INTERNATIONAL STANDARD 2023

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Lined industrial rubber footwear

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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 2023 was drawn up by Technical Committee ISO/TC 45, *Rubber and rubber products*, and circulated to the Member Bodies in June 1970.

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

Australia	Greece	Spain
Austria	India	Sweden
Belgium	Israel	Switzerland
Canada	Netherlands	Thailand
Czechoslovakia	New Zealand	United Kingdom
Egypt, Arab Rep. of	Poland	U.S.A.
France	South Africa, Rep. of	U.S.S.R.

No Member Body expressed disapproval of the document.

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Lined industrial rubber footwear

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the requirements for lined rubber footwear for general purposes and industrial use.

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 DEFINITIONS

3.1 boot upper : Upper part of the boot above the outsole covering the foot and leg.

3.2 boot vamp : Front area of the boot upper forward of the instep.

3.3 boot counter : Heel area of the upper.

3.4 heel piece : Reinforcement for stiffening the heel area only.

3.5 outer toecap : Reinforcement of the boot upper to protect the toes.

3.6 backstrip : Strip along the back centre line of the boot to reinforce it.

3.7 foxing strip : Reinforcing strip to protect the upper from scuffing, incorporated along the bottom edge of the upper before, during or after the attachment of the sole.

3.8 top binding : Narrow strip of rubber placed along the top edge of rubber boots or overshoes to give a finished appearance and to reinforce the edge.

3.9 insole : Bottom inside component of boot adjacent to the bottom of the last.

3.10 filling : Material under the insole to fill any cavity between upper and outsole.

3.11 anklet : Additional substance to reinforce the lower leg.

3.12 outsole : Bottom outside component providing the walking surface in the forepart and the walking surface, or the base for the heel at the rear.

3.13 sidestay : Additional substance to reinforce the side of the leg.

3.14 heel : Bottom outside component providing the walking surface at the rear of the boot.

3.15 tongue : Shaped piece of material to protect the foot from chafing by the closure.

3.16 eyelet stay : Reinforcement of the upper in the area where eyelets are secured.

3.17 back strengthening piece or counter reinforcement : See "heel piece".

4 FABRICS — MINIMUM REQUIREMENTS

4.1 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, in newtons, being as shown below :

	Warp	Weft
Upper and Vamp	250 N	200 N

4.2 Knitted fabrics

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

5 BOOT UPPER – MINIMUM THICKNESS

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

6 SPECIAL REINFORCEMENTS

The top of the boot shall be finished off by a top binding or other suitable means.

Eyelets, if fitted, shall be rust-resistant.

7 PHYSICAL PROPERTIES OF OUTSOLES AND HEELS

7.1 Tensile requirements before ageing

Three test pieces shall be cut from both outsoles and heels, then reduced to the required thickness by careful buffing, 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 the results is below, and the highest value above the appropriate values given in Table 1, two further pieces shall be tested. The material shall not be deemed to comply with the requirements unless the median of these results is above the appropriate value.

TABLE 1 – **Tensile and elongation requirements**

	Minimum tensile strength, MN/m^2	**Minimum elongation at break, %**
Outsoles	10,5	300
Heels	8,5	200

If the thickness of the soling is increased over the minimum specified in Table 3 by a specified percentage, the tensile strength and elongation at break requirements for soling and heel may also be reduced by the same percentage. The tensile strength shall not, however, be reduced below 8,5 MN/m^2 for the soling, or 7,0 MN/m^2 for the heel.

7.2 Tensile requirements after ageing

After ageing for 168 h at a temperature of 70 ± 1 °C in accordance with section 3 of ISO/R 188, the tensile strength and elongation at break of outsoles and heels determined as in 7.1 shall be in accordance with the values given in Table 2.

TABLE 2 – **Tensile strength and elongation requirements after ageing**

	Tensile strength, % of initial value	**Elongation at break, % of initial value**
Outsoles	± 20	+ 10 – 30
Heels	± 20	+ 10 – 30

8 SOLING AND HEELS – MINIMUM THICKNESS

The minimum thickness of outsoles and heels shall be in accordance with the requirements of Table 3.

