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RVM 5462

Advanced Automatic Recovery Voltage Meter for Diagnosis of Oil Paper Insulation

■ The Recovery Voltage Method is based on established knowledge: the phenomenon of the polarization of oil/paper impregnated insulation.

Many “high-voltage-working people“ have made this painful experience: of short-circuiting a high voltage capacitor (which was previously charged with a direct voltage), of measuring a voltage more or less 0 V and so believing that the capacitor is completely discharged, of touching the connectors of the capacitor and of feeling a shock. This shock is due to the polarization of the insulation.

There are different types of polarization. In case of moist oil-paper insulation, there is a polarization due to the water molecules contained in the insulation. By applying a DC voltage, these molecules (which were electrically neutral) acquire a polarity and try to drift in the direction of the electrical field. That means, molecules are now energized. We can short circuit and afterwards open the circuit. Some energy is still stored in the molecules. We can measure a voltage due to this stored energy, which is called the „recovery voltage“.

By this method, insulation condition is examined by tracing the polarization spectrum from the results of the recovery voltage measurements.

The instrument, the Recovery Voltage Meter model RVM 5462, which is the successor of the very well known model RVM 5461, effectively completes the range of the conventional insulation diagnosis methods, e.g. dissipation factor (tan δ) and partial discharge measurements, oil analysis, and so on.

Our specialists will gladly advise you on the use of the method and of the instrument. Furthermore, they will help you for the analysis and interpretation of the results.

FEATURES

- ☑ Measurement methods**: Charging Voltage, Recovery Voltage**, Initial voltage rise slope, Peak recovery voltage, Time to peak, Insulation resistance, Polarization index, Polarization current, Interference voltage
- ☑ **Automatic** microprocessor-controlled measurement
- ☑ Definable test procedure helps in reducing the test time
- ☑ Built-in thermal **Printer**
- ☑ **RS 232 C** interface for computer connection
- ☑ Built-in test box for **self testing**
- ☑ Analysis software available optionally
- ☑ **A handy portable instrument,** specially designed to withstand the harshest of environments
- ☑ **LCD screen** shows results in alpha-numerical and graphical form

BENEFITS

Non-destructive diagnosis of the state of paper-oil insulation systems (effect of moisture content and ageing on power transformers).

Easy to use, ready to measure on power transformers **without any knowledge about geometrical or electrical configurations.**

Clear results indications, as **water content in paper** (in percentage) and recommended maximum temperature on the transformer.

APPLICATIONS

- ■ On-Site diagnosis of oil paper isolation on power transformers.
- ■ Factory detection of non convenient power transformers drying procedures**.**

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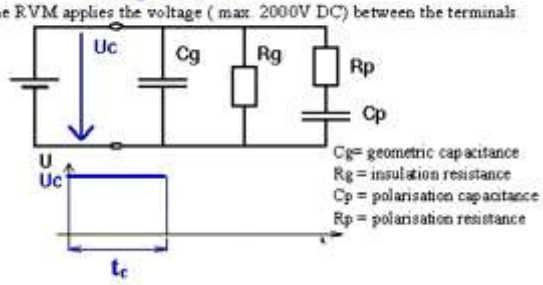
PRINCIPLE OF MEASUREMENT

FIRST STEP

Charge Time tc

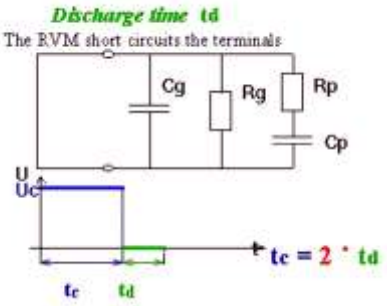
The RVM applies the voltage (max. 2000V DC) between the terminals



