



## Arbejde under spænding – Teleskopiske pinde og teleskopiske målepinde

Live working – Telescopic sticks and  
telescopic measuring sticks

A large, thin, black curved line that starts at the bottom left, rises to a peak in the middle, and then descends towards the right. A small vertical dotted line is positioned near the start of the curve.

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EUROPEAN STANDARD

**EN 62193**

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2003

ICS 13.260; 29.240.20; 29.260.99

English version

**Live working -  
Telescopic sticks and telescopic measuring sticks  
(IEC 62193:2003)**

Travaux sous tension -  
Perches télescopiques  
et perches de mesure télescopiques  
(CEI 62193:2003)

Arbeiten unter Spannung -  
Teleskopische Stangen  
und teleskopische Messstangen  
(IEC 62193:2003)

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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.

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

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

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Ref. No. EN 62193:2003 E

## Foreword

The text of document 78/513/FDIS, future edition 1 of IEC 62193, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62193 on 2003-09-23.

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- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-10-01

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

Annexes designated "informative" are given for information only.

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

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 62193:2003 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 60743	NOTE	Harmonized as EN 60743:2001 (not modified).
IEC 61472	NOTE	Harmonized as EN 61472:1995 (modified).
IEC 61477 + A1	NOTE	Harmonized as EN 61477:2002 + A1:2002 (not modified).

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1 + corr. March	1989 1990	High-voltage test techniques Part 1: General definitions and test requirements	HD 588.1 S1	1991
IEC 60068-1	1988	Environmental testing Part 1: General and guidance	EN 60068-1 <sup>1)</sup>	1994
IEC 60068-2-18	2000	Part 2-18: Tests - Tests R and guidance: Water	EN 60068-2-18	2001
IEC 60417 database	2002	Graphical symbols for use on equipment	-	-
IEC 60832 (mod)	1988	Insulating poles (insulating sticks) and universal tool attachments (fittings) for live working	EN 60832	1996
IEC 60855 (mod)	1985	Insulating foam-filled tubes and solid rods for live working	EN 60855	1996
IEC 61235 (mod)	1993	Live working - Insulating hollow tubes for electrical purposes	EN 61235	1995
IEC 61318	- <sup>2)</sup>	Live working - Quality assurance plans applicable to tools, devices and equipment	-	-

<sup>1)</sup> EN 60068-1 includes corrigendum October 1988 + A1:1992 to IEC 60068-1.

<sup>2)</sup> To be published.



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Première édition  
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**Travaux sous tension –  
Perches télescopiques et  
perches de mesure télescopiques**

**Live working –  
Telescopic sticks and  
telescopic measuring sticks**



Numéro de référence  
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CEI/IEC 62193:2003

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**LIVE WORKING –  
TELESCOPIC STICKS AND  
TELESCOPIC MEASURING STICKS**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 62193 has been prepared by IEC technical committee 78: Live working.

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

FDIS	Report on voting
78/513/FDIS	78/523/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 2010. At this date, the publication will be

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

## INTRODUCTION

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

The quality plan elements of this standard were prepared in accordance with the requirements of IEC 61318.

# LIVE WORKING – TELESCOPIC STICKS AND TELESCOPIC MEASURING STICKS

## 1 Scope

This International Standard covers telescopic sticks and telescopic measuring sticks to be used for live working on a.c. or d.c. electrical installations at 1 000 V and above for a.c. and 1 500 V and above for d.c.

The telescopic sticks are designed to accept attachments that meet appropriate live working standards and, together with these attachments, may be used to perform mechanical work on live parts at a distance. Telescopic sticks are also designed to accept diagnostic devices that meet appropriate live working standards and are used to make the diagnostic devices reach parts of an installation to be tested. Telescopic measuring sticks, or telescopic sticks equipped with graduations, are used to measure distances to or between live parts.

NOTE Under certain circumstances, the telescopic sticks covered by this standard can be used for installing portable earthing or earthing and short-circuiting equipment if the mechanical stresses during use are lower than the rated values.

The tools (telescopic sticks and telescopic measuring sticks) covered by this standard are for use under dry conditions but could also be used under very humid conditions, using appropriate working procedures.

Telescopic hook sticks are not covered by this standard. Telescopic bonding sticks and any other speciality telescopic sticks designed at the request of users are not covered by this standard.

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

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-18:2000, *Environmental testing – Part 2-18: Tests – Test R and guidance: Water*

IEC 60417-DB:2002<sup>1</sup>, *Graphical symbols for use on equipment*

IEC 60832:1988, *Insulating poles (insulating sticks) and universal tool attachments (fittings) for live working*

IEC 60855:1985, *Insulating foam-filled tubes and solid rods for live working*

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<sup>1</sup> "DB" refers to the IEC on-line database.

IEC 61235:1993, *Live working – Insulating hollow tubes for electrical purposes*

IEC 61318, *Live working – Quality assurance plans applicable to tools, devices and equipment*<sup>2</sup>

### 3 Terms and definitions

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

#### 3.1

##### **telescopic stick**

hand stick made of retractable insulating tubes including at least one filled or solid section which is fitted with a universal splined-head or other fitting and intended to be used under tension/compression and/or torque

NOTE 1 The telescopic stick may be used as a measuring stick when appropriately marked.

NOTE 2 For use in Sweden, the filled or solid section(s) may be replaced by section(s) of sealed hollow tubes.

[Definition 3.1.14 of IEC 60743, modified]

#### 3.2

##### **telescopic measuring stick**

hand stick made of retractable insulating tubes including at least one filled or solid section. This tool is used to determine conductor-to-ground and conductor-to-conductor distances and other clearances and not intended to be used under tension/compression and/or torque

NOTE For use in Sweden, the filled or solid section(s) may be replaced by section(s) of sealed hollow tubes.

[Definition 3.1.15 of IEC 60743, modified]

#### 3.3

##### **bonding stick**

hand stick used to apply bonding leads

#### 3.4

##### **tip section**

working end of the tool, filled or solid, which provides the primary insulating characteristics when fully extended. It is the part of the tool which comes in contact or in close proximity with the live part

NOTE For use in Sweden, the filled or solid-tip section may be replaced by a section of sealed hollow tube.

