IEC 61010-031

Edition 3.0 2022-12
COMMENTED VERSION

INTERNATIONAL STANDARD

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GROUP SAFETY PUBLICATION

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 61010-031:2022-12 CMV(en)



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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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

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This commented version (CMV) of the official standard IEC 61010-031:2022 edition 3.0 allows the user to identify the changes made to the previous IEC 61010-031:2015+AMD1:2018 CSV edition 2.1. Furthermore, comments from IEC TC 66 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 61010-031 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment. It is an International Standard.

It has the status of a group safety publication in accordance with IEC Guide 104.

This third edition cancels and replaces the second edition published in 2015, and Amendment 1:2018. IEC 61010-031 is a stand-alone standard.

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

a) the scope has been made succinct. General information from the scope of Edition 2 has been moved to a new Clause 4. Consequently, Clause 4 to Clause 8 of Edition 2 have been renumbered. Clause 9 of Edition 2 has been deleted;
b) in Clause 2, normative references have been dated and new normative references have been added;
c) in 3.1.4, the definition of PROBE TIP has been modified;
d) in 4.1, there is no longer any differentiation between high voltage and low voltage probe assemblies. Type C probe assemblies have been merged with Type B probe assemblies;
e) in 4.1 d) "Kelvin" probes have been added to the list of probe assemblies as a new Type E and a new Figure 5;
f) in 4.1 e), probes for voltage measurement without electrical connection to conductors have been added to the list of probe assemblies as a new Type F and a new Figure 6;
g) in 4.2.1, spread of fire is no longer considered as a HAZARD;
h) Subclause 4.4.2.5 from Edition 2 has been deleted;
i) Subclause 4.4.4.3 from Edition 2 has been deleted;
j) in 5.4.4.1 consideration has been given to SPACINGS and impedance;
k) in 6.1.1, removable parts of PROBE TIPS which bear markings are allowed;
l) in 6.1.5, the voltage to be marked for MEASUREMENT CATEGORIES is the AC line-to-neutral or DC voltage;
m) in 7.4.2, requirements for unmated CONNECTORS have been modified as follows:
    1) Table 2 has been modified and expanded,
    2) a calculation method for CLEARANCES of CONNECTORS above 20 kV has been defined,
    3) CREEPAGE DISTANCES have been aligned with CLEARANCES;
n) in 7.4.3.1 and 7.4.3.5, requirements for IP2X PROBE TIPS with retractable sleeve have been added;
o) in 7.4.3.2, PROBE TIPS are now applicable to non-contact probe assemblies;
p) in 7.5.2.3.2, the values of Table 5 have been modified;
q) in 7.6.2, voltage tests of CLEARANCES are done without humidity preconditioning;
r) pre-treatments for rigidity test from Clause 10 of Edition 2 have been moved to 9.2;
s) Subclause 11.1 of Edition 2 has been deleted;
t) addition of an exception for Type E probe assembly in 13.2. Removable parts of PROBE TIPS which bear markings are allowed;
u) Figure F.1 has been modified;
v) Annex G has been added, for determination of CLEARANCES for Table 2**;**
w) Annex H has been added, covering line-to-neutral voltages for common mains supply systems.

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

Draft	Report on voting
66/770/FDIS	66/771/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

In this document the following print types are used:

– requirements and definitions: in roman type;
– NOTES and EXAMPLES: in smaller roman type;
– *conformity and tests: in italic type;*
– terms used throughout this document which have been defined in Clause 3: SMALL ROMAN CAPITALS.

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

- reconfirmed,
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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

1 Scope ~~and object~~ 1

~~1.1 Scope~~

~~1.1.1 Probe assemblies included in scope~~

This part of IEC 61010 specifies safety requirements for hand-held and hand-manipulated probe assemblies ~~of the types described below~~ for electrical test and measurement, and their related accessories. These probe assemblies are for non-contact 2 or direct electrical connection between a part and electrical test and measurement equipment. They ~~may~~ can be fixed to the equipment or be detachable accessories for the equipment.

This group safety publication focusing on safety essential requirements is primarily intended to be used as a product safety standard for the products mentioned in the scope, but is also intended to be used by technical committees in the preparation of publications for products similar to those mentioned in the scope of this group safety publication, in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications and/or group safety publications in the preparation of its publications. 3

2 Normative references 4

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60027 (all parts), *Letters symbols to be used in electrical technology*~~

IEC 60027-1:1992, *Letter symbols to be used in electrical technology – Part 1: General*
IEC 60027-1:1992/AMD1:1997
IEC 60027-1:1992/AMD2:2005

IEC 60027-2:2019, *Letter symbols to be used in electrical technology – Part 2: Telecommunications and electronics*

IEC 60027-4:2006, *Letter symbols to be used in electrical technology – Part 4: Rotating electric machines*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*
IEC 61010-1:2010/AMD1:2016

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

~~IEC 61180-1:1992, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*~~

~~IEC 61180-2, *High-voltage test techniques for low-voltage equipment – Part 2: Test equipment*~~

~~IEC GUIDE 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*~~

~~ISO/IEC GUIDE 51, *Safety aspects – Guidelines for their inclusion in standards*~~

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply (see Annex I for index of defined terms).

