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Indian Standard

SPECIFICATION FOR
LEATHER SAFETY SHOES FOR WOMEN
WORKERS IN MINES AND STEEL PLANTS

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR LEATHER SAFETY SHOES FOR WOMEN WORKERS IN MINES AND STEEL PLANTS

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 February 1985, after the draft finalized by the Footwear Sectional Committee had been approved by the Chemical Division Council.

0.2 Considering the growing number of women workers in mines and steel plants and the social obligations on the part of the employers for their safety and protection, the Committee decided to formulate a standard for the safety shoes for workers in mines and steel plants. Help of Directorate General of Mines Safety, Dhanbad and Steel Authority of India Ltd has been taken for preparation of this standard.

0.3 Recommendations given in IS : 6519-1971* should be followed for storage and use of safety footwear.

0.4 Only one type of safety shoe has been prescribed in the standard. Some other new types may be incorporated according to feedback information from the users.

0.5 Women miners are not allowed for underground jobs, but may have to face various hazards, therefore, the leather footwear covered by this standard has internal steel toe caps with antislip design rubber soles. Till a new standard of lasts for this footwear is prescribed, lasts conforming to IS : 7329-1974† corresponding to popularly known in trade as last Model No. 6619 may be used as it is considered suitable also for the shoes covered by this standard.

0.6 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‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Code of practice for selection, care and repair of safety footwear.

†Specification for metal lasts for safety rubber-canvas ankle boots.

‡Rules for rounding off numerical values (*revised*).

1. SCOPE

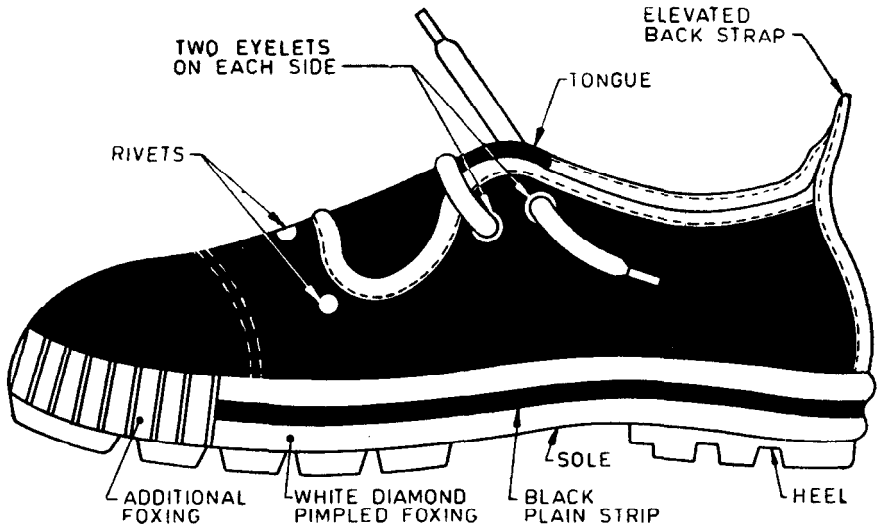
1.1 This standard prescribes the requirements and method of sampling and test for leather safety shoes with leather upper and moulded rubber sole with heel and reinforced with protective steel toe caps for use of women workers engaged in mines and steel plants.

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 2050-1967* shall apply.

3. REQUIREMENTS

3.1 **Shape and Design** — The shoe shall conform to the pattern, shape and design as shown in Fig. 1. The quarter and vamp shall be of one piece without any joints, but loose tongue shall be riveted separately from inside and the elevated back strap shall be stitched.



NOTE — The illustration is diagrammatic only and is not included to illustrate all details or design.

FIG. 1 SAFETY LEATHER FOOTWEAR FOR WOMEN MINERS AND WOMEN WORKERS IN STEEL PLANTS

*Glossary of footwear terms.

3.2 Materials

3.2.1 Upper Material — The upper leather shall be suede leather from buffalo/cow hides conforming to IS : 578-1971* and colour shall be as agreed to between the purchaser and the manufacturer.

3.2.2 Binding Material — Cotton tape, *NEWAR* of herring bone weave (see IS : 1895-1982†) 19 ± 1 mm in width and minimum 1 mm in thickness in any colour shall be used.

3.2.3 Bottom Material — The bottom material for sole with heel shall be of rubber conforming to the requirements given in Table 1. The sole with heel shall have an antislip design as shown in Fig. 2 and 3.

