bölgesi Ahi Evran Mah. Anadolu Cad. No:6 Sincan / ANKARA

NUMUNE TANIMI

SAMPLE DESCRIPTION

Marka:ASTOR; Seri No:50001; 80/100 MVA; 154/33,6 kV; 50 Hz; YNyn0; 3 Fazlı; YG/AG
Sargısı:Cu/Cu; G.Depolu; ONAN/ONAF; güç transformatörü.
Brand:ASTOR; Serial No:50001; 80/100 MVA; 154/33,6kV; 50Hz; YNyn0; 3 Phase; HV/LV
Winding:Cu/Cu; Conservator Tank; ONAN/ONAF; power transformer.

NUMUNE KABUL TARİHİ

RECEIPT OF SAMPLE

: 8.8.2015

DENEY TARİH(LER)İ

TEST DATE(S)

: 12.08.2015 - 13.08.2015

DENEY STANDART(LAR)I

TEST STANDART(S)

: İlgili test sayfasında belirtilmiştir.
Indicated on related test page(s).

RAPORUN SAYFA SAYISI

PAGES NUMBER OF REPORT

: 51

AÇIKLAMALAR

REMARKS

Kısa Devre Mekanik Dayanım testi sonrası rutin testlerin tekrarı.
Routine tests after the Ability to Withstand of Short Circuit test.



Richard Houtepen

Date: 14/8/2015

KEMA

Laboratories

Denetçi
Inspector

Richard HOUTEPEN
KEMA Laboratories

Gözlemciler
Observers

Günaltay ACARLIOĞLU
TEİAŞ

Levent ÇELİK
TEİAŞ

Türk Akreditasyon Kurumu (TÜRKAK) deney raporlarının tanınması konusunda Avrupa Akreditasyon Birliği (EA) ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanınma antlaşmasını imzalamıştır.

The Turkish Accreditation Agency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation (EA) and of the International Laboratory Accreditation (ILAC) for the Mutual recognition of calibration certificates.

Deney ve / veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (talep halinde) ve deney metotları, bu raporun tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.

The test and / or measurements results, the uncertainties (if required) with confidence probability and test methods are given on the following pages which are part of this report.

Mühür

Stamp



Rapor Tarihi

Report Date

14.8.2015

Deneyi Yapan

Tested by

Halim ÖZKAN

Onaylayan

Approved by

Erhan KARABAŞ

Test sonuçları, sadece testleri yapılan numuneye aittir.

Test results are valid for tested item.

Bu rapor, Laboratuvarımızın yazılı izni olmadan kısmen kopyalanıp çoğaltılamaz. İmzasız ve mühürlü raporlar geçersizdir.

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GİRİŞ

GİRİŞ

Transformatör karakteristikleri*Characteristics of transformer*

Marka : ASTOR
Brand
Güç (kVA) : 80000 / 100000
Power (kVA)
Bağlantı Grubu : YNyn0
Vector Group
Soğutma : ONAN / ONAF
Cooling
Fabrika No : 14-123
Factory No
Tip : YAKD'li Güç Transformatörü
Type : Power Transformer with OLTC
İmal Yılı : 2015
Production Year
Sargı (YG / AG) : Cu / Cu
Windings (HV/LV)
Toplam Ağırlık (kg) : 117000
Total Weight (kg)
Nakil Ağırlığı (kg) : 86000
Transportation Weight (kg)
Aktif Kısım Ağırlığı (kg) : 70000
Active Part Weight (kg)
Yağ Ağırlığı (kg) : 21500
Oil Weight (kg)
Yağ Markası : NYNAS Lyra X
Oil Brand
Faz / Frekans (Hz) : 3 / 50 Hz
Phase/Freq. (Hz)
Son Kullanıcı : TEİAŞ
End User

DNV-GL
Richard Houtepen
Date: 14/08/2015
KEMA Laboratories

Tarih: 12.8.2015
Date:

Testi Yapan:
Tested By:

Onaylayan:
Approved By:

Gözlemci(ler):
Observer(s):

İNDEKS

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DNV-GL
Richard Houtepen
Date: 14/8/2015
KEMA Laboratories

Tarih: 12.8.2015 Date:	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):  Observer(s): 
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

1. Gerilim çevirme oranının ölçülmesi ve faz kaymasının kontrolü
1. Measurement of voltage ratio and check of phase displacement

Poz.	Primer Gerilimi (V)	Sekonder Gerilimi (V)	Nominal Değerler	BOŞTA ÇEVİRME ORANLARI			SAPMA MİKTARI (≤ %0,5)		
				Measured Voltage Ratio			Deviation (≤ 0,5%)		
Tap	Primary Voltage (V)	Secondary Voltage (V)	Nominal Values	1U1N/2u2n	1V1N/2v2n	1W1N/2w2n	1U1N/2u2n	1V1N/2v2n	1W1N/2w2n
1	130900		3,8958	3,9029	3,9028	3,9029	0,181	0,179	0,181
2	132825		3,9531	3,9597	3,9597	3,9597	0,166	0,166	0,166
3	134750		4,0104	4,0167	4,0166	4,0167	0,157	0,154	0,157
4	136675		4,0677	4,0736	4,0736	4,0167	0,145	0,145	1,254
5	138600		4,1250	4,1308	4,1308	4,1308	0,141	0,141	0,141
6	140525		4,1823	4,1877	4,1876	4,1877	0,129	0,127	0,129
7	142450		4,2396	4,2446	4,2446	4,2446	0,118	0,118	0,118
8	144375		4,2969	4,3016	4,3015	4,3016	0,110	0,108	0,110
9	146300		4,3542	4,3586	4,3585	4,3585	0,102	0,100	0,100
10	148225		4,4115	4,4152	4,4154	4,4155	0,085	0,089	0,092
11	150150		4,4688	4,4724	4,4723	4,4724	0,082	0,079	0,082
12	152075		4,5260	4,5294	4,5293	4,5293	0,074	0,072	0,072
13	154000	33600	4,5833	4,5862	4,5861	4,5861	0,063	0,060	0,060
14	155925		4,6406	4,6431	4,6430	4,6430	0,053	0,051	0,051
15	157850		4,6979	4,7000	4,7000	4,7000	0,044	0,044	0,044
16	159775		4,7552	4,7569	4,7569	4,7569	0,036	0,036	0,036
17	161700		4,8125	4,8139	4,8138	4,8138	0,029	0,027	0,027
18	163625		4,8698	4,8708	4,8708	4,8708	0,021	0,021	0,021
19	165550		4,9271	4,9277	4,9277	4,9277	0,013	0,013	0,013
20	167475		4,9844	4,9847	4,9846	4,9847	0,007	0,005	0,007
21	169400		5,0417	5,0416	5,0415	5,0415	0,001	0,003	0,003
22	171325		5,0990	5,0985	5,0984	5,0984	0,009	0,011	0,011
23	173250		5,1563	5,1555	5,1554	5,1554	0,015	0,016	0,016
24	175175		5,2135	5,2124	5,2123	5,2124	0,022	0,024	0,022
25	177100		5,2708	5,2693	5,2693	5,2693	0,029	0,029	0,029

Faz farkının kontrolü ölçüm cihazı ile yapılmıştır. Tespit edilen faz kayması :

YNyn0

Phase displacement of the transformer checked by measuring device. Checked phase displacement :

Standart / Standard : TS EN 60076-1 MADDE 11.3, IEC 60076-1 CLAUSE 11.3

Ölçüm Cihazı / Measuring Device:

TETTEX TTR 2796


Serial No:

177783

Richard Houtepen
Date: 14/8/2015
KEMA Laboratories

Tarih: 12.8.2015 Date:	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):   Observer(s):
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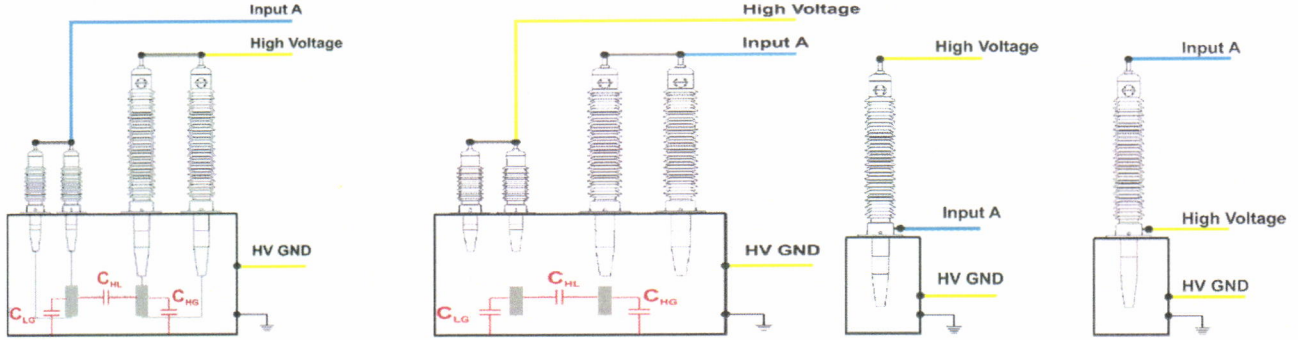
Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

2. Yalıtım sistemi kapasitanslarının ve kayıp faktörünün (tan δ) ölçülmesi.

2. Measurement of system capacitances and dissipation factor (tan δ) of the insulation system capacitance.

İki sargılı transformatörlerde ve buşingler için kapasite ve (tan δ) ölçümü için test düzenekleri.

Measurement connections of a two windings transformer and spare bushing for measurement of capacitances and (tan δ).



Test Objesi Sıcaklığı Test Object Temperature : 27,8 °C

Ortam Sıcaklığı Ambient Temp= 25,8 °C

Bağıl Nem Relative Humidity= 54,0 %

Test Noktası	Test Modu	YG GİRİŞ Bağlantısı HV INPUT to	GİRİŞ A Bağlantısı INPUT A to	YG GND Bağlantısı HV GND to	Test Gerilimi Test Voltage	Kapasite Capacitance	%'de KF (tanδ) (27,8 °C) DF % (tanδ) @ (27,8 °C)	%'de KF (tanδ) (20 °C) DF % (tanδ) @ (20 °C)	%'de PF (cosφ) (27,8 °C) PF% (cosφ) @ 27,8 °C	%'de PF (cosφ) (20 °C) PF% (cosφ) @ 20 °C
C _{HL}	UST A	YG (HV)	AG (LV)	Tank	10,0 kV	8,8940 nF	0,16%	0,15%	0,16%	0,15%
C _{HG}	GST gA+B	YG (HV)	AG (LV)	Tank	10,0 kV	4,2140 nF	0,16%	0,16%	0,16%	0,16%
C _{LG}	GST gA+B	AG (LV)	YG (HV)	Tank	10,0 kV	14,6300 nF	0,24%	0,23%	0,24%	0,23%

Buşingler Üzerinde Testler Tests on Bushings

Test Objesi Sıcaklığı Test Object Temperature : 27,8 °C

Ortam Sıcaklığı Ambient Temp= 25,8 °C

Bağıl Nem Relative Humidity= 54,0 %

Seri No	Test Noktası	Test Modu	YG GİRİŞ Bağlantısı HV INPUT to	GİRİŞ A Bağlantısı INPUT A to	YG GND Bağlantısı HV GND to	Test Gerilimi Test Voltage	Kapasite Capacitance	%'de KF (tanδ) (27,8 °C) DF % (tanδ) @ (27,8 °C)	%'de KF (tanδ) (20 °C) DF % (tanδ) @ (20 °C)
14 B 5787	C1	UST A	Üst Terminal Top Terminal	Test Ucu Test Tap	Flanş Flange	10,0 kV	269,30 pF	0,29%	0,29%
	C2	GST gA+B	Test Ucu Test Tap	Üst Terminal Top Terminal	Flanş Flange	2,0 kV	707,70 pF	0,22%	0,22%
	C1 + C2	GST gA+B	Test Ucu Test Tap	Bağlantı Yok Not connected	Flanş Flange	2,0 kV	971,80 pF	0,27%	0,27%
14 B 5788	C1	UST A	Üst Terminal Top Terminal	Test Ucu Test Tap	Flanş Flange	10,0 kV	270,50 pF	0,29%	0,29%
	C2	GST gA+B	Test Ucu Test Tap	Üst Terminal Top Terminal	Flanş Flange	2,0 kV	703,40 pF	0,27%	0,22%
	C1 + C2	GST gA+B	Test Ucu Test Tap	Bağlantı Yok Not connected	Flanş Flange	2,0 kV	968,80 pF	0,23%	0,23%
14 B 5789	C1	UST A	Üst Terminal Top Terminal	Test Ucu Test Tap	Flanş Flange	10,0 kV	267,50 pF	0,27%	0,27%
	C2	GST gA+B	Test Ucu Test Tap	Üst Terminal Top Terminal	Flanş Flange	2,0 kV	769,20 pF	0,23%	0,23%
	C1 + C2	GST gA+B	Test Ucu Test Tap	Bağlantı Yok Not connected	Flanş Flange	2,0 kV	1033,00 pF	0,25%	0,25%

Standart / Standard : IEEE C57.12.90 Madde/Clause 10.10; IEC 60076-1 Madde/Clause 11.1.2.2 a. & 11.1.2.2 c. ; TS EN 60076-1 Madde/Clause 11.1.2.2 a. & 11.1.2.2 c.

Ölçüm Cihazı / Measuring Device:

TETTEX MIDAS 2881

Seri No / Serial No :

178857

Tarih: 12.8.2015	Testi Yapan: [Signature]	Onaylayan: Richard Hautepey	Gözlemci(ler): [Signature]
Date:	Tested By:	Approved By:	Observed By:

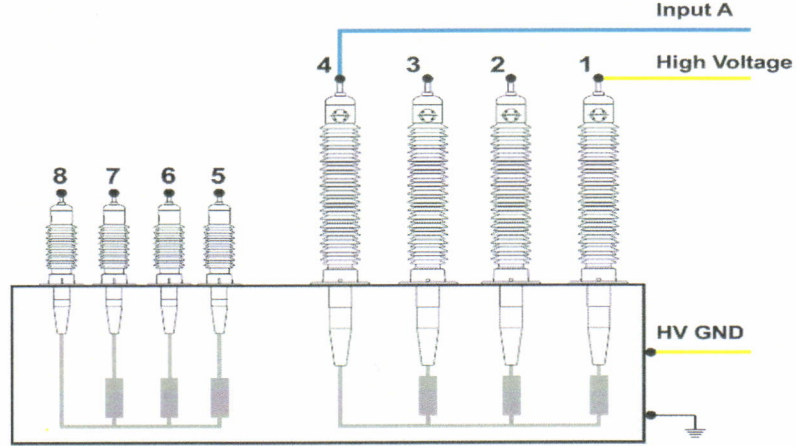
Seri No / Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim / Nom. Voltage	154/33,6 kV
Bağ. Grubu / Vector Group	YNyn0	Soğutma / Cooling	ONAN/ONAF

3. Miknatıslanma akımı ölçülmesi

3. Excitation current measurement

Miknatıslanma akımı ölçümü için test düzenekleri.

Measurement connections for excitation current measurement



Kademe Tap	Test Noktası DUT	Test Modu Test Mode	YG GİRİŞ Bağlantısı HV INPUT to	GİRİŞ A Bağlantısı INPUT A to	YG GND Bağlantısı HV GND to	Test Gerilimi Test Voltage	Miknatıslanma Akımı Excitation Current
1	1U-1N	UST A	1	4	Tank	10,0 kV	45,940 mA
	1V-1N	UST A	2	4	Tank	10,0 kV	32,280 mA
	1W-1N	UST A	3	4	Tank	10,0 kV	45,980 mA
13	1U-1N	UST A	1	4	Tank	10,0 kV	32,210 mA
	1V-1N	UST A	2	4	Tank	10,0 kV	22,220 mA
	1W-1N	UST A	3	4	Tank	10,0 kV	32,210 mA
25	1U-1N	UST A	1	4	Tank	10,0 kV	24,030 mA
	1V-1N	UST A	2	4	Tank	10,0 kV	16,190 mA
	1W-1N	UST A	3	4	Tank	10,0 kV	23,790 mA
AG LV	2U-2N	UST A	5	8	Tank	5,0 kV	174,800 mA
	2V-2N	UST A	6	8	Tank	5,0 kV	124,000 mA
	2W-2N	UST A	7	8	Tank	5,0 kV	174,700 mA

Standart / Standard : Test yöntemi olarak TEİAŞ GİS GÜÇ TRANSFORMATÖRÜ (154kV/OG) TİP TEKNİK ŞARTNAMESİ (REVİZYON:TEMMUZ 2013/İDB-4) madde 4.3.2.k. esas alınmıştır.

Test performed according to TEİAŞ GIS POWER TRANSFORMER (154kV/MV) TECHNICAL SPECIFICATION (REVISION: JULY 2013/İDB-4) clause 4.3.2.k.

Ölçüm Cihazı / Measuring Device:

TETTEX MIDAS 2881

DNV-GL

Seri No / Serial No :

178857

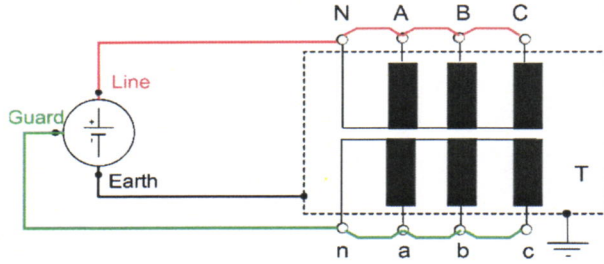
Tarih: 12.8.2015	Testi Yapan: 	Onaylayan: 	Görüşen: 
Date:	Tested By:	Approved By:	Observer(s):

Seri No / Serial No	50001	Güç / Power	80000 / 100000 kVA
Marka / Brand	ASTOR	Nom. Gerilim / Nom. Voltage	154/33,6 kV
Bağ. Grubu / Vector Group	YNyn0	Soğutma / Cooling	ONAN/ONAF

4. İzolasyon dirençlerinin ölçülmesi.(Her bir sargı ile toprak arasındaki ve sargılar arasındaki d.a. yalıtım direncinin ölçülmesi.)

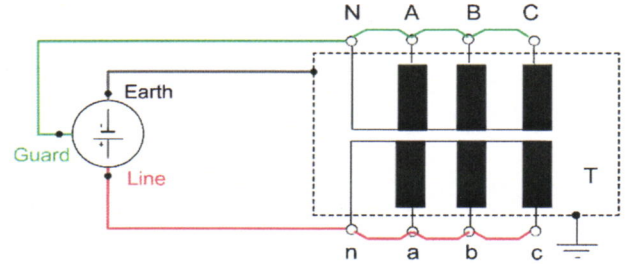
4. Measurement of d.c. insulation resistance between each winding to earth and between winding.

İzolasyon direnci ölçüm cihazı bağlantı şekilleri. Insulation resistance measurement device connection diagrams.



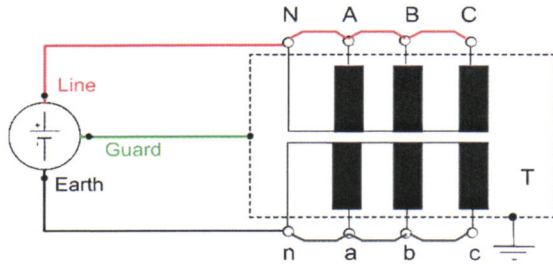
Şekil 2.1. YG - Tank ölçümü

Figure 2.1. HV - Tank measurement



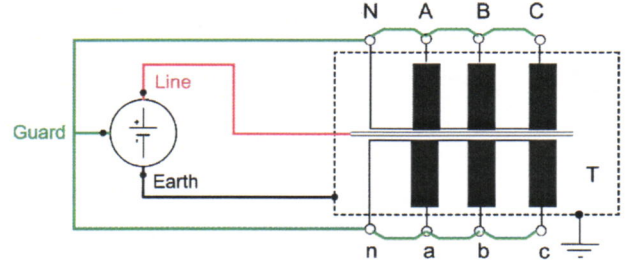
Şekil 2.2. AG - Tank ölçümü

Figure 2.2. LV - Tank measurement



Şekil 2.3. YG - AG ölçümü

Figure 2.3. HV - LV measurement



Şekil 2.4. Nüve - Tank ve Çerçeve - Tank ölçümü

Figure 2.4. Core - Tank & Frame - Tank measurement

Ölçüm Noktası Measurement Point	Gerilim (kV) Voltage (kV)	27,9°C'de İzolasyon Dirençleri (GΩ)						20°C'de İzolasyon Dirençleri (GΩ)				
		Insulation Resistances @ 27,9°C (GΩ)						Insulation Resistances @ 20°C(GΩ)				
		0s	15s	30s	45s	60s	600s	30s	60s	600s	DAR	PI
YG - Tank HV-Tank	5,0 kV	15,6	68,1	71,2	73,0	72,6	86,0	123,2	125,6	148,7	1,01966	1,184
YG - AG HV - LV	5,0 kV	95,1	118,1	134,2	149,0	160,1	329,2	232,2	277,0	569,5	1,19300	2,0562
AG - Tank LV - Tank	5,0 kV	3,5	16,5	28,0	34,6	42,0	119,2	48,4	72,7	206,2	1,50000	2,8381
Nüve - Tank Core - Tank	2,5 kV	2,7	60,8	65,4	68,8	71,1	---	113,1	123,0	---	1,08716	---
Çerçeve - Tank Frame - Tank	2,5 kV	1,2	2,2	3,3	3,8	4,1	---	5,7	7,1	---	1,24242	---
Nüve-Çerçeve Core - Frame	2,5 kV	6,8	17,6	22,1	24,4	26,3	---	38,2	45,5	---	1,19005	---

DAR : Dielektrik emilim oranı. Dielectric Absorption Ratio.

PI : Polarizasyon endeksi. Polarization Index.

$$DAR = \frac{R_{ins}(60s)}{R_{ins}(30s)}$$

$$PI = \frac{R_{ins}(600s)}{R_{ins}(60s)}$$

Richard Houtepen
Date: 14/08/2015
KEMA Laboratories

Standart / Standard : IEEE C57.12.90 MADDE/CLAUSE 10.11; TS EN 60076-1 Madde 11.1.2.2; IEC 60076-1 Clause 11.1.2.2
Test süreleri ve hesaplamalar için TEİAŞ GİS GÜÇ TRANSFORMATÖRÜ (154kV/OG) TİP TEKNİK ŞARTNAMESİ (REVİZYON:TEMMUZ 2013/İDB-4) madde 4.3.2.d. esas alınmıştır.

Test performed according to TEİAŞ GIS POWER TRANSFORMER (154kV/MV) TECHNICAL SPECIFICATION (REVISION: JULY 2013/İDB-4) clause 4.3.2.d.

