REPORT OF PERFORMANCE 07-1424

OBJECT	Power transformer		
TYPE	Dry type (cast resin)	**SERIAL No.**	07.KT.264
	10000 / 400 V – 1000 kVA (AN) – Dyn11 – 50 Hz		
MANUFACTURER	Eltaş transformator sanayi ve ticaret A.S. Izmir, Turkey		
CLIENT	Eltaş transformator sanayi ve ticaret A.S. Izmir, Turkey		
TESTED BY	KEMA HIGH-VOLTAGE LABORATORY Arnhem, the Netherlands		
DATES OF TESTS	16 until 30 October 2007		
TEST PROGRAMME	The test programme was specified by the client. Climatic and environmental tests in accordance with IEC 60076-11.		
SUMMARY AND CONCLUSION	The tests were passed with		

is Record of tests applies only to the object tested. The responsibility for conformity of any object ing the same designations with that tested rests with the Manufacturer.

This port consists of 19 pages in total.

KEMA Nederland B.V.

P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 21 January 2008

TABLE OF CONTENTS

1 IDENTIFICATION OF THE TEST OBJECT

1.1 Ratings assigned by the manufacturer

Climatic Class	C2
Environmental Class	E2

1.2 Description of the test object

Manufacturer	Eltaş transformator sanayi ve ticaret A.S., Izmir, Turkey
Type	power transformer
Designation	two-winding transformer, dry-type (cast resin)
Serial number	07.KT.264
Year of manufacture	2007
Type of cooling	AN
Number of phases	3
Rated power	1000 kVA
Rated primary voltage	10000 V
Rated secondary voltage	400 V
Rated primary current	57,74 A
Rated secondary current	1443 A
Rated frequency	50 Hz
Tapping range	9500, 9750, 10000, 10250, 10500 V
Impedance voltage	6,0%
Connection symbol	Dyn11
Primary winding material	Cu
Secondary winding material	Cu
Thermal insulation class primary winding	F
Thermal insulation class primary winding	F
Degree of protection	IP 00 (indoor)

1.3 List of drawings

The following drawing is kept in KEMA's file. KEMA has verified that this drawing adequately represent the object tested:
- Nameplate; "Cast Resin Dry Type Transformer," serial number 07.KT.264, year 09.2007.

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Mr Ahmet Gure	Eltaş transformator sanayi ve ticaret A.S.,
Mr Yusuf Aygun	Izmir, Turkey

2.2 The tests were carried out by

Name	Company
Mr W.J.W.M. Sloot	KEMA Nederland B.V.,
Mr P.H.W. Kuijpers	Arnhem, the Netherlands
Mr T. Minkhorst	
Mr A. P.M. Derksen	
Mr H. Maassen	

2.3 Purpose of the test

Purpose of the test was to verify whether the material complies with the specified requirements.

2.4 Measurement uncertainty

A table with measurement uncertainties is enclosed in A. Unless otherwise indicated in the report, the measurement uncertainties of the results presented are as indicated in this table.

2.5 Applicable standards and sequence of tests

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.
The sequence of the tests can be derived from the indicated dates and does not necessarily follow the sequence of presentation.

3 INITIAL ROUTINE TESTS

3.1 Separate-source AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 19
Test date	16 October 2007

Environmental conditions

Ambient temperature	21	°C	Ambient air pressure	1010	hPa
Temperature of test object	21	°C	Humidity	10	g/m^3

winding	tap position	voltage (kV)	frequency (Hz)	duration (min)	result
HV	3	28	50	1	passed
LV		3	50	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric tests.

Result

The tests have been passed with satisfactory results.

3.2 Induced AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 20
Test date	16 October 2007

Environmental conditions

Ambient temperature	21	°C	Ambient air pressure	1010	hPa
Temperature of test object	21	°C	Humidity	10	g/m^3

winding	tap position	voltage (V)	frequency (Hz)	duration (min)	result
LV	3	800 ($2U_r$)	100	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric test.

Result

The tests have been passed with satisfactory results.