TABLE 1 MATERIAL REQUIREMENTS FOR SOLES WITH HEELS

SL No.	CHARACTERISTIC	FOXING AND RUBBER TOE CAP	OUTER SOLE WITH HEEL	METHOD OF TEST, REF TO
(1)	(2)	(3)	(4)	(5)
i)	Relative density, <i>Max</i>	1.40	1.30	IS : 3400 (Part 9)-1978*
ii)	Hardness, IRHD	55 ± 5	60 ± 5	IS : 3400 (Part 2)-1980†
iii)	Flexing resistance, number of cycles:			
a)	Initial crack, <i>Min</i>	—	60 000	IS : 3400 (Part 16)-1974‡
b)	Cut growth at the end of 120 000 cycles, percent <i>Max</i>	—	600	IS : 3400 (Part 4)-1978§
iv)	Change in initial hardness after accelerated ageing for 24 h at $100 \pm 1^\circ\text{C}$, IRHD	+ 5 - 0	+ 5 - 0	IS : 3400 (Part 2)-1980†

*Methods of test for vulcanized rubbers: Part 9 Density (*first revision*).

†Methods of test for vulcanized rubbers: Part 2 Hardness (*first revision*).

‡Methods of test for vulcanized rubbers: Part 16 Measurement of cut growth of rubber by the use of the ross flexing machine.

§Methods of test for vulcanized rubbers: Part 4 Accelerated ageing.

*Specification for full-chrome upper leather (*second revision*).

†Specification for cotton *NEWAR* (*second revision*).

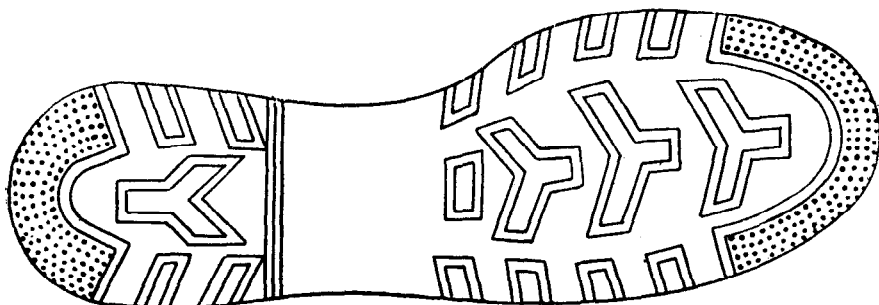


FIG. 2 STUD DESIGN OF RUBBERSOLE WITH HEEL

3.2.4 Thread for Upper Closing — Cotton sewing thread of variety No. 38 of IS : 1720-1978* shall be used. The colour of the thread shall match the shade of the upper.

3.2.5 Bottom Filling Material — Rubberized textile or rag dusts, or sponge rubber shall be used.

3.2.6 Steel Toe-Cap — Conforming to Type 2 of IS : 5852-1977† shall be used to match the contour of lasts conforming to IS : 7329-1974‡.

3.2.6.1 The steel toe-cap used in safety shoes shall be subjected to an impact test to ensure its function as a protective footwear when shoes are subjected to the impact test (see Appendix A) for evaluating the safety factor of the shoes, they shall withstand an impact of 14 kgf/m. Samples shall be considered to have passed the test, if the clearance inside the shoe at the moment of maximum depression, when subjected to an impact test, is 13.5 mm or more.

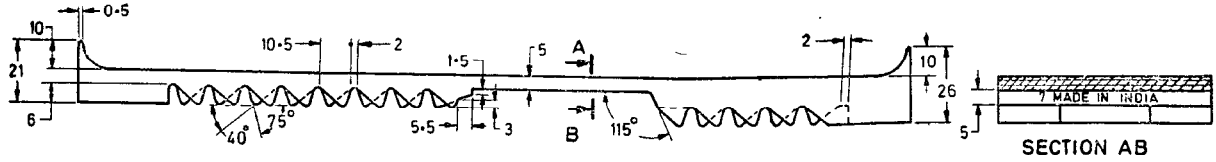
3.2.7 Fabric Laces — The footwear shall be provided with flat braided fabric laces matching the shade of the upper material of suitable length, with minimum breaking load of 45 kg, when tested between 18 cm grip; the rate of power actuated grip being 300 mm per minute. The two ends of the lace shall be provided with suitable metal or plastic tips. If laces are coloured black, it shall be free from sulphur dyes (see Appendix B).

3.3 Components — Individual leather components of the shoe shall be of thickness 1.80 mm minimum and shall be checked before fabrication of the shoes.

*Specification for cotton sewing threads (*second revision*).

