RESEARCH-DEVELOPMENT AND TESTING NATIONAL
INSTITUTE FOR ELECTRICAL ENGINEERING

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

TEST REPORT
No. 9692 / 23.06.2006

Tested product: 36 kV, 2 A - 6 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: February,1-7, 2006
June, 23-24, 2006

Test result: Passed the test

Head of LMP:
Dr. Eng. George Curcanu

ICMET LABORATORUL DE MARE PUTERE "OVIDIU RARINCA" CRAIOVA

Responsible for quality assurance:
Eng. Constantin Ilinca

ICMET - CRAIOVA AC LMP

Responsible for test group:
Eng. Constantin Iancu

Responsible for test:
Eng. Ilie Sbora

Test witnesses:

Report has 40 pages and it is edited in 4 copies from which 3 copie 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.

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
Technical specification / Drawing	- / 365.103.T61;
Order no.:	Contract Nos. 3173/29.11.2005 and 3210/22.05.2006
Product receiving date:	25.01.2006 and 20.06.2006
Serial number/year	For 2A fuses 0000426968, 0000426969, 0000426971, 0000426972, 0000426973, 0000426975, 00004269791, 0000426981 For 6A fuses 0000353999; 0000354003; 0000354004; 0000354005; 0000354006; 0000354007; 0000354008; 0000354009
Product condition at receiving	New.

PERFORMANCES ESTABLISHED BY PRODUCER

Rated voltage	[kV]	36
Rated current	[A]	2 ; 6
Rated frequency	[Hz]	50
Rated breaking capacity		
Breaking current I_1	[A]	16000
Breaking current I_2	[A]	130 ; 300
Breaking current I_3	[A]	15; 30
Maximum switching-voltage	[kV]	112

TEST PROGRAM

1. Test duty 1

- Calibration test at I_1 = 16 kA
- Three verifications of operation tests in test duty 1 at parameters: I_1 = 16 kA, Ur = 31.32 kV; Uc = 62 kV, rate of rise = 0.57 kV/µs, $\rho = 40° \div 65°$ (for 1 piece) and $\rho = 65° \div 90°$ (for two pieces) for 6 A fuse.
- Calibration test at I_1 = 16 kA
- Three verifications of operation tests in test duty 1 at parameters: I_1 = 16 kA, Ur = 31.32 kV; Uc = 62 kV, rate of rise = 0.57 kV/µs, $\rho = 40° \div 65°$ (for 1 piece) and $\rho = 65° \div 90°$ (for two pieces) for 2 A fuse.

2. Test duty 2

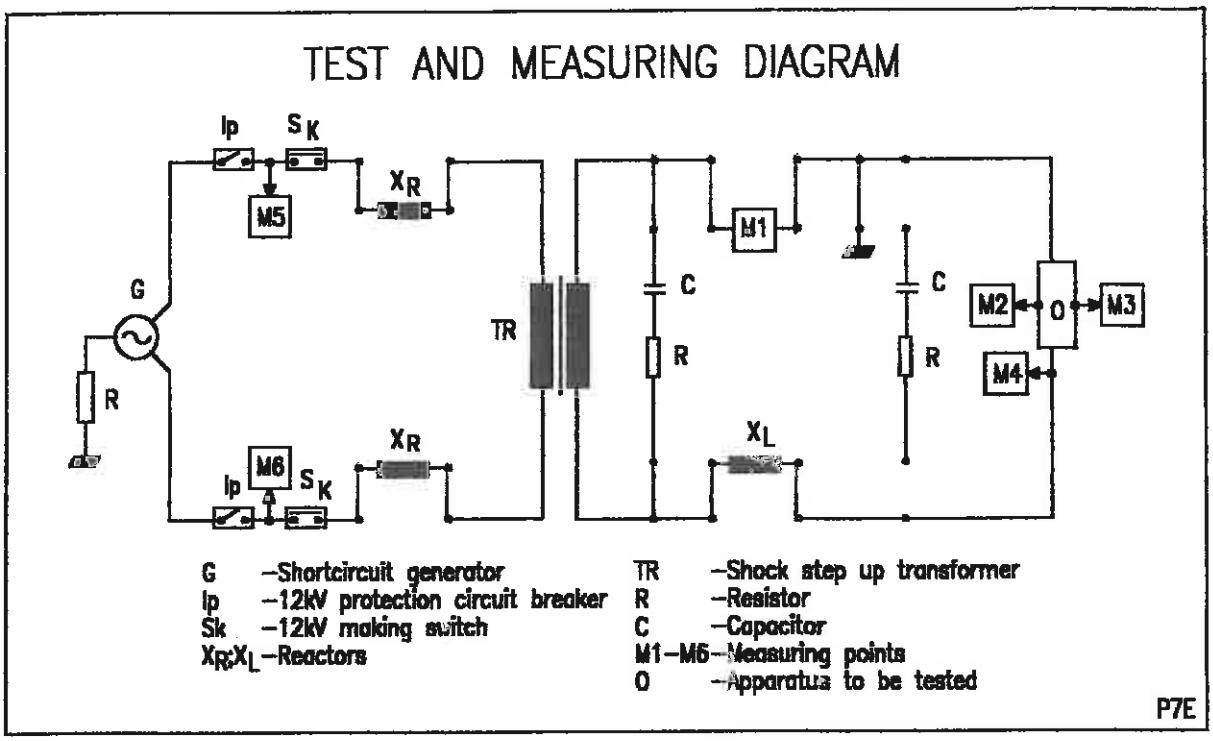
- Calibration test at I_2 = 300 A
- Three verifications of operation tests in test duty 2 of 6 A fuse at parameters: I_2 = 300 A, Ur = 31.32 kV; Uc = 66 kV, rate of rise = 0.203-0.152 kV/µs, $\varphi = 0° \div 20°$.
- Calibration test at I_2 = 130 A
- Three verifications of operation tests in test duty 2 of 2 A fuse at parameters: I_2 = 130 A, Ur = 31.32 kV; Uc = 66 kV, rate of rise = 0.203-0.152 kV/µs, $\varphi = 0° \div 20°$.

