

KS

KOREAN INDUSTRIAL STANDARD

Protective Footware

KS G 3127 : 1999

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Protective Footwears

1. Scope

This Korean Industrial Standard specifies the requirements for the shoes to protect the foot of the person who wears it in the working place of manufacturing industry, mining industry, construction industry, freight industry, forest industry, fisheries, etc., and the anti-electrostatic leather shoes and wholly rubber made protective footwears⁽²⁾ used to prevent the accidents when there are the causes of production's impediment and accidents or casualties such as electrostatic explosion, fire, electroshock and the like in the working places⁽¹⁾ carry inflammable substances(gas, steam, liquid, power, etc.), films, various paint blowers, electronic devices and the like.

Notes ⁽¹⁾ For example, It refers to the working places of oil industry, mining industry, publishing and printing industry, fiber industry, telecommunication industry, etc.

⁽²⁾ In this case, the safety shoes is the shoes with toe cap and the working shoes is that without toe cap.

Remark The units and numerical values given in { } in this Standard are based on the traditional units and are appended for reference.

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 indicated below must be applied.

- KS A 0021 Rules for Rounding of Numerical Values.
- KS C 1302 Insulation Resistance Testers(Battery Operated)
- KS C 1303 Electrical Indicating Instruments
- KS G 3116 Leather Shoes
- KS G 3405 Lats for Shoes
- KS M 6782 Tensile Testing Methods for Vulcanized Rubber
- KS M 6783 Tear Testing Methods for Vulcanized Rubber
- KS M 6788 Accelerated Aging Test Methods for Vulcanized Rubber
- KS M 6882 Testing Method for Leathers
- KS M 6887 Testing Method for Grain Crack of Leather(by Ball-Bursting Tester)

3. Definitions

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

a) safety shoes

The shoes which protect mainly the toes of wearer and also slip resistance is provided.

b) instep protector

The material to cover the upper leather parts of the safety shoes and protect the instep part of the wearer from dropping objects.

c) leather

Cow-hide tanned with chromate or mixture of chromate and tannate.

d) rubber

High polymer compound showing rubber elasticity by vulcanization or cross-linking and the generic term including natural rubber and synthetic rubber

e) foam polyurethane

Materials made by foam cross-linking the mixture of polyol ingredient, isocyanate ingredient, etc.

f) anti-electrostatic shoes

When there are the causes of production's impediment accidents and casualties such as electrostatic explosion, fire, electroshock and so on, anti-electrostatic shoes means the protective footwears used to prevent it.

4. Classification

The safety shoes must be classified as shown in Table 1.

Table 1-1. Classification According to Instep Cover

Classification	Instep cover
Leather-made	Leather
Wholly rubber-made	Oil resistant rubber
	Non-oil resistant rubber

Table 1-2. Classification According to Work Divisions(symbol)

Work division	Symbol
Heavy work	H
Standard work	S
Light work	L

Table 1-3. Classification According to Additional Performance(symbol)

Additional performance	Symbol
Penetration resistance	P
Absorption of impact energy given to heel part	E
Impact resistance of instep protector	M

Table 1-4. Classification According to the Existence of Anti-electrostatic Function and Toe cap

Classifications		Grades by anti-electrostatic function	Symbols
Leather-made	Anti-electrostatic safety shoes	1 Class	AS-1LS
		2 Class	AS-2LS
	Anti-electrostatic working shoes	1 Class	AS-1LW
		2 Class	AS-2LW
Wholly rubber-made	Anti-electrostatic safety shoes	1 Class	AS-1RS
		2 Class	AS-2RS
	Anti-electrostatic working shoes	1 Class	AS-1RW
		2 Class	AS-2RW

Remark Symbols in Table 1-4 stand for the followings.

AS : Abbreviation of Anti-Electrostatic

LS : Abbreviation of Leather Safety Shoes as the safety shoes with toe cap for prevention the electrification of static electricity

RS : Abbreviation of Rubber Safety Shoes as the safety shoes with toe cap for prevention the electrification of static electricity

LW : Abbreviation of Leather Working Shoes as the safety shoes without toe cap for prevention the electrification of static electricity

RW : Abbreviation of Rubber Working Shoes as the safety shoes without toe

1. Electrification prevention function 1 class

2. Electrification prevention function 2 class

5. Performance

5.1 Impact Resistance and Compression Resistance

The safety shoes must be that, when tested in accordance with 9.1 and 9.2, the clearance between the insole and the toe cap must conform to Table 2.

Table 2. Clearance between Insole and Toe Cap

Size(foot length)	Clearance mm
230max.	12.5min.
235 to 245	13.0min
250 to 255	13.5min
260 to 270	14.0min
275 to 285	14.5min
290min.	15.0min

5.2 Separation Resistance of Outsole

For the safety shoes made of leather, the separation resistance of outsole shall, when tested in accordance with 9.3, be 300N{30.6kgf} or more in H and S and 250N{25.5kgf} or more in L.

5.3 Leakage Preventive Property

For the wholly rubber made safety shoes must be that, when tested in accordance with 9.4, bubble must not be exhausted continuously.

5.4 Penetration Resistance

For the safety shoes requiring the penetration resistance, when testing in accordance with 9.5, the force when a nail has penetrated must be 1100N{112.2kgf} or more.

5.5 Impact Energy Absorbing Property at Heel Part

For the safety shoes requiring the impact energy absorbing property at the heel part, when testing in accordance with 9.6, the absorbed energy must be 20J{2.0kgf · m} or more.

5.6 Impact Resistance of Instep Protector

For the safety shoes requiring the instep protector, when testing in accordance with 9.7, the height of the lowest part(residual thickness of the lowest part of oil clay+bottom thickness at notched part of test shoetree) must be 25mm or more.

