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Rubber, vulcanized or thermoplastic — Antistatic and conductive products — Determination of electrical resistance

Caoutchouc vulcanisé ou thermoplastique — Produits antistatiques et conducteurs — Détermination de la résistance électrique

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fifth edition cancels and replaces the fourth edition (ISO 2878:2011), of which it constitutes a minor revision to update the normative reference in Clause 2.

Introduction

The elimination or reduction of static voltages and charges on rubber products is important in many applications. By providing suitable leakage paths the charge can be dissipated. The antistatic properties of a product are also influenced by its electrostatic charging characteristics. This document deals only with methods involving the use of leakage paths.

The addition of carbon black to a polymer in sufficient quantities causes a conductive network of carbon particles to be formed within the mixture, and materials with a wide range of electrical conductivity can be produced. The conductive network is sensitive to mechanical strain, and the electrical resistance of the material varies according to the degree of strain and the time and temperature history after straining. Antistatic properties can also be conferred on rubber materials by incorporating ionizable materials into the rubber mix.

A method for the measurement of the resistivity of specially prepared test pieces of antistatic and conductive rubber is described in ISO 1853.

Rubber, vulcanized or thermoplastic — Antistatic and conductive products — Determination of electrical resistance

WARNING 1 — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

WARNING 2 — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This document specifies a method of test to determine the electrical resistance of antistatic and conductive products manufactured wholly or in part from rubber whose electrical resistance measured between defined points, when new, does not exceed 3×10^8 Ω and whose conductivity is derived from the addition of carbon black and/or other appropriate substances to the bulk of the material.

NOTE Highly conductive mixes cannot be made in this way.

This document specifies the electrode configuration for basic geometries, but it is intended that reference be made to relevant product specifications for requirements for specific products.

It does not apply to:

a) products the relevant surfaces of which are composed of mixtures of insulating and conductive areas;

b) products with a substantial surface area of insulating material, except for footwear (which does not normally have a conductive or antistatic upper).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18899:2013, *Rubber — Guide to the calibration of test equipment*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Principle

The resistance between two positions on a product is measured, using a defined system of electrodes, by a system suited to factory inspection or service testing.

5 Apparatus and materials

5.1 Test instrument

The test shall be made with an instrument having a nominal open-circuit voltage of 500 V DC, preferably an insulation tester (ohmmeter), or with any suitable instrument known to give comparable results.

The instrument shall be sufficiently accurate to determine the resistance within 10 % and shall not dissipate more than 3 W in the product.

The resistance values obtained will vary with the applied voltage, and errors can occur when low test voltages are involved. In cases of dispute, the voltage applied to the product shall be not less than 40 V, except where this conflicts with the requirement not to dissipate more than 3 W in the product.

5.2 Electrodes and contacts

Unless otherwise specified in the product standard, electrodes shall be formed on the surface by means of a conductive silver lacquer, colloidal graphite or a conductive liquid of the following composition:

— anhydrous polyethylene glycol (of molecular mass 600): 800 parts by mass;

— water: 200 parts by mass;

— any suitable wetting agent: 1 part by mass;

— potassium chloride: 10 parts by mass.

When a conductive liquid is used, the electrode contact area shall be completely wetted and shall remain so until the end of the test.

The conductive silver lacquer or colloidal graphite shall be dried in air at room temperature; the surface resistivity of the dried film shall be below 100 Ω.

Clean metal contacts shall be applied to the electrodes so that the contact area is approximately the same size as, but not greater than, the electrodes, unless otherwise specified.

The surface of the product shall not be deformed either during the application of the contacts or during the test, unless specified in the product standard. The product shall be supported on an insulating surface except when otherwise specified. The insulating surface shall be such that its volume resistivity is greater than 10^{10} Ω·m or sufficiently great that, when using two electrodes as described in 9.1 on the insulating surface, the resistance is too great to be indicated using the instrument used to test the product.

6 Calibration

The test apparatus shall be calibrated in accordance with the schedule given in Annex A.

7 Test conditions

7.1 Test atmospheres

All tests shall be carried out under one of the following sets of standard laboratory conditions:

(23 ± 2) °C and (50 ± 5) % relative humidity

or

(27 ± 2) °C and (65 ± 5) % relative humidity.

However, where very large products are being tested, it is permissible, by agreement between supplier and customer, to use the conditions prevailing in the factory, warehouse or laboratory, provided that the relative humidity is not more than 70 %. The temperature and humidity shall then be reported.

7.2 Time-interval between forming and testing

The minimum time-interval between product manufacture and testing shall be 16 h. Whenever possible, the time-interval between manufacture and testing should not exceed three months. In other cases, tests shall be made within two months of receipt of the product by the customer.

7.3 Temperature and humidity conditioning

The products shall be conditioned for at least 16 h under one of the following sets of standard laboratory conditions:

(23 ± 2) °C and (50 ± 5) % relative humidity

or

(27 ± 2) °C and (65 ± 5) % relative humidity.

However, where very large products are being tested, it is permissible, by agreement between the supplier and customer, to use the conditions prevailing in the factory, warehouse or laboratory, provided that the relative humidity is not more than 70 %.

7.4 Mechanical conditioning

During the time-interval between manufacture and testing, or between receipt of the product and testing, the product shall be subjected to one of the following conditions:

a) Maintain in the undeformed state at room temperature without straining in any way.

b) Strain once to the maximum limit to which the product is strained in normal use. Thereafter, maintain at standard laboratory temperature.

NOTE The two methods a) and b) will not necessarily give the same results. The choice of method will normally be stated in the relevant product standard.

8 Procedure

8.1 Cleaning

Clean the surfaces of the product by rubbing with a paste of fuller's earth (aluminium magnesium silicate) and water, washing with distilled water and allowing to dry at a standard laboratory temperature. Do not buff or abrade the test surfaces.

8.2 Application of electrodes

Apply the electrodes and metal contacts (5.2) as appropriate to the product to be tested as described in Clause 9.

8.3 Reconditioning

Recondition the product for not less than 15 min and not more than 2 h under the conditions specified in 7.3.

