IEC 61557-11

Edition 2.0 2020-06
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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) ~~type A and type B~~ in TT, TN and IT systems

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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) ~~type A and type B~~ 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;
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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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) ~~type A and type B~~ 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~~s~~) ~~of type A and type B,~~ 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 ~~may~~ 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/TR 60755:2008, *General requirements for residual current operated protective devices*~~

IEC 61010-1:~~2001~~2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

~~IEC 61326-2-2, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*~~

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*

~~IEC 62020:1998, *Electrical accessories – Residual current monitors for household and similar uses (RCMs)*~~

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

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

[SOURCE: ~~IEC 62020, definition 3.1.1~~ IEC 60050-442:1998, 442-01-23]

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

3.3
residual current
I_Δ
~~vector sum of the instantaneous values of the current flowing in the main circuit of the RCM (expressed as r.m.s. value)~~

~~[IEC 62020, definition 3.2.3]~~

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 current assigned by the manufacturer which causes the RCM to operate under specified conditions~~

~~[IEC 62020, definitions 3.2.4 and 3.4.1 combined]~~

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

~~[IEC 62020, definition 3.2.4]~~

[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
~~$I_{\Delta no}$~~
value of residual current at and below which the RCM does not operate under specified conditions

~~[IEC 62020, definition 3.2.5]~~

[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, definition 3.3.12~~ IEC 62020-1:2020, 3.1.6, modified – The symbol has been added.]

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, definition 3.3.1~~ 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, definition 3.3.8~~ 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.

~~[IEC/TR 60755, definition 5.2.9.3, modified]~~

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

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

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 ~~according to IEC 62020~~.

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 ~~continuously rising~~ linearly increasing smooth direct current.

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

If ~~the continuous rate of rising~~ 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.

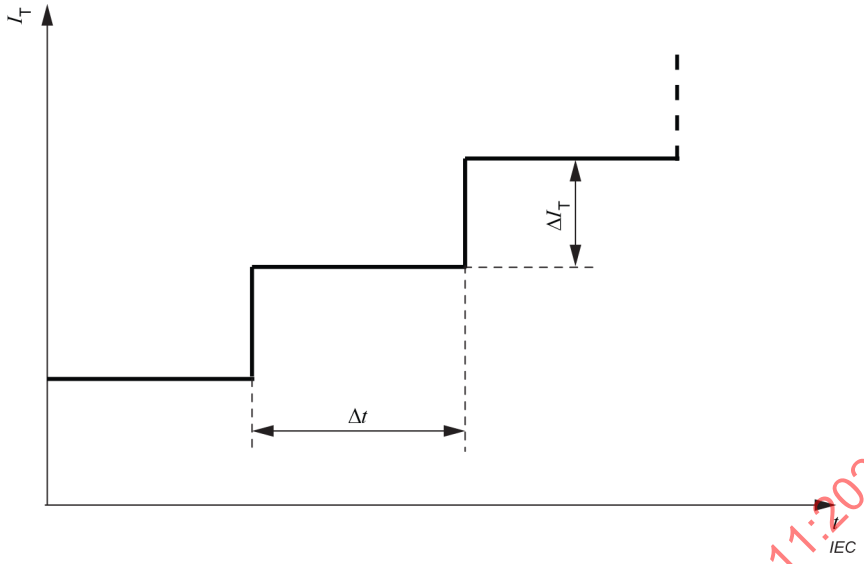


Figure 1 – Maximum step size of increasing smooth direct test current (I_T)

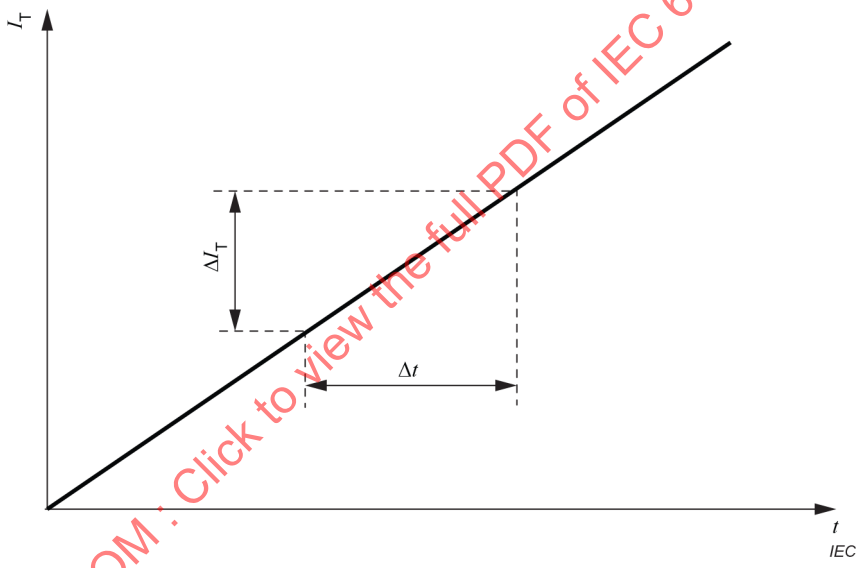


Figure 2 – Maximum gradient of linearly increasing smooth direct test current (I_T)

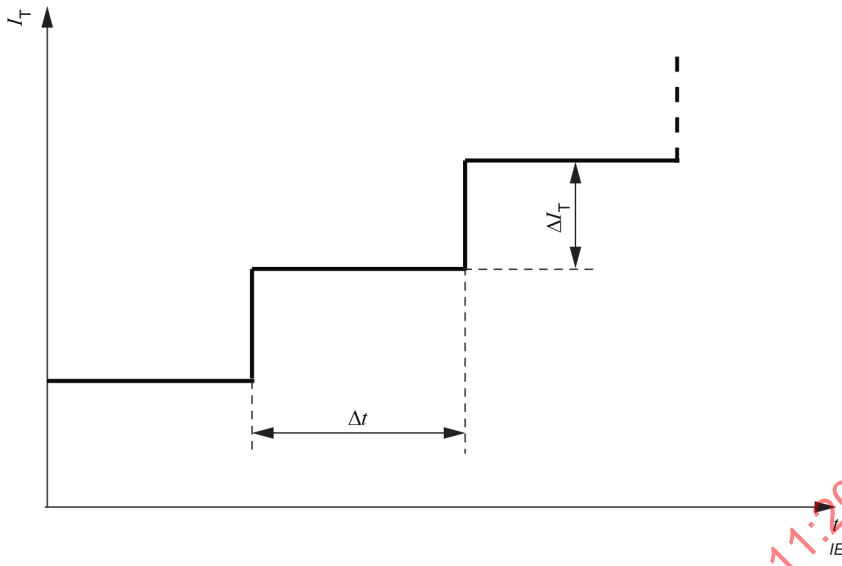


Figure 3 – Example for linearly increasing smooth direct test current (I_T): $I_{\Delta n}$ = 30 mA

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.

NOTE 2 The actual rise time depends on the system capacitance and the resistive load of the test equipment.

NOTE 3 Smooth DC test current refers to direct current with AC ripple up to 10 % (peak to peak).

4.2.2 Non-operating test

When a test at 50 % or less of the rated residual operating current is used to test the reliability of the RCM is included, the minimum test period shall be 10 s. The alarm shall not be activated.

