



UL 61010-031

Underwriters Laboratories Inc. Standard for Safety

Safety Requirements for
Electrical Equipment for
Measurement, Control and
Laboratory Use – Part 031:
Safety requirements for
hand-held probe assemblies
for electrical measurement and
test



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Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test, UL 61010-031

First Edition, Dated March 30, 2007

Summary of Topics

The revisions dated July 29, 2010 are harmonized with Canada and are co-published by CSA (Canadian Standards Association), ISA, and UL.

UL 61010-031 is an adoption of IEC 61010-031, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test (First Edition, issued January 2002). These revisions includes the adoption of IEC Amendment 1 (issued February 2008).

Please note that the national difference document incorporates all of the U.S. national differences for UL 61010-031, including the following changes to the national differences:

- 1. Addition of national difference, 1.1DV.3, regarding low-voltage attenuating and non-attenuating probe assemblies (type D) being added to the scope.***
- 2. Deletion of a national difference, 6.5.2.2DV.***

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new requirements are substantially in accordance with Proposal(s) on this subject dated January 22, 2010.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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Canadian Standards Association
CAN/CSA-C22.2 No. 61010-031-07
First Edition
(IEC 61010-031:2002, MOD)



ISA
ISA-61010-031 (82.02.02)
Second Edition



Underwriters Laboratories Inc.
UL 61010-031
First Edition

Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test

March 30, 2007

(Title Page Reprinted: July 29, 2010)

This standard is based on IEC 61010-031, First Edition (2002), and Amendment 1 (2008).



ANSI/UL 61010-031-2010

Approved
by
Standards Council
of Canada



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Commitment for Amendments

This Standard is issued jointly by the Canadian Standards Association (CSA), ISA and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA, ISA, or UL at any time. Revisions to this standard will be made only after review and approval by CSA, ISA, and UL. CSA and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue. ISA will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA and UL pages.

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This ANSI/UL Standard for Safety consists of the First edition including revisions through July 29, 2010.

The most recent designation of ANSI/UL 61010-031 and ISA-61010-031 (82.02.02) as an American National Standard (ANSI) occurred on July 29, 2010. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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Preface

This is the harmonized CSA, ISA, and UL standard for *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test*. It is the first edition of CAN/CSA-C22.2 No. 61010-031-07, the second edition of ISA-61010-031 (82.02.02), and the first edition of UL 61010-031. This edition of ISA-61010-031 (82.02.02) supersedes the previous edition of ANSI/ISA-82.02.02-1996 (IEC 61010-2-031) published in 1996. This standard is based on IEC 61010-031, first edition (2002) and Amendment 1 (2008).

CAN/CSA-C22.2 No. 61010-031-07, ISA-61010-031 (82.02.02), and UL 61010-031 contain identical requirements and identical publication dates. The presentation and format of the standards material may differ between the three published standards.

This harmonized standard was prepared by the Canadian Standards Association (CSA), ISA, and Underwriters Laboratories Inc. (UL).

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This standard was reviewed by the CSA Subcommittee on Safety Requirements for Electric Equipment for Measurement Control and Laboratory Use, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

This Standard has been approved as a National Standard of Canada by the Standards Council of Canada (SCC).

This Standard has been approved by the American National Standards Institute (ANSI) for publication as an American National Standard.

Where reference is made to a specific number of samples to be tested, the specified number is considered a minimum quantity.

Note: Although the intended primary application of this Standard is stated in its scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard adopts the IEC text with national differences.

The requirements are presented in different formats. The ISA version of the standard illustrates the national differences from the IEC text through the use of legislative text (strike-out and underline). The CSA and UL versions of the standard illustrates national differences immediately following the IEC text. National differences between the CSA and UL version and the ISA version shall be word for word except for editorial changes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one literal interpretation has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

CSA Effective Date

The effective date for CSA International will be announced through CSA Informs or a CSA Certification notice.

ISA Effective Date

The effective date for ISA is the date of publication.

UL Effective Date

As of July 29, 2010 all products Listed by UL must comply with the requirements in this standard except for the Clauses in the following list, where the effective date is July 29, 2012:

Clauses 1.2.1, 5.4.3, 6.7.4.2, 6.7.5, 9.2, and 13

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

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For ISA and UL, the text, figures and tables of IEC publication 61010-031, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test, and Amendment 1 are used in this Standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword is not a part of the requirements of this Standard but is included for information purposes only. Copies of IEC Publication 61010-031 may be purchased from ANSI, 25 West 43rd Street, 4th Floor, New York, New York, 10036, (212) 642- 4900.

