BS EN ISO 20347:2012

Incorporating corrigendum July 2014

BSI Standards Publication

Personal protective equipment — Occupational footwear (ISO 20347:2012)

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National foreword

This British Standard is the UK implementation of EN ISO 20347:2012. It supersedes BS EN ISO 20347:2004, which is withdrawn.

National Annex NA (informative) gives guidance on slip resistance in relation to footwear.

The UK participation in its preparation was entrusted to Technical Committee PH/1, Safety, protective and occupational footwear.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Date	Text affected
31 July 2014	National Annex NA inserted

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 20347

February 2012

ICS 13.340.50

English Version

Personal protective equipment - Occupational footwear (ISO 20347:2012)

Équipement de protection individuelle - Chaussures de travail (ISO 20347:2012)

Persönliche Schutzausrüstung - Berufsschuhe (ISO 20347:2012)

This European Standard was approved by CEN on 28 January 2012.

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Ref. No. EN ISO 20347:2012: E

Foreword

This document (EN ISO 20347:2012) has been prepared by Technical Committee CEN/TC 161 “Foot and leg protectors”, the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 20347:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 89/686/EEC

Clauses/sub-clauses of this European Standard	Essential requirements (ERs) of EU Directive 89/686/EEC	Qualifying remarks/Notes
	1. General requirements applicable to all PPE	
5.3.3	1.1.1 Ergonomics	
5.3.3	1.1.2.1 Highest level of protection possible	
	1.2 Innocuousness of PPE	
5.3.2; 5.4.8; 5.8.5; 6.2.1.2; 6.2.1.3; 6.2.5; 6.3	1.2.1 Absence of risks and other inherent nuisance factors	
5.4.7; 5.4.9; 5.5.4; 5.5.5; 5.6.2; 5.6.3; 5.7.2; 5.7.5	1.2.1.1 Suitable constituent materials	
5.3.3	1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user	
5.3.3	1.2.1.3 Maximum user impediment	
	1.3 Comfort and efficiency	
5.3.1.2; 5.4.3; 5.4.4; 5.4.5; 5.5.1; 5.5.2; 5.6.1; 5.7.4; 5.8.2; 5.8.3; 5.8.4; 5.8.6; 6.2.1.4; 6.2.1.5.1; 6.4.1; 6.4.2	1.3.2 Lightness and design strength	
8	1.4 Information supplied by the manufacturer	
5.4.6; 5.5.3	2.2 PPE enclosing the parts of the body to be protected	
6.2.2.1; 6.2.2.2	2.6 PPE for use in explosive atmospheres	
6.1; 7	2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	
	3.1 Protection against mechanical impact	
6.2.4; 6.2.6	3.1.1 Impact caused by falling objects and collision of parts of the body with an obstacle	
5.3.4	3.1.2 Prevention of falls due to slipping	
6.2.1.1; 6.2.1.5.2; 6.2.7	3.3 Protection against physical injury (abrasion, perforation, cuts, bites)	
6.2.3.1	3.6 Protection against heat and/or fire	
6.2.3.2	3.7 Protection against cold	
6.2.2.3	3.8 Protection against electric shock	

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20347 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 161, *Foot and leg protectors*, in collaboration with Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 3, *Foot protection*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 20347:2004), which has been technically revised. It also incorporates the Amendment ISO 20347:2004/Amd.1:2007 and the Technical Corrigenda ISO 20347:2004/Cor.1:2005 and ISO 20347:2004/Cor.2:2006.

The differences between the first edition and this second edition are as follows.

— Slip resistance has been moved from Annex A into the main body of the text (5.3.4).

— The requirements for seat region (5.2.3) have been made more specific.

— Innocuousness (5.3.5) has been added.

— The requirement for chromium VI content has been exactly specified.

— The requirement for abrasion resistance of seat region lining has been included.

— The requirements for penetration resistance have been aligned with EN 12568.

— A new kind of footwear “Hybrid Footwear” has been included (Annex A).

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INTERNATIONAL STANDARD **ISO 20347:2012(E)**

Personal protective equipment — Occupational footwear

1 Scope

This International Standard specifies basic and additional (optional) requirements for occupational footwear that is not exposed to any mechanical risks (impact or compression).

Special risks are covered by complementary job-related standards (e.g. footwear for firefighters, electrical insulating footwear, protection against chain saw injuries, protection against chemicals and against molten metal splash, protection for motor cycle riders).

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.

ISO 17075, *Leather — Chemical tests — Determination of chromium(VI) content*

ISO 20344:2011, *Personal protective equipment — Test methods for footwear*

ISO 20345:2011, *Personal protective equipment — Safety footwear*

EN 12568:2010, *Foot and leg protectors — Requirements and test methods for toecaps and penetration resistant inserts*

EN 50321, *Electrically insulating footwear for working on low voltage installations*

3 Terms and definitions

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

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

3.1
occupational footwear
footwear incorporating protective features to protect the wearer from injuries which could arise through accidents

3.2
leather
hide or skin tanned to be imputrescible

3.2.1
leather split
flesh or middle part of a hide or skin, obtained by splitting a thick leather, which is tanned to be imputrescible

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3.3
rubber
vulcanized elastomers

3.4
polymeric materials
large molecules composed of repeating structural units (monomer) typically connected by chemical bond

EXAMPLE Polyurethane (PU) or polyvinylchloride (PVC).

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 non-removable footwear component used to cover part or all of the insole

NOTE "Non-removable" means that the insock cannot be removed without being damaged.

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 cannot be bent through an angle of 45° under a load of 30 N

NOTE When tested in accordance with ISO 20344:2011, 8.4.1.

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

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

3.12
seat region
counter area
rear 10 % of the total length of the footwear (upper and sole)

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3.13
conductive footwear
footwear, the resistance of which is in the range of 0 kΩ to 100 kΩ

NOTE Resistance is measured in accordance with ISO 20344:2011, 5.10.

3.14
antistatic footwear
footwear, the resistance of which is above 100 kΩ and is less than or equal to 1 000 MΩ

NOTE Resistance is measured in accordance with ISO 20344:2011, 5.10.

3.15
electrically insulating footwear
footwear which protects the wearer against electrical shocks by preventing the passage of dangerous current through the body via the feet

3.16
fuel oil
aliphatic hydrocarbon constituent of petroleum

3.17
specific job-related footwear
safety or occupational footwear relating to a specific profession

EXAMPLE Footwear for firefighters; footwear with resistance to chain saw cutting.