When a non-operating test at 50 % or less of the rated residual operating current is included, the operating uncertainty of the calibrated test current shall not exceed 0 % to −10 % of the specified non-operating test current.

NOTE Existing leakage currents downstream can influence the verification.

4.2.3 Test of actuating time

If the set actuating time of the RCM is being tested with the test equipment, the setting of the test period on the test device shall have a resolution of minimum 0,5 s ranging up to 10 s. The setting uncertainty shall not exceed 0 % to −10 % of the set value. The test shall solely be performed with calibrated AC test current.

Other methods for the acquisition of the actuating time via optical recognition or interfacing are permissible.

NOTE The general function of RCMs is not to disconnect the power supply when a residual current above the value of the rated residual operating current occurs. The RCM indicates the increase of the residual current above the residual operating current with a signalling device, for example a lamp, buzzer, contact relay or interface-signal. Thus, the response time ~~may~~ can only be tested via the visual or additional electrical detection of this signal.

According to IEC 62020-1, the ~~response~~ actuating time of the RCM may only amount to a maximum of 10 s. The response time shall be specified by the manufacturer or shall be adjustable on the device.

If the RCM is being used for the purpose of disconnection, the tests covered by IEC 61557-6 shall apply.

4.3 ~~Prevention of danger by fault voltages exceeding 50 V a.c. or 120 V d.c. in the monitored system during measurement~~ Fault voltages exceeding U_L

Prevention of danger due to fault voltages exceeding U_L within the system under test shall be ensured during the use of the test equipment. This can be achieved as follows:

– automatic disconnection in accordance with IEC 61010-1:~~2001~~2010, Figure 1, if the residual voltage is above 50 V AC or 120 V DC;

– application of test current I_T, gradually or permanently adjustable, where the test starts with a maximum current of 3,5 mA AC or 15 mA DC in accordance with IEC 61010-1:~~2001~~2010, 6.3.2 b), including parallel test circuits, is permitted. The possibility to change the test current I_T without generating a dangerous ~~residual~~ fault voltage shall be clearly identifiable, for instance on a voltmeter;

– in special locations, the touch voltage limit is 25 V AC or 60 V DC;

– the operating uncertainty for the detection of the fault voltage shall not exceed 0 % to −20 % of the limit.

4.4 ~~Prevention of danger caused by overvoltages when the system is connected~~ Overvoltage

If the system is connected to 120 % of the nominal voltage of the system for which the test equipment is designed, neither the operator shall be harmed, nor the device be damaged. Protective devices shall not be activated. If the device is intended to be used in IT systems, the nominal voltage of the test equipment is the ~~phase to phase~~ line-to-line voltage.

If the test equipment is accidentally connected to 173 % of the nominal voltage in TN or TT systems for which the test equipment is designed for the duration of 1 min, neither the operator shall be harmed, nor the device be damaged. In this case, protective devices may be activated.

~~4.7 Electromagnetic compatibility (EMC)~~

~~The electromagnetic compatibility shall be in accordance with IEC 61326-2-2.~~

5 Marking and operating instructions

5.1 Markings

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

Rated residual operating current or rated residual operating currents of the RCM for which the test equipment has been designed for an actuating time of 10 s.

NOTE Other rated residual operating currents for ~~lower~~ a shorter duration of the actuating times ~~may~~ can be marked in addition.

The maximum voltage to earth and the rated measuring category shall be marked.

5.2 Operating instructions

5.2.1 General

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

In addition to the requirements of IEC 61557-1:2019, 5.3, the operating instructions shall include the information and warnings set out in 5.2.2 and 5.2.3.

5.2.2 Information

a) Information about special test configurations to avoid unintended tripping of residual current devices (RCD) ~~(see Annex B)~~;

b) information to avoid unintended influences on the operation of the system;

c) information for recalibration cycles and safety tests of the test equipment after repair and instructions for periodical tests.

5.2.3 Warnings

a) If the detecting circuit for the fault voltage has no probe and if a possible voltage between the protective conductor and earth influences the measurements, a warning shall be included.

b) Where the detecting circuit for the fault voltage uses the N-conductor as a probe, a warning shall be given to test the connection between the neutral point of the distribution system and earth before the test is started; a possible voltage between the N-conductor and earth may influence the measurements.

c) A warning that leakage currents in the circuit following the RCM may influence measurements and test results.

d) The earth electrode resistance of a detecting circuit for the fault voltage with a probe shall not exceed the value stated by the manufacturer.

e) A warning that the potential fields of other earthed installations may influence the determination of the fault voltage.

f) A warning that for special locations the touch voltage is limited to 25 V AC or 60 V DC.

6 Tests

6.1 General

~~The following tests in addition to those required according to IEC 61557-1 shall be executed.~~

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

Tests shall be carried out with rated residual operating currents, in addition to the values of the non-operating test currents I_T, if applicable.

The test circuit shall be adapted to test the function of the fault voltage detection circuit at the limits of the fault voltage for which the equipment is designed and in addition at the appropriate $R_A = R_{Amax}$ for each range.

The test circuit shall be adapted to each test method employed. The manufacturer's instructions shall be ~~heeded~~ observed.

NOTE

$$R_{Amax} = \frac{U_L}{I_{\Delta n}} I_{\Delta o}$$

$$R_{Amax} = \frac{U_L}{I_T}$$

where

U_L is the conventional touch voltage limit;

I_T is the test current superimposed by the test circuit;

R_A is the total earthing resistance ($R_A = R_{Amax}$);

$I_{\Delta n}$ is the rated residual operating current;

$I_{\Delta o}$ is the residual operating current.

6.2 Operating uncertainty

The operating uncertainty applies in accordance with the test conditions specified in IEC 61557-1:2019 and, in addition, the following requirements apply:

~~– the protective conductor is free of extraneous voltage,~~

~~– the system voltage remains constant during tests,~~

~~– the circuit behind the RCM is free of leakage currents,~~

~~– sinusoidal half-wave or full-wave current with rated frequency, respectively smooth direct current (see 4.1),~~

– the voltage on the protective conductor relative to earth or N shall be less than 1 Vrms;

– the system voltage remains stable within ±1 V during the measurement;

– the circuit following the residual current protective device carries a negligible leakage current;

– sinusoidal half-wave current with rated frequency, or sinusoidal full-wave current with rated frequency, or smooth direct current (see 4.2);

– the AC test current I_T shall be switched on at a zero crossing;

– the test period shall be 10 s for the maximum test current for which the test equipment is designed;

– the time limit may be omitted when testing with current greater than 500 mA;

– the resistance of the probes is within the limits stated by the manufacturer.

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

– nominal voltage of the rated range of the device,

– nominal frequency of the rated range of the device,

– reference temperature 23 °C ± 2 °C,

– reference position in accordance with the manufacturer's instructions,

– protective conductor free from extraneous voltages,

– 100 Ω resistance of the auxiliary earth electrode in a TT system.

The operating uncertainty thus evaluated shall not exceed the limits specified in 4.1 to 4.2.