For CSA, the text, figures, and tables of International Electrotechnical Commission Publication 61010-031, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test, and Amendment 1 are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not part of the requirements of this standard but is included for information purposes only.

NATIONAL DIFFERENCES

In the CSA and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 61010-031, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test, copyright 2002, and Amendment 1, copyright 2008, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

In the ISA publication of this standard, National Differences are presented using legislative text (strike-out and underline). The national difference type is identified in an informative annex.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

Note: The CSA and UL printed standards include the national difference types within the body of the text. The ISA printed standard includes the national difference types in an annex at the back of the standard.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE – Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test

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 nongovernmental 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.

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

It has the status of a group safety publication, as specified in IEC Guide 104.

IEC 61010-031 is a stand-alone standard and consequently no reference is required to IEC 61010-1, except as mentioned in the note to 1.1.

This consolidated version of IEC 61010-031 consists of the first edition (2002) [documents 66/262/FDIS and 66/272/RVD] and its amendment 1 (2008) [documents 66/383/CDV and 66/394/RVC].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes A, B and C form an integral part of this standard.

In this standard, the following print types are used:

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

1DV DE Addition:

Add the following to the end of the Foreword:

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

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SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – Part 031:

Safety requirements for hand-held probe assemblies for electrical measurement and test

1 Scope and object

1.1 Scope

This part of IEC 61010 applies to hand-held and hand-manipulated PROBE ASSEMBLIES of the types described below, and related accessories which are intended for professional, industrial process, and educational use. These PROBE ASSEMBLIES are for use in the interface between an electrical phenomenon and test or measurement equipment. They may be fixed to the equipment or be detachable accessories for the equipment.

a) Low-voltage and high-voltage, non-attenuating PROBE ASSEMBLIES(type A). Non-attenuating PROBE ASSEMBLIES that are RATED for direct connection to voltages exceeding 33 V r.m.s. or 46,7 V peak or 70 V d.c., but not exceeding 63 kV. They do not incorporate active components, nor are they intended to provide a voltage divider function or a signal conditioning function, but they may contain passive non-attenuating components such as fuses.

b) High-voltage attenuating or divider PROBE ASSEMBLIES(type B). Attenuating or divider PROBE ASSEMBLIES that are RATED for direct connection to secondary voltages exceeding 1 kV but not exceeding 63 kV. The divider function may be carried out wholly within the PROBE ASSEMBLY, or partly within the test or measurement equipment to be used with the PROBE ASSEMBLY.

c) Low-voltage attenuating or divider PROBE ASSEMBLIES(type C). Attenuating, divider or other signal conditioning PROBE ASSEMBLIES for direct connection to voltages exceeding 33 V r.m.s. or 46,7 V peak or 70 V d.c., but 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.

d) Low-voltage attenuating and non-attenuating PROBE ASSEMBLIES(type D), that are RATED for direct connection only to voltages not exceeding 33 V r.m.s., or 46,7 V peak, or 70 V d.c., and are suitable for currents exceeding 8 A.

NOTE PROBE ASSEMBLIES which

- are not within the definitions of types A, B, C, or D, or
 - which are designed to be powered from a low-voltage mains supply, or
 - include other features not specifically addressed in this standard
- may also need to meet the relevant requirements of other parts of IEC 61010 [6]¹.

¹) Figures in square brackets refer to the bibliography.

1.1DV D2 Modification of 1.1 (a), (c), and (d):

1.1DV.1 Replace the second sentence of part (a) with "Non-Attenuating PROBE ASSEMBLIES that are RATED for direct connection to voltages exceeding 30 V r.m.s. and 42,4 V peak or 60 V d.c., but not exceeding 63 kV."

1.1DV.2 Replace the second sentence of part (c) with "Attenuating, divider, or other signal conditioning PROBE ASSEMBLIES that are RATED for direct connection to voltages exceeding 30 V r.m.s. and 42,4 V peak or 60 V d.c., but not exceeding 1 kV r.m.s. or 1,5 kV d.c."

1.1DV.3 Replace part (d) with "Low-voltage attenuating and non-attenuating PROBE ASSEMBLIES (type D), that are RATED for direct connection only to voltages not exceeding 30 V r.m.s. and 42,4 V peak, or 60 V d.c., and are suitable for currents exceeding 8 A."

