BRITISH STANDARD

BS EN
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

The European Standard EN 61557-3:2007 has the status of a British Standard

ICS 17.220.20; 29.080.01; 29.240.01

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 61557-3:2007. It is identical with IEC 61557-3:2007. It supersedes BS EN 61557-3:1997, which will be withdrawn on 1 March 2010.

The UK participation in its preparation was entrusted to Technical Committee PEL/85, Measuring equipment for electrical and electromagnetic quantities.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English version

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 61557-3:2007)

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 3: Impédance de boucle

(CEI 61557-3:2007)

Elektrische Sicherheit in Niederspannungsnetzen bis AC 1 000 V und DC 1 500 V - Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen - Teil 3: Schleifenwiderstand

(IEC 61557-3:2007)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 85/292/FDIS, future edition 2 of IEC 61557-3, prepared by IEC TC 85, Measuring equipment for electrical and electromagnetic quantities, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61557-3 on 2007-03-01.

This European Standard supersedes EN 61557-3:1997.

The following changes were made with respect to EN 61557-3:1997:

– definitions complemented;

– revision of some requirements;

– addition of information on operating instructions;

– addition of new influence quantities E_9 and E_{10}.

This standard is to be used in conjunction with EN 61557-1.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2007-12-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-03-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 61557-3:2007 was approved by CENELEC as a European Standard without any modification.

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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 3: Loop impedance

1 Scope

This part of IEC 61557 specifies the requirements applicable to equipment for measuring the loop impedance between a phase conductor and the protective conductor or between a phase conductor and neutral or between two phase conductors by using the voltage drop when the circuit under test is loaded.

2 Normative references

The following referenced documents are indispensable for the application 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 61010-1:2001, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61557-1, *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*

3 Terms and definitions

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

3.1
loading method
method of loading a circuit within a distribution system to cause a voltage drop

3.2
loading equipment
equipment causing a voltage drop in a circuit

3.3
test current
current that causes a voltage drop in a circuit

3.4
system phase angle
angle between loop impedance and loop resistance of the distribution system

3.5
loop impedance
Z_s
sum of the impedances in a current loop comprising the impedance of the source of the current, the impedance of the phase conductor (e.g. protective conductor, earth electrode and earth) from the point of measurement to the other terminal of the source of the current

4 Requirements

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

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

The operating uncertainty applies to the rated operating conditions in IEC 61557-1 and the following:

– circuit to be tested without load;
– system voltage between 85 % and 110 % of the nominal voltage of the distribution system for which the equipment has been designed;
– system frequency between 99 % and 101 % of the nominal frequency of the distribution system for which the equipment has been designed;
– system voltage and frequency kept constant during the measurement;
– circuit loaded by loading equipment.

For measurements in close proximity to the transformer of the distribution system equipment with specified loop-impedance-measuring function (influence quantity for system phase angle at the minimum 30°) shall be used or a specified additional operating uncertainty shall be taken in account by the user.

NOTE In applications where the measurement of loop resistance is carried out in close proximity to the sourcing transformer (e.g. <50 m) the system phase angle may be more than 18° (e.g. up to 30°) and therefore the inductive part of the internal impedance of transformer may not be negligible.

4.2 When the loading by loading equipment causes transients on the distribution system, the operating uncertainty shall not be exceeded as a result of the transient.

Equipment with specified influence quantity $E_{6.1}$ of system phase angle of 18° shall be marked with the warning symbol No. 14 according IEC 61010-1 adjacent to the loop function marking or a warning shall be given on the display.

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

This offset shall remain included as long as it is indicated regardless of any changes in range or function.

