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NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems

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 8: Contrôleur permanent d'isolement pour réseaux IT

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CONTENTS

FOREWORD 6
1 Scope 8
2 Normative references 8
3 Terms, definitions and abbreviations 9
3.1 Terms and definitions 9
3.2 Abbreviations 13
4 Requirements 13
4.1 General requirements 13
4.2 Types of IMDs 14
4.2.1 General 14
4.2.2 Mandatory functions provided by IMDs 14
4.2.3 Mandatory service function provided by the IMD – Test function 15
4.3 Optional functions provided by IMD 15
4.3.1 General 15
4.3.2 Local transformer monitoring warning (LTMW) 15
4.3.3 Remote transformer monitoring warning (RTMW) 15
4.3.4 Remote enabling and disabling command (REDC) 16
4.4 Performance requirements 16
4.4.1 Specified response value R_{an} 16
4.4.2 System leakage capacitance C_e 16
4.4.3 Relative percentage uncertainty A of the specified response value R_{an} 16
4.4.4 Response time t_{an} 17
4.4.5 Measuring voltage U_m and measuring current I_m 17
4.4.6 Internal d.c. resistance R_i and internal impedance Z_i 17
4.4.7 Indication of the value of the insulation resistance R_F 18
4.4.8 Permanently admissible nominal voltage U_n 18
4.4.9 Permanently admissible extraneous d.c. voltage U_{fg} 18
4.4.10 Supply voltage U_S 18
4.5 Electromagnetic compatibility (EMC) 18
4.6 Safety requirements 18
4.6.1 General 18
4.6.2 Clearances and creepage distances 19
4.6.3 Protection class and earth connection of an IMD 19
4.7 Climatic environmental conditions 19
4.8 Mechanical requirements 19
4.8.1 General 19
4.8.2 Product mechanical robustness 19
4.8.3 IP protection class requirements 20
5 Marking and operating instructions 21
5.1 Marking 21
5.2 Operating instructions 22
6 Tests 23
6.1 General 23
6.2 Type tests 23
6.2.1 General 23
6.2.2 Test of response values 23

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6.2.3 Test of response time t_{an} ... 24
6.2.4 Test of peak value of the measuring voltage U_m ... 24
6.2.5 Test of the peak value of the measuring current I_m ... 24
6.2.6 Test of internal d.c. resistance R_i and internal impedance Z_i ... 25
6.2.7 Test of facilities for indicating the insulation resistance R_F ... 25
6.2.8 Test of effectiveness of the test device ... 25
6.2.9 Test of permanently admissible nominal voltage U_n ... 25
6.2.10 Test of permanently admissible extraneous d.c. voltage U_{fg} ... 25
6.2.11 Test of supply voltage U_S ... 26
6.2.12 Test of optional functions ... 26
6.2.13 Voltage tests ... 26
6.2.14 Test of electromagnetic compatibility (EMC) ... 26
6.2.15 Inspection of the marking and operating instructions ... 26
6.2.16 Mechanical tests ... 26
6.3 Routine tests ... 27
6.3.1 General ... 27
6.3.2 Test of response values ... 27
6.3.3 Test of effectiveness of the test function ... 27
6.3.4 Test of facility for indicating the insulation resistance R_F ... 27
6.3.5 Voltage tests ... 27
6.3.6 Compliance with tests of 6.3 ... 27
7 Overview of requirements and tests for IMDs ... 27
Annex A (normative) Medical insulation monitoring devices (MED-IMD) ... 29
A.1 Scope and object ... 29
A.2 Requirements ... 29
A.2.1 General ... 29
A.2.2 Types of MED-IMDs ... 29
A.2.3 Mandatory functions provided by MED-IMD ... 29
A.2.4 Performance requirements ... 30
A.2.5 Electromagnetic compatibility (EMC) ... 31
A.3 Marking and operating instructions ... 31
A.4 Tests ... 32
A.4.1 General ... 32
A.4.2 Type tests ... 32
A.5 Overview of requirements and tests for MED-IMDs ... 32
Annex B (informative) Monitoring of overload current and over-temperature ... 34
B.1 Scope and object ... 34
B.2 Requirements ... 34
B.2.1 General ... 34
B.2.2 Local transformer monitoring warning (LTMW) and/or remote transformer monitoring warning (RTMW) ... 34
B.2.3 Monitoring of overload current ... 34
B.2.4 Monitoring of over-temperature of the IT system transformer ... 34
B.3 Operating instructions ... 35
B.4 Tests ... 35
B.4.1 General ... 35
B.4.2 Test of overload current and over-temperature monitoring ... 35
Annex C (normative) Insulation monitoring devices for photovoltaic systems (PV-IMD) ... 36
C.1 Scope and object ... 36