~~a) Compliance with the permissible operating uncertainty when detecting the fault voltage shall be tested for measurements with and without a probe.~~

~~b) Compliance with the requirements in accordance with 4.5 shall be tested *(routine test)*.~~

~~c) The overload protection in accordance with 4.6 shall be tested *(type test)*.~~

~~d) Compliance with the tests in this clause shall be recorded.~~

Table 1 – Calculation of operating uncertainty

Intrinsic uncertainty or influence quantity	Reference conditions or specified operating range	Designation code	Requirements or test in accordance with the relevant parts of IEC 61557	Type of test
Intrinsic uncertainty	Reference conditions	A	IEC 61557-11:2020, 6.2	R
Position	Reference position ±90°	E_1	IEC 61557-1:2019, 4.2	R
Supply voltage	At the limits stated by the manufacturer	E_2	IEC 61557-1:2019, 4.2, 4.3	R
Temperature	0 °C and 35 °C	E_3	IEC 61557-1:2019, 4.2	T
Resistance of the probes	Within the limits stated by the manufacturer	E_5	IEC 61557-11:2020, 4.4	T
System voltage	85 % to 110 % of the nominal voltage	E_8	IEC 61557-11:2020, 4.4~~, 4.5~~	T
Operating uncertainty	$B = \pm\sqrt{A^2 + \frac{4}{3}\sum_i E_i^2}$		IEC 61557-11:2020, 4.1 IEC 61557-11:2020, 4.2 IEC 61557-11:2020, 4.3 IEC 61557-11:2020, ~~4.5~~ 6.2	R

A = intrinsic uncertainty

~~E_n~~ E_i = variations

R = routine test

T = type test

F = fiducial value

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

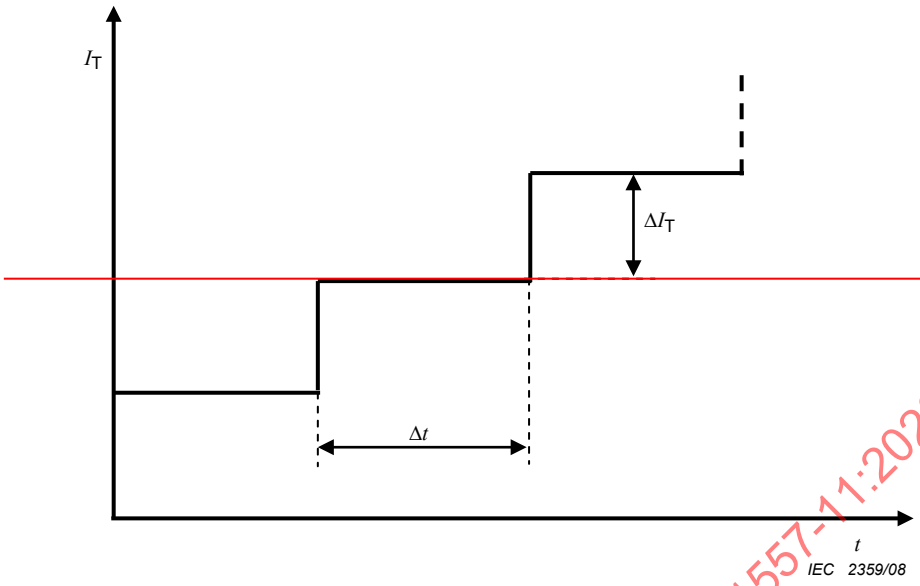
6.3 Test of protection against high fault voltages

Compliance with the permissible operating uncertainty when detecting the fault voltage shall be tested for measurements with and without a probe (routine test).

Compliance with 4.3 shall be tested in all ranges.

6.4 Test of overvoltage

The permissible overvoltage in accordance with the requirements of 4.4 shall be tested (type test).



~~$\Delta I_T \leq 2\ I_{\Delta N} / 30$ $\Delta I_T / \Delta t \leq 2\ I_{\Delta N} / 5$ s~~

~~**Key** (for Figures 1 to 3)~~

~~t time~~

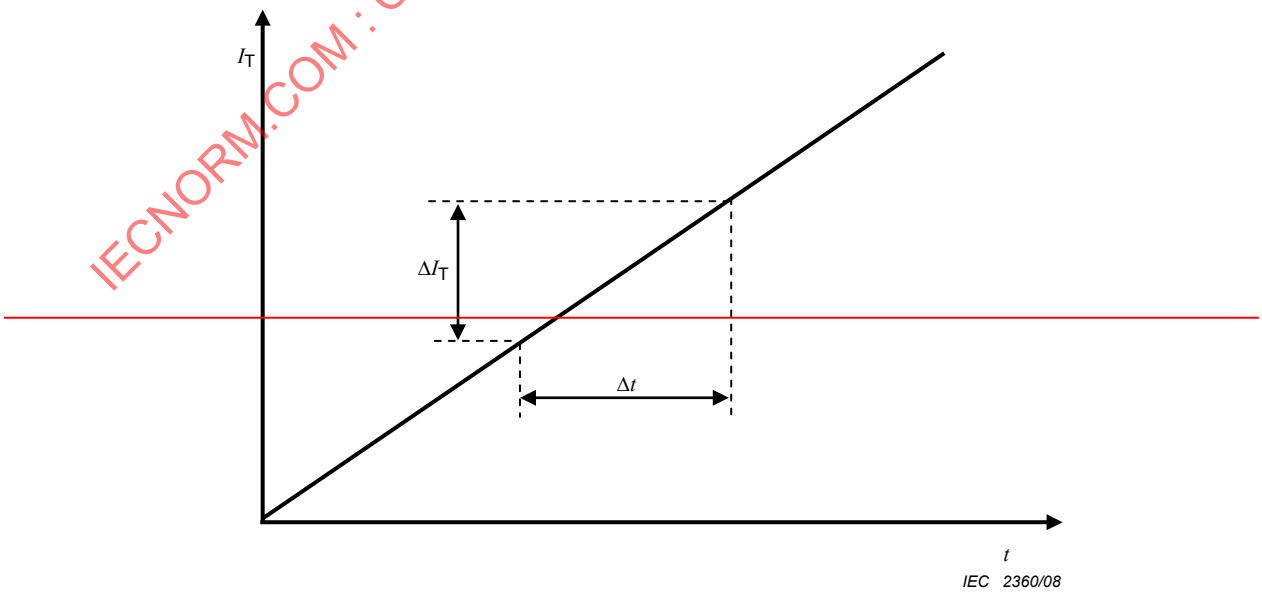
~~$I_{\Delta N}$ rated residual operating current~~

~~I_T smooth direct test current~~

~~ΔI_T steepness of continuous rising test current or steps of stepwise rising test current~~

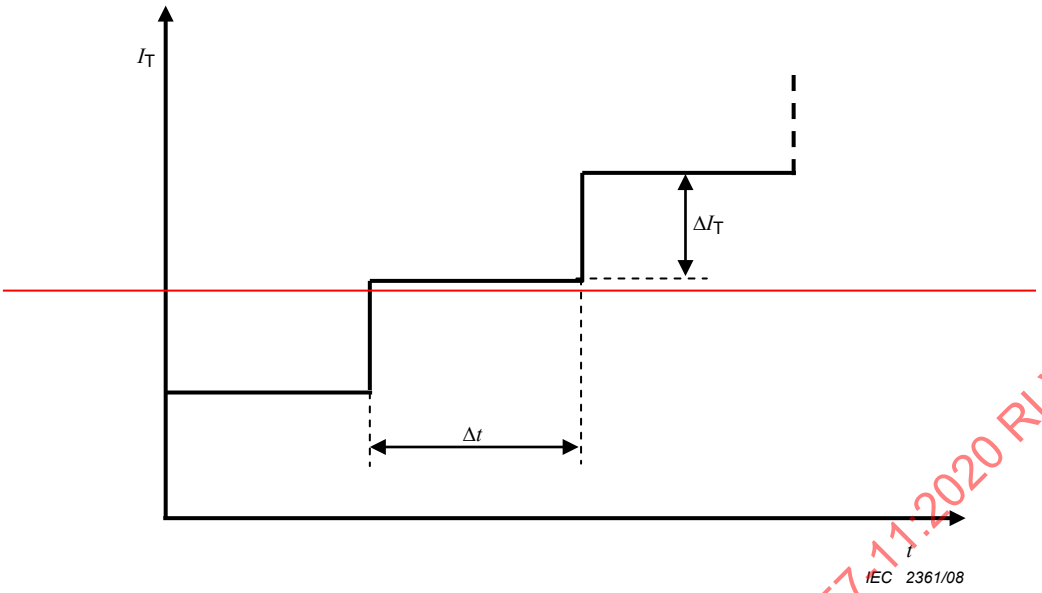
~~Δt time for one step for stepwise rising test current or time for steepness of continuous rising test current~~

