



Electricity metering equipment (AC)— General requirements, tests and test conditions

Part 31: Product safety requirements and tests (IEC 62052-31:2015 (ED.1.0) MOD)



This Australian Standard® was prepared by Committee EL-011, Electricity Metering Equipment. It was approved on behalf of the Council of Standards Australia on 12 October 2017.

This Standard was published on 7 November 2017.

The following are represented on Committee EL-011:

- Australian Chamber of Commerce and Industry
 - Australian Energy Council
 - Australian Energy Market Operator
 - Australian Industry Group
 - Consumers Federation of Australia
 - Electrical Regulatory Authorities Council
 - Energy Networks Association
 - National Electrical and Communications Association
 - National Measurement Institute
-

This Standard was issued in draft form for comment as DR AS 62052.31:2016.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all 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Standards may also be withdrawn.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 that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at **mail@standards.org.au**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard®

**Electricity metering equipment (AC)—
General requirements, tests and test
conditions**

**Part 31: Product safety requirements
and tests
(IEC 62052-31:2015 (ED.1.0) MOD)**

First published as AS 62052.31:2017.

COPYRIGHT

© Standards Australia Limited

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, unless otherwise permitted under the Copyright Act 1968.

Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 978 1 76035 937 9

PREFACE

This Standard was prepared by the Standards Australia Committee EL-011, Electricity Metering Equipment.

The objective of this Standard is to communicate to users, and also provide manufacturers, with the product safety and associated type test requirements for electricity metering equipment intended for use in Australia.

Recent policy and regulatory changes underway in Australia's National Electricity Market (NEM) are intended to encourage the accelerated roll-out of advanced metering, replacing the predominantly electromechanical metering fleet presently installed. The introduction of this Standard anticipates this large, impending change-over of metering equipment.

The Council of Australian Governments (COAG) Energy Council directed reforms that resulted in the Australian Energy Market Commission (AEMC) establishing new National Electricity Rules. These Rules mandate advanced meters for new, upgraded and replacement metering installations from December 2017. Advanced meters contain new electrical components, such as disconnect/reconnect supply control switches, interfaces to communications equipment and advanced electronic circuitry, all of which are required to operate in an exposed electrical environment, resulting in safety implications. IEC 62052-31 was developed with advanced metering in mind and with the objective of more comprehensively addressing the safety issues associated with such advanced metering.

This Standard is an adoption with national modifications and has been reproduced from IEC 62052-31:2015 (ED.1.0), *Electricity metering equipment (AC)—General requirements, tests and test conditions*, Part 31: *Product safety requirements and tests*.

This Standard has been varied and appended from the IEC Standard to take account of Australian conditions. The Australian variations to the IEC source text are listed in Appendix ZZ.

This Standard is structured as follows:

- (a) Preface.
- (b) IEC 62052-31:2015, (ED.1.0) (unedited from the Contents page to the final clause of the source document).
- (c) Appendix ZZ, Variations to IEC 62052-31:2015 (ED.1.0) for application in Australia, addressing the issues of—
 - (i) environmental conditions, including higher temperatures and protection from weather;
 - (ii) electrical insulation requirements for safety of self-contained metering equipment;
 - (iii) durability and safety of smaller conductors in large terminals;
 - (iv) safe overload performance compatible with the fault levels and associated protective devices applicable to the public electricity distribution network in Australia; and
 - (v) durability and safety within an environment of high lightning risk and prevalence of open conductors in the Australian electricity distribution network.

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

- (A) In the source text 'this part of IEC 62052' should read 'this Australian Standard'.
- (B) A full point should be substituted for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific standards.

The terms ‘normative’ and ‘informative’ have been used in this Standard 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 for information and guidance only.

This Standard signals the beginning of a programme of adoptions of IEC 62052 and IEC 62053 series Standards on electricity metering equipment. Existing adoptions will be updated and a new Part (AS 62053.24) in the series will be added as follows:

AS 62052.11 (General). Modified adoption of IEC 62052-11:2016 (ED.1.1).

AS 62052.21 (Tariff and load control). Modified adoption of IEC 62052-21:2016 (ED.1.1).

AS 62053.21 (Class 1/2 kWh). Modified adoption of IEC 62053-21:2016 (ED.1.1).

AS 62053.22 (Class 0.2/0.5 kWh). Modified adoption of IEC 62053-22:2016 (ED.1.1).

AS 62053.23 (Class 2/3 kvarh). Modified adoption of IEC 62053-23:2016 (ED.1.1).

AS 62053.24 (Class 1.0/0.5 kvarh). Modified adoption of IEC 62053-24:2016 (ED.1.1).

Attention is also drawn to the significant change posed by the implementation the National Electricity Rules in Australia, commencing December 2017, which obliges the use of direct connected metering equipped with supply control switches. During the transition to the full suite of AS 62052 and AS 62053 Standards above, conformance is required to the following parts of Clause 6.9.8.4 (including Table 22) as modified by Appendix ZZ:

- 1 UC3 fault current performance with conformance determined by test sequence, as detailed in Clause 6.10.6.1, Test sequence and sample plan, (including Table 26) referencing only SCS samples 2, 3 and 4.
- 2 Table 22, Footnote f which references Requirement 10 and requires that ‘For direct connected metering equipment intended for use at the interface with the Australian public electricity distribution network, I_{ovl} shall be ≥ 128 A’, with limited conformance determined only as per clauses—
 - (i) 10.1, Surface temperature limits for protection against burns; and
 - (ii) 10.2, Temperature limits for terminals.

This transition commences with the publication of this Standard and ends with the withdrawal of the following Standards:

AS 62052.11—2005

AS 62052.21—2006

AS 62053.21—2005

AS 62053.22—2005

AS 62053.23—2006

NOTES

NOTES

CONTENTS

FOREWORD	8
INTRODUCTION	10
1 Scope and object	12
1.1 Scope	12
1.2 Object	13
1.2.1 Aspects included in scope	13
1.2.2 Aspects excluded from scope	13
1.3 Verification	14
1.4 Environmental conditions	14
1.4.1 Normal environmental conditions	14
1.4.2 Extended environmental conditions	14
1.4.3 Extreme environmental conditions	15
2 Normative references	15
3 Terms and definitions	16
3.1 Equipment and states of equipment	16
3.2 Parts and accessories	17
3.3 Quantities	19
3.4 Tests	21
3.5 Safety terms	21
3.6 Insulation	25
3.7 Terms related to switches of metering equipment	29
4 Tests	31
4.1 General	31
4.2 Type test – sequence of tests	31
4.3 Reference test conditions	32
4.3.1 Atmospheric conditions	32
4.3.2 State of the equipment	32
4.4 Testing in single fault condition	36
4.4.1 General	36
4.4.2 Application of fault conditions	36
4.4.3 Duration of tests	38
4.4.4 Conformity after application of fault conditions	38
5 Information and marking requirements	39
5.1 General	39
5.2 Labels, signs and signals	41
5.2.1 General	41
5.2.2 Durability of markings	43
5.3 Information for selection	43
5.3.1 General	43
5.3.2 General information	43
5.3.3 Information related to meters / metering elements	44
5.3.4 Information related to stand-alone tariff-and load control equipment	44
5.3.5 Information related to supply control and load control switches	44
5.4 Information for installation and commissioning	44
5.4.1 General	44
5.4.2 Handling and mounting	45

5.4.3	Enclosure	45
5.4.4	Connection	45
5.4.5	Protection	47
5.4.6	Auxiliary power supply	48
5.4.7	Supply for external devices	48
5.4.8	Batteries	48
5.4.9	Self-consumption	48
5.4.10	Commissioning	49
5.5	Information for use	49
5.5.1	General	49
5.5.2	Display, push buttons and other controls	49
5.5.3	Switches	49
5.5.4	Connection to user's equipment	50
5.5.5	External protection devices	50
5.5.6	Cleaning	50
5.6	Information for maintenance	50
6	Protection against electrical shock	50
6.1	General requirements	50
6.2	Determination of accessible parts	51
6.2.1	General	51
6.2.2	Examination	51
6.2.3	Openings above parts that are hazardous live	52
6.2.4	Openings for pre-set controls	52
6.2.5	Wiring terminals	53
6.3	Limit values for accessible parts	53
6.3.1	General	53
6.3.2	Levels in normal condition	53
6.3.3	Levels in single fault condition	53
6.4	Primary means of protection (protection against direct contact)	56
6.4.1	General	56
6.4.2	Equipment case	56
6.4.3	Basic insulation	56
6.4.4	Impedance	56
6.5	Additional means of protection in case of single fault conditions (protection against indirect contact)	57
6.5.1	General	57
6.5.2	Protective bonding	57
6.5.3	Supplementary insulation and reinforced insulation	61
6.5.4	Protective impedance	61
6.5.5	Automatic disconnection of the supply	61
6.5.6	Current- or voltage-limiting device	62
6.6	Connection to external circuits	62
6.6.1	General	62
6.6.2	Terminals for external circuits	63
6.6.3	Terminals for stranded conductors	63
6.7	Insulation requirements	63
6.7.1	General – Electrical stresses, overvoltages and overvoltage categories	63
6.7.2	The nature of insulation	64
6.7.3	Insulation requirements for mains-circuits	64

6.7.4	Insulation requirements for non-mains-circuits	74
6.7.5	Insulation in circuits not addressed in 0 or 6.7.4	78
6.7.6	Reduction of transient overvoltages by the use of overvoltage limiting devices	84
6.8	Insulation requirements between circuits and parts	84
6.9	Constructional requirements for protection against electric shock	88
6.9.1	General	88
6.9.2	Insulating materials	88
6.9.3	Colour coding	88
6.9.4	Equipment case	88
6.9.5	Terminal blocks	89
6.9.6	Insulating materials of supply control and load switches	89
6.9.7	Terminals	90
6.9.8	Requirements for current circuits	92
6.10	Safety related electrical tests	99
6.10.1	Overview	99
6.10.2	Test methods	101
6.10.3	Testing of voltage circuits	104
6.10.4	Dielectric tests	106
6.10.5	Electrical tests on current circuits of direct connected meters without supply control switches (SCSs)	112
6.10.6	Electrical tests on current circuits of direct connected meters with SCSs	113
6.10.7	Electrical tests on load control switches (LCSs)	119
7	Protection against mechanical hazards	122
7.1	General	122
7.2	Sharp edges	122
7.3	Provisions for lifting and carrying	123
8	Resistance to mechanical stresses	123
8.1	General	123
8.2	Spring hammer test	123
9	Protection against spread of fire	124
9.1	General	124
9.2	Eliminating or reducing the sources of ignition within the equipment	125
9.3	Containment of fire within the equipment, should it occur	125
9.3.1	General	125
9.3.2	Constructional requirements	126
9.4	Limited-energy circuit	126
9.5	Overcurrent protection	128
10	Equipment temperature limits and resistance to heat	128
10.1	Surface temperature limits for protection against burns	128
10.2	Temperature limits for terminals	129
10.3	Temperatures of internal parts	130
10.4	Temperature test	132
10.5	Resistance to heat	133
10.5.1	Non-metallic enclosures	133
10.5.2	Insulating materials	134
11	Protection against penetration of dust and water	134
12	Protection against liberated gases and substances explosion and implosion – Batteries and battery charging	134

