IEC 61010-031

Edition 2.0 2018-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

AMENDMENT 1
AMENDEMENT 1

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

Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 031: Exigences de sécurité pour sondes équipées portatives et manipulées à la main pour mesurage et essais électriques

IEC 61010-031:2015-05/AMD1:2018-05(en-fr)

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

Tel.: +41 22 919 02 11
info@iec.ch
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - 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 It also gives information on projects, replaced and withdrawn publications.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
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions 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
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.

IEC Customer Service Centre - 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.

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.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

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

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions 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
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.

Service Clients - 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.

IEC 61010-031

Edition 2.0 2018-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

AMENDMENT 1
AMENDEMENT 1

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

Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 031: Exigences de sécurité pour sondes équipées portatives et manipulées à la main pour mesurage et essais électriques

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 19.080

ISBN 978-2-8322-6159-0

FOREWORD

This amendment has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment.

This bilingual version (2018-10) corresponds to the monolingual English version, published in 2018-05.

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

FDIS	Report on voting
66/664/FDIS	66/670/RVD

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

The French version of this amendment has not been voted upon.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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.

Title

Replace the part title as follows:

Part 031: Safety requirements for hand-held and hand-manipulated probe assemblies for electrical test and measurement

1 Scope and object

1.1.1 Probe assemblies included in scope

Figure 4 – Examples of Type D probe assemblies

Delete, in key 3, the words “or clamp”.

3 Terms and definitions

3.1.1
TERMINAL

Note 1 to entry:

Delete the word "connectors,".

3.1.5
CONNECTOR

Delete, in the definition, the words "a CONNECTOR of" *so that the end of the sentence will read:*

"…to connect to a TERMINAL of the equipment or to another probe assembly".

3.4.11
MEASUREMENT CATEGORY

Replace the existing text of the definition with the following:

classification of testing and measuring circuits according to the types of mains to which they are intended to be connected

4 Tests

4.3.9 Duty cycle

Replace the existing title of 4.3.9 with the following:

4.3.9 Short-term or intermittent operation

4.4.4.2 Temperature

Replace the existing second paragraph with the following:

This temperature is determined by measuring the temperature rise of the surface or part and adding it to the ambient temperature of 40 °C, or to the maximum RATED ambient temperature if higher.

4.5.2 Fuses

Replace, in the fourth sentence of the second paragraph, the word "MAINS" *(in SMALL CAPS) with* "mains" *(in regular font).*

5 Marking and documentation

5.1.5 RATING

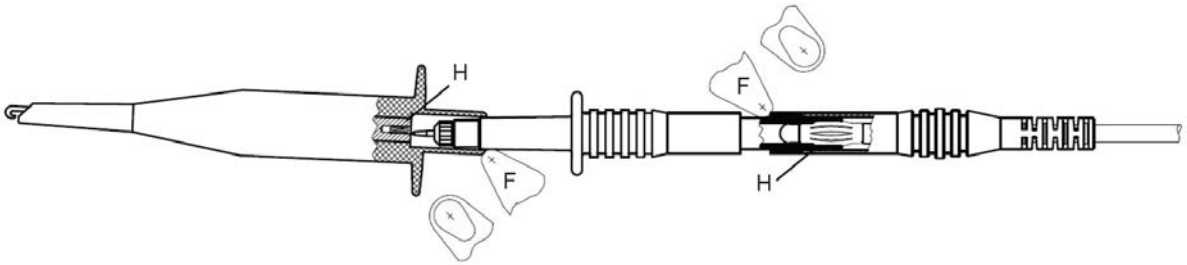
Replace, in list item a) of the first paragraph, the words "(see also 5.4.3 f) and g))" *with* "(see also 5.4.3 k))".