1.2 Object

1.2.1 Aspects included in scope

The object of this standard is to ensure that the design and methods of construction used provide adequate protection for the OPERATOR and the surrounding area against:

- a) electric shock or burn (see clauses 6, 10 and 11);
- b) mechanical HAZARDS (see clauses 7 and 8 and 11);
- c) excessive temperature (see clause 9);
- d) spread of fire from the PROBE ASSEMBLY(see clause 9).
- e) arc flash (see Clause 13).

NOTE Attention is drawn to the existence of additional requirements which may be specified by national authorities responsible for the health and safety of labour forces.

1.2.2 Aspects excluded from scope

This standard does not cover

- a) reliable function, performance or other properties of the PROBE ASSEMBLY;
- b) effectiveness of transport packaging;
- c) servicing (repair);
- d) protection of servicing (repair) personnel.

NOTE Servicing personnel are expected to be reasonably careful in dealing with obvious HAZARDS, but the design should protect against mishap in an appropriate manner, and the service documentation should point out any residual HAZARDS.

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1.3 Verification

This standard also specifies methods of verifying, through inspection and TYPE TESTING, that the PROBE ASSEMBLY meets the requirements of this standard.

1.4 Environmental conditions

This standard applies to PROBE ASSEMBLIES designed to be safe at least under the following conditions:

- a) altitude up to 2 000 m, or above 2 000 m if specified by the manufacturer;
- b) temperature 5 °C to 40 °C; or below 5 °C or above 40 °C if specified by the manufacturer;
- c) maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C;
- d) applicable RATED POLLUTION degree.

1.4ADV DR Addition of the following referencing the National Electrical Code and the Canadian Electrical Code:

This standard applies to equipment to be employed in accordance with ANSI/NFPA 70, National Electrical Code® (NEC); designed to be installed in accordance with the Canadian Electrical Code (CEC), Part I, CSA C22.1, and General Requirements – Canadian Electrical Code, Part II, CAN/CSA-C22.2 No. 0; or designed to comply with both the NEC and CEC.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61010. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61010 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60027 (all parts),
Letter symbols to be used in electrical technology

IEC 60060 (all parts),
High-voltage test techniques

IEC 60417 (all parts),
Graphical symbols for use on equipment

IEC 60529,
Degrees of protection provided by enclosures (IP Code)

IEC 60664-3,
Insulation coordination for equipment within low-voltage systems – Part 3: Use of coatings to achieve insulation coordination of printed board assemblies

ISO 7000,
Graphical symbols for use on equipment – Index and synopsis

3 Definitions

For the purpose of this part of IEC 61010 the following definitions apply.

Unless otherwise specified, the terms "voltage" and "current" mean the r.m.s. values of an alternating, direct or composite voltage or current. Where the term "mains" is used, it refers to the low-voltage electricity supply system (above the values of 6.3.2.1).

3.1 Parts and accessories

3.1.1 **TERMINAL** component provided for the connection of a device (equipment) to external conductors [IEV 151-01-03, modified]

NOTE TERMINALS can contain one or several contacts and the term includes sockets, pins, connectors, etc.

3.1.2 **ENCLOSURE** part providing protection of equipment against certain external influences and, in any direction, protection against direct contact

3.1.3 **BARRIER** part providing protection against direct contact from any usual direction of access

NOTE ENCLOSURES and BARRIERS may provide protection against the spread of fire (see 9.1).

3.1.4 **PROBE ASSEMBLY** device for making temporary contact between test or measurement equipment and a point on an electrical circuit being measured or tested. It includes the cable and the means for making a connection with the test or measurement equipment

NOTE See figures 1, 2, and 10 for examples of PROBE ASSEMBLIES and an explanation of the function of their parts.

3.1.5 **PROBE TIP** part of the PROBE ASSEMBLY which makes the connection to the point being measured or tested

3.1.6 **REFERENCE CONNECTOR** device used to connect a reference point in the test or measurement equipment (usually the functional earth TERMINAL) to a reference point on the electrical circuit being measured or tested

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

3.2 Electrical quantities

3.2.1 **RATED (VALUE)** quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment [IEV 151-04-03]

3.2.2 **RATING** set of **RATED** values and operating conditions [IEV 151-04-04]

3.2.3 **WORKING VOLTAGE** highest voltage which can continuously appear across an insulation during **NORMAL USE**

NOTE Both open-circuit conditions and normal operating conditions are taken into account.

3.3 Tests

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

NOTE This is an amplification of the IEC 151-04-15 definition to cover both design and construction requirements.

