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# INTERNATIONAL STANDARD

## Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# ELECTRICITY METERING EQUIPMENT – GENERAL REQUIREMENTS, TESTS AND TEST CONDITIONS –

## Part 11: Metering equipment

## 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.
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International Standard IEC 62052-11 has been prepared by IEC technical committee 13: Electrical energy measurement and control.

This second edition cancels and replaces the first edition published in 2003, and its amendment 1:2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition: see Annex O.

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

| FDIS | Report on voting |
|---|---|
| 13/1808/FDIS | 13/1812/RVD |

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

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

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

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

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- withdrawn,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

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to prepare themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than two years from the date of publication.

# INTRODUCTION

The general overview and organization of the IEC 6205x series of standards applicable to electricity metering and load control equipment is as follows:

| PRODUCT FAMILY STANDARDS – GENERAL REQUIREMENTS | PRODUCT FAMILIES | | | | |
|---|---|---|---|---|---|
| | **AC meters rated up to 1 000 V for direct connection or connection through conventional transformers** | **Tariff and load control equipment** | **DC meters rated up to 1 500 V for direct connection** | **AC meters for connection through LPITs (as defined in the IEC 61869 series of standards)** | **DC meters for connection through LPITs (as defined in the IEC 61869 series of standards)** |
| **NOMINAL VALUES, CONSTRUCTION, ELECTRICAL, CLIMATIC AND EMC REQUIREMENTS. TEST METHODS** | IEC 62052-11:2020 | IEC 62052-21 2004 | IEC 62052-11:2020 | Planned: IEC 62052-XX general requirements for meters for connection through LPITs. | |
| **SAFETY** | IEC 62052-31:2015 | | Planned: IEC 62052-31 2nd edition including safety requirements for DC meters | Planned: IEC 62052-XX safety requirements for meters for connection through LPITs. | |
| **DEPENDABILITY** | IEC 62059-11: 2002, IEC 62059-21:2002, IEC 62059-32-1 2011, IEC 62059-41:2006 | | Planned: IEC 62059-XX dependability requirements for DC meters | Planned: IEC 62059-XX dependability requirements for meters for connection through LPITs. | |
| **ACCEPTANCE INSPECTION** | IEC 62058-11:2008 | | | Planned: IEC 62058-XX acceptance inspection requirements for meters for connection through LPITs. | |
| **EMBEDDED SOFTWARE** | Planned: IEC 6205x-xx embedded software (firmware) requirements and test methods for electricity metering and load control equipment | | | | |

| PRODUCT FAMILY STANDARDS – PARTICULAR REQUIREMENTS AND ACCURACY CLASSES | | | | |
|---|---|---|---|---|
| **AC meters rated up to 1 000 V for direct connection or connection through conventional transformers** | **Tariff and load control equipment** | **DC meters rated up to 1 500 V for direct connection** | **AC meters for connection through LPITs (as defined in the IEC 61869 series of standards)** | **DC meters for connection through LPITs (as defined in the IEC 61869 series of standards)** |
| Electromechanical, active energy directly connected,<br>classes 0,5, 1, 2<br>IEC 62053-11:2003, IEC 62058-21:2008 | Ripple control receivers<br>IEC 62054-11:2004 | Static, DC energy, directly connected, classes 0,5, 1<br>IEC 62053-41 – | Planned: LPIT operated meters<br>IEC 62053-xx | Planned: LPIT operated meters<br>IEC 62053-xx |
| Static, active energy<br>directly connected, and transformer operated, classes 1, 2<br>IEC 62053-21:2020, IEC 62058-31:2008, | Time switches<br>IEC 62054-21:2004 | ____ | ____ | ____ |
| Static, active energy, transformer operated, classes 0,1S, 0,2S, 0,5S IEC 62053-22:2020, IEC 62058-31:2008 | ____ | ____ | ____ | ____ |
| Static, reactive energy directly connected, and transformer operated, classes 2, 3<br>IEC 62053-23:2020 | ____ | ____ | ____ | ____ |
| Static, reactive energy directly connected, and transformer operated, classes 0,5 S, 1S, 1, 2, 3<br>IEC 62053-24:2020 | ____ | ____ | ____ | ____ |
| Static, active energy directly connected, prepayment classes 1, 2<br>IEC 62055-31:2005 | ____ | ____ | ____ | ____ |

This part of IEC 62052 is to be used with relevant parts of the IEC 62052, IEC 62053, IEC 62058 and IEC 62059 series:

IEC 62052-31:2015, *Electricity metering equipment (AC) – General requirements, tests and test conditions – Part 31: Product safety requirements and tests*

IEC 62053-11:2003, *Electricity metering equipment (AC) – Particular requirements – Part 11: Electromechanical meters for active energy (classes 0,5, 1 and 2)*

