

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Safety requirements for electrical equipment for measurement, control  
and laboratory use –**

**Part 2-032: Particular requirements for HAND-HELD and hand-manipulated  
current sensors for electrical test and measurement**

**Exigences de sécurité pour appareils électriques de mesurage, de régulation  
et de laboratoire –**

**Partie 2-032: Exigences particulières pour les capteurs de courant, PORTATIFS  
et manipulés manuellement, pour essai électrique et mesurage**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC -

[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Safety requirements for electrical equipment for measurement, control  
and laboratory use –**

**Part 2-032: Particular requirements for HAND-HELD and hand-manipulated  
current sensors for electrical test and measurement**

**Exigences de sécurité pour appareils électriques de mesurage, de régulation  
et de laboratoire –**

**Partie 2-032: Exigences particulières pour les capteurs de courant, PORTATIFS  
et manipulés manuellement, pour essai électrique et mesurage**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 19.080

ISBN 978-2-8322-6994-7

**Warning! Make sure that you obtained this publication from an authorized distributor.**

**Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

|                                                                                                                        |    |
|------------------------------------------------------------------------------------------------------------------------|----|
| FOREWORD.....                                                                                                          | 4  |
| INTRODUCTION.....                                                                                                      | 7  |
| 1 Scope and object.....                                                                                                | 8  |
| 2 Normative references .....                                                                                           | 10 |
| 3 Terms and definitions .....                                                                                          | 10 |
| 4 Tests .....                                                                                                          | 11 |
| 5 Marking and documentation.....                                                                                       | 12 |
| 6 Protection against electric shock .....                                                                              | 16 |
| 7 Protection against mechanical HAZARDS.....                                                                           | 21 |
| 8 Resistance to mechanical stresses .....                                                                              | 21 |
| 9 Protection against the spread of fire .....                                                                          | 25 |
| 10 Equipment temperature limits and resistance to heat.....                                                            | 25 |
| 11 Protection against HAZARDS from fluids and solid foreign objects .....                                              | 26 |
| 12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure .....              | 26 |
| 13 Protection against liberated gases and substances, explosion and implosion .....                                    | 26 |
| 14 Components and subassemblies .....                                                                                  | 27 |
| 15 Protection by interlocks .....                                                                                      | 28 |
| 16 HAZARDS resulting from application .....                                                                            | 28 |
| 17 RISK assessment .....                                                                                               | 28 |
| Annexes .....                                                                                                          | 36 |
| Annex D (normative) Parts between which insulation requirements are specified (see 6.4, 6.5.3, 6.9.101 and 6.101)..... | 36 |
| Annex F (normative) Routine tests .....                                                                                | 38 |
| Annex K (normative) Insulation requirements not covered by 6.7 .....                                                   | 39 |
| Annex L (informative) Index of defined terms .....                                                                     | 46 |
| Annex AA (normative) MEASUREMENT CATEGORIES .....                                                                      | 47 |
| Annex BB (informative) HAZARDS pertaining to measurements performed in certain environments .....                      | 49 |
| Annex CC (informative) 4-mm "banana" TERMINALS .....                                                                   | 52 |
| Annex DD (informative) Flowchart for insulation according to the type of circuit.....                                  | 54 |
| Annex EE (normative) CLAMP MULTIMETER .....                                                                            | 57 |
| Bibliography.....                                                                                                      | 60 |
| Figure 101 – Examples of current sensors and their parts.....                                                          | 9  |
| Figure 102 – CLEARANCE between the PROTECTIVE BARRIER to the JAWS and to the HAZARDOUS LIVE conductor .....            | 19 |
| Figure 103 – Abrasion test of the JAW ENDS.....                                                                        | 22 |
| Figure 104 – Impact points for JAW impact test.....                                                                    | 23 |
| Figure 105 – Indentation device .....                                                                                  | 24 |
| Figure 106 – Test probe to check protection against short-circuits .....                                               | 34 |
| Figure 107 – Use of the test probe of Figure 106 .....                                                                 | 34 |

