

# E10 Test Specification for Type Approval

(1991)  
(Rev.1  
1993)  
(Rev.2  
1997)  
(Rev. 2.1  
July 1999)  
(Rev.3  
May 2001)  
(Corr.1  
July 2003)  
(Rev.4  
May 2004)  
(Rev.5  
Dec 2006)  
(Rev.6  
Oct 2014)  
(Rev.7  
Oct 2018)

## E10.1 General

This Test Specification is applicable, but not confined, to electrical, electronic and programmable equipment intended for control, monitoring, alarm and protection systems for use in ships.

## E10.2 Testing

These tests are to demonstrate the ability of the equipment to function as intended under the specified testing conditions.

The extent of the testing (i.e. the selection and sequence of carrying out tests and number of pieces to be tested) is to be determined upon examination and evaluation of the equipment or component subject to testing giving due regard to its intended usage.

Equipment is to be tested in its normal position if otherwise not specified in the test specification.

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### Note:

1. Rev.5 of this UR is to be uniformly implemented by IACS Societies from 1 January 2008.
2. Rev.6 of this UR is to be uniformly implemented by IACS Societies from 1 January 2016.
3. Rev.7 of this UR is to be uniformly implemented by IACS Societies for equipment for which the date of application for type approval certification is dated on or after 1 January 2020.
4. Equipment intended to be installed on ships contracted for construction on or after 1 January 2022 is to comply with Rev.7 of this UR.
5. The “contracted for construction” date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of “contract for construction”, refer to IACS Procedural Requirement (PR) No. 29.
6. The “date of application for type approval” is the date of documents accepted by the Classification Society as request for type approval certification of a new equipment type or of an equipment type that has undergone substantive modifications in respect of the one previously type approved, or for renewal of an expired type approval certificate.

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Relevant tests are as listed in the Table.

Note:

- a) \* These test requirements are harmonised with IEC 60092-504 “Electrical Installations in Ships - Part 504: Special features - Control and Instrumentation” and IEC 60533 “Electrical and electronic installations in ships – electromagnetic compatibility”. Electrical and electronic equipment on board ships, required neither by classification rules nor by International Conventions, liable to cause electromagnetic disturbance shall be of type which fulfil the test requirements of test specification items 19 and 20.
- b) As used in this document, and in contrast to a complete performance test, a functional test is a simplified test sufficient to verify that the equipment under test (EUT) has not suffered any deterioration caused by the individual environmental tests.

### Type testing condition for equipment covered by E10.1

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 individual Society provided that the Unified Requirements stated in the other columns are fulfilled. The latest edition of the normative reference applies.				
1.	Visual inspection	-	-	- conformance to drawings, design data
2.	Performance test	Manufacturer performance test programme based upon specification and relevant Rule requirements. When the EUT is required to comply with an international performance standard, e.g. protection relays, verification of requirements in the standard are to be part of the performance testing required in this initial test and subsequent performance tests after environmental testing where required in the UR.	- standard atmosphere conditions - temperature: 25°C ± 10°C - relative humidity: 60% ± 30% - air pressure: 96 KPa ± 10KPa	- confirmation that operation is in accordance with the requirements specified for particular system or equipment; - checking of self-monitoring features; - checking of specified protection against an access to the memory; - checking against effect of unerroneous use of control elements in the case of computer systems.