IEC 62053-21:2020, *Electricity metering equipment – Particular requirements – Part 21: Static meters for AC active energy (classes 1 and 2)*

IEC 62053-22:2020, *Electricity metering equipment – Particular requirements – Part 22: Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)*

IEC 62053-23:2020, *Electricity metering equipment – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)*

| | |
|---|---|
| IEC 62053-24:2020, | *Electricity metering equipment– Particular requirements – Part 24: Static meters for fundamental component reactive energy (classes 0,5S, 1S, 1, 2 and 3)* |
| IEC 62053-41: – , | *Electricity metering equipment– Particular requirements – Part 41: Static meters for direct current energy (classes 0,5 and 1)* |
| IEC 62055-31:2005, | *Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2)* |
| IEC 62056-6-1:2017, | *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object Identification System (OBIS)* |
| IEC 62056-6-2:2017, | *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes* |
| IEC 62057-1: – , | *Test equipment, techniques and procedures for electrical energy meters – Part 1: Stationary Meter Test Units (MTU)* |
| IEC 62058-11:2008, | *Electricity metering equipment (AC) – Acceptance inspection – Part 11: General acceptance inspection methods* |
| IEC 62058-21:2008, | *Electricity metering equipment (AC) – Acceptance inspection – Part 21: Particular requirements for electromechanical meters for active energy (classes 0,5, 1 and 2)* |
| IEC 62058-31:2008, | *Electricity metering equipment (AC) – Acceptance inspection – Part 31: Particular requirements for static meters for active energy (classes 0,2 S, 0,5 S, 1 and 2)* |
| IEC 62059-11:2002, | *Electricity metering equipment – Dependability – Part 11: General concepts* |
| IEC 62059-21:2002, | *Electricity metering equipment – Dependability – Part 21: Collection of meter dependability data from the field* |
| IEC 62059-32-1:2011, | *Electricity metering equipment – Dependability – Part 32-1: Durability – Testing of the stability of metrological characteristics by applying elevated temperature* |

This document is intended to be used in conjunction with the appropriate part of IEC 62053 for the type of equipment under consideration.

The test levels are regarded as minimum values for the proper functioning of the meter under normal working conditions. For special application, other test levels may be used and are subject to an agreement between the manufacturer and the purchaser.

# ELECTRICITY METERING EQUIPMENT – GENERAL REQUIREMENTS, TESTS AND TEST CONDITIONS –

## Part 11: Metering equipment

## 1 Scope

This part of IEC 62052 specifies requirements and associated tests, with their appropriate conditions for type testing of AC and DC electricity meters. This document details functional, mechanical, electrical and marking requirements, test methods, and test conditions, including immunity to external influences covering electromagnetic and climatic environments.

NOTE 1 For other general requirements, such as safety, dependability, etc., see the relevant IEC 62052 or IEC 62059 standards. For accuracy requirements and other requirements specific to class indices, see the relevant IEC 62053 standards.

This document applies to electricity metering equipment designed to:

- measure and control electrical energy on electrical networks (mains) with voltage up to 1 000 V AC, or 1 500 V DC;

NOTE 2 For AC electricity meters, the voltage mentioned above is the line-to-neutral voltage derived from nominal voltages. See IEC 62052-31:2015, Table 7.

NOTE 3 For meters designed for operation with LPITs, only the metering unit is considered a low voltage device. If the LPITs are rated for voltages exceeding 1 000 V AC, or 1 500 V DC, the combination of the metering unit and LPITs is not a low voltage device.

- have all functional elements, including add-on modules, enclosed in, or forming a single meter case with exception of indicating displays;
- operate with integrated displays (electromechanical or static meters);
- operate with detached indicating displays, or without an indicating display (static meters only);
- be installed in a specified matching sockets or racks;
- optionally, provide additional functions other than those for measurement of electrical energy.

Meters designed for operation with Low Power Instrument Transformers (LPITs as defined in the IEC 61869 series) may be tested for compliance with this document and the relevant IEC 62053 series documents only if such meters and their LPITs are tested together as directly connected meters.

NOTE 4 Modern electricity meters typically contain additional functions such as measurement of voltage magnitude, current magnitude, power, frequency, power factor, etc.; measurement of power quality parameters; load control functions; delivery, time, test, accounting, and recording functions; data communication interfaces and associated data security functions. The relevant standards for these functions may apply in addition to the requirements of this document. However, the requirements for such functions are outside the scope of this document.

NOTE 5 Product requirements for Power Metering and Monitoring Devices (PMDs) and measurement functions such as voltage magnitude, current magnitude, power, frequency, etc., are covered in IEC 61557-12. However, devices compliant with IEC 61557-12 are not intended to be used as billing meters unless they are also compliant with IEC 62052-11 and one or more relevant IEC 62053-xx particular requirements (accuracy class) standard.

