

Live working — Gloves of insulating material

The European Standard EN 60903:2003 has the status of a
British Standard

ICS 13.260; 29.240.20; 29.260.99

National foreword

This British Standard is the official English language version of EN 60903:2003. It was derived by CENELEC from IEC 60903:2003, including Corrigendum January 2005. It supersedes BS EN 60903:1993 and BS EN 50237:2000 both of which are withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by tags **[C]** **[C]**.

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 international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 65 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 17 February 2004

© BSI 2006

Amendments issued since publication

Amd. No.	Date	Comments
15049 Corrigendum No. 1	11 March 2004	Revision of supersession information
16512 Corrigendum No. 2	31 August 2006	Correction to 8.4.1.1 and 9.2.2

EUROPEAN STANDARD

EN 60903

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2003

ICS 13.260; 29.240.20; 29.260.99

Supersedes EN 60903:1992 + A11:1997 & EN 50237:1997

Incorporating Corrigendum January 2005

English version

**Live working -
Gloves of insulating material**
(IEC 60903:2002 + corrigendum 2003, modified)

Travaux sous tension -
Gants en matériau isolant
(CEI 60903:2002 + corrigendum 2003,
modifiée)

Arbeiten unter Spannung -
Handschuhe aus isolierendem Material
(IEC 60903:2002 + Corrigendum 2003,
modifiziert)

This European Standard was approved by CENELEC on 2003-07-01. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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

© 2003 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Foreword

The text of document 78/462A/FDIS, future edition 2 of IEC 60903, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60903 on 2003-07-01.

A draft amendment, prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working, was submitted to the formal vote and was approved by CENELEC for inclusion into EN 60903 on 2003-07-01.

This European Standard

- supersedes EN 60903:1992 + A11:1997, covering insulating gloves (and mitts) which would normally be used in conjunction with leather protector gloves worn over the insulating gloves (and mitts) to provide mechanical protection,
- supersedes EN 50237:1997, covering gloves (and mitts) which combine in one unique glove the insulating properties of elastomer gloves and the mechanical properties of leather gloves. The result of the combination is defined as a composite glove;
- includes requirements and testing for a "long composite glove" which extends protection to most of the upper arm.

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) 2004-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-07-01

This European Standard was prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and supports the essential requirements of Directive 89/686/EEC.

NOTE Subclauses which are additional to those in IEC 60903 are prefixed "Z".

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

Annexes designated "informative" are given for information only.

In this standard, annexes A, B, C and ZA are normative and annexes D, E, F, G, H and I are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60903:2002 and its corrigendum February 2003 was approved by CENELEC as a European Standard with agreed common modifications.

CONTENTS

INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Definitions	8
4 Classification.....	10
5 General requirements	11
5.1 Physical requirements	11
5.1.1 Composition	11
5.1.2 Shape.....	11
5.1.3 Dimensions	11
5.1.4 Thickness	12
5.1.5 Workmanship and finish	13
5.2 Mechanical requirements.....	13
5.2.1 Tensile strength and elongation at break	13
5.2.2 Tension set.....	13
5.3 Electrical requirements	13
5.4 Ageing requirements	14
5.5 Thermal requirements	14
5.5.1 Low temperature resistance.....	14
5.5.2 Flame retardancy.....	15
5.6 Gloves with special properties	15
5.6.1 Acid resistance	15
5.6.2 Oil resistance	15
5.6.3 Ozone resistance.....	15
5.6.4 Acid, oil and ozone resistance	15
5.6.5 Extremely low temperature resistance	15
5.7 Marking	16
5.8 Packaging	17
6 Specific mechanical requirements	17
6.1 Insulating gloves – Resistance to mechanical puncture	17
6.2 Composite gloves.....	17
6.2.1 Resistance to mechanical puncture	17
6.2.2 Abrasion resistance	17
6.2.3 Cutting resistance.....	17
6.2.4 Tear resistance.....	18
7 Electrical requirements for long composite gloves	18
8 General testing	19
8.1 General	19
8.2 Visual inspection and measurements.....	19
8.2.1 Shape.....	19
8.2.2 Dimensions	19
8.2.3 Thickness	20
8.2.4 Workmanship and finish	20

