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Protective footwear

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Safety Appliances Association (JSAA)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied *mutatis mutandis* pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS T 8101:2006**), which has been technically revised.

However, **JIS T 8101:2006** may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 24 March 2021.

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Protective footwear

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 20345**:2011, Edition 2, and **ISO 20346**:2014, Edition 2, with some modifications of the technical contents of part of performance requirements so as to suit for use and management method of protective footwear in Japan.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JC. Annex JA and Annex JB are unique to **JIS** and not given in the corresponding International Standards.

1 Scope

This Standard specifies the requirements for the footwear to protect the foot of the wearers in the workplaces of manufacturing industry, mining industry, construction industry, freight industry, forest industry, fishery industry, etc.

NOTE The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

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

ISO 20346:2014 *Personal protective equipment—Protective footwear* (overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS S 5037 *Sizing system for shoes*

JIS T 8010 *Testing method for withstand voltage of personal protective equipment and insulating devices*

JIS T 8107 *Test methods for protective and occupational footwear*

NOTE Corresponding International Standard: ISO 20344 *Personal protective equipment—Test methods for footwear*

3 Terms and definitions

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

3.1

ultra heavy protective footwear

footwear which incorporates features for protecting the foot of the wearer from injuries that could arise through accidents under working conditions and which is fitted with a protective toecap designed to fulfil the clearance requirement in the case where the toe region of the product is subjected to impacts of an energy level of at least 200 J and compressive load of at least 15 kN

3.2

heavy protective footwear

footwear which incorporates features for protecting the foot of the wearer from injuries that could arise through accidents under working conditions and which is fitted with a protective toecap designed to fulfil the clearance requirement in the case where the toe region of the product is subjected to impacts of an energy level of at least 100 J and compressive load of at least 15 kN

3.3

standard protective footwear

footwear which incorporates features for protecting the foot of the wearer from injuries that could arise through accidents under working conditions and which is fitted with a protective toecap designed to fulfil the clearance requirement in the case where the toe region of the product is subjected to impacts of an energy level of at least 70 J and compressive load of at least 10 kN

3.4

light protective footwear

footwear which incorporates features for protecting the foot of the wearer from injuries that could arise through accidents under working conditions and which is fitted with a protective toecap designed to fulfil the clearance requirement in the case where the toe region of the product is subjected to impacts of an energy level of at least 30 J and compressive load of at least 4.5 kN

3.5

leather

hide or skin tanned to be imputrescible

3.6

leather split

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

3.7

rubber

vulcanized elastomers

3.8

polymeric materials

large molecules composed of repeating structural units (monomers) typically connected by chemical bond among Class II protective footwear

Example Polyurethane (PU) or polyvinylchloride (PVC).

3.9

upper

generic term for the parts that wrap around the foot above the outsole of the shoe

The term is sometimes used synonymously with upper leather.

3.10

insole

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

3.11

insock

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

“Non-removable” means that the insock cannot be removed without being damaged.

3.12

lining

material covering the inner surface of the upper

The wearer's foot is in direct contact with the lining. Backing materials such as knitted fabric, stocking, etc. used in Class II footwear is not considered as lining in this Standard.

3.13

vamp lining

material covering the inner surface of the forepart of the upper

3.14

quarter lining

material covering the inner surface of the quarters of the upper

3.15

outsole

part of the sole of the shoe that touches the floor, including seat region

3.16

midsole

intermediate component, not in direct contact with the floor, in a multi-layered component at the bottom of the shoes

An outsole combined with a midsole is called a shoe sole in this Standard.

3.17

cleat

protruding part of the outer surface of the sole for the purpose of slip-resistant

3.18

penetration-resistant insert

footwear component placed in the sole complex in order to provide protection against penetration

3.19

protective toecap

footwear component designed to protect the toes of the wearer and fitted to the toe region of the footwear

3.20

metatarsal protector

component covering the instep region of the footwear to protect the instep region of the foot of the wearer from dropping objects

3.21

feather line

line connecting upper of shoe and joint part of outsole in whole circumference of shoe

3.22

electrical insulating properties

property of footwear which protects the wearer against electrical shocks by preventing the passage of dangerous current through the body via the feet if the material used in the upper and the outsole of the shoe falls under the provisions of this Standard and the sole of the shoe comes into contact with the charging part

3.23

fuel oil

aliphatic hydrocarbon constituent of petroleum

3.24

hybrid protective footwear

shoe which uses material different from the material of upper for the part which extends the upper in Class II protective footwear

See Figure A.1.

3.25

cut through

cut length exceeding 10 mm in the protective material surface nearest to the body side of the wearer in the cutting test of the protective materials

The definition above means as follows: when the specimen is a single-layered or multi-layered material constituting a final product, e.g. cut resistance protective footwear, a saw chain in motion is brought into contact with the outside surface of the specimen viewed from the wearer's body. When the saw chain decelerates and finally stops while cutting the specimen's layer(s), a cut exceeding 10 mm in length is generated on the face opposite to the face in contact with the saw chain (see **JIS T 8125-1**).

