

Australian Standard™

**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
(IEC 61010-031:2002 MOD)**



This Australian Standard was prepared by Committee EL-049, Safety of Electrical Equipment for Measurement and Laboratory Use. It was approved on behalf of the Council of Standards Australia on 12 February 2004 and published on 29 April 2004.

The following are represented on Committee EL-049:

Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
Consumers Federation of Australia
Department of Mineral Resources
Electrical Compliance Testing Association
Electrical Regulatory Authorities Council
Hunter Industries Electrical Safety Network
National Electrical and Communications Association

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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 61010.031—2004

**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 (IEC 61010-031:2002 MOD)**

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Technical Committee EL-049 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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Electrical Compliance Testing Association

NOTES

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PREFACE

This Standard was prepared by the Standards Australia Committee EL-049, Safety of Electrical Equipment for Measurement and Laboratory Use.

The objective of this Standard is to specify particular requirements for hand-held probe assemblies for electrical test and measuring equipment.

This Standard is an adoption with national modifications and has been reproduced from, IEC 61010-031:2002, *Safety requirements for electrical equipment for measurement, control and laboratory use, Part 031: Safety requirements for hand-held probe assemblies for electrical measurement*, and has been varied as indicated to take account of Australian/New Zealand conditions.

Variations to IEC 61010-031:2002 are indicated at the appropriate places throughout this standard. Strikethrough (~~example~~) identifies IEC text, tables and figures which, for the purposes of this Australian Standard, are deleted. Where text, tables or figures are added, each is set in its proper place and identified by shading (example). Added figures are not themselves shaded, but are identified by a shaded border.

This Standard is one of a series of Standards dealing with electrical test and measuring equipment. Currently this Series consists of the following parts; additional parts will be added from time to time.

AS

61010	Safety requirements for electrical equipment for measurement, control and laboratory use
61010.1	Part 1: General requirements
61010.031	Part 031: Safety requirements for hand-held probe assemblies for electrical measurement and test (this Standard)
61010.2.032	Part 032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement

This part of the Standard complements Part 1.

As this Standard is reproduced from an International Standard, the following applies:

- Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- In the source text 'this international standard' should read 'this Australian Standard'.
- A full point should be substituted for a comma when referring to a decimal marker.
- Any French text on figures should be ignored.

In this Standard, the following print types are used:

- requirements proper: in arial type;
- *test specifications: in italic type;*
- explanatory matter: in smaller arial type.

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard
**Safety requirements for electrical equipment for measurement, control
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(IEC 61010-031:2002 MOD)**

1 Scope and object**1.1 Scope**

This part of AS 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.

NOTE PROBE ASSEMBLIES which

- are not within the definitions of types A, B or C, 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 AS 61010 [6]¹⁾.

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, 8 and 11);
- c) excessive temperature (see clause 9);

¹⁾ Figures in square brackets refer to the bibliography.

- d) spread of fire from the PROBE ASSEMBLY (see clause 9).

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

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.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of AS 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 AS 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.

References to international standards that are struck through in this clause are replaced by references to Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

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

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

AS 1931 (all parts), *High-voltage test techniques*

AS/NZS 60065, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

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

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

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

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

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

~~IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*~~

AS 61010 (all parts), *Safety requirements for electrical equipment for measurement, control and laboratory use*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

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

3 Definitions

For the purpose of this part of AS 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 and 2 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 IEV 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.

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**

for the purpose of evaluating CLEARANCES one of three degrees of POLLUTION in the micro-environment, which are recognized for use with this Standard