6 Protection against electric shock

6.2.2 Examination

Figure 6 – Methods for determination of ACCESSIBLE parts (see 6.2) and for voltage tests (see 6.4.2)

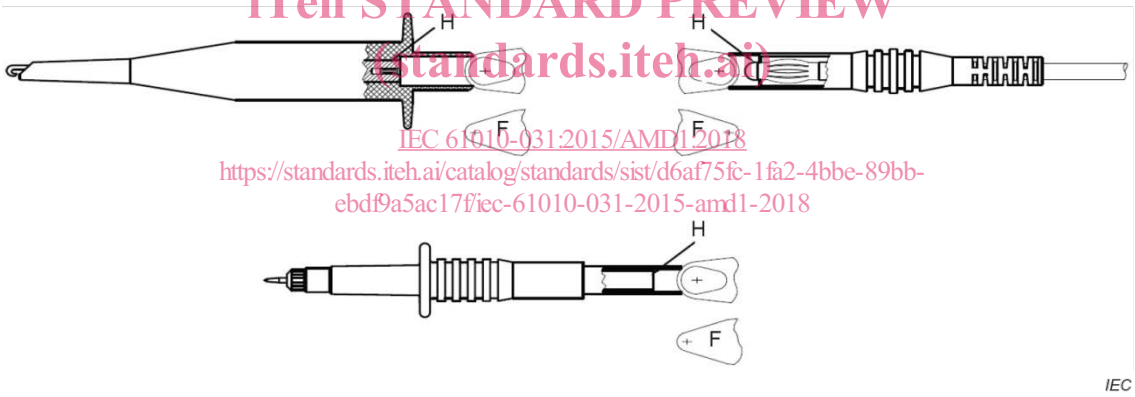
Replace the existing subfigures 6c and 6d with the following new subfigures:



Connecting parts are partially mated so as just to make electrical contact while allowing maximum access to the test finger.

Note the two possible positions of the test finger.

Figure 6c – Partially mated probe assemblies (see 6.2 and 6.4.2 b))



Key

F rigid test finger (see Figure B.1)

H potentially HAZARDOUS LIVE part

Note the two possible positions of the test finger.

Figure 6d – Unmated parts of a probe assembly (see 6.2 and 6.4.2 c))

6.3.4.1 General

Replace, in the first paragraph, the existing list with the following:

a) the probe body;

b) hand-held or hand-manipulated parts of each CONNECTOR;

c) 150 mm ± 20 mm of the PROBE WIRE or the maximum length of the cable whichever is shorter;

d) other hand-held or hand-manipulated parts.

Figure 8 – Voltage and touch current measurement

Delete, in the text of key item 2c, the words "(see 12.3.2)".

6.3.4.2 Probe assemblies with floating outer conductors

Figure 10 – Voltage and touch current measurement with shielded test probe

Delete, in the text of key item 2c, the words "(see 12.3.2)".

6.3.4.3 High frequency test probes

Replace, in the fourth paragraph, "*the circuit from A.3*" *with* "*the circuit from Figure A.3*".

6.4.1 General

Replace, in the third paragraph, the existing list with the following list:

a) DOUBLE INSULATION, consisting of BASIC INSULATION plus SUPPLEMENTARY INSULATION (see 6.4.6)
b) BASIC INSULATION plus impedance (see 6.4.4);
c) REINFORCED INSULATION (see 6.4.6);
d) PROTECTIVE IMPEDANCE (see 6.4.5).

6.4.2 CONNECTORS

Add, at the end of the sentence of 6.4.2 c) 2), "(see Figure 5)".

6.4.3.2 Protection by a PROTECTIVE FINGERGUARD

Replace the existing third paragraph with the following:

The height of the PROTECTIVE FINGERGUARD from the side where the fingers are intended to be applied shall be at least 2 mm.

6.4.3.4 Protection by tactile indicator

Replace the existing first paragraph with the following:

SPRING-LOADED CLIPS RATED for MEASUREMENT CATEGORY II or without MEASUREMENT CATEGORY for maximum 300 V which require finger pressure at about 90° to the axis of the clip are acceptable without a PROTECTIVE FINGERGUARD, provided that there is a tactile indicator to indicate the limit of safe access for the OPERATOR.