NO.	TEST	PROCEDURE ACC. TO:*	TEST PARAMETERS	OTHER INFORMATION
5.	Dry heat (see note 1)	IEC 60068-2-2 Test Bb for non-heat dissipating equipment	Temperature: 55° ± 2°C Duration: 16 hours or Temperature: 70°C ± 2°C Duration: 16 hours	<ul style="list-style-type: none"> <li>- equipment operating during conditioning and testing;</li> <li>- functional test (b) 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>
		IEC 60068-2-2 Test Be for heat dissipating equipment	Temperature: 55° ± 2°C Duration: 16 hours or Temperature: 70°C ± 2°C Duration: 16 hours	<ul style="list-style-type: none"> <li>- equipment operating during conditioning and testing with cooling system on if provided;</li> <li>- functional test (b) 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 60068-2-30 test D <sub>b</sub>	Temperature: 55°C Humidity: 95% Duration: 2 cycles 2 x (12 +12 hours)	<ul style="list-style-type: none"> <li>- measurement of insulation resistance before test;</li> <li>- the test shall start with 25°C ± 3°C 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; Duration of the second cycle can be extended due to more convenient handling of the functional test.</li> <li>- recovery at standard atmosphere conditions;</li> <li>- insulation resistance measurements and performance test.</li> </ul>
7.	Vibration	IEC 60068-2-6 Test F <sub>c</sub>	<p>2<sup>+3</sup> Hz to 13.2 Hz – amplitude ±1mm<sub>-0</sub></p> <p>13.2 Hz to 100 Hz – acceleration ± 0.7 g. For severe vibration conditions such as, e.g. on diesel engines, air compressors, etc.:</p> <p>2.0 Hz to 25 Hz – amplitude ±1.6 mm 25.0 Hz to 100 Hz – acceleration ± 4.0 g.</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 Q ≥ 2 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>- it is recommended as guidance that Q does not exceed 5.</li> </ul>



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NO.	TEST	PROCEDURE ACC. TO:*	TEST PARAMETERS		OTHER INFORMATION															
9.	Insulation resistance	<table border="1" data-bbox="600 220 1480 392"> <thead> <tr> <th data-bbox="600 220 819 304">Rated supply voltage Un (V)</th> <th data-bbox="819 220 1039 304">Test voltage (D.C. voltage) (V)</th> <th colspan="2" data-bbox="1039 220 1480 248">Min. insulation resistance</th> </tr> <tr> <td></td> <td></td> <th data-bbox="1039 248 1258 304">before test M ohms</th> <th data-bbox="1258 248 1480 304">after test M ohms</th> </tr> </thead> <tbody> <tr> <td data-bbox="600 304 819 360">Un ≤ 65</td> <td data-bbox="819 304 1039 360">2 x Un min. 24V</td> <td data-bbox="1039 304 1258 360">10</td> <td data-bbox="1258 304 1480 360">1,0</td> </tr> <tr> <td data-bbox="600 360 819 392">Un &gt; 65</td> <td data-bbox="819 360 1039 392">500</td> <td data-bbox="1039 360 1258 392">100</td> <td data-bbox="1258 360 1480 392">10</td> </tr> </tbody> </table>	Rated supply voltage Un (V)	Test voltage (D.C. voltage) (V)	Min. insulation resistance				before test M ohms	after test M ohms	Un ≤ 65	2 x Un min. 24V	10	1,0	Un > 65	500	100	10		<ul style="list-style-type: none"> <li>- For high voltage equipment, reference is made to 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 (V)	Test voltage (D.C. voltage) (V)	Min. insulation resistance																		
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10.	High voltage		<table border="1" data-bbox="600 523 1480 727"> <thead> <tr> <th data-bbox="600 523 1039 608">Rated voltage Un (V)</th> <th data-bbox="1039 523 1480 608">Test voltage (A.C. voltage 50 or 60Hz) (V)</th> </tr> </thead> <tbody> <tr> <td data-bbox="600 608 1039 639">Up to 65</td> <td data-bbox="1039 608 1480 639">2 x Un + 500</td> </tr> <tr> <td data-bbox="600 639 1039 671">66 to 250</td> <td data-bbox="1039 639 1480 671">1500</td> </tr> <tr> <td data-bbox="600 671 1039 703">251 to 500</td> <td data-bbox="1039 671 1480 703">2000</td> </tr> <tr> <td data-bbox="600 703 1039 727">501 to 690</td> <td data-bbox="1039 703 1480 727">2500</td> </tr> </tbody> </table>		Rated voltage Un (V)	Test voltage (A.C. voltage 50 or 60Hz) (V)	Up to 65	2 x Un + 500	66 to 250	1500	251 to 500	2000	501 to 690	2500	<ul style="list-style-type: none"> <li>- For high voltage equipment, reference is made to 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 Un (V)	Test voltage (A.C. voltage 50 or 60Hz) (V)																			
Up to 65	2 x Un + 500																			
66 to 250	1500																			
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11.	Cold	IEC 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>															
12.	Salt mist	IEC 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. (see Note 3)</li> <li>- on completion of exposure, the equipment shall be examined to verify that deterioration or corrosion (if any) is superficial in nature.</li> </ul>															