3.4 Safety terms

3.4.1 **ACCESSIBLE (of a part)** able to be touched with a standard test finger or test pin, when used as specified in 6.2

3.4.2 **HAZARDOUS LIVE** capable of rendering an electric shock or electric burn in **NORMAL CONDITION** or **SINGLE FAULT CONDITION** (see 6.3.1 for values applicable to **NORMAL CONDITION** and 6.3.2 for the higher values deemed to be appropriate in **SINGLE FAULT CONDITION**)

3.4.3 **HIGH INTEGRITY** not liable to become defective in such a manner as to cause a risk of **HAZARD**; a **HIGH INTEGRITY** part is considered as not subject to failure when tests under fault conditions are made

3.4.4 **PROTECTIVE IMPEDANCE** component, assembly of components or the combination of **BASIC INSULATION** and a current or voltage limiting device, the impedance, construction and reliability of which are such that when connected between parts which are **HAZARDOUS LIVE** and **ACCESSIBLE** conductive parts, it provides protection to the extent required by this standard in **NORMAL CONDITION** and **SINGLE FAULT CONDITION**

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

NOTE In most cases, **NORMAL USE** also implies **NORMAL CONDITION**, because the instructions for use will warn against using the equipment when it is not in **NORMAL CONDITION**.

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

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

NOTE If a **SINGLE FAULT CONDITION** results unavoidably in another **SINGLE FAULT CONDITION**, the two failures are considered as one **SINGLE FAULT CONDITION**

3.4.8 **OPERATOR** person operating equipment for its intended purpose

NOTE The **OPERATOR** should have received training appropriate for this purpose.

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3.4.9 **RESPONSIBLE BODY** individual or group responsible for the use and maintenance of equipment, and for ensuring that **OPERATORS** are adequately trained

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 equipment, or wetting of the contact between the human body and the environment

3.4.11 **HAZARD** potential source of harm (see 1.2)

3.5 Insulation

3.5.1 **BASIC INSULATION** insulation, the failure of which could cause a risk of electric shock

NOTE **BASIC INSULATION** may serve also for functional purposes.

3.5.2 **SUPPLEMENTARY INSULATION** 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**

3.5.3 **DOUBLE INSULATION** insulation comprising both **BASIC INSULATION** and **SUPPLEMENTARY INSULATION**

3.5.4 **REINFORCED INSULATION** insulation which provides protection against electric shock not less than that provided by **DOUBLE INSULATION**

NOTE **REINFORCED INSULATION** may comprise several layers which cannot be tested singly as **SUPPLEMENTARY INSULATION** or **BASIC INSULATION**

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

3.5.6 **POLLUTION DEGREE** a numeral indicating the level of **POLLUTION** that may be present in the environment

3.5.6.1 **POLLUTION DEGREE 1** no **POLLUTION** or only dry, non-conductive **POLLUTION**

