IS 15298-2 (2011): Personal Protective Equipment, Part 2: Safety Footwear [CHD 19: Footwear]

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IS 15298 (Part 2) : 2011
ISO 20345 : 2004

भारतीय मानक

निजी सुरक्षा उपस्कर

भाग 2 सुरक्षा फुटवियर

(पहला पुनरीक्षण)

Indian Standard

PERSONAL PROTECTIVE EQUIPMENT

PART 2 SAFETY FOOTWEAR

(First Revision)

ICS 13.340.50

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

June 2011 **Price Group 10**

Footwear Sectional Committee, CHD 19

NATIONAL FOREWORD

This Indian Standard (Part 2) (First Revision) which is identical with ISO 20345 : 2004 'Personal protective equipment — Safety footwear' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Footwear Sectional Committee and approval of the Chemical Division Council.

This standard was first published in 2002 which was identical to ISO 8782-2 : 1998 'Safety, protective and occupational footwear for professional use — Part 2: Specification for safety footwear' which has been superseded by ISO 20345 : 2004. The committee has decided to revise this standard by adopting ISO 20345 : 2004.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

c) The standard atmospheric conditions would be 27 ±2° C and 65 ±5 percent RH as ambient conditions.

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.

AMENDMENT NO. 1 JUNE 2012
TO
IS 15298 (Part 2) : 2011/ISO 20345 : 2004
PERSONAL PROTECTIVE EQUIPMENT

PART 2 SAFETY FOOTWEAR

(First Revision)

(*Second cover page, para* 3) — Insert the following new para after para 3:

This standard also makes a reference to the BIS Certification Marking of the product, details of which is given in National Annex A.

(*Page* 28, *Bibliography*) — Insert the following National Annex A at the end of the text:

'NATIONAL ANNEX A

A-1 BIS CERTIFICATION MARKING

A-1.1 The product may also be marked with the Standard Mark.

A-1.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards'

(CHD 19)

Reprography Unit, BIS, New Delhi, India

Indian Standard

PERSONAL PROTECTIVE EQUIPMENT

PART 2 SAFETY FOOTWEAR

(First Revision)

1 Scope

This European Standard specifies basic and additional (optional) requirements for safety footwear.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12568:1998, *Foot and leg protectors – Requirements and test methods for toecaps and metal penetration resistant inserts*

EN ISO 20344:2004, *Personal protective equipment - Test methods for footwear (ISO 20344:2004)*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

NOTE The component parts of footwear are illustrated in figures 1 and 2.

3.1
safety footwear
footwear, incorporating protective features to protect the wearer from injuries which could arise through accidents, fitted with toecaps, designed to give protection against impact when tested at an energy level of at least 200 J and against compression when tested at a compression load of at least 15 kN

3.2
leather

3.2.1
full grain leather
hide or skin tanned to be imputrescible having conserved the totality of its grain

3.2.2
corrected grain leather
hide or skin tanned to be imputrescible which has been subjected to mechanical buffing to modify its grain structure

3.2.3
leather split
flesh or middle part of a hide or skin tanned to be imputrescible obtained by splitting a thick leather

3.3
rubber
vulcanized elastomers

3.4
polymeric materials
for example polyurethane or polyvinylchloride

3.5
insole
non-removable component used to form the base of the shoe to which the upper is usually attached during lasting

3.6
insock
removable or permanent footwear component used to cover part or all of the insole

3.7
lining
material covering the inner surface of the upper

NOTE 1 The wearer's foot is in direct contact with the lining.

NOTE 2 Where an upper is split at the forepart to house the toecap, or if an external piece of material is stitched to the upper to form a pocket to house the toecap, the material under the toecap acts as a lining.

3.7.1
vamp lining
material covering the inner surface of the forepart of the upper

3.7.2
quarter lining
material covering the inner surface of the quarters of the upper

3.8
cleat(s)
protruding part(s) of the outer surface of the sole

3.9
rigid outsole
sole which, when the complete footwear is tested in accordance with EN ISO 20344:2004, 8.4.1, can not be bent through an angle of 45° under a load of 30 N

3.10
cellular outsole
outsole having a density of 0,9 g/ml or less with a cell structure visible under 10x magnification

3.11
penetration-resistant insert
footwear component placed in the sole complex in order to provide protection against penetration

3.12
safety toecap
footwear component built into the footwear designed to protect the toes of the wearer from impacts up to an energy level of at least 200 J and compression at a load of at least 15 kN

3.13
seat region
back part of the footwear (upper and sole)

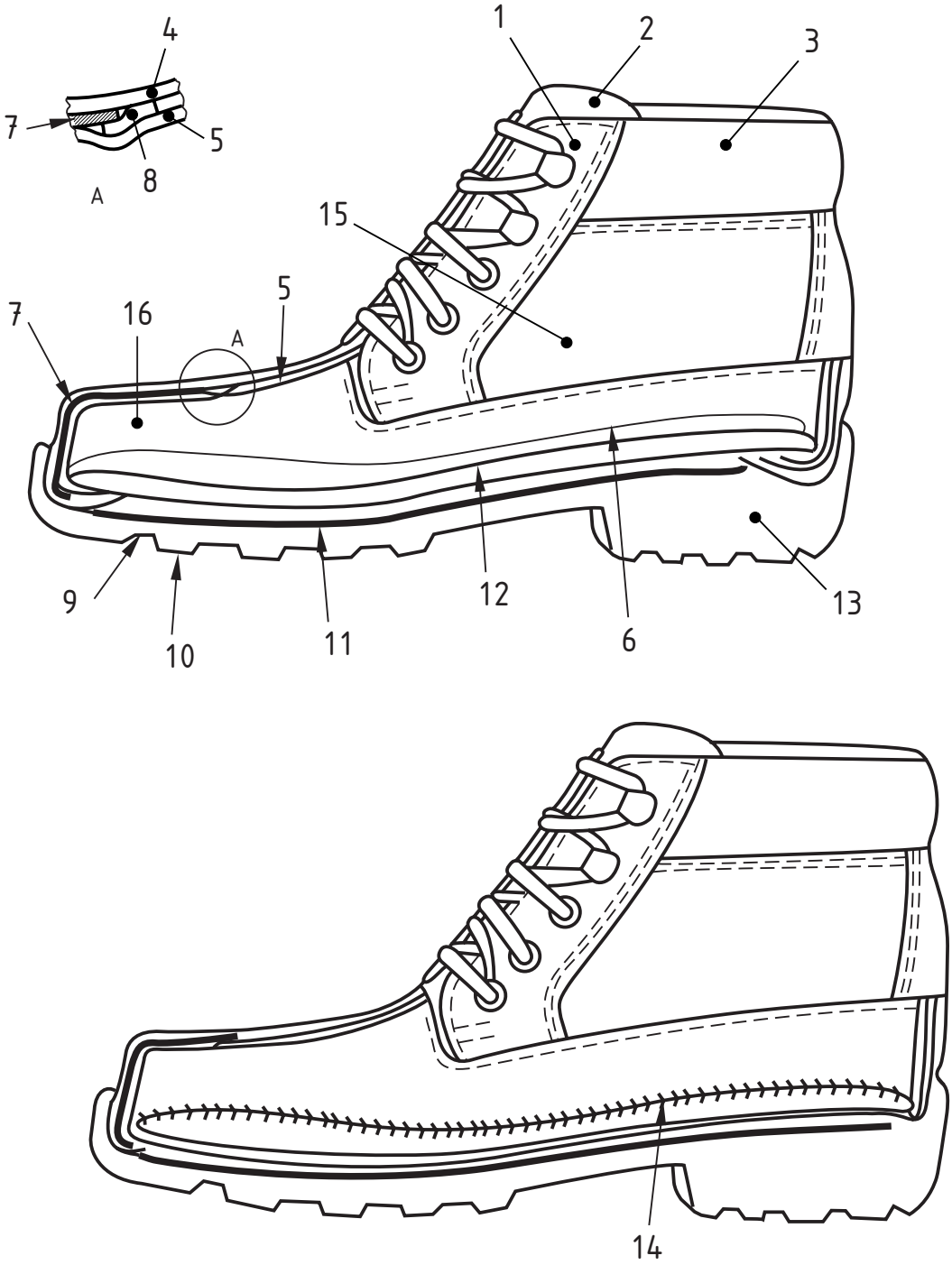
3.14
conductive footwear
footwear whose resistance, when measured according to EN ISO 20344:2004, 5.10, lies in the range of 0 to 100 kΩ

