

# EU RO Mutual Recognition Technical Requirements

<b>LEVEL GAUGES/TRANSMITTERS</b>	Version	0.0
	Adoption Date:	1 July 2016
	Application Date:	1 January 2017
	Tier	5
<p>This document is subject to controlled issue and can be found here:  <a href="http://www.euromr.org/technical-requirements">http://www.euromr.org/technical-requirements</a>  <b>*** Uncontrolled if downloaded or printed ***</b></p>		

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## 1. PRODUCT DESCRIPTION

### 1.a General description of the product

- a) These technical requirements (TR) are meant to cover mechanical and electronic level gauges/transmitters for non-essential systems on board classed vessels.
- b) Measuring principles may typically be:
  - Microwave radar level transmitter;
  - Guided wave radar level transmitter;
  - Ultrasonic level transmitter;
  - Capacitive (rod) level transmitter;
  - Float level gauge/transmitter;
  - Magnetic float level gauge/transmitter.
- c) These MR technical requirements (MR TRs) do not cover:
  - Control, monitoring and safety functions for primary- or secondary essential services, as defined by IACS Unified Interpretations SC134;
  - Glass level gauges, magnetic glass level gauges, self-powered gauges with diaphragm and capillary tube or other mechanical gauging principles that penetrate the tank where testing according to IACS UR P2 (Rules for piping design, construction and testing) typically is required;
  - Boiler remote level indicator - see separate MR TR for 'BOILER REMOTE LEVEL INDICATOR' (Tier 3);
  - Electro-pneumatic level transmitters - see separate MR TR for 'ELECTRO-PNEUMATIC LEVEL TRANSMITTERS (EPLT)' (Tier 5);

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- Pressure gauges/transmitters see separate MR TR for 'PRESSURE GAUGES/ TRANSMITTERS' (Tier 5);

## **1.b Application limitations**

These technical requirements apply to Level Gauges/Transmitters intended for marine use.

## **1.c Intended use**

Level gauging applications for non-essential systems that provide control, monitoring, alarm or safety functions.

## **1.d System context**

The equipment may for example be used to provide gauging for use in a ballast water system.

## **2. DESIGN EVALUATION**

### **2.a Engineering evaluation requirements**

#### **2.a i. Technical Requirements**

- a) Materials shall be suitable for the intended service and location;
- b) Degree of protection (IP Code) shall be documented according to IEC 60529;
- c) For the specific requirements relating to electrical and electronic level sensors and transmitters refer to the separate EU RO MR Technical Requirements for "SENSORS" (Tier 1);
- d) The unit shall be designed for the pressure specification of the intended application.

#### **2.a.ii. Technical documents to be submitted**

**IMPORTANT:** The English Language shall be used for all submitted documents;

- a) Drawings, PCB layouts, schematics, material specifications and principle of operation/functional description necessary to describe all parts of the equipment. The functional description may be in the form of user manuals, installation manuals, etc., as relevant;

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- b) Drawings and product specification of physical/electrical and logical interfaces including signal format, converters, protective circuitry, data protocol, cabling, and required configuration;
- c) Hardware and firmware name and version, as applicable, necessary to identify the equipment under test;
- d) Functional tests that are required according to **Table 1** (see page 7) have to be defined. The tests shall be suitable to monitor gauge/transmitter function/output reliably.

**Note:**

*The Manufacturer may submit the draft test programmes to the EU RO for verification prior to the commencement of any environmental and performance type testing. A certificate of accreditation for the selected laboratory/laboratories is generally required in these circumstances.*

**End of Note**

- e) Environmental- and Performance type test reports;
- f) Special operational limitations, if any;
- g) Documentation about the Production quality assurance system.
- h) Product marking.

