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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 2, sub-part 6 of a multi-part deliverable covering the Environmental conditions and environmental tests for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions";

Part 2: "Specification of environmental tests";

Sub-part 0: "Introduction";

Sub-part 1: "Storage";

Sub-part 2: "Transportation";

Sub-part 3: "Stationary use at weatherprotected locations";

Sub-part 4: "Stationary use at non-weatherprotected locations";

Sub-part 5: "Ground vehicle installations";

Sub-part 6: "Ship environments";

Sub-part 7: "Portable and non-stationary use";

Sub-part 8: "Stationary use at underground locations".

Part 1 specifies different standardized environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use.

Part 2 specifies the recommended test severities and test methods for the different environmental classes.

Part 2-0 [i.1] forms a general overview of part 2. The present document deals with ship environments.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies test severities and methods for the verification of the required resistibility of equipment according to the relevant environmental class.

The tests defined in the present document apply to the use of telecommunication equipment installed permanently or temporarily in ships and cover the environments and the vessels stated in ETSI EN 300 019-1-6 [1].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 300 019-1-6: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-6: Classification of environmental conditions; Ship environments".

[2] IEC 60068-2-1 (03-2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".

[3] IEC 60068-2-2 (07-2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".

[4] IEC 60068-2-78 (10-2012): "Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state".

[5] IEC 60068-2-14 (01-2009): "Environmental testing - Part 2-14: Tests - Test N: Change of temperature".

[6] IEC 60068-2-30 (08-2005): "Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)".

[7] IEC 60068-2-18 (03-2017): "Environmental testing - Part 2-18: Tests - Test R and guidance: Water".

[8] IEC 60068-2-6 (12-2007): "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".

[9] IEC 60068-2-27 (02-2008): "Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 019-2-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2: Specification of environmental tests; Sub-part 0: Introduction".

[i.2] IEC 60068-2 (all parts): "Environmental testing - Part 2: Tests".

[i.3] ETSI EN 300 019-1-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-0: Classification of environmental conditions; Introduction".

[i.4] IEC 60068-2-52:2017: "Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)".

[i.5] IEC 60068-2-68:1994: "Environmental testing - Part 2-68: Tests - Test L: Dust and sand".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 300 019-1-0 [i.3] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 300 019-1-0 [i.3] apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 300 019-1-0 [i.3] apply.

4 Environmental test specification

4.0 General

The equipment shall be tested in its operational state throughout the test conditions described in the present document. The detailed descriptions of the environmental conditions shall refer to clauses 4 and 5 of ETSI EN 300 019-1-6 [1].

ETSI EN 300 019-2-0 [i.1] forms a general overview of part 2 of this multi-part deliverable.

4.1 Equipment setup and configuration

The equipment shall be tested in its operational state throughout the test conditions described in the present document unless otherwise stated. Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The heat dissipation shall be maximized, except for the steady state, low temperature test, where it shall be minimized.

4.2 Performance criteria

The following performance criteria shall apply in the tests defined by the present document.

Performance criterion A:

The equipment shall function according to the manufacturer specifications before, during and after the tests. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the equipment is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion B:

The equipment shall function according to the manufacturer specifications before and after the tests. During the test it is not required to monitor the equipment functionality. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the equipment is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion C:

The equipment shall function according to the manufacturer specifications before and after the tests. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the equipment is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

During the application of the test, temporary loss of function is allowed but after the test the equipment shall restore to the normal functionality without replacement of components, manual rebooting or human intervention.

The equipment shall sustain the test without permanent structural or mechanical damage.

Performance criterion D:

This performance criterion applies to the enclosure of the equipment. No corrosion traces (e.g. rust) or deterioration of the enclosure shall occur at the end of the test.

4.3 Specification T 6.1: Totally weatherprotected locations

The tests specifications T 6.1 of the present document shall apply to equipment, depending on the selected IEC mechanical class, installed in totally weatherprotected, heated and ventilated locations following warm-up on board engine-powered vessels but excluding refrigerated cargo spaces, machinery spaces and locations containing equipment dissipating considerable amounts of heat. This class does not cover Warm Damp and Warm Damp Equable climates. See tables 1 and 4.

