

भारतीय मानक
रबड़ के जूते — विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard
RUBBER BOOTS — SPECIFICATION
(*Third Revision*)

ICS 61.060; 19.020

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Footwear Sectional Committee had been approved by the Chemical Division Council.

Rubber boots are moulded or assembled footwear that are made of rubber in combination with cotton fabric. Rubber knee boots are also known popularly in the trade as gum boots. The upper portion of this footwear extends almost up to knee height and its sole is designed to prevent slipping. These boots are meant for general protection of feet and are mostly used in slushy and water-logged areas. There are also special uses of the said kind of boots in petrol pumps and other uses in oily area where such products need to have oil resistivity property too.

In this standard two types of boots are being specified to cover the usage in general condition (Type 1) and also for use in areas where products are frequently in contact with oil and grease (Type 2).

This standard is being aligned with IS 5557 : 1999 'Safety rubber boots for testing' and other requirements are being similar group of footwear.

For the purpose of reference to any Indian Standard for the purpose of evaluation, the ambit of current and amended standard only will be attracted.

The composition of the Committee responsible for formulation of this standard is given at Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard
RUBBER BOOTS — SPECIFICATION
(Third Revision)

1 SCOPE

This standard prescribes requirements, methods of sampling and tests for rubber boots of ankle, half knee and knee boots for general purposes.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard definitions given in IS 2050 shall apply.

4 CLASSIFICATION

This standard covers following three varieties of rubber boots, in two types : Type 1 Rubber boots for general use, and Type 2 Rubber boots (Oil resistant):

- Variety 1 Rubber knee boots
- Variety 2 Rubber half knee boots
- Variety 3 Rubber ankle boots

5 REQUIREMENTS

5.1 Boots, Type 1, non-oil resistant of Variety 1, 2 and 3; and Boots, Type 2, oil resistant of Variety 1, 2 and 3.

5.1.1 Design

The boots shall be made of rubber with fabric lining as shown in Fig. 1, 2 and 3 respectively. The sole and heel shall be of antislip design or as agreed to between the purchaser and the supplier. Design shown in Figs. 1 to 3 are recommendatory only.

5.1.2 Size

The boots shall be made in sizes 5 to 11 conforming to fittings as prescribed in Paris Point 38 to 45.

5.1.3 Thickness

The minimum thickness (rubber and fabric) of the boots

for the various parts as indicated in Figs. 1 to 3 shall meet the requirements, as prescribed in Table 1.

**Table 1 Thickness at Various Parts
of the Boots**

Sl No.	Part of Boots	Position as Indicated in Figures	Minimum Thickness mm
(1)	(2)	(3)	(4)
i)	Leg	A	1.5
		B	3.0
		C	1.5
		D	3.0
		E	1.5
		F	3.5
ii)	Outsole at cleat	1	8.00
		2	2.00
		3	2.00
		4	22.00
iii)	Insole		2.0
iv)	Packing and filler (to be measured at green stage)		1.5

NOTE — Packing and filler, in moulded construction footwear, may not be required to be provided.