## **2.b Type testing requirements**

- a) Tests shall be carried out in accordance with the testing condition and method of the latest revision of IACS UR E10 with modifications given in **Table 1** in the presence of the EU RO's surveyor, and they shall be proven to satisfy the criteria of the latest revision of IACS UR E10 and **Table 1**;
- b) Test specimens shall be taken from the production line or from stocks†.
- c) Tests shall be carried out in the presence of the EU RO Surveyor. In cases where the tests are conducted at Nationally Accredited Laboratories, the presence of the EU RO surveyor may be omitted†;
- d) "Visual inspection" and "Performance test" as described by items 1 and 2 of **Table 1** shall always be witnessed by the EU RO's surveyor as this is outside the scope of the laboratory accreditation;
- e) All type testing shall be documented in accordance with ISO/IEC 17025;
- f) It is the manufacturers' responsibility to make sure that the type testing is performed in accordance with an approved test programme that is acceptable for the EU RO;

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- g) All tests defined in **Table 1** are normally to be carried out on the same unit. Using different units for the different type of tests is acceptable provided that all EMC tests are carried out on one unit (EUT 1), and all environmental tests are carried out on another unit (EUT 2);
- h) Depending on the equipment type and application, some of the tests may not be relevant. Any omission of type tests are subject to the EU RO's acceptance and the technical justification for omitting tests shall be recorded.

† For further clarification of witnessing of tests and sampling the test specimen(s), refer to paragraphs 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 <http://www.euromr.org/Guidance%20for%20Mutual%20Recognition>)

## 3. PRODUCTION REQUIREMENTS

Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval found on <http://www.euromr.org/Guidance%20for%20Mutual%20Recognition>)

## 4. MARKING REQUIREMENTS

Manufacturers of the approved equipment are, in principle, to mark the product before shipment for identification of approved equipment as per referenced standard. In addition, and as a minimum, 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;
- d) Particulars or ratings, including IP code and class of accuracy;
- e) Date of Manufacture.

## 5. TYPE APPROVAL CERTIFICATE CONTENT

The EU RO MR Type Approval Certificate shall contain the minimum information as defined in the EU RO Framework Document for the Mutual Recognition of Type Approval - see Appendix I of EU RO MR Type Approval Certificate Information.

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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) Technical characteristics which adequately express the basic article's features assuring its functional usage;
- b) Other important characteristics specified by this MR Technical Requirement, including the power supply parameter;
- c) Name and version/revision of hardware, firmware and software (as applicable).

## 6. APPROVAL DATE AND REVISION NUMBER

Date	Revision	Comment
2016-07-01	0.0	Approved by EU RO MR Advisory Board

## 7. BACKGROUND INFORMATION / REFERENCES

- a) EU RO Framework Document for the Mutual Recognition of Type Approval;
- b) IACS Unified Interpretations SC134;
- c) IACS Unified Requirements E10;
- d) IACS UR P2 (Rules for piping design, construction and testing);
- e) MR TR for 'SENSORS' (Tier 1);
- f) MR TR for 'BOILER REMOTE LEVEL INDICATOR' (Tier 3);
- g) MR TR for 'ELECTRO-PNEUMATIC LEVEL TRANSMITTERS (EPLT)' (Tier 5);
- h) MR TR for 'PRESSURE GAUGES/TRANSMITTERS' (Tier 5);
- i) IEC 60529;
- j) ISO/IEC 17025.

## 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](mailto:Secretariat@euromr.org).

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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: <http://www.euomr.org/Guidance%20for%20Mutual%20Recognition->

CONTROLLED DOCUMENT

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**Table 1: Testing condition and method**

(Any changes made to IACS UR E10 in Revision 6.0 needs to be implemented in this test plan.)

NO.	TEST	PROCEDURE ACC. TO:*	TEST PARAMETERS	OTHER INFORMATION
* indicates the testing procedure which is normally to be applied. However, equivalent testing procedure may be accepted by the RO provided that the requirements stated in the other columns are fulfilled.				
1.	Visual inspection	-	-	<ul style="list-style-type: none"> <li>- conformance to drawings, design data, marking of product</li> </ul>
2.	Performance test	Manufacturer performance test programme based upon specification and relevant Rule requirements.	<ul style="list-style-type: none"> <li>- standard atmosphere conditions</li> <li>- temperature: 25°C ± 10°C</li> <li>- relative humidity: 60% ± 30%</li> <li>- air pressure: 96 KPa ± 10KPa</li> </ul>	<ul style="list-style-type: none"> <li>- confirmation that operation is in accordance with the requirements specified for particular system or equipment;</li> <li>- checking of self-monitoring features;</li> <li>- checking of specified protection against an access to the memory;</li> <li>- checking against effect of erroneous use of control elements in the case of computer systems.</li> </ul>