#### 3.5

##### **hydrophobic**

lacking affinity for water (water repellence). An hydrophobic material prevents water droplets spreading on its surface

#### 3.6

##### **lock assembly**

device or mechanism that locks the telescopic sections in the working position

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<sup>2</sup> To be published.

**3.7****reinforced tube**

tube which is especially designed to resist mechanical strain

[Definition 3.3.1 of IEC 61235, modified]

**3.8****standard tube**

tube which may be submitted occasionally to mechanical loading and should be able to self-restore by the nature of the material itself

[Definition 3.3.2 of IEC 61235]

**3.9****light tube**

tube which has not been designed and manufactured to resist mechanical stresses except its own weight

[Definition 3.3.3 of IEC 61235]

**3.10****type test**

test performed on one or more items representative of the production, made to show that the product meets certain specifications

[Definition 3.10 of IEC 61318 and IEC 151-16-16, modified]

**3.11****routine test**

test performed on each item during or after manufacture to ascertain whether it complies with certain criteria

[Definition 3.11 of IEC 61318 and IEC 151-16-17, modified]

**3.12****sampling test**

test on a sample

[Definition 3.12 of IEC 61318 and IEC 151-16-20]

**3.13****acceptance test**

contractual test to prove to the customer that the item(s) meet(s) certain conditions of its specification

[Definition 3.13 of IEC 61318 and IEC 151-16-23, modified]

**3.14****minor defect**

defect that is not likely to materially reduce the usability of the item or product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the item

[Definition 3.5 of IEC 61318]

### 3.15

#### **major defect**

defect, other than critical, that is likely to result in failure, or to materially reduce the usability of the item or product for its intended purpose

[Definition 3.4 of IEC 61318]

### 3.16

#### **critical defect**

defect that judgement and experience indicate is likely to result in hazardous or unsafe conditions for individuals using, maintaining or depending upon the product. A defect that judgment and experience indicate is likely to prevent performance of the function of a major end item or product used in live working, such as tools or equipment

[Definition 3.3 of IEC 61318]

## 4 Classification

There is no electrical classification for the tools covered by this standard.

The tools (telescopic sticks and telescopic measuring sticks) covered by this standard are classified in two categories according to their mechanical characteristics. These categories are:

- Category 1 – tools manufactured from light and/or standard tubes and not intended to be used under tension/compression and/or torque;
- Category 2 – tools manufactured from reinforced tubes and intended to be used under tension/compression and/or torque.

Normally telescopic measuring sticks are of Category 1. Telescopic sticks are of Category 2.

## 5 Requirements

### 5.1 Safety

Tools which conform with this standard shall be designed and manufactured to be safe, provided they are used by skilled (trained) personnel, in accordance with safe methods of work and the instructions for use.

### 5.2 General

Shape(s) of all sections of the tool shall allow telescoping but need not be the same nor cylindrical.

Any attachments or end fittings shall not degrade the electrical and mechanical properties of the tool and shall comply with IEC 60832.

Except for the diameters, the raw material used for manufacturing of the tip section with circular cross-section shall comply with the requirements of IEC 60855.

NOTE The raw material for manufacturing of the tip section with non-circular cross-section should meet the requirements of tip section with equivalent circular cross-section and equivalent wall thickness.

Except for the diameters, the raw material used for manufacturing the lower sections with circular cross-section, either of Category 1 or Category 2, shall comply with the requirements of IEC 61235 for light, standard or reinforced tube respectively.

NOTE The raw material for manufacturing of the lower sections with non-circular cross-section should meet the requirements of lower sections with equivalent circular cross-section and equivalent wall thickness.

### 5.3 Requirements for the lock assembly and end caps

The lock assembly and end caps shall not reduce the electrical insulation of the tool below the requirements included in this standard.

The lock assembly shall be such that it provides a positive means of securing the sections of the tool in the extended position during use. It shall also permit manual retraction of the sections.

The lock assembly, or any other part of the tool, shall have no protruding parts capable of causing damage to the exterior or interior surface of the tool.

For tools of Category 2, the lock assemblies shall support all mechanical working stresses without deformation or failure.

### 5.4 Surface finish

The external surface of the tool shall exhibit hydrophobic properties.

NOTE The internal surface should also exhibit the same hydrophobic properties, but at this time there is no practical test to verify this property.

The external and internal surfaces shall be free of any abrasions, surface defects such as scratches, bruises, delamination, exposed fibres and blemishes that may capture an impurity and impair the dielectric integrity of the product.

Where a finish coating is applied, physical, electrical, and mechanical requirements shall be maintained.

### 5.5 Dimensional requirements

All external and internal dimensions of the different sections of a tool shall be sized to allow the sections to telescope easily in and out with minimum amount of play between sections.

Dimensions shall be supplied by the manufacturer, either in the instructions for use or in the documentary literature.

NOTE The minimum length of the tip section should be selected according to Annex A.

### 5.6 Marking

Each tool shall be marked with at least the following:

- name or trade mark of the manufacturer;
- category reference;
- date of manufacture (year and, if possible, month) and/or lot number;
- exposed length of the tip section when extended;

- warning: “the tip section has to be fully extended when performing live working”;
- symbol IEC 60417-5216 (DB:2002-10) – Suitable for live working; double triangle (see Annex B);

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 with year of publication (4 digits), (IEC 62193:2003).

In addition, each tool shall provide for an area permitting the marking of the date of the current inspection or the date of the next required inspection and test.

NOTE Additional markings such as measuring graduations or mechanical ratings may be applied at the request of the customer.

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

The markings shall be durable.

The markings shall not affect the performance of the tool. If a removable label is used, the performance shall not be affected by its removal.

## 5.7 Instructions for use

Each tool shall come with the manufacturer's instructions for use and care. These instructions shall include at least

- recommendations for attachments (fittings);
- maximum mechanical rating;
- recommendations for cleaning, storage, transportation, periodic testing, possible refinishing and possible disposal.

## 6 Type testing

In order to show compliance with this standard the manufacturer shall provide evidence that the following tests have been carried out successfully on a minimum of three tools for each type of construction assembly. If more than one tool does not pass, the test has failed. If only one tool fails, the entire sequence of the test shall be repeated on three other tools of the same design. If, again, any of the tools do not pass, the type test is considered to have failed.

### 6.1 General

Tests shall be performed on a complete tool which has been fully extended, including the extension when required.