6.4.3.5 PROBE TIPS used as CONNECTORS

Replace the text with the following text:

PROBE TIPS which can be used as CONNECTORS and are intended to be connected to specified accessories (for example to a SPRING-LOADED CLIP) shall, in combination with those accessories, also meet the requirements for CONNECTORS in fully-mated position and partially-mated position (see 6.4.2 a) and b)).

6.5.1.2.4 SOLID INSULATION

Delete the entire subclause including Table 4, Table 5, Figure 15, Figure 16 and Figure 17.

Add the following new subclause:

6.5.1.3 Solid insulation

The term “solid insulation” is used to describe many different types of construction, including monolithic blocks of insulating material and insulation subsystems composed of multiple insulating materials, organized in layers or otherwise.

The electric strength of a thickness of solid insulation is considerably greater than that of the same thickness of air. The insulating distances through solid insulation are therefore typically smaller than the distances through air. As a result, electric fields in solid insulation are typically higher, and often are less homogeneous.

Solid insulation material may contain gaps or voids. When a solid insulation system is constructed from layers of solid materials, there are also likely to be gaps or voids between layers. These voids will perturb the electric field so that a disproportionately large part of the electric field is located in the void, potentially causing ionization within the void, resulting in partial discharge. These partial discharges will influence the adjacent solid insulation and may reduce its service life.

Solid insulation is not a renewable medium: damage is cumulative over the life of the equipment. Solid insulation is also subject to ageing and to degradation from repeated high voltage testing.

Conformity is checked as specified in 6.5.2.5 and 6.5.2.6.

6.5.2.2 CLEARANCES for probe assemblies of MEASUREMENT CATEGORIES II, III and IV

Replace the existing Table 6 with the following:

Table 6 – CLEARANCES of probe assemblies RATED for MEASUREMENT CATEGORIES

Nominal a.c. r.m.s. line-to-neutral or d.c. voltage of mains to which the probe assembly is designed to be connected V	CLEARANCE mm					
	BASIC INSULATION and SUPPLEMENTARY INSULATION			REINFORCED INSULATION		
	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV
≤ 50	0,04	0,1	0,5	0,10	0,32	1,4
> 50 ≤ 100	0,1	0,5	1,5	0,32	1,4	3,0
> 100 ≤ 150	0,5	1,5	3,0	1,4	3,0	6,0
> 150 ≤ 300	1,5	3,0	5,5	3,0	6,0	10,4
> 300 ≤ 600	3,0	5,5	8	6,0	10,4	15
> 600 ≤ 1 000	5,5	8	14	10,4	15	23,9
> 1 000 ≤ 1 500	8	11	18	16	22	36
> 1 500 ≤ 2 000	14	18	22	28	36	44
> 2 000 ≤ 3 000	18	22	25	36	44	50

Replace, in the conformity statement, the word "clearance" *with* "CLEARANCE" *(in SMALL CAPS)*.

6.5.2.3.1 General

Replace, in the second paragraph, the words "required clearance" *with* "required CLEARANCE".

Add the following two new subclauses, Table 4, Table 5, Table 14, Figure 15, Figure 16 and Figure 17:

6.5.2.5 Solid insulation of probe assemblies RATED for MEASUREMENT CATEGORIES

6.5.2.5.1 General

6.5.2.5.1.1 Solid insulation of probe assemblies RATED for MEASUREMENT CATEGORIES shall withstand the electrical and mechanical stresses that may occur in NORMAL USE and in all RATED environmental conditions (see 1.4) during the intended life of the probe assembly.

The manufacturer should take the expected life of the probe assembly into account when selecting insulating materials.

