



RESEARCH-DEVELOPMENT AND TESTING NATIONAL
INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA
ROMANIA

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TEST REPORT
No. 9810 / January 25, 2007

Tested product: 22000/100 V outdoor voltage transformer

Test: Determination of errors
Short-circuit withstand capability test

Test method: According to IEC 60044-2/2003, clauses 13.6, 8.2 and 13.7

Test date: January 25th, 2007

Test result: Passed the tests

Head of LMP:
Dr. Eng. George Curcanu



Responsible for quality assurance:
Eng. Constantin Ilinca



Responsible for test group:
Eng. Constantin Iancu

Responsible for test:
Eng. I. Sboru

Test witnesses: -

Report has 7 pages and 2 annexes and it is edited in 4 copies from which 3 copies for customer.

Note:

1. Publication or reproduction of the contents of this report in any other form unless its complete photocopying is not allowed without laboratory writing approval.
2. Results refer to test product only.

P101-01

CUSTOMER Fabrika Mernih Transformatora ZAJEČAR A.D.
Paraćinski put b.b. 19000
ZAJEČAR- SRBIJA

MANUFACTURER Fabrika Mernih Transformatora ZAJEČAR A.D.
Paraćinski put b.b. 19000
ZAJEČAR- SRBIJA

IDENTIFICATION OF APPARATUS

Type	VTOP 2-20
Serial number/year	1/07
Technical specification / Drawing	See page 6
Order no.:	Contract No. 3247/20.11.2006 and Additional No.1
Product receiving's date:	January 2007
Product condition at receiving	New.

PERFORMANCES ESTABLISHED BY PRODUCER

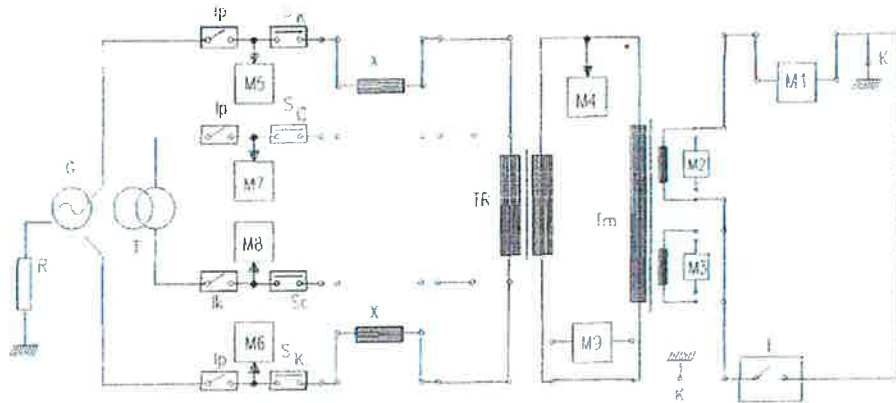
Rated primary voltage	22000	V
Rated secondary voltage	100	V
Rated frequency	50	Hz
Accuracy burden	200	VA
Accuracy class	3P	
Rated duration of short-circuit	1	s
Voltage factor	1.2	Un

TEST PROGRAM

1. Determination of errors according to IEC 60044-2, clause 13.6.
2. Short-circuit withstand capability test at the following parameters:
Uap = 22000 V, Tsc = 1 s.
3. Tests performed after short-circuit withstand capability test :
 - 3.1 Power frequency withstand test on primary winding and partial discharge measurement according to IEC 60044-2, clause 9.2
 - 3.2 Power frequency withstand test between sections and secondary windings according to IEC 60044-2, clause 9.3
 - 3.3 Determination of errors according to IEC 60044-2, clause 13.7

TEST REPORT DOCUMENTATION: Oscillograms 1 ; Tables 3 ;
Photos 1 ; Drawings 1 ;

TESTING AND MEASURING DIAGRAM



- G - Short-circuit generator
- T - Power transformer
- Ip - 12 kV protection circuit breaker
- Ik - 6 kV circuit breaker
- I - 24 kV circuit breaker
- Sk - 12 kV making switch
- Sc - 6 kV making switch
- X - Reactor
- R - Resistance
- TR - Shock step up transformer
- Tm - Measuring transformer tested
- M1-M9 - Measuring points
- K - Earthing point