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3.	External power supply failure	-	<ul style="list-style-type: none"> <li>- 3 interruptions during 5 minutes;</li> <li>- switching-off time 30 s each case</li> </ul>	<ul style="list-style-type: none"> <li>- The time of 5 minutes may be exceeded if the equipment under test needs a longer time for start-up, e.g. booting sequence</li> <li>- For equipment which requires booting, one additional power supply interruption during booting to be performed</li> <li>- Verification of:                             <ul style="list-style-type: none"> <li>- equipment behaviour upon loss and restoration of supply;</li> <li>- possible corruption of programme or data held in programmable electronic systems, where applicable.</li> </ul> </li> </ul>		
4.	Power supply variations a) electric	-	AC SUPPLY			
			Combination	Voltage(%) variation permanent	Frequency(%) variation permanent	
			1	+10	+5	
			2	+10	-5	
			3	-10	-5	
			4	-10	+5	
					voltage	frequency



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				transient 1,5 s %	transient 5s %
		5	+20	+10	
		6	-20	-10	
		DC SUPPLY			
		Voltage tolerance	± 10%		
		Continuous			
		Voltage cyclic variation	5%		
		Voltage ripple	10%		
		<p>Electric battery supply:</p> <ul style="list-style-type: none"> <li>- +30% to -25% for equipment connected to charging battery or as determined by the charging/discharging characteristics, including ripple voltage from the charging device;</li> <li>- +20% to -25% for equipment not connected to the battery during charging.</li> </ul> <p>Pressure: ±20%</p> <p>Duration: 15 minutes</p>			
	b) pneumatic and hydraulic				

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5.	Dry heat	IEC Publication 60068-2-2	<p>Temperature: <math>55^{\circ} \pm 2^{\circ}\text{C}</math></p> <p>Duration: 16 hours</p> <p>or</p> <p>Temperature: <math>70^{\circ}\text{C} \pm 2^{\circ}\text{C}</math></p> <p>Duration: 16 hours (see note 1)</p>	<ul style="list-style-type: none"> <li>– equipment operating during conditioning and testing;</li> <li>– functional test during the last hour at the test temperature;</li> <li>– For equipment specified for increased temperature the dry heat test is to be conducted at the agreed test temperature and duration.</li> </ul>
6.	Damp heat	IEC Publication 60068-2-30 test Db	<p>Temperature: <math>55^{\circ}\text{C}</math></p> <p>Humidity: 95%</p> <p>Duration: 2 cycles 2 x (12 + 12 hours)</p>	<ul style="list-style-type: none"> <li>– measurement of insulation resistance before test;</li> <li>– The test shall start with <math>25^{\circ}\text{C} \pm 3^{\circ}\text{C}</math> and at least 95% humidity;</li> <li>– equipment operating during the complete first cycle and switched off during second cycle except for functional test;</li> <li>– functional test during the first 2 hours of the first cycle at the test temperature and during the last 2 hours of the second cycle at the test temperature;</li> <li>– recovery at standard atmosphere conditions;</li> </ul>

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				<ul style="list-style-type: none"> <li>– insulation resistance measurements and performance test.</li> </ul>
7.	Vibration	IEC Publication	$2_{-0}^{+3}$ Hz to 13.2 Hz – amplitude $\pm 1$ mm	<ul style="list-style-type: none"> <li>– duration in case of no resonance condition 90 minutes at 30 Hz;</li> </ul>
		60068-2-6 Test Fc	13.2 Hz to 100 Hz – acceleration $\pm 0.7$ g.	<ul style="list-style-type: none"> <li>– duration at each resonance frequency at which <math>Q \geq 2</math> is recorded – 90 minutes;</li> </ul>
			For severe vibration conditions such as, e.g. on diesel engines, air compressors, etc.:	<ul style="list-style-type: none"> <li>– during the vibration test, functional tests are to be carried out;</li> </ul>
			2.0 Hz to 25 Hz – amplitude $\pm 1.6$ mm	<ul style="list-style-type: none"> <li>– tests to be carried out in three mutually perpendicular planes;</li> </ul>
			25.0 Hz to 100 Hz – acceleration $\pm 4.0$ g.	<ul style="list-style-type: none"> <li>– Q should not exceed 5;</li> </ul>
				<ul style="list-style-type: none"> <li>– where sweep test is to be carried out instead of the discrete frequency test and a number of resonant frequencies is detected close to each other duration of the test is to be 120 min. Sweep over a restricted frequency range between 0.8 and 1.2 times the critical frequencies can be used where appropriate. Note: Critical frequency is a frequency at which the equipment being tested may exhibit:</li> </ul>