Conformity is checked by both of the following tests:

a) the a.c. voltage test of 6.6.5.1 with a duration of at least 5 s using the applicable test voltage of Table 4 or the impulse voltage test of 6.6.5.3 using the applicable test voltage of Table 14;

b) the a.c. voltage test of 6.6.5.1 or if stressed only by d.c., the d.c. voltage test of 6.6.5.2, with a duration of at least 1 min using the test voltage determined by 6.5.2.5.1.2.

NOTE Test a) checks the effects of transient overvoltages, while test b) checks the effects of long-term stress of solid insulation.

Table 4 – a.c. test voltages for testing electric strength of solid insulation in probe assemblies RATED for MEASUREMENT CATEGORIES

Nominal a.c. r.m.s. line-to-neutral or d.c. voltage of mains being measured V	a.c. test voltage V r.m.s					
	BASIC INSULATION and SUPPLEMENTARY INSULATION			REINFORCED INSULATION		
	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV
≤ 50	370	500	840	500	720	1300
> 50 ≤ 100	500	840	1 400	720	1 300	2 200
> 100 ≤ 150	840	1 400	2 200	1 300	2 200	3 500
> 150 ≤ 300	1 400	2 200	3 300	2 200	3 500	5 100
> 300 ≤ 600	2 200	3 300	4 300	3 500	5 100	7 000
> 600 ≤ 1 000	3 300	4 300	6 600	5 100	7 000	10 000
> 1 000 ≤ 1 500	4 300	5 400	8 200	7 400	9 700	15 000
> 1 500 ≤ 2 000	6 600	8 200	9 700	12 000	15 000	18 000
> 2 000 ≤ 3 000	8 200	9 700	11 000	15 000	18 000	20 000

Table 14 – Impulse test voltages for testing electric strength of solid insulation in probe assemblies RATED for MEASUREMENT CATEGORIES

Nominal a.c. r.m.s. line-to-neutral or d.c. voltage of mains being measured V	Impulse test voltage V peak					
	BASIC INSULATION and SUPPLEMENTARY INSULATION			REINFORCED INSULATION		
	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV
≤ 50	500	800	1 500	800	1 280	2 400
> 50 ≤ 100	800	1 500	2 500	1 280	2 400	4 000
> 100 ≤ 150	1 500	2 500	4 000	2 400	4 000	6 400
> 150 ≤ 300	2 500	4 000	6 000	4 000	6 400	9 600
> 300 ≤ 600	4 000	6 000	8 000	6 400	9 600	12 800
> 600 ≤ 1 000	6 000	8 000	12 000	9 600	12 800	19 200
> 1 000 ≤ 1 500	8 000	10 000	15 000	13 500	17 900	27 100
> 1 500 ≤ 2 000	12 000	15 000	18 000	21 400	27 100	32 000
> 2 000 ≤ 3 000	15 000	18 000	20 000	27 100	32 000	36 000

6.5.2.5.1.2 Test voltage values for testing long term stress of solid insulation are determined as follows:

The test voltage for BASIC INSULATION and SUPPLEMENTARY INSULATION is calculated from:

$$U_T = A \times U_N + B$$

where

U_T is the test voltage;

U_N is the nominal a.c. r.m.s. line-to-neutral or d.c. voltage of mains being measured;

A and *B* are parameters determined as follows:

when $U_N \leq 1\,000$ V, $A = 1$ and $B = 1\,200$ V

when $U_N > 1\,000$ V, $A = 1{,}5$ and $B = 750$ V

The a.c. test voltage is equal to U_T and the d.c. test voltage is equal to $1{,}414 \times U_T$.

For REINFORCED INSULATION, the test voltage value is twice the value for BASIC INSULATION.