Ölçüm Cihazı / Measuring Device:

METREL MI 3200

Seri No / Serial No :

12140177

Tarih: / Date: 12.8.2015	Testi Yapan: / Tested By: 	Onaylayan: / Approved By: 	Gözlemci(ler): / Observer(s):  
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

5. Sargı direncinin ölçülmesi

5. Measurement of winding resistance

Direnç ölçüm sıcaklığı Measurement temperature : 28,9 °C

Poz. Tap	Test Akımı Test Current	YG SARGISI HV WINDING			Ortalama Değer Mean Value	Sapma Deviation
		1U - 1V	1V - 1W	1W - 1U		
1	19,90 A	0,44717 Ω	0,44673 Ω	0,44645 Ω	0,44678 Ω	0,161%
2	19,90 A	0,46004 Ω	0,45879 Ω	0,45896 Ω	0,45926 Ω	0,272%
3	19,90 A	0,47036 Ω	0,46903 Ω	0,46927 Ω	0,46955 Ω	0,284%
4	19,90 A	0,48053 Ω	0,47943 Ω	0,47946 Ω	0,47981 Ω	0,229%
5	19,90 A	0,49093 Ω	0,48960 Ω	0,48983 Ω	0,49012 Ω	0,272%
6	19,90 A	0,50114 Ω	0,49999 Ω	0,50004 Ω	0,50039 Ω	0,230%
7	19,90 A	0,51150 Ω	0,51025 Ω	0,51039 Ω	0,51071 Ω	0,245%
8	19,90 A	0,52188 Ω	0,52081 Ω	0,52083 Ω	0,52117 Ω	0,205%
9	19,90 A	0,53224 Ω	0,53102 Ω	0,53119 Ω	0,53148 Ω	0,230%
10	19,90 A	0,54255 Ω	0,54154 Ω	0,54146 Ω	0,54185 Ω	0,201%
11	19,90 A	0,55300 Ω	0,55174 Ω	0,55183 Ω	0,55219 Ω	0,228%
12	19,90 A	0,56325 Ω	0,56228 Ω	0,56210 Ω	0,56254 Ω	0,205%
13	19,90 A	0,55476 Ω	0,55459 Ω	0,55398 Ω	0,55444 Ω	0,141%
14	19,90 A	0,56790 Ω	0,56689 Ω	0,56674 Ω	0,56718 Ω	0,205%
15	19,90 A	0,57832 Ω	0,57707 Ω	0,57709 Ω	0,57749 Ω	0,217%
16	19,90 A	0,58844 Ω	0,58745 Ω	0,58729 Ω	0,58773 Ω	0,196%
17	19,90 A	0,59887 Ω	0,59765 Ω	0,59764 Ω	0,59805 Ω	0,206%
18	19,90 A	0,60906 Ω	0,60802 Ω	0,60789 Ω	0,60832 Ω	0,192%
19	19,90 A	0,61944 Ω	0,61828 Ω	0,61822 Ω	0,61865 Ω	0,197%
20	19,90 A	0,62977 Ω	0,62887 Ω	0,62861 Ω	0,62908 Ω	0,185%
21	19,90 A	0,64021 Ω	0,63911 Ω	0,63899 Ω	0,63944 Ω	0,191%
22	19,90 A	0,65048 Ω	0,64961 Ω	0,64930 Ω	0,64980 Ω	0,182%
23	19,90 A	0,66085 Ω	0,65978 Ω	0,65964 Ω	0,66009 Ω	0,183%
24	19,90 A	0,67114 Ω	0,67029 Ω	0,66999 Ω	0,67047 Ω	0,172%
25	19,90 A	0,68139 Ω	0,68043 Ω	0,68013 Ω	0,68065 Ω	0,185%

Poz. Tap	Test Akımı Test Current	AG SARGISI LV WINDING			Ortalama Değer Mean Value	Sapma Deviation
		1U - 1V	1V - 1W	1W - 1U		
-	31,80 A	18,8160 mΩ	18,8220 mΩ	18,8560 mΩ	18,8313 mΩ	0,213%

Standart / Standard : TS EN 60076-1 MADDE 11.2, IEC 60076-1 CLAUSE 11.2

Ölçüm Cihazı / Measuring Device: TETTEX 2293

Seri No / Serial No :

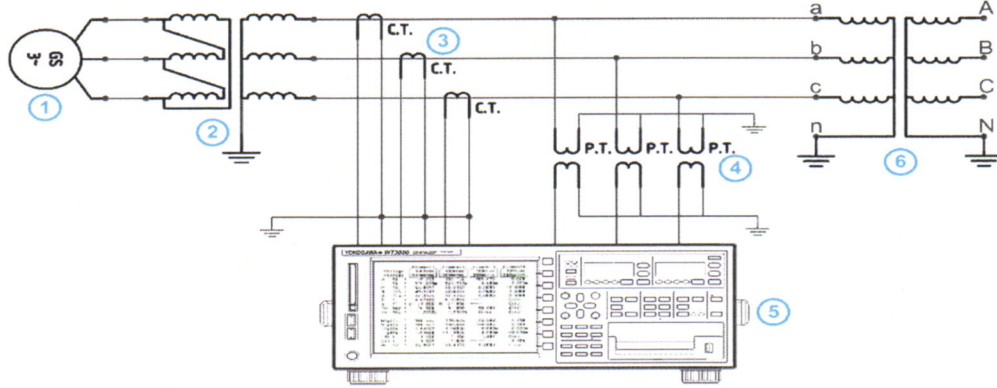
178380

Richard Houtepen
Date: 14/08/2015

KEMA Laboratories

Tarih: 12.8.2015 Date:	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):   Observer(s):
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

6.Yüksüz (Boşta) kaybın ve akımın ölçülmesi
6. Measurement of no-load loss and current


1. Senkron Jeneratör Synchronous Generator
2. Besleme Trafosu Step-Up Transformer
3. Akım Trafoları Current Transformers

4. Gerilim Trafoları Voltage Transformers
5. Güç Analizörü Power Analyzer
6. Test Transformatörü Transformer Under Test

Enerjilendirilen kısım Energized side

2U2V2W

Boşta bırakılan kısım Float side

1U1V1W

Uyarım	U_{rms}	U_{mean}	I_o	P_m	d	ΣP_o
Exitation	U_{rms}	U_{mean}	I_o	P_m	d	ΣP_o
90%	17443 V	17479 V	0,63839 A	7964,0 W	-0,00054	25967 W
	17480 V	17449 V	0,45435 A	6728,0 W		
	17472 V	17456 V	0,69850 A	11289,0 W		
	17465 V	17456 V	0,59708 A	25981,0 W		
100%	19400 V	19381 V	0,90534 A	9798,0 W	-0,00134	33187 W
	19445 V	19431 V	0,69052 A	8782,0 W		
	19434 V	19388 V	0,93688 A	14652,0 W		
	19426 V	19400 V	0,84425 A	33232,0 W		
110%	21405 V	21323 V	1,65201 A	11405,0 W	-0,00433	43352 W
	21457 V	21391 V	1,44293 A	12300,0 W		
	21435 V	21306 V	1,68237 A	19836,0 W		
	21432 V	21340 V	1,59244 A	43541,0 W		

DNV-GL

Richard Houtepen

Date: 14/01/2015

KEMA Laboratories

Standart / Standard : TS EN 60076-1 MADDE 11.4, IEC 60076-1 CLAUSE 11.4

Ölçüm Cihazı / Measuring Device: YOKOGAWA WT3000

Seri No / Serial No : 91R616989

Ölçüm Cihazı / Measuring Device: EPRO ENVOS60

Seri No / Serial No : 2/13/2151, 2/13/2152, 2/13/2153

Ölçüm Cihazı / Measuring Device: EPRO NCO72,5

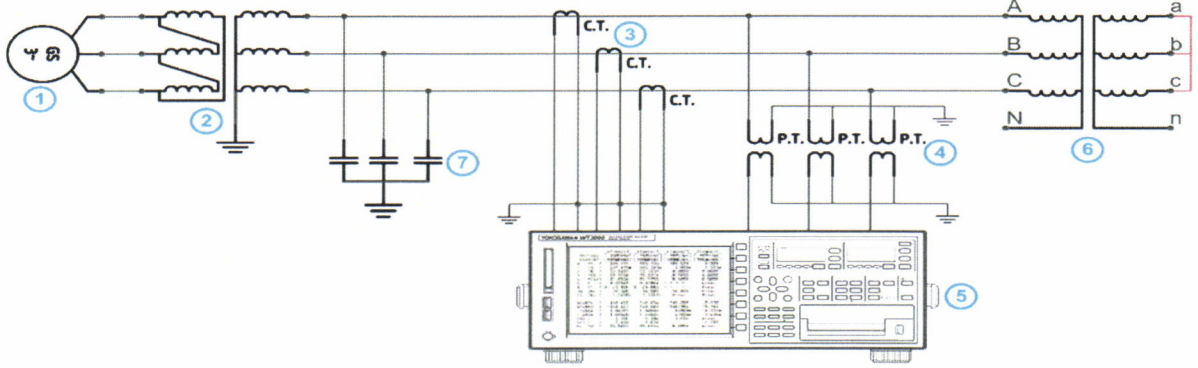
Seri No / Serial No : 2/13/2154, 2/13/2155, 2/13/2156

Tarih: 12.8.2015 Date:	Testi Yapan: [Signature] Tested By:	Onaylayan: [Signature] Approved By:	Gözlemci(ler): [Signature] Observer(s):
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

7. Kısa devre empedansının ve yükte kaybın ölçülmesi

7. Measurement of short-circuit impedance and load loss



1. Senkron Jeneratör Synchronous Generator
2. Besleme Trafosu Step-Up Transformer
3. Akım Trafoları Current Transformers
4. Gerilim Trafoları Voltage Transformers

5. Güç Analizörü Power Analyzer
6. Test Transformatörü Transformer Under Test
7. Kompanzasyon Ünitesi Capacitor Banks

Ölçüm sıcaklığı Measurement temperature : 29,1 °C

Enerjilendirilen kısım Energized side 1U1V1W

Kısadevre edilen kısım Short-circuited side 2U2V2W

Poz. Tap	Baz Güç Base Power	Nominal Akım Nominal Current	Uygulanan Akım Applied Current	Ölçülen Değerler Measured Values						
				P _U	P _V	P _W	P _Σ	P _{DC}	P _{AC}	K.D. Gerilimi S.C. Voltage
1	100 MVA	441,1 A	251,01 A	23400 W	25800 W	23900 W	73100 W	69265 W	3835 W	4856 V
1	80 MVA	352,8 A	251,01 A	23400 W	25800 W	23900 W	73100 W	69265 W	3835 W	4856 V
13	100 MVA	374,9 A	203,39 A	20270 W	22540 W	23870 W	66680 W	58971 W	7709 W	5849 V
13	80 MVA	299,9 A	203,39 A	20270 W	22540 W	23870 W	66680 W	58971 W	7709 W	5849 V
25	100 MVA	326,0 A	180,38 A	20130 W	22050 W	25490 W	67670 W	58776 W	8894 W	7327 V
25	80 MVA	260,8 A	180,38 A	20130 W	22050 W	25490 W	67670 W	58776 W	8894 W	7327 V

Poz. Tap	Baz Güç Base Power	Nominal Akıma Düzeltilmiş Değerler Correction to Nominal Current				Referans Sıcaklık (75 °C) için Düzeltilmiş Değerler Corrected Values for Reference Temperature (75 °C)			
		P _Σ	P _{DC}	P _{AC}	K.D. Gerilimi S.C. Voltage	P _{DC 75}	P _{AC 75}	P _{k 75}	% u _k
1	100 MVA	225694 W	213855 W	11839 W	14779 V	251023 W	10086 W	261109 W	11,29
1	80 MVA	144444 W	136867 W	7577 W	11823 V	160655 W	6455 W	167110 W	9,03
13	100 MVA	226564 W	200369 W	26195 W	18674 V	235193 W	22316 W	257509 W	12,13
13	80 MVA	145001 W	128236 W	16765 W	14940 V	150524 W	14282 W	164806 W	9,70
25	100 MVA	221030 W	191981 W	29049 W	22935 V	225346 W	24748 W	250095 W	12,95
25	80 MVA	141459 W	122868 W	18592 W	18348 V	144222 W	15839 W	160061 W	10,36

Standart / Standard : TS EN 60076-1 MADDE 11.4, IEC 60076-1 CLAUSE 11.4

Ölçüm Cihazı / Measuring Device:

YOKOGAWA WT3000

Seri No / Serial No :

91R616989

Ölçüm Cihazı / Measuring Device:

EPRO ENV0800

Seri No / Serial No :

2/13/2151, 2/13/2152, 2/13/2153

Ölçüm Cihazı / Measuring Device:

EPRO NC072,5

Seri No / Serial No :

2/13/2154, 2/13/2155, 2/13/2156

Tarih: Date:	12.8.2015	Testi Yapan: Tested By:	Onaylayan: Approved By:	Observer(s):
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

8. Yük altında kademe değiştiriciler üzerindeki deneyler**8. Tests on on-load tap-changers****Yük Altında Kademe Değiştirici bilgileri Onload Tap Changer information**

Üretici Manufacturer : MR

Tip Type : VMIII500Y-72,5/C-14273GR

Seri No Serial : 1547811

1	Enerjilendirilmemiş transformatörle sekiz tam çalışma çevrimi With the transformer de-energized, eight complete cycles of operation.	OLUMLU PASS
2	Enerjilendirilmemiş transformatörle ve beyan değerinin % 85'ine azaltılmış yardımcı gerilimle bir tam çalışma çevrimi. With the transformer de-energized, and with the auxiliary voltage reduced to 85 % of its rated value, one complete cycle of operation.	OLUMLU PASS
3	Beyan geriliminde ve frekansında enerjilendirilmiş transformatör ile yüksüz durumda bir tam çalışma çevrimi With the transformer energized at rated voltage and frequency at no load, one complete cycle of operation.	OLUMLU PASS
4	Bir sargı kısa devre edilmiş durumda ve kademeli sargısı uygulanabildiği kadarıyla beyan akımında iken orta kademedan itibaren her iki taraftaki iki kademe adımı arasında 10 kademe değiştirme çalışma çevrimi With one winding short-circuited and, as far as practicable, rated current in the tapped winding, 10 cycles of tap-change operations across the range of two steps on each side from where a coarse or reversing changeover selector operates.	OLUMLU PASS

Standart / Standard : TS EN 60076-1 MADDE 11.7, IEC 60076-1 CLAUSE 11.7

Standart / Standard : TS EN 60076-1 MADDE 11.4, IEC 60076-1 CLAUSE 11.4

Ölçüm Cihazı / Measuring Device: YOKOGAWA WT3000

Seri No / Serial No : 91R616989

Ölçüm Cihazı / Measuring Device: EPRO ENVOS60

Seri No / Serial No : 2/13/2151, 2/13/2152, 2/13/2153

Ölçüm Cihazı / Measuring Device: EPRO NCO72,5

Seri No / Serial No : 2/13/2154, 2/13/2155, 2/13/2156

DNV-GL
Richard Houtepen
Date: 14/8/2015
KEMA Laboratories

Tarih: 12.8.2015 Date:	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):   Observer(s):
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Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

9. Yıldırım darbe deneyi

9. Lightning impulse test

Çevre Koşulları Climate Data

Ortam Sıcaklığı Ambient Temp= 31,2 °C

Bağıl Nem Relative Humidity= 31,0 %

Hava Basıncı Air pressure= 920,2 hPa

Şekil No Figure No	Darbe No Impulse No	U _p (kV)	T ₁ (µs)	T ₂ (µs)	I _p (A)	Açıklamalar Remarks
1*	13213	-102	1,39	56,8	-257,1	2u RLI %60
2*	13214	-168,2	1,39	57,00	-415,7	2u LI %100-1
3*	13215	-170,4	1,39	57,30	-422,9	2u LI %100-2
4*	13216	-171,6	1,39	57,30	-423,8	2u LI %100-3
5	13243	-101,4	1,41	20,60	-723,1	2u RLI %60 without earth resistor
6	13244	-168	1,42	21,00	-1188,0	2u LI %100-1 without earth resistor
7	13245	-168,1	1,42	20,90	-1192,0	2u LI %100-2 without earth resistor
8	13246	-168,3	1,42	20,90	-1188,0	2u LI %100-3 without earth resistor
9*	13217	-102,6	1,39	56,40	-253,6	2v RLI %60
10*	13218	-173,9	1,39	56,90	-427,8	2v LI %100-1
11*	13219	-172,1	1,39	57,00	-421,2	2v LI %100-2
12*	13220	-169,5	1,39	57,10	-415,9	2v LI %100-3
13	13239	-100,7	1,42	20,70	-657,2	2v RLI %58 without earth resistor
14	13240	-168,5	1,42	21,00	-1115,0	2v LI %100-1 without earth resistor
15	13241	-168,6	1,43	21,00	-1115,0	2v LI %100-2 without earth resistor
16	13242	-173,2	1,42	21,00	-1154,0	2v LI %100-3 without earth resistor
17*	13221	-102,4	1,39	56,30	-256,0	2w RLI %60
18*	13222	-171,2	1,39	57,30	-426,2	2w LI %100-1
19*	13223	-170,4	1,39	57,20	-424,1	2w LI %100-2
20*	13224	-170,8	1,39	57,20	-424,0	2w LI %100-3
21	13235	-99,37	1,42	20,30	-594,3	2w RLI %58 without earth resistor
22	13236	-171,9	1,42	20,60	-1003,0	2w RLI %100-1 without earth resistor
23	13237	-173	1,42	20,70	-1021,0	2w RLI %100-2 without earth resistor
24	13238	-173,6	1,42	20,60	-1012,0	2w RLI %100-3 without earth resistor
25*	13225	-101,3	2,22	51,60	-343,7	2n RLI %60
26*	13226	-168,5	2,21	51,90	-576,9	2n LI %100-1
27*	13227	-171,5	2,21	52,00	-586,6	2n LI %100-2
28*	13228	-168,4	2,21	51,90	-574,4	2n LI %100-3

Yıldırım darbe formları Ek.1'de verilmiştir. Lightning impulses are given in Annex 1

Standart / Standard : TS EN 60076-3 MADDE 13, IEC 60076-3 CLAUSE 13

Ölçüm Cihazı / Measuring Device: DR. STRAUSS TR-AS 200-14/2

Ölçüm Cihazı / Measuring Device: DDF-1200 Voltage Divider

Richard Houtepen
Date: 14/08/2015
Seri No / Serial No: 1196
Laboratory: 1210301

Tarih: 12.8.2015 Date: 13.8.2015	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):   Observer(s):
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Şekil No Figure No	Darbe No Impulse No	U _p (kV)	T ₁ (µs)	T ₂ (µs)	I _p (A)	Açıklamalar Remarks
29	13231	-102,4	2,62	14,80	-759,2	2n RLI %60 without earth resistance
30	13232	-171,3	2,61	11,80	-1120,0	2n RLI %100-1 without earth resistance
31	13233	-168,8	2,62	11,70	-1092,0	2n RLI %100-2 without earth resistance
32	13234	-171,9	2,61	11,80	-1105,0	2n RLI %100-3 without earth resistance
33	13248	-57,53	0,92	46,00	-55,7	1N RLI %60
34	13249	-94,6	0,88	46,00	-100,4	1N LI %100-1
35	13250	-96,15	0,87	46,00	-102,2	1N LI %100-2
36	13251	-96,32	0,87	46,00	-101,7	1N LI %100-3
37	13256	-345,9	1,16	45,00	-113,1	1U RLI %53 Tap1
38	13257	-658,8	1,09	43,30	-278,9	1U LI %100-1 Tap1
39	13258	-658,2	1,09	43,30	-279,8	1U LI %100-2 Tap1
40	13259	-658,9	1,09	43,30	-278,7	1U LI %100-3 Tap1
41	13260	-349,7	1,17	56,50	-71,9	1V RLI %53
42	13261	-666,6	1,09	50,70	-136,6	1V LI %100-1
43	13262	-668,1	1,09	50,80	-143,0	1V LI %100-2
44	13263	-668,3	1,10	50,80	-138,0	1V LI %100-3
45	13264	-393,3	1,14	48,80	-69,6	1W RLI %60 Tap25
46	13265	-672,4	1,10	48,20	-163,6	1W LI %100-1 Tap25
47	13266	-669,8	1,10	48,20	-159,1	1W LI %100-2 Tap25
48	13267	-671,4	1,10	48,20	-158,6	1W LI %100-3 Tap25

Yıldırım darbe formları Ek.1'de verilmiştir. Lightning impulses are given in Annex 1

* İşaretli testlerde T₂ süresinin düzeltilmesi amacıyla toprak devresine 312 Ω direnç eklenmiştir.

* The marked tests, 312 Ω resistor is added to ground circuit to correct the T₂ time of the wave shape.

DNV-GL
Richard Houtepen
Date: 14/08/2015
KEMA Laboratories

Standart / Standard : TS EN 60076-3 MADDE 13, IEC 60076-3 CLAUSE 13

Ölçüm Cihazı / Measuring Device: DR. STRAUSS TR-AS 200-14/2

Seri No / Serial No : 1196

Ölçüm Cihazı / Measuring Device: DDF-1200 Voltage Divider

Seri No / Serial No : 1210301

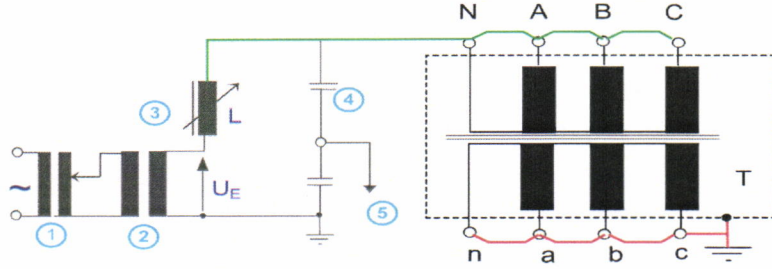
Tarih: 12.8.2015	Testi Yapan: 	Onaylayan: 	Gözlemci(ler):  
Date: 13.8.2015	Tested By:	Approved By:	Observer(s):

Seri No Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim Nom. Voltage	154/33,6 kV
Bağ. Grubu Vector Group	YNyn0	Soğutma Cooling	ONAN/ONAF

10. Uygulanan gerilim testi

10. Applied voltage test

Uygulanan Gerilim testi için bağlantı şekilleri. Connection diagrams for applied voltage test.



