BS EN 61477:2009

BSI Standards Publication

Live working — Minimum requirements for the utilization of tools, devices and equipment

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National foreword

This British Standard is the UK implementation of EN 61477:2009. It is identical to IEC 61477:2009. It supersedes BS EN 61477:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working.

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

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

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Date	Text affected

EUROPEAN STANDARD

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EN 61477

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Incorporates corrigendum February 2010

English version

Live working - Minimum requirements for the utilization of tools, devices and equipment

(IEC 61477:2009 + corrigendum 2009)

Travaux sous tension - Exigences minimales pour l'utilisation des outils, dispositifs et équipements
(CEI 61477:2009 + corrigendum 2009)

Arbeiten unter Spannung - Mindestanforderungen für die Nutzung von Werkzeugen, Geräten und Ausrüstungen
(IEC 61477:2009 + Corrigendum 2009)

This European Standard was approved by CENELEC on 2009-05-01. 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, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 78/772/FDIS, future edition 2 of IEC 61477, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61477 on 2009-05-01.

This European Standard supersedes EN 61477:2002 + A1:2002 + A2:2005.

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) 2010-02-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2012-05-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 61477:2009 with its corrigendum April 2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60895 NOTE Harmonized as EN 60895:2003 (modified).

IEC 61230 NOTE Harmonized as EN 61230:2008 (not modified).

———————

The contents of the corrigendum of February 2010 have been included in this copy.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-651	1999	International Electrotechnical Vocabulary (IEV) - Part 651: Live working	-	-
IEC 60417	Data-base	Graphical symbols for use on equipment	-	-
IEC 60743	- [1)]	Live working - Terminology for tools, equipment and devices	EN 60743	2001 [2)]

[1)] Undated reference.

[2)] Valid edition at date of issue.

Annex ZB
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.
This European Standard does not fall under any Directive of the EC.
In the relevant CEN/CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Clause **Deviation**

Germany

Regulation concerning safety and health protection when using work equipment and tools at the workplace (German Regulation Governing the Use of Work Equipment – *Arbeitsmittelbenutzungsverordnung - AMBV*) 11 March 1997

4 **1.1.1 Industrial Safety Act**

Parag. 2

1.1.2 Gesetz zur Umsetzung der EG-Rahmenrichtlinie Arbeitsschutz und weiterer Arbeitsschutz-Richtlinien (7. August 1996)

§ 12

Training of 11 March 1997

The employer shall give his employees adequate and appropriate training on occupational safety and health protection measures to be taken while at work. Such training includes instructions and explanations geared specifically to the employees' workplace or duties involved. Such training shall be given immediately after hiring new staff, in the event of any changes to the scope of duties, the introduction of new working implements/tools or any new technology prior to the employees taking up their work. The contents of the training programme shall be reviewed and adapted as the risks involved change, and shall be repeated on a regular basis if necessary.

1.1.3 German Regulation Governing the Use of Work Equipment

1.1.4 Verordnung über Sicherheit und Gesundheitsschutz bei der Benutzung von Arbeitsmitteln bei der Arbeit (Arbeitsmittelbenutzungsverordnung – AMBV) 11. März 1997

§ 6

Training

When conducting training sessions pursuant to § 12 of the German Industrial Safety Act, the employer shall take the requisite measures to ensure that the employees receive appropriate information and, if necessary, operating instruction for the work equipment to be used at the workplace in a manner and language clearly understandable for the employees. Such information and operating instructions shall at least include details about operating conditions, foreseeable equipment failure and about any experience already made with respect to the use of such work equipment.

5 **1.1.5 BGV A 2 1 April 1979 Accident Prevention Regulations**

Unfallverhütungsvorschriften – Elektrische Anlagen und Betriebsmittel (BGV A 2) – 1. April 1979

§ 6

Working with Live Parts

(1) Employees shall not work on any live parts of electrical installations and equipment, except for parts and situations covered by § 8.

(2) Before beginning with the work on any live parts of electrical installations and equipment, a de-energized condition must be established and measures taken to ensure the de-energized condition remains for the duration of the works.

(3) Paragraph 2 also applies to all adjacent active parts of electrical installations or electrical equipment if they

– are not insulated from direct contact, or

– are not protected, for the duration of the works, against direct contact by being covered or screened, such action having to take into account the voltage, frequency, type and location of use.

(4) Paragraph 2 also applies to the operation of electrical equipment adjacent to any live parts if these are not protected against direct contact.