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C.2 Requirements for PV-IMDs for PV installations 36
C.2.1 General 36
C.2.2 Types of PV-IMDs 37
C.2.3 Mandatory functions provided by PV-IMDs 37
C.2.4 Performance requirements 37
C.3 Marking and operating instructions 38
C.3.1 Marking 38
C.3.2 Operating instructions 39
C.4 Tests 39
C.4.1 General 39
C.4.2 Additional type tests 39
C.4.3 Additional routine tests 40
C.5 Overview of requirements and tests for PV-IMDs 40
Annex D (normative) Insulation monitoring function of a photovoltaic inverter (PV-IMF) or in a charge controller 41
D.1 Scope and object 41
D.2 Requirements for PV-IMFs 41
D.2.1 General requirements for PV-IMFs 41
D.2.2 Types of PV-IMFs 42
D.2.3 Mandatory functions provided by PV-IMFs 42
D.2.4 Performance requirements for PV-IMFs 43
D.2.5 Electromagnetic compatibility (EMC) 44
D.2.6 Safety requirements 44
D.2.7 Climatic environmental conditions 44
D.2.8 Mechanical requirements 44
D.3 Marking and operating instructions 44
D.3.1 Marking 44
D.3.2 Operating instructions 44
D.4 Tests 45
D.4.1 General 45
D.4.2 Type tests 45
D.4.3 Routine tests 46
D.5 Overview of requirements and tests for PV-IMF 46
Bibliography 47

Figure A.1 – Pictogram for marking a MED-IMD 32
Figure C.1 – Dynamic reference characteristics of d.c. PV system voltage 38
Figure C.2 – Pictogram for marking a PV-IMD 39

Table 1 – Abbreviations 13
Table 2 – Product mechanical requirements 20
Table 3 – Minimum IP requirements for IMDs 21
Table 4 – Pictograms for marking the type of IMD 22
Table 5 – Reference conditions for tests in operation 23
Table 6 – Reference conditions for storage tests (product not powered) 23
Table 7 – Requirements and tests applicable to IMD 28
Table A.1 – Summary of additional requirements and tests applicable to MED-IMDs 32

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Table A.2 – Emission test for MED-IMDs 33
Table C.1 – Requirements and tests for PV-IMDs 40
Table D.1 – Requirements and tests for PV-IMF integrated in the inverter 46

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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 8: Insulation monitoring devices for IT systems

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International Standard IEC 61557-8 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

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

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

a) Terms and definitions have been complemented;

b) Abbreviations are listed and explained;

c) Requirements have been revised;

d) Mandatory and optional functions and their terminology have been adapted from IEC 61557-15;

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e) Mechanical requirements have been added;

f) Information on operating instructions has been added;

g) Type tests and routine tests have been complemented;

h) An Annex C: 'Insulation monitoring devices for photovoltaic systems (PV-IMD)' has been added;

i) An Annex D: 'Insulation monitoring function of a photovoltaic inverter (PV-IMF) or in a charge controller' has been added.

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

FDIS	Report on voting
85/485/FDIS	85/502/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part of IEC 61557 shall be used in conjunction with Part 1.

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 a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures,* can be found on the IEC website.

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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 8: Insulation monitoring devices for IT systems

1 Scope

This part of IEC 61557 specifies the requirements for insulation monitoring devices (IMD) which permanently monitor the insulation resistance R_F to earth of unearthed a.c. IT systems, of a.c. IT systems with galvanically connected d.c. circuits having nominal voltages up to 1 000 V a.c., as well as of unearthed d.c. IT systems with voltages up to 1 500 V d.c. independent from the method of measuring.

IT systems are described in IEC 60364-4-41 amongst other literature. Additional data for the selection of devices in other standards should be noted.

NOTE Various standards specify the use of IMDs in IT systems. In such cases, the objective of the equipment is to signal a drop in insulation resistance R_F below a minimum limit.

