INTERNATIONAL STANDARD

ISO 2878

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Rubber — Antistatic and conductive products — Determination of electrical resistance

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

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2878 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This third edition cancels and replaces the second edition (ISO 2878:1987), which has been technically revised.

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 International Standard 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 may 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 — Antistatic and conductive products — Determination of electrical resistance

WARNING 1 — Persons using this International Standard should be familiar with normal laboratory practice. This standard 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 International Standard may 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 International Standard specifies a method of determining 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 $3 \times 10^8\ \Omega$ and whose conductivity is derived from the addition of carbon black and/or other appropriate substances to the bulk of the material.

This International Standard specifies the electrode configuration for basic geometries but reference should be made to relevant product specifications for requirements for specific products.

It does not apply to:

a) products were the relevant surfaces 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 referenced documents are indispensable for the application 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 1853, *Conducting and dissipative rubbers, vulcanized or thermoplastic — Measurement of resistivity*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Principle

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

4 Apparatus

4.1 Test instruments

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 to 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 may 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 test piece.

4.2 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 standard laboratory 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, except where otherwise stated.

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 7.1 on the insulating surface, the resistance is too great to be indicated using the instrument used to test the product.

5 Test conditions

5.1 Test atmospheres

All tests shall be carried out under one of the following sets of laboratory conditions in accordance with ISO 23529:

(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.

5.2 Time interval between product manufacture and testing

The minimum time interval between product manufacture and testing shall be 16 h. Whenever possible, the time interval between manufacture and testing shall not exceed 3 months. In other cases, tests shall be made within 2 months of receipt of the product by the customer.

5.3 Temperature and humidity conditioning

The products shall be conditioned for at least 16 h in one of the following sets of standard laboratory conditions in accordance with ISO 23529:

(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 %.

5.4 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 standard laboratory temperature without straining in any way.

b) Immediately before the temperature and humidity conditioning period, strain once to the maximum limit to which the product is strained in normal use.

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.

6 Procedure

6.1 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.

6.2 Application of electrodes

Apply the electrodes and metal contacts (4.2) as appropriate to the product to be tested as described in Clause 7.

6.3 Reconditioning

Recondition the product for not less than 15 min and not more than 2 h under the conditions specified in 5.3.

6.4 Determination

Support the product on an insulating surface and apply the voltage in the manner appropriate to the product as described in Clause 7, taking the resistance reading (5 ± 1) s after the application of the voltage.

As some materials are sensitive to moisture, take care to avoid breathing on the samples prior to and during the test.