§ 8

Admissible Deviations

Deviations from the requirements under §§ 6 and 7 are admissible if

1. owing to the type of equipment involved, the risk of electric shock or arcing can be ruled out, or

2. for compelling reasons, the de-energized condition cannot be established, provided that

- owing to the type of devices or tools used for the works in question, the risk of electric shock or arcing can be ruled out, and

- the company engages only such persons to perform this work who are professionally qualified to work on live parts, and

1.1.6 - the company sets down and implements any such additional technical, organizational and personal safety measures which will ensure adequate protection against any risks of electric shock or arcing.

1.1.7

6 1.1.8 Regulation Governing the Use of Work Equipment

Verordnung über Sicherheit und Gesundheitsschutz bei der Benutzung von Arbeitsmitteln bei der Arbeit (Arbeitsmittelbenutzungsverordnung – AMBV)
11. März 1997

§ 4

Regulations Governing Work Equipment

(1) The employer may initially only make available to the employee such work equipment which

1. corresponds to such statutory provisions by means of which other pertinent Community regulations are converted into German law, or

2. where no such statutory provisions apply, corresponds to other statutory provisions, at the very least, however, to the provisions of the Appendix.

(2) Work equipment initially made available to the employee between 1 January 1993 and 1 April 1997 shall

1. comply with the statutory provisions current at the time it was first made available to the employee by means of which other pertinent Community regulations are converted into German law, or

2. where no such statutory provisions apply, correspond to the other statutory provisions current at the time it was first made available to the employee.

In so far as, at the time the work equipment was first made available to the employee, none of the statutory provisions pursuant to Para. 1 and 2 apply or the other statutory provisions applicable at this time fall short of the requirements set forth in the Appendix, the work equipment shall be adapted in the very least to comply with the requirements of the Appendix without delay or by 30 June 1998 at the latest.

(3) If the work equipment was initially made available to the employee as early as 31 December 1992, they shall be adapted in the very least to comply with the requirements of the Appendix, without delay or by 30 June 1998 at the latest.

1.1.9 (4) The employer shall take the requisite measures to ensure that the work equipment

complies for the duration of their use with the requirements set forth under Paragraphs 1 to 3.

6.2 1.1.10 BGV A 2

Unfallverhütungsvorschriften - Elektrische Anlagen und Betriebsmittel (BGV A 2) – 1. April 1979

§ 5

Equipment Testing

(1) The company shall ensure that the electrical installations and equipment are tested for their proper working condition

1. before they are first brought into operational use and following any modification or repair works and prior to being put back into operation by an electrically skilled person or under the guidance and supervision of an electrically skilled person, as well as

2. at regular intervals.

The tests are to be fixed at such intervals that will ensure that any faults that can be expected to occur are detected in due time.

(2) When conducting the tests the relevant electrotechnical principles shall be observed.

(3) Upon request by the German employer's liability insurance association, an inspection book recording specific data is to be maintained.
1.1.11 (4) The test prior to first operational use pursuant to Paragraph 1 is not required if the company has the manufacturer's or installer's confirmation that the electrical installations and equipment are in a condition compliant with the provisions of these accident prevention regulations.

6.3 1.1.12 Regulation Governing the Use of Work Equipment

1.1.13 Verordnung über Sicherheit und Gesundheitsschutz bei der Benutzung von Arbeitsmitteln bei der Arbeit (Arbeitsmittelbenutzungsverordnung – AMBV)
11. März 1997

§ 5

Other Preventive Measures

1.1.14 If the use of any work equipment poses a special risk to the safety or health of employees, the employer shall make the necessary provisions to ensure that the employees directed to use them are permitted to decide whether or not to use the said work equipment at their own discretion. If the works in question are repairs or modifications, the employer shall also make the necessary provisions to ensure that the employees directed to perform such works are given adequate special training.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIVE WORKING – MINIMUM REQUIREMENTS FOR THE UTILIZATION OF TOOLS, DEVICES AND EQUIPMENT

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61477 has been prepared by IEC technical committee 78: Live working.

This second edition of IEC 61477 cancels and replaces the first edition published in 2001, its Amendment 1 (2002) and Amendment 2 (2004).

The document 78/772/FDIS, circulated to the National Committees as Amendment 3, led to the publication of the new edition.

The text of this standard is based on the first edition, Amendment 1, Amendment 2 and the following documents:

FDIS	Report on voting
78/772/FDIS	78/786/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This International Standard does not replace national regulations but it can be regarded as a reference for the development of national regulations. Where National regulations are in force to dictate the conditions of utilization of tools, devices and equipment for live working, these can be more stringent than the minimum requirements of this standard.