3.15
antistatic footwear
footwear whose resistance, when measured according to EN ISO 20344:2004, 5.10, lies above 100 kΩ and is less than or equal to 1 000 MΩ

3.16
electrically insulating footwear
footwear which protects the wearer against electrical shocks by preventing the passage of dangerous current through the body via the feet

3.17
fuel oil
aliphatic hydrocarbon constituent of petroleum

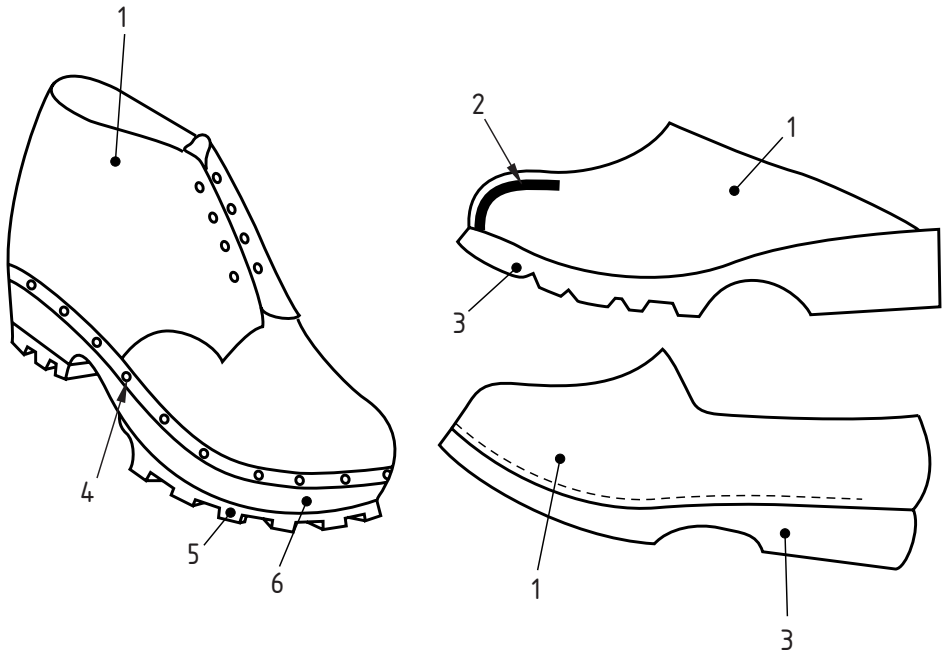
3.18
specific job related footwear
safety, protective or occupational footwear relating to a specific profession, e.g. footwear for firefighters, footwear with resistance to chain saw cutting, etc.



Key

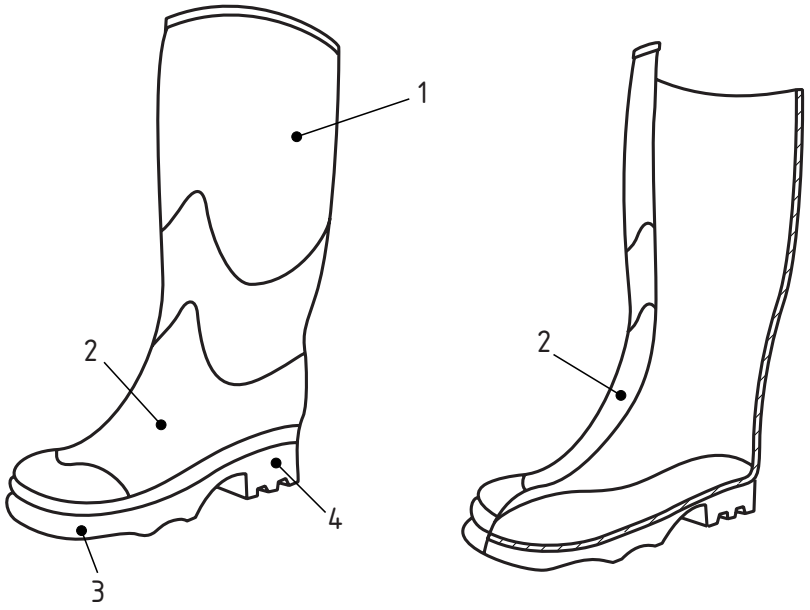
1	Facing	6	Insock	11	Penetration-resistant insert
2	Tongue	7	Toecap	12	Insole
3	Collar	8	Edge covering, e.g. foam strip	13	Heel
4	Upper	9	Outsole	14	Strobel stitching
5	Vamp lining	10	Cleat	15	Quarter
				16	Vamp

