Expressions Used for Standards Referred to in IACS Unified Requirements (Test Specifications for Automatic Devices and Equipment)

Amended Guidance

Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use

Reason for Amendment

IACS Unified Requirement (UR) E10 specifies the test specifications for automatic devices and equipment such as monitoring and alarm systems. This UR has already been incorporated into the ClassNK Rules.

IACS recently reviewed its URs related to machinery and electricity in order to unify the expressions used for the standards and conventions referred to in the URs. For this reason, IACS adopted IACS Unified Regulation E10 (Rev.8) in February 2021. In addition, IACS further revised the URs with respect to their effective dates with the adoption of IACS UR E10 (Rev.8) (Corr.1) in December 2021.

Accordingly, relevant requirements are amended based upon IACS Unified Rule E10 (Rev.8) (Corr.1).

Outline of Amendment

Adds the publication year for standards referred to in the aforementioned UR.

“Guidance for the approval and type approval of materials and equipment for marine use” has been partly amended as follows:

Part 7 CONTROL AND INSTRUMENTATION EQUIPMENT AND ELECTRICAL INSTALLATIONS

Chapter 1 APPROVAL OF USE OF AUTOMATIC DEVICES AND EQUIPMENT

1.3 Environmental Test

Paragraph 1.3.1 has been amended as follows.

1.3.1 Approval Test

(1) (Omitted)

(2) Where tests which do not fully comply with the testing condition and methods, and the criteria of **Table7.1-1,** they may comply with a standard deemed appropriate by the Society such as *IEC* 60092-504:2016 (*Electrical installations in ships - Special features, Control and instrumentation, Section* 3: *Environmental and supply conditions and testing*), *IEC* 60945:2002 (*Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results*), *IEC* 60533:2015 (*Electrical and electronic installations in ships - Electromagnetic compatibility*), *JIS F* 0807 (*General Rules for Environmental Tests of Control and Instrumentation Equipment for Marine Use*).

(3) (Omitted)

(4) (Omitted)

Table 7.1-1 has been amended as follows.

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria

Test Item	Testing condition and method	Criteria
(Omitted)		
Dry heat test	For non-heat dissipating equipment	- No abnormality is observed. - The equipment operates satisfactory.
	- The equipment is at an operating condition and apply the environmental condition of +70℃±2℃ for 16 *hours*. And check the operation of the equipment during the last hour at the test temperature and after recovery. - For equipment other than that subject to a high degree of heat (e.g. installed in consoles, housing etc. together with other heat dissipating power equipment), the environmental condition of +55℃±2℃ for 16 *hours* may be applied. - For the equipment specified for more severe temperature conditions, tests are to be carried out at agreed test temperatures and durations. - Detailed test methods are according to *Test* Bb of *IEC* 60068-2-2:2007.	
	For heat dissipating equipment	
	- The equipment is at an operating condition and apply the environmental condition of +70 $^{\circ}C \pm 2\,^{\circ}C$ for 16 *hours* with cooling system on (if provided). In addition, the operation of the equipment during the last hour at the test temperature and after recovery is to be checked. - For equipment other than that subject to a high degree of heat (e.g. installed in consoles, housing etc. together with other heat dissipating power equipment), the environmental condition of +55 $^{\circ}C \pm 2\,^{\circ}C$ for 16 *hours* may be applied. - For equipment specified for more severe temperature conditions, tests are to be carried out at agreed test temperatures for agreed durations. - Detailed test methods are according to *Test* Be of *IEC* 60068-2-2:2007.	
Damp heat test	- Apply two cycles of the environmental condition of temperature of +55℃±2℃ and relative humidity of 95%±5% for 24 *hours* every one cycle. (The start conditions for the test are +25°C±3°C and at least 95% humidity. The condition is to be applied during the first 12 *hours*, and removed during the last 12 *hours*.) The equipment is operating condition during complete first cycle and switched off during second cycle except for the operation test. And check the operation of the equipment during the first 2 *hours* of the first cycle at the environmental condition, and the performance of the equipment during the last 2 *hours* of the second cycle at the environmental condition and after recovery. - The duration of the second cycle may be extended as needed to allow for verification of equipment operation. - Detailed test methods are referred to Test *Db* of *IEC* 60068-2-30:2005.	- No abnormality is observed. - The equipment operates satisfactory.