3.18
hybrid footwear
class II footwear incorporating another material which extends the upper

NOTE See Figure A.1.

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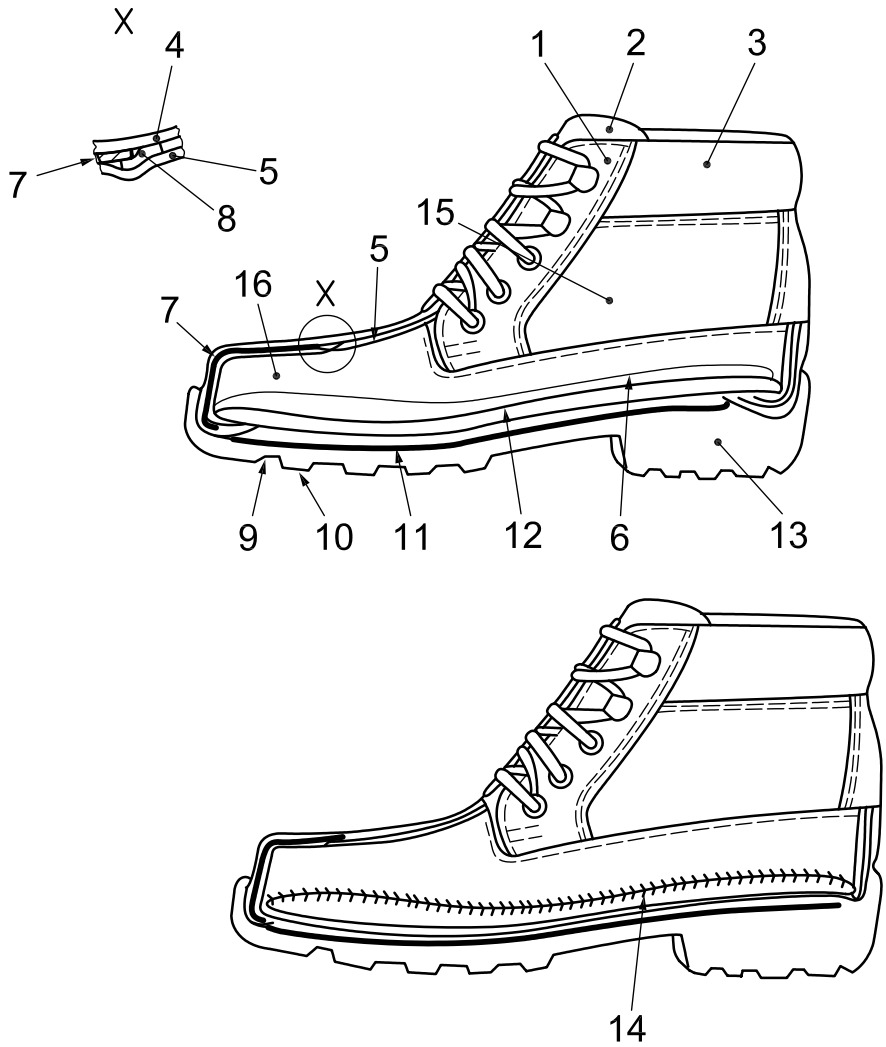

Key

1 facing
2 tongue
3 collar
4 upper
5 vamp lining
6 insock
7 toepuff
8 edge covering, e.g. foam strip
9 outsole
10 cleat
11 penetration-resistant insert
12 insole
13 heel
14 Strobel stitching
15 quarter
16 vamp

a) Example of parts of footwear of Strobel construction

Figure 1 (*continued*)

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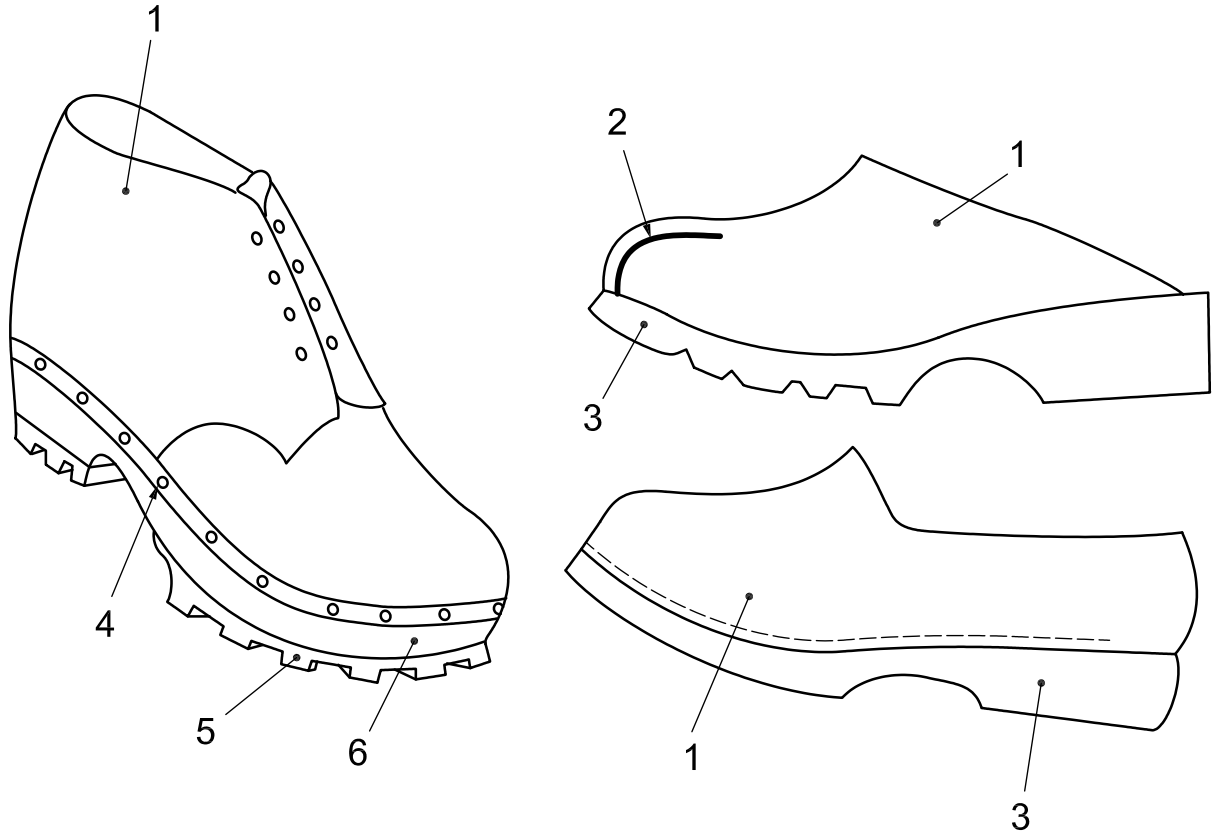