3.3 Partial discharge measurement (routine test)

Requirements and date

Standard	IEC 60076-11, clause 22.4.1.1
Test date	16 October 2007

Environmental conditions

Ambient temperature	21	°C	Ambient air pressure	1010	hPa
Temperature of test object	21	°C	Humidity	10	g/m^3

Circuit parameters

Power frequency	100	Hz	Calibration	5	pC
Bandwidth	40-400	kHz	Noise level	1	pC
Coupling capacitors	2600	pF	Circuit	direct	

phase	phase-to-earth voltage	frequency	duration	partial discharge level	inception		extinction		result
	(kV / xU_r)	(Hz)	(min)	(pC)	(kV)	(pC)	(kV)	(pC)	
1U	10,4 / 1,8U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed
1V	10,4 / 1,8U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed
1W	10,4 / 1,8U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed

Requirement

The maximum level of partial discharges shall be 10 pC.

Result

The tests have been passed with satisfactory results.

4 CLIMATIC TEST FOR C2 CLASS

4.1 Thermal shock test for C2 class transformers

Requirements and date

Standard	IEC 60076-11, clause 27.4 (tested with dc-supply)
Test dates	19 – 23 October 2007

Test details

Transformer placed in test chamber and connected as per circuit diagram in figure 1.
One temperature sensor (thermocouple) on top of top-yoke for thermal equilibrium determination.
Four temperature sensors (thermocouples) for ambient temperature determination.

Start of cooling down to -25 °C in approximately 8 hours	19 October 2007	15h00
Measurement of dc-resistance in stable temperature condition	22 October 2007	10h15
Start of thermal-shock current application (chamber cooling switched off)	22 October 2007	10h50
End of thermal-shock current application for secondary windings	22 October 2007	11h45
End of thermal-shock current application for primary windings	22 October 2007	12h06
Natural cooling of transformer until	23 October 2007	08h30

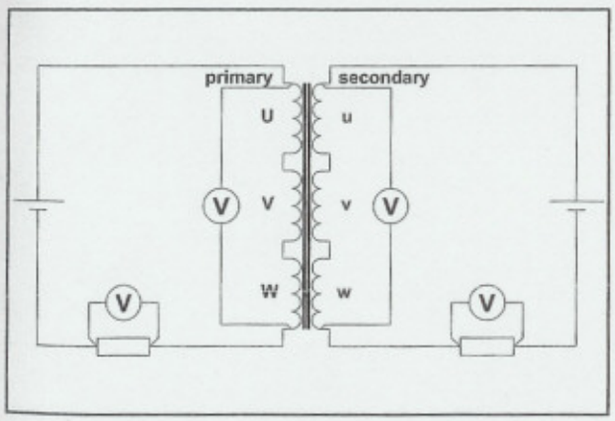


Figure 1 Thermal-shock, dc circuit diagram.

DC-resistance of phase windings (before thermal-shock in stable condition)		
U + V + W (in series) (Ω)	u + v + w (in series) (mΩ)	temperature of windings (°C)
2,214	1,181	-25,9

Thermal-shock currents (kept constant during application)	
primary (A)	secondary (A)
67 ($2 \times I_n/\sqrt{3}$)	2887 ($2 \times I_n$)

