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INTERNATIONAL STANDARD

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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 61326-2-4:2020-10 RLV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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International Standard IEC 61326-2-4 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

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

– update of the document with respect to IEC 61326-1:2020.

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

FDIS	Report on voting
65A/981/FDIS	65A/992/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.

In this document the following print types are used:

– Terms used throughout this document which have been defined in Clause 3 of this document and of IEC 61326-1:2020: SMALL CAPITALS.

This part of the IEC 61326 series is to be used in conjunction with IEC 61326-1:2020 and follows the same numbering of clauses, subclauses, tables and figures.

When a particular subclause of IEC 61326-1 is not mentioned in this part, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in IEC 61326-1 is to be adapted accordingly.

NOTE The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in IEC 61326-1;
– unless notes are in a new subclause or involve notes in IEC 61326-1, they are numbered starting from 101 including those in a replaced clause or subclause;
– additional annexes are lettered AA, BB, etc.

A list of all parts of the IEC 61326 series, under the general title *Electrical equipment for measurement, control and laboratory use, control and laboratory use – EMC requirements,* can be found on the IEC website.

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- reconfirmed,
- withdrawn,
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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

1 Scope

In addition to IEC 61326-1, this part of IEC 61326 specifies more detailed test configurations, operational conditions and performance criteria than IEC 61326-1 for equipment for

– insulation monitoring according to IEC 61557-8;

– insulation fault location according to IEC 61557-9.

This applies to insulation monitoring devices and for equipment for insulation fault location systems permanently or semi-permanently connected to the distribution system.

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.

Clause 2 of IEC 61326-1:~~2012~~2020 applies, except as follows:

Addition:

IEC 61326-1:~~2012~~2020, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61557-8:~~2007~~2014, *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*

IEC 61557-9:~~2009~~2014, *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 9: Equipment for insulation fault location in IT systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61326-1:2020 apply, except as follows.

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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

Addition:

3.101
insulation resistance
R_F
resistance in the system being monitored, including the resistance of all the connected appliances to earth

[SOURCE: IEC 61557-8:~~2007~~2014, 3.1.2]

3.102
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

[SOURCE: IEC 61557-8:~~2007, 3.3~~ 2014, 3.1.4, modified – The note to entry has been deleted]

3.103
response sensitivity
value of the evaluating current or INSULATION RESISTANCE at which the evaluator responds under specified conditions

[SOURCE: IEC 61557-9:~~2009~~2014, 3.1.4]

3.104
~~**nominal voltage of the distribution system**~~ **nominal system voltage**
U_n
~~voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred~~

value of the voltage by which the distribution system is designated and to which certain characteristics are assigned

[SOURCE: IEC 61557-1:~~2007~~2019, 3.1]

3.105
supply voltage
~~U_S~~
~~voltage at a point where the measuring equipment does or can accept electric energy as a supply~~

voltage that is used to power the measurement equipment

Note 1 to entry: If a SUPPLY VOLTAGE is specified, for instance in the supply contract, then it is called "declared SUPPLY VOLTAGE".

[SOURCE: IEC 61557-1:~~2007, 3.8, modified~~ 2019, 3.7]

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3.106
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

[SOURCE: IEC 61557-8:~~2007, 3.6~~ 2014, 3.1.6, modified – The end of the definition has been deleted]

4 General

Clause 4 of IEC 61326-1:~~2012~~2020 applies.

5 EMC test plan

5.1 General

Subclause 5.1 of IEC 61326-1:~~2012~~2020 applies.

5.2 Configuration of EUT during testing

5.2.1 General

Subclause 5.2.1 of IEC 61326-1:~~2012~~2020 applies, except as follows.

Addition:

During the tests, the EUT is supplied as specified by the manufacturer.

For EUTs having several ratings, the EUT shall be connected

– to the lowest nominal SUPPLY VOLTAGE U_S;
– to the highest NOMINAL VOLTAGE of the distribution system U_n, but not more than 400 V.