5.1.4 Materials**5.1.4.1 Rubber components**

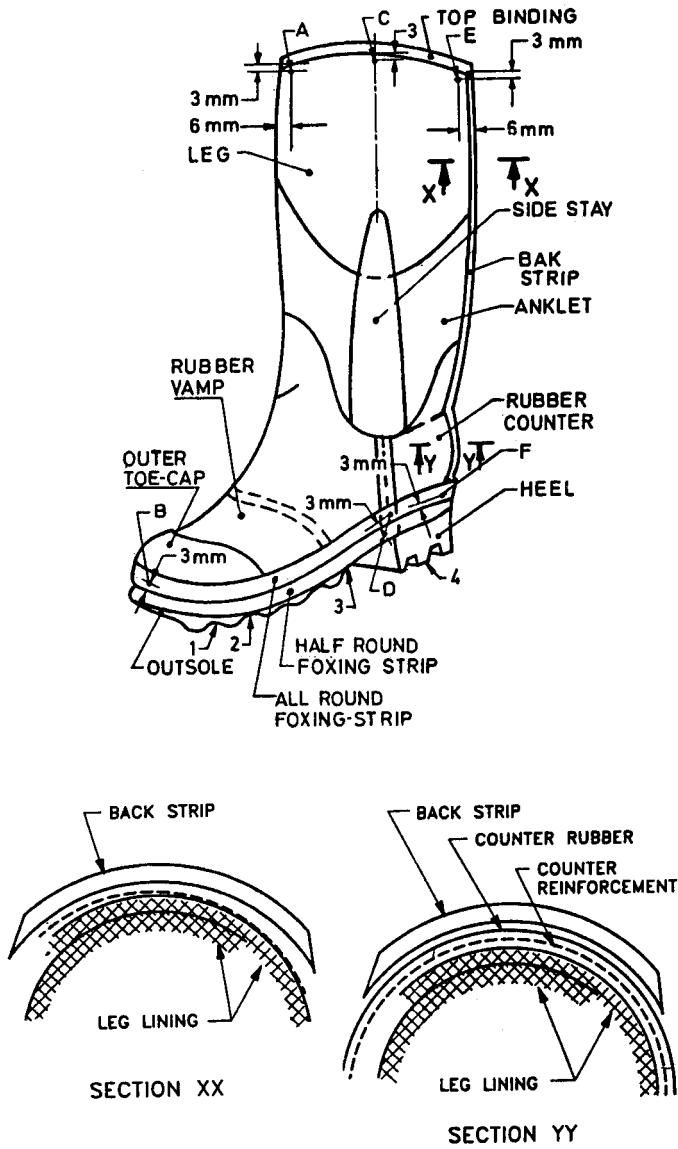
The rubber components of the boots shall be non-porous and homogeneous. These shall comply with the physical requirements as prescribed in Table 2.

5.1.4.2 Fabric

The upper shall consist of reinforcing lining fabric at leg, made of cotton or man made fabric or a suitable blend having breaking load of in warp and weft direction, being not less than 500 N in both directions when tested in accordance with IS 1969.

The reinforcing fabric for vamp and counter shall be having a breaking load of 500 N, *Min* in both warp and weft directions when tested in accordance with IS 1969.

The insole will be made out of cotton fabric having minimum breaking load of 500 N in both directions of warp and weft when tested in accordance with IS 1969, having lined with suitable rubber/cotton flock or rubber compound or rubber sponge.



Minimum substance (rubber and fabric) of boot in various parts

<i>Parts of Boot</i>	<i>Position in Figures</i>	<i>Minimum Thickness</i> mm
(1)	(2)	(3)
Leg	A	1.5
	B	3.5
	C	1.5
	D	3.5
	E	1.5
	F	4.0
Outsole	1 at cleat	8.0
	2 between cleats	2.0
	3 at waist	2.0
Heel	4	22.0

All dimensions in millimetres.