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 to be expected

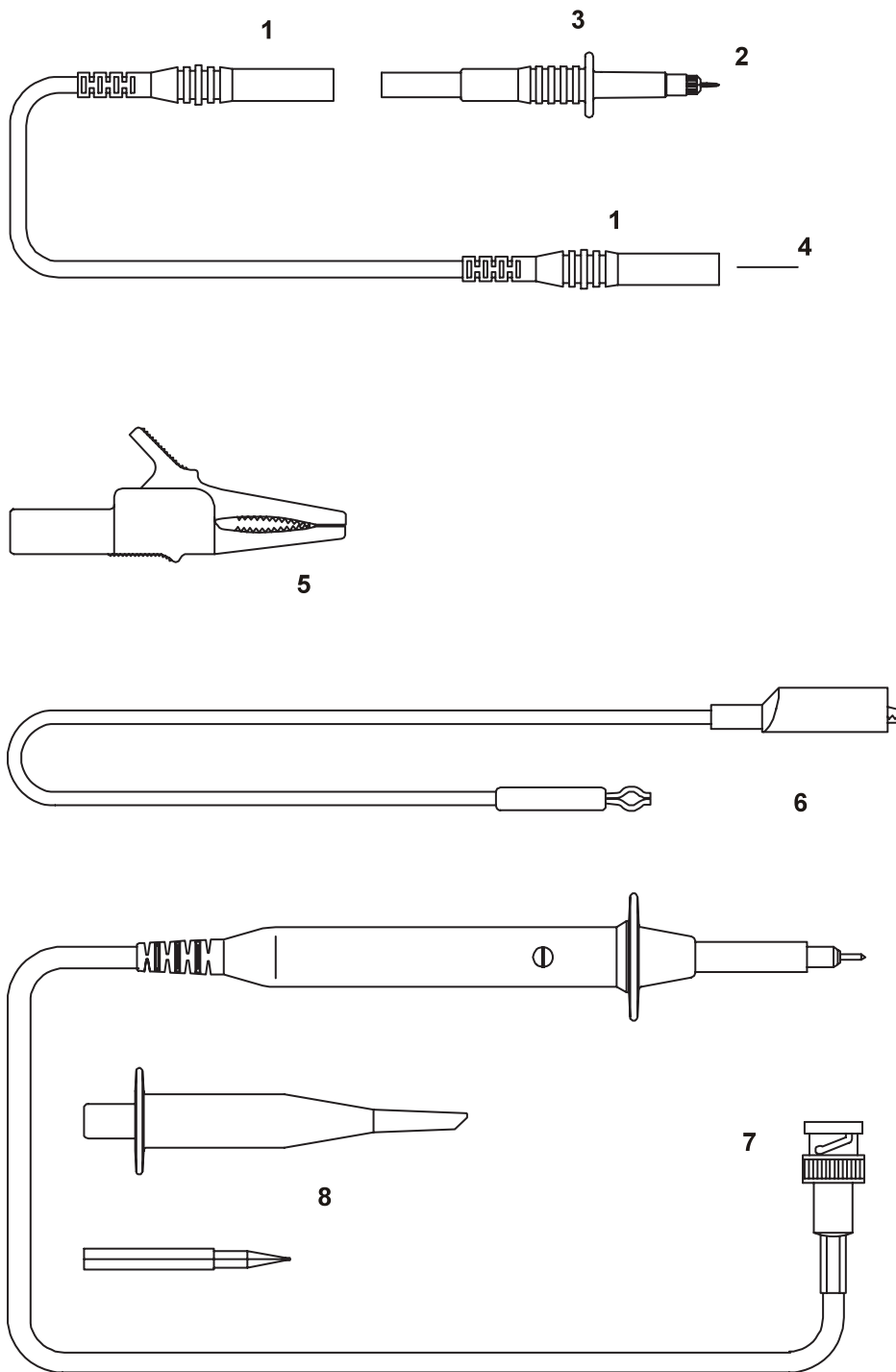
3.5.7**CLEARANCE**

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]