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria (continued)

<table>
<tr><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>Vibration test</td><td>- The equipment is at an operating condition and apply the sweeping of vibration specified in the following over the frequency range of 2 (+3, -0) Hz-100 Hz in order to find resonance points. (The points of which amplification factor : Q≥2 are considered as resonance points.)
<table>
<tr><th>Frequency</th><th>Amplitude or Acceleration</th></tr>
<tr><td>2 (+3, -0) Hz-13.2 Hz
13.2 Hz - 100 Hz</td><td>Amp. ±1.0 mm
Acceleration ±0.7 g</td></tr>
</table>
- When resonance points do not exist, apply the vibration of acceleration ± 0.7 g at 30 Hz for 90 minutes as an endurance test.
- When resonance points exist, repeat the endurance test after taking measures to avoid the resonance or apply the vibration (same amplitude or acceleration of resonance point) at the resonance frequency for 90 minutes.
- Where several resonance points are found close to each other, the sweeping endurance test for 120 minutes may be applied. In this case, the sweeping frequency range is from 0.8 to 1.2 times the frequency at the largest of several critical resonance points (mechanical resonance that sounds like chattering occurs or the equipment being tested may start to malfunction)where Q≥2.
- Check the operation of the equipment during the test.
- The test is carried out in three axis direction.
- For the equipment intended to be installed in severe vibration conditions such as near reciprocating internal combustion engines or air compressors, the testing conditions specified below are to be applied.
<table>
<tr><th>Frequency</th><th>Amplitude or Acceleration</th></tr>
<tr><td>2 (+3, -0) Hz-25.0 Hz
25.0 Hz-100 Hz</td><td>Amp. ±1.6 mm
Acceleration ±4.0 g</td></tr>
</table>
- For equipment specified for more severe vibration levels (for example, equipment installed on exhaust manifolds and fuel oil injection systems of reciprocating internal combustion engines), tests are to be carried out at agreed vibration levels, frequency ranges and durations. In such cases, the testing condition specified below may be applied as the agreed testing condition.
<table>
<tr><th>Frequency</th><th>Acceleration</th><th>Temperature</th><th>Duration</th></tr>
<tr><td>40 Hz-2000 Hz</td><td>±10.0 g</td><td>600℃</td><td>90 minutes</td></tr>
</table>
- Detailed test methods are referred to Test Fc of IEC 60068-2-6:2007.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td>Inclination test</td><td>- The equipment is at an operating condition and check the operation of the equipment with 22.5° static inclination.
- The equipment is at an operating condition and check the operation of the equipment with rolling of 22.5° at period of about 10 seconds for not less than 15 minutes.
- The test is carried out at athwartships and bow-and-stern inclinations.
- 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 athwartships inclination of 30°.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td>Cold test</td><td>- The equipment is switched off except for the operation test and apply the environmental condition of +5℃ ±3℃ for 2 hours. And check the operation of the equipment during the last hour at the test temperature and after recovery.
- For the equipment installed in open decks, etc., the environmental condition of -25℃ ±3℃ is applied.
- Detailed test methods are referred to Test Ab or Test Ad of IEC 60068-2-1:2007.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
</table>

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria (continued)