13	Components and sub-assemblies	136
13.1	General.....	136
13.2	Mains transformers tested outside equipment	138
13.3	Printed wiring boards	138
13.4	Components bridging insulation	138
13.5	Circuits or components used as transient overvoltage limiting devices	138
14	Hazards resulting from application – Reasonably foreseeable misuse	138
15	Risk assessment	139
Annex A	(normative) Measuring circuits for touch current	140
A.1	Measuring circuit for a.c. with frequencies up to 1 MHz and for d.c.	140
A.2	Measuring circuits for sinusoidal a.c. with frequencies up to 100 Hz and for d.c.	141
A.3	Current measuring circuit for electrical burns at high frequencies.....	141
A.4	Current measuring circuit for wet location	142
Annex B	(informative) Examples for insulation between parts	143
B.1	Insulation between parts – Example 1	143
B.2	Insulation between parts – Example 2	144
B.3	Insulation between parts – Example 3	145
B.4	Insulation between parts – Example 4	146
B.5	Insulation between parts – Example 5	147
Annex C	(informative) Examples for direct connected meters equipped with supply control and load control switches	149
Annex D	(normative) Test circuit diagram for the test of long term overvoltage withstand	151
Annex E	(normative) Test circuit diagram for short current test on the current circuit of direct connected meters.....	152
Annex F	(informative) Examples for voltage tests.....	154
Annex G	(normative) Additional a.c. voltage tests for electromechanical meters	158
Annex H	(normative) Test equipment for cable flexion and pull test	159
Annex I	(informative) Routine tests	161
I.1	General.....	161
I.2	Protective earth	161
I.3	AC power-frequency high-voltage test for mains-circuits	161
I.4	Mains-circuits with voltage limiting devices	161
Annex J	(informative) Examples of battery protection.....	162
Annex K	(informative) Rationale for specifying overvoltage category III	163
K.1	Transient overvoltage requirements in TC 13 standards.....	163
K.2	Electricity meters mentioned in basic safety publications and group safety publications	163
K.2.1	IEC 60664-1	163
K.2.2	IEC 60364-4-44	164
K.2.3	IEC 61010-1	164
K.3	Conclusion.....	165
Annex L	(informative) Overview of safety aspects covered.....	166
Annex M	(informative) Index of defined terms	181
Bibliography		184

Figure 1 – Measurements through openings in enclosures	52
Figure 2 – Maximum duration of short-term accessible voltages in single fault condition (see 6.3.3 a))	54
Figure 3 – Capacitance level versus voltage in normal condition and single fault condition (see 6.3.2 c) and 6.3.3 c)).....	55
Figure 4 – Acceptable arrangements of protection means against electric shock.....	57
Figure 5 – Examples of binding screw assemblies	59
Figure 6 – Distance between conductors on an interface between two layers.....	72
Figure 7 – Distance between adjacent conductors along an interface of an inner layer	72
Figure 8 – Distance between adjacent conductors located between the same two layers.....	74
Figure 9 – Example of recurring peak voltage	82
Figure 10 – Flowchart of safety related electrical tests.....	100
Figure 11 – Flow chart to explain the requirements for protection against the spread of fire.....	125
Figure 12 – Ball-pressure test apparatus.....	134
Figure 13 – Flow chart for conformity options 13.1 a), b), c) and d).....	137
Figure A.1 – Measuring circuit for a.c. with frequencies up to 1 MHz and for d.c.	140
Figure A.2 – Measuring circuits for sinusoidal a.c. with frequencies up to 100 Hz and for d.c.	141
Figure A.3 – Current measuring circuit for electrical burns	142
Figure A.4 – Current measuring circuit for wet contact	142
Figure B.1 – Insulation between parts – Example 1	143
Figure B.2 – Insulation between parts – Example 2.....	144
Figure B.3 – Insulation between parts – Example 3.....	145
Figure B.4 – Insulation between parts – Example 4.....	146
Figure B.5 – Insulation between parts – Example 5.....	147
Figure C.1 – Single phase two wire meter with UC2 SCS and 25A LCS	149
Figure C.2 – Three phase four wire meter with UC2 SCS and 2A auxiliary control switch	150
Figure D.1 – Circuit for three-phase four-wire meters to simulate long term overvoltage, voltage moved to L3.....	151
Figure D.2 – Voltages at the meter under test.....	151
Figure E.1 – Test circuit for verification of short-time withstand current test on current circuits with and without supply control switches	152
Figure E.2 – Example of short-circuit carrying test record in the case of a single-pole equipment on single-phase a.c.	153
Figure F.1 – Test arrangement for voltage tests: 3 phase 4 wire direct connected meter with supply control and load control switches	154
Figure F.2 – Test arrangement for voltage tests: 3 phase 4 wire transformer connected meter.....	156
Figure H.1 – Test equipment for cable flexion and pull test (see 6.9.7.3)	159
Figure J.1 – Non-rechargeable battery protection.....	162
Figure J.2 – Rechargeable battery protection.....	162

Table 1 – Test copper conductors for current and switch terminals	35
Table 2 – Information requirements.....	40
Table 3 – IEC 60417 symbols and ISO 7000 that may be used on metering equipment.....	42
Table 4 – Tightening torque for binding screw assemblies	60
Table 5 – Multiplication factors for clearance for altitudes up to 5 000 m.....	64
Table 6 – Overview of clauses specifying requirements and tests for insulations	67
Table 7 – Nominal / rated voltages and rated impulse voltages	68
Table 8 – Clearances for mains-circuits	69
Table 9 – Creepage distances for mains-circuits	70
Table 10 – Test voltages for solid insulation in mains-circuits	71
Table 11 – Test voltages for testing long-term stress of solid insulation in mains-circuits	71
Table 12 – Minimum values for distance or thickness of solid insulation.....	73
Table 13 – Clearances and test voltages for non-mains-circuits derived from mains-circuits of overvoltage category III	75
Table 14 – Creepage distances for non-mains-circuits	75
Table 15 – Minimum values for distance or thickness (see 6.7.4.4.2 to 6.7.4.4.4)	77
Table 16 – Clearance values for the calculation of 6.7.5.2	80
Table 17 – Test voltages based on clearances.....	81
Table 18 – Clearances for basic insulation in circuits having recurring peak voltages	83
Table 19 – Isolation classes for non-mains-circuits	85
Table 20 – Insulation requirements between any two circuits	86
Table 21 – Summary of requirements for current circuits of direct connected meters without SCS.....	95
Table 22 – Summary of requirements for current circuits of direct connected meters with SCS.....	96
Table 23 – Summary of requirements for load control switches	98
Table 24 – Correction factors according to test site altitude for test voltages for clearances	104
Table 25 – AC voltage test.....	109
Table 26 – Test sequence and sample plan for supply control switches	113
Table 27 – Power factor ranges of the test circuit	116
Table 28 – Test sequence and sample plan for load control switches.....	120
Table 29 – Limits of maximum available current.....	127
Table 30 – Values for overcurrent protection devices	127
Table 31 – Surface temperature limits in normal condition	129
Table 32 – Temperature limits for terminals	130
Table 33 – Maximum measured total temperatures for internal materials and components	131
Table G.1 – AC voltage tests of electromechanical meters.....	158
Table H.1 – Test values for flexion and pull-out tests for round copper conductors	160
Table L.1 – Overview of safety aspects.....	166

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 non-governmental 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62052-31 has been prepared by IEC technical committee 13: Electrical energy measurement and control.

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

FDIS	Report on voting
13/1639/FDIS	13/1645/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62052 series, under the general title *Electricity metering equipment (AC) – General requirements, tests and test conditions*, can be found on the IEC website.

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.*

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

NOTE 1 The following text is based on IEC Guide 104, ISO/IEC Guide 51 and IEC 60255-27:2013.

The IEC addresses safety aspects by establishing *basic*, *group* and *product* safety publications.

A *basic safety publication* covers a specific safety-related matter, applicable to many electrotechnical products. It is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51. It is not intended for use by manufacturers or certification bodies. One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications. The requirements, test methods or test conditions of basic safety publications will not apply unless specifically referred to or included in the relevant publications.

A *group safety publication* covers all safety aspects of a specific group of products within the scope of two or more product TCs. Group safety publications are primarily intended to be stand-alone product safety publications, but may also be used by TCs as source material in the preparation of their publications.

A *product safety publication* covers all safety aspects of one or more products within the scope of a single product TC.

Existing product standards established by TC 13 include a range of safety requirements, test methods and test conditions. However, an important requirement of IEC Guide 104:2010, 5.2.3 has not been met so far:

“Safety aspects and performance aspects should not be covered in the same publication, as this makes it difficult to assess conformity with safety requirements alone. If, exceptionally, there are reasons to cover them in the same publication, safety aspects and performance aspects shall be clearly distinguished from each other. If there are performance criteria which have safety implications, these are considered to be safety aspects and this shall be made clear in the publication.”

In addition, some important aspects of product safety, such as safety under single fault conditions, have not been covered so far.

The objectives of the development of this International Standard are the following:

- to specifically reference and include relevant requirements, test methods or test conditions of relevant basic safety publications so that they become applicable;
- to specifically reference and include – where appropriate, in a modified form – relevant requirements, test methods or test conditions of relevant group safety publications;
- to consider the latest developments in the technology used for the design and manufacture of equipment for electrical energy measurement and control;
- to remove any ambiguity resulting from the lack of a comprehensive product safety standard for products in the Scope of TC 13;
- to achieve a uniform approach to product safety throughout the international metering industry.

