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

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2878 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in September 1975.

It has been approved by the member bodies of the following countries:

Australia	India	Thailand
Belgium	Italy	Turkey
Brazil	Mexico	United Kingdom
Bulgaria	Netherlands	U.S.A.
Canada	New Zealand	U.S.S.R.
France	Romania	Yugoslavia
Germany	Sweden	
Hungary	Switzerland	

No member body expressed disapproval of the document.

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

0 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 but reduction of voltage may also be obtained by increasing the capacity of the system. The antistatic properties of an article 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 conducting network of carbon particles to be formed within the mixture, and materials with a wide range of electrical conductivity can be produced. The conducting network is sensitive to strain, and the electrical resistance of the material varies according to the degree of strain and the time and temperature history after strain. 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 conducting rubber is described in ISO 1853.

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method of test to determine the electrical resistance of antistatic and conductive articles and products manufactured wholly or in part from rubber, whose electrical resistance measured between defined points, when new, does not exceed $3 \times 10^8 \Omega$.

It applies neither to articles the relevant surfaces of which are composed of mixtures of insulating and conducting areas nor to articles with a substantial surface area of insulating material.

The tests are carried out on the finished product using a defined system of electrodes, by a system suited to factory inspection or service testing.

2 REFERENCES

ISO 471, *Rubber — Standard temperatures and humidities for the conditioning and testing of test pieces.*

ISO 1853, *Conducting and antistatic rubbers — Measurement of resistivity.*

ISO 2882, *Rubber, vulcanized — Antistatic and conductive products for hospital use — Electrical resistance limits.*¹⁾

ISO 2883, *Rubber, vulcanized — Antistatic and conductive products for industrial use — Electrical resistance limits.*

3 APPARATUS

3.1 Testing instruments

Except for the method given in 6.9, the test shall be made preferably with an ohm meter having a nominal open circuit voltage of 500 V d.c. or with any other instrument known to give comparable results.

The instrument shall be sufficiently accurate to determine the resistance within 10 % and shall not dissipate more than 1 W in the specimen.

The resistance values obtained will vary with the applied voltage, and errors may occur when low test voltages are involved. In case of dispute, the voltage applied to the test piece shall be not less than 40 V.

3.2 Electrodes and contacts

Except for the method given in 6.9, electrodes shall be formed on the surface by means of a conductive silver lacquer, colloidal graphite or a conductive liquid (see note).

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 resistance of the dried film should 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 no greater than, the electrodes except where otherwise stated.

1) At present at the stage of draft.

The surface of the product shall not be deformed either during the application of the contacts or during the test, except as necessary to comply with 6.5.1 and 6.5.2. The products shall be supported on an insulating surface except when specified.

NOTE — The conductive liquid shall consist of :

- anhydrous polyethylene glycol of relative molecular mass 600 : 800 parts by mass;
- water : 200 parts by mass;
- wetting agent : 1 part by mass;
- potassium chloride : 10 parts by mass.

4 CONDITIONS OF TEST

All tests shall be carried out under one of the following laboratory conditions in accordance with ISO 471 :

23 ± 2 °C and 50 ± 5 % relative humidity;

or

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

However, where very large articles 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 %.

5 PROCEDURE

5.1 Conditioning

The articles shall be conditioned for at least 16 h under one of the following standard laboratory conditions in accordance with ISO 471 :

23 ± 2 °C and 50 ± 5 % relative humidity;

or

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

However, where very large articles 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 %.

5.2 Cleaning

The surfaces of the test piece shall be clean; if necessary, they may be cleaned by rubbing with fuller's earth (aluminium magnesium silicate) and water, washing with distilled water and allowed to dry. Do not use organic materials which attack or swell the rubber, and do not buff or abrade the test surfaces.

5.3 Application of electrodes

Immediately apply the electrodes and metal contacts as appropriate to the article to be tested and as described in clause 6.

5.4 Reconditioning

Recondition the article for not less than 5 min and not more than 2 h as described in 5.1.

5.5 Testing

Apply the voltage in the manner appropriate to the article and as described in clause 6, taking the resistance reading 1 min after the application of the voltage.

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

6 PROCEDURAL DETAILS APPLICABLE TO DIFFERENT ARTICLES

6.1 Tests on one surface

Apply electrodes to two areas, each approximately 25 mm square, located on the same face of the article to be tested and situated so that the distance between their nearest edges is at least 25 % of the width of the article or 10 mm, whichever is the smaller. Alternatively, conductive silver or colloidal graphite strips 100 mm long and approximately 1 mm wide may be substituted for the 25 mm square electrodes but care should be taken to avoid the cracking of the strips.

Apply the metal contacts to the electrodes and measure the resistance.

6.2 Tests between two surfaces

Apply electrodes to two areas, each approximately 25 mm square. The test areas shall be so located that the results represent the electrical resistance of the normal discharge path in the working conditions anticipated.

Apply the metal contacts to the electrodes and measure the resistance.

6.3 Tests on products bonded or clamped to metal parts

6.3.1 Products bonded or clamped to one metal part

Apply an electrode to an area approximately 25 mm square on the working surface of the product; the area shall not be extended beyond this surface towards the metal part.

Apply a metal contact to the electrode and measure the resistance from this contact to the bonded or clamped metal.

NOTE — For tyres for hospital furniture, the test may be carried out by placing the tyre on an insulated wet metal plate and measuring the resistance between the plate and the hub of the wheel.

6.3.2 Products bonded or clamped to two metal parts

Measure the resistance between the metal parts.