DATA OF TESTING AND MEASURING CIRCUIT

Table I

Test		Short-circuit withstand capability test
Phases number		2
Source / connection		G3/Y
Transformer /Rate		TR 5, 6 / 5.35
Earthing	Source	-
	Apparatus	Net earthing connection
Reactor	[Ω]	9.7
Power factor		< 0.15
M5 - Source voltage – Voltage transformer 15000 V/100 V		
M4 - Applied voltage – Voltage transformer 35000 V / 100 V		
M1 - Apparatus current – Shunt 2 kA / 2 V		

VALUES OBTAINED ON TESTS**1. Determination of errors**

This test was performed in LIAE of Electroputere factory.

Test results are presented in Test Report No. 1/07/22.1.2007 annexed.

2. Short-circuit withstand capability test

This test was performed at primary voltage $U_p = 22000V$ with the secondary winding short-circuited.

Table 2

Oscillogram No.	U_{ap} [V]	I [A]	T_{sc} [sec]	Remarks
67992/2007	22300	79.3	1	2a-2b winding

Measurements were performed with uncertainty of: 3% for voltage; 3% for current; 2.5% for time and the confidence level $P = 95\%$.

SYMBOLS USED IN TABLES AND OSCILLOGRAMS

U_{ap} = Voltage on primary winding

I = R.m.s. value of short - circuit current through the secondary winding

T_{sc} = The duration of short - circuit

U_s = Suply source voltage

3. Tests performed after short-circuit withstand capability test

3.1. Power frequency withstand test on primary winding and partial discharge measurement was performed in High Voltage Laboratory of ICMET-Craiova.

Test results are presented in Test Report No. 41004

3.2. Power frequency withstand test between sections and secondary windings was performed in High Voltage Laboratory of ICMET-Craiova.

Test results are presented in Test Report No.41004

3.3. Determination of errors (after short-circuit withstand capability test)

This test was performed in LIAE of Electroputere factory.

Test results are presented in Test Report No. 1/07/24.01.2007 annexed.

ASSESSMENT OF THE TEST

The transformer shall be deemed to have passed this test if, after cooling to ambient temperature, it satisfies the following requirements:

Table 3

Requirements	Result
a) voltage transformer is not visibly damaged	Fulfilled
b) its errors do not differ from those recorded before tests by more than half limits of error in its accuracy class	Fulfilled, see Test Report No. 1/07/22 and 24.01.2007 annexed
c) it withstands the dielectric tests specified in 9.2 and 9.3 from IEC 60044-2, but with a voltage reduced to 90% of those given	Fulfilled, see Test Report No. 41004
d) on examination, the insulation next to the surface of both the primary and the scondary windings does not show significant deterioration	Fulfilled

Remark :

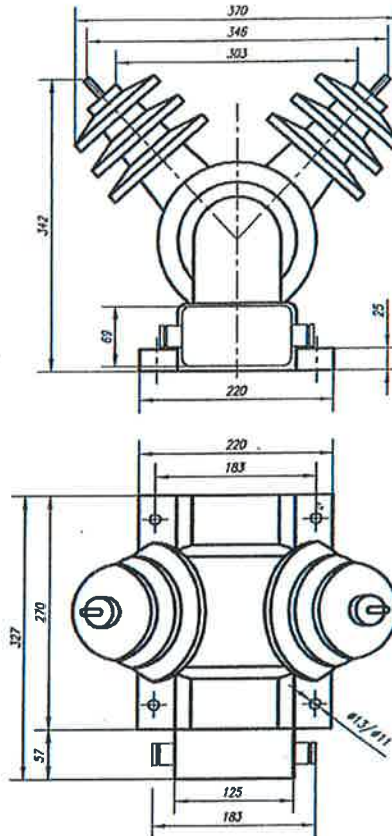
Aspect of the voltage transformer in the test circuit is presented in photo from page 5.

