

---

# INTERNATIONAL STANDARD



# 2251

---

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

---

## Lined antistatic rubber footwear

*Articles chaussants doublés, en caoutchouc anti-électrostatique*

First edition — 1975-07-15

STANDARDSISO.COM : Click to view the full PDF of ISO 2251:1975

---

UDC 685.315.4 : 678.4/.8

Ref. No. ISO 2251-1975 (E)

**Descriptors** : rubber products, footwear, antistatic agents, specifications, tests, air-tightness tests, ageing tests (materials), bend tests.

## FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

International Standard ISO 2251 was drawn up by Technical Committee ISO/TC 45, *Rubber and rubber products*, and circulated to the Member Bodies in February 1974.

It has been approved by the Member Bodies of the following countries :

Belgium	Netherlands	Thailand
Czechoslovakia	New Zealand	Turkey
Egypt, Arab Rep. of	Poland	United Kingdom
France	Romania	U.S.A.
Germany	South Africa, Rep. of	U.S.S.R.
Hungary	Spain	Yugoslavia
India	Sweden	
Mexico	Switzerland	

The Member Body of the following country expressed disapproval of the document\* on technical grounds :

Canada

\* clause 8 only.

# Lined antistatic rubber footwear

## 0 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  $10^8 \Omega$  at any time throughout its useful life. A value of  $5,0 \times 10^4 \Omega$  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 test for electrical resistance at frequent intervals and after not more than 200 h wear.

No insulating element should 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.

## 1 SCOPE AND FIELD OF APPLICATION

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

## 2 REFERENCES

ISO/R 37, *Determination of tensile stress-strain properties of vulcanized rubbers.*

ISO/R 188, *Vulcanized rubbers — Accelerated ageing or heat resistance tests.*

ISO/R 471, *Standard atmospheres for the conditioning and testing of rubber test pieces.*

ISO/R 1421, *Determination of breaking strength and elongation at break of fabrics coated with rubber or plastics.*

## 3 FABRIC — MINIMUM REQUIREMENTS

### 3.1 Woven fabrics

The lining of a boot may consist of one fabric forming the leg lining or of two or more fabrics, one forming the leg

lining and the other, or others, acting as reinforcement. The strength of the one fabric, or the composite strength if there are more than one, shall be determined in accordance with the method described in annex A, the minimum requirements, for 25 mm wide test pieces, being as shown below :

	Warp	Weft
Upper and vamp	250 N	200 N

### 3.2 Knitted fabrics

Knitted fabrics may be used by agreement between purchaser and supplier.

## 4 BOOT UPPER — MINIMUM THICKNESS

The combined thickness of the rubber and fabric shall be not less than the minimum values shown in figure 1 at the points indicated.

## 5 SPECIAL REINFORCEMENTS

If necessary the top of the boot may be finished off by a top binding or other suitable means.

Eyelets, if fitted, shall be corrosion-resistant and of non-ferrous materials.

## 6 PHYSICAL PROPERTIES OF SOLING AND HEELS

### 6.1 Tensile requirements before ageing

Three test pieces shall be cut from both outsoles and heels, then reduced by careful buffing to the thickness required by ISO/R 37, or any other 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 described in ISO/R 37, using dumb-bell test pieces. A smaller dumb-bell test piece may be used for the heels, if size makes this necessary. The size of the dumb-bell shall be stated when expressing results.

All three test pieces shall be free from visible defects. If the median of any of the sets of three values determined is below, and the highest value in the set is above, the

appropriate limit given in table 1, two further pieces shall be tested. The material shall be deemed not to comply with the requirements of this International Standard unless the median of each of the sets of five values determined is equal to or above the appropriate value given in table 1.

TABLE 1 – Tensile and elongation requirements

	Minimum tensile strength MPa	Minimum elongation at break %
Outsoles	8,5	300
Heels	7,0	200

6.2 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 above shall be in accordance with the values given in table 2.