Figure 1a) Parts of footwear of Strobel construction



1	Upper	3	Rigid sole	5	Outsole
2	Toecap	4	Reinforcing welt with nails	6	Wooden sole

Figure 1b) Parts of footwear of conventional construction



1	Upper	3	Outsole
2	Vamp	4	Heel

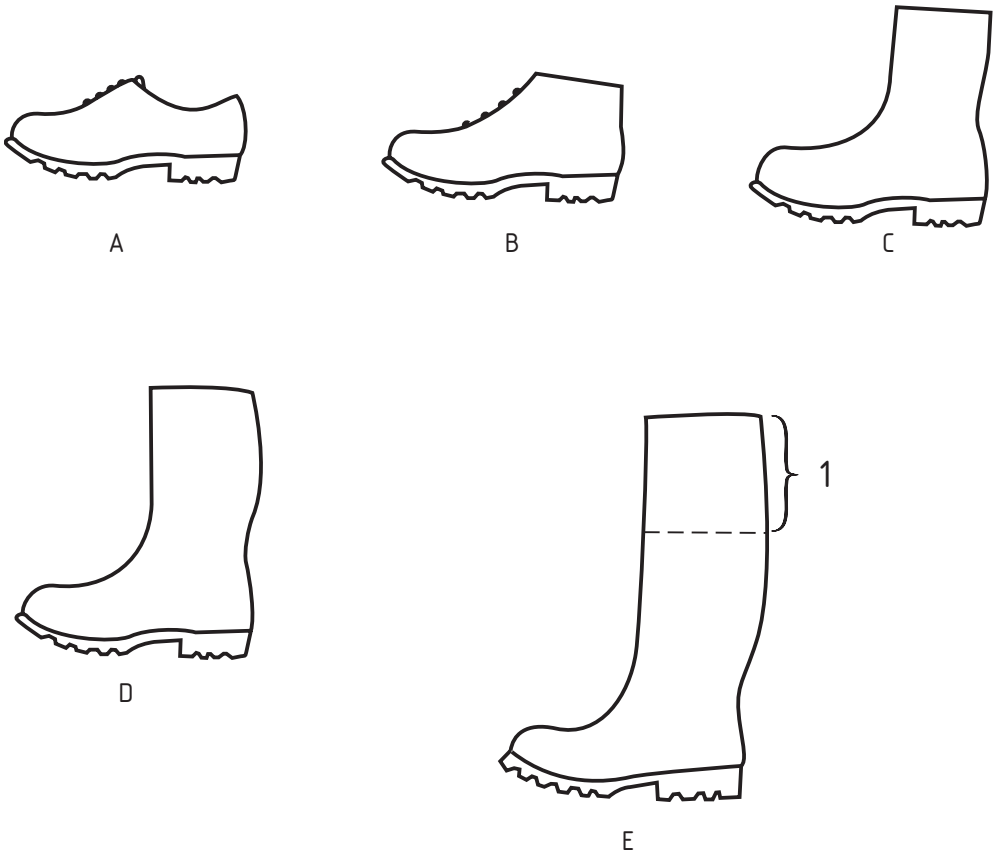
Figure 2 — Parts of all-rubber (i.e. vulcanized) or all polymeric (i.e. entirely moulded) footwear

4 Classification

Footwear shall be classified in accordance with table 1.

Table 1 — Classification of footwear

Code designation	Classification
I	Footwear made from leather and other materials, excluding all-rubber or all-polymeric footwear
II	All-rubber (i.e. entirely vulcanized) or all-polymeric (i.e. entirely moulded) footwear



1 Variable extension which can be adapted to the wearer

A Low shoe
B Ankle boot
C Half-knee boot
D Knee-height boot
E Thigh boot

NOTE Design *E* can be a knee-height boot (design *D*) equipped with a thin impermeable material which extends the upper and which can be cut to adapt the boot to the wearer

Figure 3 — Designs of footwear

5 Basic requirements for safety footwear

5.1 General

Safety footwear shall comply with the basic requirements given in table 2 and one of the 5 options given in table 3.

Footwear without both an insole and insock or without an insole but with a removable insock is non-compliant with this standard.

Table 2 — Basic requirements for safety footwear

Requirement		Clause	Classification	
			I	II
Design	Height of upper	5.2.1	X	X
	Seat region:	5.2.2		
	Design A			X
	Design B, C, D, E		X	X
Whole footwear	Sole performance:	5.3.1		
	Construction	5.3.1.1	X	
	Upper/outsole bond strength	5.3.1.2	X	
	Toe protection:	5.3.2		
	General	5.3.2.1	X	X
	Internal length of toecaps	5.3.2.2	X	X
	Impact resistance	5.3.2.3	X	X
	Compression resistance	5.3.2.4	X	X
	Behaviour of toecaps	5.3.2.5	X	X
	Leakproofness	5.3.3		X
	Specific ergonomic features	5.3.4	X	X
Upper	General	5.4.1	X	X
	Thickness	5.4.2		X
	Tear strength	5.4.3	X	
	Tensile properties	5.4.4	X	X
	Flexing resistance	5.4.5		X
	Water vapour permeability and coefficient	5.4.6	X	
	pH value	5.4.7	X	
	Hydrolysis	5.4.8		X
	Chromium VI content	5.4.9	X	
Vamp lining	Tear strength	5.5.1	X	
	Abrasion resistance	5.5.2	X	
	Water vapour permeability and coefficient	5.5.3	X	
	pH value	5.5.4	X	
	Chromium VI content	5.5.5	X	
Quarter lining	Tear strength	5.5.1	O	
	Abrasion resistance	5.5.2	O	
	Water vapour permeability and coefficient	5.5.3	O	
	pH value	5.5.4	O	
	Chromium VI content	5.5.5	O	

Table 2 — Basic requirements for safety footwear (concluded)

Requirement		Clause	Classification	
			I	II
Tongue	Tear strength	5.6.1	O	
	pH value	5.6.2	O	
	Chromium VI content	5.6.3	O	
Outsole	Thickness of non-cleated outsoles	5.8.1	X	X
	Tear strength	5.8.2	X	
	Abrasion resistance	5.8.3	X	X
	Flexing resistance	5.8.4	X	X
	Hydrolysis	5.8.5	X	X
	Interlayer bond strength	5.8.6	O	O
	Resistance to fuel oil	5.8.7	X	X

NOTE The applicability of a requirement to a particular classification is indicated in this table by the following:

X the requirement shall be met. In some cases the requirement relates only to particular materials within the classification - e.g. pH value of leather components. This does not mean that other materials are precluded from use.

O if the component part exists, the requirement shall be met.

The absence of X or O indicates that there is no requirement.

Table 3 — Basic requirements for insoles and/or insocks

Options			Component to be assessed	Requirements to fulfil					
				Thickness 5.7.1	pH [a] 5.7.2	Water absorption desorption 5.7.3	Abrasion 5.7.4.1	Chromium VI [a] 5.7.5	Abrasion 5.7.4.2
1	No insole or if present not fulfilling the requirements	Non-removable insock	Insock	X	X	X		X	X
2	Insole present	No insock	Insole	X	X	X	X	X	
		Seat sock present							
3		Full insock, non-removable	Insock and insole together	X		X			
			Insock		X			X	X
4		Full insock, removable and water permeable [b]	Insole	X	X	X	X	X	
			Insock		X			X	X
5		Full insock, removable, not water permeable [b]	Insole	X	X	X	X	X	
			Insock		X	X		X	X

X means that the requirement shall be met.

