# INTERNATIONAL STANDARD

**ISO 2251**

Second edition
1991-12-15

# Lined antistatic rubber footwear — Specification

*Articles chaussants en caoutchouc doublés, antiélectrostatiques — Spécifications*



Reference number
ISO 2251:1991(E)

## 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.

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.



International Standard ISO 2251 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.



This second edition cancels and replaces the first edition (ISO 2251:1975), of which it constitutes a technical revision.

Annexes A and B form an integral part of this International Standard.



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Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

## Introduction

This International Standard applies to lined rubber footwear with antistatic properties for special-purpose applications where portable electrical equipment may be used, or where potential electrical defects from other causes may develop, and where it is consequently necessary to have a lower limit on resistivity (upper limit on conductivity).

Experience has shown that for antistatic purposes the discharge path should have an electrical resistance not greater than 100 MΩ at any time throughout its useful life. A value of 50 kΩ for antistatic products is suggested as the lowest limit of resistance to give adequate protection against fire and dangerous electric shock in the event of any apparatus becoming defective when operating up to 250 V. During service, the resistance of footwear made from antistatic material may change significantly. The user is recommended to carry out the tests for electrical resistance at frequent intervals and after not more than 200 h wear.



No insulating element shall be introduced between the foot of the wearer and the insole of the footwear.

The floor surfaces of rooms where the footwear will be used shall also be antistatic.

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# Lined antistatic rubber footwear — Specification

## 1 Scope

This International Standard specifies the requirements for rubber footwear with antistatic properties.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:1983, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 2023:1973, *Lined industrial rubber footwear.*

## 3 Materials and design requirements

The footwear shall comply with the material and design requirements specified in ISO 2023, and in addition with the requirements of clauses 4 to 6 of the present International Standard.

## 4 Surface resistance

The surface resistance of the footwear, when tested by the method described in annex A, shall be between 75 kΩ and 50 MΩ.

## 5 Volume resistance

The volume resistance of the footwear, when tested by the method described in annex B, shall be between 100 kΩ and 100 MΩ.

## 6 Marking

Each article of footwear shall be indelibly and legibly marked with the following particulars:

a) size;

b) manufacturer's identification;

c) the number of this International Standard.

In addition, each article of antistatic footwear shall have a lemon-yellow back strip, together with a lemon-yellow rubber label bearing the word "Antistatic" affixed in a suitable position. The words "Test regularly" shall appear on each article either on or near the label.

# Annex A
(normative)

# Method of test for surface resistance

## A.1 Apparatus

### A.1.1 Resistance tester

For resistances below 10 MΩ, an insulation tester should preferably be used with a nominal open-circuit voltage of 500 V d.c., or alternatively any suitable instrument known to give comparable results may be used.

For resistances above 10 MΩ, electronic electrostatic or other suitable test instruments should be used.

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

The test instrument shall be an insulation tester having the inherent characteristics that the voltage which it applies to the test piece decreases below its open-circuit voltage at low resistance values of the test piece. This is a useful characteristic as it reduces the risk of shock and also of overheating the test piece.

Insulation testers of this type may be manually or power-driven generators or may be battery or mains-operated multi-range instruments with similar characteristics.

NOTE 1 The resistance values obtained will vary with the applied voltage and errors may occur when low test voltages are involved.

### A.1.2 Liquid electrodes and contacts

Where a liquid electrode is specified, it shall be formed on the surface by means of a conducting fluid.

This shall consist of:

| | |
|---|---|
| Anhydrous polyethylene glycol of relative molecular mass 600: | 800 parts by mass |
| Water: | 200 parts by mass |
| Soft soap: | 1 part by mass |
| Sodium or potassium chloride: | 10 parts by mass |

The electrode area shall be completely wetted and remain so until the end of the test.

Clean metal contacts shall be applied to the wetted area so that the contact area is approximately the same size but not greater than the wetted area.

Alternatively, combined electrodes consisting of a metal electrode enclosed in a water-moistened fabric pad may be used as the wet electrode.

The surface of the product shall not be deformed either during the application of the contacts or during the test.

## A.2 Procedure



### A.2.1 General

The whole item of footwear is used for the test. Both test procedures A (A.2.2) and B (A.2.3) shall be carried out on the same item of footwear.



### A.2.2 Procedure A

Place the item of footwear on a clean dry metal plate with sole and heel in contact.

Apply a metal contact to a liquid electrode 25 mm square situated in the sole or heel area of the inside of the item of footwear.

