

Australian Standard™

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

**Part 1: General requirements
(IEC 61010-1:2001 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 17 June 2003 and published on 30 June 2003.

The following are represented on Committee EL-049:

Australian Chamber of Commerce and Industry
Bureau of Steel Manufacturers of Australia
Department of Mineral Resources
Electrical Compliance Testing Association
Hunter Industries Electrical Safety Network

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Australia web site at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.com.au, or write to the Chief Executive, Standards Australia International Ltd, GPO Box 5420, Sydney, NSW 2001.

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 61010.1—2003

Safety requirements for electrical equipment for measurement, control and
laboratory use —

Part 1: General requirements (IEC 61010-1:2001 MOD)

RECONFIRMATION NOTICE

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.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 03 September 2015.

The following are represented on Technical Committee EL-049:

Australian Chamber of Commerce and Industry
Bureau of Steel Manufacturers of Australia
Electrical Compliance Testing Association

NOTES

Currently in preview, click buy full vers.

Australian Standard™

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

**Part 1: General requirements
(IEC 61010-1:2001 MOD)**

First published as AS 61010.1—2003.

COPYRIGHT

© Standards Australia International

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 5432 5

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 the general safety requirements that are generally applicable for electrical measurement, control and laboratory equipment intended for professional, industrial process and educational purposes. The essential safety requirements specified in AS/NZS 3820 that apply to electrical equipment for measurement, control and laboratory use are covered in this Standard.

This Standard is an adoption with national modifications and has been reproduced from IEC 61010-1:2001, *Safety requirements for electrical equipment for measurement, control and laboratory use—Part 1: General requirements*, and has been varied as indicated to take account of Australian conditions. This Standard includes IEC Corrigendum 1:2001 and Corrigendum 2:2003.

Variations to IEC 61010-1:2001 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. The variations are also included in a new Annex ZZ for easy reference.

Annex ZA lists alternate requirements for Australian conditions on resistance to fire.

Additional safety requirements for other allied equipment are to be covered in the relevant Part 2 series of Standards. These are intended to be published in the near future.

The Committee is also considering the publication of a handbook for guidance on the safe use of electrical test measurement equipment, some time in the future.

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

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

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.

CONTENTS

| | <i>Page</i> |
|---|-------------|
| Introduction..... | ix |
| 1 Scope and object..... | 1 |
| 1.1 Scope..... | 1 |
| 1.1.1 Equipment included in scope..... | 1 |
| 1.1.2 Equipment excluded from scope..... | 1 |
| 1.1.3 Computing equipment..... | 2 |
| 1.2 Object..... | 2 |
| 1.2.1 Aspects included in scope..... | 2 |
| 1.2.2 Aspects excluded from scope..... | 2 |
| 1.3 Verification..... | 2 |
| 1.4 Environmental conditions..... | 3 |
| 1.4.1 Normal environmental conditions..... | 3 |
| 1.4.2 Extended environmental conditions..... | 3 |
| 2 Normative references..... | 3 |
| 3 Terms and definitions..... | 5 |
| 3.1 Equipment and states of equipment..... | 5 |
| 3.2 Parts and accessories..... | 6 |
| 3.3 Electrical quantities..... | 6 |
| 3.4 Tests..... | 7 |
| 3.5 Safety terms..... | 7 |
| 3.6 Insulation..... | 8 |
| 4 Tests..... | 9 |
| 4.1 General..... | 9 |
| 4.2 Sequence of tests..... | 10 |
| 4.3 Reference test conditions..... | 10 |
| 4.3.1 Environmental conditions..... | 10 |
| 4.3.2 State of equipment..... | 10 |
| 4.4 Testing in SINGLE FAULT CONDITION..... | 12 |
| 4.4.1 General..... | 12 |
| 4.4.2 Application of fault conditions..... | 12 |
| 4.4.3 Duration of tests..... | 14 |
| 4.4.4 Conformity after application of fault conditions..... | 15 |
| 5 Marking and documentation..... | 15 |
| 5.1 Marking..... | 15 |
| 5.1.1 General..... | 15 |
| 5.1.2 Identification..... | 16 |
| 5.1.3 MAINS supply..... | 16 |
| 5.1.4 Fuses..... | 17 |
| 5.1.5 TERMINALS, connections and operating devices..... | 18 |
| 5.1.6 Switches and circuit-breakers..... | 19 |
| 5.1.7 Equipment protected by DOUBLE INSULATION or REINFORCED INSULATION..... | 19 |
| 5.1.8 Field-wiring TERMINAL boxes..... | 19 |