LIVE WORKING – MINIMUM REQUIREMENTS FOR THE UTILIZATION OF TOOLS, DEVICES AND EQUIPMENT

1 Scope

This International Standard gives the minimum requirements relative to specification, manufacture, selection, application and maintenance of tools, devices and equipment for live working.

It provides the type of information which is useful to skilled persons in order to make the use of tools, devices and equipment safer.

This type of information includes:

- the characteristics of tools, devices and equipment;
- their conditions for use;
- their conditions for maintenance;
- their conditions for storage and transportation.

Such information may be given in standards, manufacturer's instructions for use and in internal regulations set forth by companies for their own employees.

Such information should be completed by work methods, which are excluded from the scope of this standard.

In this standard, the word tool(s) is used for "tools, devices and equipment for live working" unless otherwise specified.

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

IEC 60417, *Graphical symbols for use on equipment*

IEC 60743, *Terminology for tools and equipment to be used in live working*

3 Terms and definitions

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

3.1
(electrically) skilled person
(electrically) qualified person (US)
person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create

[IEV 651-01-33]

3.2
required insulation level for live working (RILL)
statistical impulse withstand voltage of the insulation at the work location necessary to reduce the risk of breakdown of this insulation to an acceptable low level

NOTE It is generally considered that an acceptable low level is reached when the value of the statistical impulse withstand voltage is greater than or equal to the overvoltage having a probability of being exceeded by no more than 2 %.

[IEV 651-01-17]

3.3
live working zone
space around live parts where prevention of electrical hazard is assured by suitable means such as limiting access to skilled persons, maintaining the appropriate air distances to energized parts and using tools for live working

NOTE 1 The distance from the live parts to the outer boundary of a live working zone is greater or equal to the minimum working distance.

NOTE 2 The live working zone and the specific precautions that apply are generally defined by national or company regulations.

NOTE 3 In some countries the term "danger zone" is used instead of "live working zone".

[IEV 651-01-06]

3.4
tools (for live working)
tools, devices and equipment particularly designed or adapted, tested and maintained for live working

[IEV 651-01-24]

4 Characteristics of tools

The selection of tools to carry out the work to be performed requires a combination of both the advice and guidance from the manufacturer of the tools and the knowledge and experience of the user. This information enables the user to select tools that are not only the easiest to use but also ensures that tools are not used beyond their capabilities.

Those persons using the tools should be informed of the correct use of the tools and any particular safety issues that need to be observed or recognized.

4.1 Marking, graphical symbols and information to the users

It is essential for the safety of the user to have a clear meaning of the marking, including graphical symbols.

The items of marking shall be clearly and durably legible. They shall not impair the performance of the tool, particularly its insulating properties, if any.

This subclause applies to the tools considered as final products, and not to the raw material they are made of. According to that, it is considered inappropriate to mark the raw material with the double triangle.

Tools for which compliance with any IEC standard dealing with live working is claimed, shall be indicated by the following marking, as a minimum:

– symbol IEC 60417-5216 (2002-10) – Suitable for live working; double triangle;
– number of the relevant IEC standard immediately adjacent to the symbol (IEC 6XXXX).

NOTE 1 The symbol indicates a suitability for live working (see IEV 651-01-01) and then is not to be associated only with insulating tools. Conductive clothing (IEC 60895) and arc protective clothing (IEC 61482-2) are suitable for live working.

NOTE 2 Portable equipment and separate components for earthing or earthing and short-circuiting (IEC 61230) are not marked with this symbol.

Limit or rated values, such as the working load of any lifting equipment, and special properties or categories shall also be clearly indicated, where these values or indications are needed for a proper selection of the tool.

Identification of the tools can be completed through other means than marking, such as coded information (bar codes, microchips, etc.), or be associated to its packaging. It shall be particularly the case of characteristics or information not needed on the work location.

4.2 Dimensions and weight

The physical characteristics of the tools shall be assessed in order to take account of the implications for safety when in use. These characteristics are as follows:

- the weight of the tools to be handled by the workers, in particular those tools likely to be used at a distance during work, such as universal tool attachments, insulating poles, blankets and protective covers (see IEC 60743);
- the dimension(s) of the parts providing the required insulation level (for example, the distance between the handling zone and the active end of the tool, the boundaries of surface on protective covers which provide the required protection);
- the dimension(s) of the conductive parts which may enter the live working zone.

The last item is particularly useful because it has an influence on the air gap strength.

4.3 Electrical characteristics

The user of tools needs to know and understand the electrical characteristics of the various parts comprising the tools being used. This is especially important for parts which provide insulating, insulated or conductive characteristics.