NOTE For removable insocks see 8.3.

[a] those requirements are only for leather

[b] a water permeable insock is one that, when tested in accordance with EN ISO 20344:2004, 7.2, lets water through in 60 s or less

5.2 Design

Footwear shall conform to one of the designs given in figure 3.

5.2.1 Height of upper

The height of the upper measured in accordance with EN ISO 20344:2004, 6.2, shall be as given in table 4.

Table 4 — Height of upper

Footwear size		Height			
French	English	Design A mm	Design B mm min.	Design C mm min.	Design D mm min.
36 and below	up to 3 ½	< 103	103	162	255
37 and 38	4 to 5	< 105	105	165	260
39 and 40	5 ½ to 6 ½	< 109	109	172	270
41 and 42	7 to 8	< 113	113	178	280
43 and 44	8 ½ to 10	< 117	117	185	290
45 and above	10 ½ and above	< 121	121	192	300

5.2.2 Seat region

The seat region shall be closed.

5.3 Whole footwear

5.3.1 Sole performance

5.3.1.1 Construction

When used an insole shall be present in such a way that it cannot be removed without damaging the footwear.

5.3.1.2 Upper/outsole bond strength

When footwear, other than with a stitched sole, is tested in accordance with the method described in EN ISO 20344:2004, 5.2, the bond strength shall be not less than 4,0 N/mm, unless there is tearing of the sole, in which case the bond strength shall be not less than 3,0 N/mm.

5.3.2 Toe protection

5.3.2.1 General

Toecaps shall be incorporated in the footwear in such a manner that they cannot be removed without damaging the footwear.

With the exception of all-rubber and all-polymeric footwear, footwear fitted with internal toecaps shall have a vamp lining or an element of the upper that serves as a lining, and in addition the toecaps shall have an edge covering extending from the back edge of the toecap to at least 5 mm beneath it and at least 10 mm in the opposite direction.

Scuff resistant coverings for the toe region shall be not less than 1 mm in thickness.

5.3.2.2 Internal length of toecaps

When measured in accordance with the method described in EN ISO 20344:2004, 5.3, the internal toecap length shall be in accordance with table 5.

Table 5 — Minimum internal length of toecaps

Size of footwear		Minimum internal length
French	English	mm
36 and below	up to 3 ½	34
37 and 38	4 to 5	36
39 and 40	5 ½ to 6 ½	38
41 and 42	7 to 8	39
43 and 44	8 ½ to 10	40
45 and above	10 ½ and above	42

5.3.2.3 Impact resistance of safety footwear

When safety footwear is tested in accordance with the method described in EN ISO 20344:2004, 5.4, at an impact energy of at least 200 J ± 4 J, the clearance under the toecap at the moment of impact shall be in accordance with table 6. In addition, the toecap shall not develop any cracks on the test axis which go through the material, i.e. through which light can be seen.

Table 6 — Minimum clearance under toecaps at impact

Size of footwear		Minimum clearance
French	English	mm
36 and below	up to 3 ½	12,5
37 and 38	4 to 5	13,0
39 and 40	5 ½ to 6 ½	13,5
41 and 42	7 to 8	14,0
43 and 44	8 ½ to 10	14,5
45 and above	10 ½ and above	15,0

5.3.2.4 Compression resistance of safety footwear

When safety footwear is tested in accordance with EN ISO 20344:2004, 5.5, the clearance under the toecap at a compression load of 15 kN ± 0,1 kN shall be in accordance with table 6.

5.3.2.5 Behaviour of toecaps

5.3.2.5.1 Corrosion resistance of metallic toecaps

When classification II footwear is tested and assessed in accordance with EN ISO 20344:2004, 5.6.1, the metallic toecap shall exhibit no more than five areas of corrosion, none of which shall exceed 2,5 mm^2 in area.

When metallic toecaps to be used in classification I footwear are tested and assessed in accordance with EN ISO 20344:2004, 5.6.2, they shall exhibit no more than five areas of corrosion, none of which shall exceed 2,5 mm^2 in area.

5.3.2.5.2 Non-metallic toecaps

Non-metallic toecaps used in safety footwear shall comply with the requirements of EN 12568:1998, 4.3.

5.3.3 Leakproofness

When tested in accordance with EN ISO 20344:2004, 5.7, there shall be no leakage of air.

5.3.4 Specific ergonomic features

The footwear shall be considered to satisfy the ergonomic requirements if all the answers are positive in the questionnaire given in EN ISO 20344:2004, 5.1.

5.4 Upper

5.4.1 General

For designs B, C, D and E the area which shall fulfil the upper requirements shall have a minimum height measured from the horizontal surface beneath the sole in accordance with table 7.

Table 7 — Minimum height below which the upper requirements shall be completely fulfilled

Size of footwear		Design Minimum height mm			
French	English	B	C	D	E
36 and below	up to 3 ½	64	113	172	265
37 and 38	4 to 5	66	115	175	270
39 and 40	5 ½ to 6 ½	68	119	182	280
41 and 42	7 to 8	70	123	188	290
43 and 44	8 ½ to 10	72	127	195	300
45 and above	10 ½ and above	73	131	202	310

When collar and insert materials are present above the heights given in table 7, such materials shall meet the tear strength, 5.5.1, and abrasion resistance, 5.5.2, requirements for lining. In the case of leather materials they shall meet in addition the requirements for the pH value, 5.4.7, and for the chromium VI content, 5.4.9.

5.4.2 Thickness

When determined in accordance with EN ISO 20344:2004, 6.1, the thickness of the upper of classification II footwear at any point shall be in accordance with table 8.

Table 8 — Minimum thickness of upper

Type of material	Minimum thickness mm
Rubber	1,50
Polymeric	1,00

5.4.3 Tear strength

When determined in accordance with EN ISO 20344:2004, 6.3, the tear strength of the upper of classification I footwear shall be in accordance with table 9.

Table 9 — Minimum tear strength of upper

Type of material	Minimum force N
Leather	120
Coated fabric and textile	60

5.4.4 Tensile properties

When determined in accordance with EN ISO 20344:2004, 6.4, table 7, the tensile properties shall be in accordance with table 10.

Table 10 — Tensile properties

Type of material	Tensile strength N/mm^2	Breaking force N	Modulus at 100 % elongation N/mm²	Elongation at break %
Leather split	15 minimum	—	—	—
Rubber	—	180 minimum	—	—
Polymeric	—	—	1,3 to 4,6	250 minimum

5.4.5 Flexing resistance

When tested in accordance with EN ISO 20344:2004, 6.5, the flexing resistance shall be in accordance with table 11.