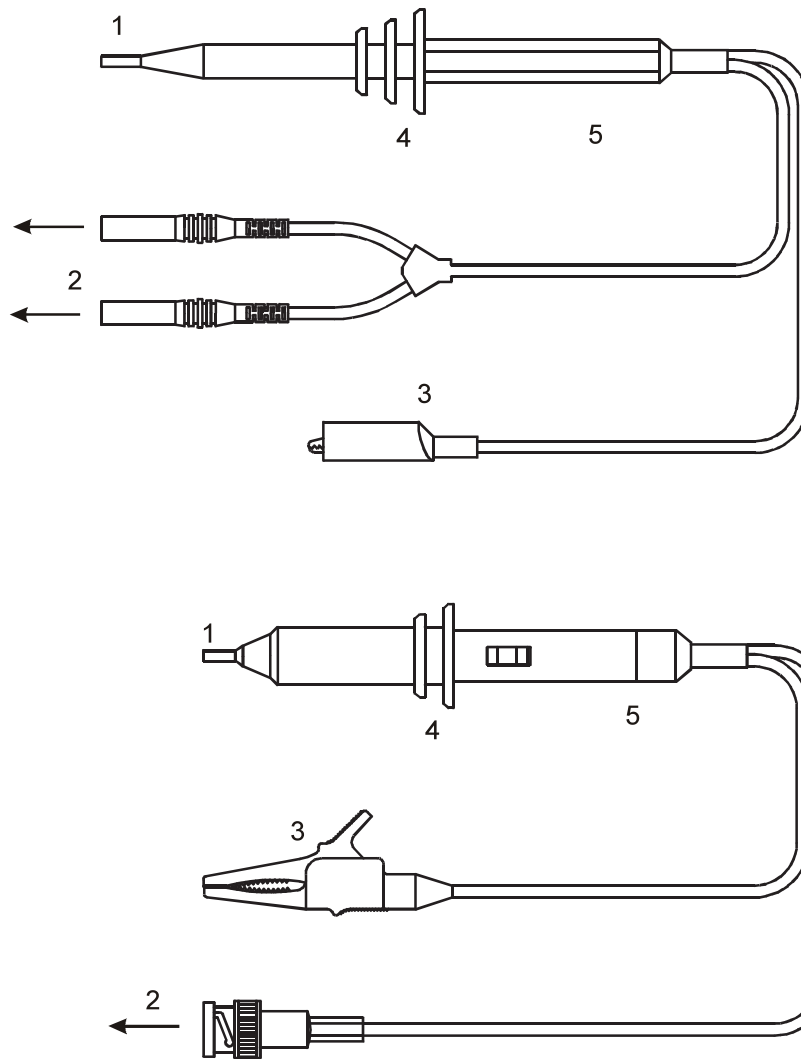


Key

- | | |
|----------------------|---------------------------|
| 1 Typical connectors | 5 Crocodile clip |
| 2 PROBE TIP | 6 Reference connector |
| 3 Probe body | 7 BNC connector |
| 4 To equipment | 8 Examples of accessories |

IEC 2597/01

Figure 1 – Examples of type A and C PROBE ASSEMBLIES



IEC 2598/01

Key

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

Figure 2 – Examples of type B PROBE ASSEMBLIES**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 it 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.

4.2 Sequence of tests

The sequence of tests is optional unless otherwise specified in the 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

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 the most 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 any 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.

4.4.3.1 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 EQUIPMENT SHALL BE OPERATED FOR A PERIOD CORRESPONDING TO THE MAXIMUM FUSING TIME OR CONTINUOUSLY FOR THE DURATION SPECIFIED IN 4.4.3.1.

4.4.4 CONFORMITY AFTER APPLICATION OF single fault conditions

4.4.4.1 *Conformity with requirements for electric shock protection is checked after the application of SINGLE FAULTS as follows:*

- a) *by making the measurements of 6.3.2 to check that no ACCESSIBLE conductive parts have become HAZARDOUS LIVE, except as permitted by 6.1.1;*
- b) *by performing a voltage test on DOUBLE INSULATION or REINFORCED INSULATION to check that there is still one level of protection by insulation. The voltage test is made as specified in 6.6 (without humidity preconditioning) with the test voltage for BASIC INSULATION.*

4.4.4.2 *Conformity with requirements for temperature protection is checked by determining the temperature of the outer surface of the PROBE ASSEMBLY.*

The temperature of the outer surface shall not exceed 105°C at maximum RATED ambient temperature.

This temperature is determined by measuring the temperature rise of the surface or part and adding it to the maximum RATED ambient temperature.

4.4.4.3 *Conformity with requirements for protection against the spread of fire is checked by placing the PROBE ASSEMBLY on white tissue-paper covering a softwood surface and covering the PROBE ASSEMBLY with cheesecloth. No molten metal, burning insulation, flaming particles, etc. shall fall on the surface on which the PROBE ASSEMBLY stands and there shall be no charring, glowing, or flaming of the tissue paper or cheesecloth. Melting of insulation material shall be ignored if the molten material could not contribute to starting a fire, and if it would be obvious to the operator that the PROBE ASSEMBLY needs to be de-energized and allowed to cool before it is touched.*

4.4.4.4 *Conformity with the requirements for protection against other HAZARDS is checked as specified in clauses 7 to 11.*