

EU RO Mutual Recognition Technical Requirements

INSULATION MONITORING DEVICES (IMD)	Version	0.2
	Adoption Date:	January 2022
	Application Date:	1 July 2022
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1. PRODUCT DESCRIPTION

1.a General description of the product

Insulation monitoring devices (IMD) permanently monitor the insulation resistance to earth of unearthed IT systems.

Types of IMDs

- a) Type AC IMD for pure a.c. IT systems,
- b) Type AC /DC IMD for a.c. and d.c. systems,
- c) Type DC IMD only for pure d.c. IT systems,

1.b Application limitations†

- a) Insulation monitoring devices which permanently monitor the insulation resistance to earth of unearthed a.c. IT system having nominal voltages up to 1000 V a.c.
- b) Insulation monitoring devices which permanently monitor the insulation resistance to the earth of unearthed d.c. IT systems with voltages up to 1500 V d.c.
- c) This Technical Requirement applies to hardware only, where software is to be considered separately.

†The EU MR type approved product is generally not used as a stand-alone product but integrated as component in a sub-system or system. When a product is presented with an EU RO MR Type Approval Certificate for given application, its acceptability with regards to conditions defined in 1b, 1c and 1d of this Technical Requirement will

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be evaluated by the EU RO in charge of classing the ship or being in charge of the unit/system certification.

1.c Intended use

Insulation monitoring devices (IMD) permanently monitor the insulation resistance to earth of unearthed IT systems and to give an insulation warning if the insulation resistance falls below the specified response value.

1.d System context

See 1.c

2. DESIGN EVALUATION

2.a Engineering evaluation requirements

2.a.i. Technical Requirements

- a) Insulation monitoring devices (IMD) shall be built according to IEC 61557-8;
- b) IMD shall provide following functions:
 - Local insulation warning: This function includes the measurement of the insulation resistance of an IT system including symmetrical and asymmetrical components,
 - Remote insulation warning: This function includes the measurement of the insulation resistance R_F of an IT system including symmetrical and asymmetrical insulation faults, an assessment of this insulation resistance and a warning output. The warning output shall be reported remotely with an output signal
 - Test function: An IMD shall comprise a test device, or be provided with means for the connection of a test device, for detecting whether the IMD is capable of fulfilling its intended functions. The IT system to be monitored shall not be directly earthed when the test function is activated, and the test function shall not negatively influence the IMD and the IT system.
- c) Performance Requirements
 - Specified response value: Its value of the insulation resistance permanently set or adjustable on the device and monitored if the insulation resistance falls below this limit. IMD with adjustable response value shall be designed in such

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a way that it is impossible to modify the settings, except by the use of a key, a tool or a password.

- System leakage capacitance
System leakage capacitance is maximum permissible value of the total capacitance to earth of the system to be monitored, including any connected appliances. IMDs shall be capable of monitoring the insulation resistance up to the system leakage capacitance for which they are designated by the manufacturer.
- Relative percentage uncertainty of the specified response value
The maximum operating uncertainty of the specified response value of IMDs is expressed by the relative percentage uncertainty.
The relative percentage uncertainty of IMDs shall be $\leq \pm 15\%$ under reference conditions given below.
 - Operation temperature: $-5\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$,
 - At nominal voltage between 0% to 115% ,
 - At supply voltage between 85% and 110% ,
 - At nominal frequency of the nominal voltage,
 - At system leakage capacitance of $1\text{ }\mu\text{F}$.
- Response time
Time required by an insulation monitoring device to respond under specified conditions. The response time under reference conditions (Reference conditions given in 2.b.iii) shall be as follows:
 - $\leq 10\text{ s}$ for type AC IMD
 - $\leq 100\text{ s}$ for type AC/DC IMD and for type DC IMD.The response time under reference conditions but with the maximum value of the system leakage capacitance shall be as follows:
 - $\leq 30\text{ min}$ for all types of IMDs.
- Measuring voltage and Measuring current
Measuring voltage is voltage present at the measuring terminals during the measurement. Measuring current is maximum current that can flow between the system and earth, limited by the internal d.c. resistance.
The peak value of the measuring voltage and the peak value of the measuring current shall not exceed the following values at 110% of the nominal voltage and at 110% of the supply voltage:

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- The peak value of the measuring voltage shall not exceed 120 V at an infinite value of the insulation resistance.
 - The peak value of the measuring current shall not exceed 10 mA at a value of the Insulation resistance = 0 Ω .
 - Internal d.c. resistance and Internal impedance
 Internal d.c. resistance is resistance of the insulation monitoring device between the terminals to the system being monitored and earth. Internal d.c. resistance of the IMD shall be at least 30 Ω /V of the nominal system voltage, but shall have a minimum of 15 k Ω .
 The internal impedance is total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency. The internal impedance of the IMD shall be at least 30 Ω /V of the nominal system voltage, but shall have a minimum of 1.8 k Ω for type AC and type AC/DC IMD.
 - Indication of the value of the insulation resistance
 IMDs which include facilities for indicating the value of the insulation resistance, manufacturer shall state the relative percentage uncertainty under rated operating conditions.
 - Permanently admissible nominal voltage
 The permanently admissible nominal voltage shall be at least 110 % of the highest nominal voltage.
 NOTE 1: For some small specific systems 105 % of permanently admissible nominal voltage is sufficient
 - Permanently admissible extraneous d.c. voltage
 Extraneous d.c. voltage is a d.c. voltage occurring in a.c. systems between the a.c. conductors and earth (derived from d.c. parts). Peak value of the permanently admissible extraneous d.c. voltage shall be at least 115 % of the highest nominal a.c. voltage. (Not applicable for pure d.c system)
 - Supply voltage
 For IMDs, without separate connections where the supply voltage is taken out of the system voltage, the working range of the supply voltage shall be equal to the voltage range of the system voltage.
- d) Safety Requirements
- General
- Safety requirements of IMDs should be as per IEC 61010-1 and IEC 61010-2-030 as applicable.

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Clearances and creepage distances

- IMDs shall have minimum clearances and creepage distances in accordance with IEC 61010-1 and IEC 61010-2-030.

Protection class and earth connection of an IMD

- IMDs shall provide protection class I or II

e) Environmental conditions

Reliable operation of Insulation Monitoring devices (IMDs) shall be ensured at relative air humidity of 95% under following ambient temperature conditions:

0°C to +55°C in enclosed spaces

0°C to +70°C (minimum) close to combustion engines, boilers and similar; in case of components intended to be mounted on machinery associated with, or in spaces subject to, higher temperature, the relevant ambient temperature range is to be in accordance with specific machinery and installation, or with specific ambient temperature

-25°C to + 45°C on open deck (-25°C to +55°C for electronic equipment)

f) Mechanical requirements

- Behaviour to vibrations:

- 2_{-0}^{+3} Hz to 13.2 Hz – amplitude ± 1 mm

- 13.2 Hz to 100 Hz – acceleration ± 0.7 g.

An amplification factor $Q \leq 5$ is considered acceptable if the equipment performs satisfactorily during the 90 minutes endurance test at particular response frequency.

- Behaviour to Shock:

- IEC 60068-2-27 Test Ea

IP protection class requirements

- Minimum IP requirement shall be based on location of installation.

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2.a.ii. Technical documents to be submitted

Prior Test

- a) Proposed test program and test schedule;
- b) Product descriptions, manuals, data sheets, assembly drawings, dimension drawings, etc. clearly identifying the product;
- c) Application limitations, working area;
- d) Instructions on fitting, assembly and operation;
- e) Details of production sites;
- f) QM-certificate according to ISO 9001;
- g) IP Test Report;
- h) For products where the function of the product is based on software the quality management system of the manufacturer has to maintain procedures for the life cycle activities and the version control.

After Test

- a) The test report with an identification number shall contain all relevant data and test results including place and date of the tests, the names of the responsible personnel carrying out the test
- b) Type references and serial numbers of the products tested

2.b Type testing requirements

- a) The type tests are intended to demonstrate the performance of the prototype according to the requirements of the applicable International Standards and the relevant Manufacturer's specification; *
- b) The version of each type of installed software at the time of testing is to be identified;
- c) Followings tests to be carried out during type testing of Insulation monitoring devices.;

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Sl.No	Test	Test Requirement
1	Response values	Response values shall be tested at the lowest and at the highest value of the specified nominal voltage and of the rated supply voltage.
2	Response time	With a symmetrical system leakage capacitance of 1 μ F and at the nominal system voltage, the insulation resistance shall be suddenly reduced from nearly infinity to 50 % of the minimum response value and the delay to the operation of the insulation warning shall be measured
3	Peak value of the measuring voltage	A peak voltage measurement shall be used to test whether the requirements given in 2.a.i.care met. The internal resistance of the voltage measuring instrument shall be at least 20 times the internal d.c. resistance of the IMD measuring circuit.
4	Peak value of the measuring current.	A peak current measurement shall be used to test whether the requirements given for the measuring current in 2.a.i.care met. The current measuring instrument shall have an internal resistance below 5 % of the internal resistance of the insulation monitoring device (IMD). The uncertainty of the current measuring instrument shall not exceed 5 % under reference conditions
5	Internal d.c. resistance and internal impedance	Test whether the requirements given in 2.a.i.care met
6	Facilities for indicating the insulation resistance	When IMDs are fitted with facilities for indicating the values of the insulation resistance, a test shall be carried out to check whether the relative percentage uncertainty limits stated by the manufacturer are met
7	Permanently admissible nominal voltage	The requirements specified in 2.a.i.c shall be tested
8	Permanently admissible extraneous d.c. voltage	The requirements specified in 2.a.i.c shall be tested for type AC IMDs.
9	Test of effectiveness of test function	Internal and external test functions, if provided, shall be tested for correct operation
10	Voltage tests	As per IACS UR E10
11	Electromagnetic compatibility (EMC)	As per IACS UR E10
12	Shock and vibration test	Shock: As per IEC 60068-2-27 Test Ea. Vibration: IACS UR E10 (An amplification factor $Q \leq 5$ is considered acceptable if the equipment performs satisfactorily during the 90 minutes endurance test at particular response frequency).