If the EUT has only a combined terminal for the SUPPLY VOLTAGE and the voltage of the distribution system, it shall be connected to the highest NOMINAL VOLTAGE, but not more than 400 V.

If the EUT has interfaces for remote functions, they shall be connected during the tests as specified by the manufacturer for normal installation.

Insulation monitoring devices and equipment for insulation fault location shall be tested separately.

5.2.2 Composition of EUT

Subclause 5.2.2 of IEC 61326-1:~~2012~~2020 applies.

5.2.3 Assembly of EUT

Subclause 5.2.3 of IEC 61326-1:~~2012~~2020 applies.

5.2.4 I/O PORTS

Subclause 5.2.4 of IEC 61326-1:~~2012~~2020 applies.

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5.2.5 AUXILIARY EQUIPMENT

Subclause 5.2.5 of IEC 61326-1:~~2012~~2020 applies.

5.2.6 Cabling and earthing (grounding)

Subclause 5.2.6 of IEC 61326-1:~~2012~~2020 applies.

5.3 Operation conditions of EUT during testing

Subclause 5.3 of IEC 61326-1:~~2012~~2020 applies, except as follows.

Addition:

5.3.101 Operational conditions

The EUT shall be set as specified by the manufacturer for normal operation.

If the EUT has adjustable SPECIFIED RESPONSE VALUES, tests shall be performed as follows:

– for insulation monitoring devices, one value shall be selected by the manufacturer among the following possibilities:
  - at the value equal or closest to the internal DC resistance value;
  - at the value equal or closest to the internal AC impedance value;
– for insulation fault location equipment, at the value in the middle of the RESPONSE SENSITIVITY range;

The INSULATION RESISTANCE shall be simulated by a single phase INSULATION RESISTANCE.

If the EUT has a selectable time delay, the time delay shall be set to the minimum value.

The SYSTEM LEAKAGE CAPACITANCE shall be set to the maximum value as defined by the manufacturer but not more than 1 µF. The SYSTEM LEAKAGE CAPACITANCE is to be installed symmetrically to all phases of U_n. For example:

– 2 × 0,5 µF for single-phase AC and for DC systems,
– 3 × 0,33 µF for 3-phase AC systems.

5.4 Specification of FUNCTIONAL PERFORMANCE

Subclause 5.4 of IEC 61326-1:~~2012~~2020 applies.

5.5 Test description

Subclause 5.5 of IEC 61326-1:~~2012~~2020 applies.

6 Immunity requirements

6.1 Conditions during the tests

Subclause 6.1 of IEC 61326-1:~~2012~~2020 applies, except as follows.

Addition:

The configuration and modes of operation during the tests shall be precisely noted in the test report.

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Tests shall be applied to the relevant PORTS in accordance with Table 101.

The tests shall be ~~conducted~~ performed in accordance with the basic EMC standards listed in the relevant table. The tests shall be carried out one at a time. If additional methods are required, the method and rationale shall be documented.

6.1.101 Electrostatic discharge immunity tests

The test shall be applied only to parts of the EUT which are accessible to the user in normal operations, for example, push-buttons and displays. This test does not apply to connection terminals.

Electrostatic discharges of positive and negative polarity shall be applied 10 times to each of the selected test points.

The points of application shall be stated in the report.

6.1.102 Electromagnetic field tests

The dwell time for each frequency shall be 1,5 times the longest response time of the EUT specified by the manufacturer, plus the time delay, see 5.3. The actual dwell time shall be stated in the test report.

6.1.103 Burst tests

PORTS for remote control functions shall be tested separately. Cables for functions not tested shall be disconnected.

The bursts shall be applied for a minimum time of 1 minute; however, the time of application shall be greater than the response time of the EUT specified by the manufacturer.

6.1.104 Surge immunity tests

In deviation from the general test conditions of 5.2.1, this test is applied at the maximum SUPPLY VOLTAGE U_S.

Pulses both with positive and negative polarity shall be injected. For AC lines, surge shall be applied with ~~a~~ phase angles being 90° and 270°.

