



Electrically Conductive Elastomers Volume Resistivity Measurement Procedures

1.0 SCOPE:

This document describes equipment and procedures, used to measure resistivity or volume resistivity of electrically conductive elastomers. It further describes test procedures intended to measure long-term electrical stability of conductive elastomers by exposure to heat and tensile set conditioning.

2.0 APPLICABLE DOCUMENTS:

ASTM D412 – Standard Test Method for Rubber Properties in Tension.

3.0 VOLUME RESISTIVITY TEST:

3.1 Equipment:

3.1.1 Ohmmeter capable of accuracy to $\pm .001$ ohm. Suggested source: Kiethley 197 autoranging ohmmeter or equivalent.

3.1.2 Dimensional gauge capable of measuring $\pm .005$ inches (e.g., snap gauges or Verniers).

3.1.3 Anhydrous isopropyl alcohol (IPA).

3.1.4 Clean lint-free cloth.

3.1.5 Four-point test probe in accordance with Figure 1. Suggested source: Chomerics, Part Number 52-99-B305-0002.

3.2 Sample Preparation:

Test specimen should be clean and free of dirt or excessive hand oils. If dirt is present, use IPA

dampened cloth and wipe surface clean. Test specimen should be allowed to sit in an unrestrained condition for a minimum of 15 minutes at room temperature (65-80°F) prior to any test measurement. If IPA wipe has been performed, ensure that all solvent has evaporated from the surface of the test specimen.

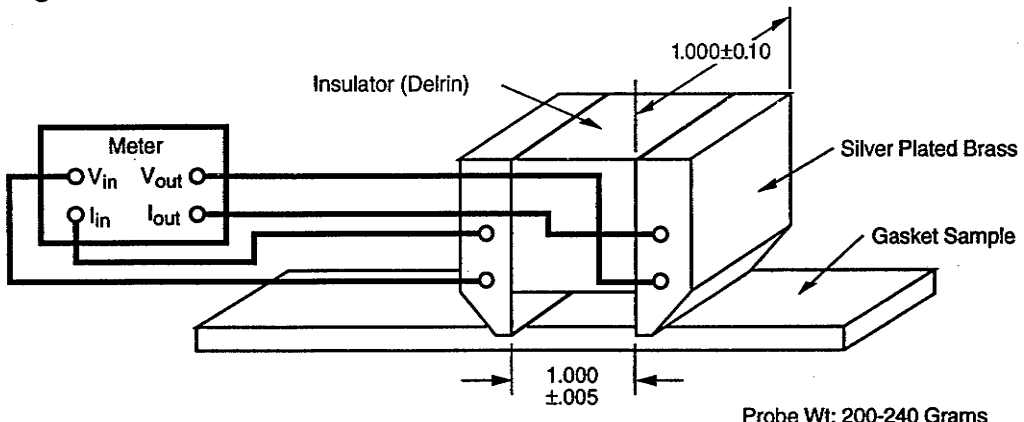
3.3 Resistivity Measurement:

Probe should be connected to ohmmeter in accordance with Figure 1. Measure the resistivity of the test specimen longitudinally by placing the probe on top of the sample such that as much of the probe contact surface comes in contact with the test specimen as its cross section will allow. The weight of the probe should be evenly distributed on the test specimen. One to two pounds of manual force may be placed on the probe by the operator. Allow the resistivity reading to stabilize (about 30 seconds) and record resistance in ohms.

3.4 Cross Section Determination:

In order to calculate volume resistivity, the cross sectional area of the test specimen must be determined. Measure all cross sectional dimensions needed to calculate to the nearest .001 inch. For example, measure only the diameter of a solid "O" cross section. A rectangular cross section would need width and height measured, etc.

Figure 1



Note: Dimensions are in inches

Electrically Conductive Elastomers – Volume Resistivity Measurement Procedures

3.5 Volume Resistivity Calculation:

The volume resistivity is calculated by Formula 1.

Formula 1

$$R_{vol.} = (R \times A) / \ell$$

Where:

- R = Resistance in ohms.
- A = Test specimen cross sectional area in cm².
- ℓ = Distance between probe contact points in cm.
For this method the probe is defined as having one inch electrode spacing, making ℓ = 2.54 cm.
- R_{vol.} = Volume resistivity in ohm-centimeters.