1. Gerilim Regülatörü Voltage Regulator

2. Uyarma Transformatörü Excitation Transformer

3. Reaktör Reactor

4. Kapasitif Gerilim Bölücü Capacitive Voltage Divider

5. Ölçüm Sistemi Measurement System

Test Edilen Kısım Tested Part	Topraklanan Kısımlar Earthed Terminals	Test Gerilimi Test Voltage	Frekans Frequency	Süre Duration
YG-N HV-N	AG; Tank LV; Tank	70 kV	50 Hz	60 s
AG LV	YG; Tank HV; Tank	38 kV	50 Hz	60 s

Standart / Standard : TS EN 60076-3 Madde 10; IEC 60076-3 Clause 10

Ölçüm Cihazı / Measuring Device:

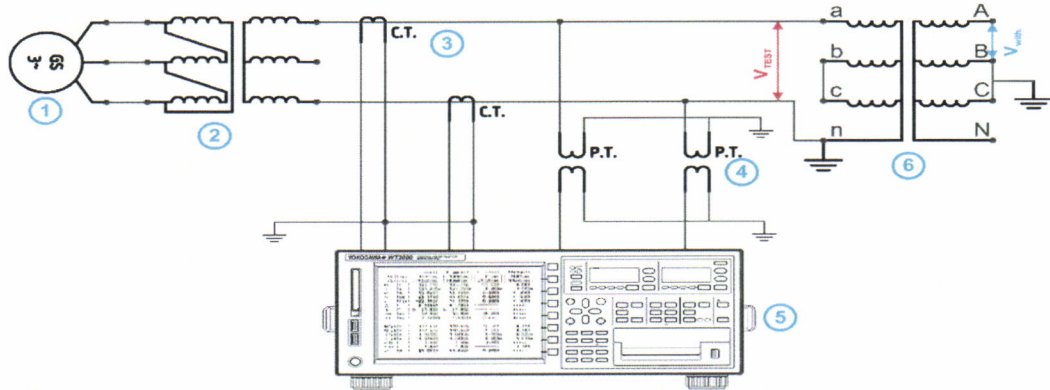
HAEFELY MSR400

Seri No / Serial No :

1M2X5D54T

11. Hat Terminali AC dayanım testi (LTAC)

11. Line terminal AC withstand test (LTAC)



1. Senkron Jeneratör Synchronous Generator

2. Besleme Trafosu Step-Up Transformer

3. Akım Trafoları Current Transformers

4. Gerilim Trafoları Voltage Transformers

5. Güç Analizörü Power Analyzer

6. Test Transformatörü Transformer Under Test

Poz. Tap	V _{WITH.}	Frekans Frequency	Süre Duration
13	275,0 kV	200 Hz	30 s

Standart / Standard : TS EN 60076-3 Madde 12; IEC 60076-3 Clause 12

Ölçüm Cihazı / Measuring Device:

YOKOGAWA WT3000

Seri No / Serial No :

91R616989

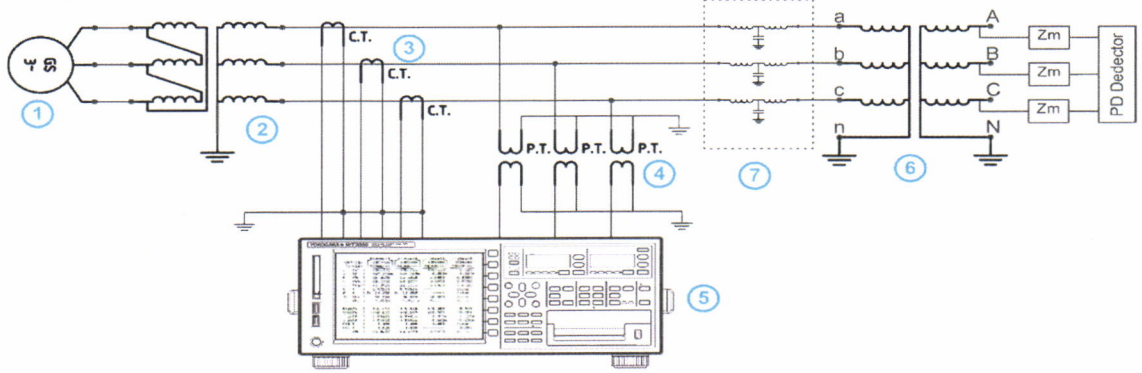
DNV-GL
Richard Houtepen
Date: 14/08/2015
KEMA Laboratories

Tarih: 13.8.2015 Date:	Testi Yapan:  Tested By:	Onaylayan:  Approved By:	Gözlemci(ler):   Observer(s):
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Seri No / Serial No	50001	Güç Power	80000 / 100000 kVA
Marka Brand	ASTOR	Nom. Gerilim / Nom. Voltage	154/33,6 kV
Bağ. Grubu / Vector Group	YNyn0	Soğutma / Cooling	ONAN/ONAF

12. Kısmi boşalma ölçümlü endüklenen gerilim testi

12. Induced voltage test with partial discharge measurement (IVPD)



1. Senkron Jeneratör / Synchronous Generator

2. Besleme Trafosu / Step-Up Transformer

3. Akım Trafoları / Current Transformers

4. Gerilim Trafoları / Voltage Transformers

5. Güç Analizörü / Power Analyzer

6. Test Transformatörü / Transformer Under Test

7. Filtre / Filter

8. Zm Ölçme Empedansı / Zm Measurement impedance



DNV-GL
Richard Houtepen
Date: 15/08/2015
EMA Laboratories

Süre / Duration	% U_r	U_{AG} U_{LV}	U_{YG} U_{HV}	PD _A PD _A	PD _B PD _B	PD _C PD _C
-	40%	13440 V	61600 V	4 pC	5 pC	3 pC
60 s	120%	40320 V	184800 V	11 pC	12 pC	8 pC
300 s	158%	53088 V	243320 V	11 pC	14 pC	9 pC
30 s	200%	67200 V	308000 V	-	-	-
300 s	158%	53088 V	243320 V	10 pC	12 pC	7 pC
600 s	158%	53088 V	243320 V	11 pC	20 pC	8 pC
900 s	158%	53088 V	243320 V	11 pC	13 pC	8 pC
1200 s	158%	53088 V	243320 V	11 pC	12 pC	8 pC
1500 s	158%	53088 V	243320 V	11 pC	12 pC	8 pC
1800 s	158%	53088 V	243320 V	11 pC	13 pC	8 pC
2100 s	158%	53088 V	243320 V	12 pC	13 pC	8 pC
2400 s	158%	53088 V	243320 V	11 pC	12 pC	7 pC
2700 s	158%	53088 V	243320 V	11 pC	12 pC	8 pC
3000 s	158%	53088 V	243320 V	11 pC	12 pC	7 pC
3300 s	158%	53088 V	243320 V	11 pC	12 pC	7 pC
3600 s	158%	53088 V	243320 V	10 pC	12 pC	7 pC
300 s	120%	40320 V	184800 V	9 pC	8 pC	7 pC
-	40%	13440 V	61600 V	4 pC	4 pC	3 pC

Standart / Standard : TS EN 60076-3 Madde 11.3; IEC 60076-3 Clause 11.3

Ölçüm Cihazı / Measuring Device: YOKOGAWA WT3000

Seri No / Serial No: 91R616989

Ölçüm Cihazı / Measuring Device: TETTEX CAL451

Seri No / Serial No: 178197

Ölçüm Cihazı / Measuring Device: TETTEX DDX 9121a

Seri No / Serial No: 178081, 179093, 179090

Tarih: 13.8.2015	Testi Yapan: <i>FD</i>	Onaylayan: <i>PK</i>	Gözlemci(ler): <i>L</i> <i>A</i>
Date:	Tested By:	Approved By:	Observer(s):

EK. 1**APPENDIX 1.**

project : 50001withKEMA

test date 12/8/2015

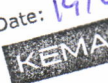
Climate - Data

temperature 31.2 °C

humidity
air-pressure31 %
920.2 hPa

50001withKEMA : LI_PK

NO	NO	Up[kV]	T1[μs]	T2 [μs]	IP2[A]	Remark
1	13213	-102	1.39	56.8	-257.1	2u RLI %60
2	13214	-168.2	1.39	57	-415.7	2u LI %100-1
3	13215	-170.4	1.39	57.3	-422.9	2u LI %100-2
4	13216	-171.6	1.39	57.3	-423.8	2u LI %100-3
5	13243	-101.4	1.41	20.6	-723.1	2u RLI %60 without earth resistor
6	13244	-168	1.42	21	-1188	2u LI %100-1 without earth resistor
7	13245	-168.1	1.42	20.9	-1192	2u LI %100-2 without earth resistor
8	13246	-168.3	1.42	20.9	-1188	2u LI %100-3 without earth resistor
9	13217	-102.6	1.39	56.4	-253.6	2v RLI %60
10	13218	-173.9	1.39	56.9	-427.8	2v LI %100-1
11	13219	-172.1	1.39	57	-421.2	2v LI %100-2
12	13220	-169.5	1.39	57.1	-415.9	2v LI %100-3
13	13239	-100.7	1.42	20.7	-657.2	2v RLI %58 without earth resistor
14	13240	-168.5	1.42	21	-1115	2v LI %100-1 without earth resistor
15	13241	-168.6	1.43	21	-1115	2v LI %100-2 without earth resistor
16	13242	-173.2	1.42	21	-1154	2v LI %100-3 without earth resistor
17	13221	-102.4	1.39	56.3	-256	2w RLI %60
18	13222	-171.2	1.39	57.3	-426.2	2w LI %100-1

Richard Houtepen
Date: 14/8/2015 KEMA Laboratories

Sayfa No, Page No: 16/51



50001withKEMA : LI_PK

NO	NO	Up[kV]	T1[μs]	T2 [μs]	IP2[A]	Remark
19	13223	-170.4	1.39	57.2	-424.1	2w LI %100-2
20	13224	-170.8	1.39	57.2	-424	2w LI %100-3
21	13235	-99.37	1.42	20.3	-594.3	2w RLI %58 without earth resistor
22	13236	-171.9	1.42	20.6	-1003	2w RLI %100-1 without earth resistor
23	13237	-173	1.42	20.7	-1021	2w RLI %100-2 without earth resistor
24	13238	-173.6	1.42	20.6	-1012	2w RLI %100-3 without earth resistor
25	13225	-101.3	2.22	51.6	-343.7	2n RLI %60
26	13226	-168.5	2.21	51.9	-576.9	2n LI %100-1
27	13227	-171.5	2.21	52	-586.6	2n LI %100-2
28	13228	-168.4	2.21	51.9	-574.4	2n LI %100-3
29	13231	-102.4	2.62	14.8	-759.2	2n RLI %60 without earth resistance
30	13232	-171.3	2.61	11.8	-1120	2n RLI %100-1 without earth resistance
31	13233	-168.8	2.62	11.7	-1092	2n RLI %100-2 without earth resistance
32	13234	-171.9	2.61	11.8	-1105	2n RLI %100-3 without earth resistance
33	13248	-57.53	0.92	46	-55.67	1N RLI %60
34	13249	-94.6	0.88	46	-100.4	1N LI %100-1
35	13250	-96.15	0.87	46	-102.2	1N LI %100-2
36	13251	-96.32	0.87	46	-101.7	1N LI %100-3
37	13256	-345.9	1.16	45	-113.1	1U RLI %53 Tap1
38	13257	-658.8	1.09	43.3	-278.9	1U LI %100-1 Tap1
39	13258	-658.2	1.09	43.3	-279.8	1U LI %100-2 Tap1
40	13259	-658.9	1.09	43.3	-278.7	1U LI %100-3 Tap1
41	13260	-349.7	1.17	56.5	-71.86	1V RLI %53
42	13261	-666.6	1.09	50.7	-136.6	1V LI %100-1

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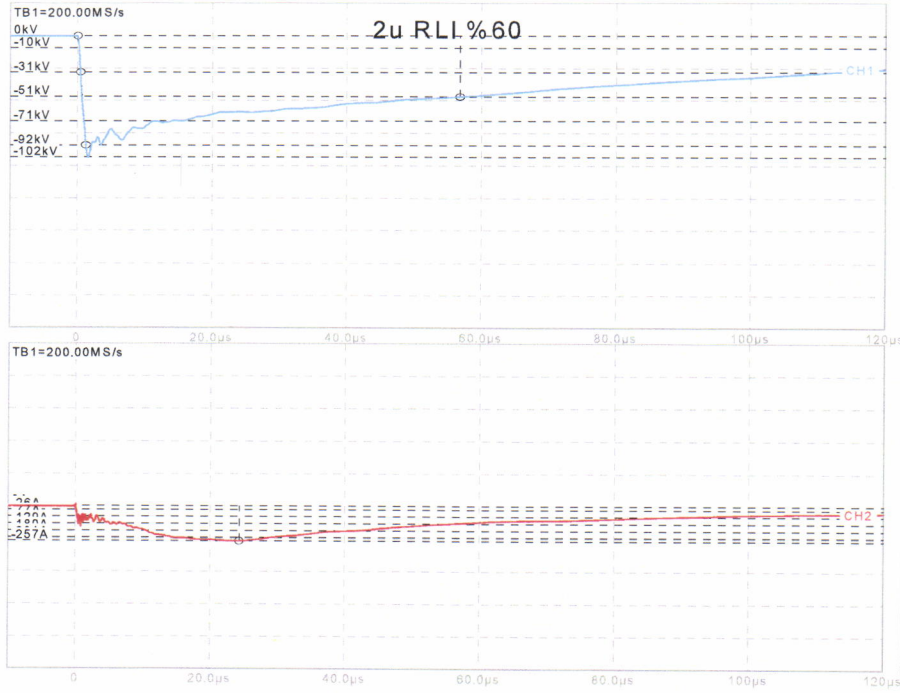
43 13262 -668.1 1.09 50.8 -143 1V LI %100-2

50001withKEMA : LI_PK

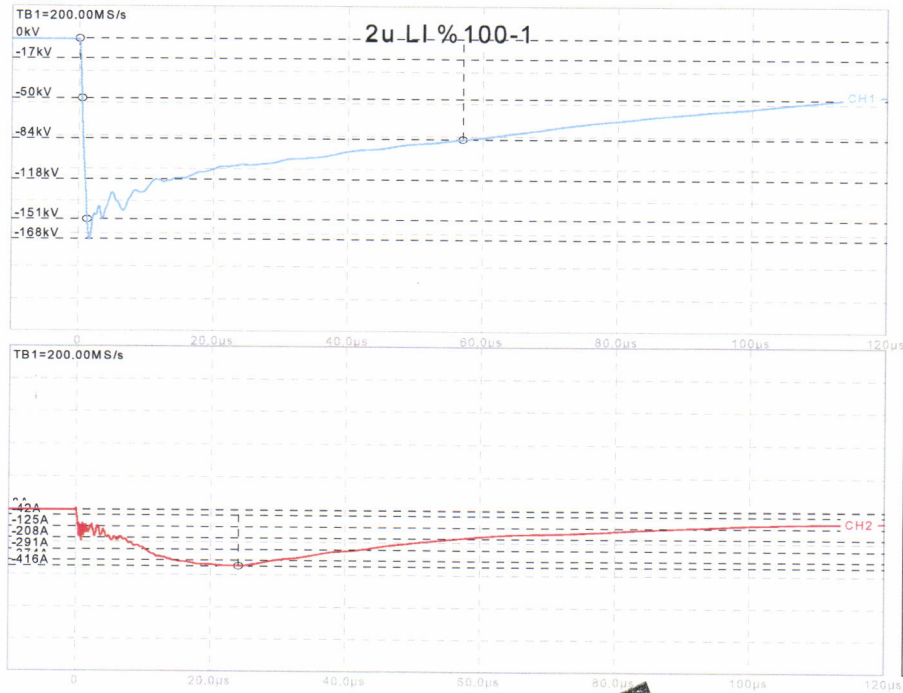
NO	NO	Up[kV]	T1[μs]	T2 [μs]	IP2[A]	Remark
44	13263	-668.3	1.1	50.8	-138	1V LI %100-3
45	13264	-393.3	1.14	48.8	-69.63	1W RLI %60 Tap25
46	13265	-672.4	1.1	48.2	-163.6	1W LI %100-1 Tap25
47	13266	-669.8	1.1	48.2	-159.1	1W LI %100-2 Tap25
48	13267	-671.4	1.1	48.2	-158.6	1W LI %100-3 Tap25

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70 2 2 2



50001withKEMA : LI_PK : NO 1



50001withKEMA : LI_PK : NO 2

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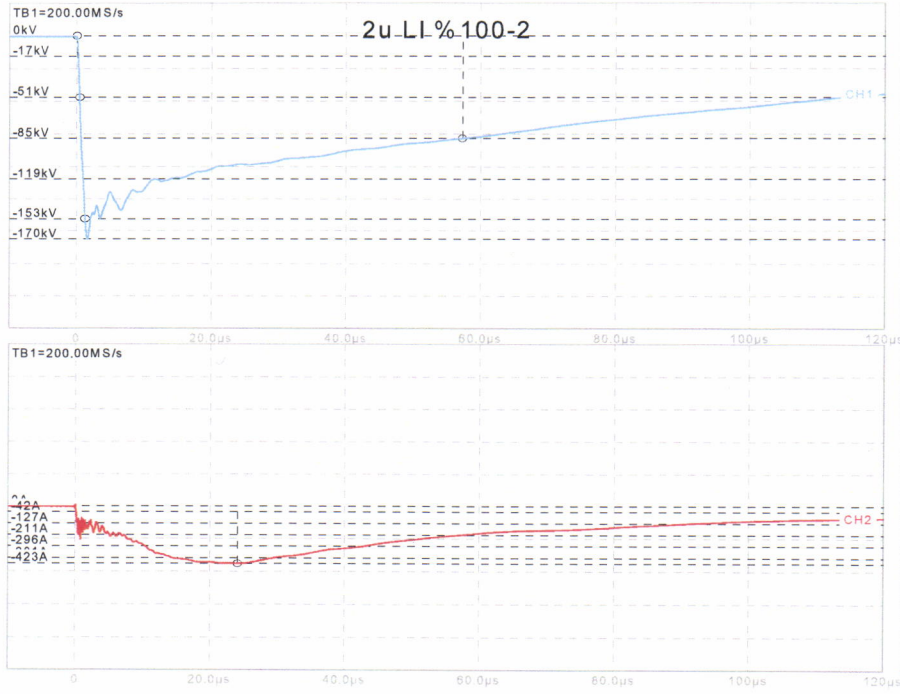
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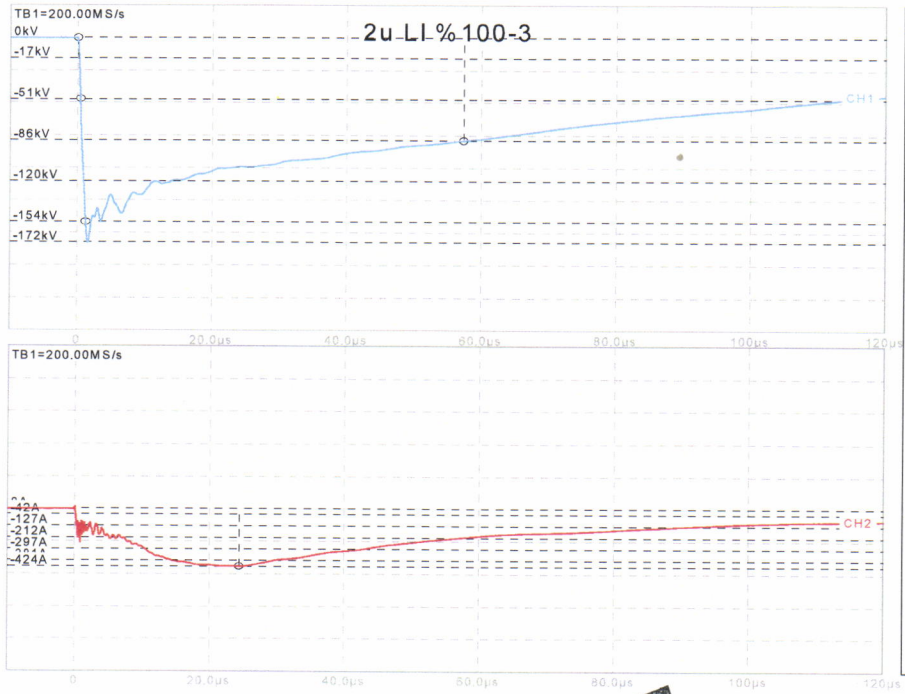
Sayfa No, Page No: 19/51

[Handwritten signatures]



No.: 3
CH1 No. 3
Terminal: X1
Up= -170.4kV
T1= 1.39µs
T2= 57.3µs
CH2 No. 3
Terminal: X2
Ip= -422.9A

50001withKEMA : LI_PK : NO 3



No.: 4
CH1 No. 4
Terminal: X1
Up= -171.6kV
T1= 1.39µs
T2= 57.3µs
CH2 No. 4
Terminal: X2
Ip= -423.8A

50001withKEMA : LI_PK : NO 4

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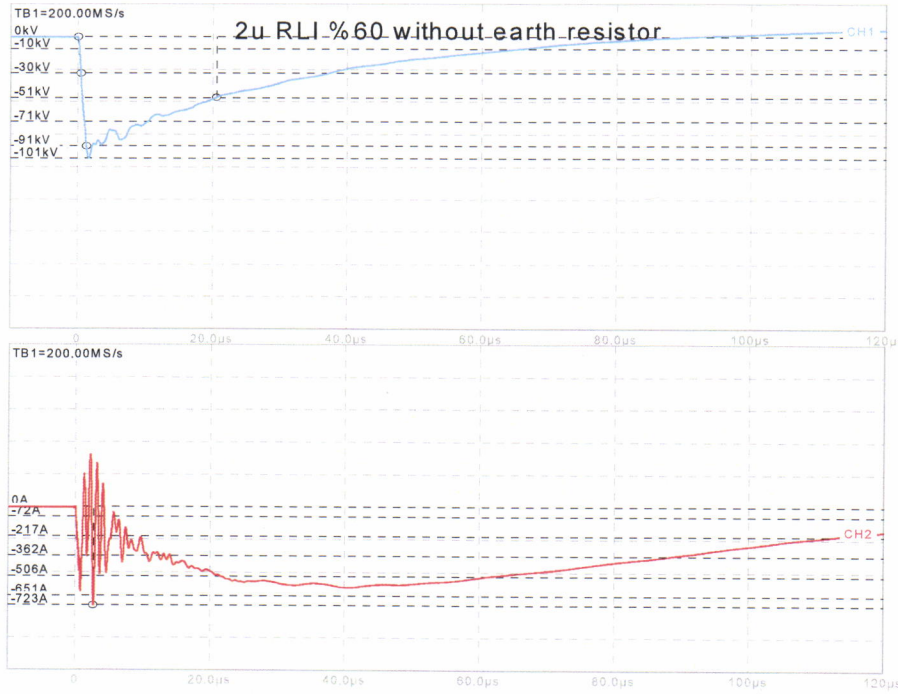
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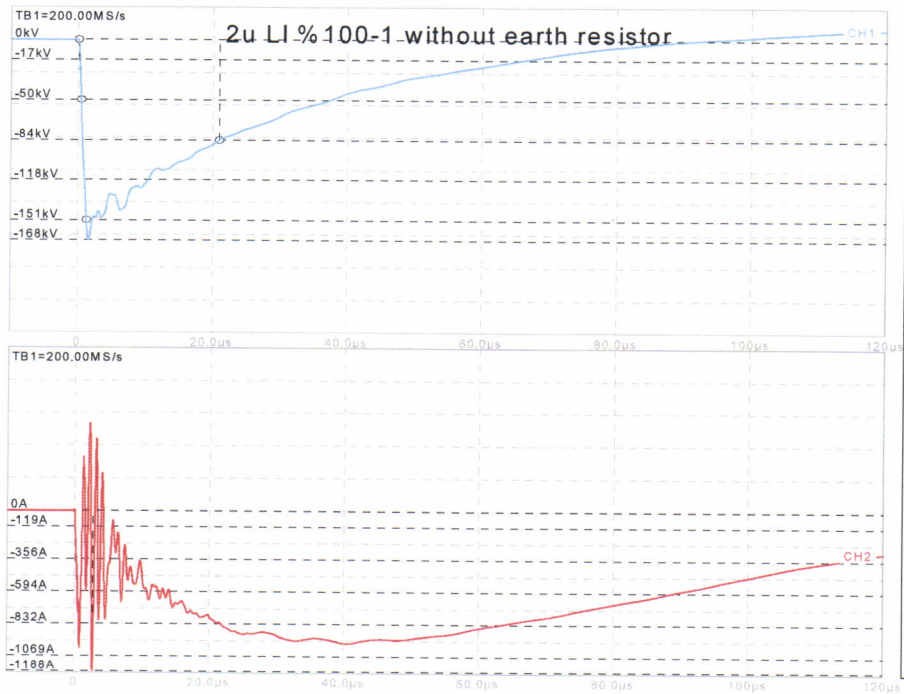
Sayfa No, Page No: 20/51

(Handwritten signatures)



No.: 5
CH1 No. 5
Terminal: X1
Up= -101.4kV
T1= 1.41µs
T2= 20.6µs
CH2 No. 5
Terminal: X2
Ip= -723.1A

50001withKEMA : LI_PK : NO 5



No.: 6
CH1 No. 6
Terminal: X1
Up= -168kV
T1= 1.42µs
T2= 21µs
CH2 No. 6
Terminal: X2
Ip= -1188A

