

Date: 1/10/57 Material: Aroclors, Pyranols
By: CM:GWM and Inerteens
Test: Resistivity

Method No. 11,607-57
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INTRODUCTION

Consult Method No. 11,752 for the sequence of electrical measurements and the terms used in connection with the determination.

The Resistivity of an electrical insulating oil is an index of its insulating properties. High resistivity indicates high resistance to the passage of electrical current and normally, but not necessarily, establishes the absence of conducting contaminants.

SAFETY

In as much as measurements must be made at a potential of 500 volts a shock hazard exists in the handling of this apparatus. With the control knob in the charge and operate position full voltage of the bridge (500 volts) is applied to the + and low terminals and through the test leads to the electrodes. Do not attempt to handle the electrodes or the test leads unless the control knob is in the "CHECK" position. Possible penalty for failure to observe this precaution: Painful shock.

PROCEDURE

1. Assemble the test cell. Place the recently cleaned (within the last 8 hours--see Method No. 11,751, Step 9) electrodes in an

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- 800-ml. beaker.
2. Measure the capacitance of the test cell (K) according to Method No. 11,608 (Dielectric Constant and Power Factor measurements).
3. Fill the cell assembly until the liquid level is $3/4$ inch above the top of the electrodes.
4. Heat the assembly on the hot plate to $100 (\pm 0.5)^{\circ}\text{C}$.
5. Place the assembly inside of the testing oven.
6. Connect the back wire inside the oven to the lead on the outer cylinder of the cell and the front wire to the lead on the inner cylinder of the cell.
7. Connect the coaxial cable from the megohm bridge to the fitting on top of the oven.

NOTE: Check to see that the other end of the coaxial cable is connected to the set of terminal at the right on the megohm bridge so that the red part of the plug is inserted into the terminal marked "+".

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8. Throw the three switches at the top of the megohm bridge to "ON" position.
9. Allow 10 minutes for assembly to reach temperature equilibrium inside the oven.

CAUTION: Make sure control knob on the megohm bridge is in "CHECK" position while making electrical connections. Otherwise, painful shock will result. There is a potential of 500 volts across the terminals used in this test.

10. Bring the galvanometer pointer to zero by turning the "ZERO ADJUST" knob in the direction in which the pointer of the galvanometer should move.
11. Turn the control knob to "CHARGE" position for 30 seconds. (Use stopwatch)
12. Turn the control knob to "OPERATE" position and return the galvanometer pointer to zero by adjustment of the "MULTIPLY BY" switch and the megohm dial.
13. Read after 30 seconds. (Time the 30 seconds by stopwatch from the time the control knob was turned to "OPERATE".)

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CALCULATION

Resistivity* = Megohm dial reading (Step 12) x "Multiply By" reading (Step 12) x capacitance of cell (K value, step 2) in uuf. x 11.29 x 0.001

Report the result in units of 10^9 ohm-cm.

* Values of resistivity are qualified by designation of temperature and voltage. These are for this test, 100°C. and 500 volts DC.

NOTE: It is important that the product under test, electrodes, and beaker be at uniform temperature for this determination. Temperature variations in different parts of the sample will cause the galvanometer zero to change constantly and give misleading results.

APPARATUS

General Radio Co. Megohm Bridge Type 544-B. This is a combination of Wheatstone bridge and vacuum tube voltmeter for indicating null. The direct measurement of resistance up to 1,000,000 megohms is made possible by the use of a vacuum tube detector which absorbs negligible amount of power.

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The voltage applied to the unknown resistor is held approximately constant, regardless of the value of the unknown resistance. This condition is necessary to measure resistance properly.

The accuracy of the instrument in the range encountered in the measurement of Arcolor resistivity, 100 to 1000 megohm is $\pm 6\%$.

The instrument is equipped with a 115 volt AC power supply which supplies all operating voltages for the bridge indicating circuits and in addition supplies 500 V DC for application to the material under test.

The instrument is completely enclosed in a waxed finish shielded oak cabinet measuring 8-1/2" wide, 22-1/2" long and 3" high.

Approximate weight--26 pounds.

TEST ELECTRODES

Two concentric nickel cylinders with feet, obtained from General Electric Co. The inner electrode has outside diameter of 2.8" and a height of 3.25" with area of 184 sq. cm. The outer electrode has inside diameter of 3" and height of 3.25" with area of 198 sq. cm. The distance between electrodes is therefore 0.1" or 0.254 cm.

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By theory, electrode constant (K) area/length is $191/0.254$ or 752 where average area is 191 sq. cm.

Also $K = 36\pi \times 10^{11} \times C$ (in Farads with air as dielectric) = $11.29 \times C$ (in uuf. with air as dielectric).

GLASS PLATE

Pyrex about 3-1/2" diameter with concentric grooves to assist in spacing electrodes. Obtain from General Electric Co.

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