BRITISH STANDARD

BS EN
50321:2000

Electrically insulating footwear for working on low voltage installations

The European Standard EN 50321:1999 has the status of a British Standard

ICS 13.260; 13.340.50

National foreword

This British Standard is the official English language version of EN 50321:1999.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

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Summary of pages

This document comprises a front cover, an inside front cover, the EN tide page, pages 2 to 17 and a back cover.

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English version

Electrically insulating footwear for working on low voltage installations

Chaussures electriquement isolantes pour travaux sur installations a basse tension

Elektrisch isolierende Schuhe zum Arbeiten in Niederspannungsanlagen

This European Standard was approved by CENELEC on 1999-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CENELEC

European Committee for Electrotechnical Standardization
Comite Europeen de Normalisation Electrotechnique
Europaisches Komitee fGr Elektrotechnische Normung

Central Secretariat: rue de Stassart, 35 B-1050 Brussels

Ref. No. EN 50321:1999 E

Contents

Foreword

This European Standard has been prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50321 on 1999-10-01.

This European Standard intends to cover the protection of personnel working on or in the vicinity of electrical installations, by adopting homogenous electrical requirements such as those defined for other personnel protective equipment, e.g. insulating gloves. It also intends to be complementary to European Standards produced by CEN/TC 161.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2000-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2002-10-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given only for information.

In this standard, annexes A, B and C are normative, and annex D is informative.

1 Scope

This standard is applicable to electrically insulating footwear used for working live or close to live parts on installations not exceeding 1 000 V a.c.

This footwear, when used in conjunction with other electrically insulating protective equipment such as gloves or blankets, prevents dangerous current from passing through persons via their feet.

This standard applies to designs A low shoe, B ankle boot, C half-knee boot, and D knee-height boot, as shown in EN 344.

Antistatic and conductive footwear are excluded from the scope of this standard.

NOTE: Extension of this standard to overshoes is under consideration. Electrical requirements of this standard may be applied to overshoes but further considerations needs to be given to non-electrical requirements.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 344	1992	Requirements and test methods for safety, protective and occupational footwear for professional use
EN 345	1992	Specification for safety footwear for professional use
EN 346	1992	Specification for protective footwear for professional use
EN 347	1992	Specification for occupational footwear for professional use
EN 60060-2 + A11	1994 1998	High-voltage test techniques - Part 2: Measuring systems (IEC 60060-2:1994)
EN 60903 + A11	1992 1997	Specification for gloves and mitts of insulating material for live working (IEC 60903:1988, mod.)
HD437S1	1984	Standard conditions for use prior to and during the testing of solid electrical insulating materials (IEC 60212:1971)
HD 588.1 S1	1991	High-voltage test techniques - Part 1: General definitions and test requirements (IEC 60060-1:1989 + corrigendum March 1990)
IEC 60050-151	1978	International Electrotechnical Vocabulary - Electrical and magnetic devices
IEC 60410	1973	Sampling plans and procedures for inspection by attributes
IEC 61318	1994	Live working - Guidelines for quality assurance plans

3 Definitions

3.1
electrically insulating footwear
denotes footwear which protects the wearer against electrical shocks by preventing the passage of dangerous current through the body via the feet

3.2
type test
a test performed on one or more devices made to a certain design to show that the design meets certain specifications [IEV 151-04-15]

3.3
routine test
a test to which each device is subjected during or after manufacture to ascertain whether it complies with certain criteria [IEV 151-04-16]

3.4
sampling test
a test performed on a number of devices taken at random from a batch [IEV 151-04-17]

3.5
acceptance test
a contractual test to prove the customer that the device meets certain conditions of its specification [IEV 151-04-20]

3.6
proof test voltage
a specified value of voltage that is applied to a device, item or component for the time defined under specified conditions to assure that the electrical strength of the insulation is above a specified value

3.7
withstand test voltage
a specified value of voltage that a device, item or component must withstand without flashover, disruptive discharge, puncture or other electric failure when that value of voltage is applied under specified conditions

4 Classification

Footwear shall be classified by electrical classes, according to their use on or near electrical installations of a defined nominal voltage, as follows:

Electrical class 00, for installations with nominal voltage up to 500 V a.c. and 750 V d.c.

Electrical class 0, for installations with nominal voltage up to 1 000 V a.c. and 1 500 V d.c.

5 Requirements

5.1 Non-electrical requirements

5.1.1 General

The requirements which are determined in EN 345, EN 346 and EN 347 are applicable.