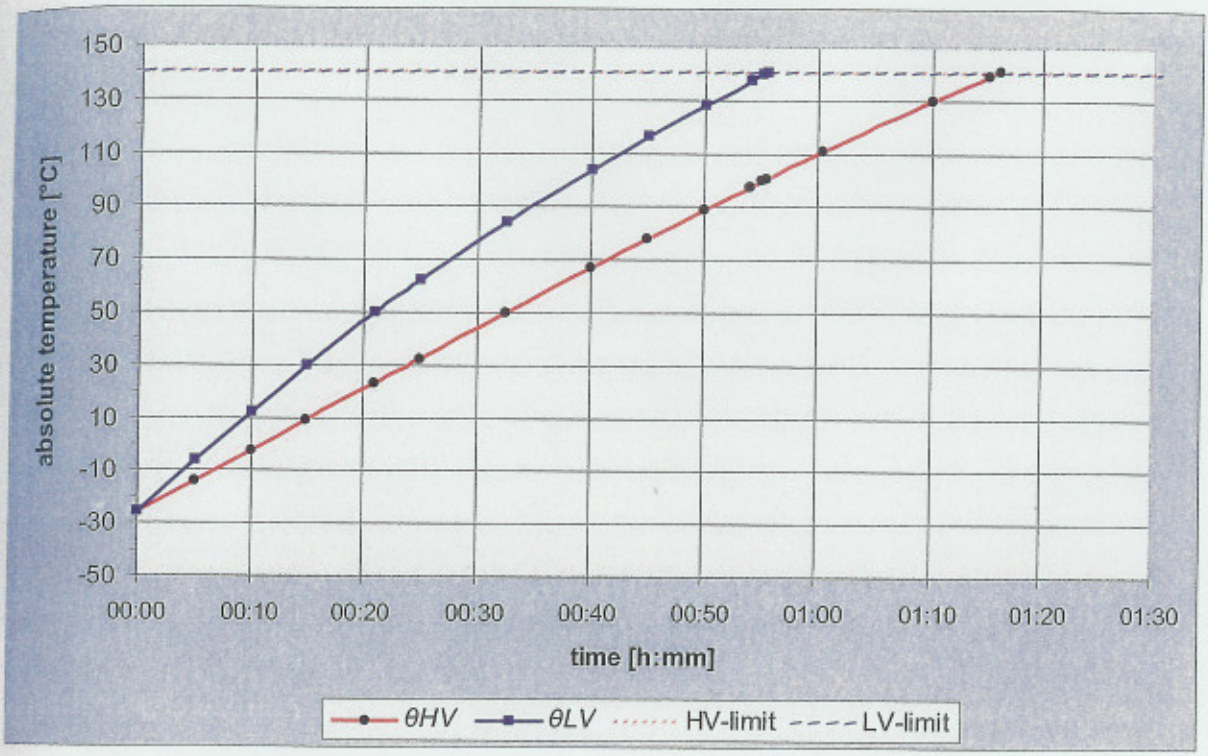


Figure 2 Thermal-shock test, temperatures on primary (HV) and secondary (LV).

Requirements

When visually inspected, the windings shall show no visible abnormality, such as cracks or slits.

Result

No visual cracks and/or slits have been detected.

4.1.1 Separate-source AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 19
Test date	23 October 2007

Environmental conditions

Ambient temperature	19 °C	Ambient air pressure	1024 hPa
Temperature of test object	19 °C	Humidity	6 g/m^3

winding	tap position	voltage (kV)	frequency (Hz)	duration (min)	result
HV	3	22,4	50	1	passed
LV		2,4	50	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric tests.

Result

The tests have been passed with satisfactory results.

4.1.2 Induced AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 20
Test date	23 October 2007

Environmental conditions

Ambient temperature	19	°C	Ambient air pressure	1024	hPa
Temperature of test object	19	°C	Humidity	6	g/m^3

winding	tap position	voltage (V)	frequency (Hz)	duration (min)	result
LV	3	640 (0,8 x $2U_r$)	100	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric test.

Result

The tests have been passed with satisfactory results.

4.1.3 Partial discharge measurement (routine test)

Requirements and date

Standard	IEC 60076-11, clause 22.4.1.1
Test date	23 October 2007

Environmental conditions

Ambient temperature	19	°C	Ambient air pressure	1024	hPa
Temperature of test object	19	°C	Humidity	6	g/m^3

Circuit parameters

Power frequency	100	Hz	Calibration	5	pC
Bandwidth	40-400	kHz	Noise level	1	pC
Coupling capacitors	2600	pF	Circuit	direct	

phase	phase-to-earth voltage	frequency	duration	partial discharge level	inception		extinction		result
	(kV / xU_r)	(Hz)	(min)	(pC)	(kV)	(pC)	(kV)	(pC)	
1U	9,2 / 1,6U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed
1V	9,2 / 1,6U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed
1W	9,2 / 1,6U_r	100	0,5	≤ 1	-	-	-	-	
	7,5 / 1,3U_r	100	5	≤ 1	-	-	-	-	passed

Requirement

The maximum level of partial discharges shall be 10 pC.