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		Note;	- malfunction and/or performance deterioration
		More severe conditions may exist for example on exhaust manifolds or fuel oil injection systems of diesel engines. For equipment specified for increased vibration levels the vibration test is to be conducted at the agreed vibration level, frequency range and duration. Values may be required to be in these cases 40 Hz to 2000 Hz – acceleration $\pm 10.0g$ at 600°C, duration 90 min.*	- mechanical resonances and/or other response effects occur, e.g. chatter
			- mechanical resonances with amplification greater than 10 will not be accepted

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7.	Vibration	<p>IEC Publication</p> <p>60068-2-6 Test Fc</p> <p>-</p> <p>-</p>	<p><math>2_{-0}^{+3}</math> Hz to 13.2 Hz – amplitude <math>\pm 1</math>mm</p> <p>13.2 Hz to 100 Hz – acceleration <math>\pm 0.7</math> g.</p> <p>For severe vibration conditions such as, e.g. on diesel engines, air compressors, etc.:</p> <p>2.0 Hz to 25 Hz – amplitude <math>\pm 1.6</math> mm</p> <p>25.0 Hz to 100 Hz – acceleration <math>\pm 4.0</math> g.</p> <p>Note;</p>	<ul style="list-style-type: none"> <li>- duration in case of no resonance condition 90 minutes at 30 Hz;</li> <li>- duration at each resonance frequency at which <math>Q \geq 2</math> is recorded – 90 minutes;</li> <li>- during the vibration test, functional tests are to be carried out;</li> <li>- tests to be carried out in three mutually perpendicular planes;</li> <li><input type="checkbox"/> Q should not exceed 5;</li> <li><input type="checkbox"/> where sweep test is to be carried out instead of the discrete frequency test and a number of resonant frequencies is detected close to each other duration of the test is to be 120 min. Sweep over a restricted frequency range between 0.8 and 1.2 times the critical frequencies can be used where appropriate. Note: Critical frequency is a frequency at which the equipment being tested may exhibit:</li> <li>- malfunction and/or performance deterioration</li> </ul>
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			<p>More severe conditions may exist for example on exhaust manifolds or fuel oil injection systems of diesel engines. For equipment specified for increased vibration levels the vibration test is to be conducted at the agreed vibration level, frequency range and duration. Values may be required to be in these cases 40 Hz to 2000 Hz – acceleration <math>\pm 10.0g</math> at 600°C, duration 90 min.*</p>	<ul style="list-style-type: none"><li>- mechanical resonances and/or other response effects occur, e.g. chatter</li> <li>- mechanical resonances with amplification greater than 10 will not be accepted</li></ul>
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8.	Inclination	Publication IEC 60092-504	<p>Static 22.5°</p> <p>Dynamic 22.5°</p>	<p>a) inclined to the vertical at an angle of at least 22.5°</p> <p>b) inclined to at least 22.5° on the other side of the vertical and in the same plane as in (a),</p> <p>c) inclined to the vertical at an angle of at least 22.5° in plane at right angles to that used in (a),</p> <p>d) inclined to at least 22.5° on the other side of the vertical and in the same plane as in (c).</p> <p>Note: The period of testing in each position should be sufficient to fully evaluate the behaviour of the equipment.</p> <p>Using the directions defined in a) to d) above, the equipment is to be rolled to an angle of 22.5° each side of the vertical with a period of 10 seconds. The test in each direction is to be carried out for not less than 15 minutes</p> <p>On ships for the carriage of liquefied gases and chemicals, the emergency power supply is to remain operational with the ship flooded up to a maximum final athwart ship inclination of 30°.</p>
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					Note: These inclination tests are normally not required for equipment with no moving parts.	
9.	Insulation resistance	-			<ul style="list-style-type: none"> <li>- For high voltage equipment, reference is made to IACS UR E11.</li> <li>- insulation resistance test is to be carried out before and after: damp heat test, cold test, salt mist test, and high voltage test;</li> <li>- between all phases and earth; and where appropriate, between the phases.</li> </ul> <p>Note: Certain components e.g. for EMC protection may be required to be disconnected for this test.</p>	
		Rated supply voltage Un	Test	Min. insulation resistance		
		(V)	voltage Un			
			(V)	before test M ohms		after test M ohms
		Un ≤ 65	2 x Un min. 24V	10		1,0
Un > 65	500	100	10			