NOTE The **POLLUTION** has no influence

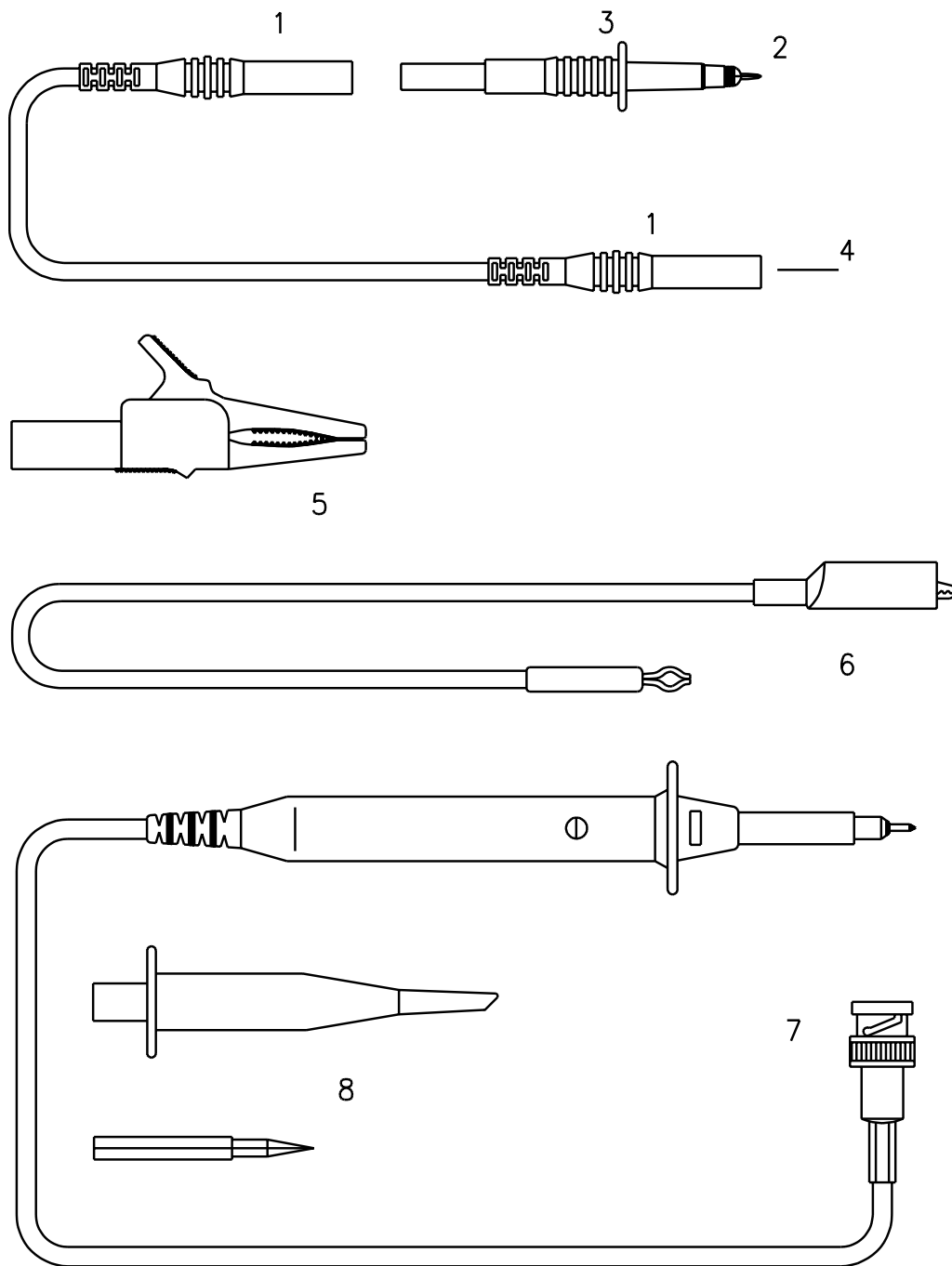
3.5.6.2 **POLLUTION DEGREE 2** only non-conductive **POLLUTION**. Occasionally, however, a temporary conductivity caused by condensation must be expected

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

3.5.7 **CLEARANCE** shortest distance in air between two conductive parts

3.5.8 **CREEPAGE DISTANCE** shortest distance along the surface of the insulating material between two conductive parts [IEV 151-03-37]