~~Figure 1 – Maximum steepness of stepwise rising smooth direct test current (I_T)~~



~~$\Delta I_T / \Delta t \leq 2\ I_{\Delta N} / 5$ s~~

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



~~$\Delta I_T \leq 2 \times 30$ mA / 30 $\leq$ 2 mA~~

~~Example for ΔI_T = 2 mA: $\Delta t \geq$ (2 mA × 5 s) / (2 × 30 mA) ≥ 167 ms~~
~~Example for ΔI_T = 0,5 mA: $\Delta t \geq$ (0,5 mA × 5 s) / (2 × 30 mA) ≥ 42 ms~~

~~NOTE 1 Existing leakage currents downstream may influence the verification.~~

~~NOTE 2 The actual rise time depends on the system capacitance and the resistive load of the test equipment.~~

~~NOTE 3 Smooth d.c. test current refers to direct current with a.c. ripple up to 10 % (peak to peak).~~

~~NOTE 4 A slow continuous or stepwise increase of the d.c. test current is required to prevent the a.c. sensitive part of the RCM type B from operating during the d.c. test.~~

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

Annex A
(informative)

Differences between RCMs and RCDs

A.1 Scope

This Annex A gives guidelines for specifying the differences between residual current monitors (RCMs) and residual current protective devices (RCDs). The understanding is important in the design of test equipment and for testing RCMs in electrical installations.

A.2 Reference documents and definition of function

Table A.1 shows the differences by definition according to the respective product standard.

Table A.1 – Normative reference and definition of function of RCM and RCD

	Product Standard	Definition of function
RCM	IEC 62020:1998, 3.3.1	A residual current monitor (RCM) is a device or an 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
RCD	IEC/TR 60755:2008, 3.3.1	A residual current device (RCD) is a mechanical switching device or association of devices designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions

IEC 62020 is the only product standard for RCMs. RCMs covered by this standard are not intended to be used as protective devices, but may be used in conjunction with protective devices (see IEC 60364-4-41).

IEC/TR 60755 is the basic product standard for RCDs. Variations of RCDs are covered by other product standards, for example IEC 61008-1 and IEC 60947-2.

If RCMs are used together with switching devices and this combination fulfils the respective RCD standards, for example IEC 60947-2 for MRCDs, this combination has to be tested in the installation with equipment covered by IEC 61557-6.

A.3 Requirements from product standards for testing RCMs

Table A.2 shows the requirements from the product standard IEC 62020:1998 which should apply when testing RCMs in installations.

Table A.2 – Requirements for testing RCMs according to product standard IEC 62020:1998

Requirement	Explanation	Consequence for testing
Type of RCM	Type A (type a.c. is not allowed) Type B existing, but is not covered by IEC 62020	Test with the applicable waveforms
Rated residual operating current	Values to be defined by the manufacturer Preferred values are : 0,006 A, 0,01 A, 0,03 A, 0,1 A, 0,3 A, 0,5 A Values can be fixed or adjustable	Test with the values defined by the manufacturer and appropriate device settings for adjustable devices should be considered The operating tolerances of the RCM (residual operating and non-operating current) are equal to that of RCDs
Actuating time	For RCMs only a maximum actuating time is defined: 10 s The actuation time can be fixed or adjustable	Defined or adjusted actuating times should be considered
Preferred values of rated frequency	RCMs type A: 50 Hz and/or 60 Hz – manufacturer can define other values, but frequency response is not defined in the product standard RCMs type B: see RCDs type B	RCDs type A: preferred value is 50 Hz RCDs type B: frequency response is limited to 1 000 Hz
Indication of the fault condition	RCMs should be provided with means for indicating the fault condition RCMs may be fitted with a resetting function to manually reset the RCM to the non-alarm state after removal of the fault. RCMs not fitted with resetting function should reset automatically after removal of the fault Where an audible alarm is provided in addition, the audible alarm should reset automatically after removal of the fault	Different to RCDs, tripping of the RCM can not be recognized due to switching off of the monitored voltage Recognition of tripping can only be performed by monitoring or controlling the respective alarm function: Examples of alarm functions: – visual indicator (required) – audible alarm (optional) – alarm contact (optional) – alarm via digital interface (optional)
Disconnection of an external CT	If the RCM is equipped with an external residual current transformer (CT), the RCM should give a warning, if the CT is disconnected	Disconnection is normally checked during the operating test of the RCM

A.4 Main technical differences between RCMs and RCDs

Table A.3 shows the main technical differences between RCMs and RCDs.

Table A.3 – Main technical differences between RCMs and RCDs

Function	RCM	RCD
Operation / Tripping (actuating)	Operation is indicated on the RCM by a visual signal on the front of the device. Additional signals for indicating operation may be : – audible alarm, – alarm contacts, – digital interface. Operation can not be recognized on an outlet, where the test is performed and which is located outside the area where the alarm on the RCM itself can be recognized	Tripping is primarily indicated by switching off the voltage Tripping can be recognized on any outlet or part of the installation where the test is performed
Actuating time	Actuating time can be anywhere between 0 s and 10 s The set or fixed actuating time should be respected Actuating time for RCMs relate to 1 × $I_{\Delta N}$ only	The maximum actuating time of RCDs is defined in the respective RCD standards Actuating time has to follow the time characteristics of the RCD standards for 1 time $I_{\Delta N}$, 2 times $I_{\Delta N}$, 5 times $I_{\Delta N}$
Operating / Tripping values	Operating values can be fixed or adjustable. Adjustment can be in steps or steplessly by switches, potentiometers or by menu settings via displays The set operating values are visible on the front of the RCM	Tripping values are fixed or adjustable in steps. The set values are indicated on the front of the device
Supply voltage dependency	RCMs are voltage dependent devices	RCDs type A may be voltage-dependent or voltage-independant. Standards for voltage-dependent RCDs are under consideration RCDs type B are generally voltage dependant
Indication of the value of the measured residual current	Some RCMs are equipped with functions for the indication of the residual current	RCDs generally have no such indication
Multi-channel devices	RCMs can be multi-channel devices. In this case several residual current sensors (CTs) are connected to one device. Setting operating values and signalling alarms are performed on this device	Generally RCDs are single channel devices

A.5 Special considerations for testing RCMs in the installation

The following points should be considered when testing already installed RCMs:

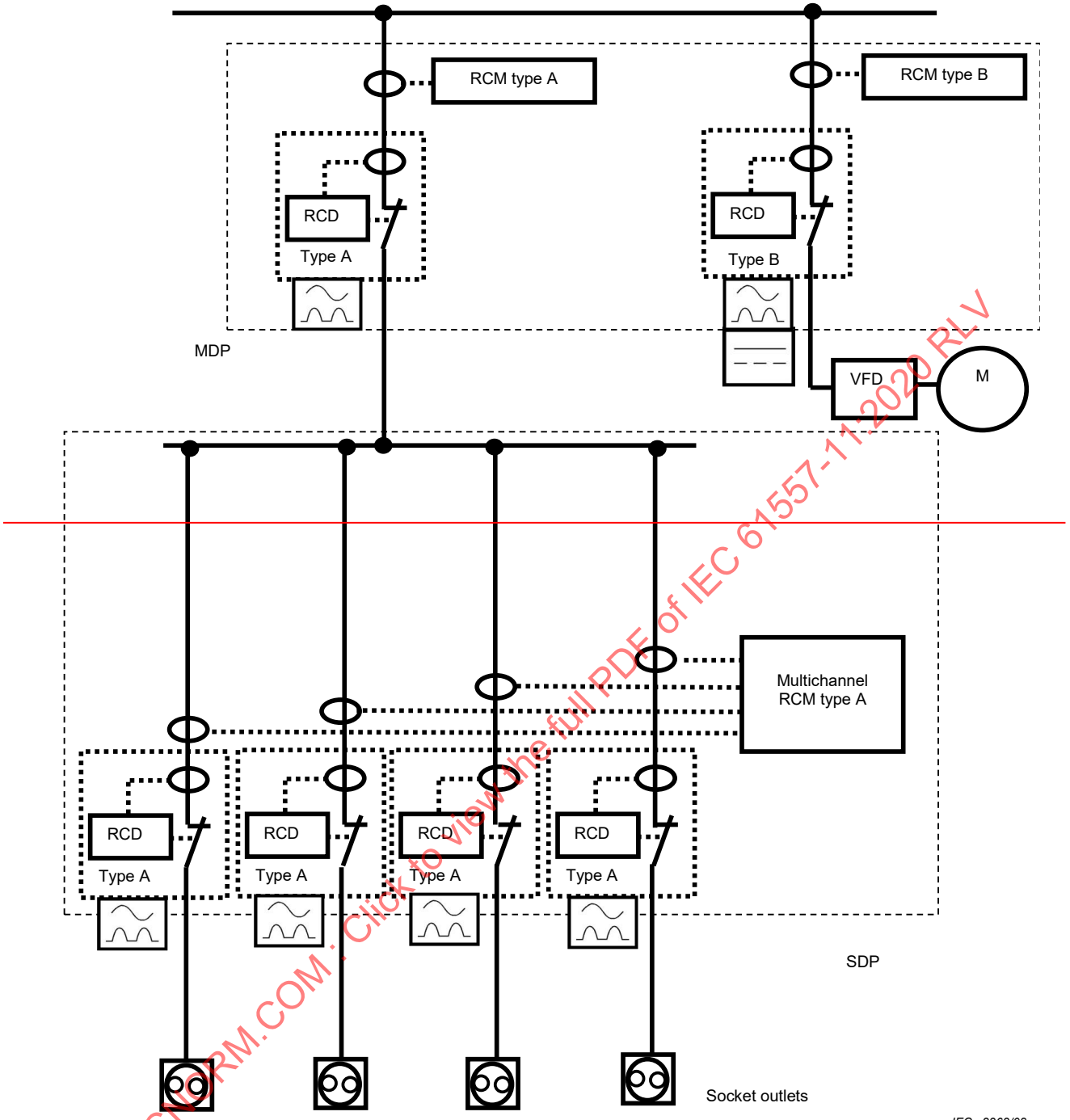
– operation of the RCM should be recognized by watching the alarm indicator on the front of the RCM or on a remote indication device;

– the settings of the test equipment should allow stepwise or continuous increase of the test current;

– for testing the operating value the time for each step or gradual increase of the test current should respect the setting of the actuating time on the RCM (0…10 s).

If other fault-indication is provided, for example audible or remote indications via alarm contact or digital interface, these indications should be tested as well.

Figure A.1 shows a typical installation where RCMs are installed in addition to RCDs.



~~Key~~

~~MDP main distribution panel~~
~~SDP sub distribution panel~~
~~VFD variable frequency device~~
~~M motor~~
~~RCD residual current device~~
~~RCM residual current monitoring device~~

~~**Figure A.1 – Typical installation with a combination of RCDs and RCMs**~~

Annex B
(informative)

Safety aspects, test methods and applications

B.1 Safety aspects

Residual current monitors (RCMs) contribute to the safety of installations by preventive measuring and monitoring of residual current. In this context the function of the RCM should be ensured over the lifetime of the RCM by periodic testing.

Periodic verification of the installation including verification of electrical loads and equipment incorporating RCMs is advised. After verification, appropriate corrective measures should be taken, e.g. repairing the installation or replacing faulty equipment, etc. (see IEC/TR 62350).

The main reasons for using RCMs are as follows:

- in supply systems, RCMs may be installed to reduce the risk of operating the protective device (RCD) in event of excessive leakage current in the installation and/or connected appliances according to IEC 60364-5-53.
- an RCM may be installed for detecting fault currents in order to give an alarm to reduce the risk of fire [adapted from IEC 60364-5-53].
- in the case of an installation under normal operation which has an effective preventive maintenance management system, periodic verification may be replaced by adequate procedures of continuous monitoring and by maintenance of the installation including all constituent equipment, by skilled persons. Appropriate records should be kept (see IEC 60364-6).
- RCMs are a part of this management system.
- in IT systems, except where a protective device (RCD) is installed to interrupt the supply in the event of the first insulation fault, an insulation fault location system or an RCM under specified conditions may be provided to indicate the first fault from a live part to exposed-conductive-parts or to earth. In accordance with IEC 60364-4-41, this device should initiate an audible and/or visual signal, which should continue as long as the fault persists.

B.2 Test methods

In general, it is intended to carry out the testing of RCMs without the tripping of protective devices.

After the visual inspection of the system and components (e.g. type of RCM) the applicable test method covered by this standard should be chosen.

If an RCM is installed in addition to an RCD, the test equipment may also be used to compare the tripping characteristics of the RCM and of the RCD. This test is useful in order to determine that the correctly specified RCD has been installed. For this purpose the test should be performed for RCMs type A and/or RCMs type B, where applicable.

B.3 Applications of test methods

The following test methods apply.

1) If only an RCM is installed in the system - no RCD - the test equipment may be connected between line and earth.

2) If an RCM is installed in combination with an RCD, the following tests may be performed

a) Tripping of RCD is allowed, see B.3 1.

b) Tripping of RCD is not allowed:

i) test equipment is connected between LINE upstream and NEUTRAL downstream.

ii) test equipment is connected between LINE 1 upstream and LINE 2 downstream.

iii) test equipment is connected between LINE and EARTH, if the RCD is installed downstream.

iv) test equipment is only connected to additional wiring through the current transformer (CT); this may also apply to testing RCMs with higher rated current.

v) in case of testing directionally discriminating RCMs in IT systems, two tests may be performed downstream.