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10.	High voltage			<ul style="list-style-type: none"> <li>– For high voltage equipment, reference is made to IACS UR E11.</li> <li>– separate circuits are to be tested against each other and all circuits connected with each other tested against earth;</li> <li>– printed circuits with electronic components may be removed during the test;</li> <li>– period of application of the test voltage: 1 minute</li> </ul>
		Rated voltage	Test voltage	
		Un	(A.C. voltage 50 or 60 Hz)	
		(V)	(V)	
		Up to 65	2 x Un + 500	
		66 to 250	1500	
251 to 500	2000			
501 to 690	2500			
11.	Cold	IEC Publication 60068-2-1	Temperature: +5°C ± 3°C  Duration: 2 hours  or  Temperature: –25°C ± 3°C  Duration: 2 hours (see note 2)	<ul style="list-style-type: none"> <li>– initial measurement of insulation resistance;</li> <li>– equipment not operating during conditioning and testing except for functional test;</li> <li>– functional test during the last hour at the test temperature;</li> <li>– insulation resistance measurement and the functional test after recovery</li> </ul>

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12.	Salt mist	IEC Publication 60068-2-52  Test Kb	Four spraying periods with a storage of 7 days after each.	<ul style="list-style-type: none"><li>– initial measurement of insulation resistance and initial functional test;</li><li>– equipment not operating during conditioning;</li><li>– functional test on the 7th day of each storage period;</li><li>– insulation resistance measurement and performance test 4 to 6h after recovery.</li></ul> <p>(see Note 3)</p> <p>On completion of exposure, the equipment shall be examined to verify that deterioration or corrosion (if any) is superficial in nature.</p>
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13.	Electrostatic discharge	IEC 61000-4-2	<p>Contact discharge: 6kV</p> <p>Air discharge: 8kV</p> <p>Interval between single discharges: 1 sec.</p> <p>No. of pulses: 10 per polarity According to test level 3.</p>	<ul style="list-style-type: none"> <li>- to simulate electrostatic discharge as may occur when persons touch the appliance;</li> <li>- the test is to be confined to the points and surfaces that can normally be reached by the operator;</li> <li>- Performance Criterion B (See Note 4).</li> </ul>
14.	Electromagnetic field	IEC 61000-4-3	<p>Frequency range:</p> <p>80 MHz to 6 GHz</p> <p>Modulation**: 80% AM at 1000Hz</p> <p>Field strength: 10V/m</p> <p>Frequency sweep rate: <math>\leq 1.5 \times 10^{-3}</math> decades/s (or 1%/3 sec) According to test level 3</p>	<ul style="list-style-type: none"> <li>- to simulate electromagnetic fields radiated by different transmitters;</li> <li>- the test is to be confined to the appliances exposed to direct radiation by transmitters at their place of installation.</li> <li>- Performance criterion A (See Note 5)</li> </ul> <p>** If for tests of equipment an input signal with a modulation frequency of 1000 Hz is necessary a modulation frequency of 400 Hz may be chosen.</p>