Result

The tests have been passed with satisfactory results. The transformer complies with the requirements for climatic C2 class.

5 ENVIRONMENTAL TEST FOR E2 CLASS

5.1 Condensation test for E2 class transformers

Requirements and date

Standard	IEC 60076-11, clause 26.3.2
Test date	23 and 24 October 2007

Environmental conditions

Ambient temperature	16	°C	Conductivity of saline water	1,5	S/m
Temperature of test object	15	°C	Humidity	> 93	%
			Duration of salt fog period	6	h

Test details

Transformer placed in outdoor test chamber (tent) in order to cool down	23 October 2007	16h00
Start of continuous atomizing salt water	24 October 2007	09h15
End of continuous atomizing salt water	24 October 2007	15h15
Start of energizing transformer at 1,1U_r	24 October 2007	15h16
End of energizing transformer at 1,1U_r	24 October 2007	15h31

terminals	earthed	applied voltage (V)	frequency (Hz)	duration (min)	observations	result
2U–2V–2W	2N, core/frame	440 (1,U_r)	50	15	no breakdown, no flashover and no sparking	passed

Requirements

During the voltage application, no flashover shall occur and visual inspection shall not show any serious tracking.

Result

The test has been passed with satisfactory results.

5.2 Humidity penetration test for E2 class transformers

Requirements and date

Standard	IEC 60076-11, clause 26.3.2
Test date	24 - 30 October 2007

Environmental conditions

Ambient temperature	50	°C	Humidity	90	%
Temperature of test object	50	°C	Duration of humidity penetration	144	h

Test details

Transformer placed in climatic test chamber under test conditions	24 October 2007	16h30
End of humidity penetration period	30 October 2007	16h30
Start of dielectric tests	30 October 2007	16h35
End of dielectric tests	30 October 2007	17h00

5.2.1 Separate-source AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 19
Test date	30 October 2007

Environmental conditions

Ambient temperature	20	°C	Ambient air pressure	1015	hPa
Temperature of test object	< 50	°C	Humidity	9	g/m^3

winding	tap position	voltage (kV)	frequency (Hz)	duration (min)	result
HV	3	22,4	50	1	passed
LV		2,4	50	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric tests.

Result

The tests have been passed with satisfactory results.

5.2.2 Induced AC withstand voltage test

Requirements and date

Standard	IEC 60076-11, clause 20
Test date	30 October 2007

Environmental conditions

Ambient temperature	20	°C	Ambient air pressure	1015	hPa
Temperature of test object	< 50	°C	Humidity	9	g/m^3

winding	tap position	voltage (V)	frequency (Hz)	duration (min)	result
LV	3	640 (0,8 x2U_r)	100	1	passed

Requirements

There should be neither flashover nor breakdown during the dielectric test.

Result

The tests have been passed with satisfactory results. The transformer complies with the requirements for environmental E2 class.