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NO.	TEST	PROCEDURE ACC. TO:*	TEST PARAMETERS	OTHER INFORMATION
13.	Electrostatic discharge	IEC 61000-4-2	Contact discharge: 6kV Air discharge: 2kV, 4kV, 8kV Interval between single discharges: 1 sec. No. of pulses: 10 per polarity According to test level 3.	<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	Frequency range: 80 MHz to 6 GHz Modulation**: 80% AM at 1000Hz Field strength: 10V/m Frequency sweep rate: $\leq 1.5 \times 10^{-3}$ decades/s (or 1%/3 sec) According to test level 3.	<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> <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> <li>- If an 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 UR E22.5.2.</li> </ul>
15.	Conducted low Frequency		<p>AC: Frequency range: rated frequency to 200th harmonic; Test voltage (rms): 10% of supply to 15th harmonic reducing to 1% at 100th harmonic and maintain this level to the 200th harmonic, min 3 V r.m.s, max 2 W.</p> <p>DC: 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> <li>- for keeping max. 2W, the voltage of the test signal may be lower.</li> </ul>

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NO.	TEST	PROCEDURE ACC. TO:*	TEST PARAMETERS	OTHER INFORMATION
16.	Conducted Radio Frequency	IEC 61000-4-6	AC, DC, I/O ports and signal/control lines: Frequency range: 150 kHz - 80 MHz Amplitude: 3 V rms (See Note 6) Modulation ***: 80% AM at 1000 Hz Frequency sweep range: $\leq 1.5 \times 10^{-3}$ decades/s (or 1%/3sec.) According to test level 2.	- Equipment design and the choice of materials is to stimulate electromagnetic fields coupled as high frequency into the test specimen via the connecting lines. - performance criterion A (see Note 5). *** 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.
17.	Electrical Fast Transients / Burst	IEC 61000-4-4	Single pulse rise time: 5 ns (between 10% and 90% value) Single pulse width: 50 ns (50% value) Amplitude (peak): 2kV line on power supply port/earth; 1kV on I/O data control and communication ports (coupling clamp) Pulse period: 300 ms; Burst duration: 15 ms; Duration/polarity: 5 min According to test level 3.	- arcs generated when actuating electrical contacts; - interface effect occurring on the power supply, as well as at the external wiring of the test specimen; - performance criterion B (see Note 4).
18.	Surge	IEC 61000-4-5	Test applicable to AC and DC power ports Open-circuit voltage: Pulse rise time: 1.2 $\mu$ s (front time) Pulse width: 50 $\mu$ s (time to half value) Amplitude (peak): 1kV line/earth; 0.5kV line/line Short-circuit current: Pulse rise time: 8 $\mu$ s (front time) Pulse width: 20 $\mu$ s (time to half value) Repetition rate: $\geq 1$ pulse/min No of pulses: 5 per polarity Application: continuous According to test level 2.	- interference generated for instance, by switching "ON" or "OFF" high power inductive consumers; - test procedure in accordance with figure 10 of the standard for equipment where power and signal lines are identical; - performance criterion B (see Note 4).



