

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V a.c and 1 500 V d.c – Equipment for testing, measuring or monitoring of protective measures –

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

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Sécurité électrique dans les réseaux de distribution basse tension de 1 000 V c.a. et 1 500 V c.c. – 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



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

FOREWORD

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

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

FDIS	Report on voting
85/446/FDIS	85/450/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 the parts in the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – 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 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

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INTRODUCTION

IEC 61010 and the existing parts of series IEC 61557 do not cover all safety aspects of testing electrical equipment of machinery. This part of IEC 61557 provides additional protection against electric shock for the testing person and bystanders during high-voltage-tests and in case of unintended use of the test equipment. It defines performance requirements for each measuring and testing function to ensure comparable results.

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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 according to IEC 60204-1.

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

[IEC 61557-14:2013](http://standards.iteh.ai/catalog/standards/sist/ed87bc15e0b24f98-a5e3-5a9cfd86db/iec-61557-14-2013)

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

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

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

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

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

IEC 61010-2-032, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement*

IEC 61557-1:2007, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – 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 a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 2: Insulation resistance*

IEC 61557-3:2007, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – 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 a.c. and 1 500 V d.c. – 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 a.c. and 1 500 V d.c. – 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 a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 10: Combined measuring equipment for testing, measuring or monitoring of protective measures*

IEC 61557-13:2001, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – 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*

3 Terms and definitions

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For the purpose 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.

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4 Requirements

4.1 General requirements

The following requirements as well as those given in IEC 61557-1 shall apply with the exception of the influence quantities E_4 (variation due to interference voltages) and E_5 (variation due to earth electrode resistance). In addition, the applicable requirements of IEC 61557-13 shall apply.

4.2 Measuring quantities

4.2.1 General

The measuring equipment shall be capable of measuring at least the following measuring quantities:

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

The combination with the following measuring functions is possible:

- dielectric strength;
- residual voltage;
- leakage current / protective conductor current.

The combination with further measuring functions is possible, provided that the measuring functions listed above will not be influenced.

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

4.2.2 Measurement of resistance of protective bonding

The measuring equipment shall be in compliance with IEC 61557-4.

4.2.3 Measurement of loop resistance

The measuring equipment shall be in compliance with IEC 61557-3.

4.2.4 Measurement of insulation resistance

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

4.2.5 Testing of the effectiveness of protective measures with RCD

The measuring equipment shall be in compliance with IEC 61557-6.

4.2.6 Testing of dielectric strength

If the equipment includes a dielectric strength test, it shall generate a sinusoidal voltage at mains frequency with values according to Table 1:

Table 1 – Test voltages

Nominal voltage U_n of unit under test (UT)	Test voltage
≤ 500 V	1 000 V
> 500 V	$2 \times U_n$

The test equipment shall be able of delivering a test current of 100 mA at the minimum and 200 mA at the maximum.

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

The uncertainty in the output of the applied test voltage for an unloaded (open circuit) condition or loaded such that a current of 100 mA is produced, shall be within between -10 % and +30 % of the voltage setting.

For protection against electric shock, the following protective measures are required:

- hardware or software key with ON/OFF function;
- additional switching device for the testing output, protected against unintended switching (e.g. barriers, shrouds, etc.);
- red control lamp indicating that a hazardous voltage is applied to the output circuit;
- continuous two-handed operation for the output circuit.

If during two-handed operation both hands will be removed, the output circuit shall be separated by electrical or mechanical means from all output terminals. If only one hand will be removed, the separation from the relevant output terminal shall fulfil the requirements of IEC 61010-1 for BASIC INSULATION.

In case of electrical separation the switching time to reach a voltage level less than 50 V between the output terminals shall be 0,1 s.

If two-handed operation is interrupted by removing one hand, the touch current flowing from the remaining contact to earth, measured with a current measuring circuit according to Figure A.1 of IEC 61010-1:2010 shall be below 3,5 mA.

The impedance of the output circuit to earth shall be $\geq 1 \text{ M}\Omega$.

The test duration shall be according to IEC 60204-1.

4.2.7 Measurement of residual voltage

If the equipment has the ability to 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 highest 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 M Ω .

4.2.8 Measurement of leakage current

If the measuring equipment has the ability to measure leakage currents, the equipment shall be in compliance with the requirements of IEC 61557-13. If other equipment or methods as described in IEC 61557-13 are used, performance and safety shall have at least the same level as in IEC 61557-13.

The manufacturer has to specify the input characteristics including the bandwidth of the input circuit.

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4.3 Construction requirements for testing equipment

4.3.1 Overload capability

The overload capability of combined measuring equipment shall be in compliance with the requirements of IEC 61557-10. In addition, no hazard shall arise for the user when the highest value of the high-voltage output is accidentally applied to the external distribution system. Protective devices may be activated. The loop impedance of the external circuit shall be $\leq 2 \text{ }\Omega$.

4.3.2 Terminals

All terminals shall be designed in such a way that during connection no unintended touching of hazardous live parts is possible.

4.3.3 Sockets for service purposes

Sockets for the connection of further external equipment shall be clearly marked. Protection against overcurrent and short-circuits shall be provided. Protection against electric shock shall be achieved by using an RCD with a tripping current of 30 mA at the maximum. All protective measures may be covered by the distribution system. In this case the inner wiring of the socket shall be designed according to the maximum nominal current, but at least 16 A.

4.3.4 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.