3) RCMs installed in combination with electronic equipment, such as motor drives, converters without galvanic separation, etc.

For testing the effectiveness of RCMs in such applications, in general it is necessary to test on several points of the installation, for example upstream of the motor drive, in the intermediate d.c. circuit of the motor drive and downstream in the electronic motor circuit.

Clause A.2 and the bibliography of this part of IEC 61557 offer additional information on application standards.

IEC/TR 62350 offers more information on potential influences when testing RCMs.

Bibliography

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-53~~:2001~~, *Low-voltage electrical installations ~~of buildings~~ – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 60364-6, *Low voltage electrical installations – Part 6: Verification*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 61008-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61326-2-2, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*

IEC 62020-1:2020, *Electrical accessories – Residual current monitors for household and similar uses (RCMs)*

IEC TR 62350, *Guidance for the correct use of residual current-operated protective devices (RCDs) for household and similar use*

IEC 61557-11

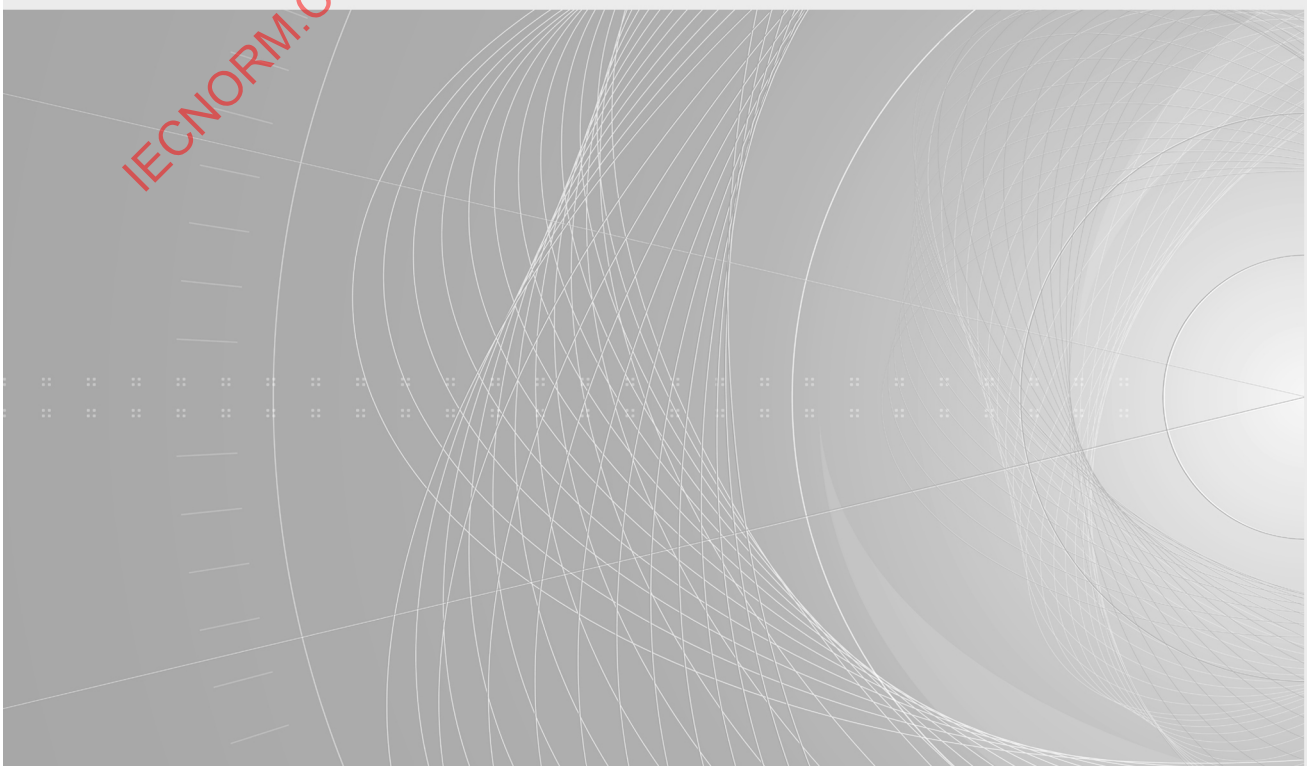
Edition 2.0 2020-06

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



IEC 61557-11:2020-06(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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;

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

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.]

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.

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.

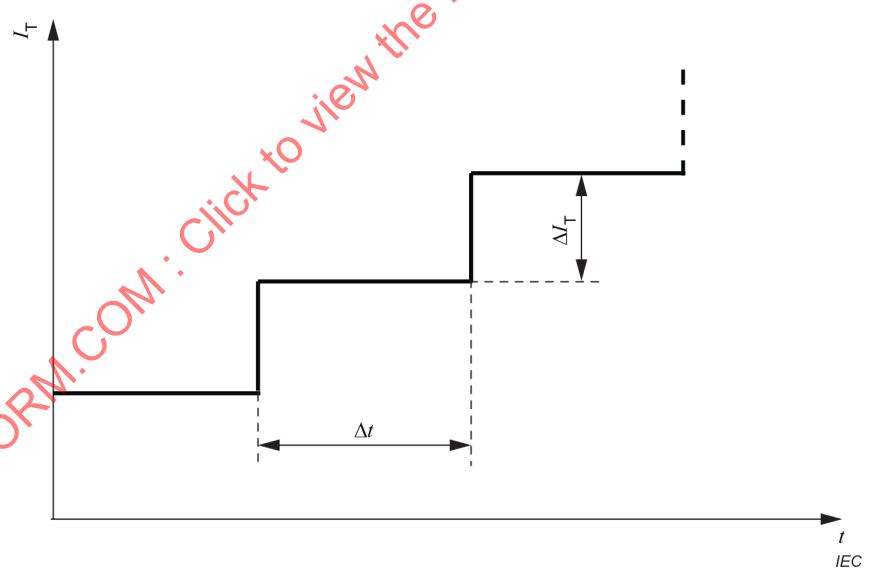

Figure 1 – Maximum step size of increasing smooth direct test current (I_T)

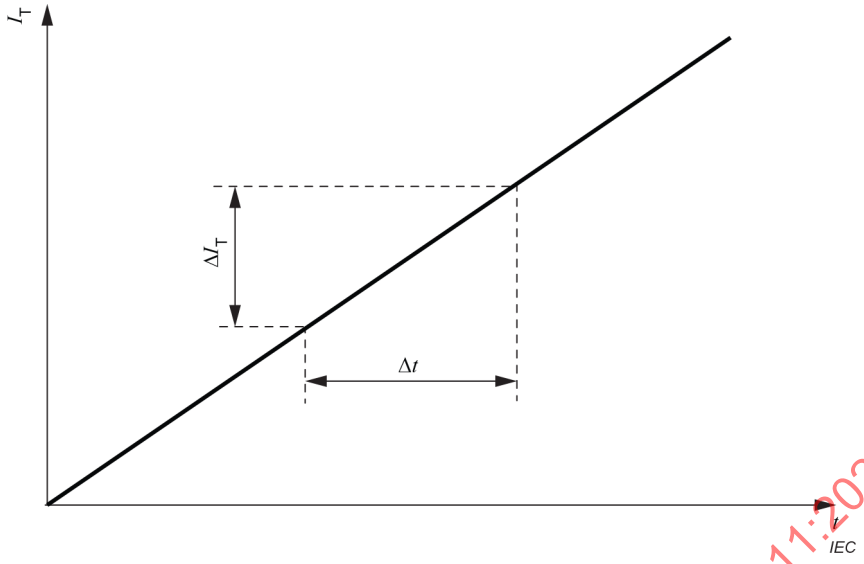

Figure 2 – Maximum gradient of linearly increasing smooth direct test current (I_T)