| | <i>Page</i> | |
|--------|--|----|
| 5.2 | Warning markings | 19 |
| 5.3 | Durability of markings | 20 |
| 5.4 | Documentation | 20 |
| 5.4.1 | General | 20 |
| 5.4.2 | Equipment RATINGS | 21 |
| 5.4.3 | Equipment installation | 21 |
| 5.4.4 | Equipment operation | 21 |
| 5.4.5 | Equipment maintenance | 22 |
| 6 | Protection against electric shock | 22 |
| 6.1 | General | 22 |
| 6.1.1 | Requirements | 22 |
| 6.1.2 | Exceptions | 22 |
| 6.2 | Determination of ACCESSIBLE parts | 23 |
| 6.2.1 | Examination | 23 |
| 6.2.2 | Openings above parts that are HAZARDOUS LIVE | 23 |
| 6.2.3 | Openings for pre-set controls | 23 |
| 6.3 | Permissible limits for ACCESSIBLE parts | 23 |
| 6.3.1 | Values in NORMAL CONDITION | 24 |
| 6.3.2 | Values in SINGLE FAULT CONDITION | 24 |
| 6.4 | Protection in NORMAL CONDITION | 27 |
| 6.5 | Protection in SINGLE FAULT CONDITION | 27 |
| 6.5.1 | PROTECTIVE BONDING | 27 |
| 6.5.2 | DOUBLE INSULATION and REINFORCED INSULATION | 30 |
| 6.5.3 | PROTECTIVE IMPEDANCE | 30 |
| 6.5.4 | Automatic disconnection of the supply | 31 |
| 6.6 | Connections to external circuits | 31 |
| 6.6.1 | General | 31 |
| 6.6.2 | TERMINALS for external circuits | 32 |
| 6.6.3 | Circuits with TERMINALS which are HAZARDOUS LIVE | 32 |
| 6.6.4 | ACCESSIBLE TERMINALS for stranded conductors | 32 |
| 6.7 | CLEARANCES and APPROACH DISTANCES | 32 |
| 6.7.1 | General requirements | 33 |
| 6.7.2 | MAINS CIRCUITS | 34 |
| 6.7.3 | Circuit other than MAINS CIRCUITS | 34 |
| 6.7.4 | Measuring circuits | 39 |
| 6.8 | Procedure for dielectric strength tests | 40 |
| 6.8.1 | Reference test earth | 40 |
| 6.8.2 | Humidity preconditioning | 40 |
| 6.8.3 | Conduct of tests | 40 |
| 6.8.4 | Voltage tests | 41 |
| 6.9 | Constructional requirements for protection against electric shock | 43 |
| 6.9.1 | General | 43 |
| 6.9.2 | ENCLOSURES of equipment with DOUBLE INSULATION or REINFORCED INSULATION | 43 |
| 6.9.3 | Over-range indication | 44 |
| 6.10 | Connection to MAINS supply source and connections between parts of equipment | 44 |
| 6.10.1 | MAINS supply cords | 44 |
| 6.10.2 | Fitting of non-detachable MAINS supply cords | 45 |