In this regard, it is necessary to distinguish between:

- the insulating or insulated parts of a tool;
- the conductive parts of a tool.

Some tools may also comprise parts made of non-conductive material which do not comply with the requirements applicable to insulating material for live working. In this case, the corresponding tool shall ensure the required insulation level and consequently shall not affect adversely the electrical insulation at work location.

The tools shall be selected on the basis of its electrical characteristics. The electrical characteristics of a tool are generally related to the maximum system voltage taking into account the required insulation level. These characteristics may be used to allocate the tool to a particular electrical classification, according to the live working product standards.

NOTE Long insulating tools such as insulating poles are generally selected in order to maintain suitable air distances to live parts; therefore, they do not need the kind of classification as explained above.

Limit values for the maximum levels of voltage to which tools should be exposed shall be given in clear terms in the instructions for use accompanying the tools or be clearly marked on the tools.

4.4 Mechanical characteristics

The following mechanical characteristics are particularly important for tools with primarily a mechanical function.

These characteristics represent the maximum mechanical stress and strain values which can be either transmitted by these tools or to which they can be subjected. These stresses and strains can arise from one or more of the following:

- traction;
- compression;
- bending;
- torsion;
- tightening torque;
- shearing.

For other categories of tools, protective equipment in particular, the characteristics of mechanical strength such as

- puncture resistance;
- cutting resistance;
- tear resistance;
- tensile strength and elongation at break;
- abrasive resistance, etc.

are also important.

4.5 Thermal characteristics

Live working tools are used in an electrical environment where thermal risks may arise, for instance:

- due to proximity of workers where electrical arcing in air can occur; or
- from melting of protective equipment when subjected to abnormal current conditions in the system.

When appropriate, tools shall comply with flame retardancy requirements, they shall guaranty that they do not aggravate the consequence of electrical arcs or comply with other kinds of thermal requirements.

5 Conditions of use

The following information is essential for anyone who uses live working tools:

- the operating range, characterized by the type of electrical installations on which it can be used or the limits of use related to the environment or the method of work;
- the verifications before use to ensure the integrity (electrical and mechanical) of the tool;
- the precautions to be observed during use.

5.1 Operating range

5.1.1 Type of installations and limits of use

The characterization of the electrical installations can be very general:

- overhead lines;
- substations;
- underground networks;
- power generation facilities.

A much more detailed description is needed in many cases. This may include for example:

- type of live parts to be worked on (for instance, use of protective covers);
- type of support (for instance, use of saddles);
- type of insulator (porcelain, toughened glass, composite).

Where tools have been designed to be only used either at a distance, at potential or in contact, it is vital that these limitations and constraints be clearly explained to the users.

Where tools using special techniques are used (e.g. sprayed-water cleaning, work from a helicopter, etc.), the limits and constraints of use shall be clearly explained to the users.

5.1.2 Environment

Where the characteristics of the tools are either limited or adversely influenced by the environmental conditions during use, such limitations and influences shall be explained to the users. The following points shall be taken into consideration (this listing is neither exhaustive nor in order of priority):

- precipitation;
- temperature (some materials suffer adverse mechanical change with very low or very high temperatures);
- altitude;
- fog.

5.2 Precautions for use

It is important that the user be familiar with the following points:

- the instructions for assembly and installation;
- the instructions for operation where necessary;
- the particular limits to be observed in use to prevent danger.

When the tool is a diagnostic device, it is important that the user be informed of:

- the functioning principle;
- the possible limitations of use due to this principle;
- ways to confirm the diagnostic, where necessary.

5.3 Verifications before use

Each time the tools are used, they shall first be subjected to a verification check in order to assure the user of their required electrical and mechanical integrity. This verification shall include the following features:

- that they have suffered no damage when being put into storage or transported (e.g. insulating surfaces are not damaged by holes, flaking, scratches and cracks);
- that they are clean;
- that they are complete where assembled from separated or detachable parts;
- that they work correctly (e.g. mechanisms are free without restriction or seizure, latches function correctly, etc.).

In the case of diagnostic devices, a built-in testing unit shall be supplied in order to verify the device before and after use.

6 Conditions for maintenance

During their working life, tools undergo wear and tear which may alter their design characteristics. Designers and manufacturers of these tools shall provide information to users concerning the measures necessary to maintain and, where necessary, restore these characteristics to the design and manufacturing values. The measures to be taken will strongly depend upon the construction features and materials used and cannot be described in the present standard. Nevertheless, some general guidance can be given concerning cleaning and repair.

