

Conductivity meter



TAND220A

Portable instrument, light and self-contained

Conforms the new IEC61620 Standard

Wide conductivity volumen range: 0.01 pS/m to 20'000 pS/m



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The measuring instrument type TAND220A conforms to the new IEC 61620 Standard. This instrument is based on the so-called “low amplitude, low frequency, alternate square wave method” and permits accurate measurement of volume conductivity and relative permittivity. The measurement of volume conductivity in the range of 0.01 pS/m to 20'000 pS/m allows the use of this instrument for quality assessment of high resistive liquids even at ambient temperature. The TAND220A works with low voltage and low current levels and represents no danger at all for its operators.

FEATURES

- Accurate and fast measurement of the volume conductivity from 10^{-14} to 10^{-8} S/m and the relative permittivity ϵ_r up to 5.
- Determination of the dissipation factor at power frequencies down to values of 10^{-6}
- Determination of the discharge time constant of electric volume charges as produced by triboelectric effects.
- Optional analogue outputs for continuous recording of the measured values
- Portable instrument, light and self-contained
- Compact test cell, easy to use, easy to clean

APPLICATIONS

- Test and documentation of the conductivity (or resistivity) of highly insulating liquids used in electrical equipment as transformers, bushings, cables, capacitors and other high voltage apparatus
- Control of the dielectric quality of liquid insulation during the manufacturing of electrical equipment
- Control of the liquid insulation quality for maintenance decisions
- Monitoring of the liquid insulation quality for failure alert purposes
- Detection of the ionic purity of high resistance liquids: tests during the synthesis of liquids, purity checking on chemicals and mineral or organic oils, ageing and degradation studies

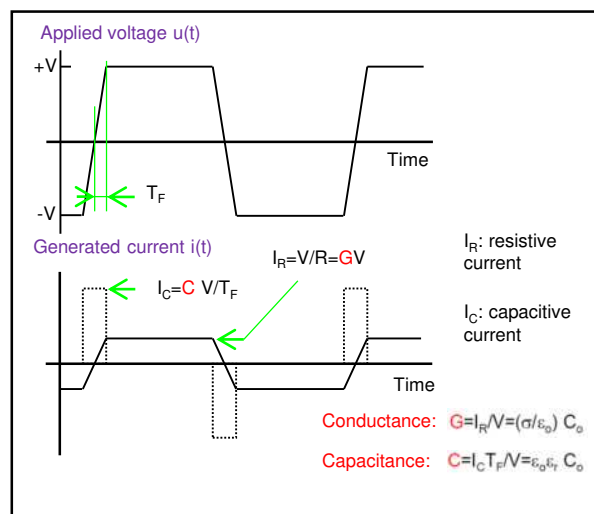
MEASURING METHOD

The liquid in the test cell is excited with a low amplitude (30 V) low frequency (0.5Hz) alternate square wave voltage without any DC component (see figure).

By measuring the current through the liquid the capacitance C and the conductance G can be determined and the values of relative permittivity ϵ_r and volume conductivity are given according to the following equations:

$$\sigma = \epsilon_0 G / C_0$$

$$\epsilon_r = C / \epsilon_0 C_0$$



Principle of operation using the alternate square wave method

The derived dissipation factor $\tan\delta$ for a given frequency f can be determined according to the following equation:

$$\tan\delta = G/2\pi f \times C = \sigma/2\pi f \times \epsilon_0 \epsilon_r$$

For determination of conductivity or $\tan\delta$, the alternate square wave method is, by far, more sensitive than the classic bridge method. It permits the determination of conductivity values down to 0.01 pS/m respectively $\tan\delta$ values down to $1E-6$ (at 50 Hz). This high sensitivity allows accurate measurements of conductivity and $\tan\delta$ at low temperatures and consequently the characterisation of liquids at room temperature can be carried out with confidence.

TEST CELL

TEST CELL

The application of a square wave excitation voltage with low amplitude of only ± 30 V permits the development of a test cell with simple design, easy to use and to clean.

The compact test cell is composed of only two parts, a container and an active part. Two coaxial electrodes (stainless steel) are attached on a cap (also stainless steel). This cap also supports two BNC connectors coupled to the two electrodes. The electrodes possess a clean, polished surface. The vessel and the active part can be cleaned according to procedures described in the appendix A. It is not possible and not necessary to disassemble the active part for cleaning purposes. The required amount of liquid for a test is about 210 ml. To reach this amount, fill in the liquid to be tested up to 23 mm from the top edge of the vessel.

The temperature of the tested liquid can be determined by introducing the electronic thermometer in the cell through the cover orifice (included)



- New oil (laboratory quality).....0.05 pS/m
- New oil (industrial quality).....0.05...0.1 pS/m
- Light used oil in good condition.....0.1...1.0 pS/m
- Middle used oil in acceptable condition.....1.0...5.0 pS/m
- Heavily used oil in bad condition.....> 5.0 pS/m

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SPECIFICATIONS

Electronic measuring instrument

Conductivity measuring range	$10^{-14} \dots 2 \times 10^{-8}$ S/m on four ranges
Uncertainty of conductivity measurements	± 1 digit $\pm 1\%$ of indicated value
Resolution of conductivity measurements	10^{-14} S/m for conductivities up to 19.99 pS/m 10^{-13} S/m for conductivities up to 199.9 pS/m 10^{-12} S/m for conductivities up to 1.999 nS/m 10^{-11} S/m for conductivities up to 19.99 nS/m
Resolution of permittivity measurements	0.001 for relative permittivities up to 1.999 0.01 for relative permittivities from 2.00 to 5.00
Uncertainty of permittivity measurements	± 1 digit $\pm 0.2\%$ of indicated value
Calibration of the test cell	Simple on-site adjustment for test cells from 50 to 70 pF
Frequency of the measurement voltage	0.5 Hz
Amplitude of the measurement voltage	± 30 V square wave with no dc part
Analogue outputs	2 V for 0 to 100%
Analogue outputs voltage span	0 ... 2 V for 0 to 100% of chosen range, short circuit proof
Weight	2.6 kg
Size(width × depth × height in mm)	260 × 283 × 115
Power supply in the field	six batteries type AA alkaline for several hours of operation
Power supply in the lab	universal mains adapter 100 ... 240 Vac 50/60 Hz delivering 6VDC
Temperature (use)	0 ... 35°C
Temperature (stock)	-10 ... 50°C
Pressure	70 ... 106 kPa
Humidity	5 ... 80% non condensing
Acceleration	<2g

Test cell

Required amount of liquid	210 ml
Vacuum capacitance	60 pF
Capacitance drift with temperature	< 50 ppm/°C
Electrode gap	1.5 mm
Material	stainless steel
Electrical connection	two standard 50Ω BNC plug
Temperature measurement	glass thermometer or electronic thermometer
Weight	1.2 kg
Size (height × diameter in mm)	125 × 82

Optional accesories:



Z1 - Heater

The instrument heats and maintains the temperature of the samples at a temperature of $90^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ to carry out the measurement in accordance with the IEC standard.



Z2 - Flow cell

The vessel for continuous measurement of tan delta is an oil circuit like that of an oil treatment plant. The probe for continuous measurement will be installed at the outlet of an oil circuit after the pump. A certain amount of oil will pass through the probe for the continuous measurement of tan delta.

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