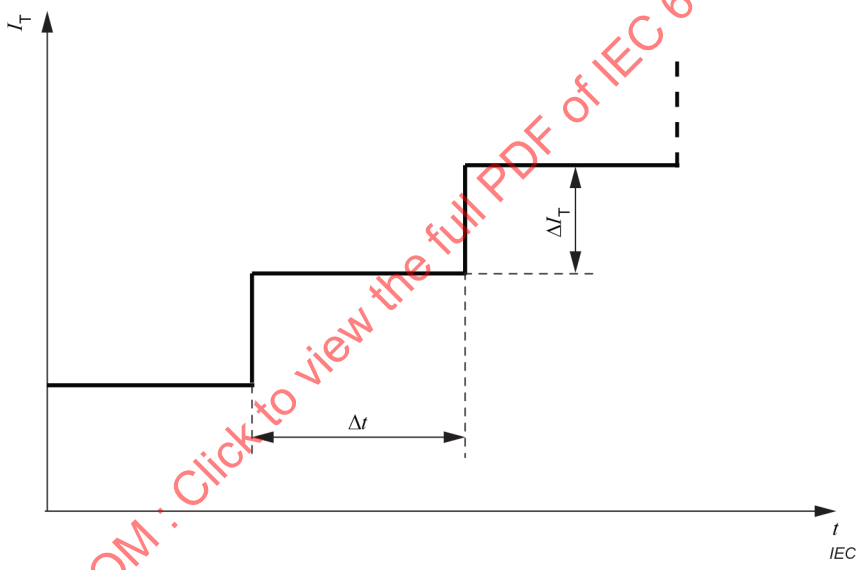

Figure 3 – Example for linearly increasing smooth direct test current (I_T): $I_{\Delta n}$ = 30 mA

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.

NOTE 2 The actual rise time depends on the system capacitance and the resistive load of the test equipment.

NOTE 3 Smooth DC test current refers to direct current with AC ripple up to 10 % (peak to peak).

4.2.2 Non-operating test

When a test at 50 % or less of the rated residual operating current is used to test the reliability of the RCM is included, the minimum test period shall be 10 s. The alarm shall not be activated.

When a non-operating test at 50 % or less of the rated residual operating current is included, the operating uncertainty of the calibrated test current shall not exceed 0 % to −10 % of the specified non-operating test current.

NOTE Existing leakage currents downstream can influence the verification.

4.2.3 Test of actuating time

If the set actuating time of the RCM is being tested with the test equipment, the setting of the test period on the test device shall have a resolution of minimum 0,5 s ranging up to 10 s. The setting uncertainty shall not exceed 0 % to −10 % of the set value. The test shall solely be performed with calibrated AC test current.

Other methods for the acquisition of the actuating time via optical recognition or interfacing are permissible.

NOTE The general function of RCMs is not to disconnect the power supply when a residual current above the value of the rated residual operating current occurs. The RCM indicates the increase of the residual current above the residual operating current with a signalling device, for example a lamp, buzzer, contact relay or interface-signal. Thus, the response time can only be tested via the visual or additional electrical detection of this signal.

According to IEC 62020-1, the actuating time of the RCM may only amount to a maximum of 10 s. The response time shall be specified by the manufacturer or shall be adjustable on the device.

If the RCM is being used for the purpose of disconnection, the tests covered by IEC 61557-6 shall apply.

4.3 Fault voltages exceeding U_L

Prevention of danger due to fault voltages exceeding U_L within the system under test shall be ensured during the use of the test equipment. This can be achieved as follows:

– automatic disconnection in accordance with IEC 61010-1:2010, Figure 1, if the residual voltage is above 50 V AC or 120 V DC;

– application of test current I_T, gradually or permanently adjustable, where the test starts with a maximum current of 3,5 mA AC or 15 mA DC in accordance with IEC 61010-1:2010, 6.3.2 b), including parallel test circuits, is permitted. The possibility to change the test current I_T without generating a dangerous fault voltage shall be clearly identifiable, for instance on a voltmeter;

– in special locations, the touch voltage limit is 25 V AC or 60 V DC;

– the operating uncertainty for the detection of the fault voltage shall not exceed 0 % to −20 % of the limit.

4.4 Overvoltage

If the system is connected to 120 % of the nominal voltage of the system for which the test equipment is designed, neither the operator shall be harmed, nor the device be damaged. Protective devices shall not be activated. If the device is intended to be used in IT systems, the nominal voltage of the test equipment is the line-to-line voltage.

If the test equipment is accidentally connected to 173 % of the nominal voltage in TN or TT systems for which the test equipment is designed for the duration of 1 min, neither the operator shall be harmed, nor the device be damaged. In this case, protective devices may be activated.

5 Marking and operating instructions

5.1 Markings

In addition to the requirements of IEC 61557-1:2019, 5.1, the following information shall be provided on the measuring equipment.

Rated residual operating current or rated residual operating currents of the RCM for which the test equipment has been designed for an actuating time of 10 s.

NOTE Other rated residual operating currents for a shorter duration of the actuating times can be marked in addition.

The maximum voltage to earth and the rated measuring category shall be marked.

5.2 Operating instructions

5.2.1 General

In addition to the requirements of IEC 61557-1:2019, 5.3, the operating instructions shall include the information and warnings set out in 5.2.2 and 5.2.3.

5.2.2 Information

a) Information about special test configurations to avoid unintended tripping of residual current devices (RCD);

b) information to avoid unintended influences on the operation of the system;

c) information for recalibration cycles and safety tests of the test equipment after repair and instructions for periodical tests.

5.2.3 Warnings

a) If the detecting circuit for the fault voltage has no probe and if a possible voltage between the protective conductor and earth influences the measurements, a warning shall be included.

b) Where the detecting circuit for the fault voltage uses the N-conductor as a probe, a warning shall be given to test the connection between the neutral point of the distribution system and earth before the test is started; a possible voltage between the N-conductor and earth may influence the measurements.

c) A warning that leakage currents in the circuit following the RCM may influence measurements and test results.

d) The earth electrode resistance of a detecting circuit for the fault voltage with a probe shall not exceed the value stated by the manufacturer.

e) A warning that the potential fields of other earthed installations may influence the determination of the fault voltage.

f) A warning that for special locations the touch voltage is limited to 25 V AC or 60 V DC.

6 Tests

6.1 General

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

Tests shall be carried out with rated residual operating currents, in addition to the values of the non-operating test currents I_T, if applicable.

The test circuit shall be adapted to test the function of the fault voltage detection circuit at the limits of the fault voltage for which the equipment is designed and in addition at the appropriate $R_A = R_{Amax}$ for each range.

The test circuit shall be adapted to each test method employed. The manufacturer's instructions shall be observed.