SECOND STEP

Discharge time td

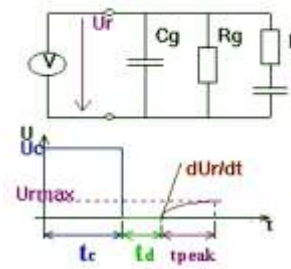
The RVM short circuits the terminals



THIRD STEP

Measurement

The RVM measures and records the following values

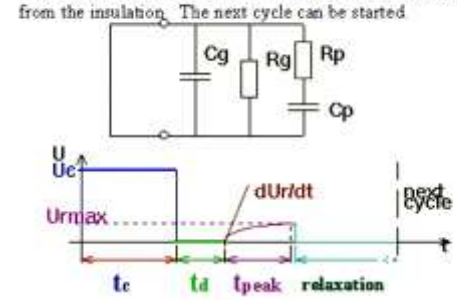


- Urmax = max recovery voltage
- tc = charge time
- dUr/dt = initial slope
- tpeak = time to the max. recovery voltage
- actual time (in hours and minutes) of the start of this third step

FOURTH STEP

Relaxation

The RVM short circuits the terminals to remove all the polarisation from the insulation. The next cycle can be started



The described measuring cycle is repeated at each charging time.

RESULT ANALYSIS

An evaluation of the measured spectra according to Fig. 3 clearly shows the change of state of the insulation. The displacement of the curve peak towards small time-constants signifies a degradation of the dielectric.

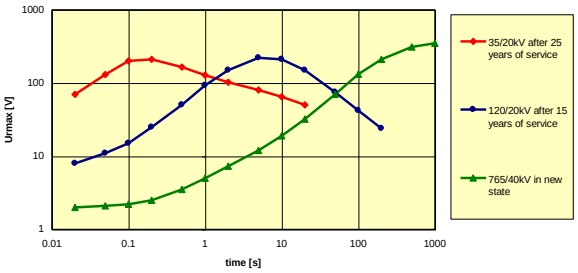
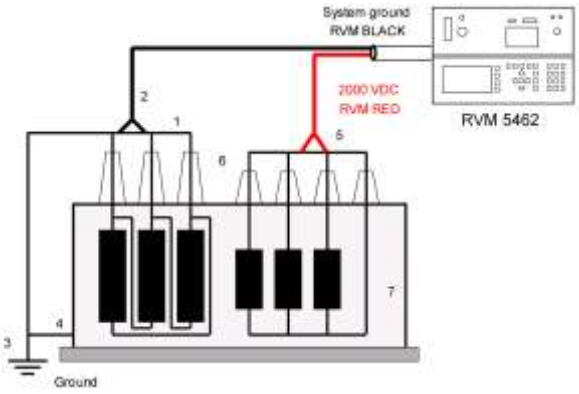


Fig. 3: Examples of polarisation spectrum curves: various transformers of different age

TEST CONNECTION



1. High voltage side of transformer to be short circuited and grounded
2. **Black Clip**, Ground of RVM to, be connected to HV Side
3. Transformer tank to be grounded
4. **Red Clip** of RVM to be connected to the Shorted LV side. Care should be taken that the RVM test voltage is lower than the rated voltage of the connected winding.
5. Bushings should be clean and proper contacts to test cables should be ensured
6. Oil and paper temperature must be stable

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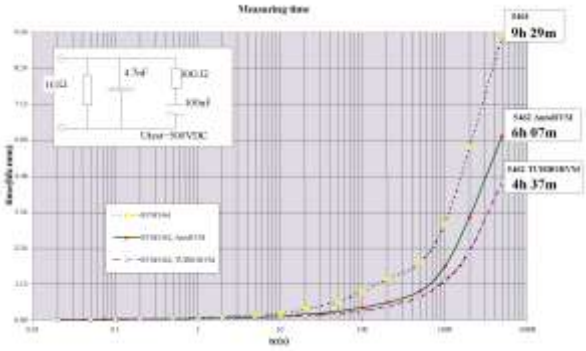
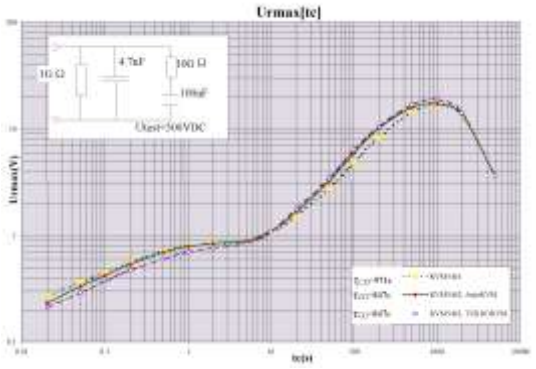
MEASURING TIME

Testing time has been drastically reduced using the feature “Turbo RVM”, allowing a complete test in around 4 hours, this time can be easily reduced as the best is the transformer the shorter the peak is located, therefore measuring times over 2’000 seconds are normally not requested, on this circumstances a measuring time of 2 hours can be reached.