|                                                                                                                                                              |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Figure D.101 – Parts of current sensors (see also Table D.101) .....                                                                                         | 36 |
| Figure AA.1 – Example to identify the locations of measuring circuits .....                                                                                  | 48 |
| Figure CC.1 – Recommended dimensions of 4-mm TERMINALS .....                                                                                                 | 53 |
| Figure DD.1 – Requirements for CLEARANCE, CREEPAGE DISTANCE and solid insulation.....                                                                        | 56 |
| Figure EE.1 – Examples of CLAMP MULTIMETERS .....                                                                                                            | 57 |
| Table 1 – Symbols .....                                                                                                                                      | 12 |
| Table 101 – CLEARANCES and CREEPAGE DISTANCES for measuring circuit TERMINALS<br>with HAZARDOUS LIVE conductive parts up to 1 000 V a.c. or 1 500 V d.c..... | 17 |
| Table 102 – Energy level for JAW impact test .....                                                                                                           | 22 |
| Table 103 – Pull forces for endcaps of flexible current sensors .....                                                                                        | 25 |
| Table 104 – Impulse voltages .....                                                                                                                           | 28 |
| Table 105 – Thickness of the test probe of Figure 106 and test voltages.....                                                                                 | 35 |
| Table D.101 – Insulation requirements for current sensors.....                                                                                               | 37 |
| Table K.101 – CLEARANCES of measuring circuits RATED for MEASUREMENT CATEGORIES .....                                                                        | 40 |
| Table K.102 – a.c. test voltages for testing electric strength of solid insulation in<br>measuring circuits RATED for MEASUREMENT CATEGORIES .....           | 41 |
| Table K.103 – Impulse test voltages for testing electric strength of solid insulation in<br>measuring circuits RATED for MEASUREMENT CATEGORIES .....        | 42 |
| Table K.104 –Test voltages for testing long-term stress of solid insulation in measuring<br>circuits RATED for MEASUREMENT CATEGORIES .....                  | 43 |
| Table K.105 – Minimum values for distance or thickness of solid insulation in<br>measuring circuits RATED FOR MEASUREMENT CATEGORIES III and IV .....        | 44 |
| Table AA.1 – Characteristics of MEASUREMENT CATEGORIES .....                                                                                                 | 48 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT  
FOR MEASUREMENT, CONTROL, AND LABORATORY USE –****Part 2-032: Particular requirements for HAND-HELD and  
hand-manipulated current sensors for electrical test and measurement**

## 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61010-2-032 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment.

This fourth edition cancels and replaces the third edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) It has been indicated that current sensors used as FIXED EQUIPMENT are not within the scope of this document.
- b) Fork-style current sensors have been added.

- c) Requirements from Part 2-033 applicable to CLAMP MULTIMETERS that have a primary purpose of measuring voltage on live MAINS have been included in the new normative Annex EE.
- d) CLEARANCES and CREEPAGE DISTANCES for measuring circuit TERMINALS exceeding 1 000 V a.c. or 1 414 V d.c. and for WET LOCATIONS have been specified.
- e) Reduced CREEPAGE DISTANCES are allowed to be according to material group I for all insulating materials.
- f) Requirements for input/output circuits of Type A, Type B and Type C current sensors have been detailed in 6.9.102.
- g) Requirements for output circuit leads have been modified.
- h) The JAW impact test has been limited to the front of the JAWS.
- i) The abrasion test for cords of flexible current sensors has been removed and replaced by a pressure test at high temperature.
- j) The voltage source for testing overvoltage limiting components or circuits may be limited to 400 V.
- k) Reference to IEC 61010-031 for probe assemblies has been added.
- l) Requirements for the prevention of TRANSIENT OVERVOLTAGES for MAINS voltage measuring circuits have been added.
- m) Requirements for measuring circuits from 1 000 V to 3 000 V have been added.
- n) An informative Annex CC about the dimensions of banana TERMINALS has been added.
- o) A flowchart for insulation according to the type of circuit has been added in a new Annex DD.

The text of this International Standard is based on the following documents:

| FDIS        | Report on voting |
|-------------|------------------|
| 66/691/FDIS | 66/695/RVD       |

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

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

A list of all parts of the IEC 61010 series, under the general title *Safety requirements for electrical equipment for measurement, control, and laboratory use*, can be found on the IEC website.

This Part 2-032 is to be used in conjunction with the latest edition of IEC 61010-1. It was established on the basis of the third edition (2010) of IEC 61010-1 and its Amendment 1 (2016), hereinafter referred to as Part 1.

This Part 2-032 supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for HAND-HELD and hand-manipulated current sensors for electrical test and measurement*.

Where a particular subclause of Part 1 is not mentioned in this Part 2-032, that subclause applies as far as is reasonable. Where this Part 2-032 states "addition", "modification", "replacement", or "deletion" the relevant requirement, test specification or note in Part 1 should be adapted accordingly.