3. Test duty 3

- Calibration test at I_3 = 30 A
- Two verifications of operation tests in test duty 3 of 6 A fuse at parameters: I_3 = 30 A, Ur = 36 kV.
- Calibration test at I_3 = 15 A
- Two verifications of operation tests in test duty 3 of 2 A fuse at parameters: I_3 = 15 A, Ur = 36 kV.

The tests are performed according to own procedure PT 03.02.

TEST REPORT DOCUMENTATION Oscillograms 27 ; Tables 6 ;
Photos 1 ; Drawings 3 ;

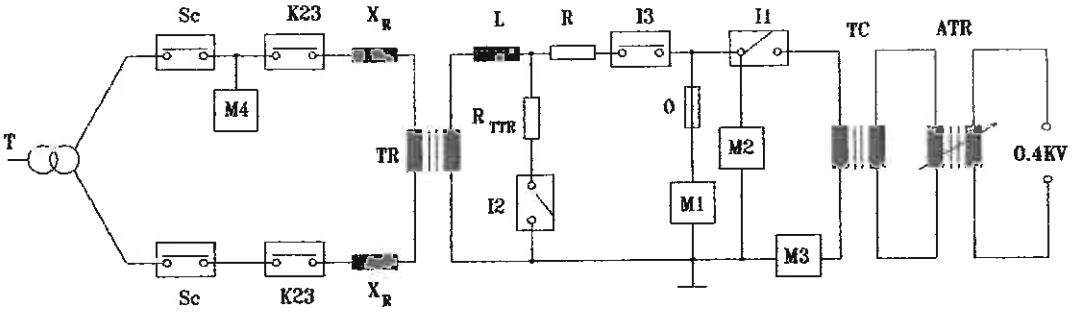


DATA OF TESTING AND MEASURING CIRCUIT

Table 1

Rated current		2 A ; 6 A	2 A ; 6 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 Ω	600 Ω
	Apparatus	Net earthing connection	
Reactor [mΩ]		125	8000 ; 3100
Power factor		< 0.15	< 0.15
Load circuit	Reactor X [Ω]	-	-
	Resistor R [Ω]	-	-
	Capacitor [μF]	-	-
	Power factor	-	-
T.R.V. adjustment	Capacitor [μF]	0.4	0.2 ; 0.2
	Resistor R [Ω]	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			

TEST AND MEASURING DIAGRAM – TEST DUTY 3



T	- 15 MVA transformer	R	- Resistor
Sc	- 6 kV making switch	R_{TRV}	- Protection resistor TRV
K23	- 12 kV protection circuit	$I_{1..3}$	- Switches
TR	- Shock step up transformer	M1-M4	- Measuring points
X_R	- Reactors	TC ; ATR	- Transformers
L	- Inductance	O	- Apparatus to be tested

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DATA OF TESTING AND MEASURING CIRCUIT

Table 2

Fuse		2A	6A
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]		250
Power factor		< 0.15	
Load circuit	Reactor L [H]	6600	1000
	Resistor R [Ω]	1200	425
	Capacitor [μF]	-	
	Power factor	0.5	
T.R.V. adjustment	Capacitor [μF]	-	
	Resistor R [Ω]	7434	
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			