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15.	Conducted low frequency		<p>AC:</p> <p>Frequency range :rated frequency to 200th harmonic;</p> <p>Test voltage (rms) : 10% of supply to 15<sup>th</sup> harmonic reducing to 1% at 100<sup>th</sup> harmonic and maintain this level to the 200<sup>th</sup> harmonic, min 3 V r.m.s, max 2 W.</p> <p>DC:</p> <p>Frequency range : 50 Hz - 10 kHz; Test voltage (rms) :10% of supply max. 2 W</p>	<ul style="list-style-type: none"> <li>- to stimulate distortions in the power supply system generated for instance, by electronic consumers and coupled in as harmonics;</li> <li>- performance criterion A ( see Note 5).</li> <li>- See figure – test set-up</li> </ul>
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16.	Conducted radio frequency	IEC 61000-4-6	<p>AC, DC, I/O ports and signal/control lines:</p> <p>Frequency range :</p> <p>150 kHz-80 MHz</p> <p>Amplitude : 3 V rms (See Note 6)</p> <p>Modulation ***: 80% AM at 1000 Hz</p> <p>Frequency sweep range: <math>\leq 1.5 \times 10^{-3}</math> decades/s (or 1%/3sec.)</p> <p>According to test level 2.</p>	<ul style="list-style-type: none"> <li>- Equipment design and the choice of materials is to stimulate electromagnetic fields coupled as high frequency into the test specimen via the connecting lines.</li> <li>- performance criterion A (see Note 5).</li> <li>*** If for tests of equipment an input signal with a modulation frequency of 1000 Hz is necessary a modulation frequency of 400 Hz may be chosen.</li> </ul>
17.	Burst/fast transients	IEC 61000-4-4	<p>Single pulse rise time: 5ns (between 10% and 90% value)</p> <p>Single pulse width: 50 ns (50% value)</p> <p>Amplitude (peak): 2kV line on power supply port/earth;</p> <p>1kV on I/O data control and communication ports (coupling clamp)</p> <p>Pulse period: 300 ms;</p> <p>Burst duration: 15 ms;</p>	<ul style="list-style-type: none"> <li>- arcs generated when actuating electrical contacts;</li> <li>- interface effect occurring on the power supply, as well as at the external wiring of the test specimen;</li> <li>- performance criterion B (see Note 4).</li> </ul>

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			Duration/polarity: 5 min According to test level 3.	
18.	Surge/voltage	IEC 61000-4-5	<p>Open-circuit voltage:</p> <p>Pulse rise time: 1.2 <math>\mu</math>s (front time)</p> <p>Pulse width: 50 <math>\mu</math>s (time to half value)</p> <p>Amplitude (peak) : 1kV line/earth; 0.5kV line/line</p> <p>Short-circuit current:</p> <p>Pulse rise time: 8 <math>\mu</math>s (front time)</p> <p>Pulse width: 20 <math>\mu</math>s (time to half value)</p> <p>Repetition rate: <math>\geq</math> 1 pulse/min</p> <p>No of pulses: 5 per polarity</p> <p>Application: continuous</p> <p>According to test level 2.</p>	<ul style="list-style-type: none"> <li>- interference generated for instance, by switching "ON" or "OFF" high power inductive consumers;</li> <li>- test procedure in accordance with figure 10 of the standard for equipment where power and signal lines are identical;</li> <li>- performance criterion B (see Note 4).</li> </ul>

Continued..

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19.	Radiated emission	CISPR 16-1, 16-2	<p>For equipment installed in the bridge and deck zone.</p> <p>Frequency range: quasi peak Limits :</p> <p>0.15-0.3 MHz 80-52dB<math>\mu</math>V/m          0.3-30 MHz 52-34dB<math>\mu</math>V/m          30 - 2000MHz 54dB<math>\mu</math>V/m          except for:          156-165 MHz 24 dB<math>\mu</math>V/m</p> <p>For equipment installed in the general power distribution zone.</p> <p>Frequency range: quasi peak Limits:</p> <p>0.15 - 30 MHz 80 - 50 dB<math>\mu</math>V/m          30-100 MHz 60-54 dB<math>\mu</math>V/m          100 - 2000 MHz 54 dB<math>\mu</math>V/m          except for:          156-165 MHz 24 dB<math>\mu</math>V/m</p>	<p>- procedure in accordance with the standard but distance 3 m between equipment and antenna</p> <p>- Alternatively the radiation limit at a distance of 3 m from the enclosure port over the frequency 156 MHz to 165 MHz shall be 30 dB micro-V/m peak.</p>
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20.	Conducted emission	CISPR 16-1, 16-2	<p>For equipment installed in the bridge and deck zone.</p> <p>Frequency range: Limits:            10-150kHz 96 - 50dBμV            150-350 kHz 60 - 50 dBμV            350 kHz-30 MHz 50 dBμV</p> <p>For equipment installed in the general power distribution zone.</p> <p>Frequency range: Limits:            10-150 kHz 120 - 69 BμV            150-500kHz 79dBμV            0.5 - 30 MHz 73 dBμV</p>	.
21.	Flame retardant	<p>IEC 60092-101</p> <p>Or            IEC 60695-11-5</p>	<p>Flame application: 5 times 15 s each.</p> <p>Interval between each application:            15s or 1 time 30s.</p> <p>Test criteria based upon application.</p> <p>The test is performed with the EUT or housing of the EUT applying needle-flame test method.</p>	<p>-</p> <p>-</p> <p>- the burnt out or damaged part of the specimen by not more than 60 mm long.</p> <p>– no flame, no incandescence or</p> <p>– in the event of a flame or incandescence being present, it shall extinguish itself within 30 s of the removal of the needle flame without full combustion of the test specimen.</p>