Measure the resistance between the electrode and the metal plate on which the item of footwear is placed.

This reading shall constitute the maximum resistance value.

### A.2.3 Procedure B

Place the item of footwear on a wetted metal plate with sole and heel in contact. The water used shall have a wetting agent added.

Apply a metal contact to a liquid electrode 25 mm square situated in the sole or heel area of the inside of the item of footwear.

Measure the resistance between the electrode and the metal plate.

This reading shall constitute the minimum resistance value.

## A.3 Expression of results

Record the results of both procedures A and B in ohms, to two significant figures.

## A.4 Test report

The test report shall contain the following information:

a) a reference to this International Standard;

b) the results obtained from both procedure A and procedure B;

c) any operation not included in the method or regarded as optional;

d) any unusual features noted during the test;

e) the date of test.

# Annex B
(normative)

# Method of test for volume resistance

## B.1 Apparatus

**B.1.1 Device for measuring electrical resistance**, comprising three electrically conductive metal studs with an apex radius of 3 mm. The studs are connected to each other with a conductor but they are insulated from the base of the apparatus. Two of the studs are 45 mm distant from each other and the third is 180 mm from the other two.

**B.1.2 Resistance tester**, as specified in A.1.1, for making the resistance measurements.

**B.1.3 Ancillary equipment**, comprising electrodes, the resistance of which shall not be greater than 1 kΩ over their overall dimensions. The external electrode is a conducting paint. The inner electrode comprises conducting spheres made of stainless-steel balls, of 5 mm diameter and of total mass 4 kg.

If the footwear is not high enough to take all the conducting spheres, the upper shall be made higher with a sleeve.

The voltage lead to the inner electrode is made by pushing the electrical conductor into the conducting spheres.

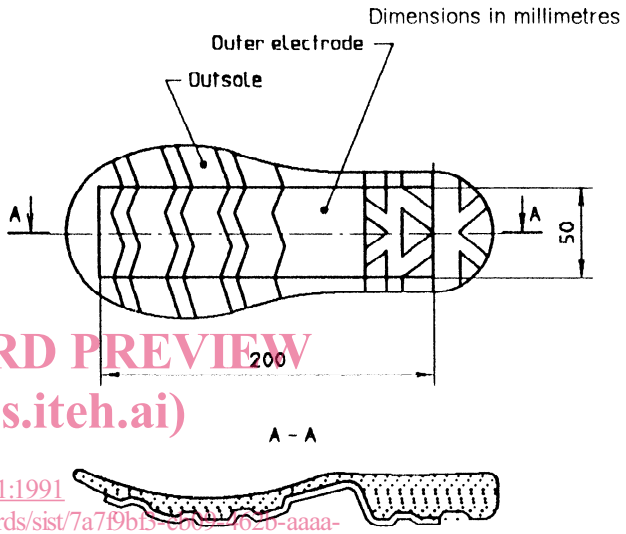




**Figure B.1 — Placing of outer electrode**

## B.2 Preparation of footwear

The whole item of footwear is used for the test. The contact surface of the outsole is cleaned with methylated spirits before the electrode is applied. Any conducting coating is removed. The external electrode is applied to the cleating of the outsole in accordance with figure B.1 so that it forms a conducting surface. The coating is tested by measuring its electrical resistance after filling the shoe with conducting spheres and placing it on the metal studs. The item of footwear is placed on the studs so that the forepart is supported by the two studs which are close together and the heel part is supported by the third stud. The resistance measured between the two studs supporting the forepart and the stud supporting the heel part shall not be greater than 1 kΩ.

## B.3 Procedure

Condition the item of footwear for at least 6 h in a heating cabinet at 50 °C. Transfer the footwear to a standard atmosphere (see ISO 471) and arrange a d.c. voltage of 100 V between the metal studs and the inner electrode so that the inner electrode has the negative polarity. Measure the electrical resistance after 10 min.

Condition the item of footwear for at least 7 days in an atmosphere of 23 °C ± 1 °C and (85 ± 3) % relative humidity and repeat the test.

## B.4 Expression of results

Record the results of both tests in ohms, to two significant figures.

## B.5 Test report

The test report shall contain the following information:

a) a reference to this International Standard;

b) the results obtained from both tests;

c) the standard atmosphere used;

d) any operation not included in the method or regarded as optional;

e) any usual features noted during the test;

f) the date of test.