5.1.2 Height of upper

The design of insulating footwear shall be A, B, C or D according to EN 344. In addition to the requirements given in Table 2 of EN 344, the height of the upper part of design A, denoted as X, shall be a minimum of 65 mm, measured as indicated in Figure 1.

5.2 Electrical requirements

Insulating footwear shall pass a proof voltage test and a withstand voltage test according to its classification.

5.3 Marking

5.3.1 The additional marking to those required by EN 345, EN 346 and EN 347 shall be the following (see Figure 2):

- symbol (double triangle);
- class;
- serial or batch number;
- month and year of manufacture.

In addition, each unit of footwear shall have a strip or space to note the date of first use, the date of examination or the date of each periodic inspection. Dimensions are given in Figure 2.

5.3.2 The marking shall be durable, clearly legible on the outside of the footwear and shall not impair its quality.

5.3.3 If a colour code is used, the symbol (double triangle) shall correspond to the following:

Class 00: beige

Class 0: red

5.3.4 Any additional marking shall be subject to agreement between the manufacturer and the customer.

5.4 Packaging

The type of packaging suitable for transport shall be defined by the manufacturer.

The packaging of each pair or of each group of pairs shall have sufficient strength to properly protect the footwear from damage.

The outside of packaging shall be marked with the name of the manufacturer or supplier, classification, size and design.

At the request of the customer or according to national regulations, information contained in annex B and instructions listed in 5.5 shall be included in the package.

5.5 Instructions for use

The following information shall be given (see annex B):

- name and full address of the manufacturer and/or his authorized representative;
- designation of the product type, commercial name or code;
- number of this European Standard (EN 50321);
- explanation of the marking.

6 Tests

6.1 General

Tests are type, routine, and sampling tests.

6.2 Non-electrical tests

6.2.1 General

Tests included in EN 344 shall be carried out according to the requirements of EN 345, EN 346 and EN 347, depending upon the use of the product and after agreement between the manufacturer and the customer.

6.2.2 Visual inspection and dimensions

The compliance with the requirements of 5.1.2 shall be checked.

6.3 Electrical tests

6.3.1 General

Electrical type tests shall be performed in a room where the temperature is (23 ± 2) °C and with (50 ± 5) % relative humidity (see HD 437 S1, standard atmosphere B).

Electrical routine tests shall be performed in a room where the temperature is 15 °C to 35 °C and the relative humidity is between 45 % and 75 % (see HD 437 S1, standard ambient).

Electrical tests shall be performed on whole footwear which fulfil the declared non-electrical requirements. For type tests, two pairs of footwear shall be used; no failure shall occur. One unit is one piece of footwear. Routine tests shall be performed on each unit. All units which fail any test shall be destroyed.

Test arrangements, power sources and procedures shall be in accordance with HD 588.1 S1/EN 60060-2.

After a type or sampling test, footwear shall not be used. These tests are considered as destructive. Footwear used for type or sampling tests shall be destroyed after the completion of the tests.

6.3.2 Test arrangement

The test is performed in a tank filled with tap water (see Figure 1).

The inner of the footwear is filled with tap water or stainless steel balls (3,5 ± 0,6) mm in diameter.

Steel balls are used for tests on footwear lined with absorbent material.

The level of water or balls inside the footwear shall correspond to the level of water outside the footwear. This level shall be at a vertical clearance value from the minimum height of the upper selected from the values given in Table 1 according to the class of the footwear to be tested.

The water or balls inside the footwear shall be connected to the high voltage terminal of the supply. The water in the tank outside the footwear shall be connected to the ground.

If a mid-sole is inserted in the footwear, for type and sampling tests only, the mid-sole shall be connected to the ground.

Table 1: Clearances to the level of water or balls

Class	Clearance (h) mm
00	30
0	40
NOTE: Permissible tolerance for the clearance is ±3 mm.	

6.3.3 Proof voltage test

Footwear submitted to test shall be preconditioned in a chamber at (23 ± 5) °C, (93 ± 2) % relative humidity for at least (24 ± 0,5) hours.

For routine tests such conditioning is not required.

Each unit of footwear shall be submitted to a proof voltage test according to its class, as set out in Table 2.

The alternating voltage shall be initially applied at a low value and gradually increased at a constant rate of rise of approximately 1 000 V/s until the specified voltage level is reached or failure occurs.

For the type and the sampling tests, the voltage shall be applied continuously for a duration of not less than 3 min. For routine tests, the duration shall not be less than 1 min.

The test is considered as passed if the specified test voltage is reached and maintained for the specified duration and the proof test current does not exceed the relevant value specified in Table 2 at any time during the proof voltage test period.