Table 11 — Flexing resistance

Type of material	Flexing resistance
Rubber	No cracking before 125 000 flexes
Polymeric	No cracking before 150 000 flexes

5.4.6 Water vapour permeability and coefficient

When tested in accordance with EN ISO 20344:2004, 6.6, and EN ISO 20344:2004, 6.8, the water vapour permeability shall be not less than 0,8 mg/(cm^2·h) and the water vapour coefficient shall be not less than 15 mg/cm^2.

5.4.7 pH value

When leather uppers are tested in accordance with EN ISO 20344:2004, 6.9, the pH value shall be not less than 3,2 and, if the pH value is below 4, the difference figure shall be less than 0,7.

5.4.8 Hydrolysis

When polyurethane uppers are tested in accordance with EN ISO 20344:2004, 6.10, no cracking shall occur before 150 000 flex cycles.

5.4.9 Chromium VI content

When leather uppers are tested in accordance with EN ISO 20344:2004, 6.11, chromium VI shall not be detectable.

5.5 Lining

NOTE The following requirements are applicable to vamp lining and quarter lining.

5.5.1 Tear strength

When determined in accordance with EN ISO 20344:2004, 6.3, the tear strength of the lining shall be in accordance with table 12.

Table 12 — Minimum tear strength of lining

Type of material	Minimum force in N
Leather	30
Coated fabric and textile	15

5.5.2 Abrasion resistance

When tested in accordance with EN ISO 20344:2004, 6.12, the lining shall not develop any holes before the following number of cycles has been performed:

— dry: 25 600 cycles;

— wet: 12 800 cycles.

5.5.3 Water vapour permeability and coefficient

When tested in accordance with EN ISO 20344:2004, 6.6, and EN ISO 20344:2004, 6.8, the water vapour permeability shall be not less than 2,0 mg/(cm^2·h) and the water vapour coefficient shall be not less than 20 mg/cm^2.

NOTE There is no requirement to test unlined stiffeners.

5.5.4 pH value

When leather linings are tested in accordance with EN ISO 20344:2004, 6.9, the pH value shall be not less than 3,2 and, if the pH value is below 4, the difference figure shall be less than 0,7.

5.5.5 Chromium VI content

When leather linings are tested in accordance with EN ISO 20344:2004, 6.11, chromium VI shall not be detectable.

5.6 Tongue

NOTE The tongue need only be tested if the material from which it is made or its thickness differs from that of the upper material.

5.6.1 Tear strength

When determined in accordance with EN ISO 20344:2004, 6.3, the tear strength of the tongue shall be in accordance with table 13.

Table 13 — Minimum tear strength of tongue

Type of material	Minimum force in N
Leather	36
Coated fabric and textile	18

5.6.2 pH value

When leather tongues are tested in accordance with EN ISO 20344:2004, 6.9, the pH value shall be not less than 3,2 and, if the pH value is below 4, the difference figure shall be less than 0,7.

5.6.3 Chromium VI content

When leather tongues are tested in accordance with EN ISO 20344:2004, 6.11, chromium VI shall not be detectable.

5.7 Insole and insock

5.7.1 Thickness

When determined in accordance with EN ISO 20344:2004, 7.1, the thickness of the insole shall be not less than 2,0 mm.

5.7.2 pH value

When leather insoles or leather insocks are tested in accordance with EN ISO 20344:2004, 6.9, the pH value shall be not less than 3,2 and, if the pH is below 4, the difference figure shall be less than 0,7.

5.7.3 Water absorption and desorption

When tested in accordance with EN ISO 20344:2004, 7.2, the water absorption shall be not less than 70 mg/cm² and the water desorption shall be not less than 80 % of the water absorbed.

5.7.4 Abrasion resistance

5.7.4.1 Insoles

When non-leather insoles are tested in accordance with EN ISO 20344:2004, 7.3, the abrasion damage shall not be more severe than that illustrated by the reference test pieces for the same family of materials before 400 cycles. (See EN ISO 20344:2004, 7.3.6).

5.7.4.2 Insocks

When non-leather insocks are tested in accordance with EN ISO 20344:2004, 6.12, the wearing surface shall not develop any holes before the following number of cycles has been performed

— dry: 25 600 cycles;

— wet: 12 800 cycles.

5.7.5 Chromium VI content

When leather insoles are tested in accordance with EN ISO 20344:2004, 6.11, chromium VI shall not be detectable.

5.8 Outsole

5.8.1 Thickness of non-cleated outsoles

When tested in accordance with EN ISO 20344:2004, 8.1, the total thickness of a non-cleated outsole, at any point, shall be not less than 6 mm.

5.8.2 Tear strength

When non-leather outsoles are tested in accordance with EN ISO 20344:2004, 8.2, the tear strength shall be not less than:

— 8 kN/m for a material with a density higher than 0,9 g/cm^3;

— 5 kN/m for a material with a density lower or equal to 0,9 g/cm^3.

5.8.3 Abrasion resistance

When non-leather outsoles other than those from all-rubber or all-polymeric footwear are tested in accordance with EN ISO 20344:2004, 8.3, the relative volume loss shall be not greater than 250 mm^3 for materials with a density of 0,9 g/cm^3 or less and not greater than 150 mm^3 for materials with a density greater than 0,9 g/cm^3.

When outsoles from all-rubber or all-polymeric footwear are tested as described in EN ISO 20344:2004, 8.3, the relative volume loss shall be not greater than 250 mm^3.

5.8.4 Flexing resistance

When non-leather outsoles are tested in accordance with EN ISO 20344:2004, 8.4, the cut growth shall be not greater than 4 mm before 30 000 flex cycles.

5.8.5 Hydrolysis

When polyurethane outsoles and soles with an outer layer composed of polyurethane are tested in accordance with EN ISO 20344:2004, 8.5, the cut growth shall be not greater than 6 mm before 150 000 flex cycles.

5.8.6 Interlayer bond strength

When tested in accordance with EN ISO 20344:2004, 5.2, the bond strength between the outer or cleated layer and the adjacent layer shall be not less than 4,0 N/mm unless there is tearing of any part of the sole, in which case the bond strength shall be not less than 3,0 N/mm.

5.8.7 Resistance to fuel oil

When tested in accordance with EN ISO 20344:2004, 8.6.1, the increase in volume shall be not greater than 12%.

If after testing in accordance with EN ISO 20344:2004, 8.6.1, the test piece shrinks by more than 0,5 % in volume or increases in hardness by more than 10 Shore A hardness units, a further test piece shall be taken and tested in accordance with the method described in EN ISO 20344:2004, 8.6.2, and the cut growth shall be not greater than 6 mm before 150 000 flex cycles.

6 Additional requirements for safety footwear

6.1 General

Additional requirements can be necessary for safety footwear, depending upon risks to be encountered at the work place. In such cases, safety footwear shall conform to the appropriate additional requirements and corresponding marking, given in table 14.

