

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Live working – Insulating sticks and attachable devices –
Part 1: Insulating sticks

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Travaux sous tension – Perches isolantes et outils adaptables –
Partie 1: Perches isolantes

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIVE WORKING – INSULATING STICKS AND ATTACHABLE DEVICES –

Part 1: Insulating sticks

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International Standard IEC 60832-1 has been prepared by IEC technical committee 78: Live working.

The first edition of IEC 60832-1 and that of IEC 60832-2 cancel and replace the first edition of IEC 60832 published in 1988. The two parts have been created to clearly separate the requirements and testing of insulating sticks from those of attachable devices.

Compared to IEC 60832, the major changes included in IEC 60832-1 are:

- integration of a cold impact test on the end fitting;
- creation of an electrical category of end fittings;
- integration of a test of the dielectric strength of internal insulation;
- modification of the dye penetration test (disappearance of fuchsine);

- application of conformity assessment for products having completed the production phase, according to IEC 61318:2007 (Edition 3), focusing on the classification of defects and the introduction of alternative testing in case of production follow-up.

The text of this standard is based on the following documents:

FDIS	Report on voting
78/838/FDIS	78/844/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.

A list of all parts of the IEC 60832 series, published under the general title *Live working – Insulating sticks and attachable devices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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- withdrawn,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.

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INTRODUCTION

The purpose of this standard is to provide essential requirements. Each user may supplement it with their own requirements. For example, the user may add requirements regarding the use of insulating sticks on d.c. electrical installations or the mechanical performance or compatibility and interchangeability with tools already in service. In such cases, caution should be taken to maintain or improve the performance of the products.

This publication has been prepared in accordance with the requirements of IEC 61477.

The products designed and manufactured according to this standard contribute to the safety of the users provided they are used by skilled persons, in accordance with safe methods of work and the instructions for use.

The product covered by this standard may have an impact on the environment during some or all stages of its life cycle. These impacts can range from slight to significant, be of short-term or long-term, and occur at the global, regional or local level.

Except for a disposal statement in the instructions for use, and special considerations for the selection of a dye (see 5.6), this standard does not include requirements and test provisions for the manufacturers of the product, or recommendations to the users of the product for environmental improvement. However, all parties intervening in its design, manufacture, packaging, distribution, use, maintenance, repair, reuse, recovery and disposal are invited to take account of environmental considerations.

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LIVE WORKING – INSULATING STICKS AND ATTACHABLE DEVICES –

Part 1: Insulating sticks

1 Scope

This part of IEC 60832 gives the essential requirements for insulating sticks for live working for use on a.c. electrical installations.

Part 2 of IEC 60832 covers devices that can be attached onto and removed from the fitting of the insulating sticks.

The products designed and manufactured according to this standard contribute to the safety of the users provided they are used by skilled persons, in accordance with safe methods of work and the instructions for use.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this international standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC 60417, *Graphical symbols for use on equipment*

IEC 60855-1, *Live working – Insulating foam-filled tubes and solid rods – Part 1: Tubes and rods of a circular cross-section*

IEC 61318:2007, *Live working – Conformity assessment applicable to tools, devices and equipment*

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

ISO 8486-1:1996, *Bonded abrasives – Determination and designation of grain size distribution – Part 1: Macrogrits F4 to F220*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61318 and the following apply.

3.1.1**insulating stick**

insulating tool essentially made of insulating tube and/or rod with end fitting(s)

[Definition 2.5.1 of IEC 60743 and IEC 651-02-01, modified]

3.1.2**rated value**

value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment or system

[IEV 151-16-08]

3.1.3**end fitting**

part permanently fitted to the end of the insulating tube or rod

[Definition 2.4.1 of IEC 60743 and IEC 651-02-02 modified]

3.1.4**type of tool**

family of tools which are of the same design and application

3.1.5**rated voltage**

U_r

maximum r.m.s. voltage for using the stick, which corresponds to the phase-to-phase voltage of three-phase networks

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3.2 Symbols

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T_N	rated torque given by the manufacturer for a given tool and for testing purposes
F_{TN}	rated tensile force given by the manufacturer for a given tool and for testing purposes
F_{CN}	rated compression force given by the manufacturer for a given tool and for testing purposes
F_{BN}	rated bending force given by the manufacturer for a given tool and for testing purposes

4 Requirements**4.1 General**

The following requirements have been prepared in order that the products covered by this standard are designed and manufactured to contribute to the safety of the users, provided they are used by persons skilled for live working, in accordance with safe method of work and the instructions for use.