IMDs according to this part of IEC 61557 can also be used for de-energized TT, TN and IT systems or appliances.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60364-7-710:2002, *Electrical installations of buildings – Part 7-710: Requirements for special installations or locations – Medical locations*

IEC 60691, *Thermal-links – Requirements and application guide*

IEC 60721-3-1, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60721-3-3, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

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IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 60947-5-4, *Low-voltage switchgear and controlgear – Part 5-4: Control circuit devices and switching elements – Method of assessing the performance of low-energy contacts – Special tests*

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

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

IEC 61326-2-4, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-4: Particular requirements – Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9*

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*

IEC 61810-2, *Electromechanical elementary relays – Part 2: Reliability*

IEC 62109-2:2011, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

CISPR 11, *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement*

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3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
extraneous d.c. voltage
U_{fg}
d.c. voltage occurring in a.c. systems between the a.c. conductors and earth (derived from d.c. parts)

3.1.2
insulation resistance
R_F
resistance in the system being monitored, including the resistance of all the connected appliances to earth

3.1.3
response value
R_a
value of the insulation resistance at which the device responds under specified conditions

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3.1.4
specified response value
R_{an}
value of the insulation resistance, permanently set or adjustable, on the device and monitored if the insulation resistance falls below this limit

Note 1 to entry: R_{an} is the value declared by the manufacturer.

3.1.5
relative uncertainty
relative percentage uncertainty
A
response value R_a minus the specified response value R_{an}, divided by the specified response value R_{an}, multiplied by 100 and stated as a percentage

$$A = \frac{R_a - R_{an}}{R_{an}} \cdot 100[\%]$$

3.1.6
system leakage capacitance
C_e
maximum permissible value of the total capacitance to earth of the system to be monitored, including any connected appliances, up to which value the insulation monitoring device can work as specified and within a response time t_{an} not exceeding 30 min

3.1.7
rated contact voltage
voltage for which a relay contact is rated to open and close under specified conditions

3.1.8
response time
t_{an}
time required by an insulation monitoring device to respond under specified conditions

3.1.9
measuring voltage
U_m
voltage present at the measuring terminals during the measurement

Note 1 to entry: In addition to the definition in IEC 61557-1, the measuring voltage U_m is the voltage present in a fault-free and de-energized system between the terminals of the system to be monitored and the terminals of the protective conductor.

3.1.10
measuring current
I_m
maximum current that can flow between the system and earth, limited by the internal d.c. resistance R_i from the measuring voltage source of the insulation monitoring device

Note 1 to entry: Measuring current I_m is designated as injected current in IEC 60364-7-710.

3.1.11
internal impedance
Z_i
total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency f_n

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3.1.12
internal d.c. resistance
R_i
resistance of the insulation monitoring device between the terminals to the system being monitored and earth

3.1.13
functional earthing
FE
earthing a point or points in a system or in an installation or in equipment for purposes other than electrical safety

Note 1 to entry: For IMDs this is the measuring connection to earth.

3.1.14
insulation monitoring device
IMD
device which permanently monitors the insulation resistance to earth of unearthed a.c. IT systems, a.c. IT systems with galvanically connected d.c. circuits having nominal voltages up to 1 000 V a.c., as well as monitoring the insulation resistance of unearthed d.c. IT systems with voltages up to 1 500 V d.c., independent from the method of measuring

3.1.15
type AC IMD
device which permanently monitors the insulation resistance to earth of unearthed a.c. IT systems

Note 1 to entry: Extraneous d.c. voltages which could occur when an insulation fault behind galvanically connected rectifiers appears can influence the monitoring function in a way that the required uncertainty for the measurement increases beyond the requirements or in some cases the monitoring process is even not guaranteed.

3.1.16
type DC IMD
device which permanently monitors the insulation resistance to earth of unearthed d.c. IT systems

3.1.17
type AC/DC IMD
device which permanently monitors the insulation resistance to earth of unearthed a.c/d.c. IT systems, d.c/a.c. IT systems or d.c. IT systems

Note 1 to entry: The insulation monitoring function is active for insulation faults in all parts of the IT system which are galvanically connected.

3.1.18
insulation fault
defect in the insulation of an electrical installation or of an equipment which can create a resistive path to earth

Note 1 to entry: The insulation fault can appear as a single fault from one line conductor or as a symmetrical fault from all line conductors.