This *product safety standard* is based on, among others, the following:

- the *basic safety standard* IEC 60664-1:2007, established by TC 109;
- standards from the IEC 60364 series related to electrical installations of buildings, established by TC 64;
- the *group safety standard* IEC 61010-1:2010 established by TC 66;

- the *group safety standard* IEC 62477-1:2012 established by TC 22;
- IEC 60255-27:2013, a *product safety standard* for measuring relays and protection equipment, established by TC 95. These products are similar in their design and to some extent in their use in equipment for electrical energy measurement and control,

To facilitate the use of this standard, an integral text has been prepared, with appropriate 539 references to source documents.

This standard cancels and replaces the safety requirements specified in earlier standards established by IEC TC 13. See also Annex L (Informative).

NOTE 2 When this standard is published, an amendment to the relevant standards affected by this standard in IEC 62052, IEC 62053 and IEC 62054 will be published, to indicate which parts of those standards are replaced / cancelled by this standard.

Being a product safety standard, this standard takes precedence over the group safety standards IEC 61010-1:2010 and IEC 62477-1:2012.

AUSTRALIAN STANDARD

Electricity metering equipment (AC)—General requirements, tests and test conditions**Part 31:
Product safety requirements and tests
(IEC 62052-31:2015 (ED.1.0) MOD)****1 Scope and object****1.1 Scope**

This part of IEC 62052 specifies product safety requirements for equipment for electrical energy measurement and control.

NOTE 1 For other requirements, see the relevant standards.

This International Standard applies to newly manufactured metering equipment designed to measure and control electrical energy on 50 Hz or 60 Hz networks with a voltage up to 600 V, where all functional elements, including add-on modules are enclosed in or form a single case.

NOTE 2 The voltage mentioned above is the voltage line-to-neutral derived from nominal voltages. See Table 7.

This International Standard also applies to metering equipment containing supply and load control switches, but only those which are electromechanical in operation.

NOTE 3 For components and sub-assemblies, see Clause 13.

When such equipment is designed to be installed in a specified matching socket, then the requirements apply to, and the tests shall be performed on, equipment installed in its specified matching socket. However, requirements for sockets and inserting / removing the meters from the socket are outside the scope of this standard.

This International Standard is also applicable to auxiliary input and output circuits.

NOTE 4 Examples are impulse inputs and outputs, control inputs and outputs, circuits for meter data exchange.

In this standard distinction is made between:

- electromechanical meters, static meters and equipment for tariff and load control;
- direct connected, current transformer operated, voltage and current transformer operated meters;
- protective class I and protective class II equipment;
- wall or cabinet mounted, rack mounted and panel mounted equipment;
- equipment intended for indoor use and outdoor use.

Equipment used in conjunction with equipment for electrical energy measurement and control may need to comply with additional safety requirements. See also Clause 13.

NOTE 5 Examples are telecommunication modems and customer information units.

This International Standard does not apply to:

- equipment where the voltage line-to-neutral derived from nominal voltages exceeds 600 V;
- portable meters;

NOTE 6 Portable meters are meters that are not permanently connected.

- laboratory and mobile meter test equipment;
- reference standard meters.

The safety requirements of this standard are based on the following assumptions:

- metering equipment has been installed correctly;
- metering equipment is used generally by unskilled persons, including meter readers and consumers of electrical energy. In many cases, it is installed in a way that it is freely accessible. Its terminal covers cannot be removed and its case cannot be opened without removing seals and using a tool;
- during normal use all terminal covers, covers and barriers providing protection against accessing hazardous live parts are in place;
- for installation, configuration, maintenance and repair it may be necessary to remove terminal cover(s), (a part of) the case or barriers so that hazardous live parts may become accessible. Such activities are performed by skilled personnel, who have been suitably trained to be aware of working procedures necessary to ensure safety. Therefore, safety requirements covering these conditions are out of the Scope of this standard.

1.2 Object

1.2.1 Aspects included in scope

NOTE 1 Subclause 1.2 is based on IEC 61010-1:2010, 1.2.

The purpose of the requirements of this standard is to ensure that hazards to the user and the surrounding area are reduced to a tolerable level.

Requirements for protection against particular types of hazard are given in Clauses 6 to 12 as follows:

- a) electrical shock or burn (see Clause 6);
- b) mechanical hazards and stresses (see Clauses 7 and 8);
- c) spread of fire from the equipment (see Clause 9);
- d) excessive temperature (see Clause 10);
- e) penetration of dust and water (see Clause 11);
- f) liberated gases, explosion and implosion (see Clause 12).

Requirements for components and sub-assemblies are specified in Clause 13.

Requirements for protection against hazards arising from reasonably foreseeable misuse are specified in Clause 14.

Risk assessment for hazards or environments not fully covered above is specified in Clause 15.

NOTE 2 Attention is drawn to the existence of additional requirements specified by national authorities responsible for health and safety.

1.2.2 Aspects excluded from scope

This standard does not cover:

- a) performance, reliability or other properties of the equipment not related to safety;
- b) EMC requirements, which are covered by the relevant type testing standards;

NOTE 1 For EMC requirements and test methods, see IEC 62052-11:2003, IEC 62052-21:2004 and IEC 62055-31:2005

- c) protective measures for explosive atmospheres (see IEC 60079-0);

- d) functional safety requirements;
- e) effectiveness of transport packaging;
- f) safety requirements of installations.

NOTE 2 The latter is generally subject to national regulation.

1.3 Verification

NOTE This subclause reproduces IEC 61010-1:2010, 1.3.

This standard also specifies methods of verifying that the equipment meets the requirements of this standard, through inspection, type tests, risk assessment and routine tests. See Clauses 4, 15 and Annex I respectively.

1.4 Environmental conditions

1.4.1 Normal environmental conditions

NOTE 1 Subclause 1.4 is based on IEC 61010-1:2010, 1.4.

This standard applies to metering equipment designed to be safe at least under the following conditions:

- a) indoor use;
- b) altitude up to 2 000 m;
- c) climatic conditions according to 3K5, but with low air temperature -10°C ; see IEC 60721-3-3:1994;

NOTE 2 3K5 specifies low air temperature -5°C , high air temperature $+45^{\circ}\text{C}$, low relative humidity 5 %, high relative humidity 95 %. See the climatogram in IEC 60721-3-3:1994, Figure B.5.

- d) voltage fluctuations up to $-20\ldots 15$ % of the nominal voltage;

The equipment may have several nominal voltages.

- e) transient overvoltages up to the levels of overvoltage category III;
- f) transient overvoltages occurring on the mains supply (see 6.7.1.1);
- g) applicable pollution degree of the intended environment (pollution degree 2 in most cases).

Manufacturers may specify more restricted environmental conditions for operation; nevertheless, the equipment shall be safe within these normal environmental conditions.

1.4.2 Extended environmental conditions

This standard applies to metering equipment designed to be safe not only under the environmental conditions specified in 1.4.1, but also under any of the following conditions for which the equipment is rated by the manufacturer:

- a) outdoor use;
- b) altitude above 2 000 m;
- c) climatic conditions according to 3K6; see IEC 60721-3-3:1994;

NOTE 1 3K6 specifies low air temperature -25°C , high air temperature $+55^{\circ}\text{C}$, low relative humidity 10 %, high relative humidity 100 %. See the climatogram in IEC 60721-3-3:1994, Figure B.6.

- d) transient overvoltages higher than what is required for overvoltage category III.

NOTE 2 Under such circumstances, additional protection can be provided by external overvoltage protection elements. However, this is beyond the Scope of this standard. Information on the effects of installing varistors in large quantities on the network can be found in IEC TR 61000-2-3:1992, 6.6.1.

1.4.3 Extreme environmental conditions

NOTE 1 The following text is based on IEC 60721-3-0:1984, 5.2.

It is recognized that extreme environmental conditions may exist.

Elements determining the environmental conditions may occur with any of their severities in combination with other elements and their respective severities. An assumption that each element may occur with its highest severity would lead to unnecessary overdesign and cost. Therefore, specifications for products to operate under such extreme environmental conditions are a matter for negotiation between the manufacturer and the purchaser.

NOTE 2 For specific climatic conditions, see IEC 60721-3-3:1994.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027-1, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 60068-2-75:2014, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60269-3, *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications) – Examples of standardized systems of fuses A to F*

IEC 60332-1-2:2004, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60332-2-2:2004, *Tests on electric and optical fibre cables under fire conditions – Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable – Procedure for diffusion flame*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60417-DB-12M, *Graphical symbols for use on equipment*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
Amd1:1999
Amd2: 2013

IEC 60617-DB-12M, *Graphical symbols for diagrams*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*
Amd 1: 2009
Amd 2: 2013

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

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

IEC 62053-52, *Electricity metering equipment (a.c.) – Particular requirements – Part 52: Symbols*

ISO 75-2, *Plastics – Determination of temperature of deflection under load – Part 2: Plastics and ebonite*

ISO 306, *Plastics – Thermoplastic materials – Determination of Vicat softening temperature (VST)*

ISO 3864-1, *Graphical symbols, Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

ISO 7000:2004, *Graphical symbols for use on equipment – Registered symbols*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Equipment and states of equipment

3.1.1

equipment

device with functions related to electrical energy measurement and control

Note 1 to entry: Examples include but are not limited to electricity meters, payment meters, tariff and load control equipment. The term “meter” is used in the text sometimes as a synonym of “metering equipment”. A meter may include, in addition to the basic energy metering function, other functions.

3.1.2

permanently connected equipment

equipment that is electrically connected to a supply by means of a permanent connection which can be detached only by the use of a tool

[SOURCE: IEC 61010-1:2010, 3.1.2]

3.1.3**tool**

external device, including keys and coins, used to aid a person to perform a mechanical function

[SOURCE: IEC 61010-1:2010, 3.1.5]

3.1.4**isolation**

function intended to prevent hazardous electric energy from appearing, for reasons of safety, in an electrical installation, or in a discrete section of the electrical installation, by separating the electrical installation or section of it from every source of electric energy

[SOURCE: IEC 60050-826:2004, 826-17-01, modified – “to make dead” replaced by “to prevent hazardous electric energy from appearing “ and “all or a discrete section of the electrical installation” replaced by “in an electrical installation, or in a discrete section of the electrical installation”]

3.2 Parts and accessories**3.2.1****protective barrier****electrically protective barrier**

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

Note 1 to entry: Depending on its construction, a protective barrier can be called a casing, cover, screen, door, guard, etc.

