



RESEARCH-DEVELOPMENT AND TESTING NATIONAL  
INSTITUTE FOR ELECTRICAL ENGINEERING

## ICMET CRAIOVA ROMANIA

### "Ovidiu Rarinca" HIGH POWER LABORATORY- LMP

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INCERCARE



## TEST REPORT No. 9511 / 13.09.2005

SR EN ISO / CEI 17025 : 2001  
CERTIFICAT DE ACREDITARE  
Nr. 004 - L

**Tested product:** 36 kV, 10 A - 16 A - 20 A back-up fuses homogeneous series

**Test:** Breaking capacity in test duties 1, 2 and 3

**Test method:** According to IEC 60282-1/2002, clause 6.6

**Test date:** September 13-15, 2005

**Test result:** Passed the test

**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. Mihai Constantinov  
Eng. Corneliu Comes



**Test witnesses:** Eng. Uroš Kovač and Eng. Branko Pesan from ETI Elektroelement d.d

Report has 39 pages 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 and RENAR writing approval.
2. Results refer to test product only.
3. Accreditation of the laboratory or any of its Test Reports issued under accreditation regime do not constitute or do not imply themselves an approval of the product by RENAR which gave the accreditation or any other body.

P101-01ae

**CUSTOMER:** ETI Elektroelement d.d.  
Obrezija 5, 1411 Izlake, Slovenia

**MANUFACTURER:** ETI Elektroelement d.d.  
Obrezija 5, 1411 Izlake, Slovenia

## IDENTIFICATION OF APPARATUS

Type	VV-THERMO
Serial number/year	0000307286, 0000307287, 0000307288, 0000307268, 0000307269, 0000307270, 0000307292, 0000307296, 0000307297, 0000307274, 0000307275, 0000307276, 0000307294, 0000307289, 0000307282, 0000307280
Technical specification / Drawing	- / 365.103.T54; 365.103.T55
Order no.:	Contract No. 3152/ 15.08.2005
Product receiving's date:	12.09.2005
Product condition at receiving	New.

## PERFORMANCES ESTABLISHED BY PRODUCER

Rated voltage	[kV]	36
Rated current	[A]	10, 20
Rated frequency	[Hz]	50
Rated breaking capacity		
Breaking current $I_1$	[A]	16000
Breaking current $I_2$	[A]	590 ; 1040
Breaking current $I_3$	[A]	60 ; 100
Maximum switching-voltage	[kV]	112

## TEST PROGRAM

### 1. Test duty 1

- Calibration test at  $I_1 = 16$  kA
- Three verification of operation tests in test duty 1 at parameters:  $I_1 = 16$  kA,  $U_r = 31.32$  kV;  $U_c = 62$  kV, rate of rise =  $0.57$  kV/ $\mu$ s,  $\rho = 40^\circ \div 65^\circ$  (for 1 piece) and  $\rho = 65^\circ \div 90^\circ$  (for two pieces) for each of  $I_n = 10$  A and  $I_n = 20$  A.