[SOURCE: IEC 60050-604:1987, 604-02-02, modified – Term definition has been adapted to suit electrical installations which can result in another fault type. Note added.]

3.1.19
symmetrical insulation fault
defect in the insulation of an electric installation or equipment creating a resistive path to earth having approximately the same resistance from all phase conductors to earth

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3.1.20
asymmetrical insulation fault
defect in the insulation of an electric installation or equipment creating a resistive path to earth having different resistances from the phase conductors to earth

3.1.21
group 2 medical locations
medical locations where applied parts are intended to be used in applications such as intracardiac procedures, operating theatres and vital treatment where discontinuity (failure) of the supply can cause danger to life

Note 1 to entry: An intracardiac procedure is a procedure whereby an electrical conductor is placed within the cardiac zone of a patient or is likely to come into contact with the heart, such conductor being accessible outside the patient's body. In this context, an electrical conductor includes insulated wires, such as cardiac pacing electrodes or intracardiac ECG-electrodes, or insulated tubes filled with conducting fluids.

[SOURCE: IEC 60364-7-710, 710.3.7, modified – Note to entry has been added.]

3.1.22
medical insulation monitoring device
MED-IMD
specific insulation monitoring device (IMD) dedicated to monitor medical IT systems of a group 2 medical location

3.1.23
medical IT system
electrical IT system having specific requirements for medical applications

[SOURCE: IEC 60364-7-710:2002, 7.3.11]

3.1.24
overload current
overload current of an electrical circuit
overload current occurring in an electric circuit according to this standard is overload current which is caused by connected loads

[SOURCE: IEC 60050-826:2004, 826-11-15, modified – The definition is about overload current instead of overcurrent, which is not caused by a short-circuit or an earth fault.]

3.1.25
PV installation
erected equipment of a photovoltaic power (PV) supply system

3.1.26
PV electrical installation
the electrical installation of a PV system starts from a PV module or a set of PV modules connected in series with their own cables, up to a distribution network or to a customer installation

3.1.27
d.c. side
part of a PV installation from the PV modules to the d.c. terminals of the PV inverter

3.1.28
a.c. side
part of a PV installation from the a.c. terminals of the PV inverter to the point of connection of the PV supply cable to the electrical installation

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3.1.29
PV inverter
device which converts d.c. voltage and d.c. current of the PV generator into a.c. voltage and a.c. current

3.1.30
system leakage capacitance of the PV installation
sum of the leakage capacitances C_e of the individual PV modules to earth including the leakage capacitances C_e of the complete PV installation

3.1.31
insulation monitoring device for photovoltaic systems
PV-IMD
insulation monitoring device suitable to monitor the insulation resistance of photovoltaic electrical installations to earth

3.1.32
insulation monitoring function of a PV inverter
PV-IMF
function integrated in the PV inverter to monitor the insulation resistance R_F of the PV input (array) to earth

3.2 Abbreviations

For the purposes of this document, the terms and abbreviations given in Table 1 apply.

Table 1 – Abbreviations

Abbreviation	Term	Clause/Subclause	Referenced standard
EMC	Electromagnetic compatibility	4.5	IEC 60050-161:1990,161-01-07
IMD	Insulation monitoring device	3.1.14	IEC 61557-8
LIW	Local insulation warning	4.2.2.2	IEC 61557-8
LTMW	Local transformer monitoring warning	4.3.2	IEC 61557-8
MED-IMD	Medical insulation monitoring device	Annex A	IEC 61557-8
PTC	Positive temperature coefficient	Annex B	IEC 61557-8
PV-IMD	Photovoltaic IMD (IMD for photovoltaic systems)	Annex C	IEC 61557-8
PV-IMF	Photovoltaic insulation monitoring function	Annex D	IEC 61557-8
RIW	Remote insulation warning	4.2.2.3	IEC 61557-8
REDC	Remote enabling / disabling command	4.3.4	IEC 61557-8
RTMW	Remote transformer monitoring warning	4.3.3	IEC 61557-8

4 Requirements

4.1 General requirements

In addition to the requirements of Clause 4 of IEC 61557-1:2007, the requirements of Clause 4 shall apply.

IMDs shall be capable of monitoring the insulation resistance R_F of IT systems including symmetrical and asymmetrical allocation of the insulation resistance R_F and to give an insulation warning if the insulation resistance R_F between either the system and earth or the

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