†Specification for protective steel toe-caps for footwear (*first revision*).

‡Specification for metal lasts for safety rubber-canvas ankle boots.



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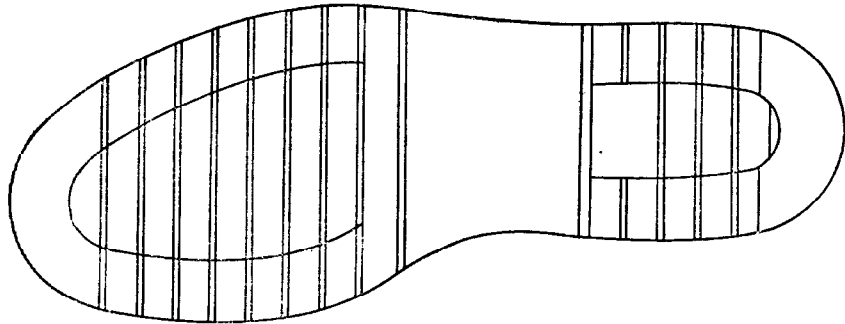


FIG. 3 RIPPLE DESIGN OF RUBBER SOLE WITH HEEL

3.3.1 The rubber sole with heel shall conform to the thickness as prescribed in Table 2.

TABLE 2 THICKNESS REQUIREMENTS OF RUBBER SOLE WITH HEEL

SL No.	COMPONENTS	THICKNESS mm, <i>Min</i>
(1)	(2)	(3)
i) <i>For Stud Design</i>		
a)	Forepart: Outside bar	10·0
	Inside bar	4·0
b)	Heel: Outside bar	15·0
	Inside bar	9·0
ii) <i>For Ripple Design</i>		
a)	Forepart: Over cleats	10·5
	Between cleats	4·5
b)	Heel: Over cleats	15·5
	Between cleats	9·5

3.4 Adhesion — Representative samples cut out from the rubber foxing and tested for adhesion in accordance with the method prescribed in IS : 3400 (Part 5)-1965* shall have an adhesion such that the rate of separation does not exceed 25 mm per minute under a load of 6·5 kg between the rubber and leather components.

3.5 Manufacture

3.5.1 The shoes shall be made on the lasts conforming to size and fitting of IS : 7329-1974† or previously approved by the purchaser and the manufacturer so as to conform to shape and design given in Fig. 1.

3.5.1.1 The upper components shall be cut to the thickness, shape and design as required (*see* Fig. 1) keeping the flesh side upwards. The counter portion of the upper shall be stitched in lock stitching machine, preferably in a heavy duty machine. The back strap shall be joined from outside duly elongated as shown in Fig. 1 with two rows of stitches. All edges shall be stitched with variety No. 38 of IS : 1720-1978‡ with single row of stitches in a binding machine. The number of stitches in all cases shall be 4 to 5 per cm.

3.5.1.2 Two aluminium (enamelled) eyelets shall be fixed on each side of quarter (*see* Fig. 1). The eyelets shall conform the size (collar diameter) 6.3 of Table 1 of IS : 5041-1978§.

*Methods of test for vulcanized rubbers: Part 5 Adhesion of rubbers to textile fabrics.

†Specification for metal lasts for safety rubber-canvas ankle boots.

‡Specification for cotton sewing threads (*second revision*).

§Specification for footwear and stationery eyelets (*first revision*).

3.5.1.3 A pre-moulded single piece rubber sole with heel shall be used. The insole shall be of drill cotton covered with rubberized textile compounds. The thickness of such insole shall be 2.50 mm, *Min* and gap between insole and outer sole shall be filled with packing material such as sponge, rubberized textile material or rubber compound (see Fig. 4).

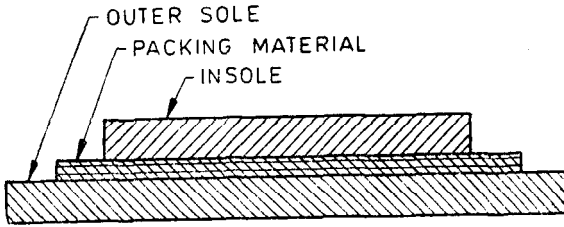


FIG. 4 POSITION OF INSERTING THE PACKING MATERIAL

3.5.1.4 Steel toe cap with drill cotton duly rubberized shall be fixed underneath to the toe. The steel toe-cap shall be inserted under the vamp with rubber packing so that free edges of the steel toe-cap are further fortified from the top, in order to prevent easy rupture of the upper in contact with steel edges of the toe-cap. A cross-section of the toe portion of shoe is shown in Fig. 5.