4.4 Specification T 6.2: Partly weatherprotected locations

The tests specifications T 6.2 of the present document shall apply to equipment, depending on the selected IEC the mechanical class chosen, to equipment installed in any location on board engine-powered vessels - excluding refrigerated cargo spaces. The class applies in all climates with the exception of Cold climates and areas with abnormal rain intensities and hurricanes. The equipment may occasionally be subjected to heavy seas, See tables 2, 4 and 5.

4.5 Specification T 6.3: Non-weatherprotected locations

The tests specifications T 6.3 of the present document shall apply to equipment to equipment installed in any location on board engine-powered vessels, including refrigerated cargo spaces. This class applies in all climates including areas with abnormal rain intensities and hurricanes. The equipment may also be subjected to heavy seas, depending on the selected IEC mechanical class, see tables 3, 4 and 5.

4.6 Specification T 6.1: Totally weatherprotected locations climatic test

This specification in table 1 shall apply to a totally weatherprotected use in ships excluding described in ETSI EN 300 019-1-6 [1]. Warm Damp and Warm Damp Equable climates, see tables 1 and 4.

Table 1: Test specification T 6.1: Totally weatherprotected locations - climatic tests

Environmental parameter			Environmental Class 6.1	Environmental test specification T6.1: Ship, totally weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance Criterion**	**Notes**
Air temperature	low	(°C)	+5	+5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	A	1
	high	(°C)	+40	+40	16 h	IEC 60068-2-2 [3]	Bb/Bd/Be: Dry heat	A	2
	change	air/water (°C)	no						
	surface	high (°C)	no						
Humidity	relative	low (%)	10	none					3
		high; (%) slow temperature change (°C)	95 +30	93 +30	96 h	IEC 60068-2-78 [4]	Cb: Damp heat steady state	A	4
		high; (%) rapid temperature change (°C)	no						
	absolute	high; (g/m^3) rapid temperature change (°C)	no						
Air	speed	(m/s)	no						
Water	temperature	high (°C)	+30	none					3
		low (°C)	no						
	rain	intensity (mm/min) volume (m^3/min) pressure (kPa)	no						
	other sources	velocity (m/s)	no						
	wetness		no						
Radiation	solar	(W/m^2)	no						
	heat	(W/m^2)	no						
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,1	none					5
		H_2S (mg/m^3)	0,01	none					5
	chlorine	sea salts	negligible						
		HCl (mg/m^3)	0,1	none					5
	nitrogen	NO_x (mg/m^3)	0,1	none					5
		NH_3 (mg/m^3)	0,3	none					5
	hydrogen fluoride	HF (mg/m^3)	0,003	none					5
	ozone	O_3 (mg/m^3)	0,01	none					5

Environmental parameter			Environmental Class 6.1	Environmental test specification T6.1: Ship, totally weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance Criterion**	**Notes**
Mechanically	dust	sedimentation	negligible						
active	sand in air		no						
substances	soot deposit		no						
Flora and	micro organisms		negligible						
Fauna	rodents, insects		negligible						

no: This condition does not occur in this class.
none: See note for detail on why test severity is not required..

NOTE 1: (Air temperature, low). The characteristic severity can be used as a cold start-up temperature, but it may be modified by the product specification. The equipment under test shall remain operational throughout this test, except for the cold start-up test which shall commence once low temperature stability is achieved.
NOTE 2: (Air temperature, high). If two temperatures are given, the higher test temperature includes heat trap effect of direct solar radiation on equipment. The equipment under test shall remain operational throughout this test, except for the start-up at high temperature, which shall commence once high temperature stability is achieved.
NOTE 3: As there is no IEC 60068-2 [i.2] test method for this parameter, no tests are defined.
NOTE 4: (Humidity, relative, high, slow temperature change). These severities are the nearest preferred values in IEC 60068-2-78 [4] Test Cb. The minor differences both in temperature and in humidity conditions are considered to be insignificant.
NOTE 5: (Chemically active substances). The characteristic severities are maximum values. For chemically active substances the characteristics severities should be considered when choosing components and materials. No test is recommended in the present document.