A protective barrier can act alone; it is then only effective when it is in place. A protective barrier can also act in conjunction with an interlocking device with or without guard locking; in this case, protection is ensured whatever the position of the protective barrier.

[SOURCE: IEC 60050-195:1998, 195-06-15]

3.2.2**restricted access area**

area accessible only to electrically skilled persons and electrically instructed persons with the proper authorization and knowledge of any safety hazards

Note 1 to entry: These areas include closed switch plants, distribution plants, switchgear cells, transformer cells, distribution systems in metal-sheet enclosures or in other closed installations.

[SOURCE: IEC 60255-27:2013, 3.56, IEC 60550:1998, 195-04-04, modified – “and knowledge of any safety hazards” and a Note have been added]

3.2.3**base**

back of the meter by which it is generally fixed and to which are attached the measuring element, the terminals or the terminal block, and the cover. For a flush-mounted meter, the meter base may include the sides of the case

[SOURCE: IEC 62052-11:2003, 3.3.3]

3.2.4**cover**

enclosure on the front of the meter, made either wholly of transparent material or opaque material provided with window(s) through which the operation indicator (if fitted) and the display can be read

[SOURCE: IEC 62052-11:2003, 3.3.4]

3.2.5**case**

comprises the base and the cover. When the case is closed, it provides protection against certain external influences and, in any direction, protection against direct contact and spread of fire

[SOURCE: IEC 62052-11:2003, 3.3.5, modified – second sentence added to align with the term “enclosure” defined in IEC 61010-1:2010]

3.2.6**terminal cover**

cover which covers the meter terminals and, generally, the ends of the external wires or cables connected to the terminals. When the meter is mounted in its normal working position and when the terminal cover is in place, it provides protection in any direction against direct contact (together with the case)

[SOURCE: IEC 62052-11:2003, 3.3.9, modified – second sentence added]

3.2.7**terminal**

conductive part of a device, electric circuit or electric network, provided for connecting that device, electric circuit or electric network to one or more external conductors

[SOURCE: IEC 60050-151:2001, 151-12-12, modified – Note which is not relevant in the context of this standard omitted]

3.2.8**protective conductor terminal**

terminal which is bonded to conductive parts of an equipment for safety purposes and is intended to be connected to an external protective earthing system

[SOURCE: IEC 61010-1:2010, 3.2.3]

3.2.9**reference earth**

part of the Earth considered as conductive, the electric potential of which is conventionally taken as zero, being outside the zone of influence of any earthing arrangement

Note 1 to entry: The concept "Earth" means the planet and all its physical matter.

[SOURCE: IEC 60050-195:1998, 195-01-01]

3.2.10**earth****local earth**

part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero

[SOURCE: IEC 60050-195:1998, 195-01-03]

3.2.11**indoor meter**

meter intended for operation under normal climatic conditions in a building or in a meter cabinet

3.2.12**outdoor meter**

meter intended for operation under extended climatic conditions

3.2.13**ventilated, adj**

designed with a means to permit circulation of air sufficiently to remove an excess of heat, fumes, or vapours

[SOURCE: IEC 60050-151:2001, 151-16-37]

3.2.14**meter cabinet**

enclosure for housing metering equipment and affording protection suitable for the intended application

Note 1 to entry: It may be fixed on a wall, built in a wall recess or it may be free-standing and self-supporting. It may also accommodate elements of the electrical installation, like fuses, circuit breakers, residual current devices.

3.2.15**specified matching socket**

base with jaws which accepts and connects to socket-mounted metering equipment

Note 1 to entry: This includes terminals for connection to the supply and load circuits; also appropriate secure fixing and sealing arrangements.

Note 2 to entry: This term only relates to metering equipment designed as a socket-mounted unit.

Note 3 to entry: The metering equipment is capable of meeting the relevant type testing requirements when it is properly installed in any specified matching socket.

[SOURCE: IEC 62055-31:2005, 3.1.9, modified – additional information is given in the Notes]

3.2.16**packaging**

products used for the containment, protection, handling, delivery and preservation of the meter from the producer to the user or consumer

3.3 Quantities**3.3.1****rated value**

value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001, 151-16-08]

3.3.2**rating**

set of rated values and operating conditions

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

3.3.3**operating range**

range for which the equipment under specified conditions is able to perform its intended function(s) according to the specified requirements

[SOURCE: IEC 60050-447:2010, 447-03-16]

3.3.4**rated voltage**

value of voltage assigned by the manufacturer, for a specified operating condition of a component, device or equipment

Note 1 to entry: Equipment may have more than one rated voltage value or may have a rated voltage range.

[SOURCE: IEC 60255-27:2013, 3.54]

3.3.5

ambient air temperature

the temperature, determined under prescribed conditions, of the air surrounding the complete equipment

Note 1 to entry: For equipment installed inside a meter cabinet, it is the temperature of the air inside the meter cabinet.

Note 2 to entry: The ambient temperature is measured at half the distance from any neighbouring equipment, but not more than 300 mm distance from the equipment case, at middle height of the equipment, protected from direct heat radiation from the equipment.

[SOURCE: IEC 60050-441:1984, 441-11-13, modified – definition adapted to metering and Note 2 added]

3.3.6

rated maximum ambient temperature

t_a

maximum temperature at which the equipment may be operated continuously

[SOURCE: IEC 61558-1:2009, 3.5.8, modified – definition adapted to metering and Note omitted]

3.3.7

working voltage

highest r.m.s. value of the a.c. or d.c. voltage across any particular insulation which can occur when the equipment is supplied at rated voltage

[SOURCE: IEC 60050-581:2008, 581-21-19]

3.3.8

rated impulse voltage

impulse withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages

[SOURCE: IEC 60664-1:2007, 3.9.2]

3.3.9

utilization category

UC

a combination of specified requirements related to the condition in which a direct connected meter with or without supply control switches fulfils its purpose, selected to represent a characteristic group of practical applications

Note 1 to entry: The specified requirements may concern e.g. the values of short circuit current, making capacities and breaking capacities (if applicable) and other characteristics, the associated circuits and the relevant conditions of use and behaviour.

Note 2 to entry: The utilization category provides information for the selection of the right meter the characteristics of which are properly co-ordinated with the characteristics of the supply side short current protection device that protects the meter.

[SOURCE: IEC 60050-441:1984, 441-17-19, modified – definition adapted to metering and Note 2 added]

3.3.10**maximum current** **$I_{\max}$**

highest value of current the meter can carry continuously and remain safe, and at which it purports to meet the accuracy requirements of the relevant standard

Note 1 to entry: The term “current” indicates r.m.s. values unless otherwise specified.

[SOURCE: IEC 62052-11:2003, 3.5.2, modified – to cover both the the safety and the accuracy aspect]

3.3.11**maximum overload current** **I_{ovl}**

highest value of current, which is not caused by a short circuit, that a direct connected meter can carry for a limited duration and remain safe

Note 1 to entry: The term “current” indicates r.m.s. values unless otherwise specified.

Note 2 to entry: The value is at least equal to the maximum current and it is subject to agreement between the manufacturer and the purchaser taking into account the characteristics of the overcurrent protection elements used in the installation for which the metering equipment is intended and other installation conditions.

Note 3 to entry: This current is not a rating and is not mandatorily marked on the equipment.

3.4 Tests**3.4.1****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 1 to entry: This is an amplification of the IEC 60050-151:2001, 151-16-16 definition to cover design as well as construction.

[SOURCE: IEC 61010-1:2010, 3.4.1]

3.4.2**routine test**

conformity test made on each individual item during or after manufacture

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

3.5 Safety terms**3.5.1****accessible part**

part which can be touched by means of the standard test finger or test pin

[SOURCE: IEC 60050-442:1998, 442-01-15, modified – to allow using either a test finger or a test pin as appropriate]

3.5.2**hazard**

potential source of harm

[SOURCE: IEC 61010-1:2010, 3.5.2]

3.5.3**hazardous live**

capable of rendering an electric shock or electric burn

[SOURCE: IEC 61010-1:2010, 3.5.3]

3.5.4

current circuit

internal connections of the meter and part of the measuring element through which flows the current of the circuit to which the meter is connected

[SOURCE: IEC 62052-11:2003, 3.2.6]

3.5.5

voltage circuit

internal connections of the meter and part of the measuring element supplied with the voltage of the circuit to which the meter is connected

Note 1 to entry: In the case of static meters, the electronic circuits are generally supplied from the voltage circuits. See also 3.5.9.

[SOURCE: IEC 62052-11:2003, 3.2.7, modified – additional information on supplying the electronic circuits moved to the Note]

3.5.6

mains

electrical network supplying the premises

3.5.7

mains-circuit

electrical circuit which is conductively connected to and energized directly from the mains

Note 1 to entry: Voltage circuits intended to be connected to the secondary side of measuring voltage transformers are classed also as mains-circuits.

3.5.8

non-mains-circuit

electrical circuit not energized directly from the mains

Note 1 to entry: This circuit may be isolated by a transformer or supplied by a battery.

Note 2 to entry: Whereas IEC 61010-1:2010 uses the terms “primary circuit” and “secondary circuit”, in this standard the terms “mains circuit” and “non-mains circuit” are used, to avoid confusion with primary and secondary circuits of instrument transformers used with transformer operated meters.

[SOURCE: IEC 62477-1:2012, 3.26, modified – additional information is given in the Notes]

3.5.9

auxiliary supply

a.c. or d.c. electrical power supply, other than the measurand, provided via dedicated terminals

Note 1 to entry: Provision of an auxiliary power supply may be necessary if the voltage circuits may become de-energized for extended periods, and some functions of the meter shall be nevertheless maintained. Such situations often occur with measuring voltage transformer operated meters in substations.

[SOURCE: IEC 60688:2012, 3.1.4, modified – definition adapted to metering and Note added]

3.5.10

auxiliary device

device in the meter intended to perform a particular function additional to the basic metrology function

Note 1 to entry: Examples are: clock, tariff / load / supply control switch, impulse input / output, data exchange unit.

Note 2 to entry: An auxiliary device may be internal or external to a meter.