Key

1 upper
2 toepuff
3 rigid sole
4 reinforcing welt with nails
5 outsole
6 wooden sole

b) Example of other footwear

Figure 1 — Types of footwear

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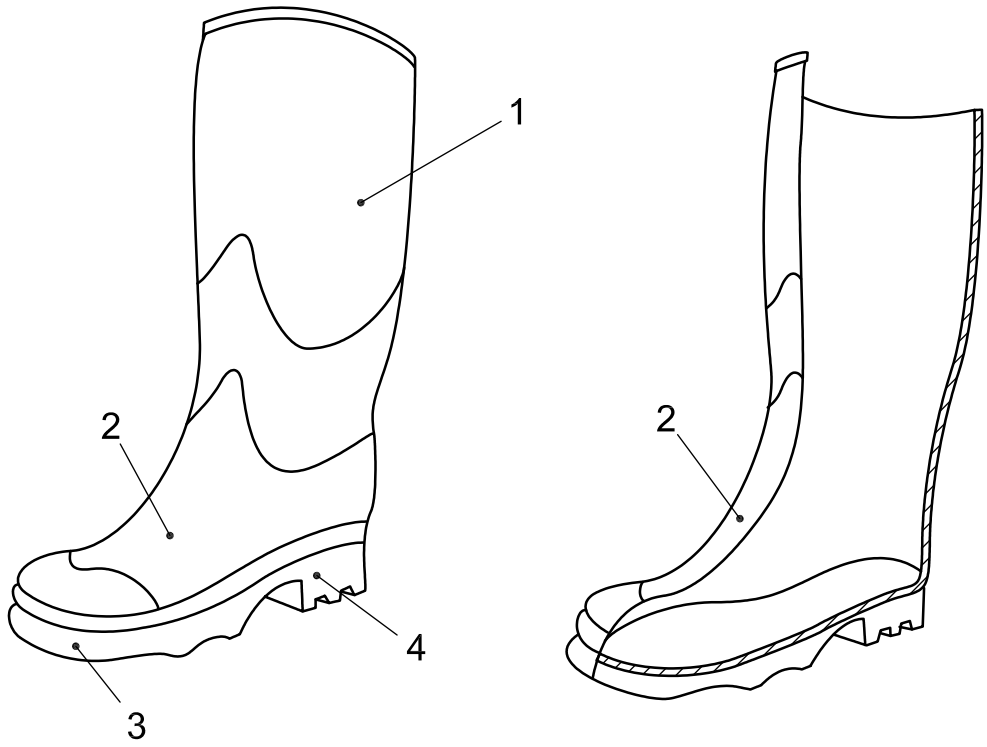

Key

1 upper
2 vamp
3 outsole
4 heel

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

4 Classification and designs

Footwear shall be classified in accordance with Table 1.

Table 1 — Classification of footwear

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

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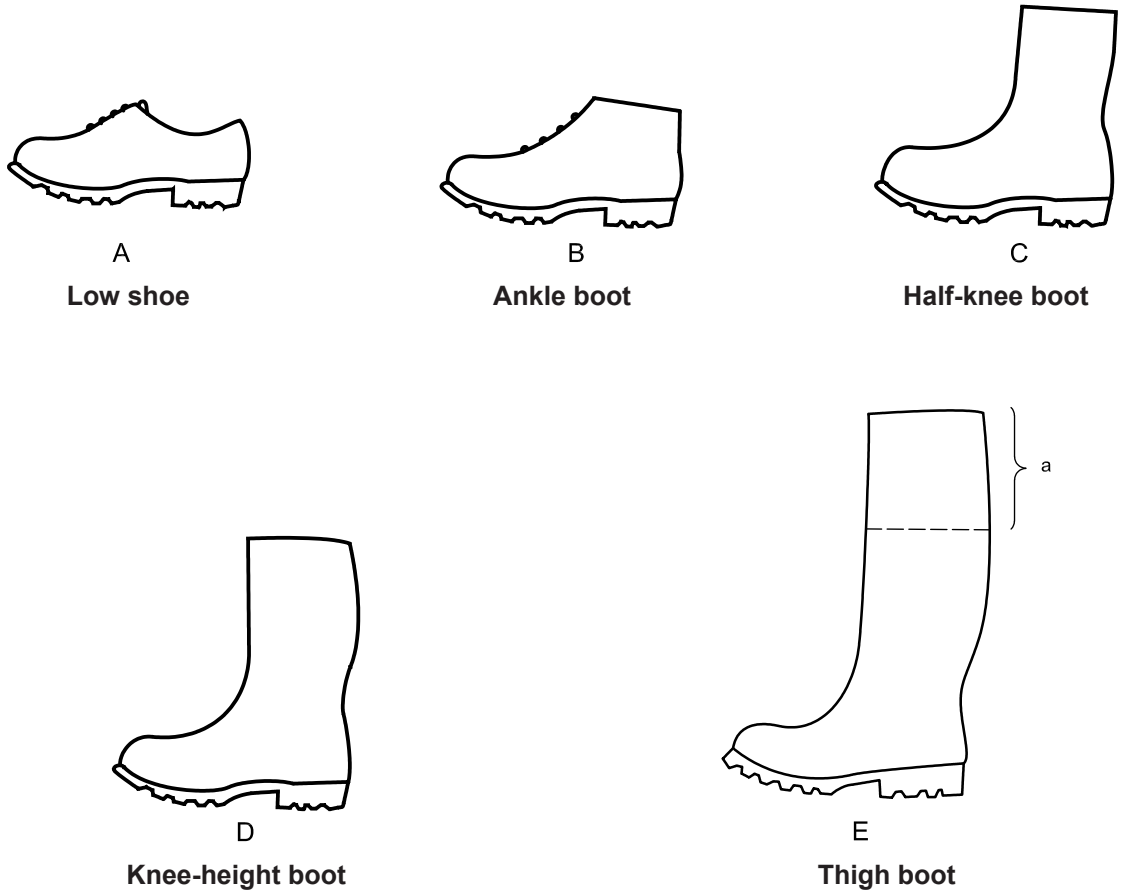

[a] Variable extension which can be adapted to the wearer.