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				<ul style="list-style-type: none"> <li>- any dripping material shall extinguish itself in such a way as not to ignite a wrapping tissue. The drip height is 200 mm ± 5 mm.</li> <li>-</li> </ul>
22.	Compass safe distance measurement	IEC 60945		- the test is applied to equipment intended for installation on the navigation bridge
23.	Acoustic noise and signals measurement	IEC 60945		- the test is applied to equipment intended for installation on the navigation bridge

### Notes:

1. Equipment to be mounted in consoles, housing etc. together with other equipment are to be tested with 70°C.
2. For equipment installed in non-weather protected locations or cold locations test is to be carried out at -25°C.
3. Salt mist test is to be carried out for equipment installed in weather exposed areas.
4. Performance Criterion B: (For transient phenomena): The EUT shall continue to operate as intended after the tests. No degradation of performance or loss of function is allowed as defined in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however allowed but no change of actual operating state or stored data is allowed.
5. Performance Criterion A: (For continuous phenomena): The Equipment Under Test shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed as defined in relevant equipment standard and the technical specification published by the manufacturer.
6. For equipment installed on the bridge and deck zone, the test levels shall be increased to 10V rms for spot frequencies in accordance with IEC 60945 at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz.

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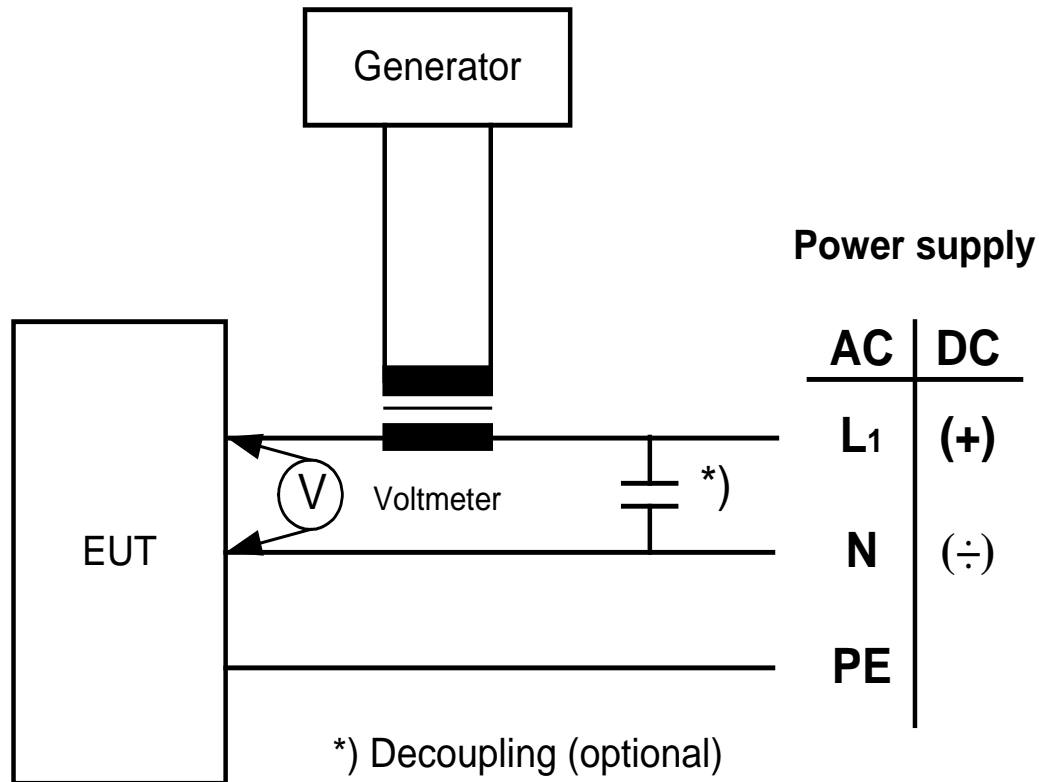


Figure - Test Set-up – Conducted Low Frequency Test

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