



RESEARCH-DEVELOPMENT AND TESTING NATIONAL
INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA ROMANIA

"Ovidiu Rarinca" HIGH POWER LABORATORY- LMP
200515-CRAIOVA Calea Bucuresti Nr. 144 ROMANIA
Phone: +40 351 402427; Fax: +40251 415482; +40251 416726;
E-mail: lmp@icmet.ro

RESEARCH



TEST REPORT No. 9513 / 14.09.2005

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

Tested product: 36 kV, 25 A - 32 A - 40 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 | 0000307257, 0000307255, 0000307262, 0000307240, 0000307241, 0000307242, 0000307258, 0000307266, 0000307265, 0000307248, 0000307250, 0000307249, 0000307253, 0000307254, 0000307244, 0000307245 |
| Technical specification / Drawing | - / 365.103.T58; 365.103.T59 |
| 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] | 25, 40 |
| Rated frequency | [Hz] | 50 |
| Rated breaking capacity | | |
| Breaking current I ₁ | [A] | 16000 |
| Breaking current I ₂ | [A] | 1040; 1950 |
| Breaking current I ₃ | [A] | 128; 213 |
| Maximum switching-voltage | [kV] | 112 |

TEST PROGRAM

1. Test duty 1

- Calibration test at I₁ = 16 kA
- Three verification of operation tests in test duty 1 at parameters: I₁ = 16 kA, U_r = 31.32 kV; U_c = 62 kV, rate of rise = 0.57 kV/μs, ρ = 40° ÷ 65° (for 1 piece) and ρ = 65° ÷ 90° (for two pieces) for each of I_n = 25 A and I_n = 40 A.

2. Test duty 2

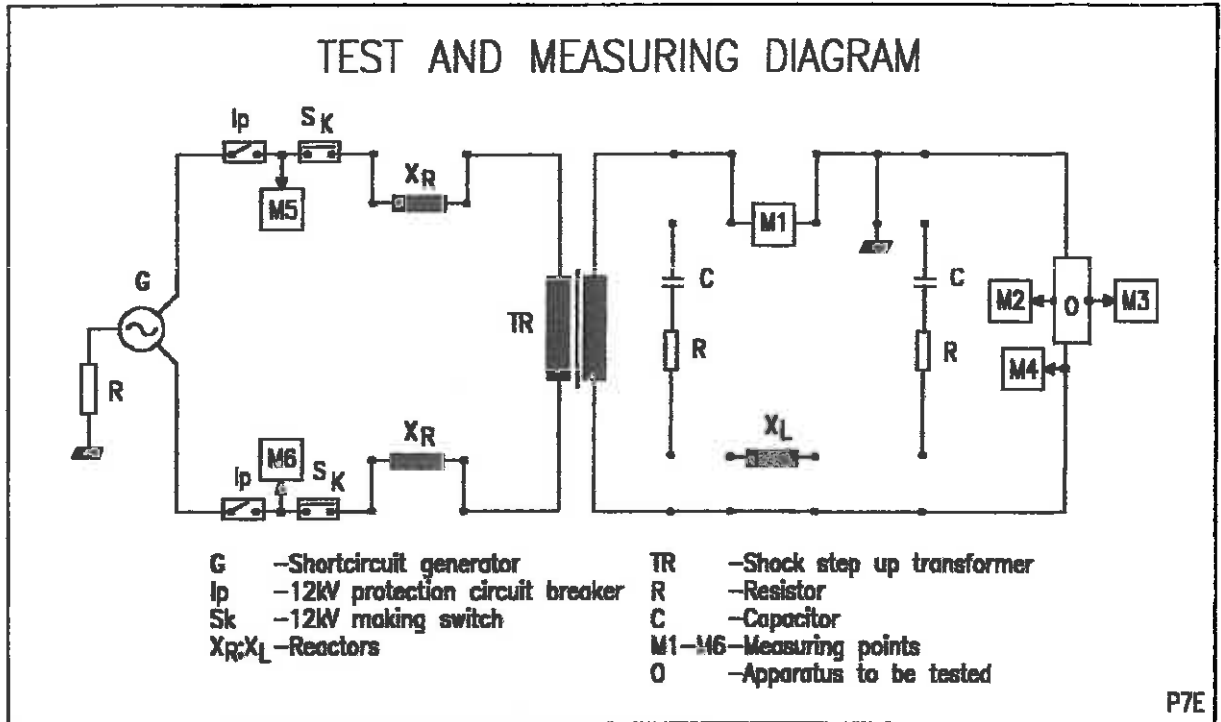
- Calibration test at I₂ = 1040 A
- Three verification of operation tests in test duty 2 of 25 A fuse at parameters: I₂ = 1040 A, U_r = 31.32 kV; U_c = 66 kV, rate of rise = 0.203-0.152 kV/μs, φ = 0° ÷ 20°.
- Calibration test at I₂ = 1950 A
- Three verification of operation tests in test duty 2 of 40 A at parameters: I₂ = 1950 A, U_r = 31.32 kV; U_c = 66 kV, rate of rise = 0.203-0.152 kV/μs, φ = 0° ÷ 20°.