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 3, Subclause 6.1	R
Position	Reference position ±90°	E_1	Part 1, Subclause 4.2	R
Supply voltage	At the limits stated by the manufacturer	E_2	Part 1, Subclauses 4.2, 4.3	R
Temperature	0 °C and 35 °C	E_3	Part 1, Subclause 4.2	T
Phase angle	At a phase angle 0° to 18°	E_6	Part 3, Subclause 4.1	T
System phase angle	At a system phase angle 0° to 18° at the bottom of the measurement range	$E_{6.1}$ [a]	Part 3, Subclause 4.1	T
System phase angle	At a system phase angle 0° to 30° at the bottom of the measurement range	$E_{6.2}$ [a]	Part 3, Subclause 4.1	T
System frequency	99 % to 101 % of the nominal frequency	E_7	Part 3, Subclause 4.1	T
System voltage	85 % to 110 % of the nominal voltage	E_8	Part 3, Subclause 4.1	T
Harmonics	5 % of 3rd harmonic at 0° phase angle 6 % of 5th harmonic at 180° phase angle 5 % of 7th harmonic at 0° phase angle (percentage of the fundamental of nominal voltage of distribution system)	E_9	Part 3, Subclause 4.1	T
D.c quantity	Add additional d.c. quantities of 0,5 % of the nominal voltage of distribution system in both polarities. It is recommended that manufacturers include E_{10} into the calculation of operating uncertainty according to this table.	E_{10} [b]	Part 3, Subclause 4.1	T
Operating uncertainty	$B = \pm (\lvert A \rvert + 1{,}15\sqrt{E_1^2 + E_2^2 + E_3^2 + E_6^2 + E_7^2 + E_8^2 + E_9^2 + E_{10}^2})$		Part 3, Subclause 4.1	R

A = intrinsic uncertainty

E_n = variations

R = routine test

T = type test

$$B\,[\%] = \pm \frac{B}{\text{fiducial value}} \times 100\,\%$$

[a] Use $E_{6.1}$ or $E_{6.2}$ as applicable.

[b] Influence quantity E_{10} takes in account possible voltage drops caused by d.c. leakage currents according to IEC 61800-5-2 on the PE or PEN- conductor.

4.4 Avoidance of the presence of a fault voltage resulting from the measurement exceeding 50 V at the point of measurement on the circuit under test shall be ensured. This can be achieved by an automatic disconnection when fault voltages with a value >50 V in accordance with Figure 1 of IEC 61010-1 occur.

4.5 The measuring equipment shall not be damaged nor shall the user be exposed to danger when the measuring equipment is connected to 120 % of the nominal voltage of the distribution system for which the measuring equipment has been designed. Protective devices shall not be activated.

4.6 The user shall not be exposed to danger and the equipment shall not be damaged when the measuring equipment is accidentally connected to a voltage having a value of 173 % of its rated voltage to earth for 1 min. Protective devices may be activated.

5 Marking and operating instructions

5.1 Marking

In addition to the marking in accordance with IEC 61557-1, the following information shall be provided on the measuring equipment.

5.1.1 Range of the resistance of the loop impedance or of the calculated short-circuit current respectively within which compliance with the uncertainty limits in accordance with 4.1 is maintained.

5.1.2 Nominal system voltage for which the equipment has been rated.

5.1.3 Rated system frequency for which the equipment has been rated.

5.1.4 Phase angle of the loading equipment when this angle is >18°.

5.2 Operating instructions

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

5.2.1 Data relating to the loading equipment if the phase angle is >18°.

5.2.2 Value and waveform of test current and duration of loading.

5.2.3 Range of system voltages within which the operating uncertainty stated in 4.1 is not exceeded.

5.2.4 Range of loop impedance (magnitude and angle) within which the operating uncertainty stated in 4.1 is not exceeded.

5.2.5 Note on possible uncertainties, for example due to preloading the circuit under test.

5.2.6 Data relating to the effect of system voltage variations and other effects from the system such as measuring in close proximity to the transformer of the distribution system. A specific user correction shall be stated, unless the instrument has a fully specified loop impedance measuring function.

6 Tests

In addition to IEC 61557-1 the following tests shall be executed.

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

– nominal system voltage;
– nominal system frequency;
– reference temperature 23 °C ± 2 °C;
– reference position in accordance with the manufacturer's statement;
– nominal distribution system supply or battery voltage respectively;
– difference between phase angle of the loading equipment and the loop impedance of the circuit under test ≤ 5°.

The operating uncertainty thus evaluated shall not exceed the limits specified in 4.1.

6.2 Compliance with the requirements in accordance with 4.3 shall be tested *(type test).*

6.3 Compliance with the requirements in accordance with 4.4 shall be tested *(routine test).*

6.4 The permissible overload in accordance with the requirements of 4.5 and 4.6 shall be tested *(type test).*

6.5 Compliance with the tests in this clause shall be recorded.

Bibliography

IEC 61800-5-2, *Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional* 1)

1) To be published.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 61010-1	2001	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements	EN 61010-1 + corr. June	2001 2002
IEC 61557-1	-[1)]	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	EN 61557-1	2007[2)]

[1)] Undated reference.

[2)] Valid edition at date of issue.

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