TABLE 3 – **Minimum thickness**

Dimensions in millimetres

	over cleats	**between cleats**	**non-cleated**
Cleated outsoles (men)	9,0	4,0	–
Cleated outsoles (women)	7,0	3,5	–
Non-cleated outsoles	–	–	5,0
Cleated heels	25,0	–	–
Non-cleated heels	–	–	20,0

The minimum combined thickness of the insole and filler shall be 4 mm for rubber/fabric composition. If the insole is made of sponge rubber, the minimum combined thickness shall be 5 mm.

The thickness of the heel shall be measured on the outside edge, and midway along the length of the heel.

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 kN/m^2.

The boot 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 ± 1 °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 section 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 given in 9.2, the uppers shall withstand not less than the number of continous 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 given in 9.2.

The testing equipment shall 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 organisation.

ANNEX A

METHOD OF PREPARATION AND TEST FOR WOVEN FABRICS

Cut strip test pieces of rectangular shape, 25 mm wide, from the upper part of the boot to be tested. These shall cover both warp way and weft way directions, and be of sufficient length to permit a free length of 75 mm between the jaws of the fabric strength testing machine.

Where the height of the product does not permit a sample to be cut giving a free length of 75 mm between the jaws, a free length of 25 mm shall be used.

Except as indicated, these shall be tested for breaking strength in both warp and weft directions in accordance with the requirements of ISO/R 1421, using the cut strip method.

The rate of extension during rest shall be 100 ± 10 mm per minute. Alternative speeds of 50 mm per minute or 300 mm per minute may be used when agreed between manufacturer and user.

Preloads applied before carrying out the cut strip test shall be as follows :

1 N for a coated fabric up to 0,2 kg/m^2

2,5 N for a coated fabric from 0,2 kg/m^2 to 0,5 kg/m^2

5 N for coated fabric above 0,5 kg/m^2

The test jaws shall be set 75 mm or 25 mm apart.

The breaking strength is expressed in newtons (N) in the warp and weft directions for a test piece 25 mm in width.

ANNEX B

METHOD OF TESTING RESISTANCE TO FLEXING

B.1 APPARATUS

The apparatus shall have the following essential features :

The machine shall have an adjustable stationary part provided with grips 25 mm across, for holding one end of each of the test pieces in a fixed position, and a similar reciprocating part for holding the other end of each of the test pieces.

The reciprocating part shall be arranged so that its motion is in the direction of, and in the same plane as, the centre line between the grips, and its travel shall be adjusted so that the two sets of grips approach each other to a distance of 13 mm and separate to a distance of 57 mm.

The eccentric which actuates the reciprocating part shall be driven by a constant speed motor to give 340 to 400 flexing cycles per minute, with sufficient power to flex at least six and preferably twelve test pieces at one time.

The test pieces shall be arranged in two equal groups, so that one group is being flexed while the other group is being straightened, thus reducing the vibration in the machine. The grips must hold the test pieces firmly, and shall enable individual adjustment to be made to the test pieces.

B.2 TEST PIECES

The test piece shall have the dimensions shown in Figure 2. Four test pieces shall be cut from the thinnest portion of the leg part of the upper containing the fewest plies of fabric. Care shall be taken to ensure that the test pieces are cut cleanly from the sample material.

B.3 FITTING

The test piece shall be folded symmetrically about its major axis so that the rubber surface is outwards. In the folded condition one tapered end shall be inserted into the fixed central grip and pushed in until the test piece touches the grip pins.

This fixed grip shall then be tightened. The corresponding movable grip shall then be taken out to its fullest extent, the test piece inserted and pulled flat, and the grip tightened. It is recommended that clips be used to keep the edges together during the insertion of the test piece in the grips, but their removal is essential before flexing commences.