NOTE The names of parts of the protective footwear are given in Annex JB.

4 Classification

Protective footwear shall be classified in accordance with Table 1, Table 2 and Table 3.

Table 1 Classification according to material class

Material class	Description	Symbol
Class I	Footwear made from leather for upper and from other materials for outsole	CI
Class II	All-rubber (i.e. entirely vulcanized) or all-polymeric (i.e. entirely moulded) footwear	CII

Table 2 Classification according to work division

Work division	Description	Symbol
Ultra heavy work	Shoe satisfying requirements for impacts of an energy level of 200 J and compression at a load of 15 kN at the toe region	U
Heavy work	Shoe satisfying requirements for impacts of an energy level of 100 J and compression at a load of 15 kN at the toe region	H
Standard work	Shoe satisfying requirements for impacts of an energy level of 70 J and compression at a load of 10 kN at the toe region	S
Light work	Shoe satisfying requirements for impacts of an energy level of 30 J and compression at a load of 4.5 kN at the toe region	L
NOTE The impact resistance and the compression resistance show the durability under the impact energy and the pressure, respectively.		

Table 3 Classification by additional requirements

Additional requirement			Symbol
Penetration resistance			P
Absorption of impact energy in seat region			E
Impact resistance of metatarsal protector			M
Slip resistance		Slip resistance Class 1	F1
		Slip resistance Class 2	F2
Water resistance			W
Cut resistance			C
Electrical insulating properties		For 600 V AC or under	I-600
		For 3 500 V AC or under	I-3500
		For 7 000 V AC or under	I-7000
Heat-resistant conductivity	High-temperature thermal conductivity on sole	High-temperature thermal conductivity Class 1	HI1
		High-temperature thermal conductivity Class 2	HI2
	Low-temperature thermal conductivity on sole	Low-temperature thermal conductivity Class 1	CI1
		Low-temperature thermal conductivity Class 2	CI2
Resistance to hot contact on outsole			H
Resistance to fuel oil on outsole			BO
Resistance to fuel oil on upper			UO
NOTE Methods for selecting protective footwear suitable for work type are given in Annex JA (informative).			

5 Basic performance

5.1 General

The basic performance shall be in accordance with Table 4.

Table 4 Basic performance

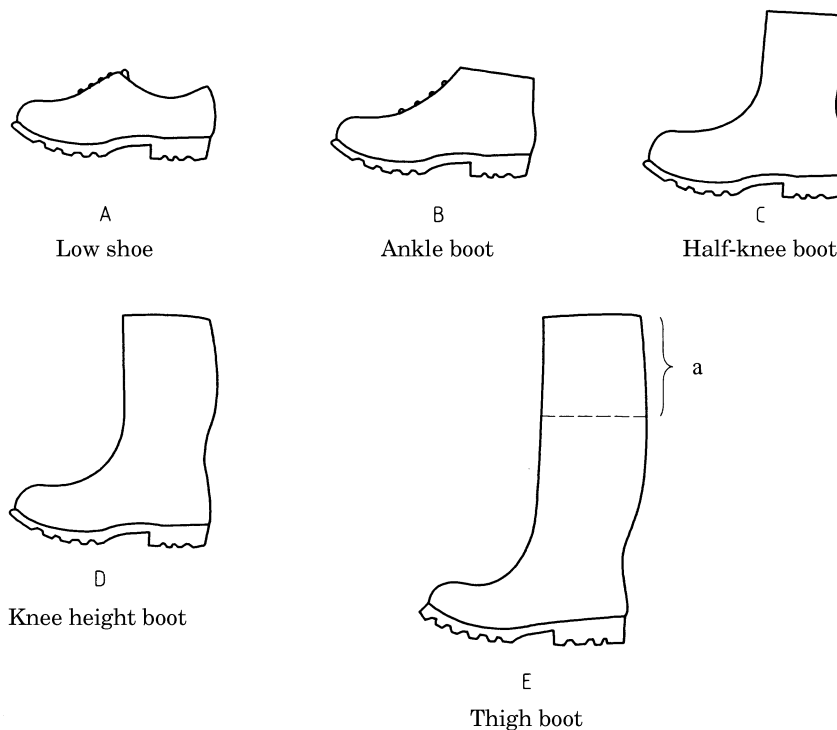
Requirement		Subclause	Classification			
			Ultra heavy work, heavy work		Standard work, light work	
			Class I	Class II	Class I	Class II
Design	General	5.2.1	◎	◎	◎	◎
	Size	5.2.2	◎	◎	◎	◎
	Seat region covered by upper	5.2.3	◎	◎	◎	◎
Whole footwear	Sole performance:	5.3.1				
	– Construction	5.3.1.1	◎		◎	
	– Upper/outsole bond strength	5.3.1.2	◎		◎	
	Toe protection:	5.3.2				
	– General	5.3.2.1	◎	◎	◎	◎
	– Internal length of toecaps	5.3.2.2	◎	◎	◎	◎
	– Performance of toecaps	5.3.2.3				
	– Corrosion resistance of metallic toecaps	5.3.2.3.1	◎	◎	◎	◎
	– High heat resistance, low heat resistance, acid resistance, alkali resistance and resistance to fuel oil of non-metallic toecaps	5.3.2.3.2	◎	◎	◎	◎
	– Impact resistance	5.3.2.4	◎	◎	◎	◎
	– Compression resistance	5.3.2.5	◎	◎	◎	◎
	– Wearability	5.3.2.6	◎	◎	◎	◎
	Leakproofness	5.3.3		◎		◎
Upper	Thickness	5.4.1	◎	◎	◎	◎
	Tensile properties	5.4.2		◎		◎
	Hydrolysis	5.4.3		◎		◎
	Grain crack	5.4.4	◎		◎	
	Ageing resistance	5.4.5		◎		◎
Outsole	Cleat	5.5.1	◎	◎	◎	◎
	Thickness and cleat height	5.5.2	◎	◎	◎	◎
	Tear strength	5.5.3	◎		◎	
	Tensile properties	5.5.4	◎	◎	◎	◎
	Hydrolysis	5.5.5	◎	◎	◎	◎
	Ageing resistance	5.5.6	◎	◎	◎	◎
- The applicability of a requirement to a particular classification is indicated by “◎”. “◎” means the requirement shall be met. - In some cases the requirement relates only to particular materials within the classification, e.g. hydrolysis property of upper and outsole made of polyurethane. This does not mean that other materials are precluded from use. NOTE 1 The absence of “◎” indicates that there is no requirement. NOTE 2 Methods for selecting protective footwear suitable for work type are given in Annex JA (informative).						