| | | |
|--------|---|----|
| 6.10.3 | Plugs and connectors | 46 |
| 6.11 | Disconnection from supply source | 46 |
| 6.11.1 | General | 46 |
| 6.11.2 | Requirements according to type of equipment | 47 |
| 6.11.3 | Disconnecting devices | 48 |
| 7 | Protection against mechanical HAZARDS | 48 |
| 7.1 | General | 48 |
| 7.2 | Moving parts | 48 |
| 7.3 | Stability | 49 |
| 7.4 | Provisions for lifting and carrying | 49 |
| 7.5 | Wall mounting | 50 |
| 7.6 | Expelled parts | 50 |
| 8 | Mechanical resistance to shock and impact | 50 |
| 8.1 | ENCLOSURE rigidity test | 51 |
| 8.1.1 | Static test | 51 |
| 8.1.2 | Dynamic test | 51 |
| 8.2 | Drop test | 52 |
| 8.2.1 | Equipment other than HAND-HELD EQUIPMENT and direct plug-in equipment | 52 |
| 8.2.2 | HAND-HELD EQUIPMENT and direct plug-in equipment | 53 |
| 9 | Protection against the spread of fire | 53 |
| 9.1 | Eliminating or reducing the sources of ignition within the equipment | 54 |
| 9.2 | Containment of fire within the equipment, should it occur | 55 |
| 9.2.1 | Constructional requirements | 55 |
| 9.3 | Limited-energy circuit | 57 |
| 9.4 | Requirements for equipment containing or using flammable liquids | 58 |
| 9.5 | Overcurrent protection | 59 |
| 9.5.1 | PERMANENTLY CONNECTED EQUIPMENT | 59 |
| 9.5.2 | Other equipment | 59 |
| 10 | Equipment temperature limits and resistance to heat | 59 |
| 10.1 | Surface temperature limits for protection against burns | 59 |
| 10.2 | Temperatures of windings | 60 |
| 10.3 | Other temperature measurements | 60 |
| 10.4 | Conduct of temperature tests | 61 |
| 10.4.1 | Temperature measurement of heating equipment | 61 |
| 10.4.2 | Equipment intended for installation in a cabinet or a wall | 61 |
| 10.5 | Resistance to heat | 61 |
| 10.5.1 | Integrity of CLEARANCES and CREEPAGE DISTANCES | 61 |
| 10.5.2 | Non-metallic ENCLOSURES | 62 |
| 10.5.3 | Insulating material | 62 |
| 11 | Protection against HAZARDS from fluids | 63 |
| 11.1 | General | 63 |
| 11.2 | Cleaning | 63 |
| 11.3 | Spillage | 63 |
| 11.4 | Overflow | 64 |
| 11.5 | Battery electrolyte | 64 |
| 11.6 | Specially protected equipment | 64 |

| | <i>Page</i> |
|---|-------------|
| 11.7 Fluid pressure and leakage | 64 |
| 11.7.1 Maximum pressure | 64 |
| 11.7.2 Leakage and rupture at high pressure | 65 |
| 11.7.3 Leakage from low-pressure parts | 65 |
| 11.7.4 Overpressure safety device | 66 |
| 12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure | 66 |
| 12.1 General | 66 |
| 12.2 Equipment producing ionizing radiation | 67 |
| 12.2.1 Ionizing radiation | 67 |
| 12.2.2 Accelerated electrons | 67 |
| 12.3 Ultraviolet (UV) radiation | 67 |
| 12.4 Microwave radiation | 67 |
| 12.5 Sonic and ultrasonic pressure | 67 |
| 12.5.1 Sound level | 67 |
| 12.5.2 Ultrasonic pressure | 68 |
| 12.6 Laser sources | 68 |
| 13 Protection against liberated gases, explosion and implosion | 68 |
| 13.1 Poisonous and injurious gases | 68 |
| 13.2 Explosion and implosion | 69 |
| 13.2.1 Components | 69 |
| 13.2.2 Batteries and battery charging | 69 |
| 13.2.3 Implosion of cathode ray tubes | 69 |
| 13.2.4 Equipment RATED for high pressures | 70 |
| 14 Components | 70 |
| 14.1 General | 70 |
| 14.2 Motors | 71 |
| 14.2.1 Motor temperature | 71 |
| 14.2.2 Series excitation motors | 72 |
| 14.3 Over-temperature protection devices | 72 |
| 14.4 Fuse holders | 72 |
| 14.5 MAINS voltage sensing devices | 72 |
| 14.6 HIGH INTEGRITY components | 73 |
| 14.7 MAINS transformers tested outside equipment | 73 |
| 14.8 Printed circuit boards | 73 |
| 14.9 Circuits or components used as transient overvoltage limiting devices | 73 |
| 15 Protection by interlocks | 74 |
| 15.1 General | 74 |
| 15.2 Prevention of reactivating | 74 |
| 15.3 Reliability | 74 |
| 16 Test and measurement equipment | 75 |
| 16.1 Current measuring circuits | 75 |
| 16.2 Multifunction meters and similar equipment | 75 |
| Annex A (normative) Measuring circuits for ACCESSIBLE current (see 6.3) | 76 |
| Annex B (normative) Standard test finger (see 6.2) | 79 |
| Annex C (normative) Measurement of CLEARANCES and CREEPAGE DISTANCES | 81 |