### 2. Test duty 2

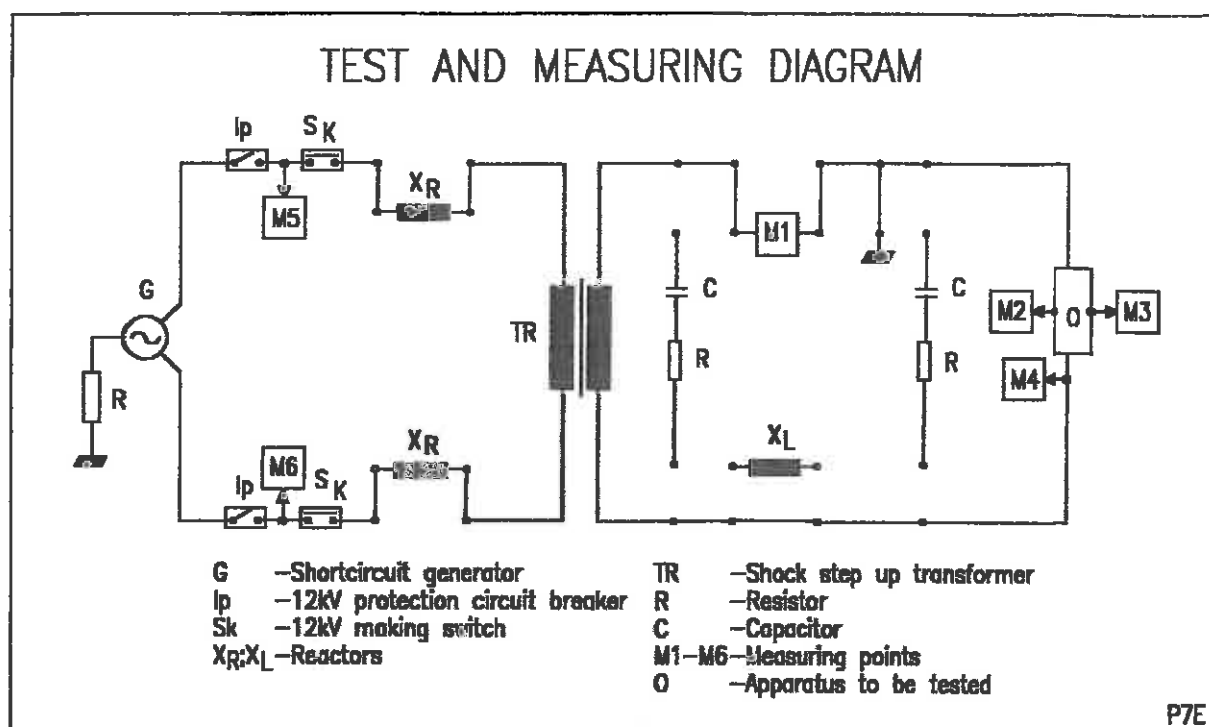
- Calibration test at  $I_2 = 590$  A
- Three verification of operation tests in test duty 2 of 10 A fuse at parameters:  $I_2 = 590$  A,  $U_r = 31.32$  kV;  $U_c = 66$  kV, rate of rise =  $0.203$ - $0.152$  kV/ $\mu$ s,  $\varphi = 0^\circ \div 20^\circ$ .
- Calibration test at  $I_2 = 1040$  A
- Three verification of operation tests in test duty 2 of 20 A at parameters:  $I_2 = 1040$  A,  $U_r = 31.32$  kV;  $U_c = 66$  kV, rate of rise =  $0.203$ - $0.152$  kV/ $\mu$ s,  $\varphi = 0^\circ \div 20^\circ$ .

### 3. Test duty 3

- Two verification of operation tests in test duty 3 of 10 A fuse at parameters:  $I_3 = 60$  A,  $U_r = 36$  kV.
- Two verification of operation tests in test duty 3 of 20 A fuse at parameters:  $I_3 = 100$  A,  $U_r = 36$  kV.

The tests are performed according to own procedure PT 03.03.