NOTE 6 Product requirements for Power Quality Instruments (PQIs) are covered in IEC 62586-1. Requirements for power quality measurement techniques (functions) are covered in IEC 61000-4-30. Requirements for testing of the power quality measurement functions are covered in IEC 62586-2.

NOTE 7 The IEC TC13 strives to consider EMC phenomena that may occur in practice in meter installations and to amend its standards to ensure that an appropriate level of electromagnetic compatibility is specified for electricity metering equipment. To this end, IEC TC13 cooperates with the relevant IEC technical committees to characterize electromagnetic phenomena, to define emission limits, immunity levels and immunity verification methods based on which the appropriate test methods and requirements can be developed in the TC13 electricity metering equipment standards.

This document is also applicable to auxiliary input and output circuits, operation indicators, and test outputs of equipment for electrical energy measurement.

NOTE 8 Some examples include pulse inputs and outputs, control inputs and outputs, and energy test outputs.

This document also covers the common aspects of accuracy testing such as reference conditions, repeatability and measurement of uncertainty.

This document does not apply to:

- meters for which the voltage line-to-neutral derived from nominal voltages exceeds 1 000 V AC, or 1 500 V DC;
- meters intended for connection with low power instrument transformers (LPITs as defined in the IEC 61869 series of standards) when tested without such transformers;
- metering systems comprising multiple devices (except of LPITs) physically remote from one another;
- portable meters;

NOTE 9 Portable meters are meters that are not permanently connected.

- meters used in rolling stock, vehicles, ships and airplanes;
- laboratory and meter test equipment;
- reference standard meters;

NOTE 10 Nominal values, accuracy classes, requirements and test methods for reference standard meters are specified in IEC 62057-1: –.

- data interfaces to the register of the meter;
- matching sockets or racks used for installation of electricity metering equipment;
- any additional functions provided in electrical energy meters.

This document does not cover measures for the detection and prevention of fraudulent attempts to compromise a meter's performance (tampering).

NOTE 11 Nevertheless, specific tampering detection and prevention requirements, and test methods, as relevant for a particular market are subject to agreement between the manufacturer and the purchaser.

NOTE 12 Specifying requirements and test methods for fraud detection and prevention would be counterproductive, as such specifications would provide guidance for potential fraudsters.

NOTE 13 There are many types of meter tampering reported from various markets; therefore, designing meters to detect and prevent all types of tampering could lead to unjustified increase in costs of meter design, verification and validation.

NOTE 14 Billing systems, such as smart metering systems, are capable of detecting irregular consumption patterns and irregular network losses which enable discovery of suspected meter tampering.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038:2009, *IEC standard voltages*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Tests A: Cold*

IEC 60068-2-2:2007, *Basic environmental testing procedures – Part 2-2: Tests – Tests B: Dry heat*

IEC 60068-2-5:2018, *Environmental testing – Part 2-5: Tests – Test S: Simulated solar radiation at ground level and guidance for solar radiation testing and weathering*

IEC 60068-2-6:2007, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60381-1:1982, *Analogue signals for process control systems – Part 1: Direct current signals*

IEC 60404-5:2015, *Magnetic materials – Part 5: Permanent magnet (magnetically hard) materials – Methods of measurement of magnetic properties*

IEC 60404-8-1:2015, *Magnetic materials – Part 8-1: Specifications for individual materials – Magnetically hard materials*

IEC 60404-8-4:2013, *Magnetic materials – Part 8-4: Specifications for individual materials – Cold-rolled non-oriented electrical steel strip and sheet delivered in the fully-processed state*

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

IEC 60721-1:1990, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*
IEC 60947-1:2007/AMD1:2010
IEC 60947-1:2007/AMD2:2014

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2017, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-12:2017, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-18:2019, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-19:2014, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at AC power ports*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on DC input power port immunity tests*

IEC 61869-3:2011, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

IEC 62052-31:2015, *Electricity metering equipment (AC) – General requirements, tests and test conditions – Part 31: Product safety requirements and tests*

IEC 62054-21:2004, *Electricity metering equipment (AC) – Tariff and load control – Part 21: Particular requirements for time switches*

IEC 62056-6-1:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object Identification System (OBIS)*

IEC 62056-6-2:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*

IEC 62057-1:*Test equipment, techniques and procedures for electrical energy meters – Part 1: Stationary Meter Test Units (MTU)*

IEC 62059-32-1:2011, *Electricity metering equipment – Dependability – Part 32-1: Durability – Testing of the stability of metrological characteristics by applying elevated temperature*

IEC GUIDE 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

JCGM 100:2008, *Evaluation of measurement data – Guide to the expression of uncertainty in measurement. (GUM 1995 with minor corrections)*

EN 10027-1:2016, *Designation systems for steels – Part 1: Steel names*