FIG. 1 RUBBER KNEE BOOT

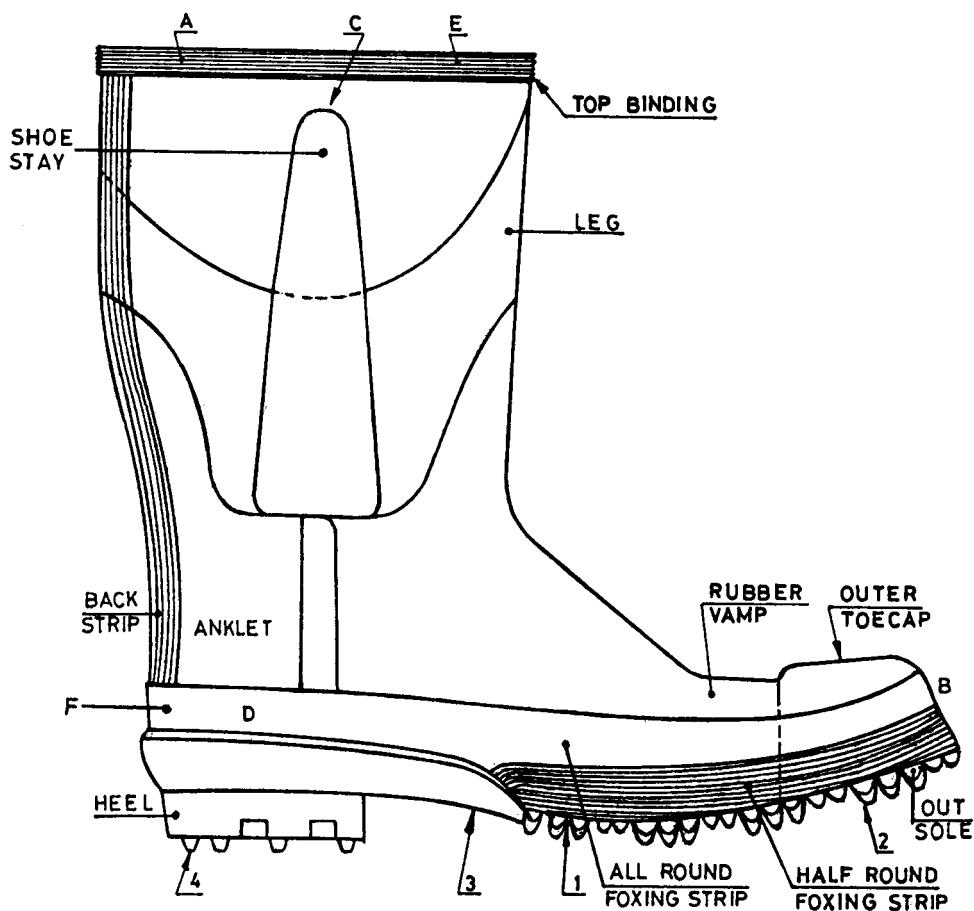
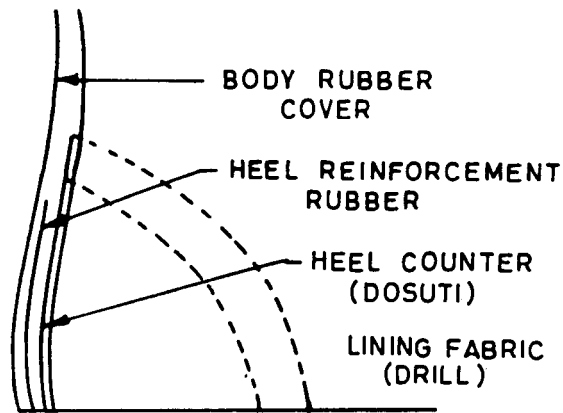
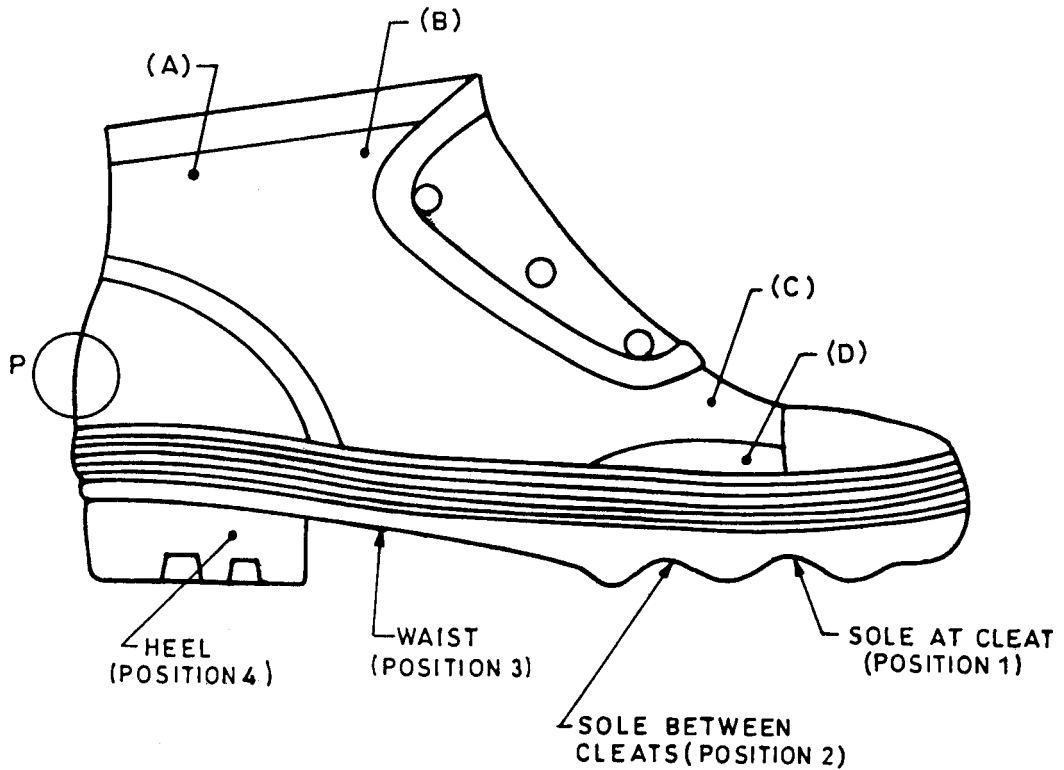