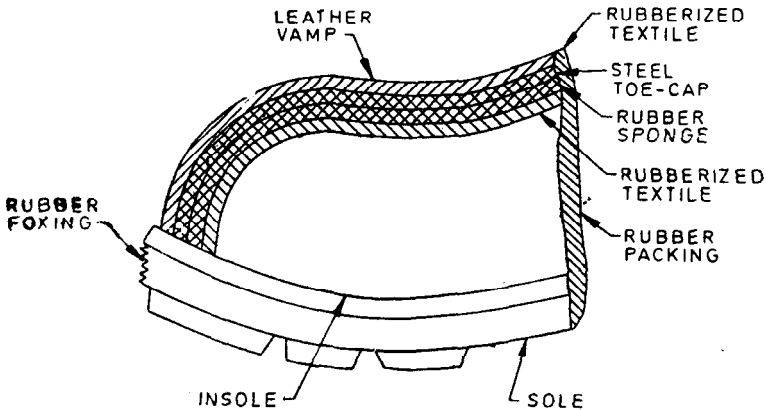


FIG. 5 CROSS-SECTION OF TOE INCORPORATING STEEL TOE-CAP

3.5.1.5 The joint of the upper and sole shall be strengthened by a 1.9 ± 1 mm strip of rubberized cloth on all sides. A white diamond pimpled or any other mutually agreed designed finish rubber foxing of 25 ± 2 mm width shall be fixed around the sole along with a black plain foxing strip of about 2 mm all round. The foxing shall not extend to the edge of the sole. The front portion of the toe shall have an additional foxing of any colour to strengthen the underneath foxing.

3.5.1.6 The insole shall be covered with a layer of drill cotton duly rubberized.

3.5.1.7 The shoes shall be made by the vulcanizing or moulding process and all parts shall be properly cemented, vulcanized and trimmed.

3.6 Finish — Each pair of shoes shall be provided with fabric laces. The finish shall be in accordance with sound manufacturing practice.

3.7 Ageing — All rubber components shall be capable of withstanding accelerated ageing without developing any sign of brittleness hardening or tackiness on ageing to $100 \pm 1^{\circ}\text{C}$ for 24 hours in an oven.

3.8 Mass — The mass of the finished shoes shall not exceed 1 350 g per pair of size 8. The mass per pair shall increase or decrease by 50 g for each bigger or smaller size respectively.

A P P E N D I X A

(*Clause 3.2.6.1*)

DETERMINATION OF IMPACT VALUE OF STEEL TOE-CAP

A-0. GENERAL

A-0-1 An impact test for determining the performance of toes of protective footwear, reinforced with steel toe-cap to withstand a blow of 14 kgf has been described.

A-1. TEST SPECIMEN

A-1.1 The shoes shall be tested only after minimum of two weeks from its manufacture.

A-1.2 The test shall be made on the toe of finished shoes sampled from each size of a lot.

A-1.3 Pattern of Shoes — The test shall apply only to shoes of the particular pattern as given in Fig. 1, 2 and 3.

A-2. TEST MACHINE

A-2.1 The test machine shall be such that a 27.0 ± 0.2 kg mass can be allowed to fall freely on vertical guides from various predetermined heights to strike a cylindrical mild steel plunger, 38 mm in diameter and 145 mm long. The plunger shall be freely supported in a vertical guide, and shall have attached to its lower end a horizontal mild steel plate bar 155 mm long, 38 mm wide and 10 mm thick. The bar shall be such that it can rest on the toe of the footwear in a position specified in **A-4.1**. The upper end of the plunger shall have a mild steel plate 63 mm wide screwed to it which can be replaced, if worn out. All the above dimensions shall have a tolerance of ± 1 mm.

A-2.1.1 The base of the machine shall be solidly constructed on hardwood, 75 mm thick. To this shall be bolted a metal block 50 mm thick to support the steel plate on which the footwear rests (see **A-4.2**).

A-3. MEASUREMENT OF IMPACT VALUE

A-3.1 Point of Measurement of Clearance Inside the Shoes — The position of point of measurement of clearance inside the shoes shall be found by using a size 8 last of the same shape as that on which the footwear to be tested was made.

A-3.1.1 The toe point is found by placing the last on a flat surface so that inside surface and toe touches two vertical planes all at right angles to each other (see Fig. 6). X is the point of contact of the toe with one of these planes. A line XY is drawn from toe to heel (the heel point can be located by eye with sufficient accuracy) and 28 mm is marked off down this line from the toe to given point A . A line perpendicular to XY is drawn through cutting the outside edge of the last at P and the inside edge of at $OQ = 0.42 \times PQ$.