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

Class II footwear can be equipped with another material which extends the upper. The requirements for this footwear are given in Annex A.

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5 Basic requirements for occupational footwear

5.1 General

Occupational footwear shall conform to the basic requirements given in Table 2.

Table 2 — Basic requirements for occupational footwear

Requirement		Subclause	Class	
			I	II
Design	Height of upper	5.2.2	X	X
	Seat region (design B, C, D, E)	5.2.3	X	X
Whole footwear	Sole performance:	5.3.1		
	— Construction	5.3.1.1	X	
	— Upper/outsole bond strength	5.3.1.2	X	
	Leakproofness	5.3.2		X
	Specific ergonomic features	5.3.3	X	X
	Slip resistance	5.3.4	X	X
	— Slip resistance on ceramic tile floor with SLS[^a]	5.3.4.2		
	— Slip resistance on steel floor with glycerine[^b]	5.3.4.3		
	— Slip resistance on ceramic tile floor with SLS and on steel floor with glycerine[^c]	5.3.4.4		
Upper	General	5.4.1	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	O
	Abrasion resistance	5.5.2	X	O
	Water vapour permeability and coefficient	5.5.3	X	
	pH value	5.5.4	X	O
	Chromium VI content	5.5.5	X	O
Quarter lining	Tear strength	5.5.1	O	O
	Abrasion resistance	5.5.2	O	O
	Water vapour permeability and coefficient	5.5.3	O	
	pH value	5.5.4	O	O
	Chromium VI content	5.5.5	O	O
Insole/insock		See Table 3	X	O
Tongue	Tear strength	5.6.1	O	
	pH value	5.6.2	O	
	Chromium VI content	5.6.3	O	

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Table 2 (*continued*)

Requirement		Clause	Class	
			I	II
Outsole	Design	5.8.1	X	X
	Tear strength	5.8.2	X	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

NOTE 1 The applicability of a requirement to a particular classification is indicated by X or O. X means 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 means that, if the component part exists, the requirement shall be met. The absence of X or O indicates that there is no requirement.

NOTE 2 For class II footwear, it is usual to have no insole present. However, if an insock is used, testing is not mandatory (although leather material, chromium VI and pH should fulfil the requirements of this International Standard).

NOTE 3 Stockings covering the last before the moulding process are not considered a lining.

^ One of the three slip resistance requirements shall be met.

a Marking symbol “SRA”.

b Marking symbol “SRB”.

c Marking symbol “SRC”.

Table 3 — Basic requirements for insoles and/or insocks

Options			Component to be assessed	Requirements to fulfil					
				Thickness	pH[a]	Water absorption/ desorption	Insole abrasion	Chromium VI[a]	Insock abrasion
				5.7.1	5.7.2	5.7.3	5.7.4.1	5.7.5	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

NOTE 1 X denotes that the requirement shall be met.

NOTE 2 For removable insocks, see 8.3.

a Applies only to leather.

b A water-permeable insock is one that, when tested in accordance with ISO 20344:2011, 7.2, lets water through in 60 s or less.

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5.2 Design

5.2.1 General

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

5.2.2 Height of upper

The height of the upper measured in accordance with ISO 20344:2011, 6.2, shall be as given in Table 4.

Table 4 — Height of upper

Size of footwear		Height			
France	UK	Design A mm	Design B min. mm	Design C min. mm	Design D and E min. mm
36 and below	up to 3 1/2	<103	103	162	255
37 and 38	4 to 5	<105	105	165	260
39 and 40	5 1/2 to 6 1/2	<109	109	172	270
41 and 42	7 to 8	<113	113	178	280
43 and 44	8 1/2 to 10	<117	117	185	290
45 and above	10 1/2 and above	<121	121	192	300

5.2.3 Seat region

The seat region shall be closed. In this area of the upper, below the minimum height given for design A in Table 8, there shall be no holes other than to form seams.

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. If there is no insole, a permanently attached insock shall be present.

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 ISO 20344:2011, 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 Leakproofness

When tested in accordance with ISO 20344:2011, 5.7, there shall be no leakage of air.

For class II footwear without a closed seat region, the requirement is not applicable.

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5.3.3 Specific ergonomic features

The footwear shall be considered to satisfy the ergonomic requirements if the questionnaire given in ISO 20344:2011, 5.1, is completed and all answers are positive.

If the footwear is rigid in accordance with ISO 20344:2011, 8.4.14, then question 4.3 of Table 2 of ISO 20344:2011 is not applicable.

5.3.4 Slip resistance requirement

5.3.4.1 General

When tested in accordance with ISO 20344:2011, 5.11.1, occupational footwear shall conform to 5.3.4.2, 5.3.4.3 or 5.3.4.4.

The requirements are applicable to conventionally soled footwear. They are not applicable to special-purpose footwear containing spikes, metal studs or similar, nor to special-purpose occupational footwear to be used on soft ground (sand, sludge, etc.).

5.3.4.2 Slip resistance on ceramic tile floor with sodium lauryl sulphate (SLS) solution

Footwear resistant to slip on a ceramic tile floor with SLS shall fulfil the requirements of Table 5.

Table 5 — Requirements for footwear resistant to slip on ceramic tile floor with SLS

Test condition of ISO 20344:2011, Table 5	Coefficient of friction
Condition A (forward heel slip)	≥ 0,28
Condition B (forward flat slip)	≥ 0,32

5.3.4.3 Slip resistance on steel floor with glycerine

Footwear resistant to slip on a steel floor with glycerine shall fulfil the requirements of Table 6.

Table 6 — Requirements for footwear resistant to slip on steel floor with glycerine

Test condition of ISO 20344:2011, Table 5	Coefficient of friction
Condition C (forward heel slip)	≥ 0,13
Condition D (forward flat slip)	≥ 0,18

5.3.4.4 Slip resistance on ceramic tile floor with SLS and on steel floor with glycerine

Footwear resistant to slip on a ceramic tile floor with SLS and on a steel floor with glycerine shall fulfil the requirements of Table 7.