6.5.2.5.1.3 Solid insulation shall also meet the following requirements, as applicable:

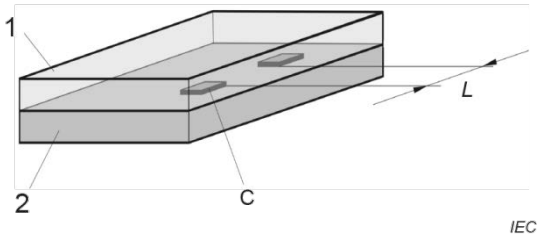
1) for solid insulation used as an ENCLOSURE or PROTECTIVE FINGERGUARD, the requirements of Clause 8;
2) for moulded and potted parts, the requirements of 6.5.2.5.2;
3) for insulating layers of printed wiring boards, the requirements of 6.5.2.5.3;
4) for thin-film insulation, the requirements of 6.5.2.5.4.

Conformity is checked as specified in 6.5.2.5.2 to 6.5.2.5.4, and in Clause 8, as applicable.

6.5.2.5.2 Moulded and potted parts

For BASIC INSULATION, SUPPLEMENTARY INSULATION, and REINFORCED INSULATION, conductors located between the same two layers moulded together (see Figure 15, item *L*) shall be separated by at least the applicable minimum distance of Table 5 after the moulding is completed.

Conformity is checked by inspection and either by measurement of the separation or by inspection of the manufacturer's specifications.



Key

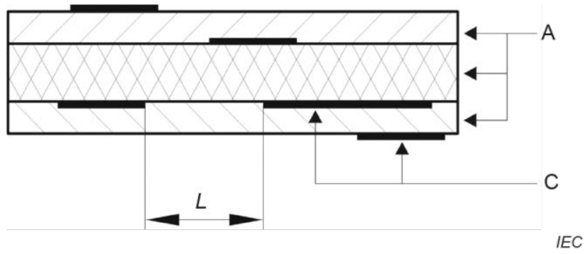
1 layer 1
2 layer 2
C conductor
L distance between conductors

Figure 15 – Distance between conductors on an interface between two layers

6.5.2.5.3 Insulating layers of printed wiring boards

For BASIC INSULATION, SUPPLEMENTARY INSULATION and REINFORCED INSULATION, conductors located between the same two layers (see Figure 16, item *L*) shall be separated by at least the applicable minimum distance of Table 5.

Conformity is checked by inspection and either by measurement of the separation or by inspection of the manufacturer's specifications.



Key

L distance between conductors on the same surface

A layers

C conductors

Figure 16 – Distance between adjacent conductors along an interface of two layers

Table 5 – Minimum values for distance or thickness

WORKING VOLTAGE V	Minimum thickness mm	Minimum distance *L* (see Figure 16) [a] mm
≤ 300	0,4	0,4
> 300 ≤ 600	0,6	0,6
> 600 ≤ 1 000 [b]	1,0	1,0

[a] These values apply for BASIC INSULATION, SUPPLEMENTARY INSULATION and REINFORCED INSULATION.

[b] For voltage above 1 000 V, a partial discharge test should be used (test procedure under consideration).

REINFORCED INSULATION of insulating layers of printed wiring boards (see Figure 16, item A) shall also have adequate electric strength through the respective layers. One of the following methods shall be used.

a) The thickness of the insulation is at least the value of Table 5.

Conformity is checked by inspection and either by measurement of the separation or by inspection of the manufacturer's specifications.

b) The insulation is assembled from at least two separate layers of printed wiring board materials, each of which is RATED by the manufacturer of the material for an electric strength of at least the value of the applicable test voltage of Table 4 or Table 14 for BASIC INSULATION.

Conformity is checked by inspection of the manufacturer's specifications.

c) The insulation is assembled from at least two separate layers of printed wiring board materials, and the combination of layers is RATED by the manufacturer of the material for an electric strength of at least the value of the applicable test voltage of Table 4 or Table 14 for REINFORCED INSULATION.

Conformity is checked by inspection of the manufacturer's specifications.

6.5.2.5.4 Thin-film insulation

For BASIC INSULATION, SUPPLEMENTARY INSULATION, and REINFORCED INSULATION, conductors located between the same two layers (see Figure 17, item *L*) shall be separated by at least the applicable SPACINGS of 6.5.2.2 and 6.5.2.4.