8.3	Mechanical tests	20
8.3.1	Tensile strength and elongation at break	20
8.3.2	Resistance to mechanical puncture	21
8.3.3	Tension set.....	21
8.4	Dielectric tests	22
8.4.1	General	22
8.4.2	AC test procedure.....	23
8.4.3	DC test procedure	24
8.5	Ageing test.....	25
8.6	Thermal tests	25
8.6.1	Low temperature test.....	25
8.6.2	Flame retardancy test.....	25
8.7	Tests on gloves with special properties	26
8.7.1	Category A – Acid resistance.....	26
8.7.2	Category H – Oil resistance.....	26
8.7.3	Category Z – Ozone resistance	27
8.7.4	Category C – Extremely low temperature resistance.....	27
8.8	Marking	27
8.9	Packaging	27
9	Specific mechanical testing	27
9.1	Abrasion resistance.....	27
9.2	Cutting resistance	28
9.2.1	Test on reference test piece	29
9.2.2	Test on glove test piece.....	29
9.3	Tear resistance	30
10	Leakage current test.....	31
10.1	General test conditions.....	31
10.2	Test arrangement.....	31
10.3	Test procedure	32
11	Quality assurance plan and acceptance tests	32
11.1	General	32
11.2	Categories of tests	32
11.3	Sampling procedure	32
11.4	Acceptance tests	32
	Annex A (normative) List and classification of tests	48
	Annex B (normative) Liquid for tests on gloves of category H – Oil resistance	51
	Annex C (normative) Sampling procedure	52
	Annex D (informative) Guidelines for the selection of the class of glove in relation to nominal voltage of a system	54
	Annex E (informative) In-service recommendations.....	55
	Annex F (informative) Typical glove dimensions.....	57
	Annex G (informative) Cotton canvas additional characteristics	58
	Annex H (informative) Acceptance tests.....	60
	Annex I (informative) Electrical limits for the use of gloves of insulating material	61
	Annex ZA (normative) Normative references to international publications with their corresponding European publications	63
	Bibliography.....	

Figure 1 – Examples of typical shapes of gloves	33
Figure 2 – Shape of mitts	34
Figure 3 – Contour of glove (see 8.2.2)	35
Figure 4 – Example of area usually in contact with energized equipment	36
Figure 5 – Marking symbols (see 5.7)	37
Figure 6 – Dumb-bell test piece for mechanical tests (see 8.3.1 and 8.3.3)	38
Figure 7 – Test plates and needle for resistance to mechanical puncture (see 8.3.2)	39
Figure 8 – Distance D from open part of glove to water line (see 8.4.1.1)	40
Figure 9 – Bend (fold) line for low and extremely low temperature test (see 8.6.1 and 8.7.4)	41
Figure 10 – Polyethylene plates for low and extremely low temperature test (see 8.6.1 and 8.7.4)	42
Figure 11 – Set-up for the flame retardancy test (see 8.6.2)	43
Figure 12 – Abrasion resistance tester (see 9.1)	44
Figure 13 – Apparatus for testing cutting resistance (see 9.2)	45
Figure 14 – Test piece direction and location for tear resistance (see 9.3)	46
Figure 15 – Shape of test piece for tear resistance (see 9.3)	46
Figure 16 – Set-up for the leakage current test (see 10.2)	47
Table 1 – Special properties	11
Table 2 – Standard lengths of gloves	12
Table 3 – Maximum thickness of the gloves	12
Table 4 – Proof test and withstand test	14
Table 5 – Surface leakage current test for long composite gloves	19
Table 6 – Clearance from open part of the glove to water line	23
Table 7 – Presentation of test results on glove test piece	30
Table A.1 – General test procedure	48
Table B.1 – Characteristics of oil no. 1	51
Table C.1 – Classification of defects	52
Table C.2 – Sampling plan for minor defects	53
Table C.3 – Sampling plan for major defects	53
Table D.1 – Designation of maximum use voltage	54
Table E.1 – Distances between the cuff of the protector glove and the top of the cuff of the insulating glove	55
Table F.1 – Details and dimensions (see Figures 1 and 2)	57
Table G.1 – Identification sheet	59
Table I.1 – Electrical limits	62

