International Standard 7232

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Rubber or plastics footwear — Antistatic sandals, sabots and clogs

Articles chaussants en caoutchouc ou en plastique — Sandales, sabots et socques antistatiques

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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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7232 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Rubber or plastics footwear — Antistatic sandals, sabots and clogs

0 Introduction

Antistatic footwear should be worn if it is necessary to minimize electrostatic build up by dissipating electrostatic charges, thus avoiding the risk of spark ignition of, for example, flammable substances and vapours, and where portable electric equipment may be used or where electrical defects from other causes may develop. In such applications, it is necessary to ensure a minimum value of resistance to protect against severe shock or against ignition of the soling. Experience has shown that, for antistatic purposes, the discharge path through footwear should normally have an electrical resistance of less than 100 MΩ at any time throughout its useful service life. To meet this requirement, a value of 50 MΩ is thus specified as the highest limit of resistance of a product when new. A value of 0,05 MΩ is specified as the lowest limit of resistance of a product when new, in order to ensure adequate protection against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective when operating at voltages up to 250 V.

During service, the electrical resistance of footwear made from antistatic material may change significantly due to flexing and contamination, and it is therefore necessary to ensure that the footwear is capable of fulfilling its designed function of dissipating electrostatic charges and also of giving any desired protection during the whole of its service life. The user is therefore recommended to carry out the test for electrical resistance at regular and frequent intervals.

In a building where antistatic footwear is in use, the resistance of the flooring should be such that it does not invalidate the protection provided by the footwear against static electricity.

In use, no insulating materials should be introduced between the inner sole of the footwear and the foot of the wearer. The use of normal hosiery is acceptable.

Provision can be made for the leakage of static electricity either by means of inserts, in which the electrical resistance is obtained by a suitably formulated polymeric material, or by having (an) electrical resistor(s) of resistance of the order of 1 MΩ fitted.

1 Scope and field of application

This International Standard specifies requirements for antistatic sandals, sabots or clogs with soles made wholly of rubber or plastics materials.

2 References

ISO 37, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 188, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

3 Construction

The footwear shall consist of a platform shaped to the foot, with an upper of leather or fabric reinforced with polymeric material covering the front part of the foot only. Inserts which allow the passage of electricity shall be securely fitted in the centre of the heel.

Additional conductors may be used in the sole area of the footwear. The resistance may also be produced by a series combination of bottom components, or the whole of the clog platform may be made of a material of acceptable resistance.

Inserts shall be finished in such a way that the top is flush with the foot and they shall not cause discomfort when the footwear is worn. If the construction incorporates an electrical resistor, the surface area of the stud acting as the static electricity leakage terminal shall be not less than 75 mm^2. 75 mm^2 shall also be the minimum surface area for polymeric inserts. Sealing washers shall be fitted between the stud of the resistance insert and the understructure of the footwear in order to avoid the resistance insert being "short-circuited" by perspiration or the ingress of moisture from the walking surface (see the figure).

4 Requirements

4.1 Metal components

Components shall be so positioned, and shall be of such materials, that sparks cannot be produced.

4.2 Electrical resistance

The resistance of the footwear, when new, when tested by the two procedures described in the annex, shall be between 0,075 and 50 MΩ. Procedure A shall be used for determining the higher limit of resistance and procedure B for determining the lower limit of resistance.

4.3 Physical properties of vulcanized rubber solings and heels

4.3.1 Tensile requirements before ageing

Three test pieces shall be cut from both the outsoles and heels and then reduced by careful buffing to the thickness required by ISO 37, or any suitable method, taking care to avoid an increase in temperature. The tensile strength and elongation at break of outsoles and heels shall then be determined according to the method specified in ISO 37 using dumb-bell test pieces. The size of dumb-bell shall be stated when expressing results.

If the median of any of the sets of these values determined is below, and the highest value in the set is above, the appropriate limit in table 1, two further pieces shall be tested.

The material shall be deemed not to comply unless the median of all five results is equal to or greater than the appropriate value.

4.3.2 Tensile requirements after ageing

After submission to the ageing treatment given in table 2, the tensile strength and elongation at break of outsoles and heels determined as specified in 4.3.1, shall be in accordance with the values given in table 2.

Table 1 — Tensile strength and elongation requirements

Part	Minimum tensile strength	Minimum elongation at break
	MPa	%
Outsole	8,5	300
Heel	7,0	200

5 Marking

The following particulars shall be marked on each article of footwear:

a) size;

b) supplier's identification;

c) reference number issued by the appropriate national standards organization;

d) the words "antistatic" and "test regularly", which may be on a lemon-yellow label affixed in a suitable position.

6 Labelling

An information label shall be supplied with each pair of footwear, stating "Moisture, contamination, damage and wear can cause the electrical resistance of this product to change. Test regularly."