Table 14 — Additional requirements for special applications with appropriate symbols for marking

Requirement		Clause	Classification		Symbol
			I	II	
Whole footwear	Penetration resistance	6.2.1	X	X	P
	Electrical properties:	6.2.2			
	Conductive footwear	6.2.2.1	X	X	C
	Antistatic footwear	6.2.2.2	X	X	A
	Electrically insulating footwear	6.2.2.3		X	I
	Resistance to inimical environments:	6.2.3			
	Heat insulation of sole complex	6.2.3.1	X	X	HI
	Cold insulation of sole complex	6.2.3.2	X	X	CI
	Energy absorption of seat region	6.2.4	X	X	E
	Water resistance	6.2.5	X		WR
	Metatarsal protection	6.2.6	X	X	M
	Ankle protection	6.2.7	X	X	AN
Upper	Water penetration and water absorption	6.3.1	X		WRU
	Construction	6.3.2	X		
	Cut resistance	6.3.3	X	X	CR
Outsole	Cleated area	6.4.1	X	X	
	Thickness of cleated outsoles	6.4.2	X	X	
	Cleat height	6.4.3	X	X	
	Resistance to hot contact	6.4.4	X	X	HRO

NOTE The applicability of a requirement to a particular classification is indicated in this table by the following:
X If the property is claimed the requirement shall be met.

6.2 Whole footwear

6.2.1 Penetration resistance

6.2.1.1 Determination of penetration force

When footwear is tested in accordance with EN ISO 20344:2004, 5.8.2, the force required to penetrate the sole unit shall be not less than 1 100 N.

6.2.1.2 Construction

The penetration-resistant insert shall be built into the bottom of the shoe in such a manner that it cannot be removed without damaging the footwear. The insert shall not lie above the flange of the safety or protective toecap and shall not be attached to it.

6.2.1.3 Dimensions

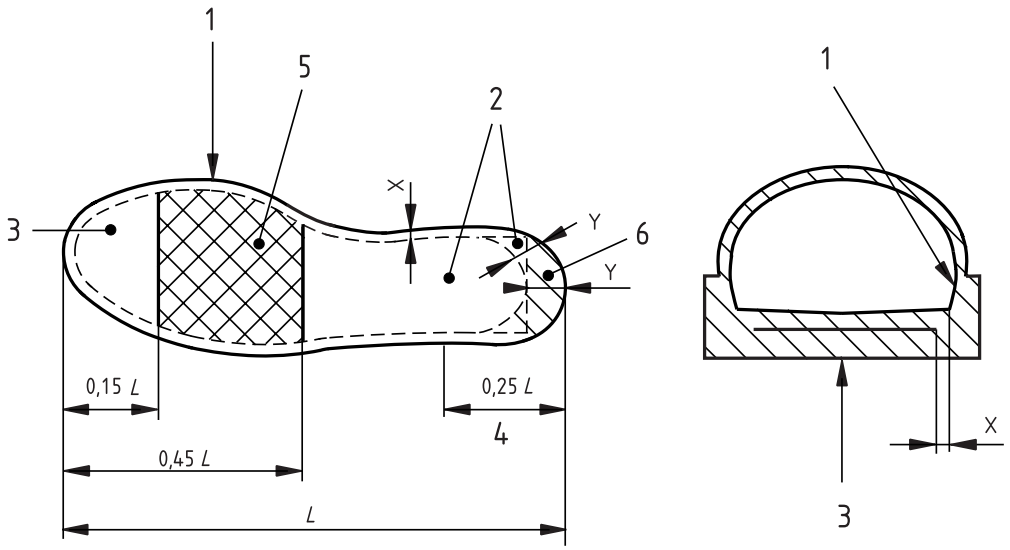
The penetration-resistant insert dimensions shall be measured according to EN 20344:2004, 5.8.1.

The penetration-resistant insert shall be of such a size that, with the exception of the heel region, the maximum distance between the line represented by the feather edge of the last and the edge of the insert (X) is 6,5 mm. In the heel region the maximum distance between the line represented by the feather edge of the last and the insert (Y) shall be 17 mm (see figure 4).

The penetration-resistant insert shall have no more than three holes of maximum diameter 3 mm to attach it to the bottom of the footwear.

The holes shall not lie in the shaded area 1 (see figure 4).

Holes in the shaded area 2 shall be disregarded (see figure 4).



Key

1 Line left by feather edge of the last

2 Alternative shapes of insert

3 Insert

4 Heel region

5 Shaded area 1

6 Shaded area 2

L Length of the inside of the bottom of the footwear

Figure 4— Position of penetration-resistant insert

6.2.1.4 Flex resistance of penetration-resistant inserts

When penetration-resistant inserts in all types of footwear are tested in accordance with EN ISO 20344:2004, 5.9, they shall show no visible signs of cracking after being subjected to $1x10^6$ flexes.

6.2.1.5 Behaviour of penetration-resistant inserts

6.2.1.5.1 Corrosion resistance of penetration-resistant metallic inserts

When all-rubber footwear is tested in accordance with EN ISO 20344:2004, 5.6.1, the penetration-resistant metallic insert shall exhibit no more than five areas of corrosion, none of which shall exceed 2,5 mm^2 in area. When penetration-resistant metallic inserts to be used in all other types of footwear are tested in accordance with the method described in EN ISO 20344:2004, 5.6.3, they shall exhibit no more than five areas of corrosion, none of which shall exceed 2,5 mm^2 in area.

6.2.1.5.2 Penetration-resistant non-metallic inserts

Penetration-resistant non-metallic inserts shall comply with the requirements of EN 12568:1998, 5.2, measuring the maximum force after being subjected to the treatments described in EN 12568: 1998, 7.1.5..

6.2.2 Electrical properties

6.2.2.1 Conductive footwear

When measured in accordance with EN ISO 20344:2004, 5.10, after conditioning in a dry atmosphere (EN ISO 20344:2004, 5.10.3.3 a)), the electrical resistance shall be not greater than 100 kΩ.

6.2.2.2 Antistatic footwear

When measured in accordance with EN ISO 20344:2004, 5.10, after conditioning in a dry and wet atmosphere (EN ISO 20344:2004, 5.10.3.3 a) and b)), the electrical resistance shall be above 100 kΩ and less than or equal to 1 000 MΩ.

6.2.2.3 Electrically insulating footwear

When measured in accordance with EN 20344:2004, 5.11, footwear shall comply with electrical class O or electrical class OO.

6.2.3 Resistance to inimical environments

6.2.3.1 Heat insulation of sole complex

When footwear is tested in accordance with EN ISO 20344:2004, 5.12, the temperature increase on the upper surface of the insole shall be not greater than 22 °C.

There shall be no distortion or embrittlement of the sole that reduces its functionality.

The insulation shall be incorporated in the footwear in such a manner that it cannot be removed without damaging the footwear.