4.7 Specification T 6.2: Partly weatherprotected locations climatic test

This specification shall apply to use in ships excluding Cold Climate and extreme weather conditions, see tables 2, 4 and 5.

Table 2: Test specification T 6.2: Partly weatherprotected locations - climatic tests

Environmental parameter				Environmental Class 6.2	Environmental test specification T6.2: Ship, partly weatherprotected locations					
Type	**Parameter**	**Detail parameter**		**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
Air temperature	low		(°C)	-25	-25	16 h	IEC 60068-2-1 [2]	Ab/Ad: Cold	A	1
	high		(°C)	+70	+70 or +85	16 h	IEC 60068-2-2 [3]	Bb/Bd: Dry heat	A	2
	change	gradual	(°C) (°C/min)	-25/+40 3	-25/+40 3	5 cycles t_1 = 3 h	IEC 60068-2-14 [5]	Nb: Change of temperature	A	3
	change	air/water	(°C)	+40/+5	none					**4**
	surface	high	(°C)	+70	none				**A**	**5**

Environmental parameter			Environmental Class 6.2	Environmental test specification T6.2: Ship, partly weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
Humidity	relative	low (%)	10	none					6
		high; (%) slow temperature change (°C)	95 +45	93 +40	96 h	IEC 60068-2-78 [4]	Cb: Damp heat steady state	A	7
		high; (%) rapid temperature change (°C)	95 -25/+35	none					8
	absolute	high; (g/m^3) rapid temperature change (°C) (%) (°C)	60 +70/+15	 90 to 100 +55	 6 cycles	 IEC 60068-2-30 [6]	 Db: Damp heat cyclic, variant 2	A	9
Air	speed	(m/s)	30	none					6
Water	temperature	high (°C)	+35	none					6
		low (°C)	freezing point	none					10
	rain	intensity (mm/min) volume (m^3/min) pressure (kPa)	6	 0,01 90	 1 min/m^2 or 5 min	IEC 60068-2-18 [7]	Rb: Impacting water method 1.2	A	11
	other sources	velocity (m/s)	3	none					12
	wetness		wet surfaces	none					13
Radiation	solar	(W/m^2)	1 120	none					14
	heat	(W/m^2)	1 200	none					14
Chemically active substances	sulphur	SO_2 (mg/m^3)	1,0	none					15
		H_2S (mg/m^3)	0,5	none					15
	chlorine	salts mist	yes	none					15
		sea salts (kg/m^3)	30	none					15
		HCl (mg/m^3)	0,5	none					15
	nitrogen	NO_x (mg/m^3)	1,0	none					15
		NH_3 (mg/m^3)	3,0	none					15
	hydrogen fluoride	HF (mg/m^3)	0,03	none					15
	ozone	O_3 (mg/m^3)	0,1	none					15
Mechanically active substances	dust	sedimentation ($mg/(m^2h)$)	3,0	none					16
	sand in air	(mg/m^3)	0,1	none					16
	soot deposit		yes	none					16
Flora and Fauna	micro organisms		mould, fungus etc.	none					17
	rodents, insects		rodents, etc.	none					17
no: This condition does not occur in this class. none: See note for detail on why test severity is not required.									