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19.	Radiated Emission	CISPR 16-2-3 IEC 60945 for 156-165 MHz	<p>Limits below 1000 MHz</p> <p>For equipment installed in the bridge and deck zone.</p> <table border="1" data-bbox="1032 328 1480 499"> <thead> <tr> <th>Frequency range:</th> <th>Quasi peak limits:</th> </tr> </thead> <tbody> <tr> <td>0.15 - 0.3 MHz</td> <td>80 - 52 dB<math>\mu</math>V/m</td> </tr> <tr> <td>0.3 - 30 MHz</td> <td>52 - 34 dB<math>\mu</math>V/m</td> </tr> <tr> <td>30 - 1000 MHz</td> <td>54 dB<math>\mu</math>V/m</td> </tr> <tr> <td>except for:</td> <td></td> </tr> <tr> <td>156 - 165 MHz</td> <td>24 dB<math>\mu</math>V/m</td> </tr> </tbody> </table> <p>For equipment installed in the general power distribution zone.</p> <table border="1" data-bbox="1032 611 1480 782"> <thead> <tr> <th>Frequency range:</th> <th>Quasi peak limits:</th> </tr> </thead> <tbody> <tr> <td>0.15 - 30 MHz</td> <td>80 - 50 dB<math>\mu</math>V/m</td> </tr> <tr> <td>30 - 100 MHz</td> <td>60 - 54 dB<math>\mu</math>V/m</td> </tr> <tr> <td>100 - 1000 MHz</td> <td>54 dB<math>\mu</math>V/m</td> </tr> <tr> <td>except for:</td> <td></td> </tr> <tr> <td>156 - 165 MHz</td> <td>24 dB<math>\mu</math>V/m</td> </tr> </tbody> </table> <p>Limits above 1000 MHz</p> <table border="1" data-bbox="1032 863 1480 922"> <thead> <tr> <th>Frequency range:</th> <th>Average limit:</th> </tr> </thead> <tbody> <tr> <td>1000 - 6000 MHz</td> <td>54 dB<math>\mu</math>V/m</td> </tr> </tbody> </table>	Frequency range:	Quasi peak limits:	0.15 - 0.3 MHz	80 - 52 dB $\mu$ V/m	0.3 - 30 MHz	52 - 34 dB $\mu$ V/m	30 - 1000 MHz	54 dB $\mu$ V/m	except for:		156 - 165 MHz	24 dB $\mu$ V/m	Frequency range:	Quasi peak limits:	0.15 - 30 MHz	80 - 50 dB $\mu$ V/m	30 - 100 MHz	60 - 54 dB $\mu$ V/m	100 - 1000 MHz	54 dB $\mu$ V/m	except for:		156 - 165 MHz	24 dB $\mu$ V/m	Frequency range:	Average limit:	1000 - 6000 MHz	54 dB $\mu$ V/m	<p>- procedure in accordance with the standard but distance 3 m between equipment and antenna</p> <p>- for the frequency band 156 MHz to 165 MHz the measurement shall be repeated with a receiver bandwidth of 9 kHz (as per IEC 60945).</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 (as per IEC 60945).</p> <p>- procedure in accordance with the standard (distance 3 m between equipment and antenna)</p> <p>- Equipment intended to transmit radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller) may be exempted from limit, within its communication frequency range, subject to the provisions in UR E22.5.2.</p>
