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Edition 2.0 2020-06

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 11: Effectiveness of residual current monitors (RCM) in TT, TN and IT systems

Sécurite électrique dans les réseaux de distribution basse tension au plus égale à 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection – Partie 11: Efficacité des contrôleurs d'isolement à courant différentiel résiduel (RCM) dans les réseaux TT, TN et IT

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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 11: Effectiveness of residual current monitors (RCM) in TT, TN and IT systems

FOREWORD

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International Standard IEC 61557-11 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

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

a) document title modified to include all types of RCM;
b) terms aligned with IEC 60050;
c) addition of requirements for testing new types of RCM;
d) moving of requirements for RCM Type B from former Annex A to main body text;

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e) 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
85/720/FDIS	85/722/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 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 "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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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 11: Effectiveness of residual current monitors (RCM) in TT, TN and IT systems

1 Scope

This part of IEC 61557 specifies the requirements for test equipment applied to the testing of the effectiveness of residual current monitors (RCM) that are already installed in distribution systems.

This test equipment can be used in any kind of network, such as a TN, TT or IT system. The test equipment can also be used for testing directionally discriminating residual current monitors (RCM) in IT systems.

It is not the purpose of this document to verify the residual current monitors (RCM) according to their product standards.

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

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 61557-6, *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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61557-1, IEC 61557-6, and the following 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

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3.1
earth fault current
current flowing to earth due to an insulation fault

[SOURCE: IEC 60050-442:1998, 442-01-23]

3.2
test current
I_T
current superimposed by the test equipment for testing the effectiveness of the RCM

3.3
residual current
I_Δ
RMS value of the vector sum of the currents flowing through the main circuit of the residual current device due to an insulation fault

[SOURCE: IEC 60050-442:2019, 442-05-19, modified – The wording "instantaneous values" has been deleted from the definition and "due to an insulation fault" has been added.]

3.4
rated residual operating current
$I_{\Delta n}$
value of residual operating current assigned to the RCM by the manufacturer at which the RCM operates under specified conditions

3.5
residual operating current
$I_{\Delta o}$
value of residual current which causes the residual current monitoring device to operate under specified conditions

[SOURCE: IEC 60050-442:2019, 442-05-20, modified: "residual current device" has been replaced with "residual current monitoring device" and symbol "$I_{\Delta n}$" has been replaced with "$I_{\Delta o}$".]

3.6
residual non-operating current
value of residual current at and below which the RCM does not operate under specified conditions

[SOURCE: IEC 60050-442:2019, 442-05-21, modified – "residual current device" has been replaced with "RCM" and the symbol has been omitted.]

3.7
actuating time
t_a
time taken for an RCM to change from the non-alarm state to the alarm state in response to the sudden appearance of a residual current which exceeds the preset level

[SOURCE: IEC 62020-1:2020, 3.1.6, modified – The symbol has been added.]

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3.8
residual current monitor
RCM
device or association of devices which monitors the residual current in an electrical installation, and which activates an alarm when the residual current exceeds the operating value of the device

[SOURCE: IEC 62020-1:2020, 3.1.1]

3.9
RCM Type A
type of RCM for which monitoring is ensured for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising

[SOURCE: IEC 62020-1:2020, 5.2.6.2, modified – The words "initiating an alarm" have been replaced with "monitoring".]

3.10
RCM Type B
type of RCM for which monitoring is ensured for residual sinusoidal alternating currents, with residual pulsating direct currents and smooth residual direct currents independent of polarity, whether suddenly applied or slowly rising

Note 1 to entry: RCM Type B are described in IEC 62020-1:2020, 5.2.6.4.

3.11
directionally discriminating RCM
type of RCM having the ability to discriminate between supply side and load side residual currents of the monitored lines, as declared by the manufacturer

Note 1 to entry: Directionally discriminating RCM are described in IEC 62020-1.

[SOURCE: IEC 62020-1:2020, 3.1.10]

4 Requirements

4.1 General

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

4.2 Functions

4.2.1 Operating test

The testing equipment shall be capable of verifying that the residual operating current of an RCM Type A tested with an AC test current is less than or equal to the value of the rated residual operating current.

Testing of an RCM Type A shall be conducted with a calibrated AC current suddenly applied at a zero crossing.

The tests shall be carried out with a sinusoidal, or mains-derived quasi-sinusoidal, test current.

If the test equipment is capable of producing half-wave test currents, testing of an RCM Type A may be carried out alternatively with half-wave test currents and/or AC current with superimposed ±6 mA DC.

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In the case of pulsed DC current, the test equipment shall be capable of testing in both polarities.

When testing an RCM Type B with a DC test current, it shall be verified that the residual operating current is less than or equal to 2 times the value of the rated residual operating current.

Testing of an RCM Type B shall be conducted separately with a suddenly applied, calibrated AC current and a linearly increasing smooth direct current.

The slope of the linear increase shall not be greater than 2 times $I_{\Delta n}$ / 5 s.

If the slope of the linear increase is simulated by a stepwise or linearly increasing test current; the increase shall not be greater than 2 times $I_{\Delta n}$ / 30 (see Figure 1 to Figure 3).

In both cases, the starting current shall be less than 0,2 times $I_{\Delta n}$.

The operating uncertainty of the increasing test current I_T shall not exceed ±10 % of the rated residual operating current $I_{\Delta n}$.

The operating uncertainty of the calibrated test current I_T shall not exceed 0 % to +10 % of the rated residual operating current $I_{\Delta n}$.

The test period shall be adapted to the set actuating time of the RCM and it shall be possible to extend the test period up to 10 s.