50001withKEMA : LI_PK : NO 6

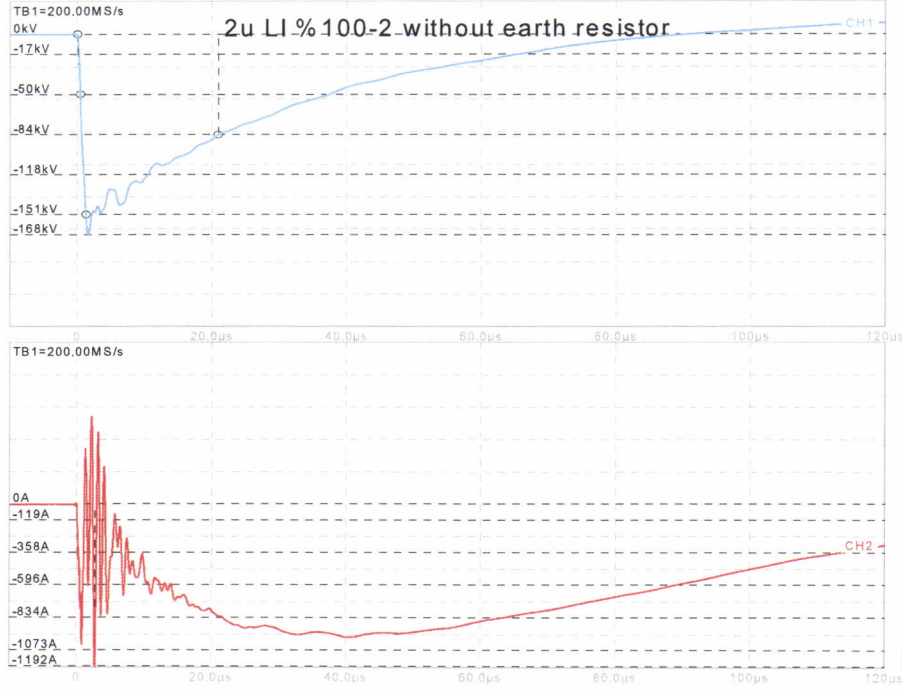
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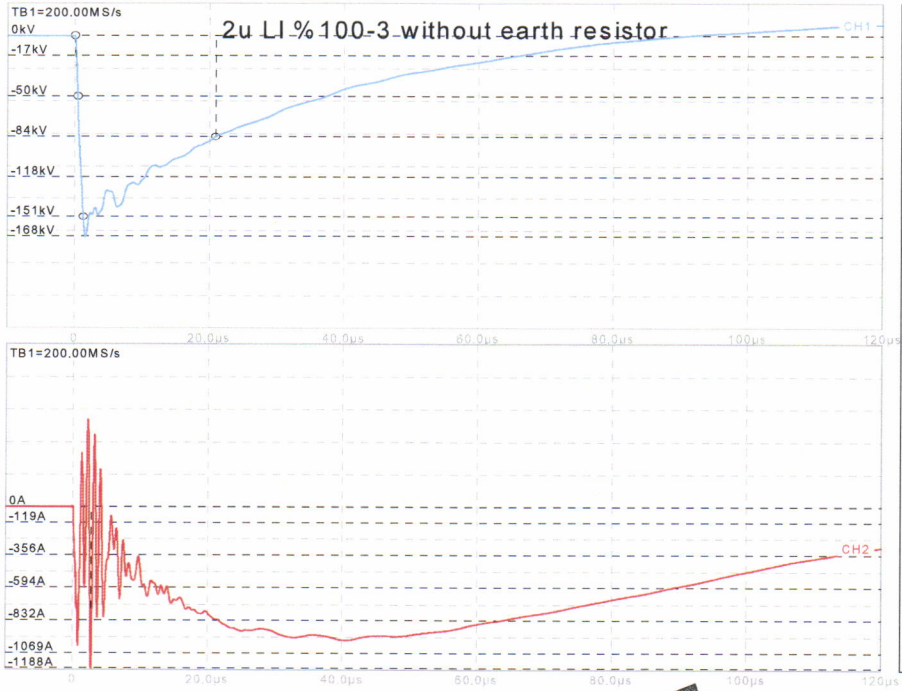
Sayfa No, Page No: 21/51

[Handwritten signatures and marks]



No.: 7
CH1 No. 7
Terminal: X1
Up= -168.1kV
T1= 1.42µs
T2= 20.9µs
CH2 No. 7
Terminal: X2
Ip= -1192A

50001withKEMA : LI_PK : NO 7



No.: 8
CH1 No. 8
Terminal: X1
Up= -168.3kV
T1= 1.42µs
T2= 20.9µs
CH2 No. 8
Terminal: X2
Ip= -1188A

50001withKEMA : LI_PK : NO 8

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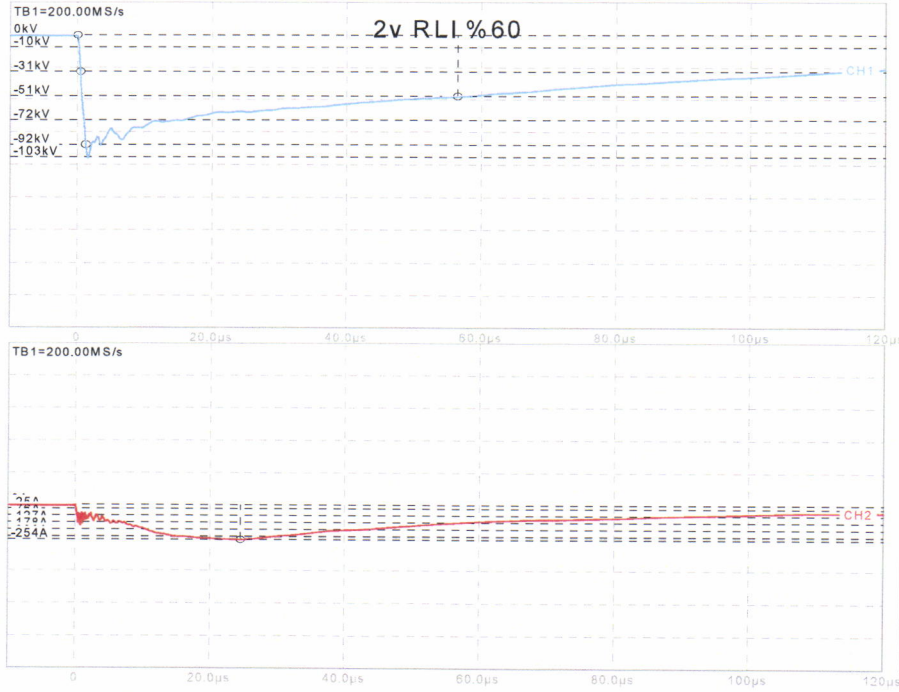
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Sayfa No, Page No: 22/51

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No.: 9

CH1 No. 9

Terminal: X1

Up= -102.6kV

T1= 1.39µs

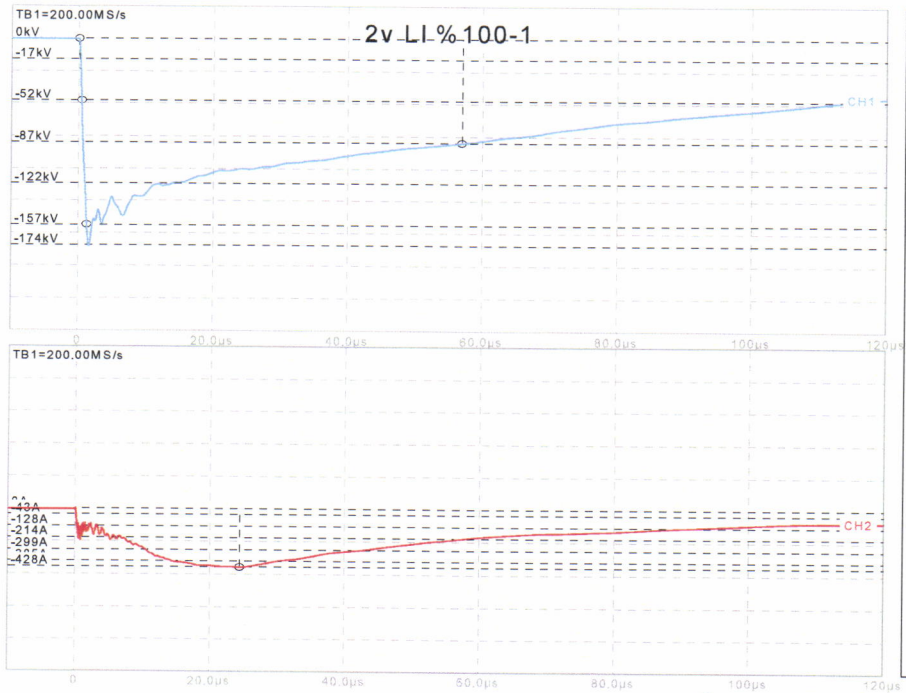
T2= 56.4µs

CH2 No. 9

Terminal: X2

Ip= -253.6A

50001withKEMA : LI_PK : NO 9



No.: 10

CH1 No. 10

Terminal: X1

Up= -173.9kV

T1= 1.39µs

T2= 56.9µs

CH2 No. 10

Terminal: X2

Ip= -427.8A

50001withKEMA : LI_PK : NO 10

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Date:

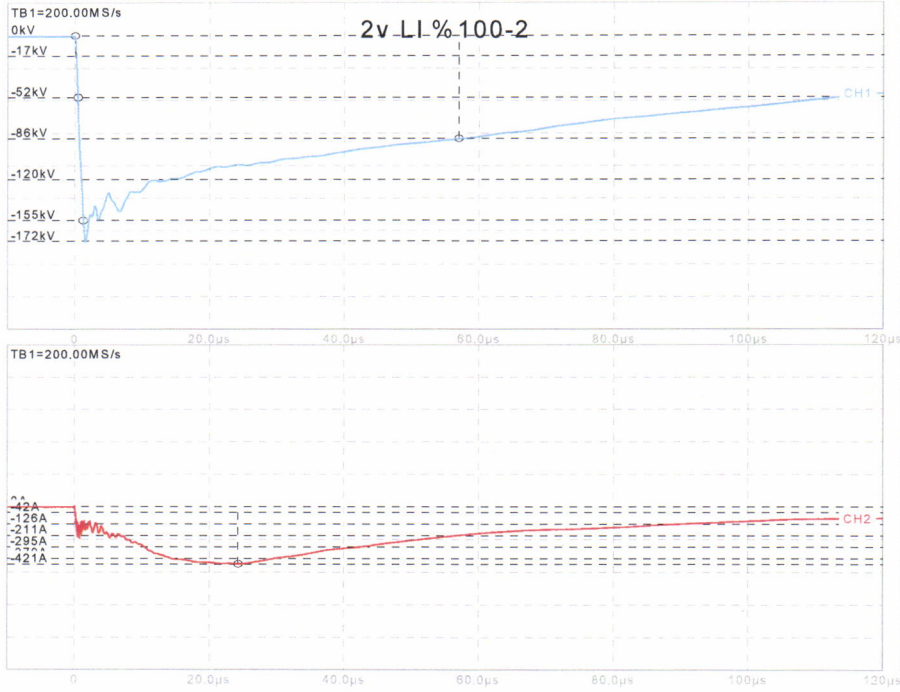
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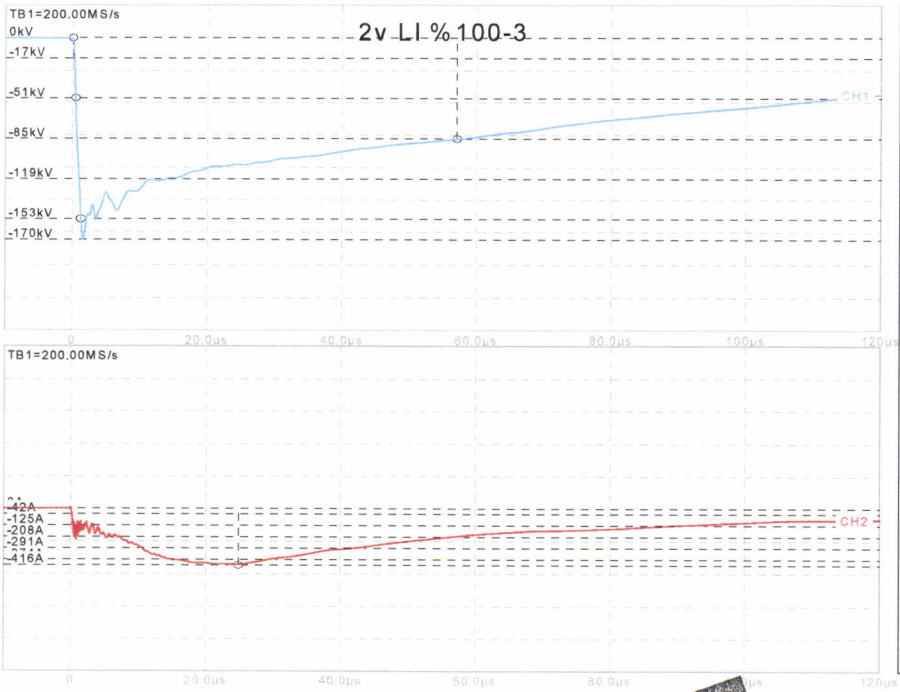
Sayfa No, Page No: 23/51

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No.: 11
CH1 No. 11
Terminal: X1
Up= -172.1kV
T1= 1.39µs
T2= 57µs
CH2 No. 11
Terminal: X2
Ip= -421.2A

50001withKEMA : LI_PK : NO 11



No.: 12
CH1 No. 12
Terminal: X1
Up= -169.5kV
T1= 1.39µs
T2= 57.1µs
CH2 No. 12
Terminal: X2
Ip= -415.9A

50001withKEMA : LI_PK : NO 12

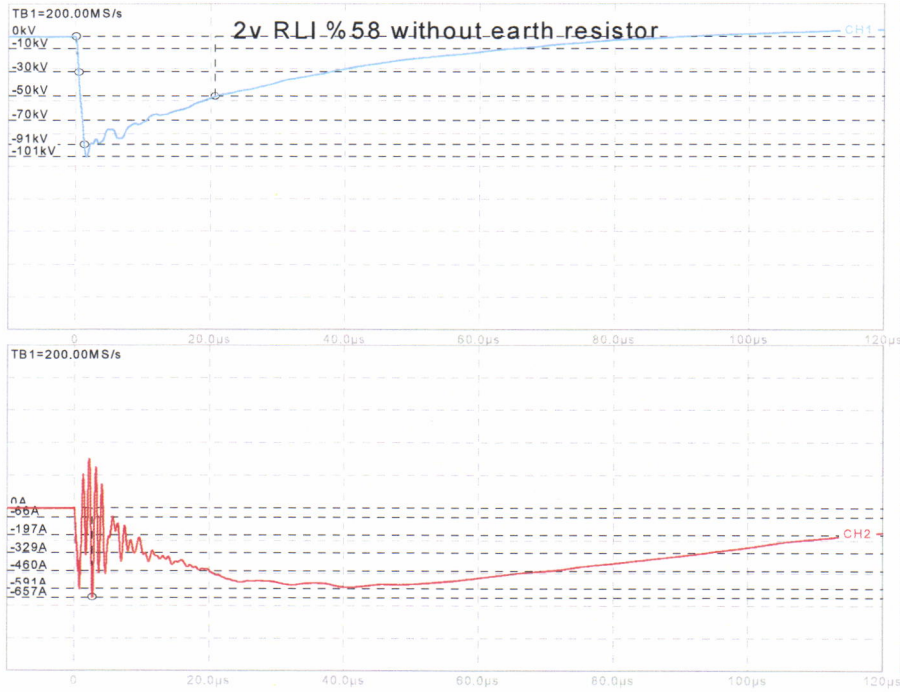
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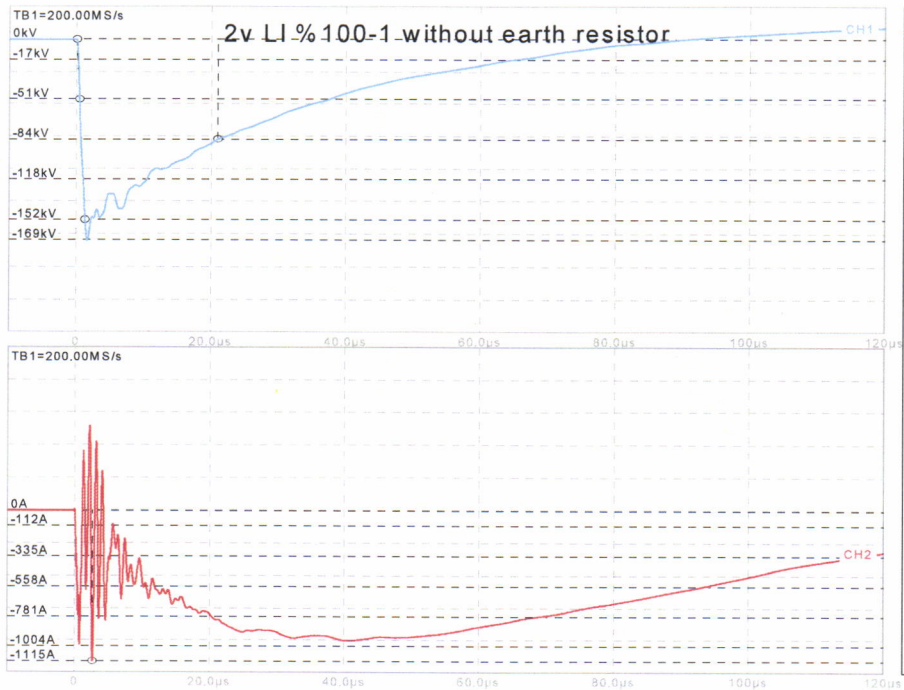
Sayfa No, Page No: 24/51

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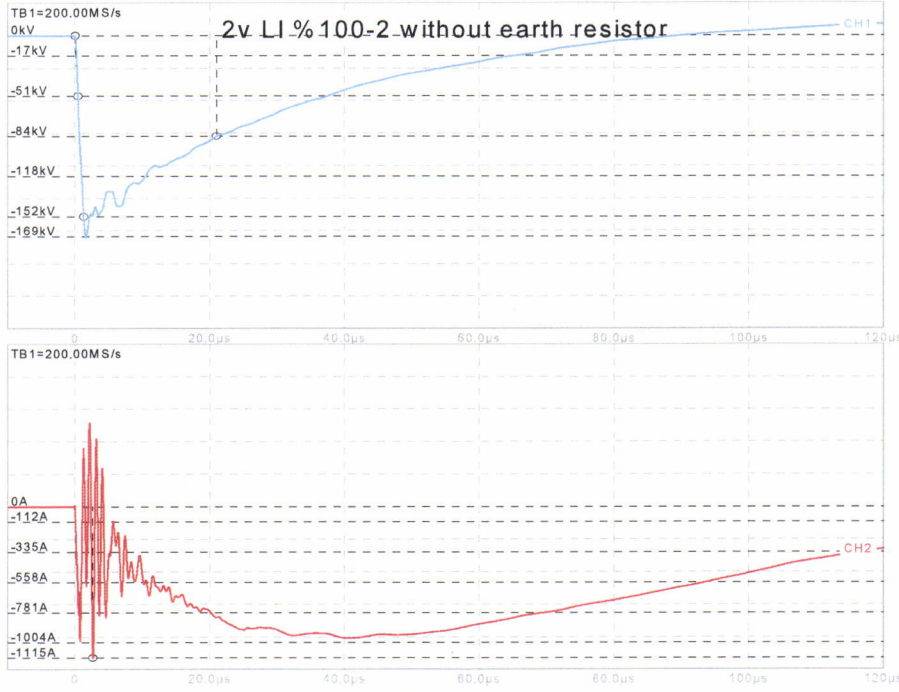
No.: 13
CH1 No. 13
Terminal: X1
Up= -100.7kV
T1= 1.42µs
T2= 20.7µs
CH2 No. 13
Terminal: X2
Ip= -657.2A

50001withKEMA : LI_PK : NO 13



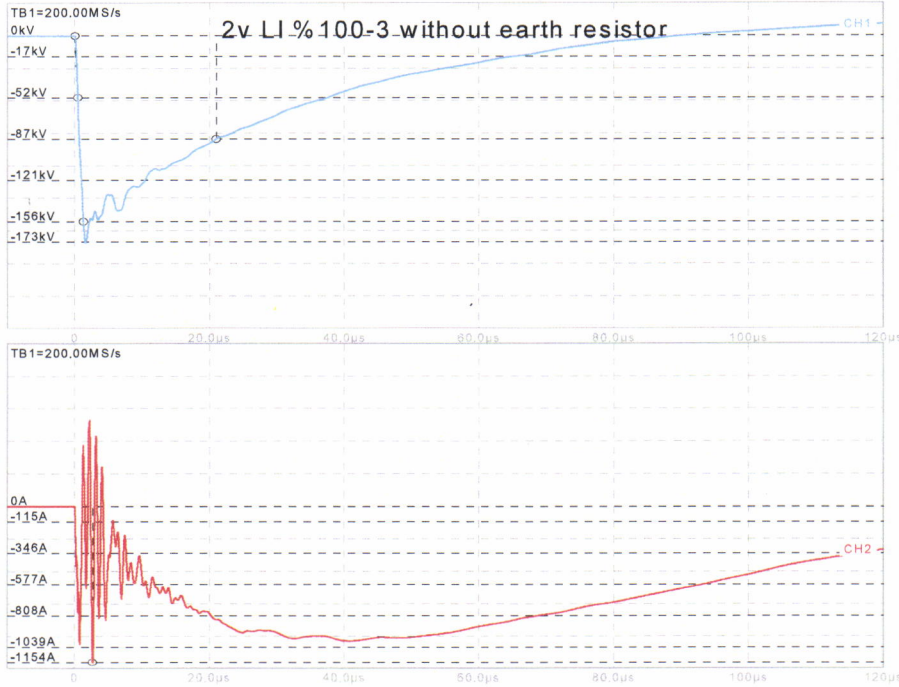
No.: 14
CH1 No. 14
Terminal: X1
Up= -168.5kV
T1= 1.42µs
T2= 21µs
CH2 No. 14
Terminal: X2
Ip= -1115A

50001withKEMA : LI_PK : NO 14



No.: 15
CH1 No. 15
Terminal: X1
Up= -168.6kV
T1= 1.43µs
T2= 21µs
CH2 No. 15
Terminal: X2
Ip= -1115A

50001withKEMA : LI_PK : NO 15



No.: 16
CH1 No. 16
Terminal: X1
Up= -173.2kV
T1= 1.42µs
T2= 21µs
CH2 No. 16
Terminal: X2
Ip= -1154A

50001withKEMA : LI_PK : NO 16

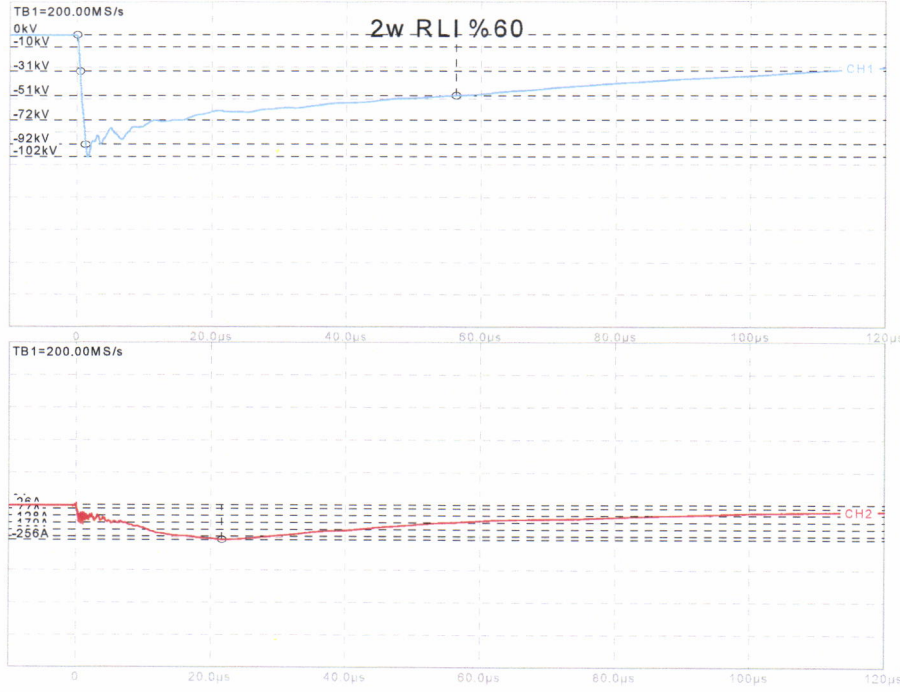
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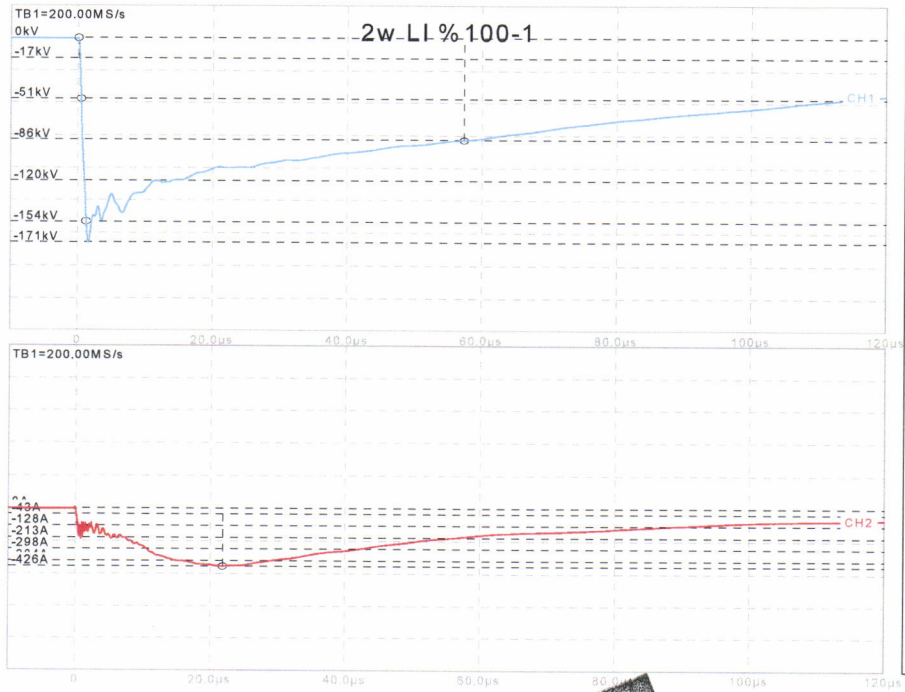
Sayfa No, Page No: 26/51