3. Test duty 3

- Two verification of operation tests in test duty 3 of 25 A fuse at parameters: I₃ = 128 A, U_r = 36 kV.
- Two verification of operation tests in test duty 3 of 40 A fuse at parameters: I₃ = 213 A, U_r = 36 kV.

The tests are performed according to own procedure PT 03.03.

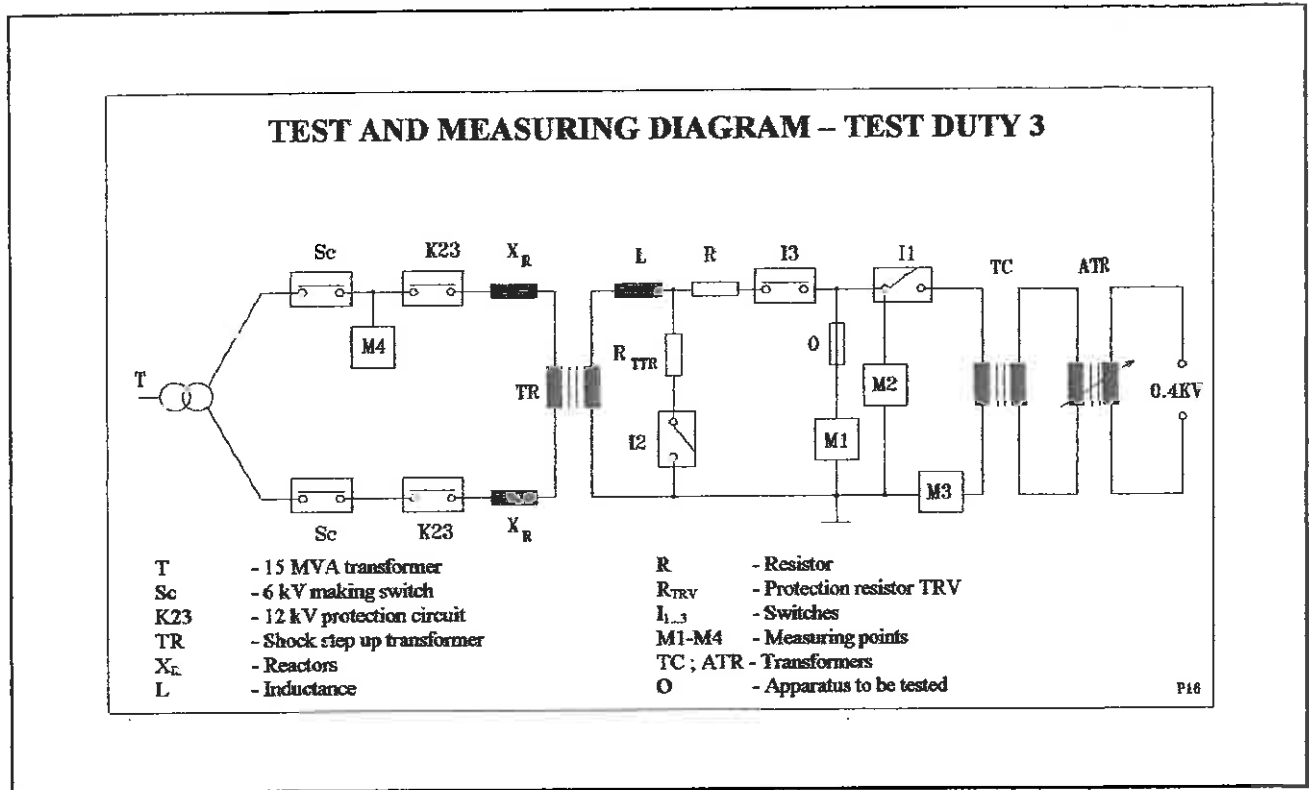
| | | | |
|----------------------------------|--------------|--------------|-----|
| TEST REPORT DOCUMENTATION | Oscillograms | 21 ; Tables | 6 ; |
| | Photos | 2 ; Drawings | 4 ; |



DATA OF TESTING AND MEASURING CIRCUIT

Table 1

| | | | |
|--|----------------|-------------------------|----------------|
| Rated current | | 25 A ; 40 A | 25 A ; 40 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 | 1500 ; 700 |
| Power factor | | < 0.15 | < 0.15 |
| Load circuit | Reactor X [Ω] | - | - |
| | Resistor R [Ω] | - | - |
| | Capacitor [μF] | - | - |
| | Power factor | - | - |
| T.R.V. | Capacitor [μF] | 0.4 | 0.2 ; 0.6 |
| adjustment | Resistor R [Ω] | 75 | 228; 105 |
| 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] | 33.3 ; 33.3 |
| Power factor | | < 0.15 |
| Load circuit | Reactor L [H] | 0.6 ; 0.3 |
| | Resistor R [Ω] | 123 ; 71 |
| | Capacitor [μF] | - |
| | Power factor | 0.5 |
| T.R.V. | Capacitor [μF] | - |
| adjustment | Resistor R [Ω] | 11500 ; 6760 |
| M1 – Apparatus current – Current transformer 200A/1A | | |
| M2 – Recovery voltage – Capacitive divider 400 pF / 400 nF | | |
| M4 – Supply voltage – Voltage transformer 15000 V / 100 V | | |