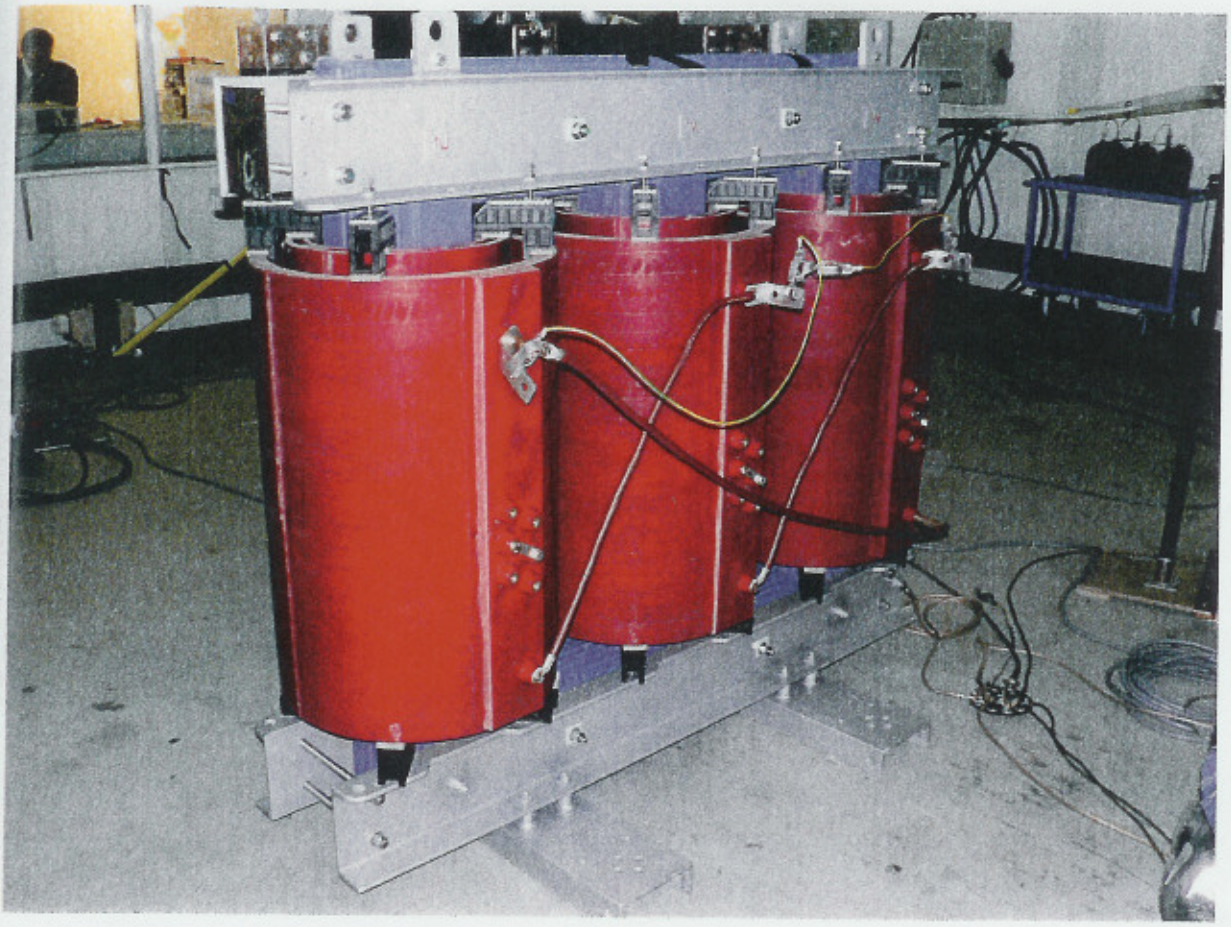
A MEASUREMENT UNCERTAINTIES

The measurement uncertainties in the results presented are as specified below unless otherwise indicated.

measurement	measurement uncertainty
dielectric tests and impulse current tests	peak value: ≤ 3% time parameters: ≤ 10%
capacitance measurement tan δ measurement	0,3% ± 0,5% ± $5x10^{-5}$
partial discharge measurement	< 10 pC : 2 pC 10 - 100 pC : 5 pC > 100 pC : 20 %
measurement of impedance ac-resistance measurement	≤ 1%
measurement of losses	≤ 1%
measurement of insulation resistance	≤ 10%
measurement of dc resistance	1 μΩ - 5 μΩ : 1% 5 μΩ - 10 μΩ : 0,5% 10 μΩ - 200 μΩ : 0,2%
radio interference test	2 dB
calibration of current transformers	2,2 x 10^{-4} Ii/Iu and 290 μrad
calibration of voltage transformers	1,6 x 10^{-4} Ui/Uu en 510 μrad
measurement of conductivity	5%
measurement of temperature	-50 °C- -40 °C: 3 K -40 °C- 125 °C : 2 K 125 °C - 150 °C : 3 K
tensile test	1%
sound level measurement	type 1 meter as per IEC 651 and ANSI S1.4.1971
measurement of voltage ratio	0,1%

B PHOTOGRAPHS OF THE TEST OBJECT

2 pages



Photograph 1 Transformer seen from the high-voltage side

Photograph 2 Transformer seen from the low-voltage side