Tests shall be performed in the chronological order specified in Annex C.

Unless otherwise specified, acceptable tolerances shall be the following.

- For dimensional tolerances refer to manufacturer specifications.
- For test set-up tolerances refer to the relevant figures.
- For dielectric test tolerances refer to IEC 60060-1.



### 6.1.1 Standard atmospheric conditions

The tool shall be pre-conditioned for 4 h and tested under the following standard atmospheric conditions (see 5.3.1 of IEC 60068-1):

Ambient temperature:	15 °C to 35 °C;
Relative humidity:	25 % to 75 %;
Atmospheric pressure:	86 kPa to 106 kPa.

## 6.2 Visual inspection and dimensional check

### 6.2.1 Visual inspection

The tool shall be inspected visually to detect constructional or functional defects (see 5.2, 5.3 and 5.4). To inspect internal surfaces, the tool shall be disassembled.

### 6.2.2 Dimensional check

The inside and outside dimensions shall be measured to verify conformity of the tool to that specified by the manufacturer (see 5.5). To measured internal dimensions, the tool shall be disassembled.

## 6.3 Durability of markings

The durability of the markings shall be checked by rubbing the markings for at least 15 s with a piece of lint-free cloth soaked in soapy water and then rubbing it for a further minimum 15 s with a piece of lint-free cloth soaked in isopropanol ( $\text{CH}_3\text{-CH(OH)-CH}_3$ ).

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

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

NOTE Markings made by moulding or engraving do not need to be tested for durability.

## 6.4 Dielectric tests

### 6.4.1 Test for hydrophobic surface properties

This test is to determine the quality of the untreated (unwaxed) surface.

#### 6.4.1.1 Preparation of the tool

Wipe the tool which is to be tested with a clean, white, lint-free polishing cloth soaked in isopropanol, until the cloth stays clean. Place the tool between two supports in the horizontal position.

Using a spray bottle or pressurized sprayer from a distance of  $(25 \pm 10)$  cm, apply a fine mist of distilled or deionized water (with a resistivity in the range of 500  $\Omega\cdot\text{m}$  to 5 000  $\Omega\cdot\text{m}$ , according to IEC 60068-2-18, Annex A) to the complete external surface (over 360°) of the tool until droplets just begin to drip from the bottom surface.

Evaluate the hydrophobic properties within 10 s after spraying is completed.

NOTE The shapes and relative separation of the water droplets should be compared with the classification of Figure 1. The hydrophobic classification (HC) may vary from one section of the tool to another; however, to achieve satisfactory results with the leakage current test of 6.4.1.2, the classification should be HC1 or HC2.

#### 6.4.1.2 Measurement of the leakage current

The marking shall be wiped dry before measuring the leakage current.

With the rest of the tool still covered with water droplets, a d.c. voltage of 100 kV shall be applied over the circumference on each section of 300 mm of the tool and the leakage current shall be measured after 1 min voltage application.

NOTE If a single tool is tested at a time, band electrodes would work well. If many tools are checked together, for example, by using a test set-up as illustrated in Figure 2, circular contact electrodes are acceptable.

The test shall be considered as passed if the leakage current measured for each section of 300 mm does not exceed 10  $\mu$ A d.c.

#### 6.4.2 Surface dielectric test of the full assembly

The following test shall be performed over the whole length of the tool, including the lock assemblies.

During the dielectric test, carried out in accordance with IEC 60060-1, the tool shall be subjected to an alternating voltage of 100 kV r.m.s. at power frequency applied between electrodes 300 mm apart for 1 min. An example of the test arrangement is shown in Figure 2. By agreement between manufacturer and customer, an equivalent test arrangement may be used. In case of dispute, the test arrangement described in Figure 2 shall be used.

It shall be made sure that, during the test, the lock assemblies do not coincide with the test electrodes.

The test shall be considered as passed if, during and after the test, the following conditions are satisfied:

- no flashover, no sparkover, no puncture;
- no visual trace of tracking or erosion on the surface.

### 6.5 Mechanical tests

#### 6.5.1 Bending test

This test is applicable only to tools of Category 2.

The tool shall be supported by a testing device so that the bottom section is tilted as shown in Figure 3 (original tilted position). The tilt shall be 305 mm from vertical at a height of 1 520 mm from the bottom of the tool.

The testing device shall not cause any damage to the tool at the supporting points. The tool shall not be supported above the 1 520 mm position.

An external mass of  $(5,6 \pm 0,1)$  kg shall then be attached to the end fitting (see Figure 3) for 1 min.

The test shall be considered as passed if, after the test, the tool does not show signs of permanent deformation and the lock assemblies continue to operate as designed.

### 6.5.2 Free fall impact test

The tool shall be positioned vertically. The bottom of the tool shall be located 600 mm above a concrete or similar surface. When released, the downward movement of the tool shall not be restricted or slowed (see Figure 4).

The test shall be considered as passed if the tool does not collapse or reveal significant signs of damage to the lock assemblies and displays no sign of cracking of the tubes.

NOTE When low temperature conditions are expected during the use of tools, the user should discuss with the manufacturer the possibility of performing this test under temperature conditions different from the standard conditions.

### 6.5.3 Tension test

This test is applicable only to tools of Category 2.

The working end of the tool shall be bolted or clamped in a fixed position. The tool shall be supported in cradles or supports to be kept straight along its axis. The force shall be applied to the bottom end of the tool along its axis through a dynamometer (see Figure 5).

The tool shall withstand a tensile load of 1 323 N along its axis for 10 min, without damage.

NOTE The cradles or supports being used to keep the tool in the horizontal axis, the distance between them is not critical. The applied tensile load is representing a severe stress (like pulling on the stick when opening a line switch).

The test shall be considered as passed if the tool does not elongate or show any signs of deterioration and the lock assemblies continue to operate as designed.

### 6.5.4 Torsion test

This test is applicable only to tools of Category 2.

The working end of the tool shall be bolted or clamped in a fixed position. The tool shall be supported in cradles or supports to be kept straight along its axis. The force shall be applied to the bottom end of the tool (see Figure 6).

A maximum torque of 50 N·m shall be reached with a rate of rise of  $(5 \pm 2)$  N·m/s. The torque shall be maintained for 1 min before observing results.