Figure 1 – Examples of type A and C PROBE ASSEMBLIES

**Key**

1 Typical Connectors

2 PROBE TIP

3 Probe body

4 To equipment

5 Crocodile clip

6 Reference connector

7 BNC connector

8 Examples of accessories

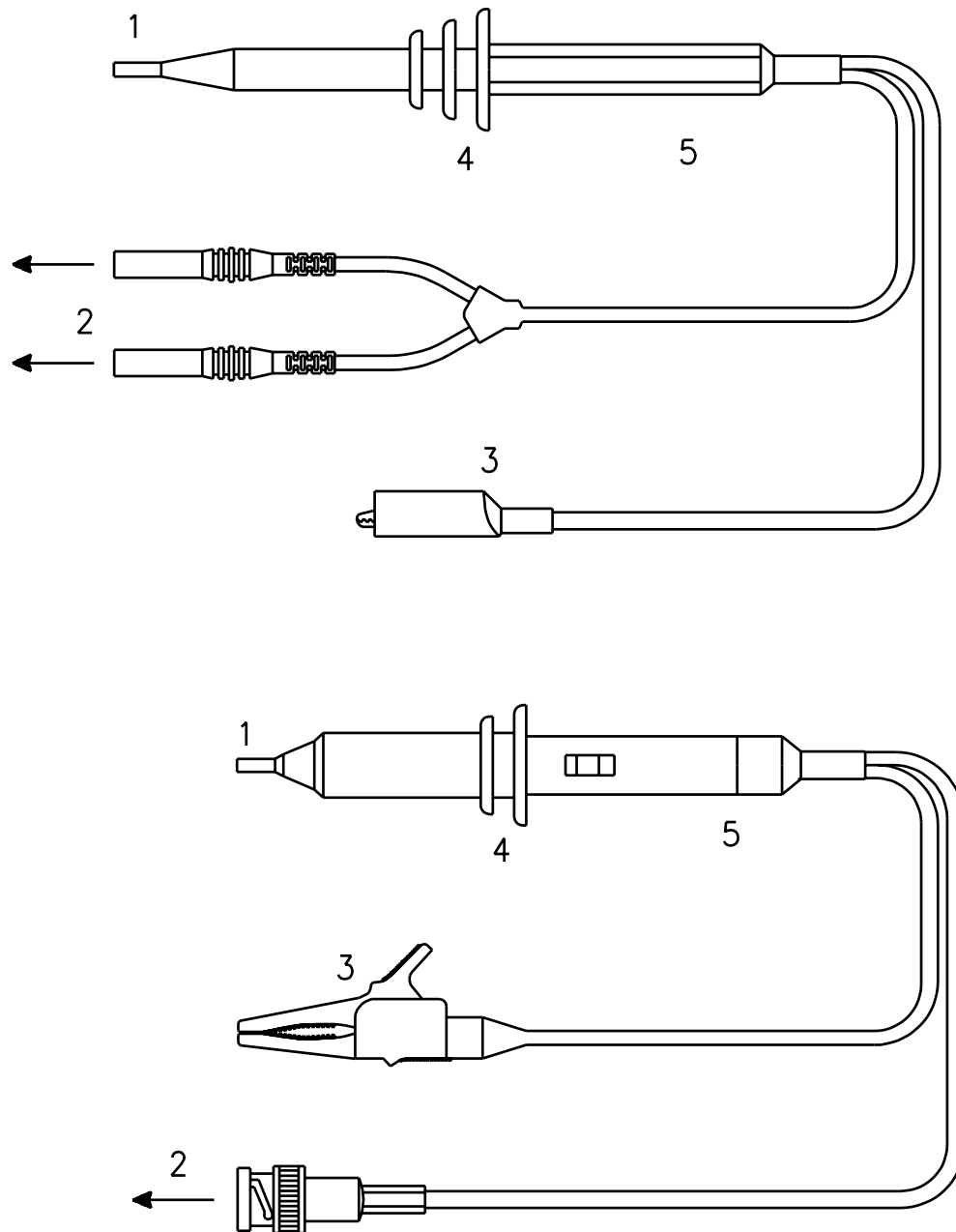
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Figure 2 – Examples of type B PROBE ASSEMBLIES

**Key**

- 1 PROBE TIP
- 2 To equipment
- 3 Reference conductor
- 4 BARRIER
- 5 Hand-held area of probe body