FIG. 2 RUBBER HALF KNEE BOOT

Table 2 Physical Requirements of Rubber Components
 [Clauses 5.1.4.1 and 5.1.5(c)]

Sl No.	Characteristics	Upper	Outer Sole Heel	Method of Test, Ref to IS 3400
(1)	(2)	(3)	(4)	(5)
i)	Relative density, <i>Max</i>	1.4	1.2	Part 9
ii)	Hardness (IRHD)	55 ± 5	60 ± 5	Part 2
iii)	Change in initial hardness after accelerated ageing at 100 ± 2°C for 24 h (IRHD)		+ 5 - 0	Part 4
iv)	Tensile strength Mpa, <i>Min</i>			
	Type 1		10.5	Part 1
	Type 2		8	
v)	Elongation at break in percent, <i>Min</i>			
	Type 1		250	Part 1
	Type 2		200	
vi)	Change in percent in tensile strength after accelerated ageing at 100 ± 2°C for 48 h			
	For Type 1		+ 5 - 25	do
	For Type 2		+ 10 - 0	
vii)	Change in elongation at break in percent			
	Types 1 and 2		+ 5 - 25	do



DETAIL AT 'P'

FIG. 3 SECTION OF COUNTER

5.1.5 Preparation of Test Pieces for Above Tests

The test pieces shall be cut from finished boots. If required test pieces shall be reduced to the required thickness by careful buffing or any other suitable method, taking care so as to avoid an abnormal increase in temperature.

Test pieces may also be taken from standard vulcanized test slab prepared from the same rubber compound from which only the boot is manufactured.

Such test slabs shall be subjected to the following checks:

- a) The difference between the density as measured from sample drawn directly from finished boots and between the sample taken from the standard rubberized test slab shall not differ by more than ± 0.05 g/cc.
- b) The Ash content does not differ by more than ± 0.50 percent when tested from the sample

taken directly from standard vulcanized test slab.

- c) Value achieved from standard vulcanized sheet, made out of moulded rubber sheet of same rubber compound, used for production of the same sample footwear, will be 30 percent higher than the value as prescribed in SI No. (iv) and (v) of Table 2.

5.1.6 Construction

5.1.6.1 Various components of the boots are to be prepared from the materials as prescribed in Fig. 1, 2 and 3 and Table 3.

Fabric used as inner lining of the footwear shall be coated with rubber compound at one side and fabric used for reinforcement will be coated with rubber at both sides.

5.1.6.2 Boots shall be made in vulcanized or moulded process or both.

5.1.7 Physical Requirements

5.1.7.1 Heat treatment

All rubber components shall be capable of withstanding, without developing any sign of brittleness or tackiness when aged at $100 \pm 2^\circ\text{C}$ at atmospheric pressure, in an air oven, for a period of 24 h in accordance with the method prescribed in IS 3400 (Part 4). On completion of the test the rubber face shall not show any sign of

damage, tackiness, brittleness or crack when viewed with unaided eye.