The test shall be considered as passed if, after being at rest for 2 min, the tool does not show signs of permanent deformation and the lock assemblies continue to operate as designed.

### 6.5.5 Wear test

The tool shall be fully extended then retracted completely 200 times consecutively.

Following this procedure, the tool shall be re-submitted to, and shall satisfy, the following tests.

For tools of Category 1:

- test for hydrophobic properties. If the tool does not pass the test, the tool fails. If the tool passes the hydrophobic test, the following tests shall be performed:

- surface dielectric test;
- free fall impact test.

For tools of Category 2:

- test for hydrophobic properties. If the tool does not pass the test, the tool fails. If the tool passes the hydrophobic test, the following tests shall be performed:
  - surface dielectric test;
  - free fall impact test;
  - tension test;
  - torsion test.

If the tool does not pass all the tests in the order listed, the tool fails.

## **7 Quality assurance plan**

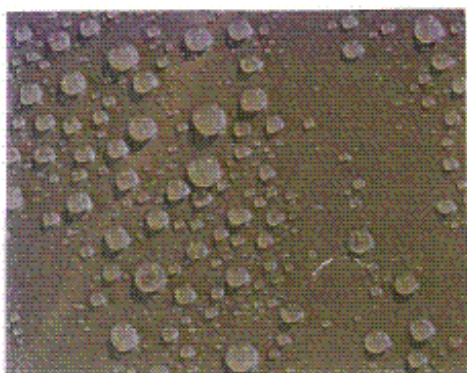
The quality assurance plan shall be in accordance with IEC 61318 and shall incorporate the requirements of Annex D.

## **8 Modifications**

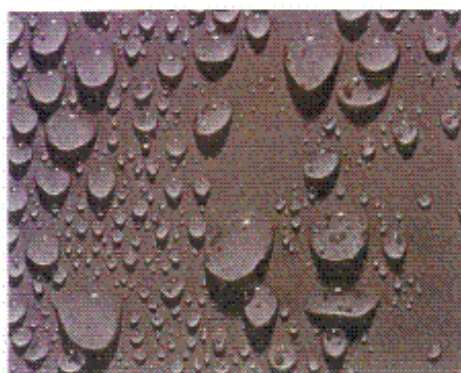
Any modification of the tool may require the type tests to be repeated, in whole or in part (if the degree of modification so justifies), as well as a change in tool reference literature.

Before carrying out any modification to any characteristic of a tool during the manufacture of an order, the manufacturer shall obtain the agreement of the customer.

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HC 1



HC 2



HC 3



HC 4



HC 5



HC 6

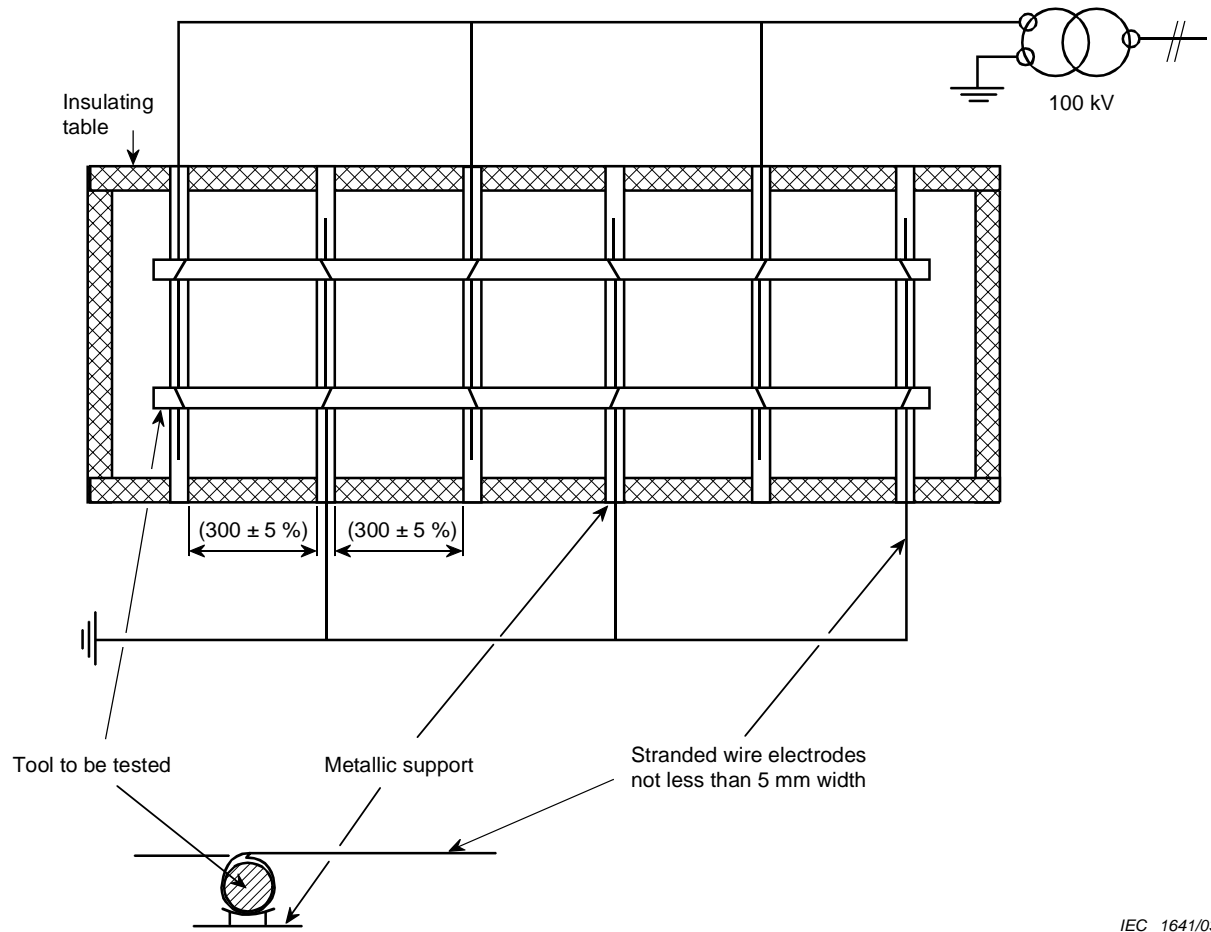
a) Typical examples of surfaces with HC from 1 to 6