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Parts and accessories

3.1.1
TERMINAL
component provided for the connection of a device (equipment) to external conductors

Note 1 to entry: TERMINALS can contain one or several contacts and the term includes sockets, pins, etc.

3.1.2
ENCLOSURE
part providing protection of a probe assembly against certain external influences and, in any direction, protection against direct contact

3.1.3
PROTECTIVE FINGERGUARD
part of the ENCLOSURE that indicates the limit of safe access and that reduces the risk of the OPERATOR touching HAZARDOUS LIVE parts

3.1.4
PROBE TIP
part of a probe assembly or accessory which ~~makes a connection to~~ can touch **5** the point being measured or tested

~~Note 1 to entry: The term "PROBE TIP" includes the conductive parts of the jaws or hooks of SPRING-LOADED CLIPS.~~

3.1.5
CONNECTOR
component which is attached to the PROBE WIRE, to connect the probe assembly to a TERMINAL of the equipment or to another probe assembly

3.1.6
REFERENCE CONNECTOR **6**
CONNECTOR for connection to a reference point

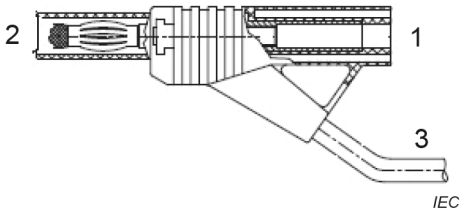
3.1.7
TOOL
external device, including a key or coin, used to aid a person performing a mechanical function

3.1.8
PROBE WIRE
flexible wire or cable used as part of the probe assembly or its accessories, consisting of one or more conductors and associated insulation

3.1.9
SPRING-LOADED CLIP
probe or probe accessory with one or more hooks or jaws forced by a spring to grip the part being measured or tested

3.1.10
STACKABLE CONNECTOR
CONNECTOR assembly which contains an additional TERMINAL

EXAMPLE Figure 1 is an example of a STACKABLE CONNECTOR with a male CONNECTOR and a female TERMINAL.



Key

1 TERMINAL for ADDITIONAL CONNECTOR

2 CONNECTOR

3 PROBE WIRE

Figure 1 – Example of a STACKABLE CONNECTOR with a male CONNECTOR and a female TERMINAL

3.2 Quantities

3.2.1
RATED ~~(condition or value)~~
RATED value
condition or quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device, or probe assembly

3.2.2
RATING
set of RATED values and operating conditions

[SOURCE: IEC 60050-151:2001, 151-16-11]

3.2.3
WORKING VOLTAGE
highest RMS value of the AC or DC voltage across any particular insulation which can continuously appear during NORMAL USE

Note 1 to entry: Transients and voltage fluctuations are not considered to be part of the WORKING VOLTAGE.

3.3 Tests

3.3.1
TYPE TEST
test of one or more samples of a probe assembly (or parts of a probe assembly) made to a particular design, to show that the design and construction meet the requirements of this document

Note 1 to entry: This is an ~~amplification~~ enlargement of the IEC 60050-151:2001, 151-16-16 definition to cover design as well as construction.

3.3.2
ROUTINE TEST
conformity test made on each individual item during or after manufacture

[SOURCE: IEC 60050-151:2001, 151-16-17]

3.4 Safety terms

3.4.1
ACCESSIBLE
able to be touched with a standard test finger or test pin, when used as specified in 7.2

3.4.2
HAZARDOUS LIVE
capable of rendering an electric shock or electric burn

3.4.3
HAZARD
potential source of harm

3.4.4
PROTECTIVE IMPEDANCE
component or assembly of components whose impedance, construction and reliability are suitable to provide protection against electric shock

3.4.5
NORMAL USE
operation, including stand-by, according to the instructions for use or for the obvious intended purpose

3.4.6
NORMAL CONDITION
condition in which all means for protection against HAZARDS are intact

3.4.7
SINGLE FAULT CONDITION 7
condition in which one means for protection against a HAZARD is defective or one fault is present which could cause a HAZARD

Note 1 to entry: If a SINGLE FAULT CONDITION results unavoidably in one or more other fault conditions, all the failures are considered as one SINGLE FAULT CONDITION.