6.3.4 Withstand voltage test

Each unit shall be submitted to a withstand voltage test given in Table 2.

The alternating voltage shall be applied gradually until the specified value is reached then immediately reduced. The rate of change of voltage both up and down shall be 1 000 V/s.

The test is considered as passed if no puncture occurs.

Table 2: Proof test voltage, proof test current and withstand test voltage

Class of footwear	Proof test voltage (kVrms)	Proof test current (mA rms)				Withstand test voltage (kVrms)
		Design (EN 344)				
		A	B	C	D	
00	2,5	1	1,5	2	3	5
0	5	2	2,5	4	5	10

6.4 Marking

The marking shall be rubbed for 15 s with a water soaked lint free cloth and then rubbed for 15 s with a lint free cloth soaked in ethyl alcohol.

The test shall be considered as passed if the marking remains easily legible and has not curled or become detached.

6.5 Packaging

Compliance with the requirements of 5.4 shall be verified by visual inspection.

7 Quality assurance plan and acceptance tests

7.1 General

In order to assure the delivery of products that meet this standard, the manufacturer shall employ an approved quality assurance plan that complies with the provisions of ISO 9000 series.

The quality assurance plan shall ascertain that the products meet the requirements contained in this standard.

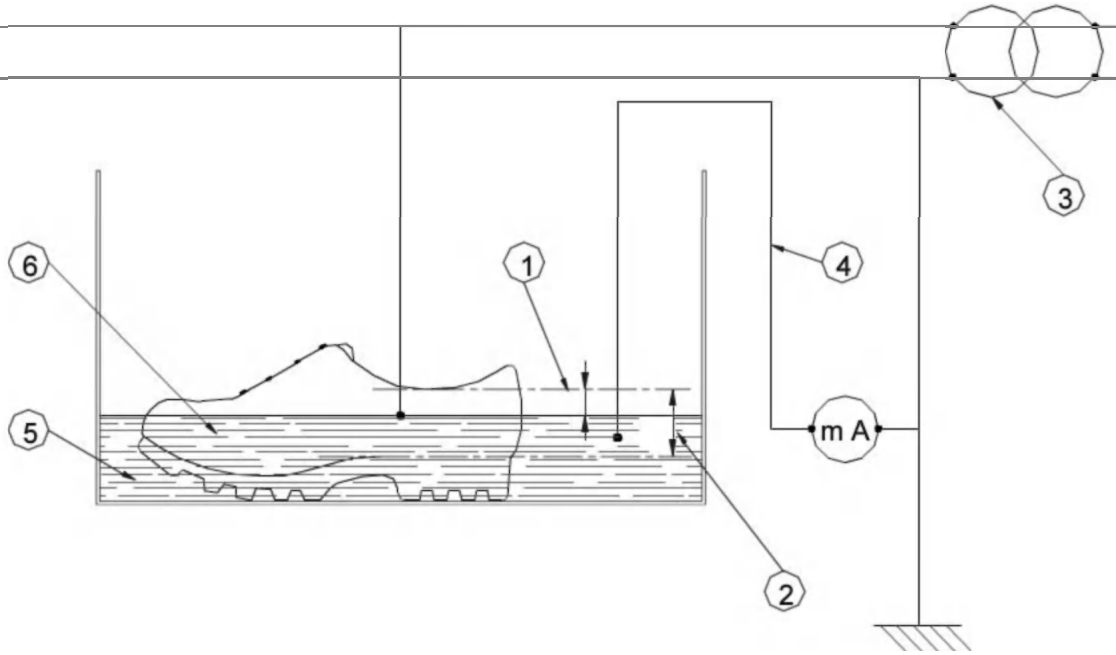
In absence of an accepted quality assurance plan as specified above, the sampling tests contained in this standard shall be carried out (see annex C).

7.2 Sampling procedure

The sampling procedure shall be in accordance with annex C.

