IEC 61557-14

Edition 2.0 2023-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures –
Part 14: Equipment for testing the safety of electrical equipment of machinery

Sécurité électrique dans les réseaux de distribution basse tension au plus égale à 1 000 V en courant alternatif et 1 500 V en courant continu – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –
Partie 14: Dispositifs de contrôle de la sécurité des appareils électriques sur machines

IEC 61557-14:2023-08(en-fr)

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Part 14: Equipment for testing the safety of electrical equipment of machinery

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IEC 61557-14 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities. It is an International Standard.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) clarifying the introduction;
b) replaced "dielectric strength" by "voltage test";
c) requirement for maximum output current has been added in 4.2.6.1;
d) tripping time at electrical switching activated by two-hand operation has been added in 4.2.6.1;

e) additional time limiting capability for the protection against electric shock for test persons and bystanders in 4.2.6.2;

f) updated references for safety testing;

g) alignment of the structure with that of the whole IEC 61557 series.

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

Draft	Report on voting
85/875/FDIS	85/884/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This International Standard is to be used in conjunction with IEC 61557-1:2019.

A list of all parts in the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures*, 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 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.

INTRODUCTION

This document defines particular requirements for test and measurement equipment used to determine the electrical safety of electrical equipment of machinery. The IEC 61010 series, other parts of the IEC 61557 series and the IEC 60204 series do not cover all safety aspects of equipment used for testing electrical equipment of machinery in accordance with the test sequence of IEC 60204-1.

This document provides additional measures to reduce the risk of electric shock for the test persons and bystanders during voltage tests in the field. This document also defines performance requirements for each test and measurement function to ensure reliable and comparable results.

ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V AC AND 1 500 V DC – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

Part 14: Equipment for testing the safety of electrical equipment of machinery

1 Scope

This part of IEC 61557 defines special requirements for test and measurement equipment used to determine the electrical safety of electrical equipment of machinery in accordance with IEC 60204-1.

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 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

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

IEC 61010-031, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 031: Safety requirements for hand-held and hand-manipulated probe assemblies for electrical test and measurement*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*
IEC 61010-1:2010/AMD1:2016

IEC 61010-2-030, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for equipment having testing or measuring circuits*

IEC 61010-2-034, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-034: Particular requirements for measurement equipment for insulation resistance and test equipment for electric strength*

IEC 61557-1:2019, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements*

IEC 61557-2, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 2: Insulation resistance*

IEC 61557-3, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 3: Loop impedance*

IEC 61557-4, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 4: Resistance of earth connection and equipotential bonding*

IEC 61557-6, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 6: Effectiveness of residual current devices (RCD) in TT, TN and IT systems*

IEC 61557-10, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 10: Combined measuring equipment for testing, measuring or monitoring of protective measures*

IEC 61557-13, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 13: Hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems*

IEC 61557-16, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 16: Equipment for testing the effectiveness of the protective measures of electrical equipment and/or medical electrical equipment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61557-1, IEC 61557-2, IEC 61557-3, IEC 61557-4, IEC 61557-6, IEC 61557-10 and IEC 61557-13 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Requirements

4.1 General requirements

In addition to the requirements of IEC 61557-1:2019, Clause 4, the following requirements shall apply.

4.2 Measuring functions

4.2.1 Required measuring functions

The measuring equipment shall be capable of measuring the following quantities as a minimum:

– resistance of protective bonding;
– fault loop impedance;
– effectiveness of residual current devices (RCDs);
– insulation resistance.

The following test or measuring functions may be combined with those listed above:

– voltage test;
– residual voltage;
– leakage current.

The measuring equipment may include further measurement functions, provided that the measuring functions listed above are not influenced.

NOTE A missing measuring function in combined equipment can be completed with a single instrument designed in accordance with the IEC 61557 series.

4.2.2 Measurement of resistance of protective bonding

This part of the measuring equipment shall be in accordance with IEC 61557-4.

4.2.3 Measurement of fault loop impedance

This part of the measuring equipment shall be in accordance with IEC 61557-3.

In addition, the earth resistance may be measured in accordance with IEC 61557-5.

4.2.4 Measurement of insulation resistance

The measuring equipment shall be in accordance with IEC 61557-2.

4.2.5 Testing of the effectiveness of protective measures with RCD

This part of the measuring equipment shall be in accordance with IEC 61557-6.

4.2.6 Voltage tests

4.2.6.1 Requirements for voltage tests

If the equipment includes a voltage test, it shall generate a quasi-sinusoidal voltage at mains frequency with values in accordance with Table 1.

NOTE 1 The test voltage is commonly derived from mains voltage.

NOTE 2 A waveform does not need to be a perfect sine curve, but be close enough to be considered sinusoidal, for all practical purposes.

Table 1 – Test voltages

Nominal voltage U_n of equipment under test (EUT)	Test voltage
≤ 500 V	1 000 V
> 500 V	2 × U_n

The rated test current shall be 100 mA AC with a tolerance of 0 % to +2 %. The minimum prospective short circuit current shall be 200 mA. The maximum output current measured via a resistor with a maximum value of 2 kΩ shall not exceed 250 mA.

