IEC 61557-4

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REDLINE VERSION

INTERNATIONAL STANDARD

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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 61557-4:2019-07 RLV(en)

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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 4: Resistance of earth connection and equipotential bonding

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International Standard IEC 61557-4 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

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

a) complement to the measurement category in Clause 4;
b) correction of the equation for operating uncertainty;
c) complement to the requirements for measuring with DC;
d) alignment of the structure with that of the whole IEC 61557 series.

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

FDIS	Report on voting
85/686/FDIS	85/695/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.

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

A list of all parts of 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 "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- withdrawn,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
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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 4: Resistance of earth connection and equipotential bonding

1 Scope

This part of IEC 61557 specifies the requirements applicable to equipment for measuring the resistance of earth conductors, protective earth conductors and conductors for equipotential bonding, including their connections and terminals, with an indication of the measured value or an indication of the limits.

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 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 61010-2-030:2017, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for equipment having testing or measuring circuits*

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61557-1 apply.

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

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

4 Requirements

~~The following requirements as well as those given in IEC 61557-1 shall apply.~~

4.1 General

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

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Equipment intended for making measurements on distribution systems shall, at the minimum, be rated for measurement category III in accordance with IEC 61010-2-030.

Equipment intended for making measurements on electrical equipment shall, at the minimum, be rated for measurement category II in accordance with IEC 61010-2-030.

Test leads and test probes used with the measuring equipment shall fulfil the requirements of IEC 61010-031.

4.2 Measuring voltage

The measuring voltage may be a DC or an AC voltage. The open-circuit voltage shall not exceed 24 V and shall not be less than 4 V.

4.3 Measuring current

The measuring current within the minimum measuring range according to 4.5 shall not be less than 0,2 A.

4.4 Measuring with DC

Resistance measuring equipment using a DC voltage as a measuring voltage shall be provided either with a reversing switch or allow the interchanging of test leads.

4.5 Measuring range

The measuring range within which the operating uncertainty in accordance with ~~4.6~~ 6.2 is maintained, shall include the values between 0,2 Ω and 2 Ω.

The measuring range shall be marked on the equipment. With analogue only presentation of the measuring results, the range shall be marked on the scale.

The measuring range to be marked in accordance with 4.5 on analogue measuring equipment shall cover at least 50 % of the length of the scale.

The division on the scale within this range shall be at least 0,5 mm per 0,1 Ω.

The resolution for digital equipment shall be at least 0,1 Ω.

~~**4.6** The maximum percentage operating uncertainty within the measuring range to be marked or stated shall not exceed ±30 %, with the measured value as fiducial value determined in accordance with Table 1.~~

The operating uncertainty applies under the rated operating conditions given in IEC 61557-1:2019, 4.3.

4.6 External resistance

When external resistances are included in the calibration as a zero offset, then this shall be indicated.

This offset shall remain included in the calibration as long as it is indicated on the measuring instrument, regardless of any changes in range or function.

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4.7 Indication of limits

Equipment ~~provided only with an indication of limits~~ that purely indicates the result of a comparison between measurements and limit values shall unambiguously display if either the upper or lower limit is reached.

4.8 Overvoltage

The user shall not be exposed to danger and the equipment shall not be damaged when the measuring equipment is accidentally connected with 120 % of the nominal voltage of the distribution system on which the measuring equipment may be used.

Protective devices of the test equipment may be activated.

5 Marking and operating instructions

5.1 Marking

In addition to ~~the marking in accordance with~~ IEC 61557-1:2019, 5.1 and 5.2, the following information shall be provided on the measuring equipment:

– open-circuit voltage;
– measuring current;
– the nominal system voltages for which the equipment has been rated;
– the measuring range in accordance with 4.~~6~~5;
– rated voltage to earth and measurement category.

5.2 Operating instructions

~~The operating instructions shall state the following information in addition to the statements specified in IEC 61557-1.~~

In addition to IEC 61557-1:2019, 5.3, the following information shall be provided in the operating instructions for the measuring equipment:

– a warning ~~indicating~~ stating that measurements shall only be carried out on de-energized circuits;
– a warning ~~indicating~~ stating that the results of measurements can be adversely affected by impedances of additional operating circuits connected in parallel or by transient currents;
– a statement on the correct operation when power is supplied by a hand-driven generator;
– for measuring equipment ~~with a supply from~~ powered by batteries/rechargeable cells, the possible number of measurements shall be stated;
– for measuring equipment using DC voltage where the measured values of both polarities are indicated, a statement about the interpretation of the results, if they are different.