It shall be ensured that all appropriate measures have been taken to minimize size and weight of the insulating sticks so as to facilitate their handling.

4.2 Electrical insulation

The tools covered by this standard shall only use foam-filled tube and/or solid rod with a circular cross-section that are in accordance with IEC 60855-1.

NOTE 1 Appropriate value of insulation should be achieved by using an appropriate length of tube or rod according to the method of work and taking into account the minimum approach distances (see IEC 61472) and the flashover characteristics of the stick.

NOTE 2 The electrical insulating characteristics of raw material used for insulating stick with non circular cross section will be covered by a future publication in the IEC 60855 series of standards.

The end fitting(s) shall be designed such as to avoid any internal insulation failure.

4.3 Electrical category of end fittings

End fittings shall be categorized according to their maximum use voltage:

- category A for use where U_r is lower than or equal to 550 kV;
- category B for use where U_r is larger than 550 kV but lower than or equal to 800 kV.

4.4 Dimensional and mechanical requirements

4.4.1 Dimensional requirements

For each type of tool complying with this part of the standard, the manufacturer shall provide in writing the dimensions or operating ranges relating to the specific functions of the tool.

4.4.2 Mechanical requirements

For each type of tool listed in Tables 1 and 2 and complying with this part of the standard, the manufacturer shall provide in writing the rated values corresponding to the characteristics specified in Tables 1 and 2.

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The clip-on ammeter stick does not require mechanical tests to be performed on it, only visual inspection (see 5.2) and dimensional check (see 5.3) shall be carried out.

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In case of tools equipped with wing screw(s), the wing screw(s) shall withstand the torsion stress of normal use.

Table 1 – Mechanical characteristics of hand sticks (to be supplied by the manufacturer)

Characteristics	Type of tools									
	Tie stick	Hook stick	Hook stick extension	Universal hand stick	Wire holding stick	Pliers stick	Wire cutter stick Binding-wire cutter stick	All-angle cog spanner stick	Flexible insulated spanner stick	Extensible universal hand stick
F_{BN}	X	X	X			X				X
F_{TN}	X (*)	X		X	X	X				X
T_N	X	X	X	X	X			X	X	X
Specific characteristics	(*) Tension strength of the rotary blade and hook		Tension strength of the connecting clamp			Tightening capability F_c	Cutting capability (maximum diameter and type of conductors)			

Table 2 – Mechanical characteristics of support sticks (to be supplied by the manufacturer)

Characteristics	Type of tools	
	Conductor support stick	Tension stick ^a
F_{TN}	X	X
F_{CN}	X	
^a Tension stick: this term includes clevis/tongue stick, tension link stick, roller link stick, swivel link stick, spiral link stick.		

4.5 Insulating sticks end fittings

4.5.1 Mechanical protection

When necessary, the ends of each stick shall be fitted with a suitable device providing mechanical protection, such as an end fitting or an end cap.

When metal end fittings are used, they shall be designed so that their edges, in proximity to the joint with the insulating tube or rod are rounded off.

The end fitting(s) of each stick shall be designed to prevent water or other polluting agents from penetrating inside the end fitting(s) of the tool or inside the insulating tube.

The end fitting(s) shall resist to shock even at low temperature.

NOTE 1 A cold impact test on the end fitting is included in 5.5.1. For tools intended to be used at temperatures lower than $-25\text{ }^{\circ}\text{C}$, the client should discuss with the manufacturer the relevance of defining a more restricting test.

NOTE 2 In general, for tools intended to be used in unusual atmospheric conditions (very high or very low temperature or relative humidity), the client should discuss with the manufacturer the relevance of defining more restricting mechanical tests in appropriate conditions.

4.5.2 Protection against corrosion

Metal parts shall be protected against corrosion, either by their composition or by the use of a suitable surface treatment.

4.5.3 Conductive parts (standards.iteh.ai)

All conductive parts attached to tubes or rods shall be clearly identified.

When this is not technically feasible, the outside of the tube or rod shall be clearly marked with a durable strip indicating the positions of internal metal parts.

All conductive parts attached to tubes or rods shall be designed and manufactured so as to reduce the danger of short-circuits.

4.6 Multiple-tube or multiple-rod tools

All tools comprising several tubes or rods shall be designed so that they can be taken apart for the purposes of maintenance.

4.7 Marking

Each tool shall be marked with the following permanent items of marking:

- manufacturer's name or trademark,
- type reference,
- year and month of manufacture,
- marking showing the electrical category of the end fitting(s) (see 4.3),
- symbol IEC 60417-5216:2002-10 – Suitable for live working; double triangle (see Annex A);

NOTE The exact ratio of the height of the figure to the base of the triangle is 1,43. For the purpose of convenience, this ratio can be between the values of 1,4 and 1,5.