7.3 Acceptance tests

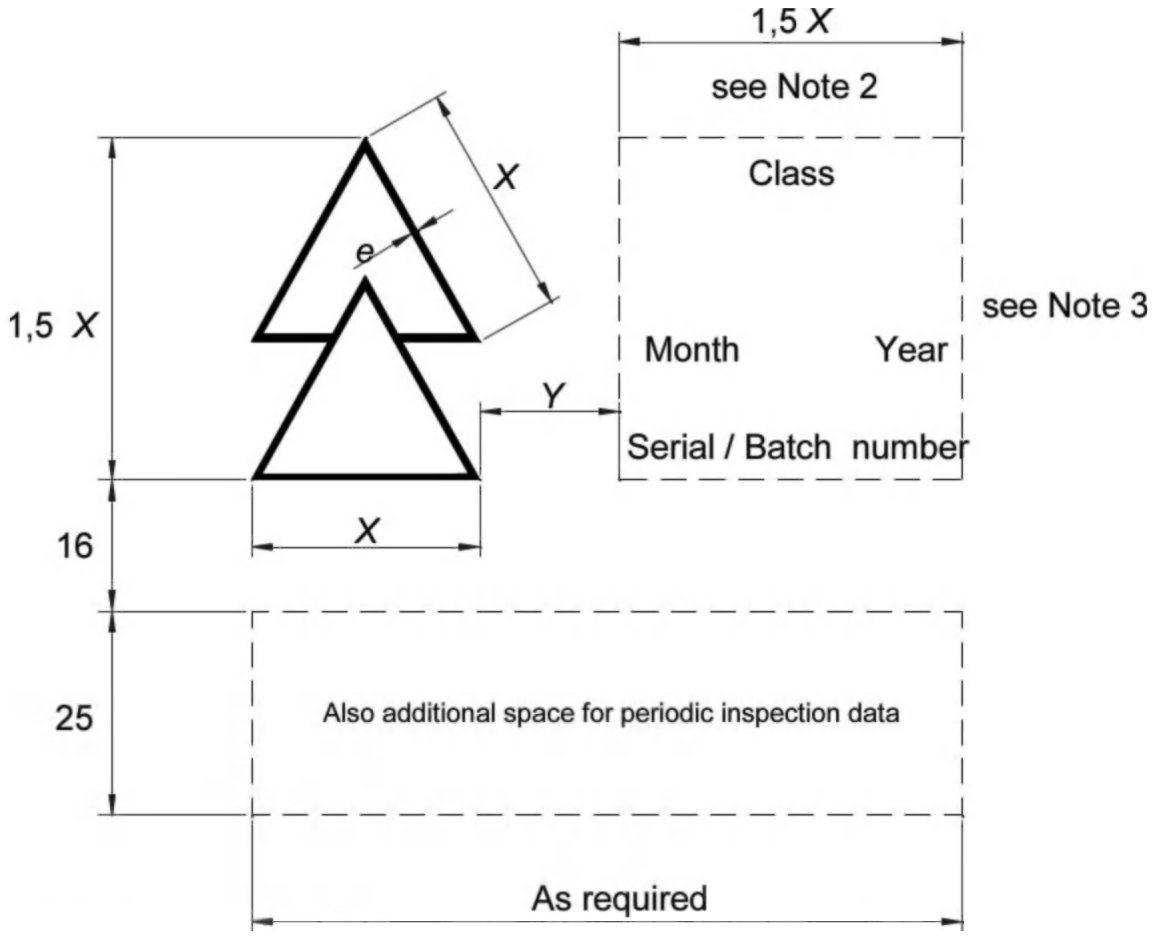
The manufacturer shall keep for inspection by the customer, all test results in accordance with the manufacturer's quality control procedures (see annex D).



Key

1	vertical clearance (h)
2	minimal height of the upper (X)
3	a.c. voltage source
4	earthed electrode
5	water
6	water or steel balls

Figure 1: Arrangement for electrical tests (see 6.3)



NOTE 1: All dimensions are in millimetres, tolerances are ±10 %.

NOTE 2: Dimensions:

X = 16, 25 or 40

e = minimum thickness of the line: 1 mm

Y= X/2

NOTE 3: Maximum is 32 letters.

Figure 2: Marking (see 5.3)

Annex A
(normative)

General test procedure

	List of tests	Type test	Routine test	Sampling test
		Subclause	Subclause	Subclause
1	Non-electrical tests	6.2		6.2
2	Electrical tests			
	Proof voltage test	6.3.3	6.3.3	6.3.3
	Withstand voltage test	6.3.4		6.3.4
3	Marking	6.4	6.4	
4	Packaging	6.5	6.5	

Annex B
(normative)

Instructions for use and periodical inspection

B1 Instructions for use

B.1.1 General

Each pair of footwear shall be accompanied by the instructions for use, which contain the information necessary for use, maintenance and the potential risk of limited effectiveness of electrical insulation according to conditions of use (i.e. mechanical or chemical aggression).

Instructions for use shall be given in the language of the user. All information shall be unambiguous.