Environmental parameter			Environmental Class 6.2	Environmental test specification T6.2: Ship, partly weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
NOTE 1: (Air temperature, low). The characteristic severity can be used as a cold start-up temperature, but it may be modified by the product specification. The equipment under test shall remain operational throughout this test, except for the cold start-up test which shall commence once low temperature stability is achieved.									
NOTE 2: (Air temperature, high). If two temperatures are given, the higher test temperature includes heat trap effect of direct solar radiation on equipment. The equipment under test shall remain operational throughout this test, except for the start-up at high temperature, which shall commence once high temperature stability is achieved.									
NOTE 3: (Air temperature, change, gradual). IEC 60068-2-14 [5] Test Nb has been chosen with characteristic severity. The equipment function shall be monitored throughout the test.									
NOTE 4: (Air temperature, change, air/water). This condition is included in the test IEC 60068-2-14 [5] Test Nb.									
NOTE 5: (Air temperature, surface, high). There is no suitable IEC 60068-2 [i.2] test method for this parameter. This phenomenon should be taken into account when selecting materials.									
NOTE 6: As there is no IEC 60068-2 [i.2] test method for this parameter, no tests are defined.									
NOTE 7: (Humidity, relative, high, slow temperature change). These severities are the nearest preferred values in IEC 60068-2-78 [4] Test Cb. The minor differences both in temperature and in humidity conditions are considered to be insignificant.									
NOTE 8: (Humidity, relative, high, rapid temperature change). Rapid temperature change is a relevant parameter and therefore equipment should be designed with this requirement in mind. The wetting effect is included in IEC 60068-2-30 [6] Test Db.									
NOTE 9: (Humidity, absolute, rapid temperature change). For rapid change of temperature IEC 60068-2-30 [6] Test Db, Variant 2 is recommended.									
NOTE 10: (Water, temperature, low). The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [5] Test Nb.									
NOTE 11: (Water, rain). IEC 60068-2-18 [7] Test Rb method 1.2 has been chosen even though it does not imitate normal rain. It is a simple hand-held shower test, which is easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The greater of the two given durations should be used.									
NOTE 12: (Water, other sources). The effect of water is covered by IEC 60068-2-18 [7] Test Rb. This test does not demonstrate the mechanical shock caused by water waves. In IEC 60068-2 [i.2] series there is no suitable test for this, but the effect has to be considered in the design of equipment. The corrosion effect of sea water should be considered when choosing materials and components. In particular, IEC 60068-2-52 [i.4] Test: Kb severity 1 is recommended.									
NOTE 13: (Water, wetness). If the equipment is in contact with wet surfaces the corrosion and degeneration effect has to be considered.									
NOTE 14: (Radiation, solar, heat). The effect of direct sun radiation is included in the higher test value in IEC 60068-2-2 [3] Test Bb/Bd as described in note 2. Photochemical tests can be made separately for components and materials.									
NOTE 15: (Chemically active substances). The characteristic severities are maximum values. For chemically active substances the characteristics severities should be considered when choosing components and materials. No test is recommended in the present document.									
NOTE 16: (Mechanically active substances). The characteristic seventies are much lower than the lowest severity in IEC 60068-2-68 [i.5] Test Lb and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.									
NOTE 17: (Flora, fauna). The characteristic severities should be considered when choosing components and materials.									

4.8 Specification T 6.3: Non-weatherprotected locations climatic tests

This specification shall apply to normal unlimited use in ships, see tables 3, 4 and 5.

Table 3: Test specification T 6.3: Non weatherprotected locations - climatic tests

Environmental parameter			Environmental Class 6.3	Environmental test specification T6.3: Ship, non weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
Air temperature	low	(°C)	-40	-40	16 h	IEC 60068-2-1 [2]	Ab/Ad: Cold	A	1
	high	(°C)	+70	+70 or +85	16 h	IEC 60068-2-2 [3]	Bb/Bd: Dry heat	A	2
	change	gradual (°C) (°C/min)	-25/+40 3	-25/+40 3	5 cycles t_1 = 3 h	IEC 60068-2-14 [5]	Nb: Change of temperature	A	3
		air/water (°C)	+40/+5	none					4
	surface	high (°C)	+70	none					5
Humidity	relative	low (%)	10	none					6
		high; (%) slow temperature change (°C)	95 +45	93 +40	21 days	IEC 60068-2-78 [4]	Cb: Damp heat steady state	A	7
		high; (%) rapid temperature change (°C)	95 -25/+35	none					8
	absolute	high; (g/m^3) rapid temperature change (°C) (%) (°C)	60 +70/+15	90 to100 +55	6 cycles	IEC 60068-2-30 [6]	Db: Damp heat cyclic, variant 2	A	9
Air	speed	m/s	50	none					6
Water	temperature	high (°C)	+35	none					6
		low (°C)	freezing point	none					10
	rain	intensity (mm/min) volume (m^3/min) pressure (kPa)	15	0,01 90	1 min/m^2 or 5 min	IEC 60068-2-18 [7]	Rb: Impacting water method 1.2	A	11
	other sources	velocity (m/s)	10	none					12
	wetness		wet surfaces	none					13
Radiation	solar	(W/m^2)	1 120	none					14
	heat	(W/m^2)	1 200	none					14