3.5.11

auxiliary circuit

circuit other than the voltage measurement, current measurement and auxiliary supply circuits intended to be connected to (an) external device(s)

[SOURCE: IEC 62052-11:2003, 3.2.8, modified – to reflect changes in technology]

3.5.12

protective impedance

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

[SOURCE: IEC 61010-1:2010, 3.5.6]

3.5.13

protective bonding

electrical connection of accessible conductive parts or of protective screening to provide electrical continuity to the means of connection of an external protective conductor

[SOURCE: IEC 61010-1:2010, 3.5.7]

3.5.14

normal use

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

[SOURCE: IEC 61010-1:2010, 3.5.8]

3.5.15

normal condition

condition in which all means of protection against hazards are intact

[SOURCE: IEC Guide 104:2010, 3.7, modified – “against hazards” added]

3.5.16

single fault condition

condition in which there is a fault of a single protection (but not a reinforced protection) or of a single component or a device

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.

[SOURCE: IEC Guide 104:2010, 3.8, modified – wording of Note 1 amended, “unavoidably” added]

3.5.17

direct contact

electric contact of persons or animals with live parts

[SOURCE: IEC 60050-195:1998, 195-06-03]

3.5.18

indirect contact

electric contact of persons or animals with exposed-conductive-parts which have become live under fault conditions

[SOURCE: IEC 60050-195:1998, 195-06-04]

3.5.19

user

person, other than a service person, installer or operator

[SOURCE: IEC 60950-1:2005, 1.2.13.6, modified – to include installer and operator]

3.5.20

service person

person having appropriate technical training and experience necessary to be aware of hazards to which they may be exposed in performing a task and of measures to minimize the risks for themselves or other persons

[SOURCE: IEC 60950-1:2005, 1.2.13.5]

3.5.21

installer

service person responsible for the installation of metering equipment and, when applicable, the provision of necessary safety related information to the user

3.5.22

operator

service person responsible for operation and maintenance of metering equipment and, when applicable, the provision of necessary safety related information to the user

3.5.23

reasonably foreseeable misuse

use of a product in a way not intended by its provider but which may result from readily predictable human behaviour

Note 1 to entry: Fraudulent attempts are not considered as foreseeable misuse.

[SOURCE: IEC 61010-1:2010, 3.5.14, modified – additional information in the Note added]

3.5.24

risk

combination of the probability of the occurrence of harm and the severity of that harm

[SOURCE: IEC 61010-1:2010, 3.5.15]

3.5.25

tolerable risk

level of risk that is accepted in a given context based on the current values of society

[SOURCE: ISO/IEC Guide 51:2014, 3.15]

3.5.26

overvoltage category

numeral defining a transient overvoltage condition

Note 1 to entry: IEC 60664-1:2007 specifies overvoltage categories I, II, III and IV.

Note 2 to entry: The term 'overvoltage category' is synonymous with the term 'impulse withstand voltage' used in IEC 60364-4-44:2007, 443.

[SOURCE: IEC 60664-1:2007, 3.10, modified – Note 1 references IEC 60664-1:2007]

3.5.27**transient overvoltage**

short-duration overvoltage

Note 1 to entry: Transient overvoltages may be immediately followed by temporary overvoltages. In such cases, the two overvoltages are considered as separate events.

Note 2 to entry: IEC 60071-1 defines three types of transient overvoltages, namely slow-front overvoltages, fast-front overvoltages and very fast-front overvoltages according to their time to peak, tail or total duration, and possible superimposed oscillations.

Note 3 to entry: The duration does not exceed a few milliseconds.

Note 4 to entry: The form of the transient overvoltage may be oscillatory or non-oscillatory, but is usually highly damped.

[SOURCE: IEC 60050-604:1987, 604-03-13, modified – additional information moved to Notes]

3.5.28**temporary overvoltage**

overvoltage of relatively long duration

Note 1 to entry: The overvoltage is undamped or weakly damped. Though normally at the power frequency, in some cases its frequency may be several times smaller or higher than power-frequency.

[SOURCE: IEC 60050-604:1987, 604-03-12, modified – to cover overvoltages with power frequency or with other frequencies]

3.6 Insulation**3.6.1****electric insulation**

part of an electrotechnical product which separates conducting parts at different electrical potentials during operation or insulates such parts from the surroundings

[SOURCE: IEC 60050-212:2010, 212-11-07]

3.6.2**functional insulation**

insulation between conductive parts, necessary for the proper functioning of the equipment

[SOURCE: IEC 60050-195:1998, 195-02-41]

3.6.3**basic insulation**

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, 195-06-06]

3.6.4**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

[SOURCE: IEC 61010-1:2010, 3.6.2, IEC 60050-195:1998, 195-06-07, modified – as in IEC 61010-1]

3.6.5**double insulation**

insulation comprising both basic insulation and supplementary insulation

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

3.6.6**reinforced insulation**

insulation which provides protection against electric shock not less than that provided by double insulation

Note 1 to entry: Reinforced insulation may be composed of several layers, which cannot be tested singly as supplementary insulation or basic insulation.

[SOURCE: IEC 61010-1:2010, 3.6.4, IEC 60050-195:1998, 195-06-09, modified – as in IEC 61010-1]

3.6.7**class I equipment****protective class I equipment**

equipment with basic insulation as provision for basic protection against electric shock and protective bonding as provision for fault protection, such that conductive parts on the outside of the equipment case cannot become live in the event of a failure of the basic insulation

[SOURCE: IEC 60255-27:2013, 3.7]

3.6.8**class II equipment****protective class II equipment**

equipment with:

- basic insulation as provision for basic protection against electric shock, and
- supplementary insulation as provision for fault protection; or
- in which basic protection and fault protection are provided by reinforced insulation

Note 1 to entry: There should be no provision for a protective conductor or reliance upon installation conditions for safety purposes. It is, however, possible to connect an earth conductor to Class II equipment for functional (for example, EMC) purposes.

[SOURCE: IEC 60255-27:2013, 3.8, IEC 60050:2008, 851.15.11, modified – The phrase "against electrical shock" and a note to entry have been added while the reference to IEC 61140:2001, 7.3 has been omitted]

3.6.9**pollution**

addition of foreign matter, solid, liquid or gaseous that can produce a permanent reduction of dielectric strength or surface resistivity of the insulation

Note 1 to entry: Ionized gases of a temporary nature are not considered as to be a pollution.

[SOURCE: IEC 60050-442:1998, 442-01-28]

3.6.10**pollution degree**

numeral characterizing the expected pollution of the micro-environment

[SOURCE: IEC 60050-581:2008, 581-21-07]

3.6.11**pollution degree 1**

no pollution or only dry, non-conductive pollution occurs, which has no influence

[SOURCE: IEC 61010-1:2010, 3.6.7]

3.6.12**pollution degree 2**

only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected

[SOURCE: IEC 61010-1:2010, 3.6.8]

3.6.13**pollution degree 3**

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, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

[SOURCE: IEC 61010-1:2010, 3.6.9]

3.6.14**micro-environment**

immediate environment of the insulation which particularly influences the dimensioning of the creepage distances

[SOURCE: IEC 60050-851:2008, 851-15-16]

3.6.15**clearance**

distance between two conductive parts along a string stretched the shortest way between these conductive parts

[SOURCE: IEC 60050-441:1984, 441-17-31]

3.6.16**creepage distance**

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

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

3.6.17**solid insulation**

solid insulating material interposed between two conductive parts

[SOURCE: IEC 60664-1:2007, 3.4]

3.6.18**disruptive discharge**

failure of insulation under electric stress, in which the discharge completely bridges the insulation under test, reducing the voltage between electrodes to practically zero

Note 1 to entry: Non-sustained disruptive discharge in which the test object is momentarily bridged by a spark or arc may occur. During these events the voltage across the test object is momentarily reduced to zero or to a very small value. Depending on the characteristics of the test circuit and the test object, a recovery of dielectric strength

may occur and may even allow the test voltage to reach a higher value. Such an event should be interpreted as a disruptive discharge.

Note 2 to entry: A disruptive discharge in a solid dielectric produces permanent loss of dielectric strength; in a liquid or gaseous dielectric the loss may be only temporary.

[SOURCE: IEC 60060-1:2010, 3.1.1]

3.6.19

sparkover

disruptive discharge that occurs in a gaseous or liquid dielectric

[SOURCE: IEC 60060-1:2010, 3.1.2]

3.6.20

flashover

disruptive discharge that occurs over the surface of a dielectric in a gaseous or liquid dielectric

[SOURCE: IEC 60060-1:2010, 3.1.3]

3.6.21

puncture

disruptive discharge that occurs through a solid dielectric

[SOURCE: IEC 60060-1:2010, 3.1.4]

3.6.22

extra-low-voltage

ELV

voltage not exceeding the relevant voltage limit of band I specified in IEC 60449

Note 1 to entry: For the purposes of this standard, the ELV values are specified in 6.3.

[SOURCE: IEC 60050-826:2004, 826-12-30]

3.6.23

SELV system

electric system in which the voltage cannot exceed the value of extra-low voltage:

- under normal conditions; and
- under single-fault conditions, including earth faults in other circuits

Note 1 to entry: SELV is the abbreviation for safety extra low voltage.

[SOURCE: IEC 60050-826:2004, 826-12-31]

3.6.24

PELV system

electric system in which the voltage cannot exceed the value of extra-low voltage:

- under normal conditions, and
- under single-fault conditions, except earth faults in other circuits

Note 1 to entry: PELV is the abbreviation for protective extra low voltage.

[SOURCE: IEC 60050-826:2004, 826-12-32]

3.7 Terms related to switches of metering equipment

3.7.1

switch

mechanical switch

mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions such as those of short circuit

Note 1 to entry: A switch may be capable of making but not breaking short-circuit currents.

[SOURCE: IEC 60050-441:1984, 441-14-10]

3.7.2

supply control switch

SCS

switch intended to control the supply to the premises

Note 1 to entry: It comprises the contacts and the parts operating the contacts, and it may include a means for manual operation.

Note 2 to entry: The supply control switch should not be confused with the supply side protection device that disconnects the supply in the case of an overcurrent fault.

3.7.3

load control switch

LCS

switch intended to control loads within the premises

Note 1 to entry: It comprises the contacts and the parts operating the contacts.

3.7.4

auxiliary control switch

switch intended to control auxiliary devices

Note 1 to entry: It comprises the contacts or their electronic equivalent and the parts operating the contacts.