In this standard:

a) the following print types are used:

- requirements: in roman type;
- NOTES: in small roman type;
- *conformity and tests: in italic type;*
- terms used throughout this standard which have been defined in Clause 3: SMALL ROMAN CAPITALS;

b) subclauses, figures, tables and notes which are additional to those in Part 1 are numbered starting from 101. Additional annexes are lettered starting from AA and additional list items are lettered from aa).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

Part 2-030 specifies the safety requirements for equipment with testing and measuring circuits which are connected for test or measurement purposes to devices or circuits outside the measurement equipment itself. Requirements of Part 2-030 have been included in this Part 2-032. Equipment within the scopes of both Part 2-030 and Part 2-032 are considered to be covered by the requirements of this Part 2-032.

Part 2-033 specifies the safety requirements for hand-held multimeters that have the primary purpose of measuring voltage on live MAINS. For equipment within the scope of Part 2-032 and Part 2-033, only this Part 2-032 is applicable.

Part 2-034 specifies the safety requirements for measurement equipment for insulation resistance and test equipment for electric strength which are connected to units, lines or circuits for test or measurement purposes. For equipment within the scope of Part 2-032 and Part 2-034, both documents should be read in conjunction.

## SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE –

### Part 2-032: Particular requirements for HAND-HELD and hand-manipulated current sensors for electrical test and measurement

#### 1 Scope and object

This clause of Part 1 is applicable except as follows:

##### 1.1.1 Equipment included in scope

*Replace the existing text with the following:*

This part of IEC 61010 specifies safety requirements for HAND-HELD and hand-manipulated current sensors described below.

These current sensors are for measuring, detecting or injecting current, or indicating current waveforms on circuits without physically opening the current path of the circuit being measured. They can be stand-alone current sensors or accessories to other equipment or parts of combined equipment (see Figure 101). These include measurement circuits which are part of electrical test and measurement equipment, laboratory equipment, or process control equipment. These current sensors and circuits need additional protective means between the current sensor, the circuit and an OPERATOR.

NOTE 1 Combined equipment is equipment that is electrically connected to a current sensor by means of a permanent connection which can be detached only by the use of a TOOL.

NOTE 2 Some current sensors are also known as current clamps, CLAMP MULTIMETERS and current probes.

Current sensors are hand-manipulated before and/or after a test or measurement, but do not necessarily need to be HAND-HELD during the test or measurement. Current sensors used as FIXED EQUIPMENT are not within the scope of this document.

The following types of current sensors are covered:

- a) Type A: a current sensor designed to be applied to or removed from HAZARDOUS LIVE UNINSULATED CONDUCTORS. Type A current sensors have defined HAND-HELD or hand-manipulated parts providing protection against electric shock from the conductor being measured, and also have protection against short-circuits between wires and between busbars during clamping.
- b) Type B: a current sensor which has protection against short-circuits between wires or busbars during clamping but without defined HAND-HELD or hand-manipulated parts which provide protection against electric shock during clamping. Additional protective means are necessary to avoid electric shock from HAZARDOUS LIVE conductors which cannot be de-energised during application or removal of the current sensor.

EXAMPLE 1 Flexible current sensors.

- c) Type C: a current sensor without protection against short-circuits between wires or busbars during clamping. Type C current sensors are intended to be applied to or removed from HAZARDOUS LIVE UNINSULATED CONDUCTORS or from non-limited-energy circuit conductors only when they are de-energised.

EXAMPLE 2 Split-core transducers.