Table 7 — Requirements for footwear resistant to slip on ceramic tile floor with SLS and on steel floor with glycerine

Test condition of ISO 20344:2011, Table 5	Coefficient of friction
Condition A (forward heel slip)	≥ 0,28
Condition B (forward flat slip)	≥ 0,32
Condition C (forward heel slip)	≥ 0,13
Condition D (forward flat slip)	≥ 0,18

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5.3.5 Innocuousness

Occupational footwear shall not adversely affect the health or hygiene of the user. Occupational footwear shall be made of materials such as textiles, leather, rubbers or plastics that have been shown to be chemically suitable. The materials shall not, in the foreseeable conditions of normal use, release, or degrade to release, substances generally known to be toxic, carcinogenic, mutagenic, allergenic, toxic to reproduction or otherwise harmful. Information claiming that the product is innocuous shall be checked.

NOTE Information about critical substances in footwear and footwear components can be found in 2.6.1 and Table 1 of ISO/TR 16178:2010.

5.4 Upper

5.4.1 General

The area which shall fulfil the requirements given in this subclause shall have a minimum height measured from the horizontal surface beneath the sole, in accordance with Table 8.

Table 8 — Minimum heights, below which the requirements for the upper shall be fulfilled

Size of footwear		Design minimum heights mm			
France	UK	A	B	C	D and E
36 and below	Up to 31/2	44	64	113	172
37 and 38	4 to 5	46	66	115	175
39 and 40	51/2 to 61/2	48	68	119	182
41 and 42	7 to 8	50	70	123	188
43 and 44	81/2 to 10	52	72	127	195
45 and above	101/2 and above	53	73	131	202

When collar and insert materials are present above the heights given in Table 8, such materials shall meet the tear strength (see 5.5.1) and abrasion resistance (see 5.5.2) requirements for lining. In the case of leather materials, they shall also meet the requirements for pH value (see 5.4.7) and for chromium VI content (see 5.4.9). Materials above the heights given in Table 8 that are not collar and insert shall fulfil the requirements for the upper.

5.4.2 Thickness

When determined in accordance with ISO 20344:2011, 6.1, the thickness of the upper of class II footwear at any point shall be in accordance with Table 9.

Table 9 — Minimum thickness of upper

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

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5.4.3 Tear strength

When determined in accordance with ISO 20344:2011, 6.3, the tear strength of the upper of class I footwear shall be in accordance with Table 10.

Table 10 — 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 ISO 20344:2011, 6.4, the tensile properties shall be in accordance with Table 11.

Table 11 — Tensile properties

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

5.4.5 Flexing resistance

When tested in accordance with ISO 20344:2011, 6.5, the flexing resistance shall be in accordance with Table 12.

Table 12 — Flexing resistance

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

5.4.6 Water vapour permeability and coefficient

When tested in accordance with ISO 20344:2011, 6.6, and ISO 20344:2011, 6.8, the water vapour permeability shall be not less than 0,8 $mg/(cm^2 \cdot h)$ 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 ISO 20344:2011, 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.

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5.4.8 Hydrolysis

When polyurethane uppers are tested in accordance with ISO 20344:2011, 6.10, no cracking shall occur before 150 000 flex cycles.

5.4.9 Chromium VI content

When determined according to the test method described in ISO 17075, the quantity of chromium VI in footwear containing leather shall not exceed 3,0 mg/kg.

5.5 Vamp and quarter lining

5.5.1 Tear strength

When determined in accordance with ISO 20344:2011, 6.3, the tear strength of the lining shall be in accordance with Table 13.

Table 13 — Minimum tear strength of lining

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

5.5.2 Abrasion resistance

When tested in accordance with ISO 20344:2011, 6.12, the lining shall not develop any holes before the following number of cycles has been performed.

— For vamp and quarter lining:

  — 25 600 cycles when dry;

  — 12 800 cycles when wet.

— For seat region lining:

  — 51 200 cycles when dry;

  — 25 600 cycles when wet.

5.5.3 Water vapour permeability and coefficient

When tested in accordance with ISO 20344:2011, 6.6, and ISO 20344:2011, 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 ISO 20344:2011, 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.

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5.5.5 Chromium VI content

When determined according to the test method described in ISO 17075, the quantity of chromium VI in footwear containing leather shall not exceed 3,0 mg/kg.

5.6 Tongue

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 ISO 20344:2011, 6.3, the tear strength of the tongue shall be in accordance with Table 14.

Table 14 — Minimum tear strength of tongue

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

5.6.2 pH value

When leather tongues are tested in accordance with ISO 20344:2011, 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 determined according to the test method described in ISO 17075, the quantity of chromium VI in footwear containing leather shall not exceed 3,0 mg/kg.

5.7 Insole and insock

5.7.1 Thickness

When determined in accordance with ISO 20344:2011, 7.1, the thickness of the insole and/or insock (see Table 3) shall be not less than 2,0 mm.

5.7.2 pH value

When leather insoles or leather insocks are tested in accordance with ISO 20344:2011, 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 ISO 20344:2011, 7.2, the water absorption shall be not less than 70 mg/cm^2 and the water desorption shall be not less than 80 % of the water absorbed.

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5.7.4 Abrasion resistance

5.7.4.1 Insoles

When non-leather insoles are tested in accordance with ISO 20344:2011, 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 ISO 20344:2011, 7.3.6).

5.7.4.2 Insocks

When insocks are tested in accordance with ISO 20344:2011, 6.12, the wearing surface shall not develop any holes before the following number of cycles has been performed:

— 25 600 cycles when dry;

— 12 800 cycles when wet.

5.7.5 Chromium VI content

When determined according to the test method described in ISO 17075, the quantity of chromium VI in footwear containing leather shall not exceed 3,0 mg/kg.

5.8 Outsole

5.8.1 Design

The outsole may be either cleated or non-cleated.

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

5.8.1.1 Thickness

The outsole can be composed of several layers. When tested in accordance with ISO 20344:2011, 8.1, the sole thickness, d_1 and d_3, shall fulfil the requirements given in Table 15.

Table 15 — Requirements for outsole thickness and cleat height

Type of outsole	Class I	Class II
Non-cleated outsole	$d_1 \geq 6$ mm	$d_1 \geq 6$ mm
Cleated outsole	$d_1 \geq 4$ mm $d_2 \geq 2{,}5$ mm	$d_1 \geq 3$ mm $d_2 \geq 4$ mm $d_3 \geq 6$ mm

5.8.1.2 Cleated area

With the exception of the region under the flange of the toecap, at least the shaded area as shown in Figure 41 of ISO 20344:2011 shall have cleats which are open to the side.

5.8.1.3 Cleat height

When tested in accordance with ISO 20344:2011, 8.1, the cleat height, d_2, is given in Table 15.