A series of five pulses is applied for each polarity and each phase angle with a time between the pulses of 1 minute or less.

6.1.105 Conducted RF tests

The dwell time for each frequency shall be 1,5 times the longest response time of the EUT specified by the manufacturer, plus the time delay (see 5.3). The actual dwell time shall be stated in the test report.

6.1.106 Power frequency magnetic field tests

The test is performed only on EUT with ~~integrated magnetic~~ magnetically sensitive ~~components~~ equipment.

It is recommended to apply the test for a minimum time of 1 minute for each frequency and orientation of the EUT. However, the time of application should be greater than the response time of the EUT.

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6.2 Immunity test requirements

Subclause 6.2 of IEC 61326-1:~~2012~~2020 does not apply.

Replacement:

The immunity requirements are given in Table 101.

NOTE The required tests correspond to the required tests applicable for equipment of INDUSTRIAL ELECTROMAGNETIC ENVIRONMENTS.

Table 101 – Immunity tests

PORT	Phenomenon	Basic standard	Test value	Performance criteria (as defined in 6.4)
Enclosure	ESD	IEC 61000-4-2	±4 kV contact discharge, ±8 kV air discharge	A2 A2
Enclosure	Electromagnetic field	IEC 61000-4-3	~~80 MHz to 1 000 MHz, 10 V/m1,4 GHz to 2 GHz, 3 V/m 2,0 GHz to 2,7 GHz, 1 V/m~~ ~~80 % AM modulation~~ 10 V/m (80 MHz to 1 000 MHz) 3 V/m (1,4 GHz to 6 GHz) [a]	~~A1~~ A1 A1
AC and DC power supply, AC and DC connections to distribution system (including connection to earth) and I/O signal/control connected directly to distribution network	Fast transients (burst)	IEC 61000-4-4	~~2 kV (5/50 ns, 5 kHz)~~ ±2 kV (5 kHz or 100 kHz) [b]	A2
I/O signal/control (including functional earth lines and remote connections)			~~1 kV (5/50 ns, 5 kHz)~~ ±1 kV (5 kHz or 100 kHz)	A2
AC power supply, AC connections to distribution system (including connection to earth) and I/O signal/control connected directly to distribution network	Surge	IEC 61000-4-5	~~2 kV lineto earth~~ ~~1 kV linetoline~~ ±2 kV line-to-ground ±1 kV line-to-line	B A2
I/O signal/control (including functional earth lines and remote connections)			~~1 kV lineto earth~~ ±1 kV line-to-ground	B
All PORTS except ENCLOSURE PORT	Conducted RF	IEC 61000-4-6	~~150 kHz to 80 MHz, 10 V~~ ~~Common mode~~ ~~80 % AM modulation~~ 10 V (150 kHz to 80 MHz)	A1
Enclosure	Power frequency magnetic field	IEC 61000-4-8	30 A/m (50 Hz, 60 Hz) Only for EUT with integrated magnetic sensitive components	A1

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PORT	Phenomenon	Basic standard	Test value	Performance criteria (as defined in 6.4)
AC power	Voltage dip	IEC 61000-4-11	0 % during 1 cycle,	A2
			40 % during 10/12 ~~a~~ cycles [b]	C
			70 % during 25/30 cycles [c]	C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 cycles [c]	C

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level as above 1,4 GHz is recommended.

[b] DC POWER PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

[c] For example, "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

6.3 Random aspects

Subclause 6.3 of IEC 61326-1:~~2012~~2020 applies.

6.4 Performance criteria

Subclause 6.4 of IEC 61326-1:~~2012~~2020 does not apply, with the exception of performance Criterion C defined in IEC 61326-1:2020, 6.4.4.