6 Tests

6.1 General

In addition to IEC 61557-1:2019, Clause 6, the following tests shall be ~~executed~~ performed.

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6.2 Operating uncertainty

The operating uncertainty shall be determined in accordance with Table 1. In this process, the intrinsic uncertainties shall be determined under the following reference conditions:

– nominal value of the supply voltage;

~~– nominal r.p.m. of the hand-driven generator when used as a supply;~~

– nominal r/min when power is supplied by a hand-driven generator;

– reference temperature 23 °C ± 2 °C;

– reference position in accordance with the manufacturer's statement.

~~The operating uncertainty thus evaluated shall not exceed the limits specified in 4.6.~~

The maximum operating uncertainty within the measuring range to be marked or stated shall not exceed ±30 %, with the measured value as fiducial value determined in accordance with Table 1.

Table 1 – Calculation of operating uncertainty

Intrinsic uncertainty or influence quantity	Reference conditions or specified operating range	Designation code	Requirements or tests in accordance with relevant parts of IEC 61557	Type of test
Intrinsic uncertainty	Reference conditions	A	~~Part 4, subclause 6.1~~ IEC 61557-4:2019, 6.2	R
Position	Reference position ±90° approximately	E_1	~~Part 1, subclause 4.2~~ IEC 61557-1:2019, 4.2	R
Supply voltage	At the limits stated by the manufacturer	E_2	~~Part 1, subclauses 4.2, 4.3~~ IEC 61557-1:2019, 4.2, 4.3	R
Temperature	0 °C and 35 °C (± 2°)	E_3	~~Part 1, subclause 4.2~~ IEC 61557-1:2019, 4.2	T
Operating uncertainty	$B = \pm\sqrt{A^2 + \frac{4}{3}\sum_i E_i^2}$		~~Part 4, subclause 4.6~~ IEC 61557-4:2019, 4.5	R

Key

A = intrinsic uncertainty

~~E_n~~ E_i = variations

R = routine test

T = type test

F = fiducial value

$$B[\%] = \pm\frac{B}{F} \times 100\ \%$$

6.3 Open-circuit voltage

The lower value of open-circuit voltage shall be measured and compliance with the requirements under 4.2 shall be tested (~~*routine*~~ type test).

The upper value of open-circuit voltage shall be measured and compliance with the requirements under 4.2 shall be tested (type test).

6.4 Measuring current

The measuring current shall be measured and compliance with the requirement under 4.3 shall be tested (routine test).

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6.5 Indication of limits

Compliance with the requirements under 4.7 shall be tested (type test).

6.6 Overvoltage

The permissible overload in accordance with 4.~~9~~8 shall be tested.

~~For this purpose, a d.c. voltage with sequential polarity change and an a.c. voltage of 1,2 times the magnitude of the nominal voltage of the distribution system shall be applied in turns for a duration of 10 s to the measurement terminals. The test shall be performed with the measuring equipment switched on and off. After this, the measuring equipment shall not be damaged *(type test)*.~~

For this purpose, an AC voltage of 1,2 times the amplitude of the nominal voltage of the distribution system shall be applied in succession for a duration of at least 10 s to each of the measurement terminals. The test shall be performed with the measuring equipment switched on and off. After this, the measuring equipment shall not be damaged (type test).

After tests with AC overvoltage, defects, if any, shall be clearly indicated. Indications and displayed values shall not lead to unsafe interpretations.

After tests with AC overvoltages, the equipment shall stay within the specification. This includes reactivation of protective devices by the user without any repair.

The replacement of fuses accessible to the user should be considered as reactivation of a protective device.

Instead of an AC voltage, a DC voltage 1,5 times the AC voltage with sequential polarity change may be used.

~~**6.6** The possible number of measurements until the limit of the voltage range specified by the battery check facility is reached, shall be determined. In this process, the measuring equipment shall be loaded with a test resistance of (1 Ω ± 5 mΩ) for 5 s with intervals of 25 s between each new loading *(type test)*.~~

~~**6.7** Compliance with the tests in this clause shall be recorded.~~

6.7 Battery life in battery operated instruments

In this process, the measuring equipment shall be loaded with a test resistance of (1 Ω ± 5 mΩ) using a duty cycle of at least 5 s measurement time and an interval of approximately 25 s between measurements (type test).

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