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5.8.2 Tear strength

When non-leather outsoles are tested in accordance with ISO 20344:2011, 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 than or equal to 0,9 g/cm^3.

5.8.3 Abrasion resistance

When outsoles other than those from all-rubber or all-polymeric footwear are tested in accordance with ISO 20344:2011, 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 ISO 20344:2011, 8.3, the relative volume loss shall be not greater than 250 mm^3.

5.8.4 Flexing resistance

When outsoles are tested in accordance with ISO 20344:2011, 8.4, the cut growth shall be not greater than 4 mm before 30 000 flex cycles.

Spontaneous cracks are accepted in the following circumstances.

a) Only the centre of the tread area shall be assessed for cracking, i.e. cracks under the toecap zone shall be ignored.

b) Superficial cracks up to 0,5 mm deep shall be ignored.

c) Soles shall be deemed to be satisfactory if cracks are no deeper than 1,5 mm, no longer than 4 mm and no more than five in number.

5.8.5 Hydrolysis

When polyurethane outsoles and soles with an outer layer composed of polyurethane are tested in accordance with ISO 20344:2011, 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 ISO 20344:2011, 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.

6 Additional requirements for occupational footwear

6.1 General

Additional requirements can be necessary for occupational footwear depending upon risks to be encountered at the workplace. In such cases, occupational footwear shall conform to the appropriate additional requirements and corresponding marking given in Table 16.

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Table 16 — Additional requirements for special applications with appropriate symbols for marking

Requirement		Clause	Class		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	See EN 50321
	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
	Ankle protection	6.2.6	X	X	AN
	Cut resistance	6.2.7	X	X	CR
Upper	Water penetration and absorption	6.3	X		WRU
Outsole	Resistance to hot contact	6.4.1	X	X	HRO
	Resistance to fuel oil	6.4.2	X	X	FO

NOTE The applicability of a requirement to a particular classification is indicated in this table by an 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

6.2.1.1.1 Metallic anti-penetration insert

When footwear is tested in accordance with ISO 20344:2011, 5.8.2, the force required to penetrate the sole unit shall be not less than 1 100 N.

6.2.1.1.2 Non-metallic anti-penetration insert used as an insole

When footwear is tested in accordance with ISO 20344:2011, 5.8.3, using a force of at least 1 100 N, the tip of the test nail shall not penetrate through the test piece. In order to achieve a “pass” result, the tip of the test nail shall not protrude from the test piece. This can be checked by visual, cinematographic or electrical detection.

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. Except for non-metallic inserts that also function as an insole, the insert shall not lie above the flange of the safety toecap and shall not be attached to it.

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6.2.1.3 Dimensions

The penetration-resistant insert dimensions shall be measured according to ISO 20344:2011, 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 13 of ISO 20344:2011).

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 of Figure 13 of ISO 20344:2011.

Holes in the shaded area 2 of Figure 13 of ISO 20344:2011 shall be disregarded.

6.2.1.4 Flex resistance of penetration-resistant inserts

When penetration-resistant inserts in all types of footwear are tested in accordance with ISO 20344:2011, 5.9, they shall show no visible signs of cracking or delamination after being subjected to 1×10^6 flex cycles.

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 ISO 20344:2011, 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. When penetration-resistant metallic inserts to be used in all other types of footwear are tested in accordance with the method described in ISO 20344:2011, 5.6.3, they shall exhibit no more than five areas of corrosion, none of which shall exceed 2,5 mm^2.

Both before and after testing in accordance with the method described in 5.3, the metal toecaps shall exhibit not more than three areas of corrosion, none of which shall measure more than 2 mm in any direction.

6.2.1.5.2 Penetration-resistant non-metallic inserts

Penetration-resistant non-metallic inserts shall comply with the requirements of EN 12568:2010, 6.4, measuring the maximum force after being subjected to the treatments described in EN 12568:2010, 7.4.

6.2.2 Electrical properties

6.2.2.1 Conductive footwear

When measured in accordance with ISO 20344:2011, 5.10, after conditioning in a dry atmosphere [see ISO 20344:2011, 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 ISO 20344:2011, 5.10, after conditioning:

— in a dry atmosphere, the electrical resistance shall be above 100 kΩ and less than or equal to 1 000 MΩ;

— in a wet atmosphere, the electrical resistance shall be above 100 kΩ and less than or equal to 1 000 MΩ.

NOTE See ISO 20344:2011, 5.10.3.3, for determination of dry and wet atmospheres.

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6.2.2.3 Electrically insulating footwear

Electrically insulating footwear shall meet the requirements of EN 50321.

6.2.3 Resistance to inimical environments

6.2.3.1 Heat insulation of sole complex

When footwear is tested in accordance with ISO 20344:2011 5.12, with the temperature of the hotplate, T_{hp}, at 150 °C, the temperature increases (final temperature, T_f, minus initial temperature, T_i) on the upper surface of the insole after 30 min shall be not greater than 22 °C.

After testing, the footwear shall conform to the requirements given in ISO 20344:2011, Annex B.

Except for the insock, 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 ISO 20344:2011, 5.13, the temperature decrease on the upper surface of the insole shall be not more than 10 °C.

Except for the insock, 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 ISO 20344:2011, 5.14, the energy absorption of the seat region shall be not less than 20 J.

6.2.5 Water resistance

The total area of water penetration inside the footwear shall be not greater than 3 cm^2 when tested in accordance with either:

— ISO 20344:2011, 5.15.1, after 100 trough lengths, or

— ISO 20344:2011, 5.15.2, after 15 min.

6.2.6 Ankle protection

When tested in accordance with ISO 20344:2011, 5.17, the mean value of the test results shall not exceed 10 kN and no single value shall exceed 15 kN.

6.2.7 Cut resistance footwear

6.2.7.1 Design

Cut resistance footwear shall not be of design A (see Clause 4 and 5.2.1).

6.2.7.2 Construction

Cut resistance 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.