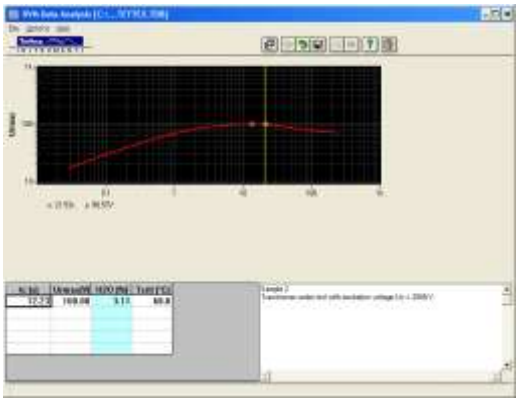
Test results and corresponding measuring times (bottom figure) of three different RVM tests performed on a test box simulating a new transformer with nominal time constant of 1000s (the capacitance and resistance elements used to build the test box have a tolerance of ±10%, i.e. the range of the simulated dominant time constant is between 810s and 973s).



For advance users, is possible to define an “own test procedure“ inserting the criteria for curve recording and peak detection.

ANALYSIS OF SOFTWARE

The optional additional software 5462/SWRVM2 allows easy and fast evaluation of the measurement results, providing information as the water content in the paper and the recommended maximum running temperature for the transformer.



The software use the database created by the 5461/SWRVM1 software (included in the scope of supply) and allows temperature corrections and header data modifications.

In addition, other graphics like tpeak in function of tc or dUr/dt in function of Urmax are available for expertise evaluation.

Easy to use reporting tool is also included to create Taylor made measurement results reports.

SCOPE OF SUPPLY

Standard supply

Type 5462 recovery voltage meter (RVM) with incorporated RS 232C interface, external printer connector, built-in test box for self testing and thermal paper printer.

Qty. 1 Tri-axial measurement cable 20 m
Qty. 1 Grounding cable 10 m
Qty. 2 Rolls thermal paper (no. 017834-00)
Qty. 1 Power cable
Qty. 1 Software for data acquisition (5462/SWRVM1)

Other optional supplies

- Data link for RS 232C interface, 3m
- Software for data analysis 5462/SWRVM2

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TECHNICAL SPECIFICATIONS

SERIES 4860 STANDARD SYSTEMS

System

Display	16 x 40-character back-light Black and White graphic LCD
Interface	RS 232C for computer connection
Emergency switch	
Built-in thermal paper printer	
External printer connector	
Built-in test box for self testing (max. test voltage 2000VDC, approx. 10s dominant time constant)	
Internal temperature measurement, thermal overheating protection.	

Test voltage

Measuring range	50...2000 V DC adjustable in 1 V steps
Basic setting	2000 V DC
Max. deviation from the set value	± 0.2 %
Current-carrying capacity (permanent)	5 mA
Max. short circuit current	200 mA, 100 ms
Delayed short-circuit protector	

Charging and discharging time range	t_C , t_d 10 ms... 99 999 s
Charging / discharging time relation (t_C/ t_d)	0.1….10 , Basic setting 2
Charging and discharging current measurement capability	20mA…10pA (max resolution: 1pA) Error limits ± 1 % + 5pA
Resistance measuring range	1 MΩ ... 1000 GΩ Error limits (to 100GΩ) ± 1.5 %

Electrometer data

Measuring range	-200 ... +1000 V
Error limits	± 1%
Current input	≤ 1 pA

Operating Conditions

Voltage supply	85…260 V_{AC}, 50/60 Hz
Power input	max. 40 VA
Temperature range	Instrument operating temperature 0°C...40°C Recommended test object temperature ≥ 8°C

Mechanical

Dimensions	47 x 19 x 37 cm (18.5” x 7.5” x 14.6”)
Weight	10 kg (22 lbs)

Standards

Reference and rated operating conditions as per IEC 359, rated range of use I.
This instrument is designed in accordance with the safety requirements of VDE 0411/part 1 and IEC 348 (safety class I).