Environment temperature during the test was 12°C.



Photo – Aspect of the voltage transformer in the testing circuit

Broj (veza)	Naziv Outdoor Voltage Transformer VTOP 2 - 20	VTOP 2 - 20
		Izvršno ra



TECHNICAL DATA:

Type	VTOP2	-	20
Highest voltage for equipment [kV]			24
Rated primary voltage [kV]	TABLE STANDARTIZED TRANSFORMERS		
Rated secondary voltage [V]	TABLE STANDARTIZED TRANSFORMERS		
Power frequency test voltage [kV/1min]			50
Lightning impulse test voltage [kV]			125
Rated frequency [Hz]			50, 60
Rated voltage factor/rated duration			1,2Un
Weight [kg]			28
Mounted	in any position		
Temperature rang: [°C]	-55°C to 75 °C		
Normative references	IEC 60044-2		



D.O.O. 'FMT'
ZAJECAR

	Ime i prezime	Datum	Polpis	Broj lista
Obradio	M.Sokolovic	03.04.2006		
Kontrolisao	M.Gajic, BSEE			



Oscillogram No. 67992 / 2007

**S.C. ELECTROPUTERE CRAIOVA-ROMANIA**

DIVIZIA APARATAJ ELECTRIC

LABORATORUL DE ÎNCERCĂRI APARATE ELECTRICE

1100, CRAIOVA, ROMANIA LIAE Fax:0251/438740

CALEA BUCURESTI,144

Tel:0251/437441;438775

TEST REPORT No:1 /07

VOLTAGE TRANSFORMER

Type VTOP 2-20

Rated voltage 22000/100 V

Serial number:1/ 07

Accuracy class 3

Burden 200 VA

Standard IEC-60044-2

Frequency 50 Hz

TEST REPORT**1.Before short-circuit withstand capability test****1.1 Verification of terminal markings and polarity****Result: passed the test****1.2. Test for accuracy**

Windings	Accuracy class	U/Un [%]	Ratio error ϵ [%] 1/1 Zn	Ratio error ϵ [%] 1/4 Zn	Phase displacement [δ] (min) 1/1 Zn	Phase displacement [δ] (min) 1/4 Zn
2a - 2b Zn= 200VA	3	80	-0,96	+0,83	+1	0
		100	-1,04	+0,75	+4	+3
		120	-1,15	+0,64	+8	+8

Result: passed the test**2.Test results were satisfactory according to IEC-60044-2**

HEAD OF LABORATORY

FOREMAN

METROLOGIST

dipl.eng.. Dronisie T.

dipl.eng. Marin N

Predoi N.


Date 24.01.2007

- Notes: 1.The result of tests refers only to the Voltage Transformer, which is under testing.
2.The total or partial copyright of this test report is forbidden.
3.This test report contains 1 page.

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Tel:0251/437441;438775

TEST REPORT No:1 /07

VOLTAGE TRANSFORMER

Serial number:1/ 07

Standard IEC-60044-2

Type VTOP 2-20

Rated voltage 22000/100 V

Accuracy class 3

Burden 200 VA

Frequency 50 Hz

TEST REPORT**1.After short-circuit withstand capability test****1.1 Verification of terminal markings and polarity****Result: passed the test****1.2. Test for accuracy**

Windings	Accuracy class	U/Un [%]	Ratio error ϵ [%] 1/1 Zn	Ratio error ϵ [%] 1/4 Zn	Phase displacement [δ] (min) 1/1 Zn	Phase displacement [δ] (min) 1/4 Zn
2a - 2b Zn= 200VA	3	80	-0,97	+0,82	+1	0
		100	-1,06	+0,72	+4	+3,6
		120	-1,19	+0,0	+9	+8,7

Result: passed the test**2.Test results were satisfactory according to IEC-60044-2****HEAD OF LABORATORY****FOREMAN****METROLOGIST**

dipl.eng.. Dionisie T.

dipl.eng. Marin N

Predoi N.


Date 22.01.2007

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