Hydrophobicity classification	Description of the droplets
HC1	Only small discrete circular droplets
HC2	Only discrete, mostly circular droplets of varying size
HC3	Mostly discrete non-circular droplets, sides begin to flatten
HC4	Both discrete droplets and water running
HC5 – HC6	Increasing amount of water running and sheeting

b) Description of droplet surface with HC from 1 to 6

IEC 1640/03

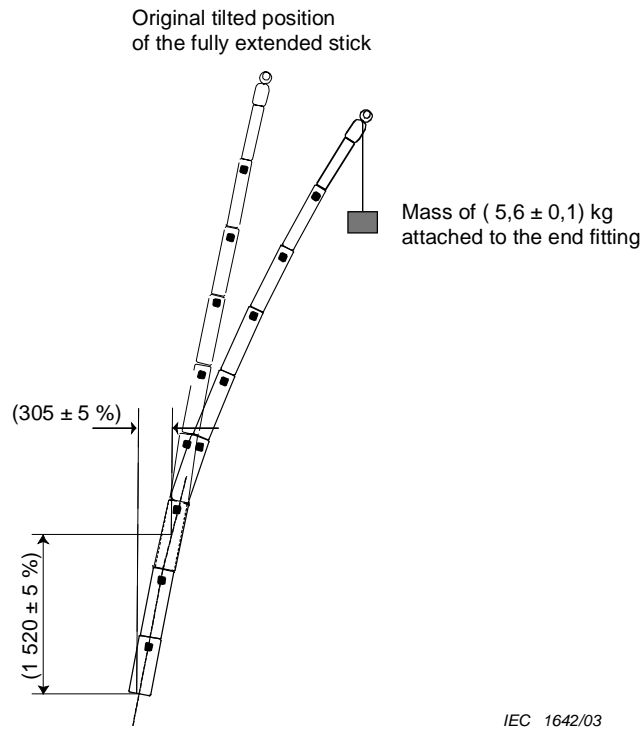
**Figure 1 – Test for surface hydrophobic properties – visual observation (see 6.4.1.1)**



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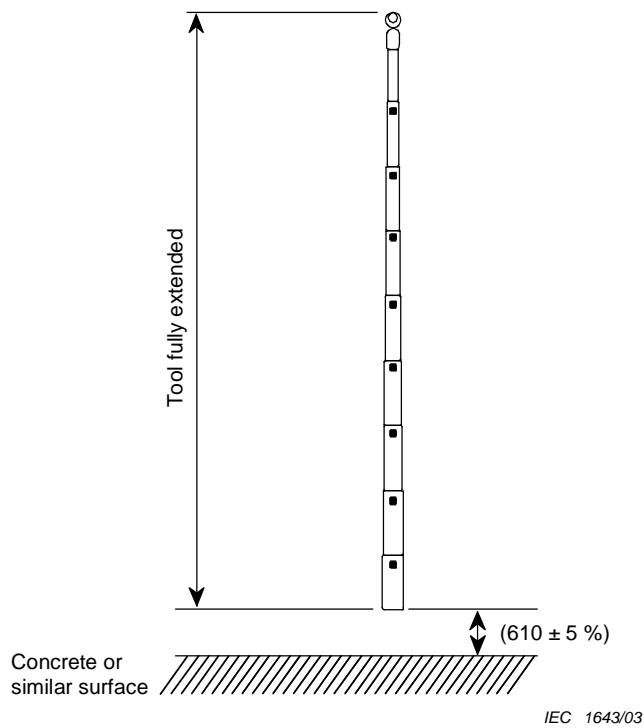
Dimensions in millimetres

**Figure 2 – Surface dielectric test (see 6.4.2)**



*Dimensions in millimetres*

**Figure 3 – Bending test (see 6.5.1)**



*Dimensions in millimetres*

**Figure 4 – Free fall impact test (see 6.5.2)**

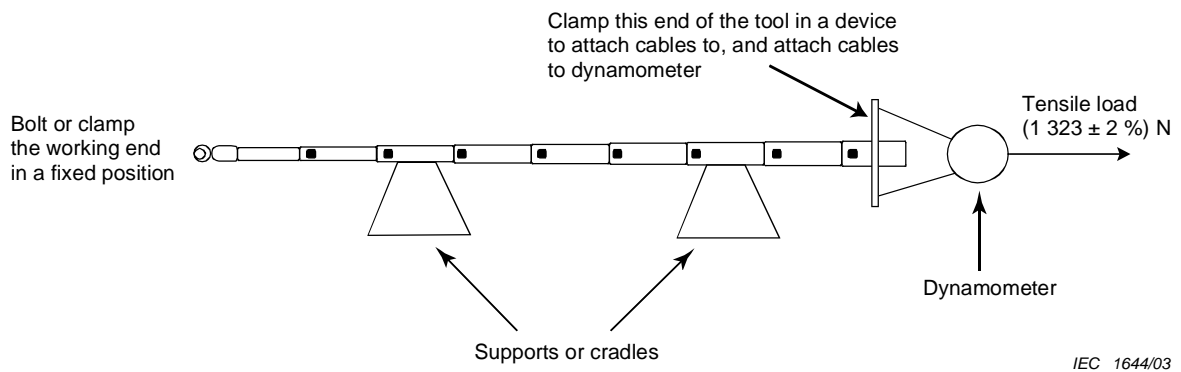


Figure 5 – Tension test (see 6.5.3)

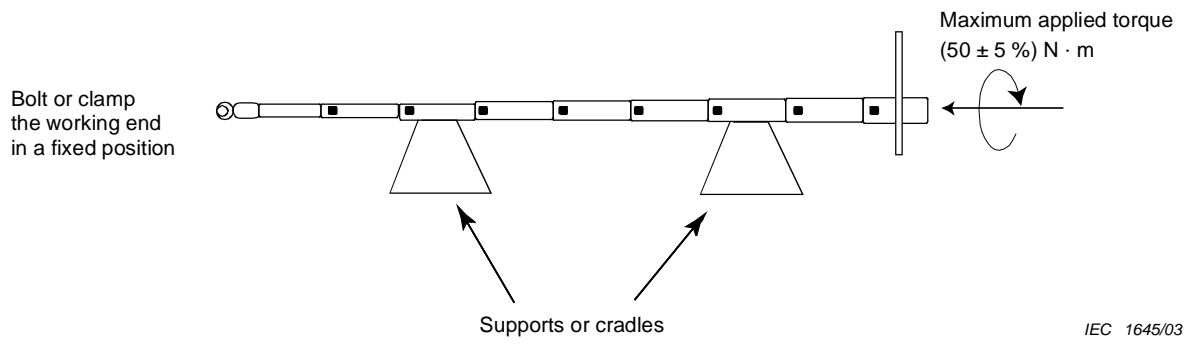


Figure 6 – Torsion test (see 6.5.4)



## **Annex A** (informative)

### **Selection of the length of the tip section of the tool**

In a telescopic stick and a telescopic measuring stick, the tip section is considered as the primary insulation.