5.1.7.2 Composite breaking load test

The strength of the composite upper when tested in accordance with method as prescribed below shall be such that it withstands minimum breaking load of 220 N at both directions.

5.1.7.2.1 Prescribed method of composite breaking load test

From the upper, representative sample of 25 ± 0.5 mm width is to be cut along the length of the boot of enough length so as to make it convenient to allow a distance of 50 mm between the jaws of the tensile testing machine.

Rate of traverse of the pulling jaw shall be 100 ± 10 mm/min. Three such test pieces from each direction will be required to be obtained from the made-up footwear and will be subjected to test to break each test piece.

Mean value of results for each side are to be taken for record.

5.1.7.3 Flexing endurance

The vamp portion of upper and sole shall withstand continuous flexes as prescribed in Table 4 and when tested in accordance with the method prescribed in Annex B. The samples for flexing endurance shall be taken after the same samples are aged and tested and conform to the requirements prescribed in 5.1.7.1.

Table 3 Material Requirement for Rubber Boots

(Clause 5.1.6.1)

SI No.	Components	Material
(1)	(2)	(3)
i)	Leg	Inside fabric/Outside rubber
ii)	Vamp	do
iii)	Counter	Rubberized fabric
iv)	Inner reinforcement at vamp	Rubber or rubberized fabric
v)	Heel piece (reinforcement at outer rubber side at counter)	Rubber
vi)	Toe cap	Rubber
vii)	Back strip	Rubber
viii)	Foxing strip	Rubber
ix)	Top binding	Rubber
x)	Insole	Outside fabric/inside rubber or sponge or suitable rubber compound
xi)	Filler	Rubber or rubber with fabric composition
xii)	Outer sole	Rubber
xiii)	Heel	Rubber
xiv)	Counter reinforcement or back strengthening piece	Rubber or rubberized fabric
xv)	Anklet	Rubber
xvi)	Full bellow tongue for Variety 3	Single texture rubberized fabric
xvii)	Snap fastener for Variety 3	Plastic/synthetic or any other suitable material as agreed to between the supplier and the purchaser

**Table 4 Number of Flex Cycles for Boot
Upper and Sole
(Clause 5.1.7.3)**

Sl No.	Position of Individual Test Pieces	No. of Flexes Min
(1)	(2)	(3)
i)	Upper (Vamp portion)	125 000
ii)	Outsole	60 000

5.1.7.4 Leakage resistance test

Finished boots excepting Variety No. 3 will be sealed from the top and will be subjected to minimum pressure of 15 kN/m² and will be immersed in water. Boots will be immersed in a manner that 75 mm from the top of the boot will remain outside the water boots, for a minimum duration of 2 min and will be examined for escape of air and there shall be no leakage.

For Variety No. 3 the boots will be immersed in water, up to a depth of 60 mm, from the bottom of the boot without application of any air pressure for a duration of not less than 30 min. There will be no wet feeling inside the boot and no sippage of water will take place.

5.1.7.5 Consolidation tests

- a) *For Type 1 boots* — From the leg, cut a strip of 25 ± 0.5 mm width along the length of the boot and of sufficient length to permit separation over a length of 75 mm. Carry out the test on two test pieces (one from each odd) at the rate of traverse of 100 ± 10 mm per minute in accordance with IS 3400 (Part 5) or static dead load method as given in Annex D. The individual adhesion value for consolidation test noted/recorded, shall not be less than 30 N (3.0 kgf) for each of the test pieces.

In case of dead load method, rate of separation should not be 25 mm/min, *Max*.

NOTE — Manual recording may also be done in absence of the machine with auto recording device.

- b) *For Type 2 boots* — The individual adhesion value for consolidation test noted/recorded, shall not be less than 15 N (1.5 kgf) for each of the test pieces.

In case of dead load method rate of separation should not be more than 25 mm/min, *Max*.

5.1.7.6 Resistance to oil

The rubber of upper, sole and heel of the Type 2 boots

shall pass the tests when tested in accordance with method as per Annex C and the volume swell of such test pieces will not exceed 15 percent.