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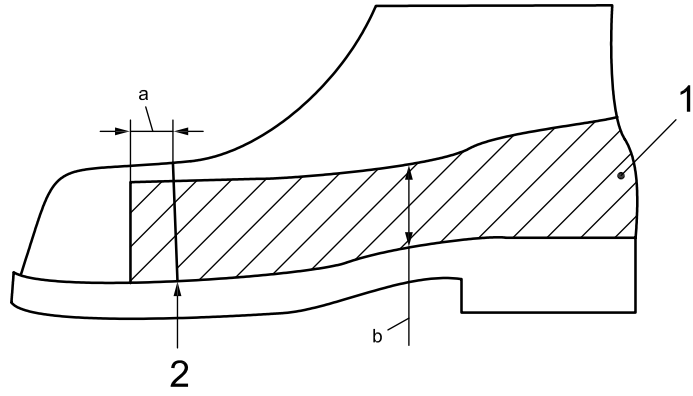
There shall be no gap between the toecap and the protective material. The protective material shall be permanently attached to the footwear. If different materials are used for protection against cutting, they shall either be attached to each other or overlap (see Figure 4).



Key

1 protective area

2 rear edge of toecap

[a] Overlap of 10 mm over toecap.

[b] Minimum height of 30 mm above the feather line.

Figure 4 — Coverage of protective area

6.2.7.3 Resistance to cutting

When tested in accordance with the method described in ISO 20344:2011, 6.14, the cut-resistant index (see EN 388) shall be not less than 2,5.

6.2.7.4 Penetration resistance

Cut-resistant footwear shall also comply with the requirements of 6.2.1.

6.3 Upper — Water penetration and absorption

When tested in accordance with ISO 20344:2011, 6.13, the water penetration (expressed as the 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 %.

Non-functional and decorative stitching and perforations shall not be used on footwear on which water resistance of the upper is claimed, unless they fulfil the above requirements.

When the requirement of 6.2.5 has been met, non-functional and decorative stitching and perforations are acceptable.

6.4 Outsole

6.4.1 Resistance to hot contact

When tested in accordance with ISO 20344:2011, 8.7, rubber and polymeric outsoles shall not melt and shall not develop any cracks when bent around the mandrel.

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6.4.2 Resistance to fuel oil

When tested in accordance with ISO 20344:2011, 8.6.1, the increase in volume shall be not greater than 12 %.

If, after testing in accordance with ISO 20344:2011, 8.6.1, the test piece shrinks by more than 1 % 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 ISO 20344:2011, 8.6.2, and the cut growth shall be not greater than 6 mm before 150 000 flex cycles.

7 Marking

Each item of occupational footwear shall be clearly and permanently marked, e.g. by embossing or branding, with the following:

a) size;

b) manufacturer's identification mark;

c) manufacturer's type designation;

d) year and at least quarter of manufacture;

e) reference to this International Standard, i.e. ISO 20347:2011;

f) symbol(s) from Table 2 and Table 16 appropriate to the protection provided and/or, where applicable, the appropriate category (OB,O1 to O5), as described in Table 17.

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

Table 17 — Marking categories of occupational footwear

Category	Basic requirements (Table 2 and Table 3)	Additional requirements
OB	I or II	
O1	I	Closed seat region Antistatic properties Energy absorption of seat region
O2	I	As O1, plus: Water penetration and absorption
O3	I	As O2, plus: Penetration resistance Cleated outsole
O4	II	Closed seat region Antistatic properties Energy absorption of seat region
O5	II	As O4, plus: Penetration resistance Cleated outsole

NOTE For ease of marking, this table categorizes occupational footwear with the most widely used combinations of basic and additional requirements.

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Table 18 — Marking categories of occupational hybrid footwear

Category	Basic requirements (see Annex A)	Additional requirements
OBH	Hybrid footwear	

For any additional marking on the footwear related to safety, the manufacturer shall provide evidence to support the claim and explanation in the user notice.

EXAMPLE If bearing the “acid resistant” marking, the sole would be at least tested according to EN 13832-1 (degradation) and would meet the requirements of EN 13832-3:2006, 6.2.2.3.

8 Information to be supplied

8.1 General

Occupational footwear shall be supplied to the customer with information written at least in the official language(s) of the country of destination. All information shall be unambiguous and shall include the following.

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

b) Notified body involved in type examination; for category III products, the notified body involved with Article 11 of EU Directive 89/686 EEC.

c) Reference to this International Standard, i.e. ISO 20347:2011.

d) Explanation of any pictograms, markings and levels of performance.

e) A basic explanation of the tests that have been applied to the footwear, if applicable.

f) 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);

   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.

g) Reference to accessories and spare parts, if relevant.

h) Type of packaging suitable for transport, if relevant.

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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 its entire life. Where necessary, it is therefore recommended that the user 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 should be introduced between the inner sole of the footwear and the foot of the wearer. If an 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 adequate protection against electric shock as it only introduces 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 resistance limit 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 might 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 its entire life. It is recommended that the user establish an in-house test for electrical resistance, which is carried out at regular and frequent intervals.

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

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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 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."

8.3 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.

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Annex A
(normative)

Hybrid footwear

A.1 General

The hybrid footwear shall fulfil the following requirements.

A.2 Height

The measurement, H, between the lowest point of the top of the visible polymer (or rubber) part and the ground (see Figure A.1) shall have a minimum height corresponding to the values given in Table 8, design B.

A.3 Area A

Area A, the lower part of the footwear, shall fulfil the requirements of class II footwear (see Table 2), except for leakproofness, 5.3.2. If present, the insole and/or insock shall fulfil the requirements given in Table 3.

A.4 Area B

Area B, the material which extends the upper, shall fulfil the requirements given in ISO 20345:2011, 5.4.3, 5.4.4, 5.4.6, 5.4.7, and 5.4.9.

The lining shall fulfil the requirements of ISO 20345:2011, 5.5.

A.5 Water resistance

The footwear shall fulfil the requirements given in ISO 20345:2011, 6.2.5.

If the method used is ISO 20344:2011, 5.15.1, the depth of water defined in ISO 20344:2011, 5.15.1.4 shall be at least H, in millimetres.

If the method used is ISO 20344:2011, 5.15.2, the depth of water defined in ISO 20344:2011, 5.15.2.4.7 shall be at least H, in millimetres.