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No.: 17
CH1 No. 17
Terminal: X1
Up= -102.4kV
T1= 1.39µs
T2= 56.3µs
CH2 No. 17
Terminal: X2
Ip= -256A

50001withKEMA : LI_PK : NO 17



No.: 18
CH1 No. 18
Terminal: X1
Up= -171.2kV
T1= 1.39µs
T2= 57.3µs
CH2 No. 18
Terminal: X2
Ip= -426.2A

50001withKEMA : LI_PK : NO 18

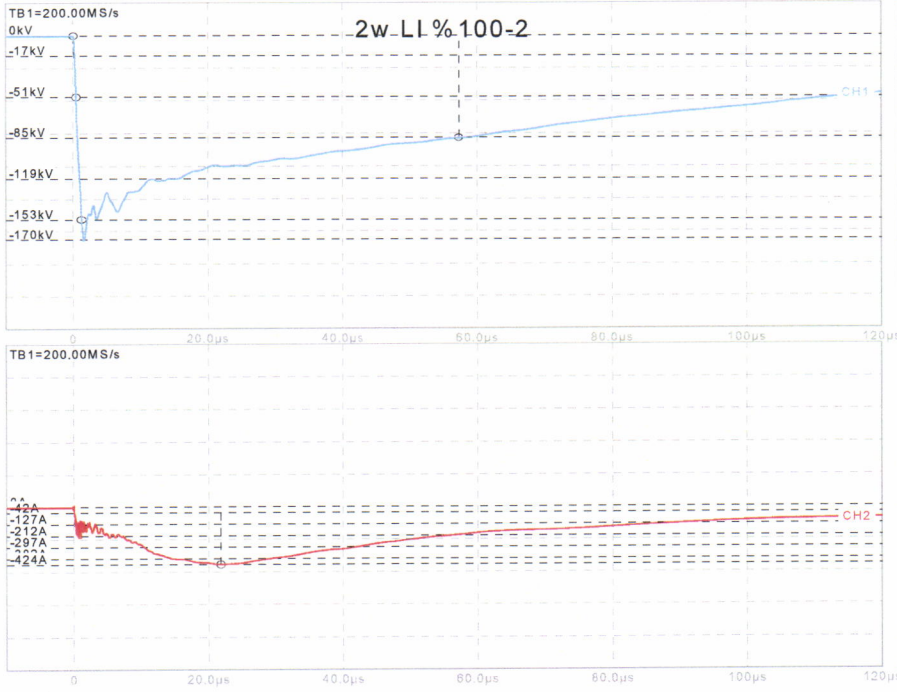
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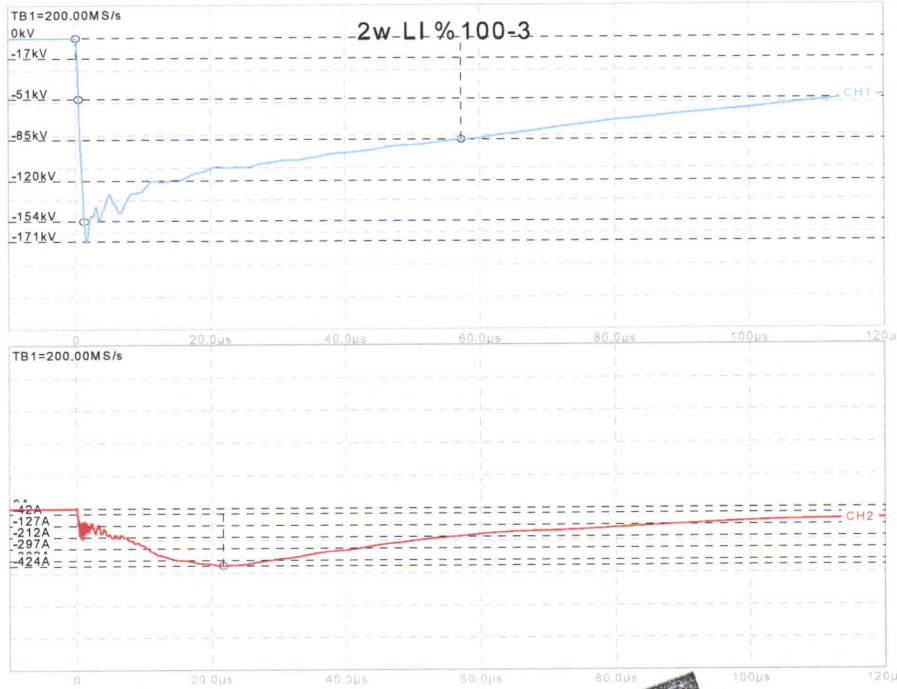
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[Handwritten signatures]



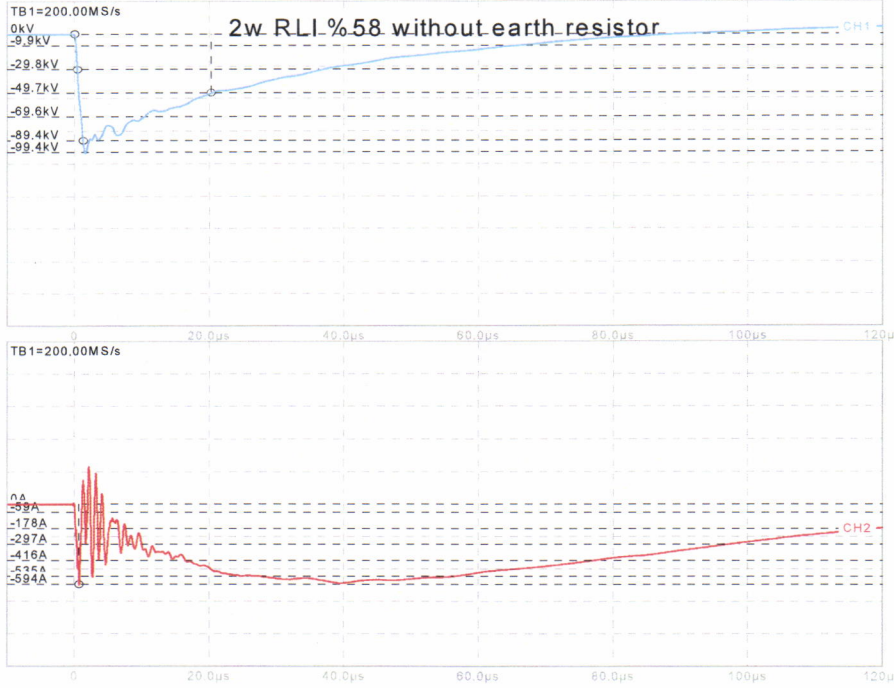
50001withKEMA : LI_PK : NO 19



50001withKEMA : LI_PK : NO 20

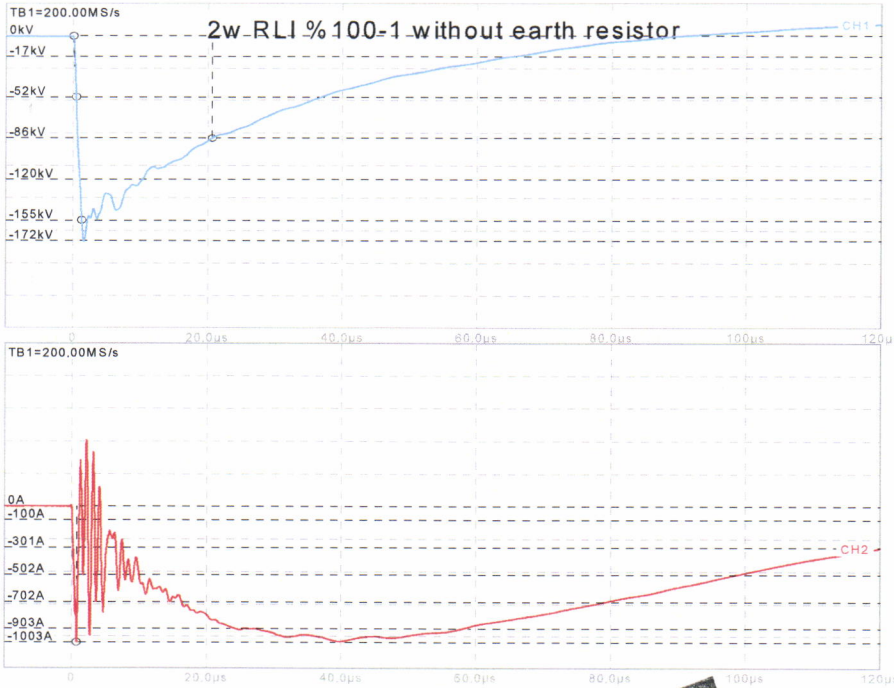
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No.: 21
CH1 No. 21
Terminal: X1
Up= -99.37kV
T1= 1.42µs
T2= 20.3µs
CH2 No. 21
Terminal: X2
Ip= -594.3A

50001withKEMA : LI_PK : NO 21



No.: 22
CH1 No. 22
Terminal: X1
Up= -171.9kV
T1= 1.42µs
T2= 20.6µs
CH2 No. 22
Terminal: X2
Ip= -1003A

50001withKEMA : LI_PK : NO 22

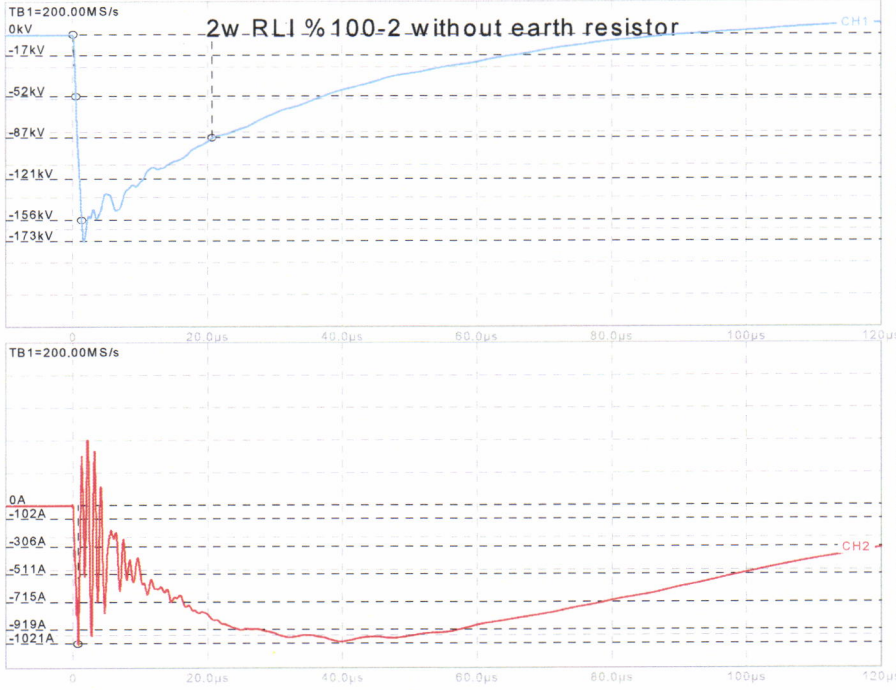
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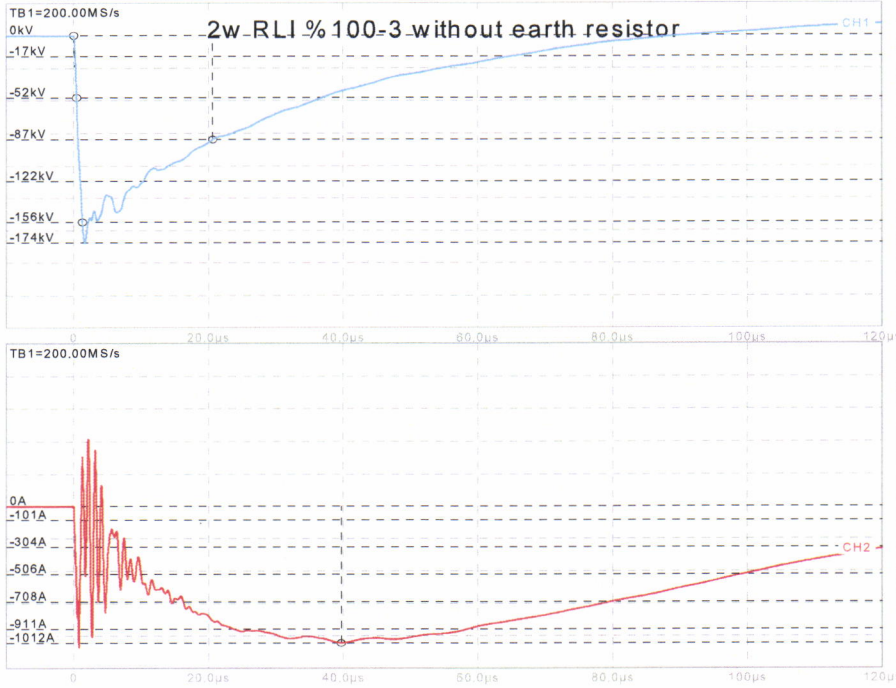
Sayfa No, Page No: 29/51

[Handwritten signatures]



No.: 23
CH1 No. 23
Terminal: X1
Up= -173kV
T1= 1.42µs
T2= 20.7µs
CH2 No. 23
Terminal: X2
Ip= -1021A

50001withKEMA : LI_PK : NO 23



No.: 24
CH1 No. 24
Terminal: X1
Up= -173.6kV
T1= 1.42µs
T2= 20.6µs
CH2 No. 24
Terminal: X2
Ip= -1012A

50001withKEMA : LI_PK : NO 24

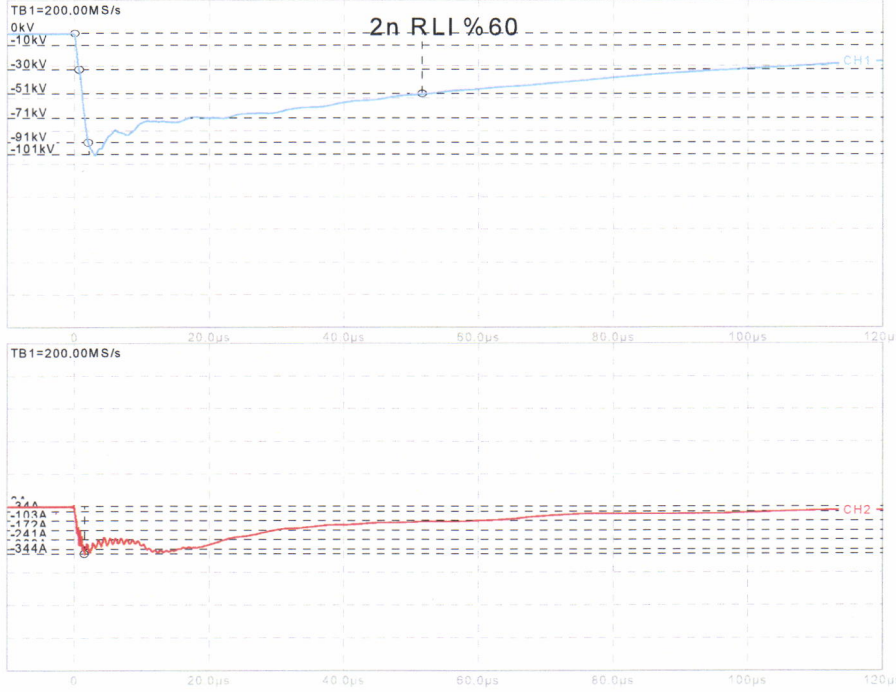
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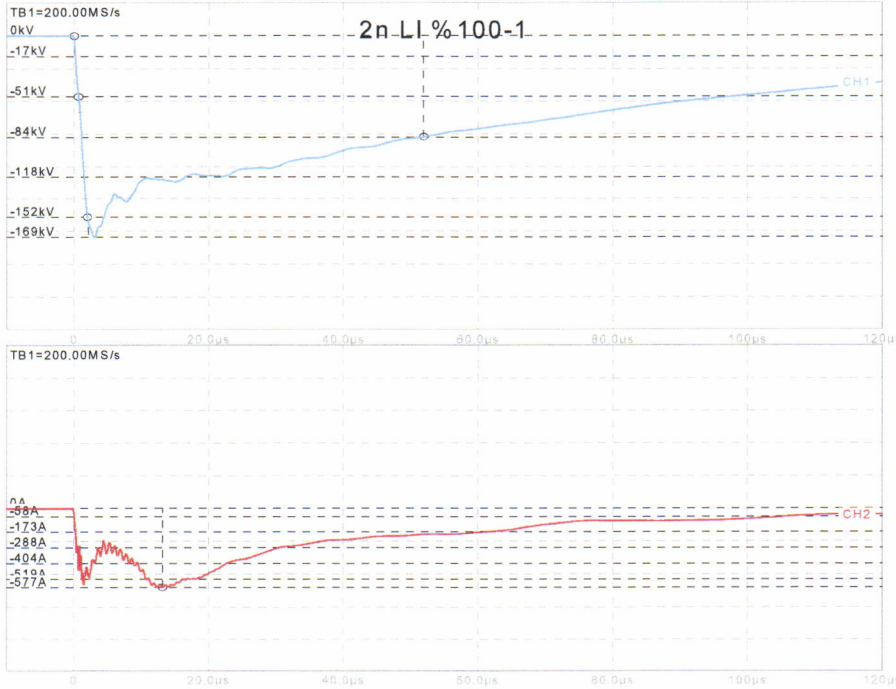
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50001withKEMA : LI_PK : NO 25

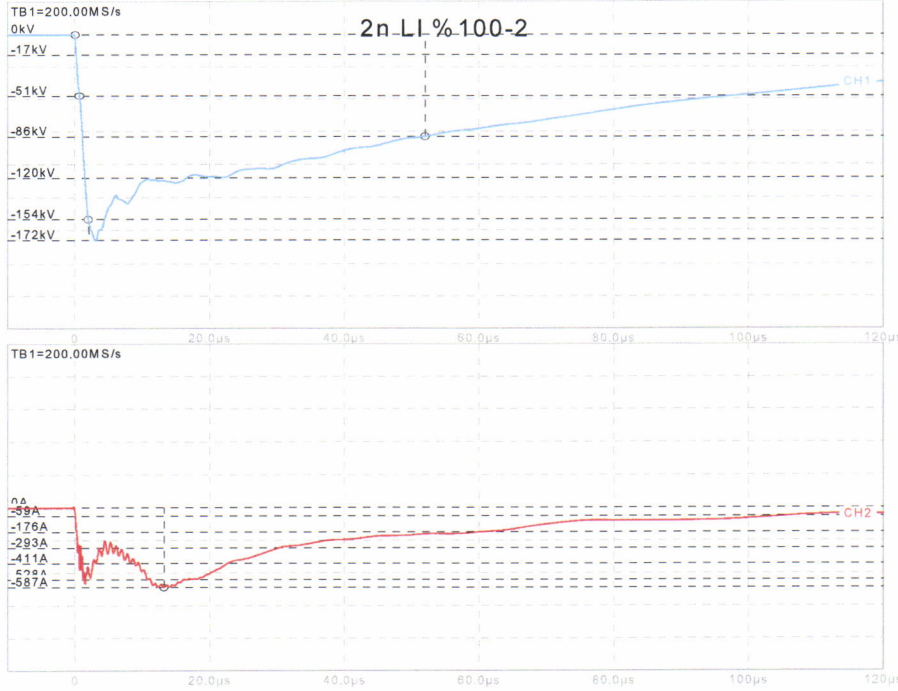


50001withKEMA : LI_PK : NO 26

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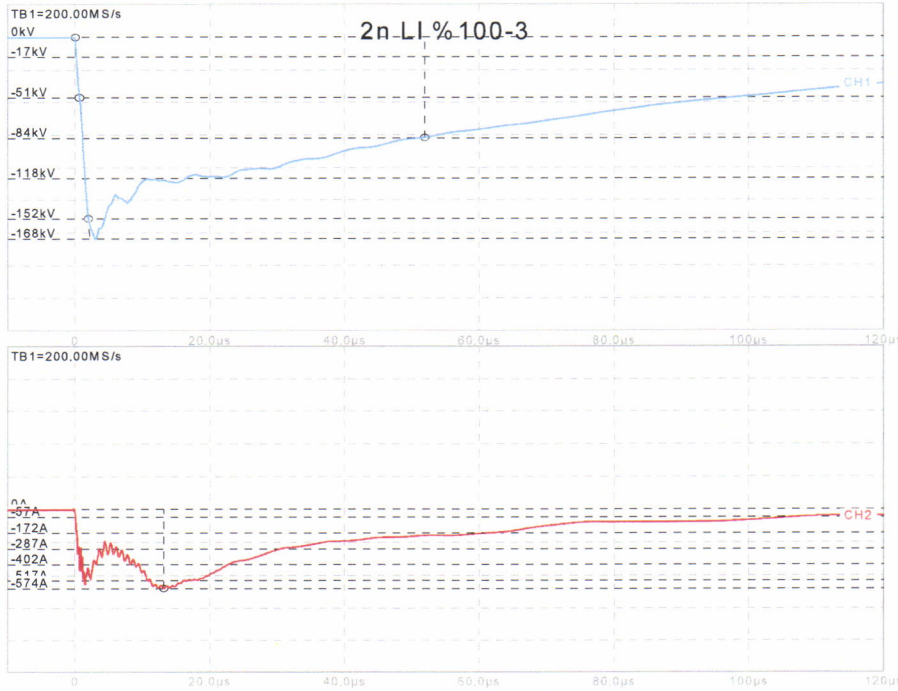
Sayfa No, Page No: 31/51

[Handwritten signatures and marks]



No.: 27
CH1 No. 27
Terminal: X1
Up= -171.5kV
T1= 2.21µs
T2= 52µs
CH2 No. 27
Terminal: X2
Ip= -586.6A

50001withKEMA : LI_PK : NO 27



No.: 28
CH1 No. 28
Terminal: X1
Up= -168.4kV
T1= 2.21µs
T2= 51.9µs
CH2 No. 28
Terminal: X2
Ip= -574.4A