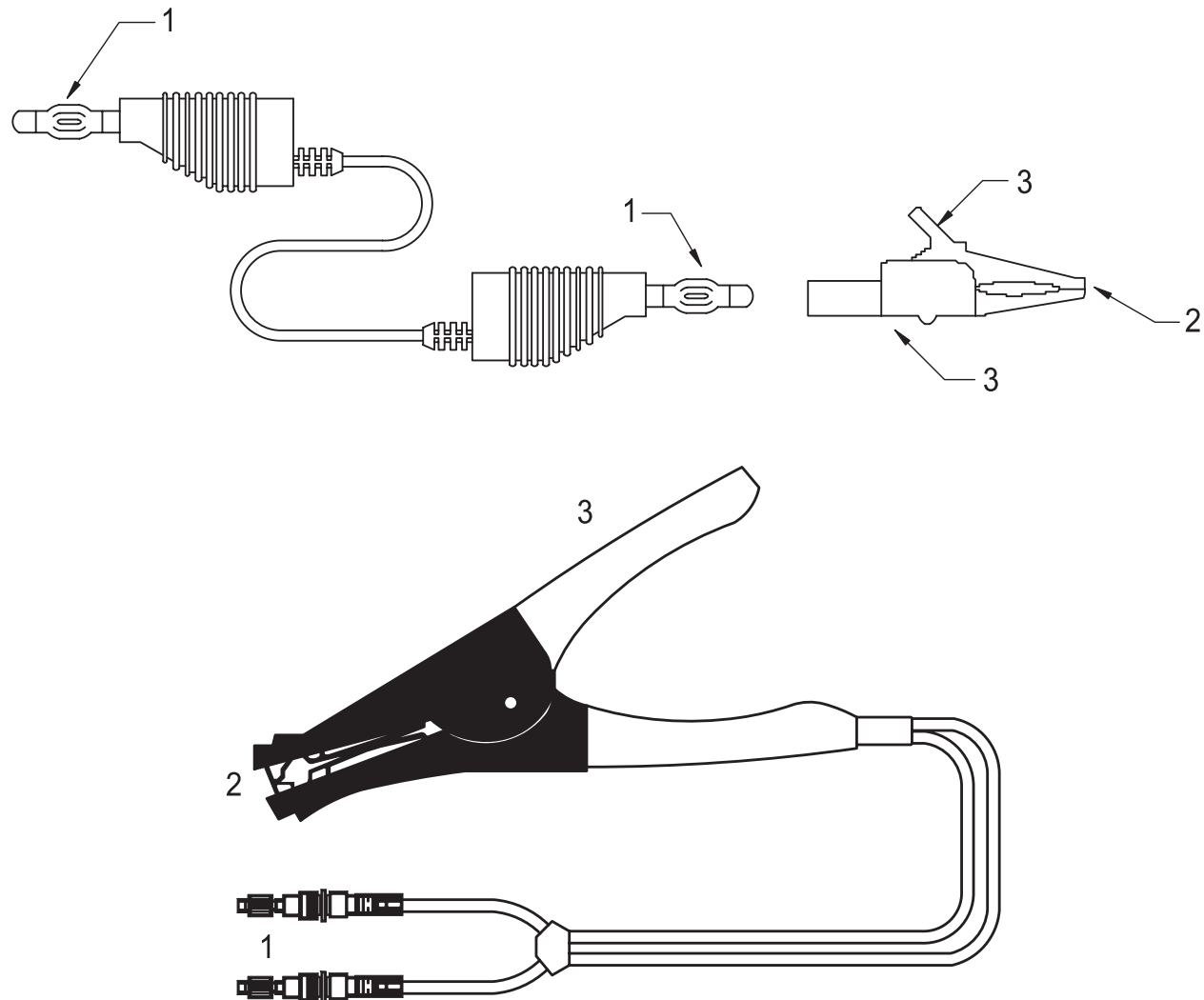
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Figure 10 – Examples of type D PROBE ASSEMBLIES



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KEY

- 1 connector
- 2 jaw
- 3 hand-held area of crocodile clip or clamp

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4 Tests

4.1 General

Tests in this standard are TYPE TESTS to be carried out on samples of PROBE ASSEMBLIES or their parts. Their only purpose is to check that the design and construction ensure conformity with this standard.

Tests on components or parts of the PROBE ASSEMBLY meeting the requirements of the relevant standards need not be repeated during TYPE TESTS of the whole PROBE ASSEMBLY.

If a PROBE ASSEMBLY is of more than one probe type (see 1.1), each type shall be tested according to its applicable requirements.

Conformity with the requirements of this standard is checked by carrying out all applicable tests, except that a test may be omitted if examination of the PROBE ASSEMBLY demonstrates conclusively that the equipment would pass the test. Tests are carried out under

a) reference test conditions (see 4.3);

b) SINGLE FAULT CONDITIONS (see 4.4).

NOTE 1 If the RATED range of environmental conditions for PROBE ASSEMBLIES is wider than that stated in 1.4, the manufacturer should make sure (for example, by suitable alteration of test requirements or additional tests) that the safety requirements of this standard are still fulfilled.

NOTE 2 If when carrying out a conformity test, there is any uncertainty about the exact value of the applied or measured quantity (for example, voltage) due to the tolerance,

- the manufacturer should ensure that at least the specified test value is applied;
- the test house should ensure that no more than the specified test value is applied.

NOTE 3 PROBE ASSEMBLIES which have been TYPE TESTED may no longer be suitable for their intended function because of the residual effect of stresses resulting from tests. For this reason TYPE TESTS should never be carried out (for example, by the RESPONSIBLE BODY) after the PROBE ASSEMBLIES have left the manufacturer.

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4.2 Sequence of tests

The sequence of tests is optional unless otherwise specified in this standard. The PROBE ASSEMBLIES under test shall be carefully inspected after each test. If the result of a test causes doubt whether any earlier tests would have been passed if the sequence had been reversed, these earlier tests shall be repeated. Tests under fault conditions may be destructive and may follow those under reference test conditions.