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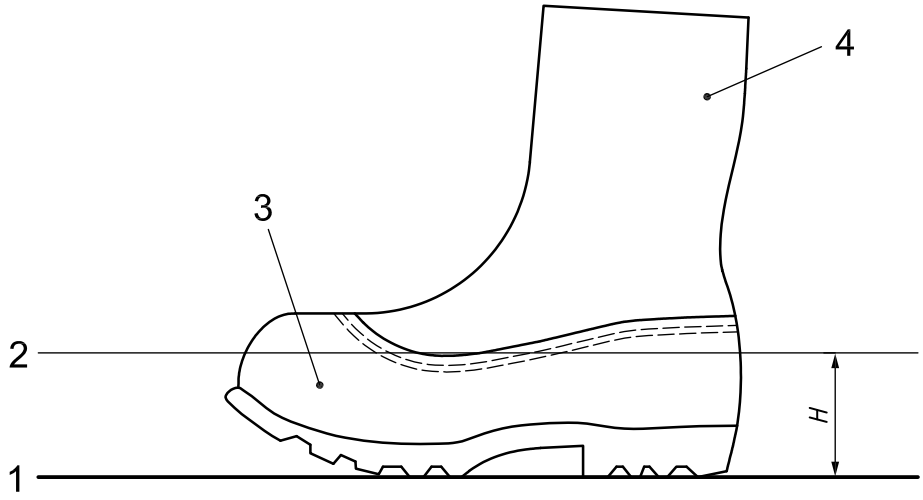

Key

1 ground
2 lowest point of the top of the visible polymer (or rubber) part
3 area A
4 area B
H depth of water

Figure A.1 — Design of hybrid footwear

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[4] EN 13832-1, *Footwear protecting against chemicals — Part 1: Terminology and test methods*

[5] EN 13832-3:2006, *Footwear protecting against chemicals — Part 3: Requirements for footwear highly resistant to chemicals under laboratory conditions*

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National Annex NA
(informative)

Slip Resistance

NA.1 Introduction

This informative annex provides the reader with information on slip resistance in relation to footwear. When specifying and selecting footwear, slip resistance should be given a high priority.

In this context slip resistance is a specific term referring to the coefficient of friction between the footwear and the floor.

Slips, trips and falls are the biggest cause of accidents in the work place across Europe. Many other types of accident such as a fall from height are often initiated by a slip. In addition to the personal costs of these accidents, the resultant injuries may bring about great financial costs.

The slip resistance test defined in EN ISO 13287 provides a benchmark to give end users a better idea of which products will work well in service. The information given here is intended to interpret and to complement the test data generated by EN ISO 13287, and to ultimately reduce the number of accidents and associated costs.

Footwear should not be assumed to be slip resistant unless this has been demonstrated by laboratory testing. Further valuable information may be gained from additional testing. The UK committee recommend footwear field trials to assess suitability in the work place as suggested in relevant European PPE (Personal Protective Equipment) legislation.

Terms such as “anti-slip”, “non-slip”, “slip proof” are misleading and should not be used.

It is important that slip resistant footwear is in use at all times when there is a potential risk of slip; comfortable footwear will encourage this.

NA.2 Explanation of EN ISO 13287 and marking codes SRA, SRB or SRC

According to Pye and Harrison if the coefficient of friction value is below 0.24 then it is highly likely that a slip will occur during normal walking. A higher figure will reduce the likelihood of slipping accidents. It is generally accepted that at a value of 0.36 the pedestrian has a low risk of slip.

The standard EN ISO 13287 test conditions and performance thresholds associated with marking codes SRA, SRB and SRC are considered basic requirements. Often it is found that footwear can achieve higher levels than just meeting SRA, SRB or SRC.

- SRA Marked footwear has been tested on ceramic tile wetted with dilute soap solution. This represents a generic test for assessing performance on water based contaminants.
- SRB Marked footwear has been tested on stainless steel with glycerol. This represents a generic test to mimic performance on more viscous contaminants such as oil. It should be noted that this test condition is particularly demanding and results in this test tend to be inherently low.
- SRC Marked footwear has been tested under both the above conditions and represents a test for footwear where both types of contaminant may be encountered.

It is important to note that in the opinion of the UK committee the SRC code may be considered misleading as it does not necessarily mean that the footwear has superior slip resistance to that only claiming SRA or SRB. For example, if the intended conditions of use only involve wet paved surfaces then it is better to have excellent SRA performance rather than lower levels of slip resistance when tested under both SRA and SRB conditions. It is always better to use protective equipment that has been shown to perform well under test conditions that are as similar as possible to the conditions of use.

It should also be noted that neither the SRA nor the SRB test conditions mimic outdoor environments when walking on heavy or loose ground. Under these conditions small cleats or narrow tread patterns may become clogged with contamination such as mud or gravel thus leading to a significant reduction in slip resistance. Once again, additional testing and trials may be more informative than the standard slip resistance test results.

No footwear can ever provide complete safety under particularly demanding conditions such as spillages of cooking or mineral oil. Under such conditions, slip-resistant footwear may only reduce the risk. Often the only solution in such circumstances is to either prevent contamination in the first place or promptly clean-up the spill.

NA.3 Additional testing

NA.3.1 General

The standard details specific combinations of floor surface and liquid contaminant (lubricant) to be used for testing. However, it is clearly impossible for any limited set of test conditions to successfully model the wide range of walking surfaces encountered in real-life. In the majority of cases it would be useful to know the performance of footwear when tested against other surfaces and contaminants.

NA.3.2 Additional surfaces

Slip resistance is highly dependent on the test conditions and the particular combination of surface and contaminant. It would therefore be prudent to test footwear, as far as is practicable, against real-life surfaces and other challenges.

Caution should be applied when testing or using footwear on profiled floors. Such combinations may give the impression of providing slip resistance through friction; in many cases this impression could be misleading. Specific tread patterns may interlock with profiled floors. This interaction may change quickly with even a small amount of wear.

NA.4 Factors influencing footwear performance

NA.4.1 General

The heel and forepart cleat (tread) patterns and the material from which they are made are both important for slip resistance. A softer material and close-packed cleat pattern generally works well with fluid contaminants. A more open pattern usually works better with solid loose contaminants. Ideally all footwear should be trialled in the end-use environment.

NA.4.2 Durability of slip resistance

Slip resistance properties are generally only measured on new footwear. Slip-resistance is likely to change with wear. For example, if the cleated sole-pattern has fine detail, this may quickly be worn away with use. It may therefore be desirable to monitor the performance of footwear throughout

its service-life. Monitoring may include periodic inspection of footwear, field-trials involving used footwear, and recording of slip-related incidents.

NA.4.3 Other factors

Footwear performance may be impaired by the following factors:

- clogging of cleats;
- soiling;
- degradation due to exposure to certain environmental contaminants;
- wear;
- damage;
- exceeding the service life.

The UK committee recommends footwear is cleaned, maintained, inspected and replaced as necessary to ensure optimum performance.

Bibliography

[1] BRE Building Elements Floors and Flooring P. W. Pye and H. W. Harrison, 1997

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