6.2.3.2 Cold insulation of sole complex

When footwear is tested in accordance with EN ISO 20344:2004, 5.13, the temperature decrease on the upper surface of the insole shall be not more than 10 °C.

The insulation shall be incorporated in the footwear in such a manner that it cannot be removed without damaging the footwear.

6.2.4 Energy absorption of seat region

When footwear is tested in accordance with EN ISO 20344:2004, 5.14, the energy absorption of the seat region shall be not less than 20 J.

6.2.5 Water resistance

When tested in accordance with EN ISO 20344:2004, 5.15.1, the total area of water penetration after 100 trough lengths shall be not greater than 3 cm^2 or when tested in accordance with EN ISO 20344:2004, 5.15.2, no water penetration shall occur before 15 min.

6.2.6 Metatarsal protection

6.2.6.1 Construction

The metatarsal protective device shall be made from suitable materials and be of a suitable shape, such that under impact the resulting forces are distributed over the sole, the toecap and as large a surface of the foot as possible.

The metatarsal protective device shall be attached to the footwear in such a manner that it cannot be removed without damaging the footwear.

The metatarsal protective device shall fit the shape of the footwear at the inner and outer side of the foot and shall be designed so as not to impair normal foot movement.

6.2.6.2 Impact resistance of metatarsal protective device

When tested in accordance with EN ISO 20344:2004, 5.16, the minimum clearance at the moment of impact shall be in accordance with table 15.

Table 15 — Minimum clearance at impact

Size of footwear		Minimum clearance after impact
French	English	mm
36 and below	Up to 3 ½	37,0
37 and 38	4 to 5	38,0
39 and 40	5 ½ to 6 ½	39,0
41 and 42	7 to 8	40,0
43 and 44	8 ½ to 10	40,5
45 and over	10 ½ and above	41,0

6.2.7 Ankle protection

When tested in accordance with EN ISO 20344:2004, 5.17, the mean value of the test results shall not exceed 20 kN and no single value shall exceed 30 kN.

6.3 Upper

6.3.1 Water penetration and water absorption

When tested in accordance with EN ISO 20344:2004, 6.13, the water penetration (expressed as mass increase of the absorbent cloth after 60 min) shall not be higher than 0,2 g and the water absorption shall not be higher than 30 %.

6.3.2 Construction

Non-functional and decorative stitching and perforations shall not be used on footwear for which water resistance of the upper is claimed.

6.3.3 Cut resistance

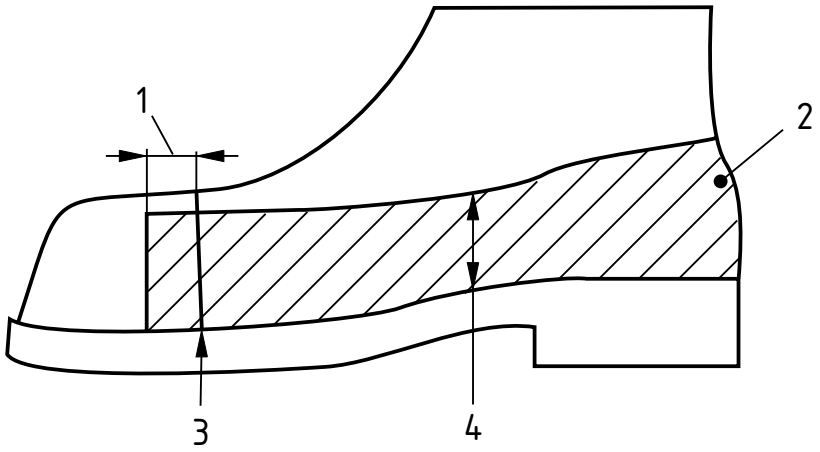
6.3.3.1 Design

Footwear shall not be of design A as described in clause 4.

6.3.3.2 Construction

Footwear shall have a protective area extending from the feather edge to at least 30 mm above it and from the toecap to the heel end of the footwear. It extends beyond the rear end of the toecap by at least 10 mm.

There shall be no gap between the toecap and the protective material. The protective material shall be permanently attached to the footwear. If different materials are used for protection against cutting, they shall either be attached to each other or overlap (see figure 5).



Key

1 10 mm overlap over toecap
2 Protective area
3 Rear edge of toecap
4 30 mm minimum height above the feather line

Figure 5— Coverage of protective area

6.3.3.3 Resistance to cutting

When tested in accordance with the method described in EN ISO 20344:2004, 6.14, the factor *I* shall be not less than 2,5.

6.3.3.4 Penetration resistance

Footwear shall also comply with the requirements of 6.2.1.

6.4 Outsole

6.4.1 Cleated area

With the exception of the region under the flange of the toecap, at least the shaded area as shown in figure 6 shall have cleats which are open to the side.

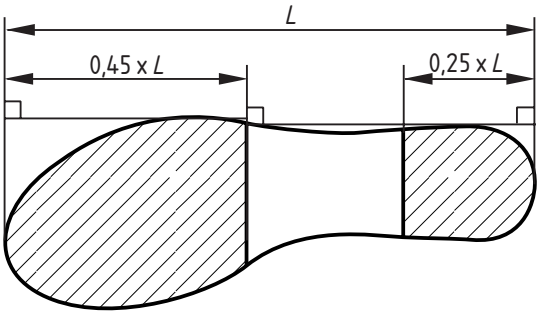


Figure 6 — Cleated area

6.4.2 Thickness of cleated outsoles

When tested in accordance with EN ISO 20344:2004, 8.1, for direct-injected, vulcanized or cemented outsoles the thickness d_1, shall be not less than 4 mm, for multilayered outsoles, the thickness d_1 shall be not less than 4 mm, and for all-rubber and all-polymeric footwear, the thickness d_1 shall be not less than 3 mm and the thickness d_3 shall be not less than 6 mm.

6.4.3 Cleat height

When tested in accordance with EN ISO 20344:2004, 8.1, for direct-injected, vulcanized or cemented outsoles the cleat height d_2 shall be not less than 2,5 mm. For multilayered outsoles the cleat height d_2 shall be not less than 2,5 mm and for all-rubber and all-polymeric footwear the cleat height, d_2 shall be not less than 4 mm.

NOTE Outsoles with a cleat height of less than 2,5 mm are regarded as uncleated.

6.4.4 Resistance to hot contact

When tested in accordance with EN ISO 20344:2004, 8.7, rubber and polymeric outsoles shall not melt and shall not develop any cracks when bent around the mandrel. When tested in the same way leather outsoles shall develop no cracks or charring which extend into the corium when bent around the mandrel.