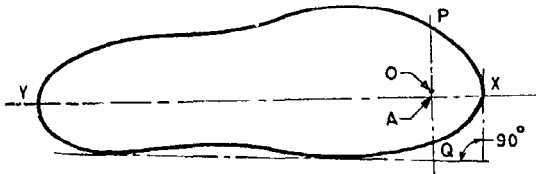


FIG. 6 POSITION OF MEASUREMENT OF CLEARANCE
INSIDE THE SHOE

NOTE — For the last shape other than size 8, the procedure given in **A-3.1** may be modified suitably by the testing laboratory if, in their opinion, the position obtained for measuring clearance is not a reasonable one.

A-3.1.2 The footwear to be tested shall be drilled through the sole in such a manner that, with the last in the footwear, the drill comes through the insole at the point *O* on the last, and is approximately perpendicular to the surface of the last at this point. A suitable jig can be devised for this purpose.

A-3.2 Method of Measurement of Clearance at the Moment of Maximum Depression — A device capable of measuring the clearance, at the moment of maximum depression, between the insole and upper shall be fixed to the insole by means of screw passing through the hole drilled in the position defined in **A-3.2.1** (see Fig. 7).

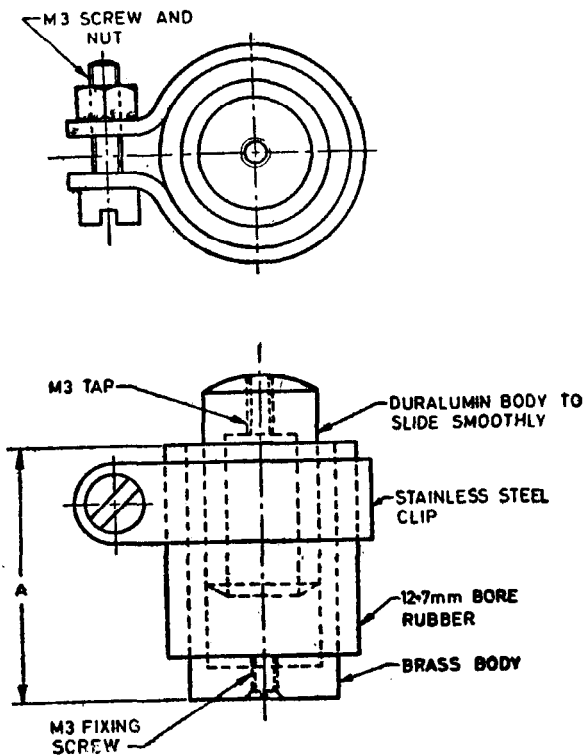


FIG. 7 CAPSULE FOR MEASURING THE CLEARANCE AT THE MOMENT OF MAXIMUM DEPRESSION

A-4. PROCEDURE

A-4.1 Clamping of Shoes — The shoe with the measuring device inserted, shall be lightly clamped so that it cannot move longitudinally or laterally, with its toe part on the flat horizontal steel plate. The angle of the footwear shall be such that the front 65 mm of the sole is judged by the operator to be on the average horizontal, and the footwear shall be supported in this position by a wedge being such that it supports only the heel and no part of the sole.

A-4.2 Position of Shoe — The shoe clamped as specified in **A-4.1** shall be positioned under the striking bar so that the measuring capsule is 10 mm behind the centre line of the bar. The bar shall rest on the shoe with its longest direction roughly at right angles to the length of the footwear.

A-4.3 Adjust the mass to a height of 500 ± 5 mm above the top of the vertical plunger as specified in **A-2.1** and allow it to fall freely. This gives the mass an impact of 14 kgf/m as required. Measure the clearance inside the footwear at the moment of maximum depression in millimetres and report the value.

A P P E N D I X B(*Clause 3.2.7*)**METHOD FOR DETERMINATION OF SULPHUR DYES IN BLACK COLOURED LACES****B-1. PROCEDURE**

B-1.1 Boil the laces in alkaline hydrosulphite solution for one minute. If the shade is reduced to pale brown or yellow colour and an oxidation restores to the original colour, sulphur dyes shall be suspected to be present.

B-1.2 For confirmation, boil the laces in acid stannous chloride solution in a test tube covered with a piece of filter paper moistened with lead acetate. A blackish/brown stain with metallic lusture confirms the presence of sulphur dyes.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²