Other sections made of hollow tubes may also be considered to be insulating, provided they are properly maintained (inside and outside). The extent to which these tubes are a part of the overall protection should be determined by the user.

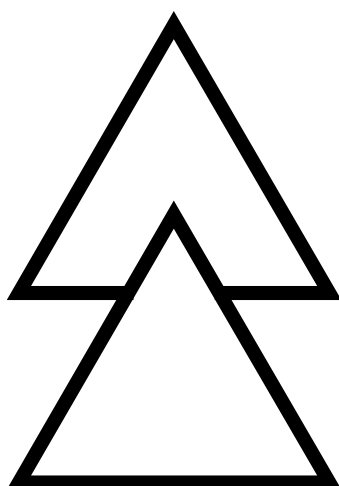
NOTE When in service and subjected to contamination, the inside of hollow tubes may become dirty and wet and do not give the assurance of a good insulation.

Users should select the minimum length of the tip section or extension according to the method of work and taking into account the minimum approach distances (see IEC 61472) and the flashover characteristics of the stick.

The use of the stick by personnel not trained for live working could request additional insulation.

**Annex B**  
(normative)

**Suitable for live working; double triangle**  
(IEC-60417-5216:2002-10)



IEC 1646/03

## Annex C (normative)

### Chronology of tests

**Table C.1 – Sequence of tests**

Order of tests	Type of tests	Subclauses		Category 1			Category 2		
		Requirements	Tests	Type	Routine	Sampling	Type	Routine	Sampling
1	Visual inspection	5.2 5.3 5.4	6.2.1	x	x		x	x	
2	Dimensional check	5.5	6.2.2	x		x	x		x
3	Durability of markings	5.6	6.3	x		x	x		x
4	Free fall impact	5.3	6.5.2	x		x	x		x
5	Tension	5.3	6.5.3				x		
6	Torsion	5.3	6.5.4				x		
7	Bending	5.3	6.5.1				x		
8	Hydrophobic surface properties	5.4 5.6	6.4.1	x		x	x		x
9	Surface dielectric test	5.3 5.6	6.4.2	x	x		x	x	
10	Wear	5.3	6.5.5	x			x		

## **Annex D** (normative)

### **Quality assurance plan**

#### **D.1 General**

This annex includes the details of the quality assurance plan for the products covered by this standard. The quality assurance plan defines the necessary tests to control the product quality and conformance to this standard.

The quality assurance plan includes three elements:

- routine tests;
- sampling plans;
- acceptance tests (see Annex E).

#### **D.2 Routine tests**

The routine tests as specified in Table C.1 shall be performed according to the chronological order indicated.

The visual observation and the surface dielectric test will provide the inspector with the means to detect and evaluate the severity of the surface defect. Any defects found may be considered critical, major or minor.

#### **D.3 Sampling plans**

##### **D.3.1 General**

The sampling procedure does not follow the guidance provided in ISO 2859-1, since the nature of the product, because of the degree of risk to personnel involved and the quantity produced, does not lend itself to the integral application of this standard. Since these important distinctions exist, special individual quality assurance measures are herein incorporated.

Each lot, defined in the sampling plans, consists of tools of the same category.

##### **D.3.2 Classification of defects**

The sampling plan and procedure is based on the type of defect likely to be found for the tools covered in this standard. The defects are identified as to whether they are major or minor.

Table D.1 gives the type of defects corresponding to each test retained for the sampling procedure.

**Table D.1 – Classification of defects**

List of tests	Subclause	Major	Minor
Dimensional check	6.2.2	X	
Durability of markings	6.3		X
Free fall impact	6.5.2	X	
Hydrophobic surface properties	6.4.1	X	

**D.3.3 Plan for major defects**

The number of tools undergoing the tests and the acceptance criterion shall be in accordance with Table 1 of IEC 61318.

**D.3.4 Plan for minor defects**

The number of tools undergoing the tests and the acceptance criterion shall be in accordance with Table 3 of IEC 61318.

**D.3.5 Procedure when testing is carried out in a laboratory other than the manufacturer's**

If, during the conduct of the sampling tests, the tools in a lot or batch are found to have a major defect, the testing shall be terminated and the manufacturer or supplier notified.

In such a case, the manufacturer or supplier may ask the customer or testing laboratory to submit proof that the test procedure and equipment conform to the applicable clauses of this standard.

When such proof has been established, the manufacturer or supplier may request that his representative witness the testing of additional tools from the shipment.

All rejected lots shall be returned as directed by the manufacturer or supplier.

**D.4 Records**

The test results shall be made available to the customers for a time period according to IEC 61318.

## **Annex E** (normative)

### **Acceptance tests**

As defined in IEC 61318, an acceptance test is a contractual test to prove to the customer that the item(s) or product(s) in question meet(s) certain conditions of the customer's specification. These tests may be carried out on every item (routine test) or on a sampling of the items (sampling test).

These tests are performed to verify that a certain design meets certain specifications (type test) and is acceptable to the customer.

If a customer requests in his specification that the device shall meet this IEC standard only, the acceptance tests (both routine and sampling) are those which are specified in this standard.

The customer may request additional tests or modify the sampling size but shall include this in his own specification. The expansion of the acceptance testing beyond the tests required in this standard is subject to agreement between the customer and the supplier.

The customer may wish to witness the tests, have them witnessed by a third party or accept the results of the tests carried out by the manufacturer. The customer may prefer to perform the tests in his own laboratory or specify that the tests be carried out in an independent laboratory of his choosing. This additional test expense is subject to agreement between the customer and the supplier.