NOTE

$$R_{Amax} = \frac{U_L}{I_{\Delta n}} I_{\Delta o}$$

$$R_{Amax} = \frac{U_L}{I_T}$$

where

U_L is the conventional touch voltage limit;

I_T is the test current superimposed by the test circuit;

R_A is the total earthing resistance ($R_A = R_{Amax}$);

$I_{\Delta n}$ is the rated residual operating current;

$I_{\Delta o}$ is the residual operating current.

6.2 Operating uncertainty

The operating uncertainty applies in accordance with the test conditions specified in IEC 61557-1:2019 and, in addition, the following requirements apply:

– the voltage on the protective conductor relative to earth or N shall be less than 1 Vrms;
– the system voltage remains stable within ±1 V during the measurement;
– the circuit following the residual current protective device carries a negligible leakage current;
– sinusoidal half-wave current with rated frequency, or sinusoidal full-wave current with rated frequency, or smooth direct current (see 4.2);
– the AC test current I_T shall be switched on at a zero crossing;
– the test period shall be 10 s for the maximum test current for which the test equipment is designed;
– the time limit may be omitted when testing with current greater than 500 mA;
– the resistance of the probes is within the limits stated by the manufacturer.

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

– nominal voltage of the rated range of the device,
– nominal frequency of the rated range of the device,
– reference temperature 23 °C ± 2 °C,
– reference position in accordance with the manufacturer's instructions,
– protective conductor free from extraneous voltages,
– 100 Ω resistance of the auxiliary earth electrode in a TT system.

The operating uncertainty thus evaluated shall not exceed the limits specified in 4.1 to 4.2.

Table 1 – Calculation of operating uncertainty

Intrinsic uncertainty or influence quantity	Reference conditions or specified operating range	Designation code	Requirements or test in accordance with the relevant parts of IEC 61557	Type of test
Intrinsic uncertainty	Reference conditions	A	IEC 61557-11:2020, 6.2	R
Position	Reference position ±90°	E_1	IEC 61557-1:2019, 4.2	R
Supply voltage	At the limits stated by the manufacturer	E_2	IEC 61557-1:2019, 4.2, 4.3	R
Temperature	0 °C and 35 °C	E_3	IEC 61557-1:2019, 4.2	T
Resistance of the probes	Within the limits stated by the manufacturer	E_5	IEC 61557-11:2020, 4.4	T
System voltage	85 % to 110 % of the nominal voltage	E_8	IEC 61557-11:2020, 4.4	T
Operating uncertainty	$B = \pm\sqrt{A^2 + \frac{4}{3}\sum_i E_i^2}$		IEC 61557-11:2020, 4.1 IEC 61557-11:2020, 4.2 IEC 61557-11:2020, 4.3 IEC 61557-11:2020, 6.2	R

A = intrinsic uncertainty
E_i = variations
R = routine test
T = type test
F = fiducial value

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

6.3 Test of protection against high fault voltages

Compliance with the permissible operating uncertainty when detecting the fault voltage shall be tested for measurements with and without a probe (routine test).

Compliance with 4.3 shall be tested in all ranges.

6.4 Test of overvoltage

The permissible overvoltage in accordance with the requirements of 4.4 shall be tested (type test).

Bibliography

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-5-53, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 60364-6, *Low voltage electrical installations – Part 6: Verification*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 61008-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61326-2-2, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*

IEC 62020-1:2020, *Electrical accessories – Residual current monitors for household and similar uses (RCMs)*

IEC TR 62350, *Guidance for the correct use of residual current-operated protective devices (RCDs) for household and similar use*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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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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La Norme internationale IEC 61557-11 a été établie par le comité d'études 85 de l'IEC: Équipement de mesure des grandeurs électriques et électromagnétiques.

Cette deuxième édition annule et remplace la première édition parue en 2009. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) le titre du présent document a été modifié pour inclure tous les types de RCM;

b) termes alignés avec l'IEC 60050;

c) ajout des exigences pour les essais de nouveaux types de RCM;

d) déplacement des exigences pour les RCM de type B de l'ancienne Annexe A dans le texte normatif;

e) alignement de la structure sur celle de l'ensemble de la série IEC 61557.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
85/720/FDIS	85/722/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Cette Norme internationale doit être utilisée conjointement avec l'IEC 61557-1:2019.

Une liste de toutes les parties de la série IEC 61557, publiées sous le titre général *Sécurité 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*, peut être consultée sur le site web de l'IEC.

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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

1 Domaine d'application

La présente partie de l'IEC 61557 spécifie les exigences relatives au matériel d'essai appliqué à l'essai de l'efficacité des contrôleurs d'isolement à courant différentiel résiduel (RCM – *Residual Current Monitors*) déjà installés dans les réseaux de distribution.

Ce matériel d'essai peut être utilisé dans n'importe quel type de réseau tel qu'un réseau TN, TT ou IT. Le matériel d'essai peut également être utilisé pour l'essai des contrôleurs d'isolement à courant différentiel résiduel (RCM) sélectifs en direction dans des réseaux IT.

Le présent document n'a pas pour objet de vérifier les contrôleurs d'isolement à courant différentiel résiduel (RCM) selon leurs normes de produit.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 61010-1:2010, *Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 1: Exigences générales*

IEC 61557-1:2019, *Sécurité 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 1: Exigences générales*

IEC 61557-6, *Sécurité 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 6: Efficacité des dispositifs à courant différentiel résiduel (DDR) dans les réseaux TT, TN et IT*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans l'IEC 61557-1, l'IEC 61557-6 ainsi que les suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
courant de défaut à la terre
courant qui s'écoule à la terre lors d'un défaut d'isolement

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

3.2
courant d'essai
I_T
courant superposé par le matériel d'essai en vue de l'essai de l'efficacité du RCM

3.3
courant différentiel résiduel
I_Δ
valeur efficace de la somme vectorielle des courants circulant dans le circuit principal du dispositif de coupure différentiel lors d'un défaut d'isolement

[SOURCE: IEC 60050-442:2019, 442-05-19, modifiée – L'expression "valeurs instantanées" a été supprimée de la définition et les termes "lors d'un défaut d'isolement" ont été ajoutés.]

3.4
courant différentiel de fonctionnement assigné
$I_{\Delta n}$
valeur du courant différentiel de fonctionnement assignée au RCM par le fabricant et qui fait fonctionner le RCM dans des conditions spécifiées

3.5
courant différentiel de fonctionnement
$I_{\Delta o}$
valeur du courant différentiel qui fait fonctionner le contrôleur d'isolement à courant différentiel résiduel dans des conditions spécifiées

[SOURCE: IEC 60050-442:2019, 442-05-20, modifiée: "dispositif de coupure différentiel" remplacé par "contrôleur d'isolement à courant différentiel résiduel" et symbole "$I_{\Delta n}$" remplacé par "$I_{\Delta o}$".]

3.6
courant différentiel de non-fonctionnement
valeur du courant différentiel pour laquelle, et au-dessous de laquelle, le RCM ne fonctionne pas dans des conditions spécifiées

[SOURCE: IEC 60050-442:2019, 442-05-21, modifiée – "dispositif de coupure différentiel" remplacé par "RCM" et le symbole a été omis.]

3.7
temps de réponse
t_a
temps mis par un RCM pour passer de l'état de non-alarme à l'état d'alarme en réponse à l'apparition soudaine d'un courant différentiel résiduel dépassant le niveau prédéterminé

[SOURCE: IEC 62020-1:2020, 3.1.6, modifiée – Le symbole a été ajouté.]