INTRODUCTION

In this document, the clauses on requirements and testing are reorganized in order to bring together the common requirements and tests, then to lay down separately those which are specific to insulating gloves for electrical protection normally worn under leather protector gloves as opposed to those specific to insulating gloves for combined electrical and mechanical protection. This arrangement meets the basic necessity that a same quality level of electrical insulation is achieved for all types of insulating gloves.

This document has been prepared according to the requirements of IEC 61477 where applicable.

LIVE WORKING – GLOVES OF INSULATING MATERIAL

1 Scope

This International Standard is applicable to:

- insulating gloves and mitts which should normally be used in conjunction with leather protector gloves worn over the insulating gloves to provide mechanical protection;
- insulating gloves and mitts usable without over-gloves for mechanical protection.

Unless otherwise stated, the use of the term “glove” includes both gloves and mitts. The use of the term “insulating gloves” designates gloves providing electrical protection only. The use of the term “composite gloves” designates gloves providing electrical and mechanical protection.

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.

IEC 60050(151):2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050(601):1985, *International Electrotechnical Vocabulary (IEV) – Chapter 601: Generation, transmission and distribution of electricity – General*

IEC 60050(651):1999, *International Electrotechnical Vocabulary (IEV) – Part 651: Live working*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2:1994, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60212:1971, *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

IEC 60417 (all parts), *Graphical symbol for use on equipment*

IEC 60743:2001, *Live working – Terminology for tools, equipment and devices*

IEC 61318:1994, *Live working – Guidelines for quality assurance plans*

IEC 61477:2001, *Live working - Minimum requirements for the utilization of tools, devices and equipment*

ISO 37:1994, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

ISO 472:1999, *Plastics – Vocabulary*

ISO 2592:2000, *Determination of flash and fire points – Cleveland open cup method*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 2977:1997, *Petroleum products and hydrocarbon solvents – Determination of aniline point and mixed aniline point*

ISO 3104:1994, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 9000:2000, *Quality management systems – Fundamentals and vocabulary*

ISO 9001:2000, *Quality management systems – Requirements*

ISO 9004:2000, *Quality management systems – Guidelines for performance improvements*

3 Definitions

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

3.1

composite gloves

insulating gloves made with integrated mechanical protection

[IEV 651-07-11 modified and definition 8.3.1 of IEC 60743]

3.2

insulating gloves

gloves made of elastomer or plastic material, used for the protection of the worker against electrical hazards

[IEV 651-07-09 and definition 8.2.3 of IEC 60743]

3.3

long composite gloves

composite gloves used to extend the protection of the worker over the arms up to the armpits

[Definition 8.3.2 of IEC 60743]

3.4

mitt

glove with multiple fingers enclosed in one covering

3.5

bell cuff glove

glove with an enlarged shape from the wrist to the cuff in such a way as to facilitate pull-on over a thick garment

3.6

contour glove

glove shaped at the upper part of the gauntlet in such a way as to facilitate the bending of the arm

3.7

curved glove

glove on which the fingers are slightly bent in a position corresponding to the position the hand forms when while holding an object

3.8

lined glove

glove with an inside lining of textile attached to the plastic or to the elastomer

3.9

elastomer

generic term that includes rubber, latex and elastomeric compounds that may be natural or synthetic or a mixture or a combination of both

[Definition 2.4.3 of IEC 60743]

3.10

plastic

material which contains, as an essential ingredient, a high polymer and which at some stage in its processing into finished products can be shaped by flow

NOTE 1 Elastomeric materials which are also shaped by flow, are not considered as plastics.