The instructions for use shall contain:

- name of the manufacturer or his representative;
- product type, commercial name or code;
- number of this standard;
- explanation of the symbol "double triangle";
- information that the electrically insulating footwear cannot be used alone and that it is necessary to use other compatible protective equipment according to the risks involved in the work;
- instructions for use in respect of potential risk of loss of protection due to ageing or unappropriate cleaning, limited effectiveness of insulation according to the conditions of use;
- information about periodic inspection (see B.2) and in which manner they have to be put down on the marking panel;
- information about storing, use, cleaning and maintenance with maximum periods between maintenance checks.

B.1.2 Storage

The conditions of storage are an important factor for the conservation of electrical and mechanical performance of insulating footwear. Insulating footwear should be stored before first use and between successive uses in a suitable box or container. They should not be compressed, folded or stored close to any source of heat. They should not be exposed for long periods to sunlight, artificial light or others sources of ozone. It is recommended that the storage temperature be kept in the range (20 ±15) °C.

B.1.3 Examination before use

Before each use, a careful visual examination shall be made. If mechanical or chemical damages or slight cracking are detected, the footwear should not be used. In case of doubt, the footwear must undergo routine electrical test.

The upper must be dry.

The user will check that the class of the footwear corresponds to the nominal voltage that it is likely to encounter during use.

B.1.4 Precautions in use

Insulating footwear should not be used in situations where there is a risk of cutting, perforation, mechanical or chemical aggression which could partially reduce its insulating properties.

Particular care should be taken when the footwear is to be used in wet conditions.

NOTE: If the footwear is used under wet conditions such that the top of the upper (within about 10 cm) becomes wet or damp, then the insulating properties will be partially or totally eliminated.

B.1.5 Precautions after use

If the footwear becomes dirty or contaminated (oil, tar, paint, etc.), particularly the upper, it should be carefully cleaned and dried on the outside in accordance with the manufacturer's recommendations.

B.2 Periodic inspection

Periodic inspection consists of a thorough visual examination and, if appropriate, an electrical testing according to 6.3.3, carried out in intervals in accordance with the manufacturer's recommendations and national regulations if applicable.

NOTE: An interval of one year is recommended in the case of absence of national regulations.

Annex C
(normative)

Sampling procedure

C.1 General

The sampling procedure does not follow in its entirety the sampling procedure developed in IEC 60410:1973. The product covered by this standard does not lend itself to the application of the above mentioned standard, due to its nature.

The sampling procedure used in conjunction with this standard on footwear has been specially developed based on the quality assurance practices of ISO 9000 series. When those requirements are not followed, the procedure of this annex is applicable.

C.2 Classification of defects

Defects are classified as major or minor (see definition in IEC 60410). Guidance for selection is given in IEC 61318.

Routine tests are performed to detect critical defects.

Non-electrical defects shall be considered following their own standard either major or minor.

Table C.1: Classification of defects

Description of test	Subclause	Minor	Major
Visual inspection and dimensions	6.2.2	x	
Electrical tests	6.3		
Proof voltage test	6.3.3		x
Withstand voltage test	6.3.4		x
Marking	6.4		x
Packaging	6.5		x
NOTE: The unit of the sample is the footwear.			

C.3 General sampling plan

C.3.1 Plans for major defects

Table C.2: Major defects

Batch or lot size	Sample size	Number of defects for acceptance	Number of defects for rejection
0-151	5	0	1
151-500	8	0	1
501-3 200	13	1	2
3 201-35 000	20	1	2
NOTE: For a batch less than 5, the sample size is the same number.			

C.3.2 Plans for minor defects

Table C.3: Minor defects

Batch or lot size	Sample size	Number of defects for acceptance	Number of defects for rejection
0-90	5	0	1
91-500	8	2	3
151-3 200	13	3	4
3 201-35 000	20	5	6
NOTE: For a batch less than 5, the sample size is the same number.			

Annex D
(informative)

Acceptance tests

As defined in IEV 151-04-20, an acceptance test is a contractual test to prove to the customer that the device meets certain conditions of its specification. These tests may be carried out on every unit (routine tests) or on a sampling of the units (sampling tests).

If a customer specifies that the device must meet this CENELEC specification only, the acceptance tests are those (both routine and sampling) which are specified in this standard.

The customer may wish to witness the tests, have someone witness them, or simply accept the results of the tests as carried out by the manufacturer. He may also specify that the tests be carried out in an independent laboratory of his choosing or even in his own laboratory.

Further, the customer may specify additional tests or larger sampling sizes, when he is purchasing from a new manufacturer, because he has experienced problems with a particular manufacturer, or he is purchasing a new product or a new design.

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London
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