7 Marking

Each item of safety footwear shall be clearly and permanently marked, for example by embossing or branding, with the following:

a) size;

b) manufacturer’s identification mark;

c) manufacturer’s type designation;

d) year of manufacture and at least quarter;

e) the number and year of this European Standard, i.e. EN ISO 20345:2003;

f) the symbol(s) from table 14 appropriate to the protection provided or, where applicable, the appropriate category (SB, S1. .. S5), as described in table 16.

NOTE The markings for e) and f) should be adjacent to one another.

Table 16 — Marking categories of safety footwear

Category	Basic requirements (Table 2 and Table 3)	Additional requirements
SB	I or II	
S1	I	Closed seat region Antistatic properties Energy absorption of seat region
S2	I	As S1 plus Water penetration and water absorption
S3	I	As S2 plus Penetration resistance Cleated outsole
S4	II	Antistatic properties Energy absorption of seat region
S5	II	As S4 plus Penetration resistance Cleated outsole
NOTE For ease of marking, table 16 categorizes safety footwear with the most widely used combinations of basic and additional requirements.		

8 Information to be supplied

8.1 General

Safety footwear shall be supplied to the customer with information written at least in the official language(s) of the state of destination. All information shall be unambiguous. The following information shall be given:

a) Name and full address of the manufacturer and/or his authorized representative;

b) Notified body involved in type examinationl; for category III products the notified body involved with article 11;

c) Number and year of the standard;

d) Explanation of any pictograms, markings and levels of performance. A basic explanation of the tests that have been applied to the footwear, if applicable;

e) Instructions for use:

1) tests to be carried out by the wearer before use, if required;

2) fitting; how to put on and take off the footwear, if relevant;

3) application; basic information on possible uses and, where detailed information is given, the source;

4) limitations of use (e.g. temperature range, etc.);

5) instructions for storage and maintenance, with maximum periods between maintenance checks (if important, drying procedures to be defined);

6) instructions for cleaning and/or decontamination;

7) obsolescence deadline or period of obsolescence;

8) if appropriate, warnings against problems likely to be encountered (modifications can invalidate the type approval, e.g. orthopaedic footwear);

9) if helpful, additional illustrations, part numbers etc.

f) Reference to accessories and spare parts, if relevant;

g) The type of packaging suitable for transport, if relevant.

8.2 Electrical properties

8.2.1 Conductive footwear

Each pair of conductive footwear shall be supplied with a leaflet containing the following wording.

"Electrically conductive footwear should be used if it is necessary to minimize electrostatic charges in the shortest possible time, e.g. when handling explosives. Electrically conductive footwear should not be used if the risk of shock from any electrical apparatus or live parts has not been completely eliminated. In order to ensure that this footwear is conductive, it has been specified to have an upper limit of resistance of 100 kΩ in its new state.

During service, the electrical resistance of footwear made from conducting material can change significantly, due to flexing and contamination, and it is necessary to ensure that the product is capable of fulfilling its designed function of dissipating electrostatic charges during the whole of its life. Where necessary, the user is therefore recommended to establish an in-house test for electrical resistance and use it at regular intervals. This test and those mentioned below should be a routine part of the accident prevention programme at the workplace.

If the footwear is worn in conditions where the soling material becomes contaminated with substances that can increase the electrical resistance of the footwear, wearers should always check the electrical properties of their footwear before entering a hazard area.

Where conductive footwear is in use, the resistance of the flooring should be such that it does not invalidate the protection provided by the footwear.

In use, no insulating elements, with the exception of normal hose, should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties."

8.2.2 Antistatic footwear

Each pair of antistatic footwear shall be supplied with a leaflet containing the following wording.

"Antistatic footwear should be used 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 if the risk of electric shock from any electrical apparatus or live parts has not been completely eliminated. It should be noted, however, that antistatic footwear cannot guarantee an adequate protection against electric shock as it introduces only a resistance between foot and floor. If the risk of electric shock has not been completely eliminated, additional measures to avoid this risk are essential. Such measures, as well as the additional tests mentioned below, should be a routine part of the accident prevention programme at the workplace.

Experience has shown that, for antistatic purposes, the discharge path through a product should normally have an electrical resistance of less than 1 000 MΩ at any time throughout its useful life. A value of 100 kΩ is specified as the lowest limit of resistance of a product when new, in order to ensure some limited protection

against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective when operating at voltages of up to 250 V. However, under certain conditions, users should be aware that the footwear might give inadequate protection and additional provisions to protect the wearer should be taken at all times.

The electrical resistance of this type of footwear can be changed significantly by flexing, contamination or moisture. This footwear will not perform its intended function if worn in wet conditions. It is, therefore, necessary to ensure that the product is capable of fulfilling its designed function of dissipating electrostatic charges and also of giving some protection during the whole of its life. The user is recommended to establish an in-house test for electrical resistance and use it at regular and frequent intervals.

Classification I footwear can absorb moisture if worn for prolonged periods and in moist and wet conditions can become conductive.

If the footwear is worn in conditions where the soling material becomes contaminated, wearers should always check the electrical properties of the footwear before entering a hazard area.

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.

In use, no insulating elements, with the exception of normal hose, should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties".

8.2.3 Electrically insulating footwear

Footwear with insulating properties provides limited protection against the inadvertent contact with damaged electrical apparatus and therefore each pair shall be supplied with a leaflet containing the following wording.

a) Electrically insulating footwear shall be worn if there is a danger of electric shock, for example from damaged live electrical apparatus.

b) Electrically insulating footwear cannot guarantee 100% protection from electric shock and additional measures to avoid this risk are essential. Such measures, as well as the additional tests mentioned below, should be part of a routine risk assessment programme.

c) The electrical resistance of footwear should meet the requirements of EN 50321:1999, 6.3 at any time throughout the life of the footwear.

d) This level of protection can be affected during service by:

    1) Footwear becoming damaged by nicks, cuts, abrasions or chemical contamination, regular inspections are necessary, worn and damaged footwear should not be used.

    2) Classification I footwear can absorb moisture if worn for prolonged periods and in moist and wet conditions, and can become conductive.

e) If footwear is worn in conditions where the soling material becomes contaminated, for example by chemicals, caution should be taken when entering hazardous areas as this can well affect the electrical properties of the footwear.

f) It is recommended that the users establish an appropriate means of having the electrical insulating properties of footwear inspected and tested whilst in service.

8.3 Insocks

If the footwear is supplied with a removable insock it should be made clear in the leaflet that testing was carried out with the insock in place. A warning shall be given that the footwear shall only be used with the insock in place and that the insock shall only be replaced by a comparable insock supplied by the original footwear manufacturer.

If the footwear is supplied without an insock it should be made clear in the leaflet that testing was carried out with no insock present. A warning shall be given that fitting an insock can affect the protective properties of the footwear.

Bibliography

[1] prEN ISO 19952, *Footwear - Vocabulary*

[2] EN 50321: 1999 *Electrically insulating footwear for working on low voltage installations*

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