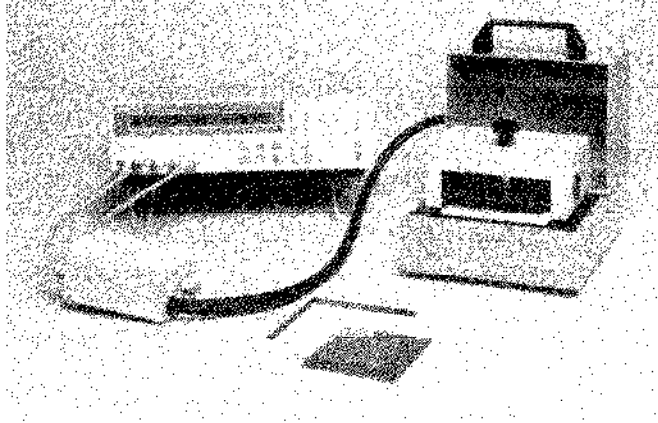


## Insulation Resistance Measurement of the Plate Type Materials

- HP 4339A High Resistance Meter -



### Measurement Configuration

- \* HP 4339A High Resistance Meter
- \* HP 16008B Resistivity Cell

### INTRODUCTION

For improving the quality of the insulation materials such as electric insulator, polymer,, it is important to evaluate their characteristics, especially insulation resistance. This note describes the solution offered by the HP 4339A High Resistance Meter for realizing these requirements of the insulation resistance measurement.

### PRESENT PROBLEM OF THE HIGH RESISTANCE MEASUREMENT

(1) The measured value 60 seconds after the test voltage applied can't be easily determined by using a clock, and it depends on testers so that the consistent measurement results can't be obtained.

(2) Surface or volume resistivity is an important measurement parameter to evaluate a insulation material, and you have to calculate the volume or surface resistivity using the resistance measurement result.

(3) The stable insulation resistance value can't be obtained by using an existing product.

(4) The fixture's electrode sizes necessary for the measurement standard has been unavailable.

(5) The parasitic errors in the fixture prevents you from obtaining the correct measurement results.

### HP 4339A SOLUTION

#### (1) Test Sequence Program

The HP 4339A has the test sequence program which automatically perform a sequential measurement step for charge/measure/discharge. So you can automatically get the consistent measurement result after charging a device during your specified time (for example 60 seconds).

#### (2) Automatic Resistivity Calculation

The volume resistivity and surface resistivity are calculated using the following formula.

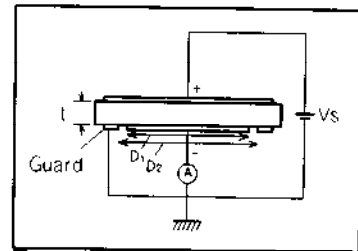


Figure 1. Volume Resistivity

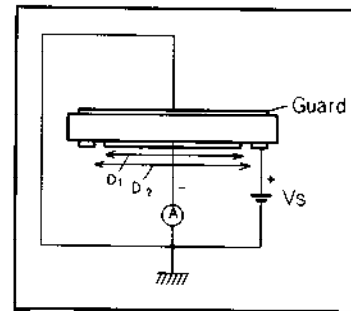


Figure 2. Surface Resistivity

Volume Resistivity [ $\Omega$  cm]:

$$\rho_v = \frac{\pi \times \left( D_1 + \frac{B(D_2 - D_1)}{2} \right)^2}{4t} \times \frac{R_v}{10}$$

Surface Resistivity [ $\Omega$ ]:

$$\rho_s = \frac{\pi(D_1 + D_2)}{D_2 - D_1} R_s$$

where,

D1: Main Electrode Diameter [mm]

D2: Guard Ring Diameter [mm]

B: Effective Area Coefficient

t: Sample Thickness [mm]

R<sub>v</sub>: Volume Resistance [ $\Omega$ ]

R<sub>s</sub>: Surface Resistance [ $\Omega$ ]



For more information call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

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By entering the thickness value of the device and the electrode size of the test fixture into the HP 4339A before measurement, you can get volume or surface resistivity reading on the HP 4339A display without calculation. So it is very easy to get the resistivity values.

### (3) Stable Measurement

Normally the measurement results of the ultra high resistance (above  $1 \times 10^{14} \Omega$ ) may be unstable due to the external noise. The HP 4339A can measure the resistance up to  $1.6 \times 10^{16} \Omega$ , and employs the triaxial input terminal configuration which minimizes the influence of the external noise. In addition, the test fixture with the shield cover and averaging function (1 through 256) can make the stable measurement.

### (4) HP 16008B Test Fixture

The HP 16008B Resistivity Cell with the HP 4339A offers you the stable measurement of the surface and volume resistance/resistivity. Table 1 shows you the major HP 16008B specification.

Table 1. HP 16008B Specification

Electrode Size:	26/50/76 mm <sup>1</sup>
Device Size (diameter):	50 mm to 125 mm
Device Thickness:	10 $\mu$ m to 10 mm
Operating Load:	10 kgf max.
Operating Temperature:	-30 to 100 °C

1: 50 mm is standard  
26/76 mm is optional

In addition, three kinds of the electrodes for the HP 16008B can satisfy the various standards for the insulation material evaluation listed in Table 2.

Table 2. Major Standards for plate type insulation materials

Standard	Material	Electrode Diameter (mm)
JIS:		
K-6911	Plastic	50
C-2318	Polyester Film	50
C-2141	Ceramic	50
ASTM:		
D-257	General	26/50/76

### (5) OPEN Correction

There can be a parasitic error due to the test fixture, and it causes the measurement error. In the ultra high resistance measurement, the leak current through the stray path can be large error affecting the measurement values. The HP 4339A has the OPEN correction capability which minimizes this error of the test fixture, and it allows you to make a reliable measurement.

### CONCLUSION

Using above advanced techniques, the HP 4339A High Resistance Meter can realize the remarkable improvements in the reliability and efficiency of the insulation resistance measurements.