## **Annex F** (informative)

### **In-service recommendations**

This annex is to help the users by giving at least the following information.

#### **F.1 Storage and transportation care**

All tools should be stored and transported, separate from each other, in such a manner as to prevent abrasion or physical contact with any surface that would damage the tool surface.

Storage facilities, such as tool trailers, tool canisters or compartments on vehicles, etc., should be maintained in such a manner as to prevent the accumulation of water, dirt or any other foreign material. It is recommended that tools should be stored in a clean and waxed condition.

#### **F.2 Use**

These tools complete with attachments are used to perform mechanical work on live parts at a distance. Tools equipped with a diagnostic device are used to reach parts of an installation to be tested. Tools equipped with graduations are used to measure distances to or between live parts.

When performing live working, the following conditions apply.

- Since only the tip section is considered as providing primary insulation, it shall be fully extended. Should work require reaching through or passing between live parts, caution should be exercised.
- The tool is intended to be used under dry conditions and its extended length should never be in contact with the ground or any possibly moist material.
- The tool is intended for light tension/compression and torque. Users should not exceed its mechanical capability.

The advantage of a telescopic tool is its compactness. The disadvantage is its flexibility. The users should take into consideration these aspects when developing safe and efficient methods of works.

#### **F.3 Inspection and cleaning (daily procedure)**

##### **F.3.1 Inspection**

The surface of each tool should be inspected for any defects that may cause it to fail during use such as blemishes, deep cuts, scratches, or abrasions.

Before and after use each day, the following procedure should be used.

- a) Wipe the surface of the tool with a clean white lint-free rag.
- b) Inspect the surface of the tool for dirt, creosote, grease, or any other foreign material. If any of these contaminants are found, clean according to F.3.2.
- c) Inspect the surface of the tool for deep cuts, scratches, nicks, gouges, or dents. If any are found, remove the tool from service.
- d) Visually inspect the tool for a glossy surface. If the tool does not have a glossy surface, clean and wax the tool according to the directions given below.

### **F.3.2 Cleaning**

If a tool has to be cleaned, the following procedure is recommended.

- a) Wipe glossy surface with a clean lint-free rag.
- b) Use only approved live line tool cleaners to clean the glossy surface of the tool. Follow the instructions printed on the container.

### **F.4 Field conditioning**

All tools shall be cleaned and waxed as needed, but at least every two years according to the following procedure.

- a) Clean the tool according to F.3.2. Manufacturer approved cleaning pads are available to facilitate the cleaning process of highly contaminated surfaces.
- b) Wax the glossy surface of the tool using only manufacturer approved wax.

### **F.5 Testing**

The tool's cleanliness, i.e., one that is not contaminated, and glossy waxed surface are keys to providing the maximum dielectric qualities. All tools should be electrically tested at least every two years.

### **F.6 Additional information**

#### **F.6.1 Cleaning**

Do not use soap detergents, liquid or powdered form, to clean tools under field conditions because of the following possible problems:

- the above-described cleaning agents will leave conductive residue unless rinsed with generous amounts of water (usually not available in the field);
- abrasive cleaners will destroy the surface gloss on the tool.

All tools that are subjected to such cleaning agents should be electrically tested under water droplet spray conditions to ensure complete removal of residue from soap-type cleaners.



### **F.6.2 Waxing**

Waxing the glossy surface of telescopic tools not only protects the glossy surface but also adds to the electrical integrity of the tool. Wax provides a protective barrier against dirt, creosote, etc., which is easily removed with an approved live line tool cleaner.

Waxing is not necessary after each and every use of the tool, but rather as needed to maintain a glossy surface. Only approved waxes should be used.

### **F.6.3 Testing guidelines**

All tests shall be performed by personnel thoroughly familiar with the testing equipment and the procedures. Safety precautions and the testing equipment instruction manuals shall be observed at all times.

The tool's cleanliness, i.e., one that is not contaminated, and has a smooth, glossy waxed surface, are keys to providing the maximum dielectric qualities. All tools should be electrically tested at least every two years.

A label should be attached to each tool that passes the electrical test indicating the next test date (two years from the date testing performed).

### **F.6.4 Inspection procedure**

All tools should be inspected for surface irregularities or structural damage. All tools with significant surface irregularities should be cleaned, waxed, and electrically tested. All tools with structural damage to the surface or at a joint, such as a hinged, pinned, or epoxied location should be repaired prior to electrically testing. All tools that fail the electrical test should be tagged and put aside for repair and refinishing before re-testing or they should be discarded. All tools should be cleaned and waxed prior to testing. The testing methods are described below.

### **F.6.5 Electrical testing procedure**

The electrical testing procedure should include a water droplet spray test made according to 6.4.1 (see Figure F.1 for an example of test arrangement). Suitable testing equipment also includes "hand-held" testers. The test procedure for each is slightly different based on the test equipment used. The intent of electrical testing is to verify the integrity of the tool along its entire "working length". Working length is defined as that section or length of the tool that provides the insulating characteristics necessary for employee protection.

### **F.6.6 Refinishing procedure**

All tools which have significant surface irregularities, cannot be cleaned sufficiently, or show excessive leakage current during the testing should be refinished and tested before being placed back in service. Spot refinishing is acceptable, depending on the general condition of the tool. The spot refinishing should be made according to the manufacturer's instructions and will be accomplished by using the following procedure.

- a) Light sanding is necessary to remove any marks or contamination remaining on the surface and to provide a more suitable surface for refinishing. Sand the surface of the tool with fine flint sandpaper. Scratches and dents should receive special attention to be sure that all dirt and impurities are removed.

- b) Deep dents or gouges will be filled with a two-part epoxy material available from the respective tool manufacturers in colours to match their tools. Clear epoxy resin, which is obtainable at most boating or automotive parts stores may be used if the above materials are not readily available. After the epoxy has been mixed and applied according to the manufacturer's instructions, a piece of cellophane tape, adhesive side out, may be pulled over the repaired area to produce a smooth surface which will blend with the circumference of the tool. Allow the epoxy to harden, then remove the tape. The area should then be sanded to restore the original profile and surface smoothness and to remove particles of tape remaining on the repaired areas.
- c) Wipe the tool down with a degreasing solvent and a clean soft cloth to remove the sanding dust and oily handprints.
- d) The tool is now ready to have the finish applied. Use a manufacturer recommended high gloss, pre-mixed polyurethane refinishing material which may be applied direct from the can using a sponge applicator. Thinning, if necessary, should be done according to the directions on the label. Mixing and application instructions are supplied with these products and shall be followed explicitly.