[SOURCE: IEC 62052-21:2004, 3.5.3 and 3.5.4, merged and modified – to make the definition more general and to provide additional information in the Note]

3.7.5

maximum total current

I_{tot}

r.m.s. value of the total current that all the switches of a stand-alone tariff- or load-control equipment can carry continuously at the same time under specified conditions

[SOURCE: IEC 62052-21:2004, 3.5.8, modified – “r.m.s.” and “stand alone” added]

3.7.6

short-circuit current

over-current resulting from a short circuit due to a fault or an incorrect connection in an electric circuit

[SOURCE: IEC 60050-441:1984, 441-11-07]

3.7.7

prospective current <of a circuit with or without a switching device>

current that would flow in the circuit if it was replaced by a conductor of negligible impedance

[SOURCE: IEC 60050-441:1984, 441-17-01, modified – Note removed]

3.7.8

breaking current <of a switching device or a fuse>

current in a pole of a switching device or in a fuse at the instant of initiation of the arc during a breaking process

[SOURCE: IEC 60050-441:1984, 441-17-07]

3.7.9

breaking capacity <of a switching device or a fuse>

value of prospective current that a switching device or a fuse is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441:1984, 441-17-08, modified – Notes removed]

3.7.10

making capacity <of a switching device or a fuse>

value of prospective current that a switching device is capable of making at a stated voltage under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441:1984, 441-17-09, modified – Note removed]

3.7.11

short-circuit making capacity

making capacity for which the prescribed conditions include a short circuit at the terminals of the switching device

[SOURCE: IEC 60050-441:1984, 441-17-10]

3.7.12

short-time withstand current

current that a circuit or a switching device in the closed position can carry during a specified short time under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441:1984, 441-17-17]

3.7.13

fused short-circuit current

conditional short-circuit current when the current limiting device is a fuse

[SOURCE: IEC 60050-441:1984, 441-17-21]

3.7.14

minimum switched current

smallest current that a switch is able to make, carry and break at the rated breaking voltage and under prescribed conditions

[SOURCE: IEC 62055-31:2005, 3.5.1, modified – payment meter” replaced by “switch”]

3.7.15

trip-free mechanical switching device

mechanical switching device, the moving contacts of which return to and remain in the open position when the opening (i.e. tripping) operation is initiated after the initiation of the closing operation, even if the closing command is maintained

Note 1 to entry: To ensure proper breaking of the current which may have been established, it may be necessary that the contacts momentarily reach the closed position.

Note 2 to entry: The wording of IEC 60050-441:1984, 441-16-31 has been completed by adding "(i.e. tripping)" since the opening operation of a trip-free mechanical switching device is automatically controlled.

[SOURCE: IEC 60947-1:2007, 2.4.23]

4 Tests

4.1 General

NOTE This subclause is based IEC 61010-1:2010, 4.1.

Tests in this standard are type tests to be carried out on samples of equipment or parts. Their only purpose is to check that the design and construction ensure conformity with this standard.

Annex I specifies routine tests to be performed by manufacturers on equipment which has both hazardous live parts and accessible conductive parts.

The equipment shall at least meet the requirements of this standard. It is permissible to exceed the requirements. If, in this standard, a lower limit is specified for a conformity value, then the equipment may demonstrate a larger value. If an upper limit is specified for a conformity value, the equipment may demonstrate a lower value.

Tests on sub-assemblies that meet the requirements of the relevant standards specified in this standard, and are used in accordance with them, need not be repeated. However, sub-assemblies are exposed to the tests when fitted in the equipment. The complete equipment with the sub-assemblies fitted shall pass the tests.

See also Clause 13.

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 equipment and design documentation demonstrates conclusively that the equipment would pass the test. Tests are carried out under both reference test conditions (see 4.3) and fault conditions (see 4.4).

Where conformity statements in this standard require inspection, this may include examination of the equipment by measurement, examination of the markings on the equipment, examination of the instructions supplied with the equipment, examination of the data sheets of the materials or components from which the equipment is manufactured, etc. In each case, the inspection will either demonstrate that the equipment meets the applicable requirements of the clause, or will indicate that further testing is required.

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

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

4.2 Type test – sequence of tests

NOTE This subclause reproduces IEC 61010-1:2010, 4.2.

The sequence of tests is optional unless otherwise specified. The equipment 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.

4.3 Reference test conditions

4.3.1 Atmospheric conditions

NOTE 1 This subclause is based on IEC 60068-1:2013, but with values taken from IEC 62052-11:2003.

The standard range of atmospheric conditions for carrying out measurements and tests shall be as follows:

- a) ambient temperature: 15 °C to 25 °C;
In countries with hot climates, the manufacturer and the test laboratory may agree to keep the ambient temperature between 20 °C to 30 °C.
- b) relative humidity 45 % to 75 %;
- c) atmospheric pressure of 86 kPa to 106 kPa.
- d) No hoar frost, dew, percolating water, rain, solar radiation, etc. shall be present.

If the parameters to be measured depend on temperature, pressure and/or humidity and the law of dependence is unknown, the atmospheric conditions for carrying out measurements and tests shall be as follows:

- e) ambient temperature: 23 °C $\pm$ 2 °C;
- f) relative humidity 45 % to 55 %.

NOTE 2 The values are from IEC 60068-1:2013, 4.2, wide tolerance for temperature and wide range for humidity.

4.3.2 State of the equipment

4.3.2.1 General

NOTE Subclause 4.3.2 is based on IEC 61010-1:2010, 4.3.2, modified as appropriate for metering.

Unless otherwise specified, each test shall be carried out on the equipment assembled for normal use, and under the least favourable combination of the conditions given in 4.3.2.2 to 4.3.2.10. In case of doubt, tests shall be performed in more than one combination of conditions.

To be able to perform some tests, like testing in single fault condition, verification of clearances and creepage distances by measurement, placing thermocouples, checking corrosion, a specially prepared specimen may be needed and / or it may be necessary to cut a permanently closed specimen open to verify the results.

4.3.2.2 Position of equipment

The equipment shall be mounted in its normal working position, including a matching socket where applicable and with any ventilation unimpeded. Equipment intended to be built into a wall, recess, cabinet, etc., shall be installed as specified in the manufacturer's instructions. See also 10.4.

4.3.2.3 Plug-in modules

Any plug-in modules that may be used with the equipment under test and / or batteries shall be either connected or not connected.

NOTE Examples for plug-in modules are communication modules provided or recommended by the manufacturer.

4.3.2.4 Covers and removable parts

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

4.3.2.5 Connection of the voltage and current circuits

The equipment shall be connected for its intended purpose, (i.e. together with a specified matching socket where applicable), or not connected.

Unless otherwise specified, the least favourable conditions that may occur in real life conditions shall be selected from the following as applicable:

- a) the voltage circuits of meters shall be either energized or not energized. When energized, the voltage shall be between 80 % of the lowest reference voltage and 115 % of the highest reference voltage. If the permitted tolerance is higher, then the voltage shall be at any voltage in the operating range;
- b) in the case of single-phase equipment, the voltage shall be connected with both normal and reverse polarity (line and neutral reversed);
- c) in the case of three-phase equipment, one, two, or three phase voltages shall be connected. When all three phase voltages are connected, then the voltages shall be connected with both normal and reverse phase sequence;
- d) the current circuits shall be loaded with a current up to $I_{\max}$ or not loaded;

In the case of polyphase equipment, the current circuits shall carry a balanced load.

NOTE For supply and load control switches, see 4.3.2.6. For auxiliary control switches, see 4.3.2.7.

- e) equipment for tariff and load control shall be either energized or not energized. When energized, the voltage shall be between 80 % of the lowest reference voltage and 115 % of the highest reference voltage. If the permitted tolerance is higher, then the voltage shall be at any voltage in the operating range;
- f) in the case of equipment with a (separate) auxiliary power supply, the auxiliary supply voltage shall be connected or not connected. In the case of d.c. or single phase a.c. auxiliary power supply, the voltage shall be connected with both normal or reverse polarity if this latter is possible;
- g) the frequency shall be any rated frequency.

4.3.2.6 Supply and load control switches

Unless otherwise specified, all supply control switches (SCSs) and load control switches (LCSs) shall be in the closed position. When a SCS is closed, it shall carry a current equal to $I_{\max}$. When a LCS is closed, it shall carry a current equal to its rated operational current I_e . If there are several LCSs present, the total current shall not be more than I_{tot} .

NOTE 1 Switches may be controlled locally or remotely and they may be operated locally.

NOTE 2 For testing direct connected meters equipped with SCSs see 6.10.6. For testing load control switches see and 6.10.7.

4.3.2.7 Connection of the auxiliary circuits

Auxiliary input circuits shall be either connected to any voltage within their rated operating voltage range or not connected.

The rated load impedance of auxiliary output circuits shall be either connected or not connected.

Auxiliary control switches shall be either in the closed or in the open position. When an auxiliary control switch is closed, it shall be loaded or not loaded with rated current.

4.3.2.8 Connection of batteries

In the case of equipment equipped with a battery, if the means of connection permits reversal, the battery shall be connected with both reverse and normal polarity.

4.3.2.9 Protective conductor terminals

Protective conductor terminals, if any, shall be connected to earth.

4.3.2.10 Physical token carriers

Payment meters equipped with physical token carrier acceptors may be tested with the token carrier (or metallic test token carrier) inserted or not inserted unless explicitly specified for particular tests.

4.3.2.11 Test cables

NOTE 1 This subclause does not apply to installation, which is generally subject to national wiring regulations.

NOTE 2 This subclause is based on IEC 60947-1:2007, 8.3.3.3.4.

Test cables for connecting the current circuits, supply control switches and load control switches shall be single core or stranded, suitable insulated cables with cross-sections as given in Table 1. The length of the test cables shall be:

- 1 m for cross-sections up to and including 35 mm² (or AWG 2);
- 2 m for cross-sections larger than 35 mm² (or AWG 2).

For the terminals of voltage circuits and auxiliary circuits the test cables shall be single core or stranded, suitably insulated cables of 1 mm², unless otherwise specified by the manufacturer.