| | <i>Page</i> |
|---|-------------|
| Annex D (normative) Parts between which insulation requirements are specified (see 6.4 and 6.5.2)..... | 86 |
| Annex E (normative) Reduction of POLLUTION degrees | 89 |
| Annex F (normative) ROUTINE TESTS | 90 |
| Annex G (informative) Leakage and rupture from fluids under pressure | 91 |
| Annex H (informative) Index of defined terms..... | 96 |
| Annex ZA (normative) Resistance to fire | 99 |
| Annex ZZ (normative) Variations to IEC 61010-1:2001 for application in Australia and New Zealand | 102 |
| Figure 1 – Maximum duration of short-term temporary ACCESSIBLE voltages in SINGLE FAULT CONDITION | 25 |
| Figure 2 – Charged capacitance level in NORMAL CONDITION and SINGLE FAULT CONDITION | 26 |
| Figure 3 – Detachable MAINS supply cords and connections | 45 |
| Figure 4 – Impact test using sphere | 52 |
| Figure 5 – Flow chart to explain the requirements for protection against the spread of fire | 54 |
| Figure 6 – Baffle | 56 |
| Figure 7 – Area of the bottom of an ENCLOSURE to be constructed as specified in 9.2.1 b)1)..... | 57 |
| Figure 8 – Ball-pressure test apparatus | 63 |
| Figure 9 – Ratio between hydraulic test pressure and RATED maximum working pressure | 66 |
| Figure 10 – Flow chart for conformity options 14.1 a), b), c) and d)..... | 71 |
| Figure A.1 – Measuring circuit for a.c. with frequencies up to 1 MHz and for d.c. | 76 |
| Figure A.2 – Measuring circuits for a.c. with sinusoidal frequencies up to 100 Hz and for d.c. | 77 |
| Figure A.3 – Current measuring circuit for electrical burns | 78 |
| Figure A.4 – Current measuring circuit for wet contact..... | 78 |
| Figure B.1 – Rigid test finger (test probe 11 of IEC 61032) | 79 |
| Figure B.2 – Jointed test finger (test probe B of IEC 61032)..... | 80 |
| Figure C.1 – Examples of methods of measuring CLEARANCE and CREEPAGE DISTANCES..... | 85 |
| Figures D.1 a) to D.1 d) – Protection between HAZARDOUS LIVE circuits and circuits not exceeding the values of 6.3.2 in NORMAL CONDITION and having external TERMINALS of ACCESSIBLE parts..... | 86 |
| Figures D.1 e) to D.1 h) – Protection between HAZARDOUS LIVE circuits and other circuits which do not exceed the values of 6.3.2 in NORMAL CONDITION and which have external TERMINALS | 87 |
| Figure D.2 a) and D.2 b) – Protection from a HAZARDOUS LIVE internal circuit for an ACCESSIBLE part which is not bonded to other ACCESSIBLE parts | 87 |
| Figure D.2 c) and D.2 d) – Protection from a HAZARDOUS LIVE primary circuit for ACCESSIBLE TERMINALS of a secondary circuit which does not exceed the values of 6.3.2 in NORMAL CONDITION | 88 |
| Figure D.3 – Protection of external ACCESSIBLE TERMINALS of two HAZARDOUS LIVE circuits..... | 88 |
| Figure G.1 – Conformity verification process | 92 |