NOTE 1 In dry, cold weather, the prepared tool should be wiped with a clean, slightly damp cloth to reduce static before the finish is applied. This will prevent dust and lint particles that are in the air from becoming attracted to the tool during the refinishing process.

NOTE 2 Solvents must not be used on a newly finished surface 48 h after application.

- e) The surface of the tool should be coated with approved wax. Apply a thin uniform coat and buff thoroughly with a clean, soft cloth to produce a dry lustrous surface.
- f) The tool should then be electrically tested according to the instructions given above.

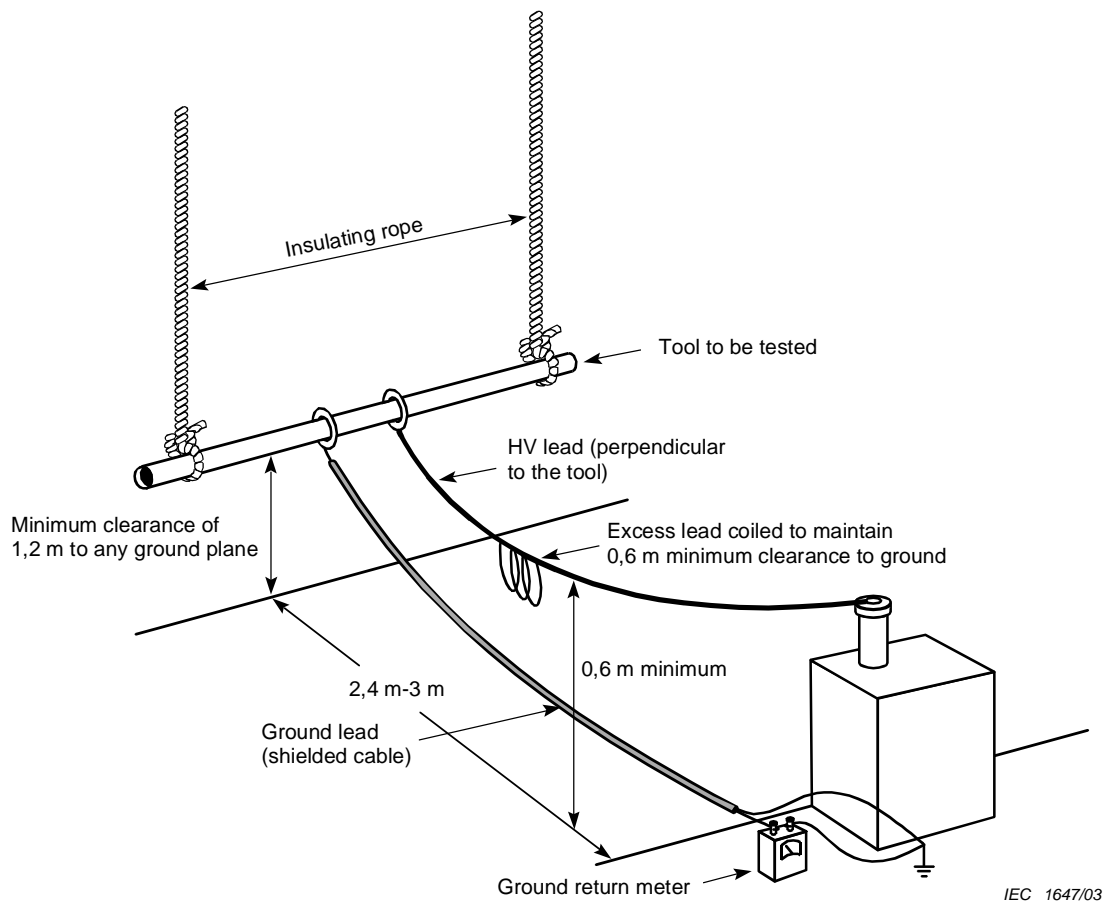
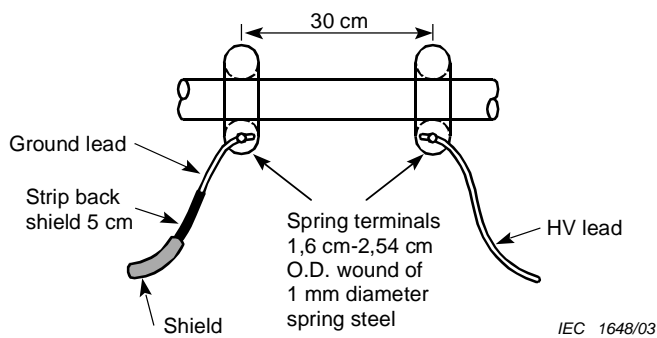


Figure F.1a – General test arrangement



NOTE Bend back tips of leads and apply solder so that lead tips will be held between spring coils.

Figure F.1b – Details of the terminal at tool

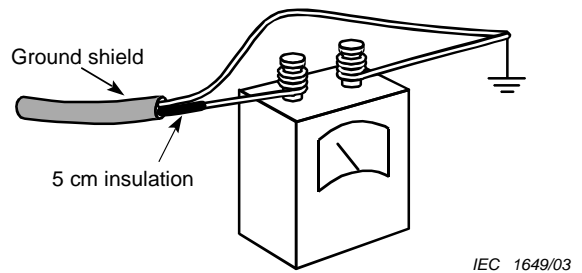


Figure F.1c – Details of the ground lead connection at meter

Figure F.1 – Typical set-up for high-voltage tests

## Bibliography

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

IEC 61472, *Live working – Minimum approach distances – Method of calculation*

IEC 61477:2001, *Live working – Minimum requirements for the utilization of tools, devices and equipment*  
Amendment 1:2002<sup>3</sup>

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*

STRI Guide 92/1, *Hydrophobicity Classification Guide*, Swedish Transmission Research Institute

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<sup>3</sup> There exists a consolidated edition 1.1 (2002) that includes edition 1 and its amendment.

**Egne notater/Notes:**

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