- number of the relevant IEC standard immediately adjacent to the symbol, (IEC 60832-1).

The marking shall be durable, clearly visible and legible to a person with normal or corrected vision without additional magnification. The marking shall be placed in a position remote from the strip indicating the positions of internal metal parts.

Other characteristics or information not needed at the work location, like the year of publication of the standard, shall be associated to the product item by other means, such as coded information (bar codes, microchips, etc.), or shall be associated to its packaging.

No marking shall adversely affect performance of insulating parts. Where a removable marking (e.g. a stick-on label) is used, the electrical performance of the tool shall remain unaffected when the marking is removed.

4.8 Instructions for use

Each tool shall be supplied with the manufacturer's written instructions for use and care.

These instructions shall be prepared in accordance with the general provisions given in IEC 61477.

These instructions shall include, as a minimum, recommendations for maximum mechanical load (see 4.4.2), cleaning, storage and transportation, periodic testing, possible repair and disposal of the tool.

5 Tests

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5.1 General

The present standard provides testing provisions to demonstrate compliance of the product to the requirements of Clause 4. These testing provisions are primarily intended to be used as type tests for validation of the design input. Where relevant, alternative means (calculation, examination, tests, etc.), are specified within the test subclauses for the purpose of insulating sticks having completed the production phase.

To show compliance with this standard, the manufacturer shall prove that the type tests referred to in Tables B.1 and B.2 have been successfully carried out on at least three tools of each type of assembly.

However, when differences between various types of tools are limited in number, tests that are unaffected by the differing characteristics of the tools can be carried out on a single type of tool and the results can be used for the other tool types.

Tensile force tests need not be repeated when tool types only differ in the length of the insulating foam-filled tube or solid rod.

The tests referred to in Tables B.1 and B.2 shall be performed in the specified numbered order.

The required values of mechanical forces specified in Clause 5 shall be reached using a rate of increase between 1 % and 10 % of the rated force per second. The forces shall be applied with an accuracy of ± 5 %.

NOTE For example, if the rated tensile force stated by the manufacturer for a given tool is $F_{TN} = 100$ N, the rate of increase will be between 1 N/s and 10 N/s and the applied force to the tool will be between 95 N and 105 N.

The dimensions specified in mm in Clause 5 shall be verified with an accuracy of ± 2 %.

Unless otherwise specified, room temperature shall be (25 ± 10) °C.

When visual inspection is specified, it shall be understood to be visual inspection by a person with normal or corrected vision without additional magnification.

5.2 Visual inspection

Each tool shall be visually inspected to detect manufacturing defaults and to check proper functioning and compliance with requirements included in 4.2, 4.5, 4.6, 4.7 and 4.8 where applicable.

5.3 Dimensional check

Each tool shall be measured to ensure that its dimensions match the manufacturer's rated dimensions.

5.4 Durability of marking

The durability of the marking shall be verified by thoroughly cleaning the marking for at least 1 min with a piece of lint-free cloth dampened with water and then rubbing it vigorously for a further minimum of 1 min with a piece of lint-free cloth dampened with isopropanol (CH₃-CH(OH)-CH₃).

NOTE 1 It is the employer's duty to ensure that any relevant legislation and any specific safety instructions regarding the use of isopropanol are fully observed.

The test shall be considered as passed if the marking remains legible and the letters do not smear.

The surface of the tool may change. No signs of loosening shall be present for labels.

NOTE 2 Marking made by moulding or engraving need not be subjected to this test.

5.5 Mechanical tests

5.5.1 Cold impact test on the end fitting

If the tool has more than one end fitting, each different type of end fitting shall be tested.

The end fitting of the tool shall be left in a chamber at a temperature of $(-25 \pm 3) ^\circ\text{C}$ for at least 2 h. The impact test shall be performed at a time interval not greater than 120 s after removing the end fitting from the chamber.

NOTE Depending on the relative dimensions of the test chamber and of the tool under test, it is permitted to have only the tested extremity of the tool inserted in the test chamber by a porthole.

The height (H) of fall of the hammer shall be calculated in relation to its weight (P), so that the impact force (W) on the end fitting shall be equal to that of the complete tool falling from a height of 0,6 m on a hard surface:

$$H = \frac{W}{P} = \frac{0,6F}{P}$$

where

H is the height of fall of the hammer, in metres,

F is the weight of the complete tool to be tested, in newton,

P is the weight of the hammer, in newton.