NOTE 2 In some countries, particularly in the United Kingdom, it is a permitted option to use the term "plastics" as the singular form as well as the plural form.

[ISO 472 and definition 2.4.4 of IEC 60743]

3.11

cuff

open part of a glove above the gauntlet

3.12

cuff roll

roll or reinforced edge of a glove at the cuff

3.13

fork

part of glove at the junction of two fingers, or finger and thumb

3.14

gauntlet

part of a glove from the wrist to the open part of the glove

3.15

palm

part of glove covering the face of the central inside hand

3.16

wrist

the narrowest part of the glove above the cuff

3.17

disruptive discharge

passage of an arc following dielectric breakdown

NOTE 1 The term “sparkover” (in French “amorçage”) is used when a disruptive discharge occurs in a gaseous or liquid dielectric.

NOTE 2 The term “flashover” (in French “contournement”) is used when a disruptive discharge occurs at least partly along the surface of a solid dielectric surrounded by a gaseous or liquid medium.

NOTE 3 The term “puncture” (in French “perforation”) is used when a disruptive discharge occurs through a solid dielectric producing permanent damage.

[IEV 651-01-18 and definition 2.7.7 of IEC 60743, modified]

3.18

nominal voltage (of a system)

suitable approximate value of voltage used to designate or identify a system

[IEV 601-01-21]

3.19

proof test voltage

specified voltage that is applied to a device for the time defined under specified conditions to assure that the electrical strength of the insulation is above a specified value

3.20

withstand test voltage

voltage that the device withstands without disruptive discharge, or other electric failure when voltage is applied under specified conditions

3.21

acceptance test

contractual test to prove to the customer that the device meets certain conditions of its specification

[IEV 151-16-23, modified]

3.22

routine test

test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria

3.23

sampling test

test on a number of devices taken at random from a batch

3.24

type test

test on one or more devices made to a certain design to show that the design meets certain specifications

4 Classification

The gloves covered under this standard shall be designated as follows:

- by class, as class 00, class 0, class 1, class 2, class 3 and class 4;
- by special properties, by the addition of a suffix as shown in Table 1.

For composite gloves, only classes 00, 0 and 1 are available at the present time. At higher classes, additional data are needed. For long composite gloves, only classes 1, 2 and 3 are available at the present time.

Guidance as to temperature range at which gloves can be used is given in Annex E.

Table 1 – Special properties

Category	Resistant to
A	Acid
H	Oil
Z	Ozone
R	Acid, oil, ozone
C	Extremely low temperature
NOTE 1 Category R combines the characteristics of categories A, H and Z.	
NOTE 2 Any combination of categories may be used.	

5 General requirements

5.1 Physical requirements

5.1.1 Composition

All gloves may be lined or unlined, have an exterior covering, or not, for protection against chemical attack, or be specially compounded to reduce the effects of ozone.

Insulating gloves for electrical protection are usually made of elastomer.

Composite gloves are usually made of elastomer or plastic. In case of excessive wear or damage on the exterior of a composite glove made up of layers of different colours, the different colour layer underneath will appear.

5.1.2 Shape

The gloves shall be provided with a cuff. Gloves may be manufactured with or without cuff roll.

NOTE The shape of a glove is indicated in Figure 1a. The letter “h” in Figure 1a represents the curve of the finger in curved gloves. The shape of a mitt is indicated in Figure 2. The shape of a long composite glove is indicated in Figure 1b. The shape of a bell cuff glove is illustrated in Figure 1c.

5.1.3 Dimensions

Table 2 gives the standard lengths of gloves.