<table>
<tr><th>Test Item</th><th colspan="2">Testing condition and method</th><th>Criteria</th></tr>
<tr><td>Salt mist test</td><td colspan="2">- The equipment is switched off except when its operation is checked. Apply four cycles of the environmental condition of spraying NaCl liquid for 2 hours and leaving for 7 days. Check the operation of the equipment during the 7th day of each cycle and the performance of the equipment during 4 to 6 hours after recovery.
- Verify whether the deterioration or corrosion of the equipment is superficial upon completion of the test.
- Detailed test methods are referred to Test Kb of IEC 60068-2-52:2017.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td rowspan="5">Electrostatic discharge immunity test</td><td colspan="2">- Check the operation of the equipment when the electrostatic discharge immunity test is carried out according to the following condition.</td><td rowspan="5">- Performance Criterion B(*2)</td></tr>
<tr><td>Contact discharge</td><td>6 kV</td></tr>
<tr><td>Air discharge</td><td>2, 4, 8 kV</td></tr>
<tr><td>Interval between single discharges</td><td>1 sec.</td></tr>
<tr><td>No. of Pulses</td><td>10 per polarity</td></tr>
<tr><td colspan="2">- Detailed test methods are referred to Level 3 of IEC 61000-4-2:2008.</td></tr>
<tr><td rowspan="6">Radiated radio frequency immunity test</td><td colspan="2">- Check the operation of the equipment when the radiated radio frequency immunity test is carried out according to the following condition.</td><td rowspan="6">- Performance Criterion A(*1)</td></tr>
<tr><td>Frequency range</td><td>80 MHz - 6 GHz</td></tr>
<tr><td>Modulation</td><td>80% AM at 1 kHz</td></tr>
<tr><td>Field strength</td><td>10 V/m</td></tr>
<tr><td>Frequency sweep rate</td><td>≤1.5×10⁻³decades/sec.
(or 1% / 3sec.)</td></tr>
<tr><td colspan="2">- If for tests of equipment an input signal with a modulation frequency of 1 kHz is necessary a modulation frequency of 400 Hz may be chosen.
- If equipment is intended to receive radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller), then the immunity limits at its communication frequency do not apply, subject to the provisions in 5.2 of Annex D18.1.1, Part D of the Rules for the Survey and Construction of Steel Ships.
- Detailed test methods are according to Level 3 of IEC 61000-4-3:2020.</td></tr>
<tr><td colspan="4">(Omitted)</td></tr>
<tr><td rowspan="7">Conducted high frequency immunity test</td><td colspan="2">- Check the operation of the equipment when the conducted high frequency immunity test is carried out according to the following condition.</td><td rowspan="7">- Performance Criterion A(*1)</td></tr>
<tr><td>Frequency range</td><td>150 kHz - 80 MHz</td></tr>
<tr><td>Modulation</td><td>80% AM at 1 kHz</td></tr>
<tr><td>Amplitude</td><td>3 V rms</td></tr>
<tr><td>Frequency sweep range</td><td>≤1.5×10⁻³decades/sec.
(or 1% / 3sec.)</td></tr>
<tr><td colspan="2">- This test is to be applied to AC, DC, I/O ports and signal/control lines.
- If for tests of equipment an input signal with a modulation frequency of 1 kHz is necessary a modulation frequency of 400 Hz may be chosen.
- For equipment installed in the bridge and deck zone, the following test levels are to be added.</td></tr>
<tr><td>Spot frequencies</td><td>2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz</td></tr>
<tr><td>Amplitude</td><td>10 V rms</td></tr>
<tr><td colspan="2">- Detailed test methods are referred to Level 2 of IEC 61000-4-6:2013.</td></tr>
</table>

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria (continued)

Test Item	Testing condition and method			Criteria
Electrical burst/fast transient immunity test	- Check the operation of the equipment when the electrical burst/fast transient immunity test is carried out according to the following condition.			- Performance Criterion B(*2)
	Single pulse time		5 *nS* (between 10% and 90% value)	
	Single pulse width		50 *nS* (50% value)	
	Amplitude		line on power supply port/earth: 2 *kV*	
			line on I/O data control and communication ports (coupling clamp): 1 *kV*	
	Pulse period		300 *mS*	
	Burst duration		15 *mS*	
	Duration		5 *min./polarity*	
	- Detailed test methods are referred to *Level* 3 of *IEC* 61000-4-4:2012.			
Surge immunity test	- Check the operation of the equipment when the surge immunity test is carried out according to the following condition. - The test applies to AC and DC power ports.			- Performance Criterion B(*2)
	Open circuit voltage	Pulse rise time	1.2 μS(front time)	
		Single pulse width	50 μS(time to half value)	
		Amplitude (peak)	line/earth: 1 *kV*	
			line/line: 0.5 *kV*	
	Short circuit current	Pulse rise time	8 μS (front time)	
		Single pulse width	20 μS (time to half value)	
	Reputation rate		at least 1 *pulse/min*.	
	No. of pulses		5 *per polarity*	
	- Test circuit is shown in **Fig. 7.1-2** where power and signal lines are identical. - Detailed test methods are referred to *Level* 2 of *IEC* 61000-4-5:2017.			

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria (continued)

