



BSI Standards Publication

Conducting and dissipative rubbers, vulcanized or thermoplastic - Measurement of resistivity

National foreword

This British Standard is the UK implementation of ISO 1853:2018. It supersedes BS ISO 1853:2011, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/22, Testing and analysis of rubber.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 97186 0

ICS 83.060

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2018.

Amendments/corrigenda issued since publication

Date	Text affected
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INTERNATIONAL STANDARD

ISO
1853

Fourth edition
2018-07-19

Conducting and dissipative rubbers, vulcanized or thermoplastic — Measurement of resistivity

*Caoutchoucs vulcanisés ou thermoplastiques conducteurs et
dissipants — Mesurage de la résistivité*



Reference number
ISO 1853:2018(E)
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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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

This fourth edition cancels and replaces the third edition ([ISO 1853:2011](#)), which has been technically revised. The main changes compared to the previous edition are as follows:

- in [Clause 3](#), terms have been newly defined;
- in [4.3](#), the length of the test piece has been changed from 70 mm to 95 mm;
- in [Annex A](#), information on the solid-state electrometer manufacturer has been updated;
- in [Annex B](#), a calibration schedule has been added.

Introduction

Rubber is normally regarded as a material of high electrical resistivity; consequently, it is widely used as an insulator. However, the incorporation of various materials, in particular certain forms of carbon black, greatly reduces the electrical resistance so that volume resistivities between $10^{13} \Omega\cdot\text{m}$ and $0,01 \Omega\cdot\text{m}$ are obtainable.

There are various technical and industrial purposes for which rubber with a reduced resistivity is a useful material, the most frequent application being for the dissipation of static charges. In certain circumstances, a lower limit of resistance is specified on a product with this latter application, as a safety precaution to prevent its ignition or to prevent severe shock to a person in contact with it, in the event of faulty insulation or nearby electrical equipment.

Products which, while conducting away static charges, are sufficiently insulating to fulfil the safety requirements above are termed “dissipative rubbers” (the description antistatic rubber is also used). Products which do not fulfil the safety requirements are termed “conducting” rubbers. Since the dimensions of the product are involved, it is not possible to define a suitable range of volume resistivity for either of these classes, but only a range of resistance values between defined points. However, conductive materials are generally considered to have a resistivity below $10^6 \Omega\cdot\text{m}$ and dissipative materials to have a resistivity between $10^5 \Omega\cdot\text{m}$ and $10^{10} \Omega\cdot\text{m}$.

The principal hazard, apart from static electricity, in most buildings and with most electrical equipment is from leakage currents from normal voltage supply mains. To guard against these hazards, it is recommended that the lower limit of resistance for a dissipative rubber product be $5 \cdot 10^4 \Omega$ for 250 V mains supplies, which is a maximum current of 5 mA. The limit can be proportionally less for lower voltages.

The maximum resistance which will permit the dissipation of static charges depends on the rate of generation of charge required to produce the minimum voltage which can be regarded as a hazard in a particular application.

Effect of temperature changes and strain on conducting and dissipative rubbers

The resistance of rubber and plastics made conductive by the addition of carbon black is very sensitive to strain and temperature history, since resistance depends on the structural configuration of the carbon particles in the matrix.

Under normal conditions of service with varying temperature and strain history, the resistance of a sample of a given material can vary considerably, for example by a hundred or more times, between freshly strained materials at room temperatures and material which has remained unstrained for a short period at 100 °C.

To make valid comparisons on test pieces, a conditioning treatment is specified so that the measurements are made on test pieces brought close to a condition of zero strain.

Electrode systems

Certain types of electrode, when applied to these rubbers, have a contact resistance which can be many thousands of times greater than the intrinsic resistance of the test piece. Dry contacts under light pressure or point contacts are particularly poor.

The definition of a suitable electrode system is therefore an important part of this document and, in order to satisfy the various practical requirements for tests on laboratory-prepared test pieces, several electrode systems have been selected and are described in [Clauses 4, 5 and 6](#).