Table 2 – Standard lengths of gloves

Class	Standard length mm ^b				
	280	360	–	–	–
00	280	360	–	–	–
0	280	360	410	460	–
1	–	360	410	460	800 ^a
2	–	360	410	460	800 ^a
3	–	360	410	460	800 ^a
4	–	–	410	460	–
^a Long composite gloves.					
^b The permissible variation in length shall be ± 15 mm for any class, except for long composite gloves where permissible variation shall be ± 20 mm.					

For contour-cuff gloves, the difference between the maximum and minimum lengths (see Figure 3) shall be $50 \text{ mm} \pm 6 \text{ mm}$ except for long composite gloves where this difference shall be $100 \text{ mm} \pm 12 \text{ mm}$.

It is not practicable to specify other dimensions, but typical glove dimensions are suggested in Annex F.

5.1.4 Thickness

The minimum thickness shall be determined only by the ability to pass the dielectric tests defined in 5.3.

The maximum thickness on the flat surface of a glove (no ribbed area if present) shall be as given in Table 3 in order to obtain the appropriate flexibility.

Table 3 – Maximum thickness of the gloves

Class	Thickness mm		
	Insulating gloves	Composite gloves	Long composite gloves
00	0,50	1,8	
0	1,00	2,3	
1	1,50	^a	3,1
2	2,30		4,2
3	2,90	–	4,2
4	3,60	–	
^a Under consideration.			

Gloves of categories A, H, Z and R may require additional thickness which shall not exceed 0,6 mm.

5.1.5 Workmanship and finish

Gloves shall be free on both inner and outer surfaces from harmful physical irregularities that can be detected by thorough test and inspection.

Harmful physical irregularities shall be defined as any feature that disrupts the uniform, smooth surface contour, such as pinholes, cracks, blisters, cuts, conductive embedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples and prominent mould marks.

The working area is defined as all finger and thumb forks, the palm and the palm side of the fingers and thumb (see Figure 4).

Palm and finger surfaces designed to improve the grip shall not be considered as irregularities.

5.2 Mechanical requirements

These requirements are applicable to the basic glove or sample material taken from the finished glove.

5.2.1 Tensile strength and elongation at break

The average tensile strength shall not be less than 16 MPa (see 8.3.1).

The average elongation at break shall not be less than 600 % (see 8.3.1).

5.2.2 Tension set

The tension set shall not exceed 15 % (see 8.3.3).

5.3 Electrical requirements

All gloves shall pass the proof and withstand voltage tests along with the a.c. proof test current requirements, as specified in Table 4 and Clause 8, according to their class.

Table 4 – Proof test and withstand test

Class of gloves ^d	AC tests					DC tests		
	Proof test voltage kV rms	Maximum proof test current ^{b, c} mA rms				Withstand test voltage kV rms	Proof test voltage Avg kV	Withstand test voltage Avg kV
		Glove length mm						
		280	360	410	≥ 460			
00	2,5	12	14	N/a ^a	N/a	5	4	8
0	5	12	14	16	18	10	10	20
1	10	N/a	16	18	20	20	20	40
2	20	N/a	18	20	22	30	30	60
3	30	N/a	20	22	24	40	40	70
4	40	N/a	N/a	24	26	50	60	90

^a N/a = Not applicable.

^b Gloves which, during tests, show proof test current values equal to or less than the values indicated in Table 4, will during normal use, have actual leakage current values much lower than the threshold of ventricular fibrillation. This is because the contact area with water during these tests is much greater than the contact area of the hand on the inside of the glove and the contact area of the glove with live electrical parts of equipment handled during normal use. Moreover, the proof test voltage is higher than the recommended maximum use voltage.

^c For routine tests, the proof test current given by Table 4 shall be reduced by 2 mA.

^d Refer to Annex D for the selection of the class of the gloves.

The proof test (see 8.4.2.1 or 8.4.3.1) is deemed successful if

- the proof test voltage is reached and maintained during the test period,
- the proof test current does not exceed the specified values during the test period. Current measurement may be done continuously or at the end of the test period.