Environmental parameter			Environmental Class 6.3	Environmental test specification T6.3: Ship, non weatherprotected locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
Chemically active substances	sulphur	SO_2 (mg/m^3)	1,0	none					15
		H_2S (mg/m^3)	0,5	none					15
	chlorine	salts mist	yes	none					15
		sea salts (kg/m^3)	30	none					15
		HCl (mg/m^3)	0,5	none					15
	nitrogen	NO_x (mg/m^3)	1,0	none					15
		NH_3 (mg/m^3)	3,0	none					15
	hydrogen fluoride	HF (mg/m^3)	0,03	none					15
	ozone	O_3 (mg/m^3)	0,1	none					15
Mechanically active substances	dust	sedimentation ($mg/(m^2h)$)	3,0	none					16
	sand in air	(mg/m^3)	0,1	none					16
	soot deposit		yes	none					16
Flora and	micro organisms		mould, fungus, etc.	none					17
Fauna	rodents, insects		rodents, etc.	none					17

no: This condition does not occur in this class.
none: See note for detail on why test severity is not required
NOTE 1: (Air temperature, low). The characteristic severity can be used as a cold start-up temperature, but it may be modified by the product specification. The equipment under test shall remain operational throughout this test, except for the cold start-up test which shall commence once low temperature stability is achieved.
NOTE 2: (Air temperature, high). If two temperatures are given, the higher test temperature includes heat trap effect of direct solar radiation on equipment. The equipment under test shall remain operational throughout this test, except for the start-up at high temperature, which shall commence once high temperature stability is achieved.
NOTE 3: (Air temperature, change, gradual). IEC 60068-2-14 [5] Test Nb has been chosen with characteristic severity. The equipment function shall be monitored throughout the test.
NOTE 4: (Air temperature, change, air/water). This condition is included in the test IEC 60068-2-14 [5] Test Nb.
NOTE 5: (Air temperature, surface, high). There is no suitable IEC 60068-2 [i.2] test method for this parameter. This phenomenon should be taken into account when selecting materials.
NOTE 6: As there is no IEC 60068-2 [i.2] test method for this parameter, no tests are defined.
NOTE 7: (Humidity, relative, high, slow temperature change). These severities are the nearest preferred values in IEC 60068-2-78 [4] Test Cb. The minor differences both in temperature and in humidity conditions are considered to be insignificant.
NOTE 8: (Humidity, relative, high, rapid temperature change). Rapid temperature change is a relevant parameter and therefore equipment should be designed with this requirement in mind. The wetting effect is included in IEC 60068-2-30 [6] Test Db.
NOTE 9: (Humidity, absolute, rapid temperature change). For rapid change of temperature IEC 60068-2-30 [6] Test Db, Variant 2 is recommended.
NOTE 10: (Water, temperature, low). The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [5] Test Nb.
NOTE 11: (Water, rain). IEC 60068-2-18 [7] Test Rb method 1.2 has been chosen even though it does not imitate normal rain. It is a simple hand held shower test, which is easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The greater of the two given durations should be used.
NOTE 12: (Water, other sources). The effect of water is covered by IEC 60068-2-18 [7] Test Rb. This test does not demonstrate the mechanical shock caused by water waves. In IEC 60068-2 [i.2] series there is not a suitable test for this, but the effect has to be considered in the design of equipment. The corrosion effect of sea water should be considered when choosing materials and components. In particular, IEC 60068-2-52 [i.4] Test: Kb severity 1 is recommended.
NOTE 13: (Water, wetness). If the equipment is in contact with wet surfaces the corrosion and degeneration effect has to be considered.
NOTE 14: (Radiation, solar, heat). The effect of direct sun radiation is included in the higher test value in IEC 60068-2-2 [3] Test Bb/Bd as described in note 2. Photochemical tests can be made separately for components and materials.
NOTE 15: (Chemically active substances). The characteristic severities are maximum values. For chemically active substances the characteristics severities should be considered when choosing components and materials. No test is recommended in the present document.
NOTE 16: (Mechanically active substances). The characteristic seventies are much lower than lowest severity in IEC 60068-2-68 [i.5] Test Lb and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.
NOTE 17: (Flora, fauna). The characteristic severities should be considered when choosing components and materials.