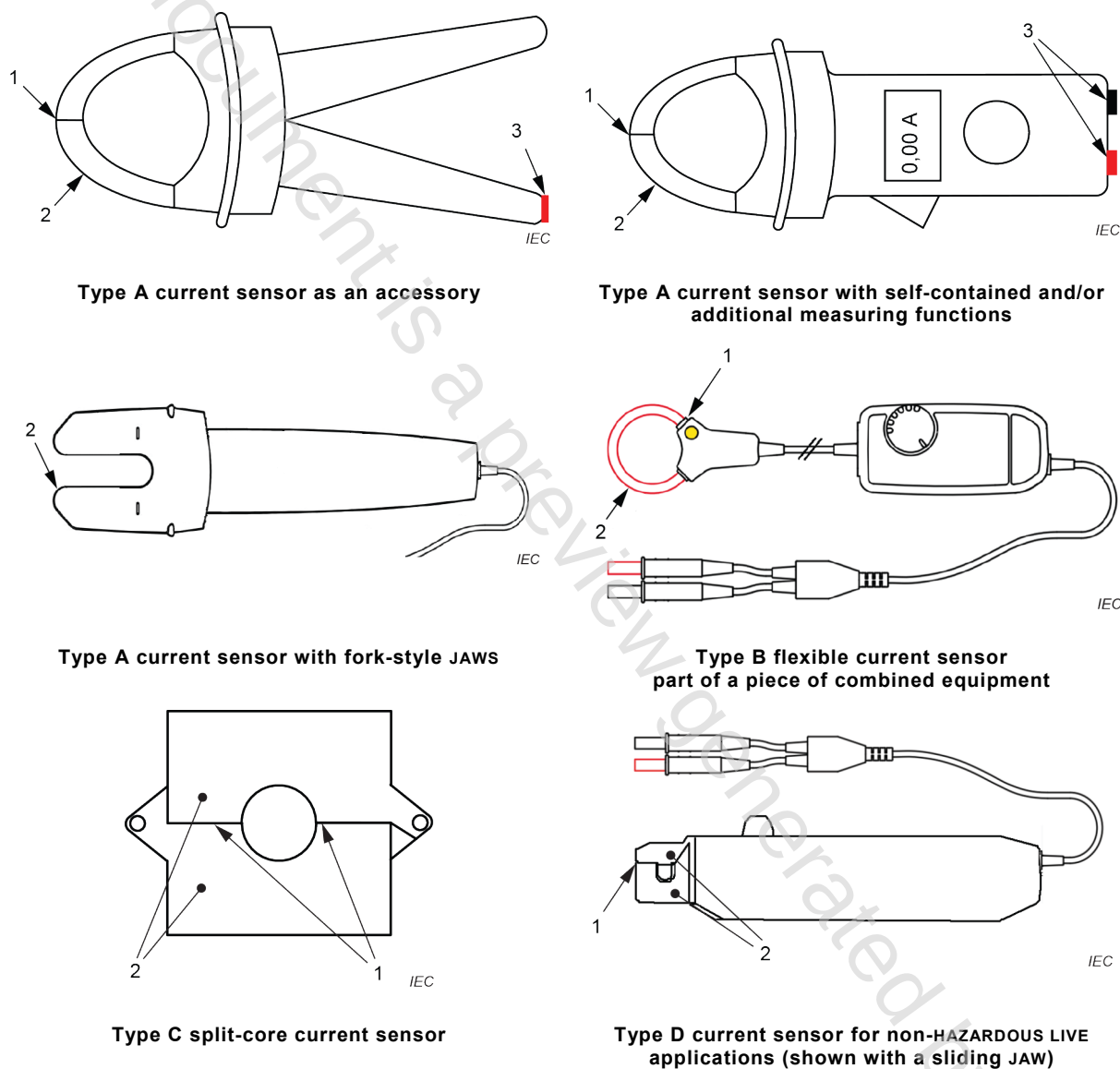
- d) Type D: a current sensor designed to be applied to or removed from insulated conductors or from limited-energy circuit conductors.

EXAMPLE 3 Current probes for oscilloscopes and earth leakage current detectors.

All current sensors can also be used with insulated conductors. In this case, HAZARDS are limited to acceptable levels by the insulation of the conductors.

Additional requirements for CLAMP MULTIMETERS are given in Annex EE.

Figure 101 shows graphical representations of typical current sensors for illustration purposes. Current sensors can look different depending on the design.



**Figure 101 – Examples of current sensors and their parts**

### 1.2.1 Aspects included in scope

Add the following three new paragraphs at the end of the subclause:

Requirements for protection against HAZARDS resulting from NORMAL USE and REASONABLY FORESEEABLE MISUSE of measuring circuits are given in Clause 101.

Requirements for prevention of HAZARD from arc flash and short-circuits are given in Clause 102.

Requirements for reliance on the displayed value of CLAMP MULTIMETERS are given in Clause EE.5 .

## 2 Normative references

This clause of Part 1 is applicable except as follows:

*Replace "IEC 61010-031" with the following new reference:*

IEC 61010-031:2015, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 031: Safety requirements for hand-held and hand-manipulated probe assemblies for electrical test and measurement*  
IEC 61010-031:2015/AMD1:2018

*Replace "IEC 61180-1 (all parts)", "IEC 61180-1" and "IEC 61180-2", with the following new reference:*

IEC 61180, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

## 3 Terms and definitions

This clause of Part 1 is applicable except as follows:

### 3.1 Equipment and states of equipment

*Add the following two new terms and definitions:*

#### 3.1.101

##### **HAND-HELD**

intended to be supported by one hand during NORMAL USE

#### 3.1.102

##### **CLAMP MULTIMETER**

HAND-HELD multi-range and multifunction measuring instrument intended to measure current on a live MAINS without physically opening the conductors, voltage on a live MAINS and other electrical quantities such as resistance

### 3.2 Parts and accessories

*Add the following two new terms and definitions:*

#### 3.2.101

##### **JAW**

part of a current sensor which surrounds or partially surrounds the conductor under test

#### 3.2.102

##### **JAW END**

part of the JAW where opening occurs while clamping around a conductor