4.0 HEAT AGE TESTING:

4.1 Equipment:

The equipment needed includes all equipment in Section 3.1 of this specification plus an air circulating oven capable of 1.25 times the maximum operating temperature of the specimen material as specified on the manufacturer's data sheet.

4.2 Procedure:

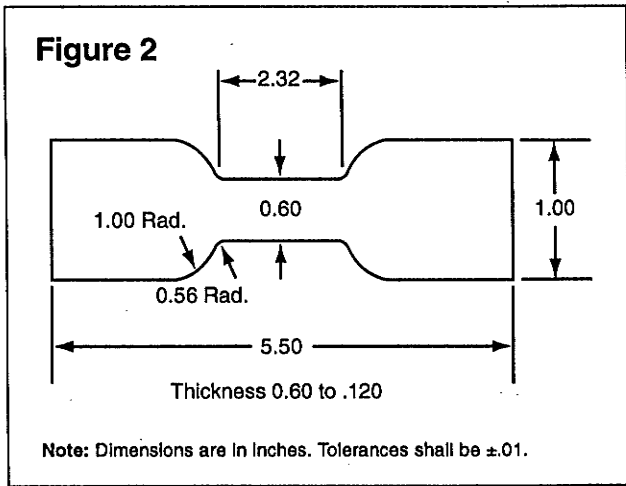
Determine the initial volume resistivity of the test specimen (for reference purposes) using Sections 3.1-3.5 of this specification. Place test specimen into oven and expose for 24 continuous hours at 1.25 times the specimen material's maximum operating temperature. After 24 hours of heat exposure remove sample and allow to cool to room temperature. Wipe test specimen clean with IPA dampened cloth. Allow to dry and determine volume resistivity as described in Sections 3.1-3.5 of this specification. **CAUTION:** If specimen material contains silver, oven must be free of sulfur bearing materials (e.g., neoprene rubber, most paper products) to prevent the formation of silver sulfides.

5.0 POST TENSILE TESTING:

5.1 Equipment:

The equipment needed includes all equipment in Section 3.1 of this specification plus the following items:

- A) Tension testing machine in accordance with ASTM D412.
- B) Die capable of cutting test sample as shown in Figure 2.



5.2 Procedures:

Cut test specimen from stock material in accordance with Figure 2. Determine the initial volume resistivity of the test specimen by using Sections 3.1-3.5 of this specification (for reference purposes). Elongate test specimen to break in accordance with ASTM D412. Within 30 minutes determine the volume resistivity of the largest of the two pieces by using Sections 3.1-3.5 of this specification. The cross sectional area of the test specimen is defined as the smallest cross section between the probe contact points. This test is recommended to be a qualification test only. However, it is also recommended that the same test be performed on an actual part of an occasional basis (since it is a destructive test).



Chomerics, div. of Parker Hannifin Corp., 77 Dragon Court, Woburn, MA 01888-4014 Tel: 617-935-4850 FAX: 617-933-4318
 Parker Hannifin PLC, Chomerics Europe, Parkway, Globe Park Estate, Marlow, Bucks., SL7 1YB, England Tel: (44) 1628 486030 FAX: (44) 1628 890053
 France Freephone Tel: (0590) 8170 Germany Freephone Tel: (0130) 818074

NOTICE: The information contained herein is to the best of our knowledge true and accurate. However, since the varied conditions of potential use are beyond our control, all recommendations or suggestions are presented without guarantee or responsibility on our part and users should make their own tests to determine the suitability of our products in any specific situation. This product is sold without warranty either expressed or implied, of fitness for a particular purpose or otherwise, except that this product shall be of standard quality, and except to the extent otherwise stated on Chomerics' invoice, quotation, or order acknowledgement. We disclaim any and all liability incurred in connection with the use of information contained herein, or otherwise. All risks of such are assumed by the user. Furthermore, nothing contained herein shall be construed as a recommendation to use any process or to manufacture or to use any product in conflict with existing or future patents covering any product or material or its use.