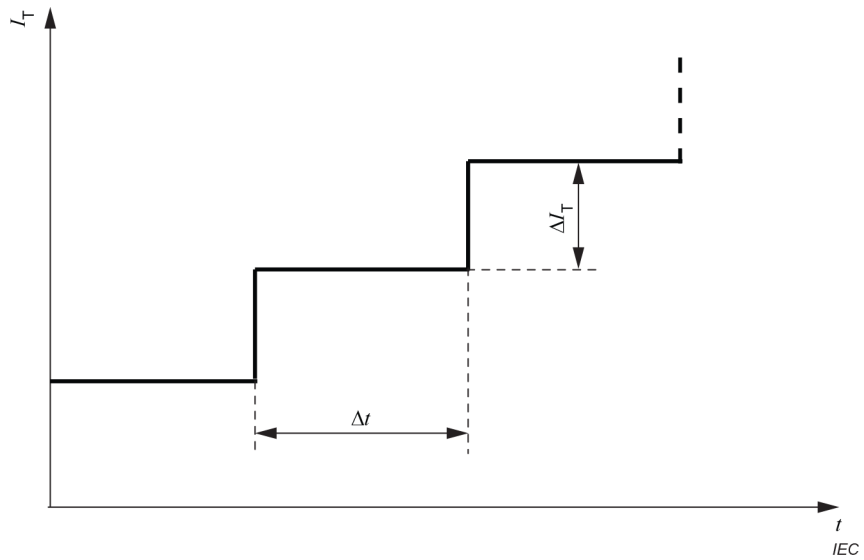

Figure 1 – Maximum step size of increasing smooth direct test current (I_T)

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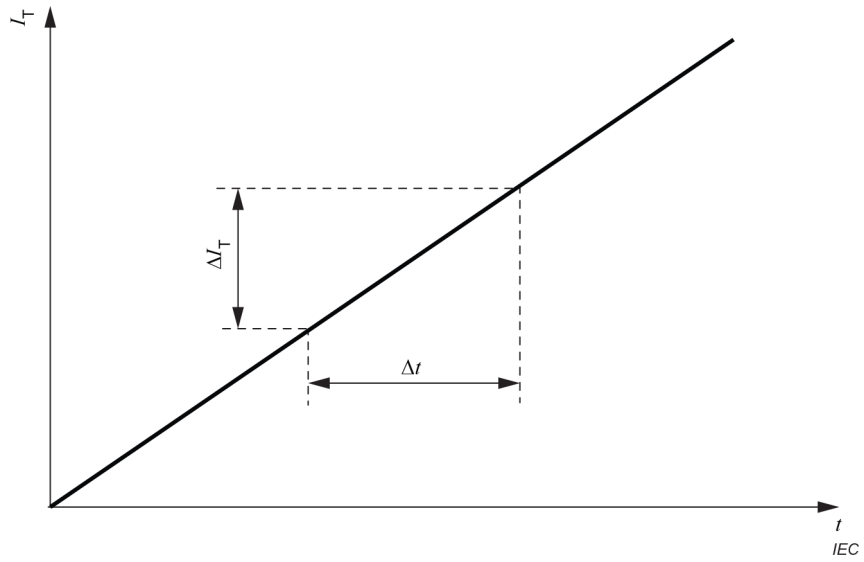

Figure 2 – Maximum gradient of linearly increasing smooth direct test current (I_T)

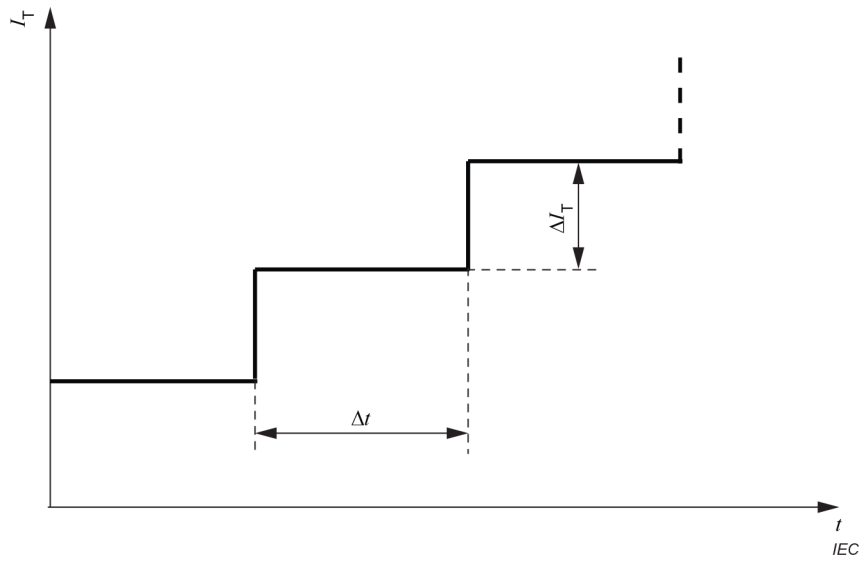

Figure 3 – Example for linearly increasing smooth direct test current (I_T): $I_{\Delta n}$ = 30 mA

Key (for Figure 1 to Figure 3)

t	time
$I_{\Delta n}$	rated residual operating current
I_T	smooth direct test current
ΔI_T	slope of the linear increasing test current or steps of stepwise rising test current
Δt	time for one step for linearly increasing test current or time for steepness of continuous rising test current

A slow continuous or stepwise increase of the DC test current is required to prevent the AC sensitive part of the RCM Type B from operating during the DC test.

Example for ΔI_T = 2 mA: ≥ 167 ms

Example for ΔI_T = 0,5 mA: ≥ 42 ms

NOTE 1 Existing leakage currents downstream can influence the verification.

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