TABLE 2 – Tensile and elongation requirements after ageing

Ageing treatment	Tensile strength % of unaged value		Elongation at break % of unaged value
	outsoles	heels	
168 h at 70 ± 1 °C in accordance with the oven method described in ISO/R 188	± 20	± 20	+ 10 - 30

7 SOLING – MINIMUM THICKNESS

The minimum thickness of soling shall be in accordance with the requirements of table 3.

TABLE 3 – Minimum thicknesses

Dimensions in millimetres

	Minimum outer sole thickness		Minimum total thickness including insole and filling	
	non-cleated	cleated (at cleats)	non-cleated	cleated (at cleats)
Industrial, men's	6,0	11,0*	9,0	14,0**
Industrial, women's	6,0	9,0*	9,0	12,0**
Light	4,0	8,0	7,0	11,0

\* Minimum thickness between cleats not less than 4,0 mm.

\*\* Minimum thickness between cleats not less than 7,0 mm.

8 ELECTRICAL RESISTANCE

The resistance of the footwear, when tested by the method described in annex C, shall be between  $5,0 \times 10^4 \Omega$  and  $5,0 \times 10^7 \Omega$ .

9 TESTS

9.1 Leakage test

When finished boots are tested by the manufacturer, there shall be no leakage of air.

After sealing the top of the boots, air shall be forced in, to a pressure of 15 kPa.

The boots shall then be immersed in water to within 75 mm of the top and examined for escape of air.

Ankle boots which show any sign of leakage in the vicinity of either the eyelets or the gusset shall be submitted to an immersion test. The boots shall be weighted and immersed in water to within 75 mm of the top for a period of 16 h and then examined to see if water has penetrated to the inside of the boot.

9.2 Dry heat ageing test

All rubber components shall be capable of withstanding exposure to air at a temperature of  $100 \pm 1 \text{ °C}$  and at atmospheric pressure for a period of 24 h in suitable apparatus, without developing any signs of brittleness or tackiness. For the purpose of this test, the test pieces may be entire articles or pieces cut from them. The test shall be carried out in accordance with the general provisions given in clause 3 of ISO/R 188.

9.3 Flexing test

When tested in accordance with annex B after having been submitted to the dry heat ageing test described in 9.2, the uppers shall withstand not less than the number of continuous flexes given in table 4 without the rubber face showing pinholes or any sign of cracking, and without separation of the plies when viewed with the unaided eye. For this purpose only those parts of the test piece shall be observed which are under tension during the test, i.e. the folds which form a diamond shape. Pinholes or cracking associated with machine damage shall be ignored.

The test pieces shall receive a minimum of 2 days' rest after having been subjected to the dry heat ageing test described in 9.2.

The testing equipment should be kept away from any source of ozone.

TABLE 4 – Flexing test limits

Thickness mm	Minimum number of flexes	
	handbuilt type	moulded type
up to 2,00	125 000	75 000
over 2,00 up to 2,25	110 000	50 000
over 2,25	90 000	40 000

## 10 MARKING

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

- a) size;
- b) manufacturer's identification;
- c) reference number issued by the appropriate national standards organization;
- d) 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.