Table 1 – Test copper conductors for current and switch terminals

Range of test current A	Conductor size ^{a, b}		
	Cross-section mm ²	Size AWG / kcmil	Equivalent cross-section mm ² (for sizes given in AWG / kcmil)
0 < I ≤ 8	1,0	18	0,82
8 < I ≤ 12	1,5	16	1,3
12 < I ≤ 15	2,5	14	2,1
15 < I ≤ 20	2,5	12	3,3
20 < I ≤ 25	4,0	10	5,3
25 < I ≤ 32	6,0	10	5,3
32 < I ≤ 50	10	8	8,4
50 < I ≤ 65	16	6	13,3
65 < I ≤ 85	25	4	21,2
85 < I ≤ 100	35	3	26,7
100 < I ≤ 115	35	2	33,6
115 < I ≤ 130	50	1	42,4
130 < I ≤ 150	50	0	53,5
150 < I ≤ 175	70	00	67,4
175 < I ≤ 200	95	000	85
200 < I ≤ 225	95	0000	107,2
225 < I ≤ 250	120	250 kcmil	127
250 < I ≤ 275	150	300 kcmil	152
275 < I ≤ 300	185	350 kcmil	177
300 < I ≤ 350	185	400 kcmil	203
350 < I ≤ 400	240	500 kcmil	253
NOTE This table is based on IEC 60947-1:2007, Table 1 and Table 9.			
AWG: American Wire Gauge size.			
Circular mils: The standard unit of a – large – wire's cross-sectional area.			
kcmil: thousand circular mils.			
^a For convenience of testing and with the manufacturer's consent, smaller conductors than those given for a stated test current may be used.			
^b Either of the two conductors specified for a given test current range may be used.			

Unless otherwise specified by the manufacturer, stranded cables shall be terminated by fitting cable end ferrules and they shall be correctly crimped with an appropriate crimping tool. All contact surfaces shall be free of oxide layers.

NOTE 3 See DIN 46228-1:1992-08 *Aderendhülsen; Rohrform ohne Kunststoffhülse*. English title: *Tubular end-sleeves without plastic sleeve*.

Terminal screws, where used, shall be tightened according to the manufacturer's instructions.

4.3.2.12 Information on tests

NOTE 1 The following is based on IEC 60255-27:2013, 10.4.

The following data for each test to be conducted shall be available from the manufacturer on request:

- the type, cross-sectional area, length and termination of connecting cables, if these can affect the type test results, for example temperature rise. If these are different from the values specified in Table 1, the reasons shall be given;
- the position of the equipment where relevant;
- the state of the equipment;

NOTE 2 This includes voltages and currents applied to the terminals, parts fitted or not, position of switches etc.

- measurement uncertainty for all measurement results.

Where applicable, the data shall include:

- initial measurement;
- measurement during the individual test;
- final measurement.

4.4 Testing in single fault condition

4.4.1 General

NOTE Subclause 4.4 is based on IEC 61010-1:2010, 4.4, modified as applicable for metering.

The manufacturer may provide guidance to the test laboratory on how to perform tests in single fault condition. The following general guidelines and requirements apply.

- a) examination of the equipment and its circuit diagram will generally show the fault conditions which are liable to result in hazards and which, therefore, shall be applied;
- b) fault tests shall be made as specified for checking conformity, unless it can be demonstrated that no hazard could arise from a particular fault condition;
- c) the equipment 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 shall be recorded for each test.

4.4.2 Application of fault conditions

4.4.2.1 General

Fault conditions shall include those specified in 4.4.2.2 to 4.4.2.8. They shall be applied 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 equipment or part shall pass the applicable tests of 4.4.4.

4.4.2.2 Protective impedance

The following requirements apply:

- a) if a protective impedance is formed by a combination of components, and unless each component is certified to fail in an open circuit state, each component shall be short-circuited or disconnected, whichever is less favourable;
- b) if a protective impedance is formed by the combination of basic insulation and a current or voltage limiting device, both the basic insulation and the current or voltage limiting device shall be subjected to single faults, applied one at a time. Basic insulation shall be bridged and the current or voltage limiting device shall be short-circuited or disconnected, whichever is less favourable;

- c) if a protective impedance is formed with a single component that meets the requirements of 6.5.4, it need not be short-circuited or disconnected.

4.4.2.3 Equipment or parts for short-term or intermittent operation

These shall be operated continuously if continuous operation could occur in a single fault condition.

NOTE Individual parts include relays and other electromagnetic devices.

4.4.2.4 Transformers

4.4.2.4.1 General

NOTE Subclause 4.4.2.4 applies only to transformers used within the metering equipment.

Transformers shall be tested as specified in 4.4.2.4.2 to 4.4.2.4.4.

A transformer damaged during one test may be repaired or replaced before the next test.

4.4.2.4.2 Short circuit test for voltage transformers

NOTE This subclause reproduces IEC 61010-1:2010, 4.4.2.7.2.

Each untapped output winding, and each section of a tapped output winding, which is loaded in normal use, shall be tested in turn, one at a time, to simulate short circuits in the load. Overcurrent protection devices remain fitted during the test. All other windings are loaded or not loaded; whichever load condition of normal use is less favourable.

4.4.2.4.3 Overload

NOTE This subclause reproduces IEC 61010-1:2010, 4.4.2.7.3.

Each untapped output winding, and each section of a tapped output winding, is overloaded in turn one at a time. The other windings are loaded or not loaded whichever load condition of normal use is less favourable. If any overloads arise from testing in the single fault conditions of 4.4, secondary windings shall be subjected to those overloads.

Overloading is carried out by connecting a variable resistor across the winding. The resistor is adjusted as quickly as possible and readjusted, if necessary, after 1 min to maintain the applicable overload. No further readjustments are then permitted.

If overcurrent protection is provided by a current-breaking device, the overload test current is the maximum current which the overcurrent protection device is just capable of passing for 1 h. Before the test, the device is replaced by a link with negligible impedance. If this value cannot be derived from the specification, it is to be established by test.

For equipment in which the output voltage is designed to collapse when a specified overload current is reached, the overload is slowly increased to a point just before the point which causes the output voltage to collapse.

In all other cases, the loading is the maximum power output obtainable from the transformer.

4.4.2.4.4 Open circuit of current transformers

The secondary side of (a) current transformer(s) (CTs) shall be open-circuited.

If this condition cannot occur in practice, this test may be omitted. For example, this test may be omitted for potted CTs soldered and mechanically secured to the printed wiring board, or for CTs with their secondary side connected to the printed wiring board by mechanically secured cables, such that solder joints are protected from mechanical stress.

4.4.2.5 Equipment with auxiliary supply

NOTE This subclause reproduces IEC 61010-1:2010, 4.4.2.9.

Equipment designed to be operated with an auxiliary supply shall be connected to that supply or not, whichever is less favourable.

4.4.2.6 Mains-circuits and hazardous voltage non-mains-circuits

NOTE 1 This subclause is based on IEC 60255-27:2013, 5.2.2.6.

Single fault conditions shall be applied by open-circuiting or short-circuiting components in mains-circuits and hazardous voltage non-mains-circuits, within the equipment, where these may create a risk of electric shock or fire.

NOTE 2 A single fault condition test for varistors is under consideration.

4.4.2.7 Overloads

NOTE 1 This subclause is based on IEC 60255-27:2013, 5.2.2.7.

NOTE 2 This subclause refers to all auxiliary circuits, and not to the main current and load control circuits.

Single-fault conditions shall be applied where a circuit or component overload may create a fire or electric shock hazard. This includes connection of the most unfavourable load impedances to terminals and connectors which deliver power or signal outputs from the equipment.

It is permitted to use fusible links, overcurrent protection devices and the like to provide adequate protection.

Where there are multiple outlets with the same internal circuitry, the single-fault test can be limited to one outlet only.

4.4.2.8 Intermittently rated resistors

NOTE This subclause is based on IEC 60255-27:2013, 5.2.2.8.

Continuous dissipation in resistors designed for intermittent dissipation shall be considered under the single fault conditions assessment.

4.4.2.9 Double insulation

If double insulation is applied then it shall be verified by short circuiting the basic and then the supplementary insulation, one at a time. It shall be ascertained that basic insulation is maintained.

For components bridging insulation, see 13.4.

4.4.3 Duration of tests

NOTE This subclause reproduces IEC 61010-1:2010, 4.4.3.1.

The equipment 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 there is an indication that a hazard of electric shock, spread of fire or injury to persons may eventually occur, the test shall be continued for 4 h unless one of these hazards arises before that.

4.4.4 Conformity after application of fault conditions

NOTE This subclause reproduces IEC 61010-1:2010 4.4.4, mutatis mutandis.

4.4.4.1 General

Conformity with the requirements for protection against electric shock after the application of single faults is checked as follows:

- a) *by making the measurements of 6.3.3 to check that no accessible conductive parts have become hazardous live;*
- b) *by performing a voltage test on double insulation or reinforced insulation to check that the protection is still at least at the level of basic insulation. The voltage tests are made as specified in 6.10.4.3.3 without humidity preconditioning, with a test voltage for basic insulation;*
- c) *by measuring the temperature of transformer windings if the protection against electrical hazards is achieved by double insulation or reinforced insulation within the transformer. The temperatures of Table 33 shall not be exceeded.*

4.4.4.2 Temperature

Conformity with the requirements for protection against excessive temperature rise is checked by determining the temperature of the accessible surface of the enclosure and of the parts. See Clause 10.

4.4.4.3 Spread of fire

Conformity with the requirements for protection against the spread of fire is checked by placing the equipment on white tissue-paper covering a softwood surface and covering the equipment with cheesecloth. No molten metal, burning insulation, flaming particles, etc. shall fall on the surface on which the equipment is placed and there shall be no charring, glowing, or flaming of the tissue paper or cheesecloth. Melting of insulation material shall be ignored if no hazard could arise.

4.4.4.4 Other hazards

Conformity with other requirements for protection against hazards is checked as specified in Clauses 7 to 14.

5 Information and marking requirements

5.1 General

NOTE Clause 5 is based on the following references:

- IEC 62052-11:2003, 5.12, IEC 62052-21:2004, 5.12, IEC 62055-31:2005, 5.13;
- IEC 61010-1:2010 Clause 5; and
- IEC 62477-1:2012 Clause 6.

The purpose of this Clause 5 is to define the safety-related information necessary for the safe selection, installation and commissioning, for use, and for maintenance of metering equipment. The required information is presented in Table 2 showing where the information shall be provided. References to explanatory and technical subclauses are given.

Unless otherwise stated, the requirements of this Clause shall apply to all metering equipment in the scope of this standard.

All information shall be in an appropriate language, and documents shall have identification references.