| | <i>Page</i> |
|---|-------------|
| Table 1 – Symbols | 17 |
| Table 2 – Tightening torque for screw assemblies | 29 |
| Table 3 – Multiplication factors for CLEARANCE for altitudes up to 5 000 m | 33 |
| Table 4 – CLEARANCES and CREEPAGE DISTANCES for MAINS CIRCUITS | 34 |
| Table 5 – CLEARANCES for circuits derived from MAINS CIRCUITS | 36 |
| Table 6 – CLEARANCE values for the calculation of 6.7.3.2 | 37 |
| Table 7 – CREEPAGE DISTANCES | 38 |
| Table 8 – CLEARANCES for measurement categories II, III and IV | 39 |
| Table 9 – Test voltages for BASIC INSULATION | 42 |
| Table 10 – Correction factors for test voltage according to test site altitude | 43 |
| Table 11 – Physical tests on power supply cords | 46 |
| Table 12 – Acceptable perforation of the bottom of an ENCLOSURE | 56 |
| Table 13 – Limits of maximum available current | 58 |
| Table 14 – Overcurrent protective device | 58 |
| Table 15 – Surface temperature limits in NORMAL CONDITION | 60 |
| Table 16 – Insulation material of windings | 60 |
| Table 17 – Impulse withstand voltages | 74 |
| Table 18 – Output impedance for impulse generators | 74 |
| Table E.1 – Reduction of the POLLUTION degree of internal environment through the use of additional protection | 89 |
| Table G.1 – Test pressures for equipment with pressures above 14 MPa | 94 |

INTRODUCTION

This part 1 specifies the safety requirements that are generally applicable to all equipment within its scope. For certain types of equipment, these requirements will be supplemented or modified by the special requirements of one, or more than one, particular part 2 of the standard which must be read in conjunction with the part 1 requirements.

X

NOTES

STANDARDS AUSTRALIA

Australian Standard**Safety requirements for electrical equipment for measurement,
control and laboratory use—
Part 1: General requirements (IEC 61010-1:2001 MOD)**

Any table, figure or text of the international standard that is struck through is not part of this standard. Any Australian/New Zealand table, figure or text that is added is part of this standard and is identified by shading.

1 Scope and object**1.1 Scope****1.1.1 Equipment included in scope**

This part of IEC 61010 specifies general safety requirements for electrical equipment intended for professional, industrial processes, and educational use, any of which may incorporate computing devices, as defined in a) to d) below, when used under the environmental conditions of 1.4.

a) Electrical test and measurement equipment

This is equipment which by electrical means tests, measures, indicates or records one or more electrical or non-electrical quantities, also non-measuring equipment such as signal generators, measurement standards, power supplies, transducers, transmitters, etc.

NOTE All indicating and recording electrical measuring instruments (except those excluded in 1.1.2) fall within the scope of IEC 61010 unless they are panel meters designed only for building-in to other equipment. Built-in panel meters are considered to be components and only need to meet the relevant requirements of IEC 61010, or other standards, as part of the equipment into which they are built.

b) Electrical control equipment

This is equipment which controls one or more output quantities to specific values, with each value determined by manual setting, by local or remote programming, or by one or more input variables.

c) Electrical laboratory equipment

This is equipment which measures, indicates, monitors or analyses substances, or is used to prepare materials, and includes in vitro diagnostic (IVD) equipment

This equipment may also be used in areas other than laboratories, for example self-test IVD equipment may be used in the home.

d) Accessories intended for use with the above (for example, sample handling equipment).**1.1.2 Equipment excluded from scope**

This standard does not apply to equipment within the scope of

- a) IEC 60065 (Safety requirements for audio, video and similar electronic apparatus);
- b) IEC 60204 (Controls for electrical machines);
- c) AS/NZS 60335 (Safety of household and similar electrical appliances);
- d) IEC 60364 (Electrical installations of buildings);
- e) IEC 60439-1 (Low-voltage switchgear and controlgear assemblies);
- f) IEC 60521 (Class 0,5; 1 and 2 alternating current watt-hour meters);