5.1.7.7 Height of the boots

In absence of any agreement between the purchaser and the supplier, height of the Variety No. 1 boots, measured from the seat, shall be 340 ± 5 mm for size 8 with an increase or decrease of 5 mm for each size of increase or decrease respectively.

In absence of any agreement between the purchaser and the supplier, height of the Variety No. 2 boots, measured from the seat shall be 250 ± 5 mm for size 8 with increase or decrease of 5 mm for each size of increase or decrease respectively. In absence of any agreement between the purchaser and the supplier, height of the Variety No. 3 boots, measured from the seat, shall be 120 ± 2.5 mm for size 8 with increase or decrease of 2.5 mm for each size of increase or decrease respectively.

6 MARKING AND PACKING

6.1 Marking

All markings shall be given on the insole/leg lining. Brand/Trade name of the manufacturer, name of the item, month and year of manufacture, size, batch number, licence number, Standard Mark, variety and type, and name of the manufacturer are to be marked on the insole/leg lining legibly with suitable ink.

6.1.1 BIS Certification Marking

6.1.1.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6.2 Packing

The right and left boots of each pair shall be packed in a suitable container as agreed to between the purchaser and the supplier.

7 SAMPLING AND CRITERIA FOR CONFORMITY

The scale of sampling and criteria for conformity shall be as prescribed in IS 6368 or as agreed to between the purchaser and the supplier.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
1969 : 1985	Methods for determination of breaking load and elongation of woven textiles fabrics (<i>second revision</i>)	(Part 2) : 1995	Hardness (<i>second revision</i>)
2050 : 1991	Glossary of terms relating to footwear (<i>first revision</i>)	(Part 4) : 1987	Accelerated ageing (<i>second revision</i>)
3400	Method of test for vulcanized rubbers	(Part 5) : 1986	Adhesion of rubber to textiles fabric (<i>second revision</i>)
(Part 1) : 1987	Tensile stress and strain properties (<i>second revision</i>)	(Part 9) : 1978	Density (<i>first revision</i>)
		(Part 16) : 1974	Measurement of cut growth of rubber by the use of Ross Flexing machine
		6368 : 1971	Method of sampling of rubber and rubber combination footwear

ANNEX B

(Clause 5.1.7.3)

METHOD OF DETERMINATION OF FLEXING ENDURANCE FOR VAMP AND UPPER

B-1 The machine has an adjustable stationary part, provided with grips of 25 mm across for holding one end of each of the test pieces in a fixed position and a similar but reciprocating part for holding the other end of each test piece.

The reciprocating part is arranged so that the motion is in the direction of and in the same plane as the centre line between grips. Its travel is adjusted so that the two sets of grips approach each other to a distance of 57 mm. The eccentric which actuates the reciprocating part is driven by a constant speed motor to give 300 ± 10 flexing cycles/min for vamp.

The motor should have sufficient power to flex at least six and preferably twelve test pieces at a time. The test pieces should 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 shall hold the test pieces firmly and enable individual adjustment to be made to the test pieces.

B-2 TEST PIECE

The test pieces shall have the dimension shown in Fig. 4 where the size and the style of the footwear permits. Test pieces are to be taken out from one article of footwear. In other cases take three or two test pieces whichever is possible, from one article of footwear. Test pieces are to be cut from the vamp of the upper. Care to be taken to ensure that the test pieces are cut out cleanly from the sample material.

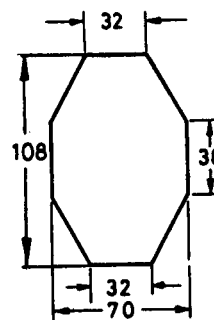


FIG. 4 TEST PIECE FOR FLEXING TEST

B-3 TEST PIECE FOR FLEXING TEST**B-3.1 Procedure**

Fold the test piece symmetrically about its major axis so that the rubber surface is outwards. In the folded condition insert one tapered end into the fixed central grip and push in until sample touches the grip pins. Tighten this fixed grip. Take out the corresponding movable grip to its fullest extent; insert the test piece and pull flat and tighten the grip. It is recommended that clips may be used to keep the edges together during the insertion of the test piece in the grips, but their removal is essential before the flexing commences.