Table 2 – Information requirements

Information	Subclause reference	Location ^{a, b}						Technical subclause reference
		C	D	P	IM	UM	MM	
For selection	5.3							
General information	5.3.2							
Manufacturer's name or trade mark		M		M	M	M	M	–
Designation of function		O	O	O	O	O	O	–
Type		M		M	M	M	M	
Space for approval mark		M						–
Serial number		M	O	O				–
Protective class		M		M	M		M	–
Rated impulse voltage		M		M	M		M	6.7.1.3 6.7.3.1 Annex K
Utilization category (UC) for direct connected meters only		M		M	M		M	6.9.8.3 6.9.8.4
Environmental conditions, storage				O	M		M	–
Environmental conditions, operation, including				O	M		M	1.4
• mechanical conditions				O	O		O	
• climatic conditions				O	O		O	
• altitude				O	O		O	
• location (dry or wet)				O	O		O	
IP rating		O		M	M		M	11
Reference to standards		M		M	M	M	M	–
Reference to instructions					M	M	M	–
<i>For meters</i>	5.3.3							
Reference voltage(s)		M			M	M	M	–
Reference current and current range		M			M	M	M	
<i>For stand-alone tariff and load control equipment</i>	5.3.4							
Supply voltage(s)		M			M	M	M	–
<i>Supply control switches</i>	5.3.5							6.9.8
The rated operating voltage: U_e ;		M		M	M	M	M	
<i>Load control switches</i>								
The rated operating voltage: U_e ;		M		M	M	M	M	
The rated operating current: I_e ;		M		M	M	M	M	
The maximum permanent total current of the load control switches: I_{tot} ;		M		M	M	M	M	
For installation and commissioning	5.4							
Handling and mounting	5.4.2			O	M		M	–
Enclosure	5.4.3				M			6.9.4, 10.1
Connection requirements	5.4.4				M		M	–
Connection and wiring diagrams	5.4.4.2	M			M		M	–
Mains terminals	5.4.4.3	M			M		M	6.9.7
Auxiliary terminals	5.4.4.4	M			M		M	–
Connecting cables	5.4.4.5				M		M	6.9.7.2
Isolation from the supply	5.4.4.6				M		M	

Information	Subclause reference	Location ^{a, b}						Technical subclause reference
		C	D	P	IM	UM	MM	
Protection requirements	5.4.5				M		M	–
Protective class and earthing	5.4.5.1	M			M		M	6.5.2
External protection devices	5.4.5.2				M		M	–
Auxiliary power supply	5.4.6				M		M	–
Supply for external devices	5.4.7				M		M	–
Batteries	5.4.8	M		M	M	O	M	12
Self-consumption	5.4.9				M		M	
Commissioning	5.4.10				M		M	–
For use	5.5							
General	5.5.1					M		–
Display, push buttons and other controls	5.5.2					M		10.1
Switches	5.5.3	M	M			M		6.9.8
Connection to user's equipment	5.5.4					M		6.8
External protection devices	5.5.5					M		–
Cleaning	5.5.6				M	M	M	5.2.2
For maintenance	5.6							–
Maintenance instructions	5.6						M	
^a Location: C = Case. These markings may appear on nameplate(s) or may be carried by the meter cover(s) in a permanent manner. Connection diagrams may be marked on the underside of the terminal cover(s). D = Display; P = Packaging; IM = Instruction manual. UM = User manual. MM = Maintenance manual. ^b M = Mandatory, O = Optional ^c The installation, user and maintenance manuals may be combined as appropriate and, if acceptable to the customer, may be supplied in electronic format. When more than one of any product is supplied to a single customer, it is not necessary to supply a manual with each unit, if acceptable to the customer.								

5.2 Labels, signs and signals

5.2.1 General

Labelling shall be in accordance with good ergonomic principles so that notices, controls, indications, test facilities etc. are sensibly placed and logically grouped to facilitate correct and unambiguous identification.

NOTE The term "Label" is used here in a general sense. Labels are realized using various technologies, e.g. moulding, laser marking and engraving, on adhesive labels, etc.

The size of warning markings shall be as follows:

- symbols shall be at least 2,75 mm high. Text shall be at least 1,5 mm high and contrast in colour with the background;
- symbols or text moulded, stamped or engraved in a material shall be at least 2,0 mm high. If not contrasting in colour, they shall have a depth or raised height of at least 0,5 mm.

All safety related equipment labels should be placed in such a way that they will:

- be readily visible to the intended viewer; and
- alert the viewer to any hazard in time to take appropriate action.

Where a hazard is present after the removal of a cover, a warning label shall be placed on the equipment. The label shall be visible before the cover is removed.

SAFETY MARKING SHALL WHEREVER POSSIBLE TAKE PRECEDENCE OVER ANY FUNCTIONAL MARKINGS.

Letter symbols for quantities and units shall be as specified in IEC 60027-1.

Graphic symbols shall conform to IEC 62053-52, IEC 60417-DB-12M, IEC 60617-DB-12M, and ISO 7000 as appropriate. IEC 60417-DB-12M and ISO 7000 symbols that may be used on metering equipment are shown in Table 3. Symbols not shown in these standards shall be explained where used. There are no colour requirements for symbols.

The documentation of the metering equipment shall include a statement that it shall be consulted in all cases where symbol 14 of Table 3 is marked, in order to find out the nature of the potential hazards and any actions which have to be taken to avoid them.

Labels shall:

- be conspicuous, legible and durable;
- be concise and unambiguous;
- state the hazards involved and give ways in which risks can be reduced.

Table 3 – IEC 60417 symbols and ISO 7000 that may be used on metering equipment

Number	Symbol	Reference	Description
1			Not used
2			Not used
3			Not used
4			Not used
5a		IEC 60417-5017	Earth; ground
5b		IEC 60417-5018	Functional earthing; functional grounding (US) ^a
6		IEC 60417-5019	Protective earth; protective ground
7		IEC 60417-5020	Frame or chassis
8			Not used
9			Not used
10			Not used
11		IEC 60417-5172	Protective class II equipment (Double or reinforced insulation)
12		IEC 60417-5036	Dangerous voltage
13			Not used
14		ISO 7000-0434B	Caution, refer to accompanying documents.
15		ISO 7000-1641	Operator's manual; operating instructions
^a There may be national differences concerning the use of this symbol.			

When instructing the person(s) concerned as to:

- **what to avoid:** the wording should include “no”, “do not”, or “prohibited”;
- **what to do:** the wording should include “shall”, or “must”;
- **the nature of the hazard:** the wording should include “caution”, “warning”, or “danger”, as appropriate;
- **the nature of safe conditions:** the wording should include the noun appropriate to the safety device.

Safety signs shall comply with ISO 3864-1.

The signal words indicated hereinafter shall be used and the following hierarchy respected:

- **DANGER** to call attention to a high risk, for example: “High voltage”;
- **WARNING** to call attention to a medium risk, for example: “This surface can be hot”;
- **CAUTION** to call attention to a low risk, for example; “Some of the tests specified in this standard involve the use of processes imposing risks on persons concerned.”

Danger, warning and caution markings on the metering equipment shall be prefixed with the word “DANGER”, “WARNING”, or “CAUTION” as appropriate in letters not less than 3,2 mm high. The remaining letters of such markings shall be not less than 1,6 mm high.

Conformity is checked by inspection.

5.2.2 Durability of markings

When feasible, placement of the label should provide protection from foreseeable damage, fading, or visual obstruction caused by abrasion, ultraviolet light, or substances such as lubricants, chemicals and dirt.

An adhesive that is permanent shall be used to secure adhesive labels.

Conformity is checked by performing the following test for durability of markings on the outside of the equipment. The markings are rubbed by hand, without undue pressure, for 30 s with a cloth soaked with each cleaning agent recommended by the manufacturer and with 70 % isopropyl alcohol.

After the above treatment the markings shall be clearly legible and adhesive labels shall not have worked loose or become curled at the edges.

5.3 Information for selection

5.3.1 General

Metering equipment shall be provided with information relating to its function, electrical characteristics and intended environment, so that its fitness for purpose can be determined. This information includes, but is not limited to the information specified in 5.3.2 to 5.3.5 that follow here.

5.3.2 General information

- manufacturer's name or trade mark;
- designation of function and type. Designation of the function shall be preferably in local language;

NOTE 1 Examples for function are “kWh meter”, “Smart meter”, “Time switch”, “Ripple control receiver”.

- space for approval mark;

- serial number. The serial number shall uniquely identify the metering equipment. If it is located on a removable cover, the number shall also be marked on the base of the metering equipment or stored in its non-volatile memory and displayed on its electronic display;

NOTE 2 Metering equipment often carry additional identifiers, like bar codes, location identifiers, etc.

- protective class;
- rated impulse voltage;
- utilization category (UC), for direct connected meters only;
- environmental conditions for storage;
- environmental conditions, operation: the conditions under which the metering equipment is designed to be used. This shall identify:
 - mechanical conditions (vibration, shock);
 - climatic conditions (indoor / outdoor, temperature, humidity, altitude, pollution, ultra-violet etc.);
 - altitude where relevant;
 - location – dry or wet – where relevant;
- IP rating. See also 5.4.3 and Clause 11;
- reference to the relevant product standard(s);
- reference to instructions for installation (IM), operation (UM) and maintenance (MM).

5.3.3 Information related to meters / metering elements

- reference voltage(s) and voltage range(s) as specified in the relevant product standards;
- reference current and current range as specified in the relevant product standards.

5.3.4 Information related to stand-alone tariff-and load control equipment

- supply voltage reference voltage(s) and voltage range(s) as specified in the relevant product standards.

5.3.5 Information related to supply control and load control switches

For supply control switches (SCSs) the following information shall be provided:

- the rated operating voltage: U_e if different from the reference voltage of the meter;

For load control switches (LCSs) the following information shall be provided:

- the rated operating voltage U_e if different from the reference voltage of metering equipment;
- the rated operating current I_e . The marking shall be provided at or near the load side terminal of the circuit switched. If the load switch has independent terminals, the marking shall appear in square brackets;
- the maximum permanent total current of the load control switches at the maximum operating temperature: I_{tot} .

See also 6.9.8.4 and 6.9.8.5.

5.4 Information for installation and commissioning

5.4.1 General

Safe and reliable installation is the responsibility of the installer. The manufacturer of metering equipment shall provide information to support this task. This information shall be unambiguous, and may be in diagrammatic form.