Designation: ~~D6095 – 12~~ D6095 – 12 (Reapproved 2018)

Standard Test Method for
Longitudinal Measurement of Volume Resistivity for Extruded Crosslinked and Thermoplastic Semiconducting Conductor and Insulation Shielding Materials[1]

This standard is issued under the fixed designation D6095; 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 covers the procedure for determining the volume resistivity, measured longitudinally, of extruded crosslinked and thermoplastic semiconducting, conductor and insulation shields for wire and cable.

1.2 In common practice the conductor shield is often referred to as the strand shield.

1.3 Technically, this test method is the measurement of a resistance between two electrodes on a single surface and modifying that value using dimensions of the specimen geometry to calculate a resistivity. However, the geometry of the specimen is such as to support the assumption of a current path primarily throughout the volume of the material between the electrodes, thus justifying the use of the term "longitudinal volume resistivity." (See ~~3.1.2.1)~~3.1.2.1.)

1.4 Whenever two sets of values are presented, in different units, the values in the first set are the standard, while those in parentheses are for information only.

1.5 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement, see 7.1.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
D257 Test Methods for DC Resistance or Conductance of Insulating Materials
D1711 Terminology Relating to Electrical Insulation
D4496 Test Method for D-C Resistance or Conductance of Moderately Conductive Materials

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *semiconducting, adj*—moderately conductive, see Terminology D1711 and Test Method D4496.

3.1.2 *longitudinal volume resistivity, n*—an electrical resistance multiplied by a factor calculated from the geometry of a specimen volume between electrodes in contact with one, and only one, surface of the specimen.

3.1.2.1 *Discussion*—

In normal wire and cable usage, the longitudinal volume resistivity is simply referred to as "volume resistivity." This usage is at variance with terminology in Test Methods D257, Terminology D1711, and Test Method D4496.

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[1] This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.07 on Electrical Insulating Materials.

Current edition approved ~~Nov. 1, 2012~~Nov. 1, 2018. Published ~~November 2012~~November 2018. Originally approved in 1997. Last previous edition approved in ~~2006~~2012 as ~~D6095 – 06.~~D6095 – 12. DOI: ~~10.1520/D6095-12.~~10.1520/D6095-12R18.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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*A Summary of Changes section appears at the end of this standard

4. Significance and Use

4.1 The electrical behavior of semiconducting extruded shielding materials is important for a variety of reasons, such as safety, static charges, and current transmission. This test method is useful in predicting the behavior of such semiconducting compounds. Also see Test Method D4496.

5. Apparatus

5.1 See Test Method D4496 for a description of the apparatus, except the electrode system which is described in 7.2.

6. Sampling and Test Specimens

6.1 Take one 2-ft (600-mm) sample from each lot, or from each 25000 ft (7600 m) of completed cable, whichever is less.

6.2 The specimen consists of a 10 in. (250 mm) length of cable core with all layers external to the semi-conducting insulation shield removed. Use this specimen to test the insulation shield. To test the conductor shield, bisect the sample longitudinally and remove the conductor. Use only one piece of the conductor shield as the test specimen.

6.3 Condition the specimens in accordance with Test Method D4496.

6.3.1 If the shielding materials are crosslinked, condition the cable core (jacket removed) overnight at 50°C to eliminate any acetophenone that is potentially present. Then proceed with the conditioning in accordance with Test Method D4496.

7. Procedure

7.1 **Warning**—Thoroughly instruct all operators as to the correct procedures for performing tests safely.

7.2 Apply an electrode system consisting of four annular bands of silver paint approximately 0.25 in. (6.5 mm) wide to the insulation shield. There must be a distance of at least 2 in. (50 mm) of shield between the potential electrodes (the two inner bands) and a distance of 1 in. of shield between the current electrodes (the outer bands) and the potential electrodes. See Annex A1 of Test Method D4496.

7.3 For measurement of the conductor shield, bisect the sample longitudinally and remove the conductor. Then, using only one piece of the bisected shield, apply the silver paint electrode system as described in 7.2 only to the conductor shield.

7.4 Condition the specimen for 1 h at the rated operating temperature of the cable to ensure thermal equilibrium of the specimen.

7.5 Determine the resistance between the potential electrodes of the test specimen using a direct test voltage and a measuring system meeting the requirements of Test Method D4496. Make two measurements, one at 23 ± 2°C (73 ± 4°F) and one at the rated operating temperature of the insulation material. See the procedure and Appendix X1 of Test Method D4496 concerning the prevention of specimen self-heating. Limiting the power to 100 mW and the test time to 1 min is recommended.

7.6 When a high degree of accuracy is not required, use a two-electrode method employing any technique that permits the resistance to be measured with an accuracy of ±5 %. Space the electrodes at least 2 in. (50 mm) apart. Make two tests, one at 23 ± 2°C (73 ± 4°F) and one at the rated operating temperature of the insulation material.

8. Calculation

8.1 For each shielding material and each temperature, calculate the volume resistivity by using the following equations:

Insulation Shielding:
$$\rho = [2R(D_b{}^2 - d_b{}^2)]/L \tag{1}$$

Conductor Shielding:
$$\rho = [R(D_a{}^2 - d_a{}^2)]/L \tag{2}$$

where:

ρ = volume resistivity, Ω-cm,
R = measured resistance, Ω,
L = distance between potential electrodes, in.,
D_a = diameter over conductor shielding, in.,
d_a = diameter over conductor, in.,
D_b = diameter over insulation shielding, in., and
d_b = diameter over insulation, in.

NOTE 1—Even though the dimensions are measured in inches, the value of the volume resistivity is reported in Ω-cm. This is because not all constants and conversion factors are shown in Eq 1 and Eq 2. See Appendix X1 for a discussion on the derivation of the formulas.

9. Report

9.1 Report the following information:
9.1.1 Sample conditioning time and temperature,