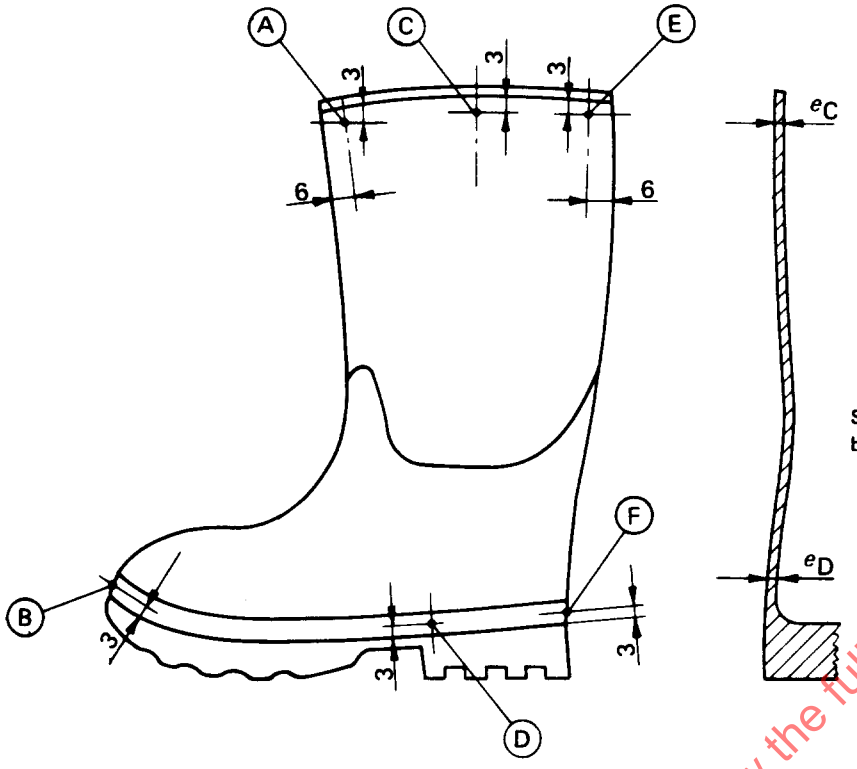
NOTE – The test piece shall not be under tension.

B.4 PROCEDURE

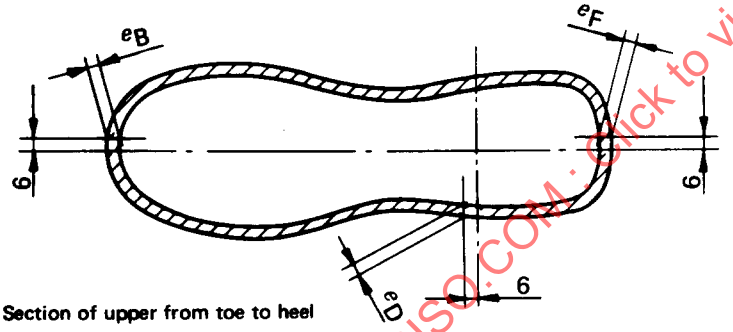
A complete to-and-fro movement of the grip shall be counted as one flex cycle. The length of test shall be calculated in flex cycles and not in time units.

The flex cycle may be determined by using a trip counter operated by one of the movable grips. The ambient temperature shall be one of the standard temperatures laid down in ISO/R 471.

Dimensions in millimetres



Section of upper from top of boot to heel



Section of upper from toe to heel

Minimum thicknesses at specified points	
e_A	1,5
e_B	3,5
e_C	1,5
e_D	3,5
e_E	1,5
e_F	4,0