5.2 Design

5.2.1 General

Footwear shall conform to one of the designs given in Figure 1.

Design E can be a knee-height boot (Design D) equipped with a thin impermeable material as indicated by “a” which extends the upper and which can be cut to adapt the boot to the wearer.



a Variable extension which can be adapted to the wearer.

Figure 1 Designs of protective footwear

5.2.2 Size

Protective footwear sizes shall be in accordance with the requirements of **JIS S 5037**.

5.2.3 Seat region covered by upper

The seat region shall be constructed so that the foot is covered by the upper.

5.3 Product performance

5.3.1 Outsole performance

5.3.1.1 Construction

When an insole is used, it shall not be possible to remove it 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 protective footwear other than with a stitched sole is tested in accordance with the method described in **JIS T 8107, 5.1**, the upper/outsole bond strength shall be not

less than 300 N for footwear for ultra heavy work (U), heavy work (H) and standard work (S) and not less than 250 N for footwear for light work (L). Both left and right shoes shall be tested and shall satisfy the above specified value.

In the case where the shoe sole is multi-layered, the bond strength of the upper and the midsole in contact with the upper shall be tested.

5.3.2 Toe protection

5.3.2.1 General

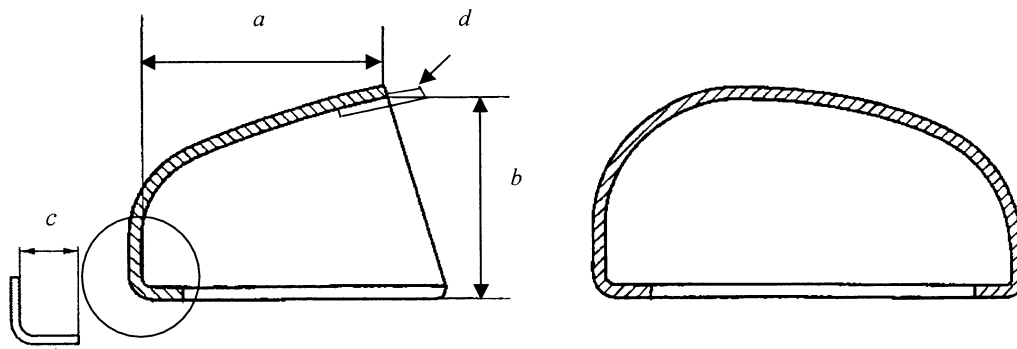
Toecaps shall be incorporated in the footwear in such a manner that they cannot be removed without damaging the footwear. Class II protective footwear fitted with internal toecaps shall have a vamp lining or an element of the upper that serves as a lining. Footwear shall be equipped with a reinforcing material (Figure 2, d) or a material with a reinforcing function inside the back edge of the toecap. The toecap, when it is formed with a folded part beneath the sole, shall satisfy the requirement for the width c of the horizontal base of the folded part beneath the sole shown in Figure 2. Scuff-resistant coverings for the toe region shall be not less than 1 mm in thickness at the centre of back edge of the coverings.