50001withKEMA : LI_PK : NO 28

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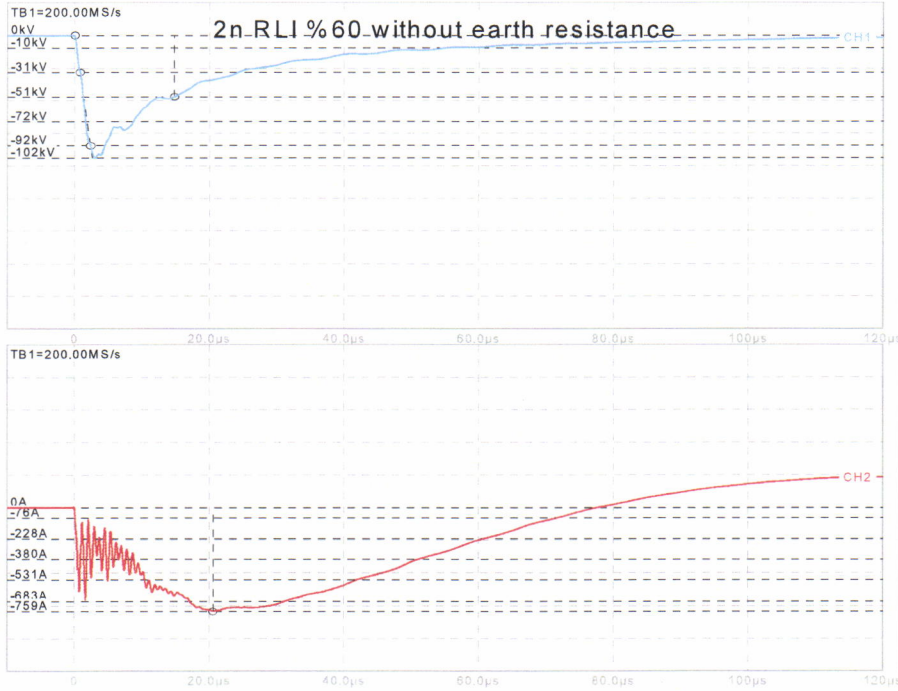
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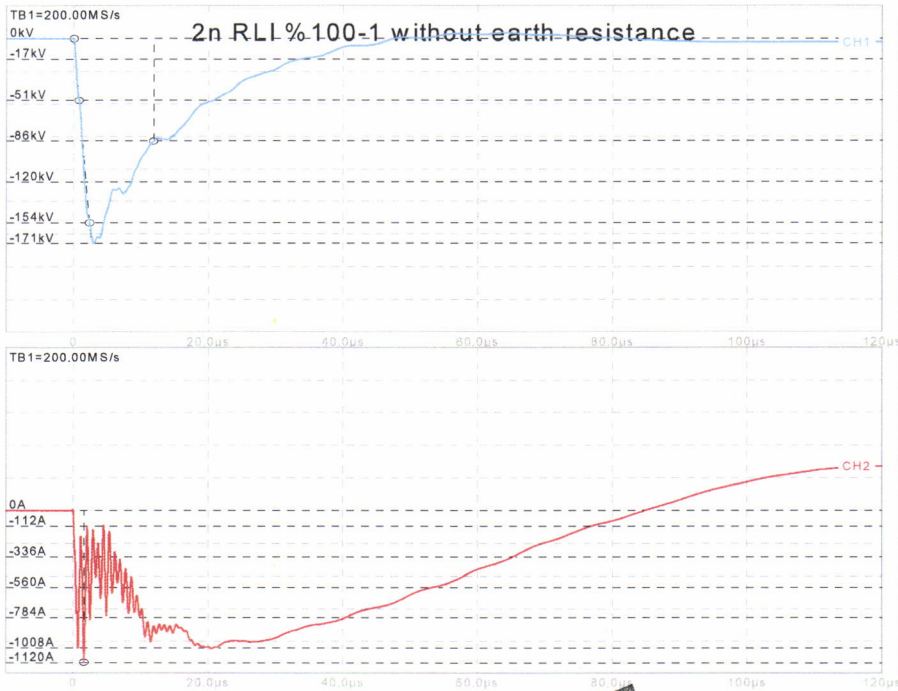
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[Handwritten signatures and marks]



50001withKEMA : LI_PK : NO 29

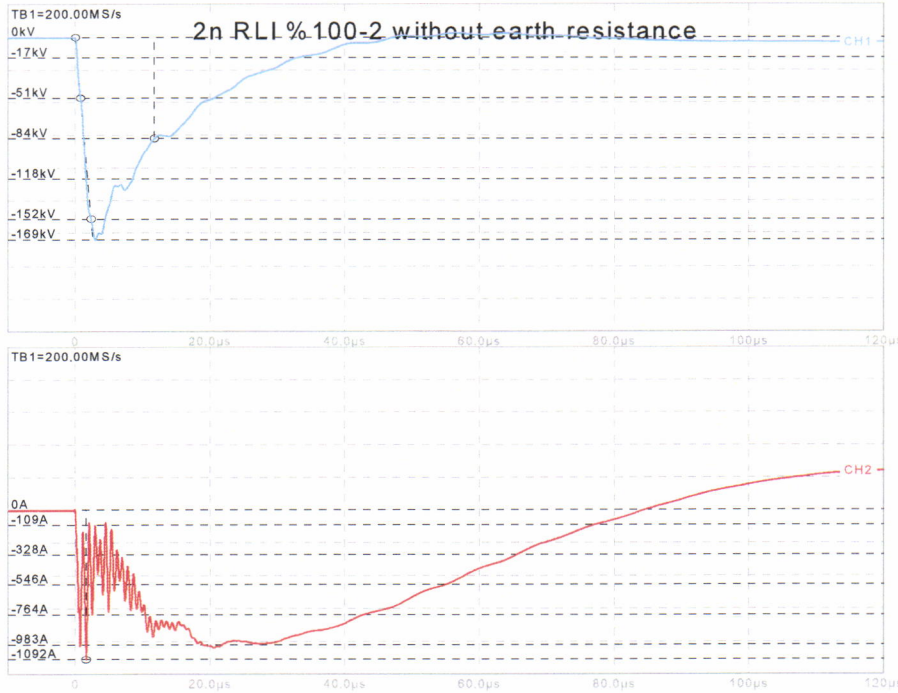


50001withKEMA : LI_PK : NO 30

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No.: 31

CH1 No. 31

Terminal: X1

Up= -168.8kV

T1= 2.62µs

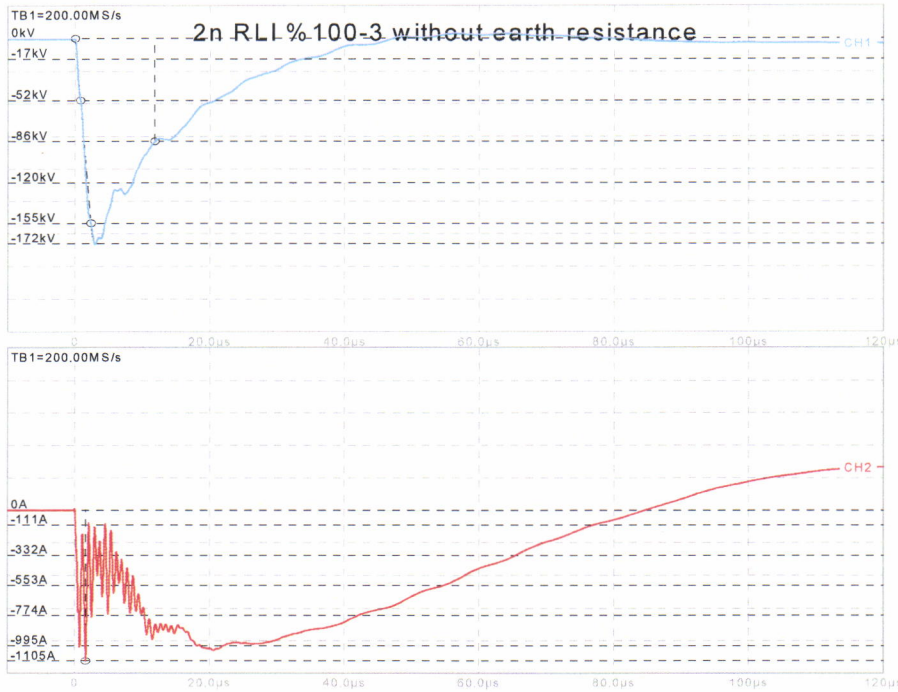
T2= 11.7µs

CH2 No. 31

Terminal: X2

Ip= -1092A

50001withKEMA : LI_PK : NO 31



No.: 32

CH1 No. 32

Terminal: X1

Up= -171.9kV

T1= 2.61µs

T2= 11.8µs

CH2 No. 32

Terminal: X2

Ip= -1105A

50001withKEMA : LI_PK : NO 32

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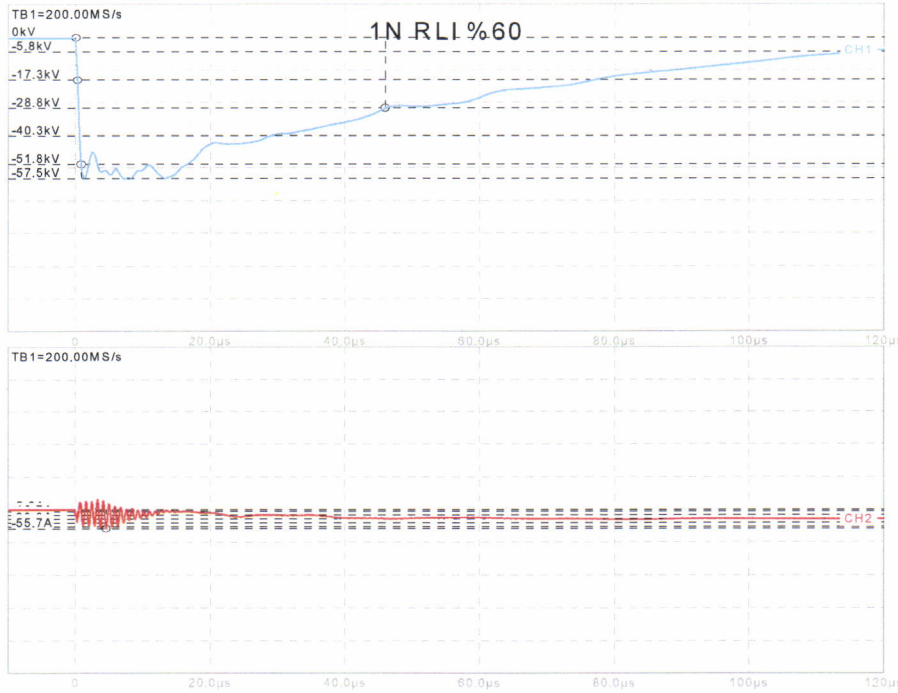
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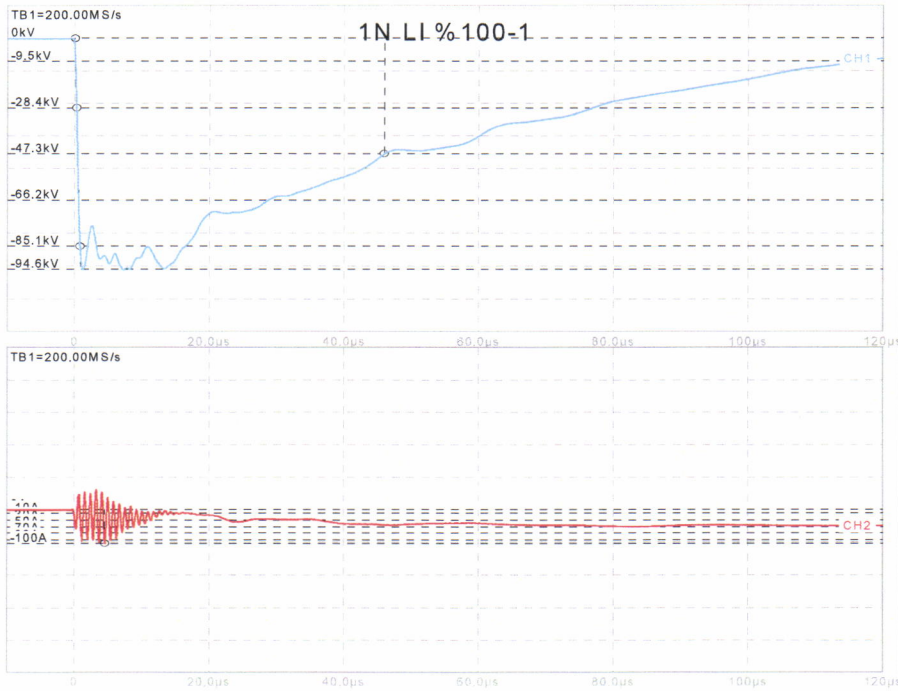
Sayfa No, Page No: 34/51

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No.: 33
CH1 No. 33
Terminal: X1
Up= -57.53kV
T1= 0.92µs
T2= 46µs
CH2 No. 33
Terminal: X2
Ip= -55.67A

50001withKEMA : LI_PK : NO 33



No.: 34
CH1 No. 34
Terminal: X1
Up= -94.6kV
T1= 0.88µs
T2= 46µs
CH2 No. 34
Terminal: X2
Ip= -100.4A

50001withKEMA : LI_PK : NO 34

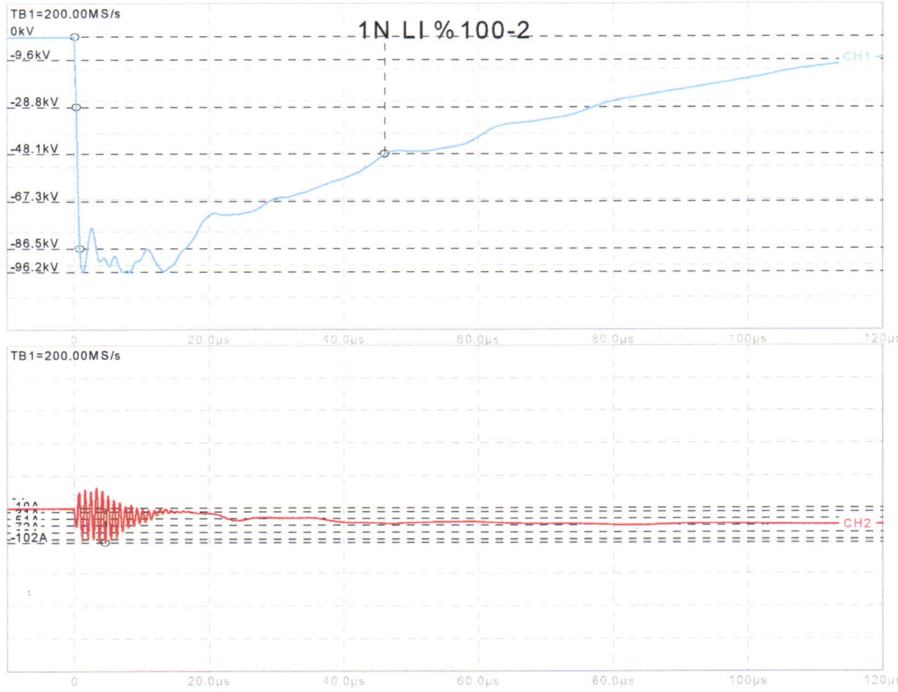
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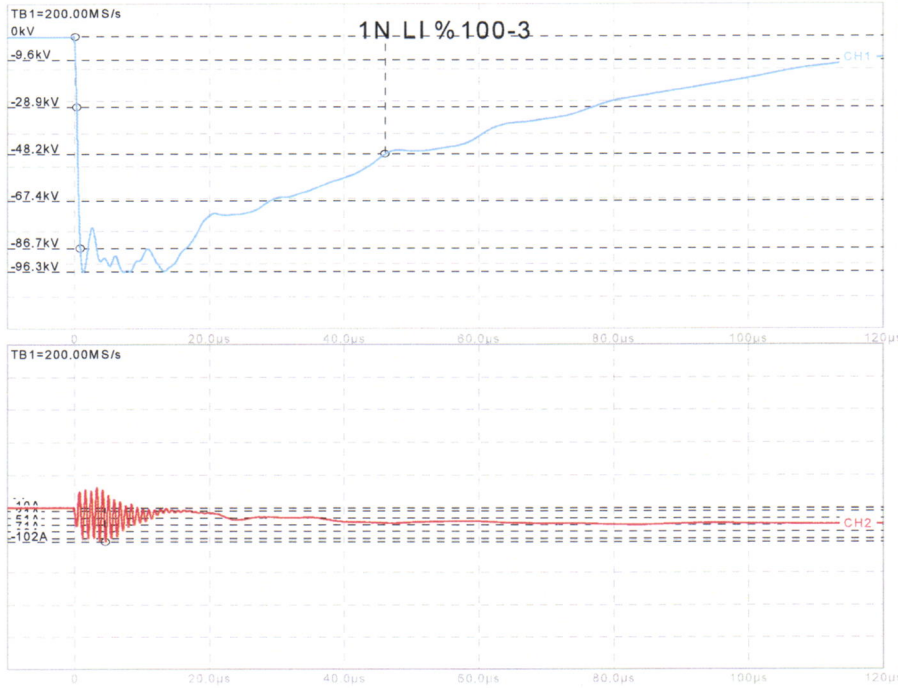
Sayfa No, Page No: 35/51

[Handwritten signatures]



No.: 35
CH1 No. 35
Terminal: X1
Up= -96.15kV
T1= 0.87µs
T2= 46µs
CH2 No. 35
Terminal: X2
Ip= -102.2A

50001withKEMA : LI_PK : NO 35



No.: 36
CH1 No. 36
Terminal: X1
Up= -96.32kV
T1= 0.87µs
T2= 46µs
CH2 No. 36
Terminal: X2
Ip= -101.7A

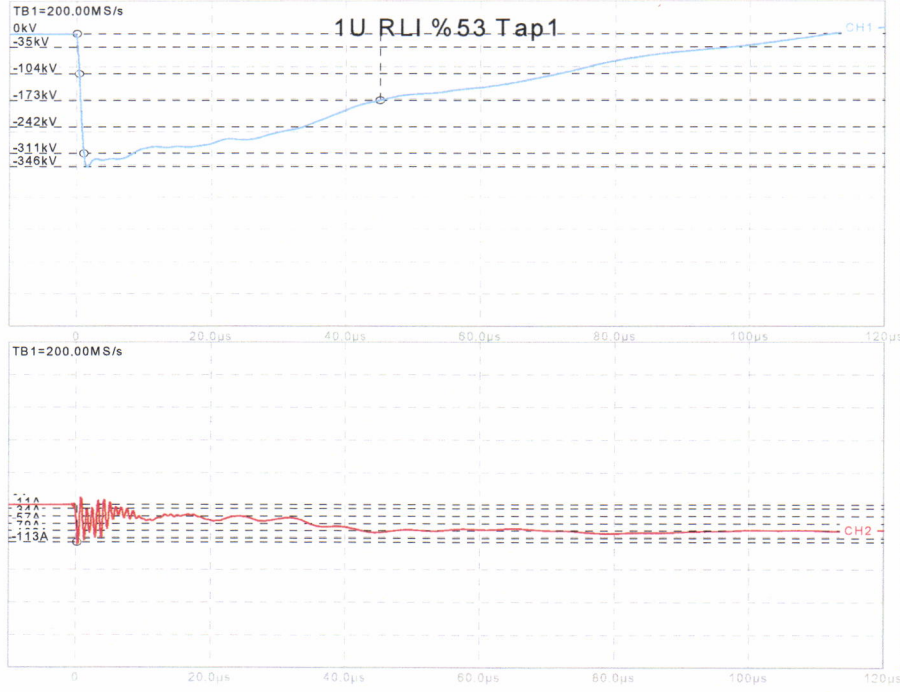
50001withKEMA : LI_PK : NO 36

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No.: 37

CH1 No. 37

Terminal: X1

Up= -345.9kV

T1= 1.16µs

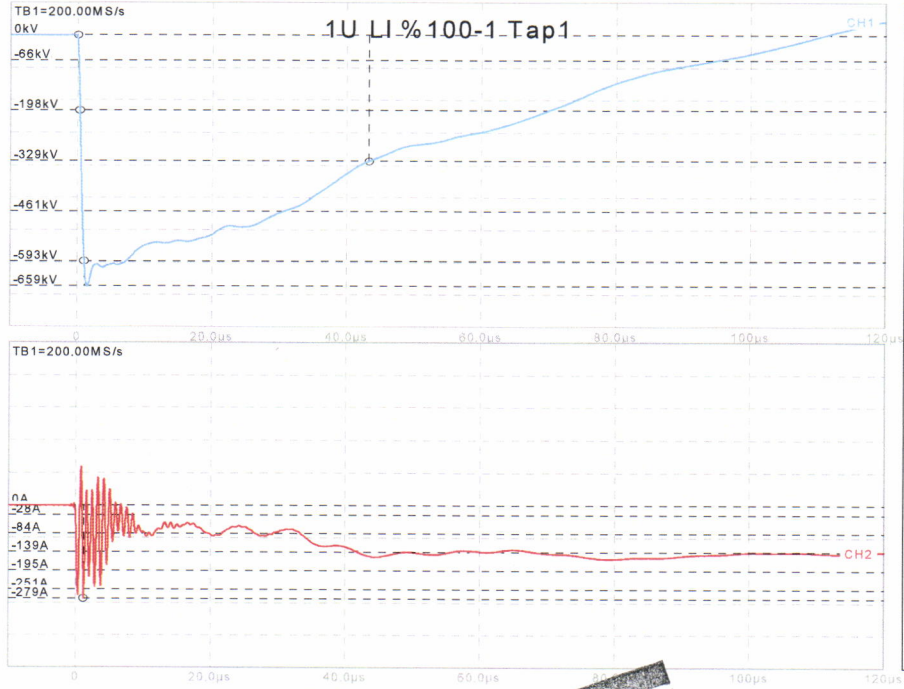
T2= 45µs

CH2 No. 37

Terminal: X2

Ip= -113.1A

50001withKEMA : LI_PK : NO 37



No.: 38

CH1 No. 38

Terminal: X1

Up= -658.8kV

T1= 1.09µs

T2= 43.3µs

CH2 No. 38

Terminal: X2

Ip= -278.9A

50001withKEMA : LI_PK : NO 38

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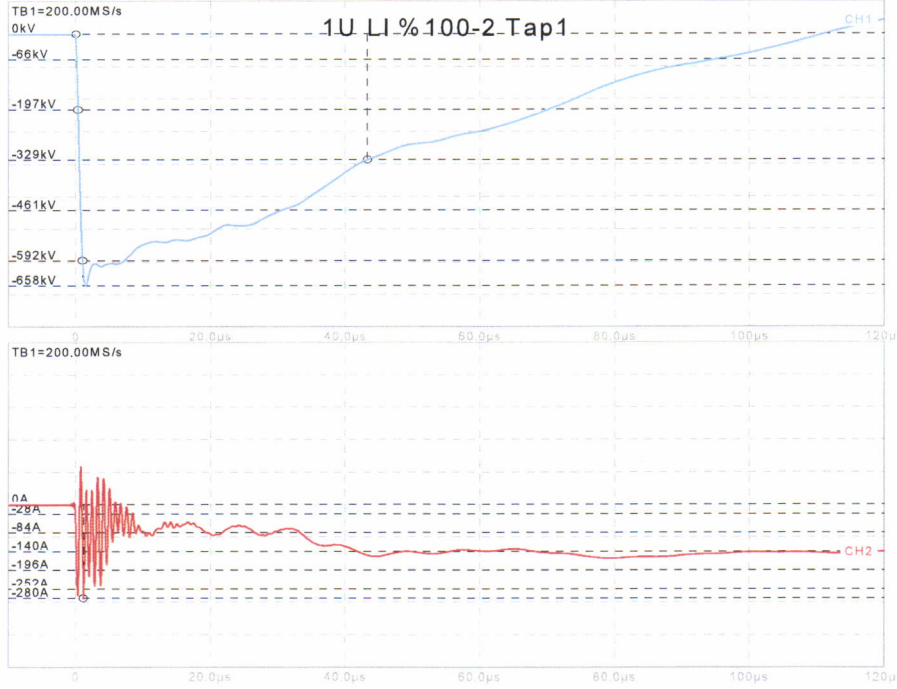
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Date: 19/8/2015

