



Standard Test Method for Determination of D-C Resistivity of Writing Paper (Keithley Method)¹

This standard is issued under the fixed designation D 4949; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method describes the procedure for determination of both surface and volume (bulk) d-c resistivity of writing paper. This test method is specific for the Keithley 6105 resistivity adapter.

1.2 This test method has been developed as a special case for use on writing papers processed in high-speed nonimpact printers where resistivity control is critical. It is not in conflict with Test Method D 257.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials²

D 585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Products³

D 644 Test Method for Moisture Content of Paper and Paperboard by Oven Drying³

D 645 Test Method for Thickness of Paper and Paperboard³

D 685 Practice for Conditioning Paper and Paper Products for Testing³

D 1749 Practice for Interlaboratory Evaluation of Test Methods Used with Paper and Paper Products³

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process⁴

E 337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)³

3. Terminology

3.1 Definitions:

¹ This test method is under the jurisdiction of ASTM Committee D-6 on Paper and Paper Products and is the direct responsibility of Subcommittee D06.92 on Test Methods.

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² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 15.09.

⁴ Annual Book of ASTM Standards, Vol 14.02.

3.1.1 *surface resistivity*—the surface resistivity of a material is the ratio of the potential gradient parallel to the current along its surface to the current per unit width of the surface. Surface resistivity of a material is numerically equal to the surface resistance between two electrodes forming opposite sides of a square. The size of the square is immaterial.

3.1.2 *volume resistivity*—the volume resistivity of a material is the ratio of the potential gradient parallel to the current in the material to the current density.

4. Summary of Test Method

4.1 A paper specimen is placed between appropriate metal electrodes. An electrical voltage is applied for a fixed period of time and the resultant current between two electrodes is measured accurately. By using appropriate electrodes, surface and volume resistance may be measured separately. From this information, a calculation of both surface and volume resistivity can be made.

5. Significance and Use

5.1 Paper generally is considered to be a material having good electrical insulating characteristics; for example, relatively high resistivity when dry. However, in certain applications, control of electrical resistivity to within specified limits is an important function, and resistivity measurement techniques are required.

5.2 While it is possible to measure resistivity using a variety of instruments (Test Methods D 257), this test method is specific for the Keithley Model 6105 resistivity adapter.⁵ The precision statement was based on the use of that instrument. Studies have shown that results will vary depending upon the type of resistivity adapter used and if reproducibility between different instruments in the same laboratory or between different laboratories is to be achieved, it is essential that the same model resistivity adapter be used in each determination.

5.3 The power supply and electrometer referred to in this method are manufactured by Keithley and the procedure describes their use. It is believed that comparable equipment manufactured by others would serve the same purpose. The precision statement was developed with Keithley equipment.

5.4 The control of resistivity is of special importance on

⁵ Manufactured by Keithley Instruments, Inc., 28775 Aurora Rd., Cleveland, OH 44139.