5.3.2.2 Dimensions of toecaps

When measured in accordance with the method described in **JIS T 8107, 5.2.1** and **5.2.2**, the toecap dimensions shall be in accordance with Table 5.

Table 5 Dimensions of toecaps

Size of footwear	Internal length a mm			Height at the highest point of back edge b mm		Width of horizontal base of folded part beneath the sole c mm
	Ultra heavy work, heavy work	Standard work	Light work	Ultra heavy work, heavy work, standard work	Light work	
23 and below	34 min.	31 min.	28 min.	33 min.	28 min.	3 or over up to and incl. 10
23.5 to 24.5	36 min.	33 min.	30 min.			
25 to 25.5	38 min.	35 min.	32 min.			
26 to 27	39 min.	36 min.	33 min.			
27.5 to 28.5	40 min.	38 min.	35 min.			
29 and above	42 min.	40 min.	37 min.			



a Internal length *c* Width of horizontal base of folded part beneath the sole
b Height at the highest point of back edge *d* Reinforcing material

Figure 2 Example of measurement position of dimensions of each part of toecaps

5.3.2.3 Performance of toecaps

5.3.2.3.1 Corrosion resistance of metallic toecaps

When Class I footwear is tested and assessed in accordance with **JIS T 8107, 5.2.3.1.2**, the metallic toecap shall exhibit no more than three areas of corrosion, none of which shall measure more than 2 mm in any direction.

When Class II protective footwear is tested and assessed in accordance with **JIS T 8107, 5.2.3.1.3**, the metallic toecap shall exhibit no more than three areas of corrosion, none of which shall measure more than 2 mm in any direction.

5.3.2.3.2 High heat resistance, low heat resistance, acid resistance, alkali resistance and resistance to fuel oil of non-metallic toecaps

When the non-metallic toecap used for footwear is tested for high heat resistance, low heat resistance, acid resistance, alkali resistance and resistance to fuel oil in accordance with **JIS T 8107, 5.2.3.2**, the specimen shall show no significant visible deformation prior to impact testing, and the specimen after impact testing shall not develop any cracks which split the specimen into two.

5.3.2.4 Impact resistance

When protective footwear is tested in accordance with the method described in **JIS T 8107, 5.3**, the clearance (height of the lowest part of oil clay) between the toecap and insole in the case where impact energy corresponding to the work division in Table 2 is applied shall be in accordance with Table 6.

In addition, the toecap shall not develop any cracks which split the specimen into two.

Table 6 Clearance between toecap and insole

Size of footwear	Clearance between toecap and insole mm
23 and below	12.5 min.
23.5 to 24.5	13.0 min.
25 to 25.5	13.5 min.
26 to 27	14.0 min.
27.5 to 28.5	14.5 min.
29 and above	15.0 min.

5.3.2.5 Compression resistance

When protective footwear is tested in accordance with the method described in **JIS T 8107, 5.4**, the clearance (height of the lowest part of oil clay) between the toecap and insole in the case where compressive load corresponding to the work division in Table 2 is applied shall be in accordance with Table 6. In addition, the toecap shall not develop any cracks which split the specimen into two.

5.3.2.6 Wearability

Concerning the wearability of the protection performance of the toe region of the protective footwear using materials other than rubber or polyurethane for the midsole, when tested in accordance with **JIS T 8107, 5.5**, the clearance (height of the lowest part of oil clay) between the insole and the toecap observed in the impact resistance and compression resistance tests shall be in accordance with Table 6, and the toecap shall not develop any cracks which split the specimen into two. The specimen after testing shall show no significant visible deformation or feather line separation induced by the test.

5.3.3 Leakproofness

When the leakproofness of Class II protective footwear is tested in accordance with **JIS T 8107, 5.6**, there shall be no leakage of air.

5.4 Upper**5.4.1 Thickness**

The thickness of upper, when measured in accordance with **JIS T 8107, 6.1**, shall be in accordance with Table 7.

Table 7 Thickness of upper

Material type	Thickness mm	
	Ultra heavy work, heavy work, standard work	Light work
<u>Leather</u>	<u>1.50 min.</u>	<u>1.20 min.</u>
<u>Rubber</u>	<u>1.50 min.</u>	<u>1.20 min.</u>
<u>Polymeric material</u>	<u>1.00 min.</u>	
<u>• For Class II protective footwear using knitted fabric or stocking as the backing fabric, the thickness given in the table shall include the thickness of such materials.</u>		