NOTE — The test piece should not be under tension.

B-4 EXPRESSION OF RESULTS

A complete to and fro movement of the grip is counted as one flex cycle. Report the number of cycles required to start cracking. The flex cycle may be determined by using a trip counter operated by one of the movable grips.

ANNEX C

(Clause 5.1.7.6)

METHOD OF TEST FOR OIL RESISTANCE

C-1 GENERAL

Samples shall be taken from the soles, the heels and the upper part of the boot to be tested. Any fabric adhering to the upper shall be removed by buffing or other suitable means before proceeding with the test.

C-2 CONDITIONING OF TEST PIECES

The test pieces shall be conditioned for not less than 3 h at $27 \pm 2^\circ\text{C}$.

C-3 TEMPERATURE OF TEST

The test temperature shall be the same as that chosen for conditioning.

C-4 DURATION OF TEST

$$24 \begin{matrix} +2 \\ -0 \end{matrix} \text{ h}$$

C-5 IMMERSION LIQUID

C-5.1 2, 2, 4-Tri Methyl Pentane, 85 percent (v/v).

C-5.2 Toluene, 15 percent (v/v).

NOTE — The materials shall be chemically pure.

C-6 SIZE OF TEST PIECES

For the soles and heels of the boots, the test pieces shall be 1 to 3 cm³ in volume and of a uniform thickness of 2.0 ± 0.2 mm.

For the upper part of the boots, a test piece of 1 to 3 cm³ in volume shall be prepared after removal of the fabric, the area depending on the thickness, but neither the length nor the breadth shall be greater than 50 mm.

C-7 APPARATUS

A stoppered glass bottle or tube shall be used, its dimensions being such that, the test pieces remain completely immersed in the immersion liquid, and are freely exposed at oil surfaces without restraint.

C-8 PROCEDURE

C-8.1 Three test pieces shall be used. Each test piece shall be weighed in air to the nearest milligram (mass, m_1) and then in distilled water at the standard laboratory temperature (mass, m_2) care being taken to ensure that all air bubbles are removed.

C-8.2 The test pieces shall be blotted dry with filter paper or with a textile fabric that does not deposit lint, and then placed, suitably separated, in a glass container with a volume of the immersion liquid at least 15 times the combined volume of the test pieces and sufficient to keep them totally immersed.

C-8.3 The container shall be stoppered, kept at the required temperature and the rubber shielded from light during the test.

Only test pieces of the same vulcanizate shall be placed in any one container. If the density of the rubber is less than that of the liquid, a means shall be provided for holding the test pieces completely below the surface of the liquid.

C-8.4 At the end of the immersion period, surplus immersion liquid shall be quickly wiped from the test pieces with filter paper or (textile fabric which does not deposit lint). Each test piece then being placed immediately in a tared and stoppered weighing bottle; and its mass in air determined (mass, m_3) to the nearest milligram. The test piece shall then be removed from the bottle and immediately weighed in distilled water (mass, m_4) at the standard laboratory temperature. The time for each transference of the test pieces after removal from the immersion liquid shall not exceed 30 s.

C-9 CALCULATION

The change in volume shall be calculated as follows:

$$V = \frac{(m_3 - m_4) (m_1 - m_2)}{m_1 - m_3} \times 100$$

where

m_1 = initial mass of test pieces in air,

m_2 = initial mass of test pieces in water,

m_3 = mass of the treated rubber test piece in air,
and

m_4 = mass of the treated rubber test pieces in water.

The results of the three test pieces shall be averaged.

The maximum time between the date of manufacture, where known, and testing shall be 3 months. Where the date of manufacture is not known, the maximum time for testing shall be 6 weeks from the date of receipt.

ANNEX D

(Clause 5.1.7.5)

STATIC LOAD METHOD

D-1 STATIC LOAD METHOD

D-1.1 Apparatus

The apparatus required for the consolidation test by the static mass method consists of a supporting frame, testing clamps mandrels, calibrated weights and weight carriers. The supporting frame shall be made up of such design that clamps for strip specimens hang on it vertically and mandrels and rings specimens are supported on it horizontally. The frame shall be of sufficient height to permit the weight carrier to be suspended from the test specimens by means of clamps and shall hang freely during the progress of the test. Provision shall also be made to support the mandrels

so that they revolve freely with minimum friction. Suitable apparatus is shown in Fig. 5.

