INTERNATIONAL STANDARD

ISO 20349-1

First edition
2017-07

Personal protective equipment — Footwear protecting against risks in foundries and welding —

Part 1: Requirements and test methods for protection against risks in foundries

Équipement de protection individuelle — Chaussures de protection contre les risques dans les fonderies et lors d'opérations de soudage —

Partie 1: Exigences et méthode d'essai pour la protection contre les risques dans les fonderies

Reference number
ISO 20349-1:2017(E)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by the European Committee Standardization (CEN) Technical Committee CEN/TC 161, *Foot and leg protectors in equipment*, in collaboration with ISO Technical Committee 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 first edition of ISO 20349-1 cancels and replaces ISO 20349:2010, which has been technically revised.

A list of all parts in the ISO 20349 series can be found on the ISO website.

Personal protective equipment — Footwear protecting against risks in foundries and welding —

Part 1: Requirements and test methods for protection against risks in foundries

WARNING — This document calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

1 Scope

This document specifies requirements and test methods for footwear protecting users against risks, such as those encountered in foundries.

Footwear complying with this document also offers other protection as defined in ISO 20345.

NOTE Gaiters over boot and clothing intended to provide protection to the feet and legs against molten metal are addressed by ISO 11612.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 17227:2002, *Leather — Physical and mechanical tests — Determination of dry heat resistance of leather*

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

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

EN 702:1995, *Protective clothing — Protection against heat and flame — Test method — Determination of the contact heat transmission through protective clothing or its materials*

EN 12477, *Protective gloves for welders*

EN 15090:2012, *Foot wear for firefighters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20345 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Classification of footwear

Footwear shall be class I footwear manufactured from leather and other materials, excluding all-rubber or all-polymeric footwear

5 Sampling and conditioning

For test methods described in ISO 20344, the number of test pieces and conditioning applied shall be as described within the method.

For test methods defined within this document, the assessment and testing shall be carried out on the smallest, one of the middle and the largest size, covering the full range of manufacturing size. Unless otherwise stated, within the test method, the specimens shall be conditioned in accordance with the requirements given in ISO 20344.

If it is not possible to obtain a large enough test piece from the footwear, then a sample of the material from which the component has been manufactured may be used instead. This should be noted in the test report.

6 Requirements

Footwear protecting against risks as found in foundries shall conform to the requirements specified in Table 1.

Table 1 — Performance requirements

Requirements		Standard clause		Footwear classification class I
		ISO 20345:2011	ISO 20349-1:2016	
Design	Height of upper		7.1	X
	Seat region	5.2.3		X
Whole footwear	Footwear Design Sole performance:	5.3.1	7.2	X
	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
	Internal length	5.3.2.2		X
	Impact resistance	5.3.2.3		X
	Compression resistance	5.3.2.4		X
	Behaviour of toecaps	5.3.2.5		X
	Specific ergonomic features Footwear removal time	5.3.4	7.8	X X
	Innocuousness		7.9	X
	Slip resistance ^	5.3.5		X
	Slip resistance on tile floor ceramic with SLS (S RA)	5.3.5.2		
	Slip resistance on steel floor with glycerol (SRB)	5.3.5.3		
	Slip resistance on ceramic tile floor with SLS and on steel floor with glycerol (SRC)	5.3.5.4		

Table 1 *(continued)*

Requirements		Standard clause		Footwear classification class I
		ISO 20345:2011	ISO 20349-1:2016	
Whole footwear	Perforation resistance (P)	6.2.1		*
	Antistatic footwear (A)	6.2.2.2		*
	Electrically insulating footwear (Symbol according to EN 50321)	6.2.2.3		*
	Cold insulation of sole complex (CI)	6.2.3.2		*
	Energy absorption of seat region (E)	6.2.4		*
	Water resistance (WR)	6.2.5		*
	Metatarsal protection (M)	6.2.6		*
	Ankle protection (AN)	6.2.7		*
	Cut resistance (CR)	6.2.8		*
	Resistance to effects of molten metal (Fe or Al)		7.3	X
	Resistance of upper to contact heat transmission		7.4	X
	Burning behaviour		7.5	X
	Heat insulation of sole complex		7.6	X
Upper (all parts)	Tear strength	5.4.3		X
	Tensile properties	5.4.4		X
	Water vapour permeability and coefficient	5.4.6		X
	pH value	5.4.7		X
	Chromium VI content	5.4.9		X
	Water penetration and water absorption (WRU)	6.3		*
	Surface shrinkage		7.7	X
Tongue	Tear strength pH Value Chromium VI content	5.6.1 5.6.2 5.6.3		O O O
Insole/ insock		Table 3		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 1 *(continued)*

Requirements		Standard clause		Footwear classification class I
		ISO 20345:2011	ISO 20349-1:2016	
Outsole	Outsole design	5.8.1		X
	Tear strength	5.8.2		X
	Abrasion resistance	5.8.3		X
	Flexing resistance	5.8.4		X
	Interlayer bond strength	5.8.6		O
	Resistance to hot contact	6.4.1		X
	Resistance to fuel oil (FO)	6.4.2		*
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. * If the property is claimed, the requirement given in the appropriate clause shall be met. ^ One of the three slip resistance requirements shall be chosen.				