The withstand test (see 8.4.2.2 or 8.4.3.2) is deemed successful if the voltage at which electrical puncture occurs equals or exceeds the specified withstand values.

5.4 Ageing requirements

Test pieces shall be submitted to high temperature tests (see 8.5) to simulate the effects of ageing.

For dumb-bell test pieces, the lowest value of tensile strength at break shall be a value of not less than 80 % of the unaged value. The tension set shall not exceed 15 %.

Each glove shall also pass the dielectric proof test, but without being subjected to the moisture conditioning.

5.5 Thermal requirements

5.5.1 Low temperature resistance

No tear, break or crack shall be visible on the gloves, after being subjected to a low temperature test (see 8.6.1).

Each glove shall also pass the dielectric proof test, but without being subjected to moisture conditioning.

5.5.2 Flame retardancy

Sample pieces taken from the gloves shall be flame retardant (see 8.6.2). The flame shall not have reached the reference line located on the test piece 55 mm from its edge (e.g. from the tip of the finger), within 55 s after withdrawal of the flame.

5.6 Gloves with special properties

5.6.1 Acid resistance

Gloves of category A shall be acid resistant (see 8.7.1). After immersion in a sulfuric acid solution, gloves shall successfully pass the following tests:

- dielectric proof test, but without moisture conditioning;
- tensile strength and elongation at break: the values obtained shall not be less than 75 % of the values obtained on gloves that have not been exposed to acid.

5.6.2 Oil resistance

Gloves of category H shall be oil resistant (see 8.7.2). After immersion in a oil, gloves shall successfully pass the following tests:

- dielectric proof test, but without moisture conditioning;
- tensile strength and elongation at break: the values obtained shall not be less than 50 % of the values obtained on gloves that have not been exposed to oil.

5.6.3 Ozone resistance

Gloves of category Z shall be ozone resistant (see 8.7.3). After conditioning, the gloves shall exhibit no cracks under visual inspection. Each glove shall pass the dielectric proof test, but without being subjected to moisture conditioning.

5.6.4 Acid, oil and ozone resistance

Gloves of category R shall be acid, oil and ozone resistant.

5.6.5 Extremely low temperature resistance

Gloves of category C shall be resistant to extremely low temperatures. No tear, break or crack shall be visible on the gloves after being subjected to an extremely low temperature test (see 8.7.4).

Each glove shall also pass the dielectric proof test, but without being subjected to moisture conditioning.

5.7 Marking

Each glove which is claimed to comply with the requirements of this standard shall bear a label and/or marking giving the following information:

- symbol IEC 60417-5216 – Suitable for live working; double triangle (see Figure 5a);
-  number of the relevant European Standard immediately adjacent to the symbol with year of publication (EN 60903:2003); 
- name, trademark or identification of the manufacturer;
- category, if applicable;
- size;
- class;
-  serial number or batch number; 
- month and year of manufacture.

Composite gloves shall also be identified with a mechanical symbol (hammer), adjacent to the double triangle (see Figure 5b). The length of the hammer (x) shall be equal to the length of one side of the triangles.

Markings and/or labels shall be adjacent to the cuff but not closer than 2,5 mm.

Markings shall be clearly visible and legible to a person with normal or corrected vision without additional magnification.

In addition, each glove shall provide the user or the testing laboratory either

- an area permitting the marking of the date of the current inspection or date of next required inspection and test, or
- any other suitable means to identify the date the glove is put into service and the dates of periodic inspection and test.

The marking or label shall not impair the quality of the glove, it shall be durable and shall remain visible after being subjected to a durability test (see 8.8).

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

When a colour code for symbols is used, it shall correspond to the following:

- class 00 – beige;
- class 0 – red;
- class 1 – white;
- class 2 – yellow;
- class 3 – green;
- class 4 – orange.

5.8 Packaging

Each pair of gloves shall be packaged in an individual container or package of sufficient strength to properly protect the gloves from damage. The outside of the container or package shall be marked with the name of the manufacturer or supplier, the classification, category, size, length and cuff design.