If the test equipment has a display to indicate the actual test voltage, the maximum operating uncertainty shall be ±5 %.

The amplitude of the test voltage output shall be regulated such that any variation is within 10 % and +30 % of the rated test voltage within 500 ms after changing the load from an unloaded condition (open circuit) to a loaded condition (100 mA) and vice versa. The maximum voltage overshoot shall be less than 200 % of the rated test voltage.

The touch current measured at each output terminal via the measuring circuit in accordance with IEC 61010-1:2010, Figure A.1, to earth shall not exceed 3,5 mA AC. The EUT shall not be connected.

The voltage test duration is defined in IEC 60204-1.

The test equipment shall have provisions against unintended energizing of the output. Such methods of protection shall include one of the examples in accordance with IEC 61010-2-034:2017, 6.9.101, a), b) or c) and in addition two-hand operation method d).

Two-hand operation can be provided by electronic or mechanical means.

In the case of electrical switching activated by two-hand operation, the tripping time shall not exceed 70 ms.

4.2.6.2 Additional time limiting capability

If the equipment provides the possibility to set a tripping current of 30 mA for the output current, then the setting shall be clearly indicated and the maximum tripping time shall be 250 ms.

NOTE The additional time limiting capability will increase the protection against electric shock for bystanders in the case of large machinery where the testing person does not have visibility of the whole test area.

Test equipment shall have provisions for discharging the EUT in accordance with IEC 61010-2-034.

Test equipment shall include protective measures to avoid automatic reenergizing of the output in accordance with IEC 61010-2-034.

4.2.7 Measurement of residual voltage

If the equipment can measure the residual voltage, the operating uncertainty to measure this voltage shall be within 0 % to +15 % of the 60 V limit, and the operating uncertainty to set the measuring time limit shall be within 0 % and −15 % of the 1 s limit or 5 s limit.

Evaluated voltages in linear systems shall be calculated as if they were measured during the maximum amplitude of the interrupted voltage. If the manufacturer specifies the test equipment to be used in non-linear systems, the measuring method shall be explained in the operating instructions.

The input impedance of the voltage measurement circuit shall be at least 20 MΩ.

4.2.8 Measurement of leakage current

If the measuring equipment can measure leakage currents, this part of the measuring equipment and attached current sensors shall be in accordance with the requirements of IEC 61557-13 (for current clamps and sensors) or IEC 61557-16 (for electrical equipment or medical electrical equipment).

4.3 Construction requirements for testing equipment

4.3.1 Overload capability

The overload capability of combined measuring equipment shall be in accordance with IEC 61557-10. In addition, no hazard shall arise for the user when the maximum value of the output voltage is accidentally applied to the energized external distribution system.

To check this requirement, the output voltage is applied for one minute to each combination of the nominal line-to-neutral mains voltage specified for the equipment.

Protective devices may be activated. The loop impedance of the main circuit used to perform the overload test shall be equal to or lower than 2 Ω.

4.3.2 Sockets for service purposes

Sockets for the connection of further external equipment shall be clearly marked. Protection against overcurrent and short-circuits for the mains circuits connected to these sockets shall be provided by:

a) double insulation between active conductors, and between each active conductor and the protective conductor, or

b) overcurrent protective devices.

In case of solution a), a clear warning shall be given in the documentation not to connect to unprotected outlets.

The inner wiring of the service socket shall be designed according to the maximum nominal current, but at least for 16 A.

4.3.3 Degree of protection

The degree of protection for the enclosure, except service-sockets and terminals, shall be at least IP40 in accordance with IEC 60529.

4.3.4 Overvoltage and measurement categories

4.3.4.1 Overvoltage category

The supply circuit of the testing equipment shall be rated at least for overvoltage category II, in accordance with IEC 61010-2-034.

4.3.4.2 Measurement category

With the exception of the measuring circuit for resistance of protective bonding, insulation resistance and the voltage test circuit, all other measuring circuits of the test equipment shall be rated at least for CAT III in accordance with IEC 61010-2-034.

The measuring circuit for resistance of protective bonding and insulation resistance shall be rated at least CAT II. The voltage test circuit may be classified as secondary circuit in accordance with IEC 61010-2-034 if the circuit is separated from the mains circuit by a transformer.

4.4 Accessories

Specified accessories shall comply with the requirements of IEC 61010-031.

5 Markings and operating instructions

5.1 Markings

In addition to the markings in accordance with IEC 61557-1:2019, 5.1 and 5.2, as well as markings in accordance with other relevant parts of the IEC 61557 series, IEC 61010-1, IEC 61010-2-030, and IEC 61010-2-034, the measuring equipment shall have the following information clearly visible:

– service-socket, if applicable, with maximum rated current;

– test and measurement terminals;

– measuring function;

– instructions for connection.