7 Specific requirements

7.1 Height of upper

When tested in accordance with ISO 20345:2011, 5.2.2, the height of upper shall be not less than Design C

7.2 Footwear design

7.2.1 There shall be no features on the outer surface of the footwear that could trap molten metal around the front 2/3 of the footwear. Straps and buckles to enable fastening that could present a trapping risk are permitted around the rear 1/3 of the footwear. Measurements are made on the upper from rear most point of the counter to the front of the toe (see Figure 1).

7.2.2 There shall be no upward facing seams around the front 2/3 of the footwear. Upward facing seams, for example the counter seam are permitted around the rear 1/3 of the footwear. Measurements are made on the upper from rear most point of the counter to the front of the toe (see Figure 1).

7.2.3 The vamp shall consist of one single piece with a length of at least one third of the total length of the footwear (see Figure 1).

7.2.4 All upper seams shall have an overlap of ≥ 10 mm.

7.2.5 The top of the boot shall be fitted with a feature to permit adjustment to give a close fit to the wearer's leg.

7.2.6 Measure vertically from the floor surface to height, *h*, as given in Table 2. Metal fittings to enable adjustment and fastening (e.g. buckles) on the exterior surface of the footwear below height, *h*, within the rear third of the footwear shall be covered to prevent heat damage or molten metal sticking, which could affect their proper operation (see Figure 1). Metal rivets to strengthen structural seams are permitted but shall be covered on the inner surface of the footwear to reduce heat transfer to the foot.

7.2.7 If there is a tongue, it should be fully covered by parts of the upper. If the material is exposed on any points it shall be treated as an upper.

Table 2 — Height, *h*

Footwear size		Height, *h*, below which all metal fixtures to enable fastening and adjustment shall be covered
French	English	mm
36 and below	up to 31/2	113
37 and 38	4 to 5	115
39 and 40	51/2 to 6 1/2	119
41 and 42	7 to 8	123
43 and 44	81/2 to 10	127
45 and above	101/2 and above	131

7.3 Resistance to the effects of molten metal

Testing shall be carried out in accordance with Annex A and the results shall be as follows.

a) There shall be no penetration of molten metal to inner surface.

b) After-f lame time shall be no more than 5 s after cessation of pouring.

c) No melting or ignition of inner surface.

7.4 Resistance of upper to contact heat transmission

Testing shall be carried out in accordance with the procedure described in EN 702 with a contact temperature of 500 °C. The threshold time shall be ≥ 6 s and there shall be no melting of the inner surface. All material combinations shall be tested. One test piece of each material combination shall be taken from the smallest, middle and largest sizes of footwear. If the footwear incorporates rivets in the upper, one additional test piece shall be taken including the rivet in the test area from each of the smallest, middle and largest sizes of footwear.

7.5 Burning behaviour

Footwear shall comply with EN 15090:2012, 6.3.3.

7.6 Heat insulation of sole complex

Testing shall be carried out in accordance with the procedure described in ISO 20344:2011, 5.12 with the following modifications:

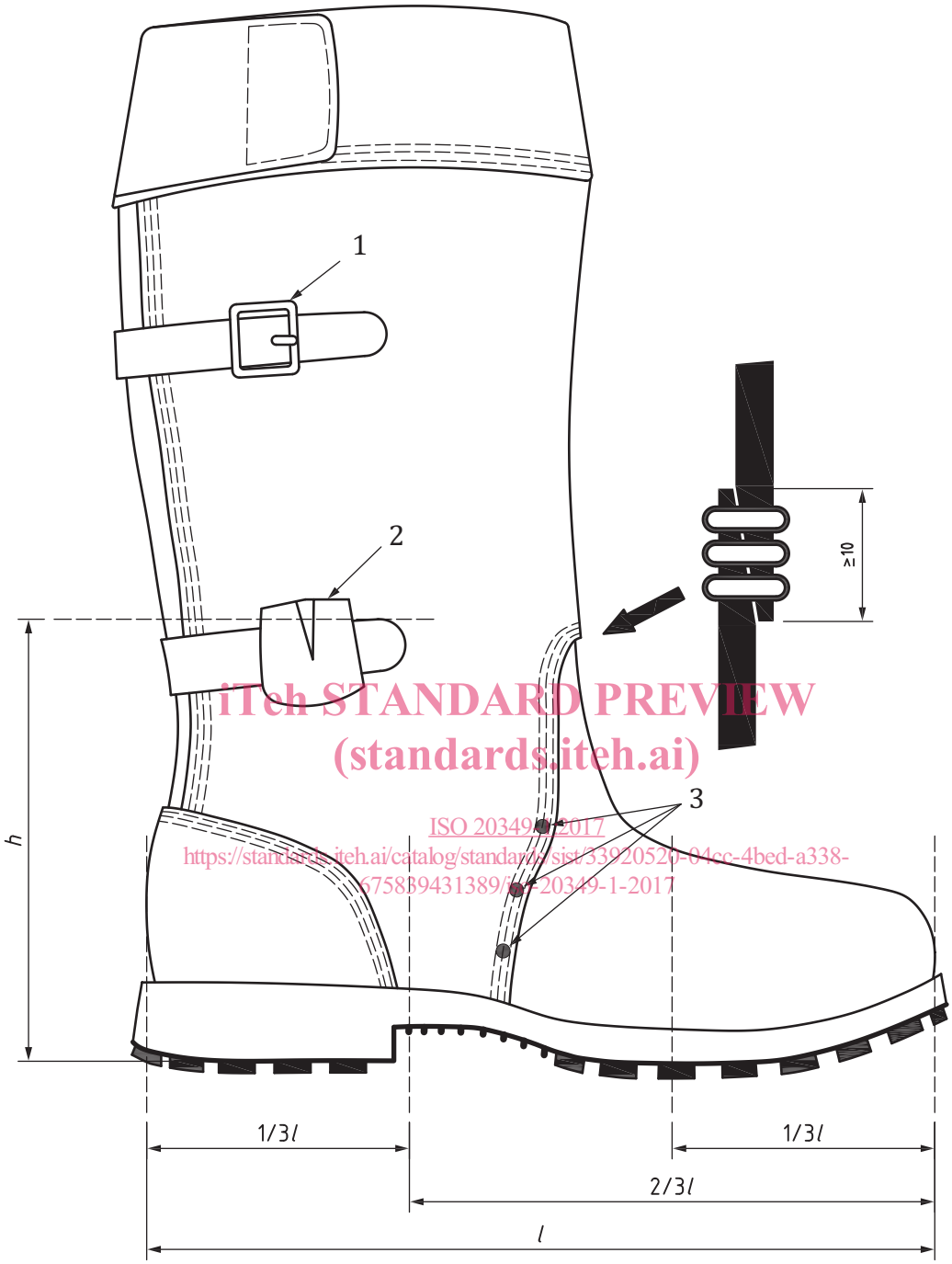
— sand bath temperature of 250 °C, exposure time of 40 min;

— the temperature inside the footwear shall be not more than 42 °C after 10 min.

7.7 Surface shrinkage of leather

Testing shall be carried out in accordance with ISO 17227:2002, 7.6. The test temperature shall be (180 ± 5) °C and the testing time 5 min ± 10 s. The area dimensional change shall not be more than 10 %.

Dimensions in millimetres



Key

h height below which all metal components in the upper must be coated or covered
l total length of footwear from toe to heel
1 exposed metal buckle
2 flap covering metal buckle
3 metal rivets covered on the inner surface

Figure 1 — Footwear design

7.8 Footwear removal time

The test subject shall remove the footwear as quickly as possible. This assessment is carried out while wearing protective gloves for welders complying with EN 12477 Type A with a dexterity of level 1. The removal of a single boot shall be timed. The time required to the remove the footwear shall be not greater than 5 s for a single boot. Three different sizes shall be used.

NOTE Several attempts at removal are permitted to ensure the test subject is fully familiar with the particular fastening system.

7.9 Innocuousness

Footwear protecting against risks as found in foundries shall not adversely affect the health or hygiene of the user. Footwear protecting against risks as found in foundries shall be made of materials, such as textiles, leather, rubbers, 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 ISO/TR 16178.

8 Marking

Each item of footwear protecting against risks as found in foundries shall be clearly and permanently marked with at least the following information:

a) the name or trademark of the manufacturer;

b) a product code that uniquely identifies the footwear;

c) the size of the footwear;

d) the year and month of manufacturing at least;

e) the number and date of this document (i.e. ISO 20349-1:2017); note that d) and e) should be adjacent to each other, as specified in ISO 20345;

f) all the marking codes given in ISO 20345 may be applied when the relevant tests have been passed and in conformance with those found in Table 1, as applicable, the following marking shall be used:

   — marking code Al indicates the footwear complies with 5.3, using aluminium as test metal,

   — marking code Fe indicates the footwear complies with 5.3, using iron as test metal,

g) the graphical symbol ISO 7000-2417 shown in Figure 2 indicating the protection against heat and flame;

h) an instruction to refer to the instructions for use provided with the item, such as the graphical symbol indicating that the user should see the information supplied by the manufacturer (a letter "i" in an open book; see graphical symbol ISO 7000-1641, see Figure 3).

Figure 2 — Graphical symbol ISO 7000-2417 to indicate PPE for protection against heat and flame