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

 Text deleted 

5.Z1 Manufacturer's instructions

Each pair of gloves shall come with the manufacturer's instructions for use and care.

These instructions shall include, as a minimum, the following information:

- the significance of any marking (see 5.7);
- the type of packaging suitable for transport (see 5.8);
- the classes and categories appropriate to different levels of risks and the corresponding limit of use (see Annex D);
- performance as recorded during the technical tests to check the levels or classes of protection (see Clauses 8, 9 and 10);
- the end of life deadline or period to end of life of the product; alternatively, the conditions of periodic inspection and electrical re-testing ensuring a safe use until the end of life of the product (see E.5);
- storage, use, cleaning, maintenance, servicing and disinfection. Cleaning, maintenance or disinfectant products recommended by the manufacturer and the relevant instructions;
- these gloves are intended to be used exclusively for electrical purpose. 

6 Specific mechanical requirements

6.1 Insulating gloves – Resistance to mechanical puncture

The average resistance to mechanical puncture shall be greater than 18 N/mm, as specified in 8.3.2.

6.2 Composite gloves

6.2.1 Resistance to mechanical puncture

The resistance to mechanical puncture shall correspond to a force value greater than 60 N, as specified in 8.3.2.

6.2.2 Abrasion resistance

The average abrasion, as obtained from the abrasion resistance test, shall be no more than 0,05 mg/r, as specified in 9.1.

6.2.3 Cutting resistance

The cutting resistance shall correspond to a calculated index at least equal to 2,5, as specified in 9.2.

6.2.4 Tear resistance

The tear resistance shall correspond to an average force value greater than 25 N, as specified in 9.3.

7 Electrical requirements for long composite gloves

Long composite gloves shall meet the proof test voltage requirements of 5.3 using the procedures of 8.4.

The portion of the glove up to the elbow shall meet the withstand test voltage requirements of 5.3 using the procedures of 8.4.

In addition, long composite gloves shall pass a surface leakage current test as specified in Table 5 and Clause 10.

The surface leakage test is deemed successful if:

- the test voltage is reached and maintained without flashover during the test period;
- the leakage current does not exceed the specified values at any time during the test period;
- no sign of tracking or erosion is visible on the surface.

**Table 5 – Surface leakage current test
for long composite gloves**

Class of gloves	Test voltage kV rms	Maximum leakage current mA rms
1	10	10
2	20	10
3	30	10

8 General testing

8.1 General

Each of the following subclauses defines whether type, routine or sampling tests are required.

Gloves which have been subjected to type tests or sampling tests should not be reused.

The allotment of these gloves into various testing lots, the quantity required and the order in which these tests are carried out are given in Annex A. The gloves used in the visual tests shall also be used in one of the other tests.

Gloves shall be preconditioned for a period of $2\text{ h} \pm 0,5\text{ h}$ at a temperature of $23\text{ °C} \pm 2\text{ °C}$ and $50\% \pm 5\%$ relative humidity (see IEC 60212, standard atmosphere B), except for gloves to be tested for water absorption as part of the type or sampling tests; these gloves shall be conditioned in accordance with 8.4.1.

8.2 Visual inspection and measurements

Visual inspection shall be carried out by a person with normal or corrected vision without additional magnification.

8.2.1 Shape

Type test and sampling test (see 5.1.2 and Figures 1 and 2)

The shape of the glove shall be verified by visual inspection.

8.2.2 Dimensions

Type test and sampling test (see 5.1.3, Figures 1, 2, 3 and Annex F)

The length of the glove shall be measured from the tip of the second finger to the outer edge of the cuff. The measurement is made with the glove in a relaxed position and the edge of the cuff perpendicular to the line of measurement.

The difference in length for contour-cuff gloves shall be measured with the glove in the relaxed position, along a line parallel to the length dimension, as shown in Figure 3.