STANDARDSISO.COM : Click to view the full PDF of ISO 2251:1975

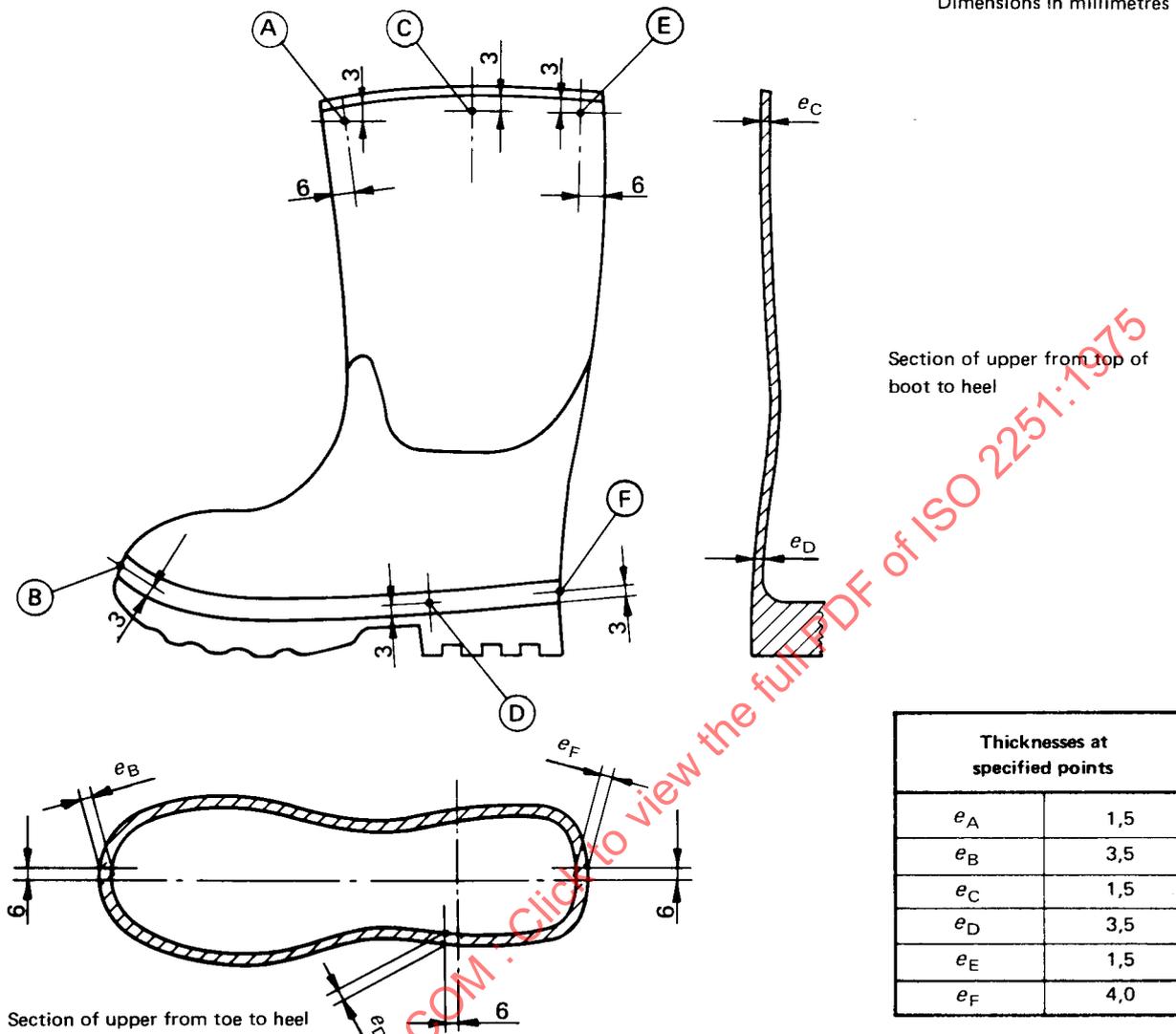


FIGURE 1 – Lined antistatic rubber boot

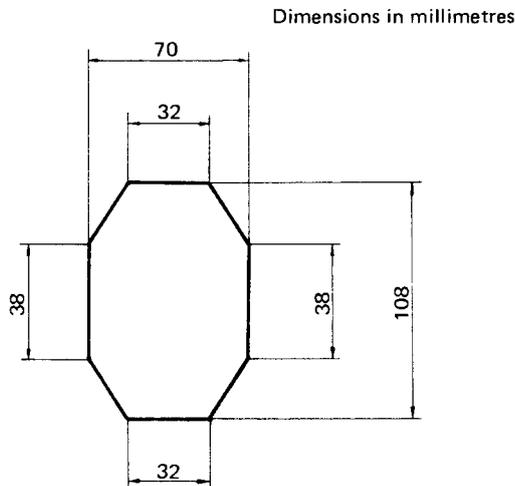


FIGURE 2 – Test piece for flexing test