5.7 Function of Electrostatic

For the electrification function of anti-electrostatic shoes, when testing in accordance with 9.10, it must be Table 3.

Table 3. The Grade by Function of Electrification Prevention

Grade	The function as anti-electrostatic shoes(electric resistance R for one unit) Ω	Informative reference
Class 1	$1.0 \times 10^5 < R < 1.0 \times 10^8$	In the case of dealing the inflammable substances whose firing energy is not less than 0.1mJ and steam(methane, propane, etc.)
Class 2	$1.0 \times 10^5 < R < 1.0 \times 10^7$	In the case of dealing the inflammable substances whose firing energy is under 0.1mJ and steam(hydrogen, acetylene, etc.)

6. Construction

6.1 Construction in General

The general construction of the safety shoes must be as follows.

- a) The toe cap is fitted to the toe box in the manufacturing process in such a way that it is impossible to remove unless it is destroyed and is for protecting the toes of the wearer from impact and compression.
- b) The outsole is the shape effective for slip resistance.
- c) Foot is secured against injury by top cap, penetration preventing plate, etc.
- d) Weight lightening, sultrineos prevention, comfort in wearing, etc. are taken into account and, hence, suitable for working.
- e) Anti-electrostatic shoes must be the construction lets static electricity electrified to human body run out from the bottom of shoes.

6.2 Construction of Each Part and Dimension

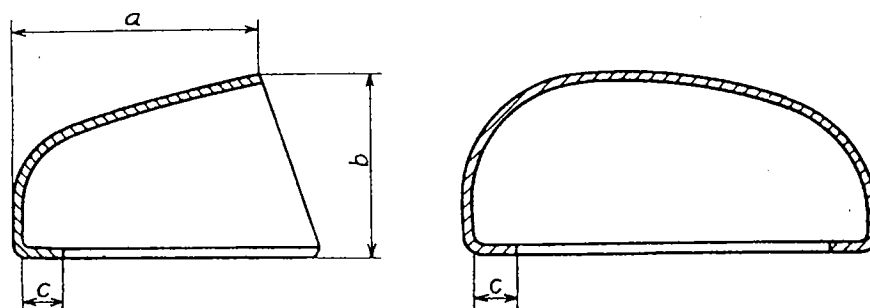
6.2.1 Instep Cover

The instep cover must be that thickness is uniform, there is no defect such as flaw and the thickness is 1.5mm or more in H and S and 1.2mm or more in L.

6.2.2 Toe Cap

The toe cap must be that all surfaces are finished smooth, edges and corners are rounded, all surfaces and those made of steel are given rust preventing treatment all over surface. The dimensions must be as follows(see Figure 1).

- a) The horizontal distance between the upper center of arch and the tip of toe "a" is 40mm to 60mm in H and S and 30mm to 50mm in L.
- b) The height "b", at the highest point of toe cap, is 33mm or more in H and S and 28mm or more in L.
- c) The flanged bottom edge is bent almost horizontally and the width of horizontal bottom edge "c" is 3mm or more.



(Sharp shows an example)

Fig 1. Toe Cap

6.2.3 Outsole

The thickness of the outsole(including the heel) shall, when measuring the thinnest part of the outsole in accordance with 9.9.2, be 3.5mm or more in H, 3.0mm or more in S and 2.5mm or more in L.

7. Sizes of Safety Shoes

The sizes of the safety shoes must be as specified in **KS G 3405**.

8. Materials

8.1 Instep Cover

The instep cover must be made of leather or rubber and shall, when tested in accordance with 9.8, conform with Table 3.

Table 4 Performance of Upper Leather

Item		Leather	Whole rubber	
			Oil resistant rubber	Non-oil resistant rubber
Tensile test	Tensile strength MPa(kgf/cm ²)	-	10(102.0)min	13(132.6)min
	Elongation %	-	350min.	420min.
Aging test	Rate of variation of tensile strength %	-	-20 to +20	-20 to +20
Immersion test	Rate of variation of volume %	-	12max	-
Grain crack ⁽³⁾	Thrusting up height mm	6.0min	-	-
	Force N(kgf)	150(15.3)min	-	-
Chrome content		3 to 5.5	-	-

Note ⁽³⁾ In the leather without grain surface, there must not be remarkable abnormality on the surface under the condition in Table 4.

8.2 Outsole

The outsole(including the heel) must be made of rubber, foam polyurethane or their multi-layer combination and shall, when tested in accordance with 9.9, conform with Table 5.

Table 5. Physical Performance of Outsole

Item		Leather made		Whole rubber made	
		Oil resistant rubber	Foam poly-urethane	Oil resistant rubber	Non-oil resistant rubber
Tensile test	Tensile strength MPa(kgf/cm ²)	14(142.8)min.	6(61.2)min.	10(102.0)	13(132.6)min.
	Elongation %	300min.	300min.	350min.	420min.
Tearing	Tearing strength N/mm(kgf/cm)	35(35.7)min.	25(25.5)min.	-	-
Aging test	Rate of variation of tensile strength %	-15 to +15	-20 to +20	-20 to +20	-20 to +20
Immersion test	Rate of variation of volume %	12max.	12max.	12max.	-

9. Test Methods

9.1 Impact Test

The impact test must be as follows.

a) Impact Test Apparatus

The impact test apparatus must be able to drop freely the steel striker of (20 ± 0.2)kg in mass from a specific height along the vertical guide in order to give a specific impact energy. The end part of the impact striker must be of the wedge shape of the angle 90° ± 1° the tip of which is finished round with a radius of 3mm, the height is 40mm and the length of cutting is at least 60mm(see Figure 2).