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[Handwritten signature]

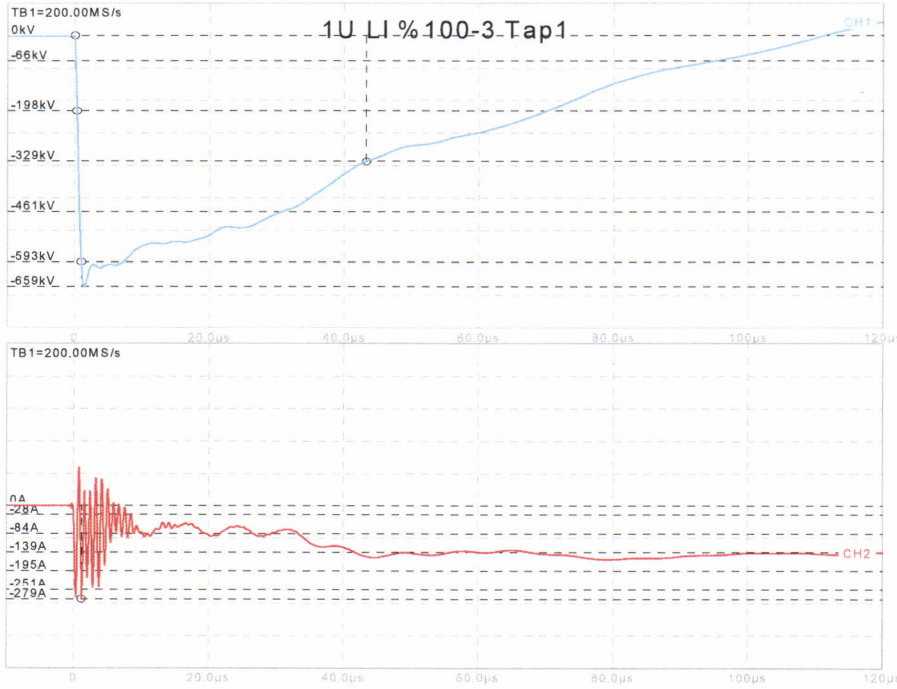
[Handwritten signature]



No.: 39

CH1 No. 39
Terminal: X1
Up= -658.2kV
T1= 1.09µs
T2= 43.3µs
CH2 No. 39
Terminal: X2
Ip= -279.8A

50001withKEMA : LI_PK : NO 39



No.: 40

CH1 No. 40
Terminal: X1
Up= -658.9kV
T1= 1.09µs
T2= 43.3µs
CH2 No. 40
Terminal: X2
Ip= -278.7A

50001withKEMA : LI_PK : NO 40

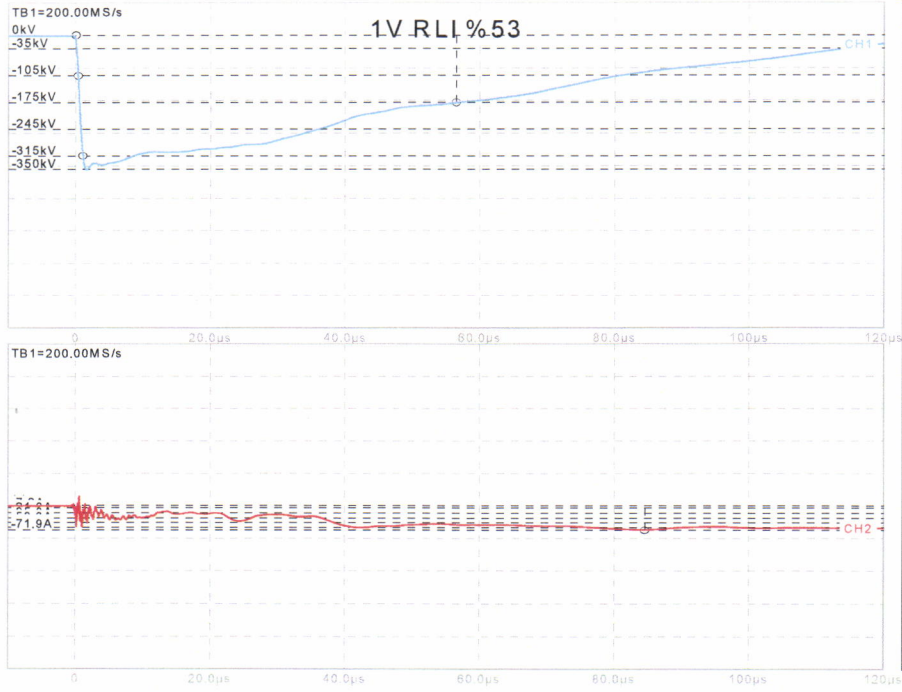
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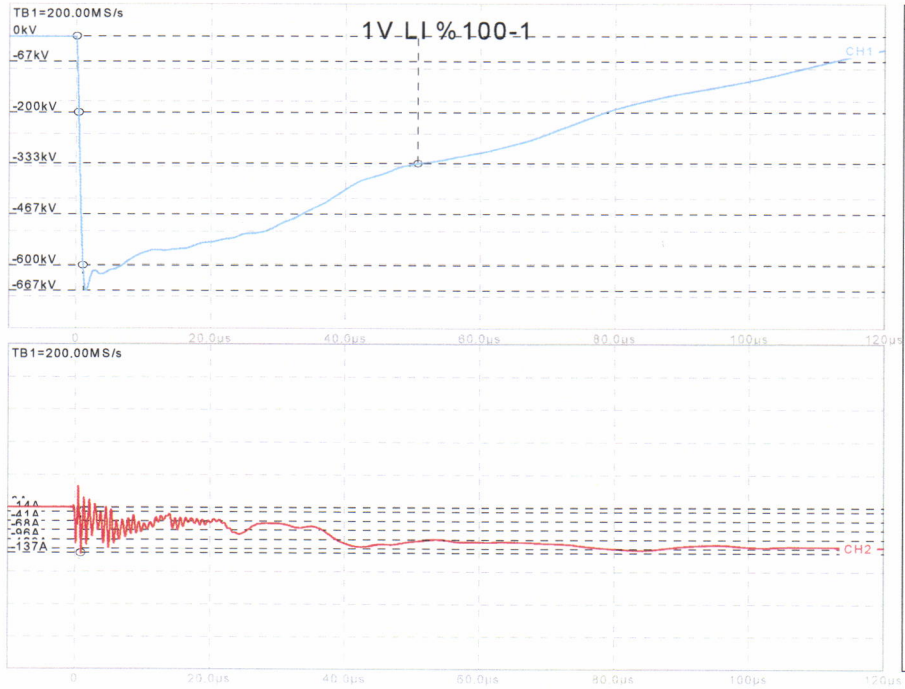
[Handwritten signatures and marks]



No.: 41

CH1 No. 41
Terminal: X1
Up= -349.7kV
T1= 1.17µs
T2= 56.5µs
CH2 No. 41
Terminal: X2
Ip= -71.86A

50001withKEMA : LI_PK : NO 41



No.: 42

CH1 No. 42
Terminal: X1
Up= -666.6kV
T1= 1.09µs
T2= 50.7µs
CH2 No. 42
Terminal: X2
Ip= -136.6A

50001withKEMA : LI_PK : NO 42

DNV-GL

Richard Houtepen

Date:

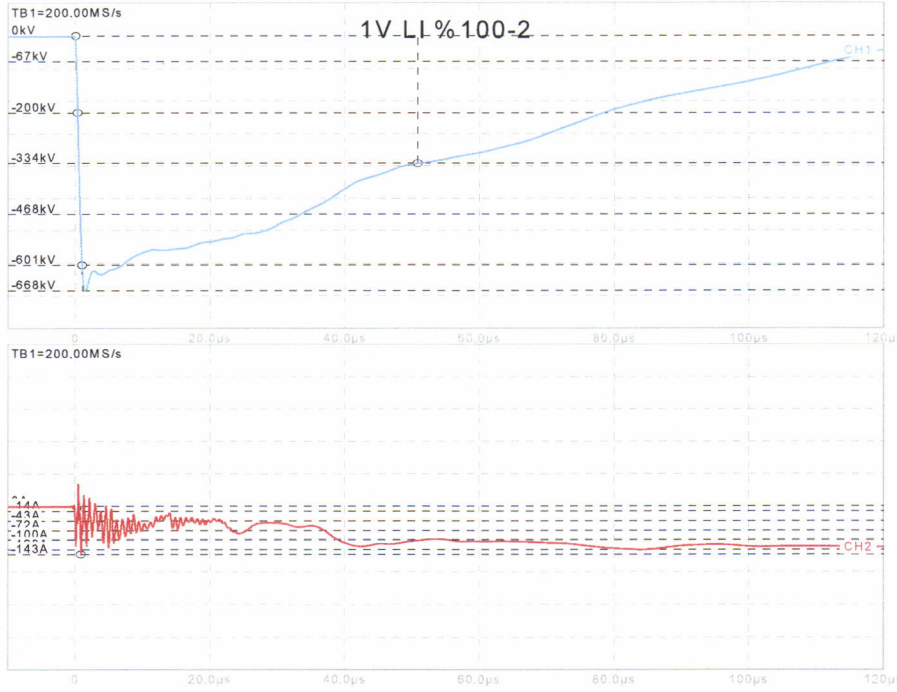
14/10/2015

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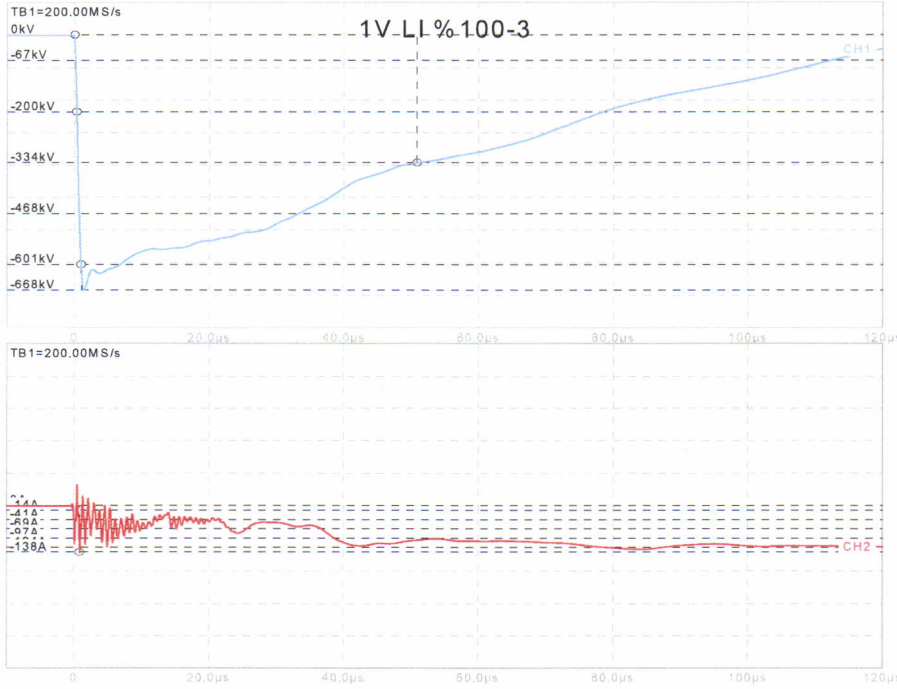
Sayfa No, Page No: 39/51

[Handwritten signatures]



No.: 43
CH1 No. 43
Terminal: X1
Up= -668.1kV
T1= 1.09µs
T2= 50.8µs
CH2 No. 43
Terminal: X2
Ip= -143A

50001withKEMA : LI_PK : NO 43



No.: 44
CH1 No. 44
Terminal: X1
Up= -668.3kV
T1= 1.1µs
T2= 50.8µs
CH2 No. 44
Terminal: X2
Ip= -138A

50001withKEMA : LI_PK : NO 44

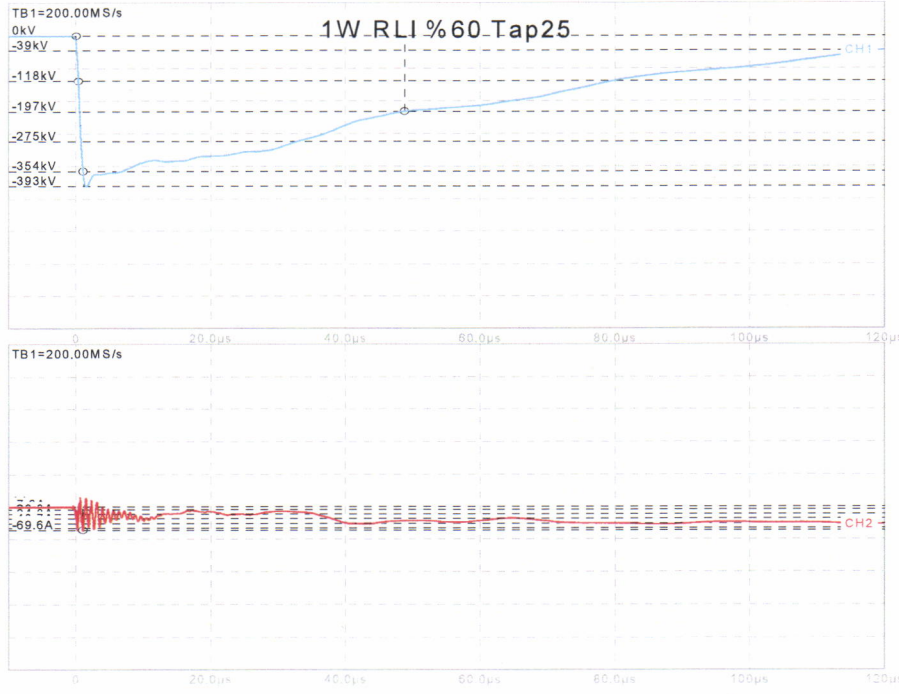
DNV-GL

Richard Houtepen
Date: 14/8/2015

KEMA Laboratories

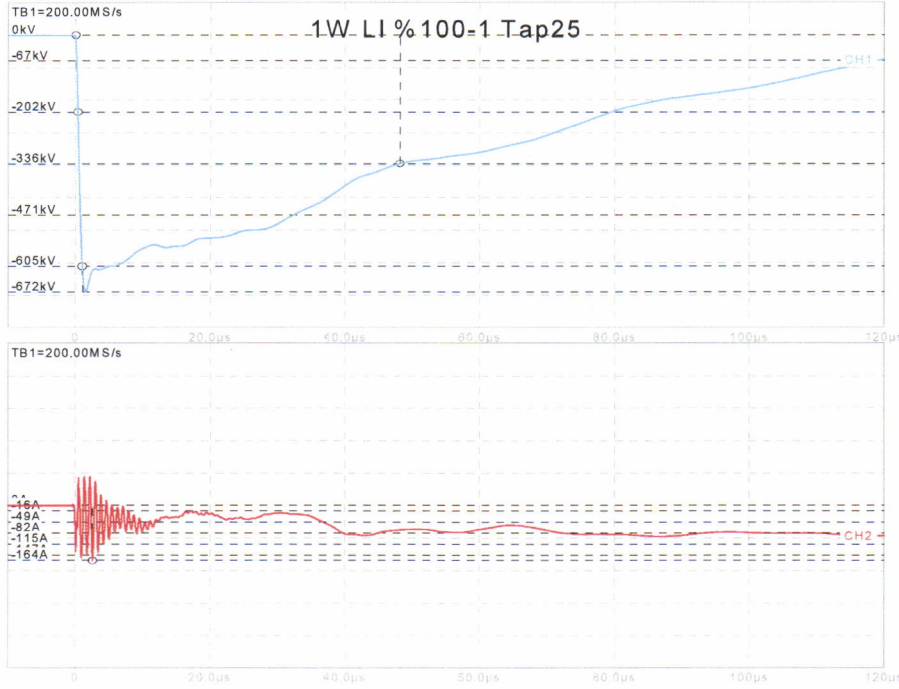
Sayfa No, Page No: 40/51

[Handwritten signatures and marks]



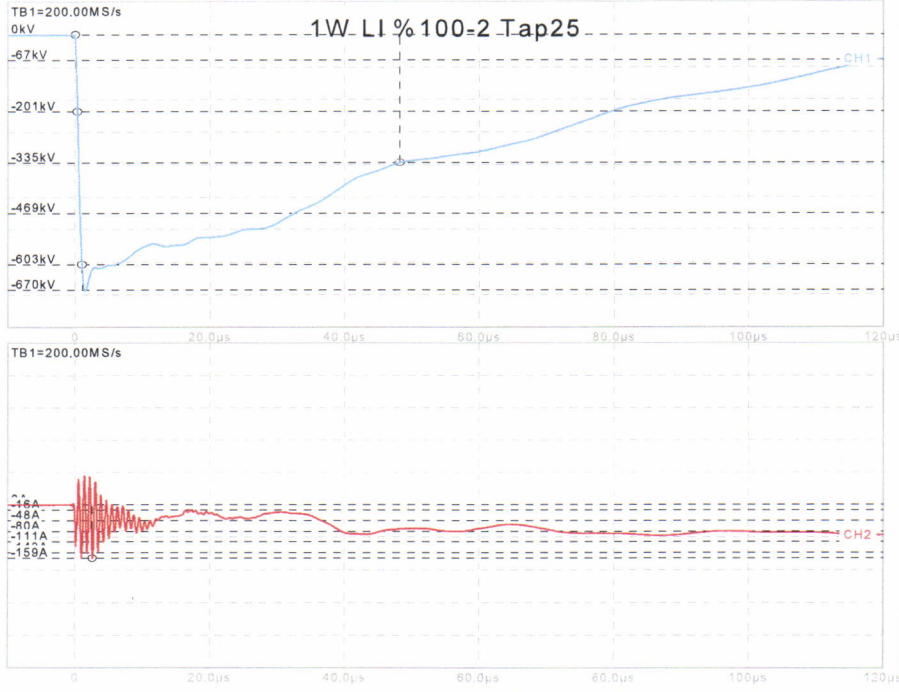
No.: 45
CH1 No. 45
Terminal: X1
Up= -393.3kV
T1= 1.14µs
T2= 48.8µs
CH2 No. 45
Terminal: X2
Ip= -69.63A

50001withKEMA : LI_PK : NO 45



No.: 46
CH1 No. 46
Terminal: X1
Up= -672.4kV
T1= 1.1µs
T2= 48.2µs
CH2 No. 46
Terminal: X2
Ip= -163.6A

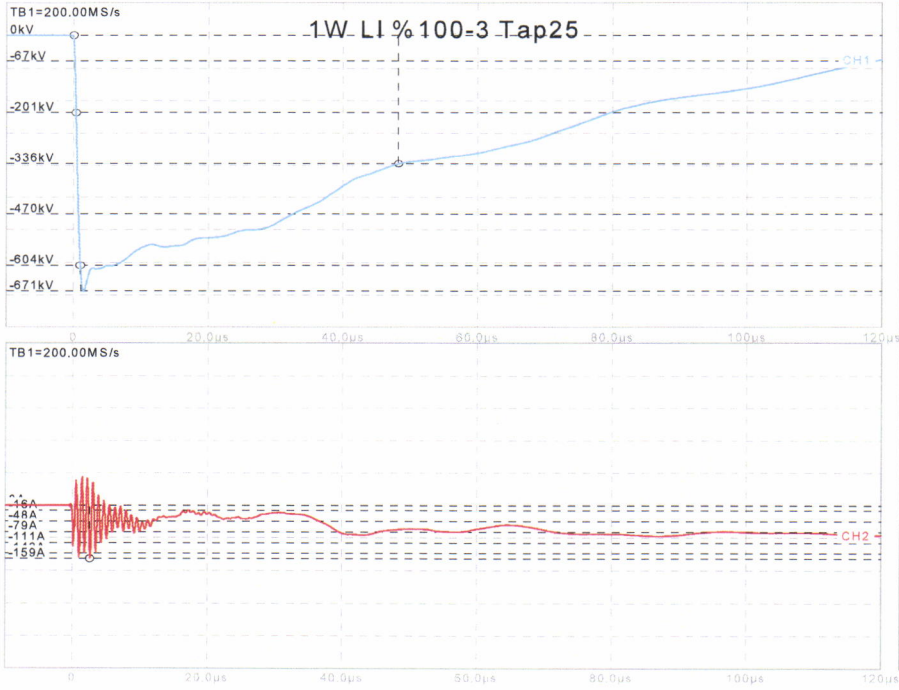
50001withKEMA : LI_PK : NO 46



No.: 47

CH1 No. 47
Terminal: X1
Up= -669.8kV
T1= 1.1µs
T2= 48.2µs
CH2 No. 47
Terminal: X2
Ip= -159.1A

50001withKEMA : LI_PK : NO 47



No.: 48

CH1 No. 48
Terminal: X1
Up= -671.4kV
T1= 1.1µs
T2= 48.2µs
CH2 No. 48
Terminal: X2
Ip= -158.6A

50001withKEMA : LI_PK : NO 48

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Richard Houtepen
Date: 14/8/2015

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Sayfa No, Page No: 42/51

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10



TİPİ	PTR 100000 /170G	FAZ SAYISI	3	İZOLASYON SEVİYELERİ			
SERİ NO		FREKANS	50 Hz	SARGI	YG	YG-N	AG
İMALAT YILI		BAĞLANTI GRUBU	YNyn 0	LI (kV)	650	95	170
STANDART	TS IEC 60076-1	SOĞUTMA TİPİ	ONAN/ONAF	AC (kV)	275	38	70

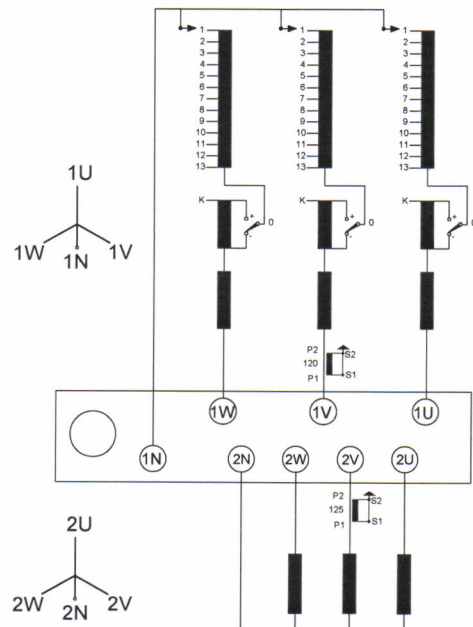
NOMİNAL GÜÇ (kVA)	POZ.	NOMİNAL GERİLİM (V)		NOMİNAL AKIM (A)		KISA DEVRE GERİLİMİ (%)
		YG	AG	YG	AG	
80000 / 100000	1	130900				
	13	154000	33600	299,9 / 374,9	1374,6 / 1718,3	
	25	177100				

KISA DEVRE AKIMI MAX (KA)	YG	AG	KADEME DEĞİŞTİRİCİ TİPİ : MR VM III 500Y-72.5 C-14273GR		
KISA DEVRE SÜRESİ MAX (s)		3	NOMİNAL İZOLASYON	:	LI 350 AC 140
İZOLASYON SINIFI		A	NOMİNAL AKIM	:	500 A SERİ NO :
MAX ÇEVRE SICAKLIĞI		45 °C	TOPLAM AĞIRLIK		117,000 kg
SICAKLIK ARTIŞI (SARGI / YAĞ)		60 / 55 K	NAKİL AĞIRLIK (YAĞSIZ)		86,000 kg
VAKUM DAYANIMI		TAM	AKTİF KISIM AĞIRLIĞI		70,000 kg
YAĞ CİNSİ		NYNAS LYRA X	YAĞ AĞIRLIĞI		21,500 kg

YG					Kaba Seçim
Poz.	Gerilim (V)	Akım (A)		Hassas Seçim	
		ONAN	ONAF		
1	130900	352,8	441,1	13	0- 
2	132825	347,7	434,7	12	
3	134750	342,8	428,5	11	
4	136675	337,9	422,4	10	
5	138600	333,2	416,6	9	
6	140525	328,7	410,9	8	
7	142450	324,2	405,3	7	
8	144375	319,9	399,9	6	
9	146300	315,7	394,6	5	
10	148225	311,6	389,5	4	
11	150150	307,6	384,5	3	
12	152075	303,7	379,6	2	
13A	154000	299,9	374,9	1	0+ 
13				K	
13B				13	
14	155925	296,2	370,3	12	
15	157850	292,6	365,8	11	
16	159775	289,1	361,4	10	
17	161700	285,6	357,1	9	
18	163625	282,3	352,8	8	
19	165550	279,0	348,7	7	
20	167475	275,8	344,7	6	
21	169400	272,7	340,8	5	
22	171325	269,6	337,0	4	
23	173250	266,6	333,2	3	
24	175175	263,7	329,6	2	
25	177100	260,8	326,0	1	

AG				
	Gerilim (V)	Akım (A)		
		ONAN	ONAF	
	33600	1374,6	1718,3	

AKIM TRANSFORMATÖRLERİ				
Sembol	Bağlantı	Çevirme Oranı (A/A)	Güç (VA)	Sınıfı
120	S1-S2	450 / 2	10	3
125	S1-S2	1720 / 2	10	3



14-123 78 06 00

Richard Houtepen
Date: 16/8/2015
Laboratories

Date: 10/1/2011

Laboratories

420

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Değişiklik	Tarih	Hazırlayan	Kontrol	Onay	Açıklama

TARİH	HAZIRLAYAN	KONTROL	ONAY	REVİZ. NO.	00
10.11.2014	E. DOLAP	E. ARSLAN	H. ÜNSAL	REVİZ. TARİHİ	---

PTR 100000 / 170 G	RESİM NO.
İŞARET PLAKASI	14-123 78 06 00
	ÖLÇEK

ASTOR® Bulut Okuldan nimbireti. Genel Teftişleri ISO 27005 / TS 19001-2 mabes	PTR 100000 / 170 G		14-123 78 06 00
	İŞARET PLAKASI	ÖLÇEK	

TEREDÜT ETTİĞİNİZ KONULARI LÜTFEN SORUNUZ.	-/-	✓
--	-----	---



BASINÇ TEST RAPORU
PRESSURE TEST REPORT

Müşteri / Customer : TEİAŞ

Trafo Seri No / Serial Nr : 50001

Sayfa No / Page Nr.: 44/51

Güç / Power (kVA)

80000 / 100000

Gerilim / Voltage (kV):

154 / 33,6

BASINÇ-YAĞ SIZDIRMAZLIK TEST RAPORU

Fabrika Kabul testlerine hazır halde olan, yağ ile ilgili tüm bağlantıları tamamlanmış transformatöre Basınç-Yağ sızdırmazlık testi uygulanmıştır.