In addition, conditions for maintenance includes the periodic checks and verifications that are carried out to ensure that the electrical and mechanical characteristics are maintained or properly restored.

6.1 Cleaning

Insulating characteristics and, in some cases, the mechanical functioning of tools, can be adversely affected by contamination and soiling. Users shall be instructed in the use of appropriate cleaning materials and techniques.

The cleaning materials shall ensure a correct removal of dirt, grime and contamination deposits commonly encountered during use. Such dirt, grime and contamination is mainly composed of greasy products and solid particles (including sand, soil and metallic dusts), some of which are likely to be conductive.

These cleaning products shall not cause deterioration of the tools nor adversely affect the insulating surfaces and shall comply with the applicable environmental protection requirements.

The cleaning procedures shall include the following:

- a full description of the cleaning operation which may include, where necessary, rinsing and drying operations;
- recommended frequency of cleaning operations (all insulating or insulated tools shall be cleaned after each use and before being put into storage).

A practice is to cover the insulating surfaces of tools, after cleaning, with a water-repellent coating; in this case, users shall be instructed in the use of this practice, in compliance with the first paragraph of 6.1.

6.2 Periodic checks and verifications

Periodic checks and verifications provide an assurance of the effectiveness of the maintenance procedures being implemented for tools used for live working.

These checks and verifications generally include visual, electrical and mechanical inspections and tests.

These checks and verifications shall be derived from the tests set out in the relevant standards for the tools concerned. It may be necessary to modify some of these test values as these are drafted to take account of degradation due to ageing and use. The advice and guidance of the manufacturer should be sought concerning the appropriate test values.

As visual inspections are subjective by nature, its is recommended that examples of typical and unacceptable deterioration be given to the inspecting staff in the suitable form, for comparison purposes with the tools being inspected.

The periodicity of inspections shall be defined in conjunction with the advice and guidance from the manufacturer of the tool. The following factors shall also be taken into account when deciding on periodicity:

- ageing of the tool, depending on the constructional features and materials used;
- wear and tear taking place in normal use;
- frequency of use.

It is acknowledged that tools used for live working on low-voltage installations (below 1 kV r.m.s.) do not need regular electrical testing to verify their insulating properties, unless otherwise specified. This is because of the margins provided by the levels of dielectric strength employed in their design. Visual inspections of these tools provide a sufficient verification of their characteristics.

6.3 Repair

It is important that users be familiar with the kinds of repair which may need to be carried out. These repairs are generally carried out to restore required characteristics and may be effected:

- by the manufacturer (or the supplier); or
- by the user.

In the latter case, it is recommended that instructions be provided by the manufacturer, to ensure that repair operations are carried out under the correct conditions.

Such instructions shall include the following:

- details of products to be used for repair work;
- details of storage conditions, in particular temperature limits and maximum storage periods for the products;
- how the products shall be used, in particular the methods for preparation and application;
- environmental conditions in which the repair shall take place;
- repair procedures, specifying the various steps, preparation, application and verification.

NOTE The decision-making process whether or not to repair tools takes into account regulatory, economical and technical factors. These factors are specific to each tool so that it is not possible in this standard to give guidance or general criteria for this process.

When decision is not to repair, recycling and disposal shall be processed in environmentally safe conditions.

7 Conditions for storage and transportation

The required characteristics of the tools can be adversely affected by incorrect storage and transportation.

When deciding how and where to store tools, account shall be taken of all the factors, including environmental factors, which may adversely affect them. Such factors, depending on the constructional features and material used, can include:

- relative humidity, temperature (hot and cold), thermal radiation, ultra-violet radiation, aggressive products including ozone;
- method of storage (long flexible objects, such as mats and blankets, deteriorate when stored for a long time, either folded or compressed by heavy loads which cause permanent distortion).

Where tools are stored for transport purposes, the supports and containers used should be designed and constructed so that the tools are protected from the effects of vibration, shock and damage to both insulating and insulated surfaces as well as from impact with hard objects and surfaces.

It is important to complement these arrangements with guidance on the arrangements for the storage of tools at work locations. Such arrangements should ensure that tools are kept clean and dry.

Bibliography

IEC 60895, *Live working – Conductive clothing for use at nominal voltage up to 800 kV a.c. and +/- 600 kV d.c.*

IEC 61230, *Live working – Portable equipment for earthing or earthing and short-circuiting*

IEC 61482-2, *Live working – Protective clothing against the thermal hazards of an electric arc – Part 2: Requirements* [1)]

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1) To be published.

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