<table>
<tr><th>Test Item</th><th colspan="3">Testing condition and method</th><th>Criteria</th></tr>
<tr><td rowspan="3">Radiated emission test</td><td colspan="3">- Radiated emission test is to be carried out according to the following.</td><td rowspan="2">- Radiated emission is to be within limits in the table.</td></tr>
<tr><td>Frequency range:
Up to 1 GHz</td><td colspan="2">
- For equipment installed in the bridge and deck zone.
<table>
<tr><th>Frequency range</th><th>Quasi peak limits (dBμV/m)</th></tr>
<tr><td>150 kHz - 300 kHz</td><td>80 – 52</td></tr>
<tr><td>300 kHz - 30 MHz</td><td>52 – 34</td></tr>
<tr><td>30 MHz - 156 MHz</td><td>54</td></tr>
<tr><td>156 MHz - 165 MHz</td><td>24</td></tr>
<tr><td>165 MHz - 1 GHz</td><td>54</td></tr>
</table>
- For equipment other than the above.
<table>
<tr><th>Frequency range</th><th>Quasi peak limits (dBμV/m)</th></tr>
<tr><td>150 kHz - 30 MHz</td><td>80 - 50</td></tr>
<tr><td>30 MHz - 100 MHz</td><td>60 - 54</td></tr>
<tr><td>100 MHz - 156 MHz</td><td>54</td></tr>
<tr><td>156 MHz - 165 MHz</td><td>24</td></tr>
<tr><td>165 MHz - 1 GHz</td><td>54</td></tr>
</table>
- Distance between equipment and antenna is to be 3 m.
- For the frequency band 156 MHz to 165 MHz, the measurement is to be repeated with a receiver bandwidth of 9 kHz (as per IEC 60945:2002).
- The radiation limit at a distance of 3m from the enclosure port at the frequency range of 156 MHz to 165 MHz may be 30 dBμV/m (peak value) (as per IEC 60945:2002).
- Detailed test methods are referred to CISPR 16-2-3:2016. For the frequency band 156 MHz to 165 MHz, Detailed test methods are according to IEC 60945:2002.
</td></tr>
<tr><td>Frequency range:
Above 1 GHz</td><td colspan="2">
<table>
<tr><th>Frequency range</th><th>Average limit (dB μ V/m)</th></tr>
<tr><td>1 GHz - 6 GHz</td><td>54</td></tr>
</table>
- Distance between equipment and antenna is to be 3 m.
- Equipment intended to transmit radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller) may be exempted from limits, within its communication frequency range, subject to the provisions in 5.2 of Annex D18.1.1, Part D of the Guidance for the Survey and Construction of Steel Ships.
- Detailed test methods are according to CISPR 16-2-3:2016.
</td><td></td></tr>
</table>

Table7.1-1 Environmental Test Items, Testing Conditions, Methods, and Criteria (continued)

<table>
<tr><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td rowspan="8">Conducted emission test</td><td colspan="2">- Conducted emission test is to be carried out according to the following.
- The test applies to AC and DC power ports.</td><td rowspan="8">- Conducted emission is to be within limits in the table.</td></tr>
<tr><td colspan="2">- For equipment installed in the bridge and deck zone.</td></tr>
<tr><td>Frequency range</td><td>Limits (dB㎶V)</td></tr>
<tr><td>10 kHz - 150 kHz
150 kHz - 350 kHz
350 kHz - 30 MHz</td><td>96 – 50
60 - 50
50</td></tr>
<tr><td colspan="2">- For equipment other than the above.</td></tr>
<tr><td>Frequency range</td><td>Limits (dBμV)</td></tr>
<tr><td>10 kHz - 150 kHz
150 kHz - 500 kHz
500 kHz - 30 MHz</td><td>120 - 69
79
73</td></tr>
<tr><td colspan="2">- Detailed test methods are referred to CISPR 16-2-1:2017.</td></tr>
<tr><td>Flame retardant test</td><td colspan="2">- Flame generator:
a) Outer diameter of burner: 0.9 mm or below
b) Length of flame: 12 mm±1 mm
c) Gas: Butane or Propane 95 %
- A flame is to be applied to flammable enclosures of equipment being tested for 30 sec., and then the flame is removed.
- A wrapping tissue is laid under the equipment keeping the 200 mm±5 mm distance to catch any material that drips down.
- Detailed test methods are referred to IEC 60695-11-5:2016.</td><td>- No flame, no incandescence or
- In the event of a flame or incandescence being present, it extinguishes itself within 30 sec. after removal of the flame without full combustion of the equipment.
- Any dripping material extinguishes itself in such a way as to not ignite the wrapping tissue.</td></tr>
</table>

Remarks:

(1) A simplified test may be used instead of a performance test to verify equipment operation if such testing is sufficient to show the equipment has not suffered any deterioration and no abnormalities were caused by the individual environmental tests.

(2) (*1) Performance Criterion A: The Equipment Under Test (EUT) is to continue to operate as intended during and after the tests. No degradation of performance or loss of function is allowed as defined in relevant equipment standard and the technical specification published by the manufacturer.

(*2) Performance Criterion B: The EUT is to continue to operate as intended after the test. 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 less of function or performance which is self recoverable is however allowed but no change of actual operating state or stored data is allowed.