Transformatör Taban Basıncı : 0,38 bar

İlave / Ek Basınç : 0,62 bar

Tank tabanında ölçülen test basıncı : 1 bar

Başlangıç Tarih ve Saati : 10.08.2015 / 17:30

Bitiş Tarih ve Saati : 11.08.2015 / 17:30

Test süresi : 24 Saat

Test Sonuç ve Değerlendirmesi : Test edilen transformatöre ait hiçbir donanım ve yüzeyde yağ sızıntısına rastlanmamış ve test basıncında değişiklik gözlemlenmemiştir. Test başarı ile tamamlanmıştır.

PRESURE-OIL LEAKAGE TEST REPORT

After all parts related with oil assembled on Transformer which is ready for Factory Acceptance Tests is subjected to Oil leakage Test.

Transformer Bottom Pressure : 0,38 bar

Additional Pressure : 0,62 bar

Measured Tank Bottom Pressure : 1 bar

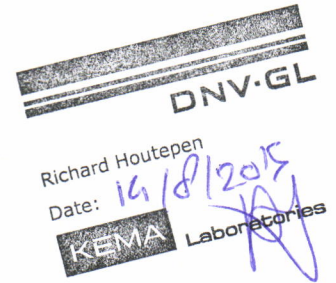
Starting, Date and Time: 10.08.2015 / 17:30

Finishing ,Date and Time : 11.08.2015 / 17:30

Test Duration : 24 hours

Results of test : All parts, accessories and surfaces of tested transformer found without any oil leakage and no any changing observed on test pressure. The transformer Oil leakage test completed succesfully.

Test cihazı / Testing device : KELLER ECO 1 Manometer (Sn:24722)



Adı soyadı
Name& Surname

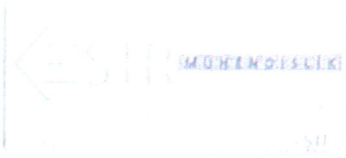
Tarih / Date
İmza / Signature

KALİTE KONTROL
QUALITY CONTROL

UGUR HASDAĞLI
PRODUCT QUALITY MANAGER
11.08.2015

MÜŞTERİ VEYA TEMSİLCİSİ
CUSTOMER OR REPRESENTATIVE

Handwritten signatures of customer representative



ASTOR TRANSFORMER

Yay. No.	01.01.2015
Yay. Tarihi	01.01.2015
Rev. No.	01
Rev. Tarihi	11.03.2015
Sayfa No.	1 / 1

Transformatör

Elektriksel, Kimyasal ve Fiziksel Test Raporları

13.08.2015



[Handwritten signatures]

TEST&DEVREYE ALMA / TEST&COMMISSIONING

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www.kesir.com.tr

NO: 10524



ASTOR TRANSFORMER den alınan 2 adet transformatörden elektriksel, kimyasal ve fiziksel testler için numuneler alınmış ve analizleri yapılmıştır.

Analiz Sonuçları ilgili test föylerinde belirtilmiş olan standart kodlarına göre değerlendirilmiştir.
Buna göre;

- 50001 seri nolu başlangıç numunesinde bütün değerler standart limitler içerisinde.
- 50001 seri nolu test bitiş numunesinde bütün değerler standart limitler içerisinde.
- 50003 seri nolu başlangıç numunesinde bütün değerler standart limitler içerisinde.
- 50003 seri nolu test bitiş numunesinde bütün değerler standart limitler içerisinde.

Transformatörlerin daha verimli ve emniyetli işletilmesi bakımından belirli periyotlarla yağ-gaz numuneleri alınarak yağdaki elektro-kimyasal değişimlerin takip edilmesi tavsiye edilir.

Saygılarımla,

İpek KOCA

EKLER:

- 4 adet yağda çözünmüş gaz analizi test protokolü
- 4 adet yağ numune test protokolü sonuç föyü

DNV-GL
Richard Houtepen
Date: 14/8/2015
KEMA Laboratories

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KEŞİR MÜHÜR
KEŞİR MÜHÜR
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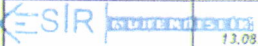


		KESİR MÜHENDİSLİK ELEKTRİK MAK. İNŞ. SAN. VE TİC. LTD. ŞTİ. TEST LABORATUVARI Geniş Mah. Hıdırcan Cad. No: 15 Ümraniye, 34275 İstanbul Telefon No: (0216) 496 41 95(215) Fax No: (0216) 496 41 10 Web Site: www.kesir.com.tr e-mail: laboratuvar@kesir.com.tr						
Transformator İzolasyon Yağı Test Raporu <i>Transformer Insulation Oil Test Report</i> (Category B / above 72,5 kV and up to and including 170 kV)								
Müşteri / Client	ASTOR TRANSFORMER		Tesis - Tesis Bölümü / Plant Section					
Transformator Bilgileri / Transformer Information				Numune Bilgileri / Sample Information				
İsim / Name	BASLANGIÇ NUM.	Tipi / Type	Seri No / Serial No	Numune Alın / Sample Received	Alınış Tarihi / Date Of Receipt	13.08.2015		
Marka / Brand	ASTOR TRANSFORMATOR	Vektör Grubu / Vector Group	00001	Standard / Sampling Standard	ASTM D923 IEC 60557	Alınış Saati / Time Of Receipt		
Güç / Power MVA	100	Soğutma Tipi / Cooling Type	ONAN / ONAN	Numune Bölgesi / Sample Point		Geliş Tarihi / Date Of Arrival	13.08.2015	
Gerilimi / Voltage kV	134/13,5	Yağ Miktarı / Oil Quantity		Yağ Sıcaklığı / Oil Temperature		Test Tarihi / Date Of Test	13.08.2015	
İmalat Yılı / Date of manufacture	2015	Test Nedeni / Reason For Test		Ortam Sıcaklığı / Ambient Temp		Rapor No / Report Number	1015000144	
Kavanoz No: / Bottle Number						Numune No / Sample Number		
ELEKTRİKSEL FİZİKSEL KİMYASAL TESTLER <i>Electrical Physical Chemical Tests</i>								
Yapılan Testler / Done Tests	Ölçülen Değerler / Measured Values	Belirsizlik / Uncertainty	Birim / Unit	Limit Değerler / Suitable Values			Test Standardı / Standard Of Test	SONUÇ / Result
				İyi / Good	Uygun / Fair	Kötü / Poor		Limit Standardı / Limit of Standard
Dielektrik gerilim testi / Dielectric Breakdown	58,7	2%	kV	> 50	40-50	< 40	IEC-60156	IEC 60422
Güç faktörü / Power Factor(90°C)	0,1528	5%	%	≤ 0,1	0,10-0,50	> 0,50	ASTM D924	ASTM D1487
Su miktarı / Water Content	11,42	10%	ppm	< 20	20-30	> 30	ASTM D1533	IEC 60422
Renk tayini / Color	< 0,5	8%	Sayısal	≤ 1	1-2	> 2	ASTM D1524	IEC 60422
Asidite testi / Neutralization Number	0,0581	10%	mg KOH/gr	≤ 0,10	0,1-0,2	> 0,20	IEC 60201-1	IEC 60422
İç yüzey gerilim testi / Interfacial Tension	40	5%	mN/m	> 28	22-28	< 22	ASTM D971	IEC 60422
Özgül Yoğunluk / Specific Gravity(15C°)	0,874	7%	gr/cm³	≤ 0,91	-	> 0,91	ASTM D1298	ASTM D1487
Parlama Noktası / Flash Point	151	3%	°C	≥ 145	-	< 145	ASTM D92	ASTM D1487
Viskozite * / Viscosity(40C°)	12,7	5%	°C	16,5 ≤	-	≤ 11	ASTM D445	ASTM D1487
Anilin Noktası * / Aniline Point	59	2%	°C	84 ≥	-	63 ≥	ASTM D611	ASTM D1487
Yorum/Interpretation: Analiz sonuçları sadece analiz yapılan numuneyi temsil etmektedir.								
Mühür / Seal	Tarih / Date	Testi Yapan / Tester	Kontrol Eden / Controller					
	13.08.2015	İp-K KÜÇÜK	Mehmet ÖZDEMİR					
Bu rapor Kesir Mühendislik Test Laboratuvarı yazılı izni olmadan, kısmen de olsa kopyalanıp çoğaltılamaz, imzasız ve mühürlü raporlar geçersizdir. This report shall not be reproduced other than in full except with the permission of the Kesir Engineering Test Laboratory. Testing reports without signature and seal are not valid. Bu test raporu Uluslararası Birimler Sisteminde (SI) tanımlanmış birimleri realize eden ulusal ölçüm standartlarına izlenebilirliği belgeler. This test report traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).								
*Değer edilen genişletilmiş ölçüm belirsizliği, standart belirsizliğin k=2 olan genişletme katsayısı ile çarpımı sonucunda %25 oranında güvenlilik seviyesi sağlanmaktadır. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.								
Dok.No FR 510-02 Yay.Tarihi 02.01.2013		Rev02 Rev. Tarih 08.07.2015		Sayfa No		1/1		

DNV-GL

Richard Houtepen
 Date: 14/08/2015

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Transformatör İzolasyon Yağı Test Raporu Transformer Insulation Oil Test Report (Category B / above 72,5 kV and up to and including 170 kV)								
Müşteri / Client	ASTOR TRANSFORMER	Taahhüt / Commitment						
Transformatör Bilgileri / Transformer Information			Numune Bilgileri / Sample Information					
İsim / Name	BİTLEY NÜH	Tipi / Type		Numuneyi Alan / Sample Personnel				
Markası / Brand	ASTOR TRANSFORMER	Sevki No / Serial No		Alınış Tarihi / Date Of Receipt	13.08.2015			
Güç / Power MVA	100	Yükler Grubu / Vector Group	YENİSİ	Standart / Sampling Standard	IEC 60157			
Geliş / Power MVA	100	Soğutma Tipi / Cooling Type	ONAN / ONAF	Numune Bölgesi / Sample Point				
Geliş / Power MVA	100	Yağ Miktarı / Oil Quantity		Geliş Tarihi / Date Of Arrival	13.08.2015			
Geliş / Power MVA	100	Yağ Sıcaklığı / Oil Temperature		Test Tarihi / Date Of Test	13.08.2015			
İnşaat Yılı / Date of Manufacture	2015	Test Nodul / Reason For Test		Rapor No / Report Number	915009246			
Kavram No / Bottle Number				Numune No / Sample Number				
ELEKTRİKSEL FİZİKSEL KİMYASAL TESTLER Electrical Physical Chemical Tests								
Yapılan Testler / Done Tests	Ölçülen Değerler / Measured Values	Belirsizlik / Uncertainty	Birim / Unit	Limit Değerler / Suitable Values			Test Standartı / Standard Of Test	SONUÇ / Result
				İyi / Good	Uygun / Fair	Kötü / Poor		Limit Standartı / Limit of Standard
Dielektrik gerilim testi / Dielectric Breakdown	66,9	2%	kV	> 50	40-50	< 40	IEC 60155	IEC 60422
Güç faktörü / Power Factor (90°C)	0,1448	5%	%	≤ 0,1	0,10-0,50	> 0,50	ASTM D924	ASTM D3487
Su miktarı / Water Content	11,49	10%	ppm	< 20	20-30	> 30	ASTM D1533	IEC 60422
Renk tayini / Color	< 0,5	8%	Sayısal	≤ 1	1-2	> 2	ASTM D1524	IEC 60422
Asidite testi / Neutralization Number	0,0598	10%	mg KOH/gr	≤ 0,10	0,1-0,2	> 0,20	IEC 62021-1	IEC 60422
İç yüzey gerilim testi / Interfacial Tension	40	5%	mN/m	> 28	22-28	< 22	ASTM D971	IEC 60422
Özgül Yoğunluk / Specific Gravity (15°C)	0,874	7%	gr/cm³	≤ 0,91	-	> 0,91	ASTM D1298	ASTM D3487
Parlama Noktası / Flash Point	150	3%	°C	≥ 145	-	< 145	ASTM D92	ASTM D3487
Viskozite * / Viscosity (40°C)	12,5	5%	°C	16,5 ≤	-	≤ 11	ASTM D445	ASTM D3487
Anilin Noktası * / Aniline Point	69,1	2%	°C	84 ≥	-	63 ≥	ASTM D611	ASTM D3487
Yorum/Interpretation: Analiz sonuçları sadece analiz yapılan numuneyi temsil etmektedir.								
 Richard Houtepen Date: 14/08/2015  Laboratories								
Mühür / Seal	Tarih / Date	Testi Yapan / Tester	Kontrol Eden / Controller					
	13.08.2015	İpek KOCA	Mehmet ÖZDEMİR					
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Dok.No FR 510 02 Yay.Tarihi 02.01.2013 Rev02 Rev. Tarih 08.07.2015 Sayfa No 1/1								

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Transformatör Yağı Test Raporu Transformer Oil Test Report					
Müşteri / Client	ASTOR TRANSFORMER		Tesis - Tesis Bölümü / Plant Section		
Transformatör Bilgileri / Transformer Information			Numune Bilgileri / Sample Information		
İsme / Name	BRİS NUM	Tipi / Type	Seri No / Serial No	Numuneyi Alan / Sampled Personel	Alınış Tarihi / Date Of Receipt
Markası / Brand	ASTOR TRANSFORMATÖR	Vektör Grubu / Vector Group	Yük 0	Standart / Standard	Alınış Saati / Time Of Receipt
Güç / Power MVA	100	Soğutma Tipi / Cooling Type	ONAN / ONAF	Numune Bölgesi / Sample Point	Geliş Tarihi / Date Of Arrival
Gerilimi / Voltage kV	154/13,5	Yağ Miktarı / Oil Quantity		Yağ Sıcaklığı / Oil Temperature	Test Tarihi / Date Of Test
İmalat Yılı / Date of manufacture	2015	Test Nedeni / Reason For Test		Ortam Sıcaklığı / Ambient Temp	Rapor No / Report Number
Sıra No / Sample No					Numune No / Sample Number
YAĞDA ÇÖZÜNMÜŞ GAZ ANALİZİ TESTLERİ Analysis of dissolved gas in the oil					
Gazın Türü / Gas Type	Formül / Formula	Ölçülen / Measured	Birim / Unit	Belirsizlik / Uncertainty	Limit Değerler / Limit & Values
Hidrojen / Hydrogen	H ₂	0	ppm	± 5 ppm & 10%	≤ 100 IEEE Std. C57.104.2008
Karbondioksit / Carbon dioxide	CO ₂	207	ppm	± 10 ppm & 10%	≤ 2500 IEEE Std. C57.104.2008
Karbonmonoksit / Carbon monoxide	CO	8	ppm	± 2 ppm & 10%	≤ 350 IEEE Std. C57.104.2008
CO ₂ /CO	-	25,875	%	-	> 0,3 IEC 60399
Etilen / Ethylene	C ₂ H ₄	0	ppm	± 2 ppm & 10%	≤ 50 IEEE Std. C57.104.2008
Etan / Ethane	C ₂ H ₆	0	ppm	± 2 ppm & 10%	≤ 55 IEEE Std. C57.104.2008
Metan / Methane	CH ₄	0	ppm	± 2 ppm & 10%	≤ 120 IEEE Std. C57.104.2008
Asetilen / Acetylene	C ₂ H ₂	0	ppm	± 2 ppm & 10%	≤ 1 IEEE Std. C57.104.2008
TDCG / Total Diss. Combustible Gas	-	8	ppm	-	≤ 720 IEEE Std. C57.104.2008
Oksijen / Oxygen	O ₂	21249	ppm	10%	Bu gaz için belirlenmiş sınır değeri yoktur. There is no specific limit value for this gas.
Azot / Nitrogen	N ₂	62209	ppm	10%	Bu gaz için belirlenmiş sınır değeri yoktur. There is no specific limit value for this gas.
O ₂ /N ₂	-	0,3415744	%	-	> 0,3 IEC 60399
TDCG / Total Dissolved Gas	-	83458	ppm	-	Toplam Çözünmüş gaz için belirlenmiş sınır değeri yoktur. There is no specific limit value for total dissolved gas.
Test Standardı / Test Method : ASTM D 3612 & IEC 60567 Test Cihazı / Test Instrument : MORGAN SCHAFFER Transformer Fault Gas Analysis / Instrument ID:1001					
Yorum/Interpretation: Analiz sonuçları sadece analiz yapılan numuneyi temsil etmektedir.					
Mühür / Seal	Tarih / Date	Testi Yapan / Tester	Kontrol Eden / Controller		
 Kesir Mühendislik Elektrik Mak. İnş. San. ve Tic. Ltd. Şti. Sangazi Vargi Dalgası : 548 008 5154	13.08.2015	İpek KOÇ	Mehmet ÖZDEMİR		
Bu rapor, Kesir Mühendislik Test Laboratuvarı yazılı izni olmadan, kısmen de olsa kopyalanıp çoğaltılamaz. İmzasız ve mührsüz raporlar geçersizdir. This report shall not be reproduced other than in full except with the permission of the Kesir Engineering Test Laboratory. Testing reports without signature and seal are not valid. Bu test raporu Uluslararası Birimler Sisteminde (SI) tanımlanmış birimlerle realize edilen ulusal ölçüm standartlarına itidilenebilirliği belgeler. This test report the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).					
"Beyan edilen genişletilmiş ölçüm belirsizliği; standart belirsizliğin k=2 olan genişletme katsayısı ile çarpımı sonucunda %95 aralığında güvenlilik seviyesi sağlamaktadır" The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.					
Dok.No:FR.510.04 Yay.Tarihi:02.01.2013 Rev02 Rev. Tarih :08.07.2015			Sayfa No 1/1		

Richard Houtepen
Date: 14/08/2015

REMA Laboratories

FUNCTIONAL TESTS

Fonksiyonel Testler



Customer (Müşteri):
Project No (Proje No):
Serial No (Seri No):

TEİAŞ
TP 14.123
50001

Drawing No (Çizim No):
Power and Voltage (Güç ve Gerilim):
Date (Tarih):

100 MVA - 154 kV
13.08.2015

Accessory Aksesuar	Part No Parça No	Function Fonksiyon	Brand Marka	Type Tipi	Contact Type Kontak Tipi	Serial No Seri No
1) Buchholz Relay (Main Tank) Buchholz Rölesi (Ana Tank)	801	Alarm ☒ Trip ☒	Comem	BR 80	4 NO	74616
2) Buchholz Relay (Seperator) Buchholz Rölesi (Seperatör)	802	Alarm ☒ Trip ☐	Elmek	BR 25	2 NO	
3) Buchholz Relay (OLTC) Buchholz Rölesi (OLTC)	805	Alarm ☐ Trip ☒	MR	RS 2001	2 NO	
4) Oil Level Gauge (Main Tank) Yağ Seviye Göstergesi (Ana Tank)	815	Alarm ☒ Trip ☐	Elmek	KYSB	4 NO	
5) Oil Level Gauge (OLTC) Yağ Seviye Göstergesi (OLTC)	816	Alarm ☒ Trip ☐	Elmek	KYSA	4 NO	
6) Oil Temperature Thermometer Yağ Sıcaklık Termometresi	834	Alarm ☒ Fan Start ☒ Trip ☒ Fan Stop ☒	Qualitrol	34601	6 NO	1052169-2
7) Winding Temperature Thermometer Sargı Sıcaklık Termometresi	833	Alarm ☒ Fan Start ☒ Trip ☒ Fan Stop ☒	Qualitrol	35601	6 NO	1052171-9
8) Pressure Relief Device (Main Tank) Basınç Emniyet Ventili (Ana Tank)	855	Alarm ☐ Trip ☒	Qualitrol	LPRD 208		50168925-1
9) Pressure Relief Device (OLTC) Basınç Emniyet Ventili (OLTC)	810	Alarm ☐ Trip ☒	MR			
10) Shutter Çekvalf	810	Alarm ☐ Trip ☒	ETI	ES-R 80		6-640867

Kontrol Eden ASTOR Personeli

Adı ve Soyadı	Ünvanı	İmza
Ahmet Becer	Tasarım Müh	

Kontrol Eden Müşteri veya Vekili

Adı ve Soyadı	Ünvanı	İmza

Type test Certificate of short-circuit performance

Astor Transformer

Ankara, Turkey

has successfully passed the type test sequence on a three-phase oil-immersed type

power transformer

Type: PTR 62500 /170G

Rating: 62,5 MVA – 154 kV $\pm$ 12 x 1,25% / 33,6 kV - Ynyn0 – 50 Hz

The test object passed the required clauses of

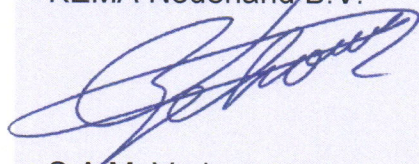
IEC 60076-5

The test results are recorded in Certificate No.

2181-15

This Certificate is issued on 23 October 2015.

KEMA Nederland B.V.



S.A.M. Verhoeven

Director Testing, Inspections & Certification The Netherlands

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