Replacement:

The performance criteria A1, A2 and B for the evaluation of the immunity test results are given in Table 102. ~~The performance criteria C defined in IEC 61326-1:2012, 6.4.4 applies.~~

Table 102 – Performance criteria definition

Function	Criterion A1 (for permanent phenomena)	Criterion A2 (for transient phenomena)	Criterion B
Alarm functions	In Quiescent mode [a]: The alarm digital output and the visual indicators shall not switch to the alarm state during the test.	In Quiescent mode [a]: The alarm digital output and the visual indicators shall not switch to the alarm state during the test.	In Quiescent mode [a]: The alarm digital output and the visual indicators may switch to the alarm state but shall not remain in the alarm state after the test.
	In Operate mode [a]: The alarm digital output and the visual indicators shall switch to the alarm state and remain in the alarm state during the test.	In Operate mode [a]: The alarm digital output and the visual indicators shall switch to the alarm state and remain in the alarm state during the test.	In Operate mode [a]: The alarm digital output and the visual indicators need not remain in the alarm state during this test but shall switch to or remain in the alarm state after the test.
Measurement functions	When insulation fault location equipment includes indicators for the INSULATION RESISTANCE or equivalent values, the measurement uncertainty during the immunity test shall not be greater than the specified measurement uncertainty declared by the manufacturer.	During the test, the measurement functions may be transiently influenced. After the test, the EUT shall continue to operate as intended for normal operation.	During the test, the measurement functions may be transiently influenced. After the test, the EUT shall continue to operate as intended for normal operation.

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Function	Criterion A1 (for permanent phenomena)	Criterion A2 (for transient phenomena)	Criterion B
Man machine Interface functions	Visual indicators (for example, displays, LEDs) and remote functions (for example, analogue or digital control interfaces) shall work as intended.	Visual indicators (for example, displays, LEDs) and remote functions (for example, analogue or digital control interfaces) may be transiently influenced.	Visual indicators (for example, displays, LEDs) and remote functions (for example, analogue or digital control interfaces) may be transiently influenced.
[a] Quiescent mode and Operate mode are defined in Table 103.			

Table 103 – Test conditions for quiescent and operate modes

Operation modes	Definition
Quiescent mode (the device is operating under conditions where – as a result of INSULATION RESISTANCE measurement – no alarm should be detected)	For devices allowing the SPECIFIED RESPONSE VALUE R_{an} to be configured within a range of values, the test shall be performed in accordance with 5.3.101. For devices with a fixed value for the SPECIFIED RESPONSE VALUE R_{an}, the test shall be made with this specified value. For insulation monitoring devices, an INSULATION RESISTANCE R_F of 1,3 × R_{an} is applied. For equipment for insulation fault location, the following values shall be applied: – for equipment evaluating the INSULATION RESISTANCE: 1,3 × (the specified RESPONSE SENSITIVITY plus uncertainty of RESPONSE SENSITIVITY declared by the manufacturer); – for equipment evaluating the current: 0,7 × (the specified RESPONSE SENSITIVITY minus uncertainty of RESPONSE SENSITIVITY declared by the manufacturer).
Operate mode (the device is in a mode where an alarm should be detected)	For devices allowing R_{an} to be configured within a range of values, the test shall be performed in accordance with 5.3.101. For devices with a fixed value for R_{an}, the test shall be made with this specified value. For insulation monitoring devices, an INSULATION RESISTANCE R_F of 0,7 × R_{an} is applied. For equipment for insulation fault location, the following values shall be applied: – for equipment evaluating the INSULATION RESISTANCE: 0,7 × (the specified RESPONSE SENSITIVITY minus uncertainty of RESPONSE SENSITIVITY declared by the manufacturer); – for equipment evaluating the current: 1,3 × (the specified RESPONSE SENSITIVITY plus uncertainty of RESPONSE SENSITIVITY declared by the manufacturer).

After the immunity tests, the EUT shall operate as intended in accordance with the requirements of IEC 61557-8 or IEC 61557-9.

7 Emission requirements

7.1 Conditions during measurements

Subclause 7.1 of IEC 61326-1:~~2012~~2020 applies.

7.2 Emission limits

Subclause 7.2 of IEC 61326-1:~~2012~~2020 applies, except as follows:

Addition:

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