3.4.8
OPERATOR
person operating the probe assembly for its intended purpose

3.4.9
RESPONSIBLE BODY
individual or group responsible for the safe use and maintenance of probe assemblies

3.4.10
WET LOCATION
location where water or another conductive liquid may be present and is likely to cause reduced human body impedance due to wetting of the contact between the human body and the probe assembly, or wetting of the contact between the human body and the environment

3.4.11
MEASUREMENT CATEGORY 8
classification of testing and measuring circuits according to the types of mains to which they are intended to be connected

Note 1 to entry: MEASUREMENT CATEGORIES take into account overvoltage categories, short-circuit current levels, the location where the test or measurement is to be made and some forms of energy limitation or transient protection included in the building installation (see Annex F for more information).

3.4.12
REASONABLY FORESEEABLE MISUSE
use of a product in a way not intended by the supplier, but which may result from readily predictable human behaviour

3.5 Insulation

3.5.1
BASIC INSULATION 9
insulation ~~of HAZARDOUS LIVE parts~~ which provides basic protection

Note 1 to entry: This concept does not apply to insulation used exclusively for functional purposes.

[SOURCE: IEC 60050-195:~~1998~~2021, 195-06-06]

3.5.2
SUPPLEMENTARY INSULATION 10
independent insulation applied in addition to BASIC INSULATION ~~in order to provide protection against electric shock in the event of a failure of BASIC INSULATION~~ that provides fault protection

[SOURCE: IEC 60050-195:2021, 195-06-07]

3.5.3
DOUBLE INSULATION
insulation comprising both BASIC INSULATION and SUPPLEMENTARY INSULATION

[SOURCE: IEC 60050-195:~~1998~~2021, 195-06-08]

3.5.4
REINFORCED INSULATION 11
insulation that provides a degree of protection against electric shock ~~not less than that provided by~~ equivalent to DOUBLE INSULATION

Note 1 to entry: REINFORCED INSULATION can comprise several layers that cannot be tested singly as BASIC INSULATION or SUPPLEMENTARY INSULATION.

[SOURCE: IEC 60050-195:2021, 195-06-09]

3.5.5
POLLUTION
addition of foreign matter, solid, liquid or gaseous (ionized gases), that ~~may~~ can produce a reduction of dielectric strength or surface resistivity

3.5.6
POLLUTION DEGREE
numeral indicating the level of POLLUTION that ~~may~~ can be present in the environment

3.5.7
POLLUTION DEGREE 1
no POLLUTION or only dry, non-conductive POLLUTION occurs, which has no influence

3.5.8
POLLUTION DEGREE 2
only non-conductive POLLUTION occurs except that occasionally a temporary conductivity caused by condensation is expected

3.5.9
POLLUTION DEGREE 3 **12**
conductive POLLUTION occurs, or dry, non-conductive POLLUTION occurs which becomes conductive due to condensation which is expected

Note 1 to entry: In such conditions, probe assembly is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

3.5.10
CLEARANCE
shortest distance in air between two conductive parts

3.5.11
CREEPAGE DISTANCE
shortest distance along the surface of a solid insulating material between two conductive parts

[SOURCE: IEC 60050-151:2001, 151-15-50]

3.5.12
SPACING
any combination of CLEARANCES and CREEPAGE DISTANCES

4 General

4.1 Type of probe assemblies

The safety of the following types of probe assemblies are covered by this document.

a) Type A: ~~low-voltage and high-voltage,~~ non-attenuating probe assemblies. Non-attenuating probe assemblies that are RATED for direct connection to voltages exceeding 30 V AC RMS, 42,4 V peak, or 60 V DC, but not exceeding 63 kV. They do not incorporate components which are intended to provide a voltage divider function or a signal conditioning function, but they ~~may~~ can contain non-attenuating components such as fuses (see Figure 2).

b) Type B: ~~high-voltage~~ attenuating or divider probe assemblies. Attenuating or divider probe assemblies that are RATED for direct connection to ~~secondary~~ voltages exceeding ~~1 kV r.m.s. or 1,5 kV d.c.~~ 30 V AC RMS, 42,4 V peak, or 60 V DC but not exceeding 63 kV ~~r.m.s. or d.c~~. The divider function ~~may~~ can be carried out wholly within the probe assembly, or partly within the test or measurement equipment to be used with the probe assembly (see Figure 3 a) and Figure 3 b)).

~~b) Type C: low-voltage attenuating or divider probe assemblies. Attenuating or divider probe assemblies for direct connection to voltages not exceeding 1 kV r.m.s. or 1,5 kV d.c. The signal conditioning function may be carried out wholly within the probe assembly, or partly within the test or measurement equipment intended to be used with the probe assembly (see Figure 3).~~ **13**