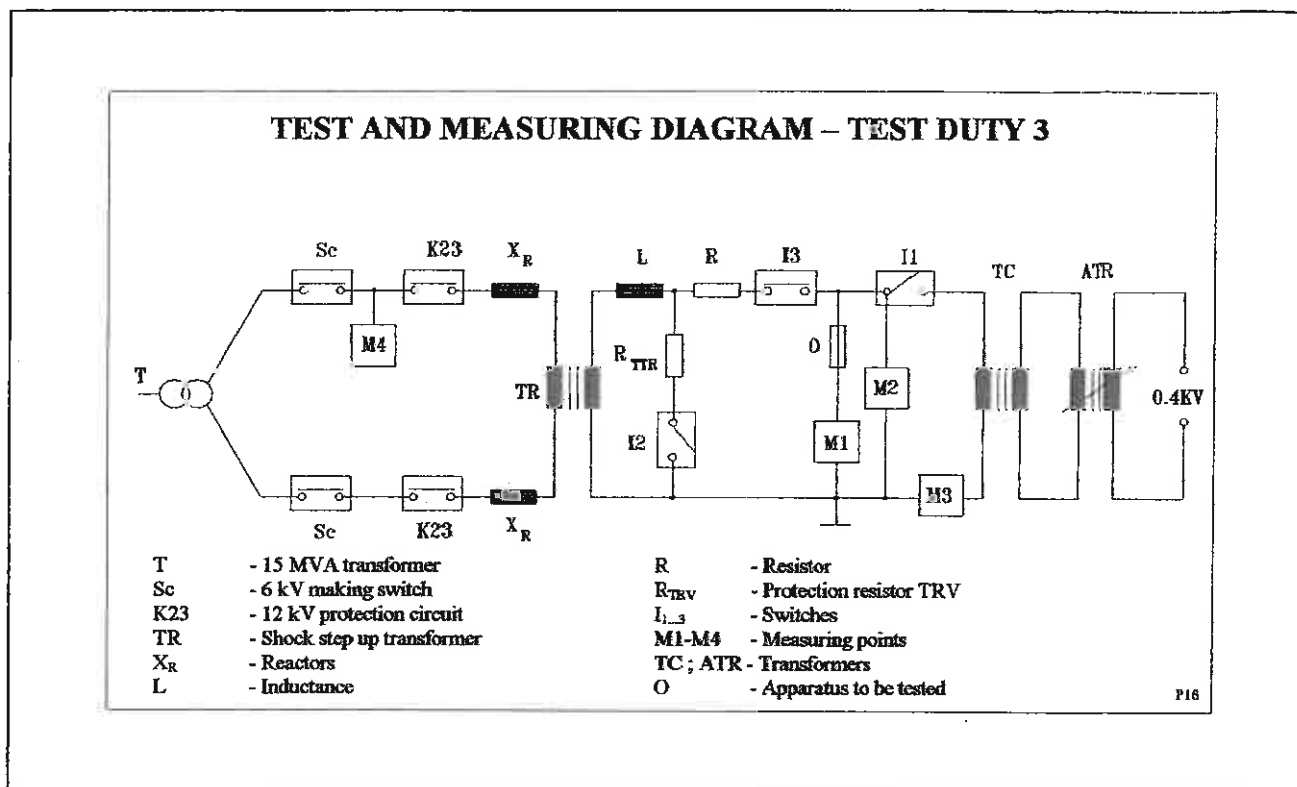
<b>TEST REPORT DOCUMENTATION</b>	Oscillograms	21 ; Tables	6 ;
	Photos	2 ; Drawings	4 ;



### DATA OF TESTING AND MEASURING CIRCUIT

Table 1

Rated current		10 A ; 20 A	10 A ; 20 A
Test duty		1	2
Phases number		2	2
Source/ connection		G2 / Y	G2 / Y
Transformer/rate		TR 5, 6, 8, 9 / 2.67	TR4 / 4.28
Earthing	Source	600 $\Omega$	600 $\Omega$
	Apparatus	Net earthing connection	
Reactor	[m $\Omega$ ]	125	2800 ; 1500
Power factor		< 0.15	< 0.15
Load circuit	Reactor X [ $\Omega$ ]	-	-
	Resistor R [ $\Omega$ ]	-	-
	Capacitor [ $\mu$ F]	-	-
	Power factor	-	-
T.R.V.	Capacitor [ $\mu$ F]	0.4	0.2 ; 0.2
adjustment	Resistor R [ $\Omega$ ]	75	340 ; 228
M1 - Apparatus current		Shunt 20 kA/2 V	Shunt 2 kA/ 2 V
M2 - Recovery voltage – Capacitive divider 50 kV / 7 V			
M5 - Supply source voltage – Voltage transformer 15000 V / 100 V			



### DATA OF TESTING AND MEASURING CIRCUIT

Table 2

Test duty		3
Phases number		2
Source/ connection		Network, 15 MVA transformer
Transformer/rate		TR 8, 9 / 8.56
Earthing	Source	-
	Apparatus	Net earthing connection
Reactor	[mΩ]	600 ; 50
Power factor		< 0.15
Load circuit	Reactor L [H]	1.36 ; 0.735
	Resistor R [Ω]	300; 162
	Capacitor [μF]	-
	Power factor	0.5
T.R.V.	Capacitor [μF]	-
adjustment	Resistor R [Ω]	26200 ; 14400
M1 – Apparatus current – Current transformer 100A/1A		
M2 – Recovery voltage – Capacitive divider 400 pF / 400 nF		
M4 – Supply voltage – Voltage transformer 15000 V / 100 V		