4.3 Reference test conditions

4.3.1 Environmental conditions

Unless otherwise specified in this standard, the following environmental conditions (but not conflicting with those of 1.4) shall exist in the test location:

- a) a temperature of 15 °C to 35 °C;
- b) a relative humidity of not more than 75 %;
- c) an air pressure of 75 kPa to 106 kPa;
- d) no hoarfrost, dew, percolating water, rain, solar irradiation, etc.

4.3.2 State of PROBE ASSEMBLIES

Unless otherwise specified, tests shall be carried out on the PROBE ASSEMBLIES assembled for NORMAL USE and under the least favourable combination of the conditions given in 4.3.3 to 4.3.9.

When dimensions or mass make it unsuitable to carry out particular tests on a complete PROBE ASSEMBLY, tests on sub-assemblies are allowed, provided it is verified that the assembled PROBE ASSEMBLY will be in accordance with this standard.

4.3.3 Position of the PROBE ASSEMBLY

The PROBE ASSEMBLY shall be in any position of NORMAL USE and with any ventilation unimpeded.

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4.3.4 Accessories

Accessories and OPERATOR interchangeable parts available from, or recommended by, the manufacturer for use with the PROBE ASSEMBLY under test shall be either connected or not connected.

4.3.5 Covers and removable parts

Covers or parts which can be removed without using a TOOL shall be removed or not removed.

4.3.6 Input and output voltages

Input and output voltages, including floating voltages shall be set to any voltage within the RATED voltage range.

4.3.7 Controls

Controls which the OPERATOR can adjust by hand shall be set to any position except for combinations of settings prohibited by the manufacturer, as shown by marking on the PROBE ASSEMBLY.

4.3.8 Connections

The PROBE ASSEMBLY shall be connected for its intended purpose, or not connected.

4.3.9 Duty cycle

PROBE ASSEMBLIES for short-term or intermittent operation shall be operated for the longest period and have the shortest recovery period consistent with the manufacturer's instructions.

4.4 Testing in SINGLE FAULT CONDITION

4.4.1 General

The following requirements apply.

- a) Examination of the PROBE ASSEMBLY and its circuit diagram will generally show the fault conditions which are liable to result in HAZARDS within the meaning of this standard and which, therefore, shall be applied.
- b) Fault tests shall be made unless it can be demonstrated that no HAZARD could arise from a particular fault condition.
- c) The PROBE ASSEMBLY shall be operated under the least favourable combination of reference test conditions (see 4.3). These combinations may be different for different faults and they should be recorded for each test.

4.4.2 Application of fault conditions

Fault conditions shall include those specified in 4.4.2.1 to 4.4.2.4. They shall be applied only one at a time and shall be applied in turn in any convenient order. Multiple simultaneous faults shall not be applied unless they are a consequence of an applied fault.

After each application of a fault condition, the PROBE ASSEMBLY or part shall pass the applicable tests of 4.4.4.

4.4.2.1 PROBE ASSEMBLIES or parts for short-term or intermittent operation

These shall be operated continuously if continuous operation could occur in a SINGLE FAULT CONDITION.

4.4.2.2 Outputs

Outputs of type B and C PROBE ASSEMBLIES shall be short-circuited one at a time.

4.4.2.3 Insulation between circuits and parts

Insulation between circuits and parts which is below the level specified for BASIC INSULATION shall be bridged to check against the spread of fire.

NOTE See 9.1 for an alternative method of checking protection against spread of fire.

4.4.2.4 Components

Components (except HIGH INTEGRITY components) of type B and type C PROBE ASSEMBLIES shall be short-circuited or open-circuited, whichever is less favourable.

4.4.3 Duration of tests

The PROBE ASSEMBLY shall be operated until further change as a result of the applied fault is unlikely. Each test is normally limited to 1 h since a secondary fault arising from a SINGLE FAULT CONDITION will usually manifest itself within that time. If at the end of 1 h there is an indication that a risk of electric shock, spread of fire or injury to persons may eventually occur, the test shall be continued until one of these HAZARDS does occur or for a maximum period of 4 h.

If a fault is terminated by the opening of a fuse and if the fuse does not operate within approximately 1 s, the current through the fuse under the relevant fault condition shall be measured. Evaluation with the pre-arcing time/current characteristics shall be made to find out whether the minimum operating current of the fuse is reached or exceeded and what is the maximum time before the fuse operates. The current through the fuse may vary as a function of time. If the minimum operating current of the fuse is not reached in the test, the PROBE ASSEMBLY shall be operated for a period corresponding to the maximum fusing time or continuously for 1 h or 4 h, as specified above.