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20.	Conducted Emission	CISPR 16-2-1	<p>Test applicable to AC and DC power ports</p> <p>For equipment installed in the bridge and deck zone.</p> <table border="1" data-bbox="1032 1161 1480 1278"> <thead> <tr> <th>Frequency range:</th> <th>Limits:</th> </tr> </thead> <tbody> <tr> <td>10 - 150 kHz</td> <td>96 - 50 dB<math>\mu</math>V</td> </tr> <tr> <td>150 - 350 kHz</td> <td>60 - 50 dB<math>\mu</math>V</td> </tr> <tr> <td>350 kHz - 30 MHz</td> <td>50 dB<math>\mu</math>V</td> </tr> </tbody> </table>	Frequency range:	Limits:	10 - 150 kHz	96 - 50 dB $\mu$ V	150 - 350 kHz	60 - 50 dB $\mu$ V	350 kHz - 30 MHz	50 dB $\mu$ V																					
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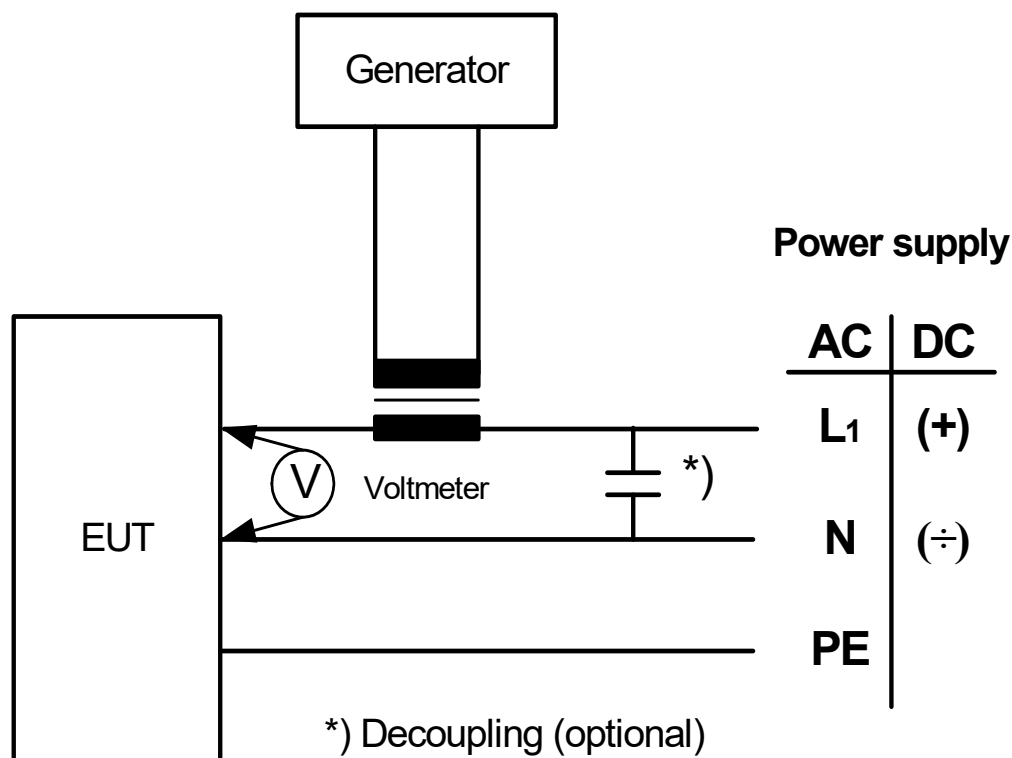
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			<p>For equipment installed in the general power distribution zone.</p> <table border="1" data-bbox="1032 300 1480 416"> <thead> <tr> <th data-bbox="1032 300 1256 331">Frequency range:</th> <th data-bbox="1256 300 1480 331">Limits:</th> </tr> </thead> <tbody> <tr> <td data-bbox="1032 331 1256 355">10 - 150 kHz</td> <td data-bbox="1256 331 1480 355">120 - 69 dB<math>\mu</math>V</td> </tr> <tr> <td data-bbox="1032 355 1256 379">150 - 500 kHz</td> <td data-bbox="1256 355 1480 379">79 dB<math>\mu</math>V</td> </tr> <tr> <td data-bbox="1032 379 1256 416">0.5 - 30 MHz</td> <td data-bbox="1256 379 1480 416">73 dB<math>\mu</math>V</td> </tr> </tbody> </table>	Frequency range:	Limits:	10 - 150 kHz	120 - 69 dB $\mu$ V	150 - 500 kHz	79 dB $\mu$ V	0.5 - 30 MHz	73 dB $\mu$ V	
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21.	Flame retardant	IEC 60092-101 or  IEC 60695-11-5	<p>Flame application: 5 times 15 s each. 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>	<ul style="list-style-type: none"> <li>- the burnt out or damaged part of the specimen by not more than 60 mm long.</li> <li>- no flame, no incandescence or</li> <li>- 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.</li> <li>- any dripping material shall extinguish itself in such a way as not to ignite a wrapping tissue. The drip height is 200 mm <math>\pm</math> 5 mm.</li> </ul>								

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Notes:

1. Dry heat at 70 °C is to be carried out to automation, control and instrumentation equipment subject to high degree of heat, for example mounted in consoles, housings, etc. together with other heat dissipating power equipment.
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.



**Figure - Test Set-up – Conducted Low Frequency Test**

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