D-2 CALIBRATION OF APPARATUS

Calibrate the weights annually.

D-3 CUTTING TOOLS

Maintain the cutting tool carefully so that the edge is sharp enough to avoid leaving ragged edges and pulling outside threads from the fabric.

D-4 PROCEDURE

Separate the parts of the strip to be tested by hand at one end of the strip specimen and at a sufficient

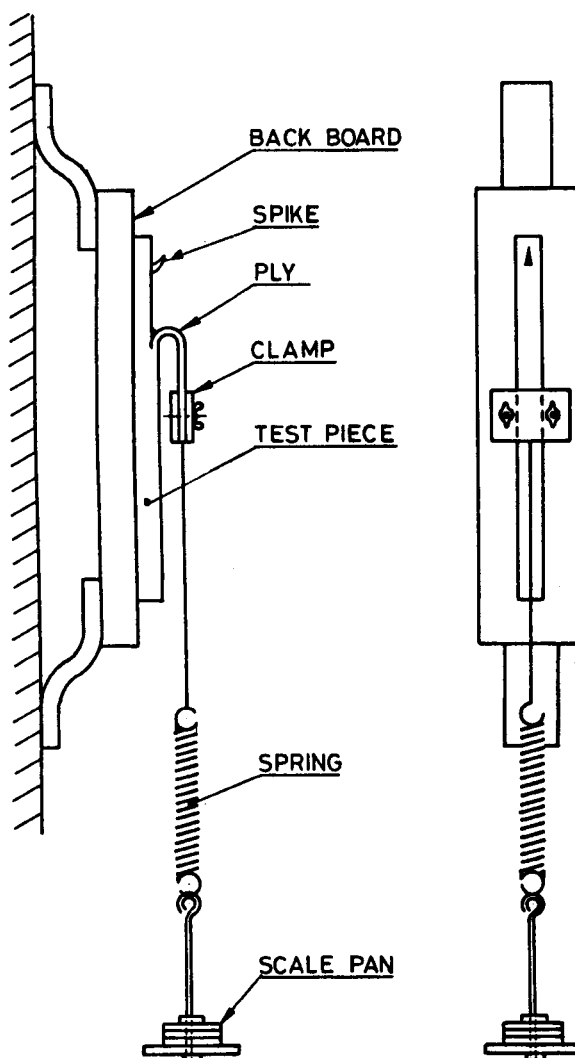


FIG. 5 APPARATUS FOR STATIC LOAD METHOD ON STRIP TEST PIECE

distance to permit the jaws of the testing clamp to be attached. Suspend the strip on the spike of the vertical frame or board and attach the ply to be separated to the grip. Attach the loaded scale pan to the grip through a light spring. The total mass of the grip, spring loaded scale pan and attachments shall be taken as the applied load. Obtain either the load required to cause separation of 25 mm/min graphically by selecting various loads or for a known or specified load. Determine the rate of separation. Repeat the procedure on the separate plies from the face ply to the centre ply. Test the second specimen commencing

with the back ply and proceeding again to the center ply.

NOTE — Precautions should be taken during the test to prevent side threads from pulling out and interfering with the test result. Where this occurs excessively due to the threads not being parallel to the edge of the strip the test piece shall be discarded and a fresh one will be prepared.

D-5 EXPRESSION OF RESULTS

Express the result as average force in Newtons per millimetre width required to cause a separation of the plies at 25 mm/min or obtain the rate of separation at a known or specified load.

ANNEX E

(Foreword)

COMMITTEE COMPOSITION

Footwear Sectional Committee, CHD 19

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Central Footwear Training Institute, Chennai	SHRI PREM PAL
Central Leather Research Institute, Chennai	SHRI B. N. DAS DR R. RAJARAMAN (<i>Alternate</i>)
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.	