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13	Expose to cold	As per IACS UR E10, low temperature test for 16 hours
14	Any other environmental test (if applicable)	As per IACS UR E10, for humidity test cyclic, a performance test after 46 hours to be carried out. Surface moisture may be removed by hand prior to this test
15	Inspection of the marking and operating instructions	Marking requirements of Clause 4 shall be checked. Operating instruction to be provided along with device.

* For further clarification of witnessing of tests and sampling the test specimen(s), refer to paragraph 6, 7 and 8 of the EU RO "Design Evaluation Scheme" procedure (Appendix V of EU RO Framework Document for the Mutual Recognition of Type Approval found on <https://www.euomr.org/technical-requirements>)

2.c Type testing requirement for certificate renewal

- a) The manufacturer is to notify the RO of any modification or changes to the manufacturing specifications that may affect the MR TA to be renewed.
- b) If the specified standard(s) is(are) amended or revised, the product is to be re-approved prior to it being supplied to vessels to which the amended standards apply.
- c) The Software history to be provided for review.

3. PRODUCTION REQUIREMENTS

- a) Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval).
- b) Production certification according to ISO 9001 by accredited certification bodies;
- c) QM/QS audit (annual) shall be submitted to EU RO for review;
- d) Production of the equipment is limited to those facilities listed on the EU RO certificate;
- e) The EU RO shall be granted access to all manufacturing and testing facilities, and to be provided with all the information necessary to perform its duties; General terms and conditions of the EU RO shall be observed.
- d) Changes to the embedded software (firmware/ system software), if software changes of relevance will void the EU RO certification. The EU RO shall be kept informed of all new version numbers including a description and impacts of change.

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4. MARKING REQUIREMENTS

Manufacturers of the approved equipment are, in principle, to mark the product before shipment for identification of approved equipment and, in addition, at least the following items to be marked at the suitable place:

- a) Manufacturer's name or equivalent;
- b) Type No. or symbol;
- c) Serial No. and date of manufacture;
The serial number on the outside of the device and, if this is not possible, inside the device.
- d) Particulars or ratings;
- e) Date of manufacture;
- f) Type of IT system to be monitored or Type of the IMD marked with a pictogram;
- g) Nominal system voltage or range of the nominal voltage;
- h) Nominal value of the rated supply voltage or working range of the rated supply voltage;
- i) Nominal frequency of the rated supply voltage or working range of frequencies for the rated supply voltage;
- j) Specified response value or minimum and maximum specified response value;
- k) IP Class Rating.

5. TYPE APPROVAL CERTIFICATE CONTENT

The following information is specifically applicable to products relevant to this Technical Requirement and shall be included on the EU RO MR Type Approval Certificate:

- a) Certificate Heading;
- b) Certificate number;
- c) Company Information;
- d) Product Information;
- e) Term of Validity;
- f) Rules & Standards;
- g) Hardware, firmware [major version. minor version], software name and revision, if and as applicable.
- h) Generic Sentence;

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i) Generic Statement.

6. APPROVAL DATE AND REVISION NUMBER

Date	Revision	Comment
2019-01-01	0.0	Approved by EU RO MR Steering Committee
2019-01-14	0.1	CRF048
28 December 2021	0.2	Software update (ref. 18042g) and new 2c

7. BACKGROUND INFORMATION / REFERENCES

- EU RO Framework Document for the Mutual Recognition of Type Approval;
- IEC 61557-8: -Insulation Monitoring devices for IT Systems;
- IEC 61557-1: -Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 1: General requirements;
- IEC 61010-1, 2,: - Safety requirements for electrical equipment for measurement, control, and laboratory use;
- IEC 61326-2-4: Electrical equipment for measurement, control and laboratory use - EMC requirements;
- IEC 60721-3: Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities;
- IEC 60068-2-6: Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal);
- IEC 60529: - Degrees of protection provided by enclosures (IP Code);
- IACS E10: - Test Specification for Type Approval.

8. MAINTENANCE & CLARIFICATION OF TECHNICAL REQUIREMENTS

Anyone wishing to propose changes to this document or request clarification of technical issues should contact the EU RO MR Group Secretariat in the first instance:

Secretariat@euromr.org.

Review and approval of change requests shall follow the EU RO MR Maintenance Process detailed in the EU RO Framework Document for the Mutual Recognition of Type Approval: <https://www.euromr.org/technical-requirements>

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