FIGURE 1 – **Industrial rubber boot**

Dimensions in millimetres

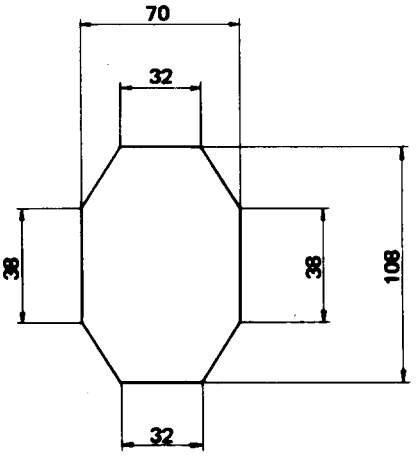
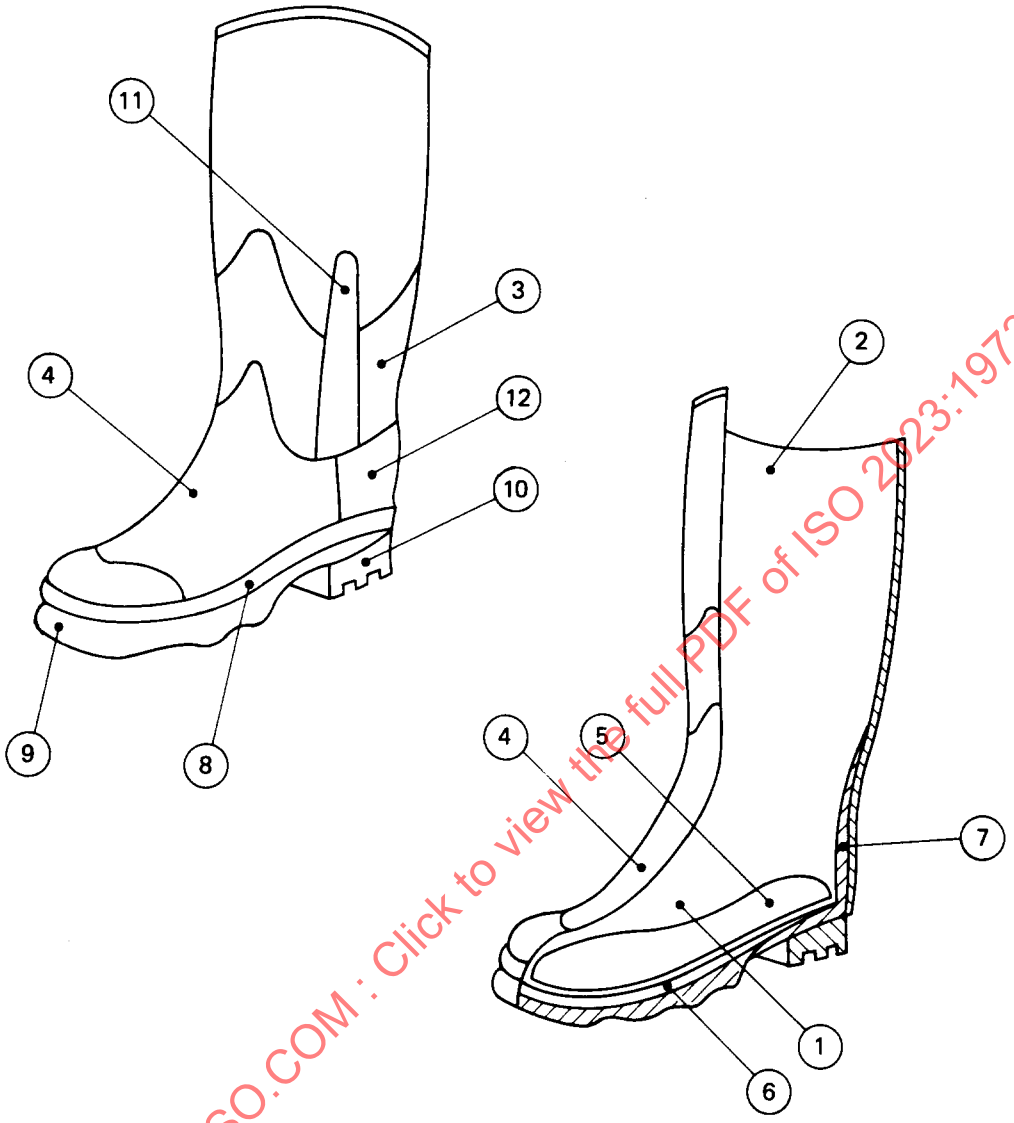


FIGURE 2 – **Test piece for flexing test**



1 Feet lining
2 Leg lining
3 Anklet
4 Rubber vamp
5 Insole
6 Filling
7 Heel reinforcement
8 Foxing strip
9 Outsole
10 Heel
11 Sidestay
12 Rubber counter

These illustrations show the general location of parts, all of which are not necessarily included in the construction, or implied in the specification.

In the case of moulded boots, the terms indicate a particular area of the boot, rather than a separate part.

FIGURE 3 – **Industrial rubber boots : "knee type"**