Table 2 — Tensile strength and elongation requirements after ageing

Ageing treatment	Tensile strength		Elongation at break
	% of unaged value		% of unaged value
	Outsoles	Heels	
168 h at 70 ± 1 °C in accordance with the oven method specified in ISO 188	± 20	± 20	+10 −30

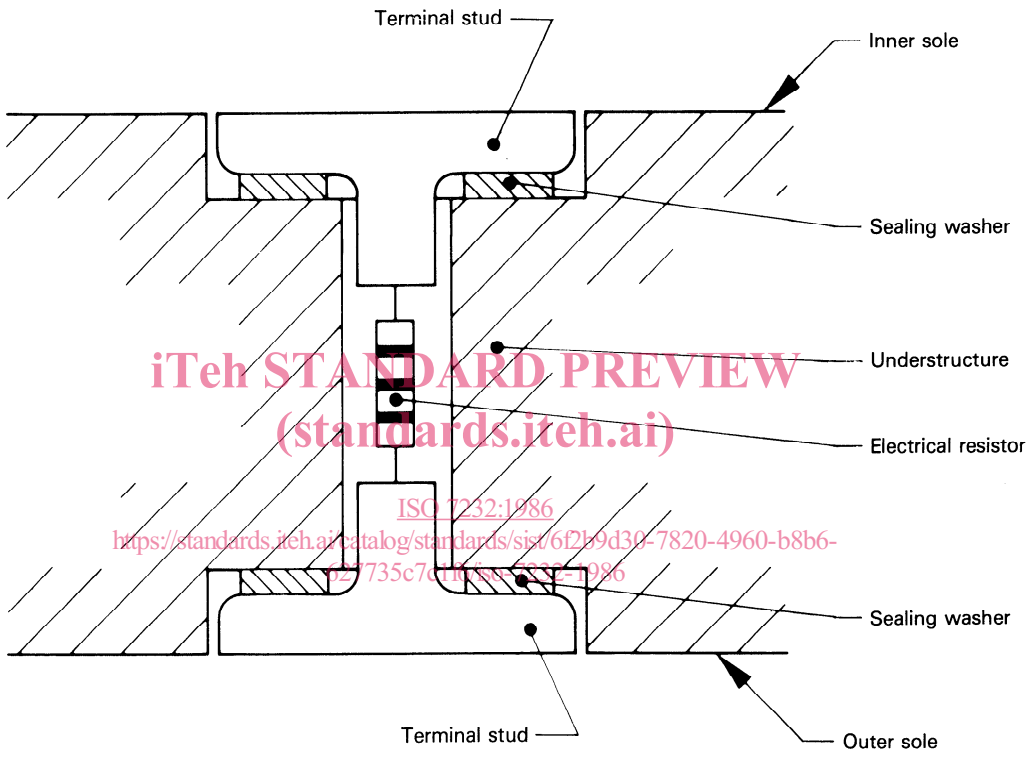

Figure — Metal insert

Annex

Determination of electrical resistance

(This annex forms an integral part of the Standard.)

A.1 Principle

Measurement of the electrical resistance between the insole and the outsole by the application of a potential difference.

A.2 Apparatus

A.2.1 Test instrument

For resistances below 10 MΩ, the test should preferably be carried out using an insulation tester having a nominal open circuit voltage of 500 V d.c. or using any suitable instrument known to give comparable results.

For resistances above 10 MΩ, electronic, electrostatic, or other suitable test instruments known to give comparable results should be used.

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

Insulation testers have the inherent characteristic that the voltage that they apply to the test piece decreases below their 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.

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.

A.2.2 Liquid electrodes and contacts

Liquid electrodes shall be formed on the surface of the footwear by means of a conducting fluid which shall consist of 10 parts of potassium or sodium chloride to 200 parts by volume of water.

The electrode area shall be completely wetted and shall 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 may be used as the wet electrode.

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

A.3 Test piece

The test piece shall be the whole item of footwear.

A.4 Procedure

A.4.1 Procedure A

Place the footwear on a clean dry metal plate with the sole and the heel in contact. Apply a liquid electrode 25 mm square to the insert or to the metal stud of the resistor situated in the sole or heel area of the inside of the footwear.

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

Take the lowest reading as the maximum value of resistance.

In case of dispute, carry out the measurement with a force of 45 N applied to the 25 mm square electrode.

A.4.2 Procedure B

Place the footwear on a wetted metal plate with the sole and the 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 footwear.

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

Take the lowest reading as the minimum value of resistance.

In case of dispute, carry out the measurement with a force of 45 N applied to the 25 mm square electrode.

NOTE — The liquid electrode may be conveniently applied by using openweave fabric saturated with the conducting fluid the same dimensions as the metal electrode.

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