4.9 Specification T 6.1, T 6.2 and T 6.3: protected and partly protected installation, mechanical tests

This specification shall apply to all classes in ships environment covered by the present document, see tables 4 and 5.

Table 4: Test specification T 6.1 to T 6.3: Ship locations - mechanical tests (IEC Class 6M3)

Environmental parameter			Environmental Class 6.1 to 6.3	Environmental test specification T 6.1 to 6.3: Ship locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance Criterion**	**Notes**
Vibration	sinusoidal	displacement (mm) acceleration (m/s^2) frequency range (Hz) axes of vibration	1,5 20 2 to 18 18 to 200	1,5 19,6 5 to 18 18 to 200 3 axes	3 x 10 sweep cycles	IEC 60068-2-6 [8]	Fc: vibration (sinusoidal)	A	1
	sinusoidal	displacement (mm) acceleration (m/s^2) frequency range (Hz) axes of vibration	1,5 20 2 to 18 18 to 200	1,0 7,0 5 to 13 13 to 80 3 axes	3 x 10 sweep cycles	IEC 60068-2-6 [8]	Fc: vibration (sinusoidal)	A	2
Shocks	shocks	shock spectrum type duration (ms) acceleration (m/s^2) mass (kg) shocks directions of shocks	I II III 11 6 2, 3 100 300 500	half sine 6 300 ≥ 100 6	3 shocks in each direction	IEC 60068-2-27 [9]	Ea: Shock	A	3
	bump	acceleration (m/s^2) mass (kg) duration (ms) bumps direction of bumps	no	250 < 100 6 6	100 bumps in each direction	IEC 60068-2-27 [9]	Eb: Bump	A	3
Acceleration, steady state		x-direction (m/s^2) (surge) y-direction (m/s^2) (sway) z-direction (m/s^2) (heave)	5 6 10	none none none					
Angular motion	static	rotation around (deg) x-axis (list)	15	none					
	static	rotation around (deg) y-axis (trim)	10	none					
	dynamic	rotation around (deg) x-axis (roll) (Hz)	22,5 0,14	none					
	dynamic	rotation around (deg) y-axis (pitch) (Hz)	10 0,2	none					
	dynamic	rotation around (deg) z-axis (yaw) (Hz)	4 0,05	none					

Environmental parameter			Environmental Class 6.1 to 6.3	Environmental test specification T 6.1 to 6.3: Ship locations					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance Criterion**	**Notes**

no: This condition does not occur in this class.
none: See note for detail on why test severity is not required.
NOTE 1: (Vibration, sinusoidal).
Test severity covers all types of vessels in any condition.
The severities are given as peak values. Test severity values not specified in IEC 60068-2-6 [8]. The test severity is the same as the characteristic severity. In class 6M4 the maximum test frequency has been reduced because between 150 Hz and 200 Hz the contribution is insignificant. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
A 30-minute endurance test shall be carried out at any significant resonant frequencies.
NOTE 2: (Vibration, sinusoidal).
Test severity covers larger types of ships that do not navigate in ice.
The severities are given as peak values. Test severity values not specified in IEC 60068-2-6 [8]. The test severity is lower than the characteristic severity, which is considered to be too severe for this class. The maximum test frequency has been reduced because between 80 Hz and 200 Hz the contribution is insignificant. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
A 30-minute endurance test shall be carried out at any significant resonant frequencies.
NOTE 3: (Shocks).
Shock to a hull is most likely to be perceived by the equipment as a bump. A shock test is specified for equipment ≥ 100 kg as this is the most practical test.
The severities are given as peak values. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
If the normal attitude is specified then the number of directions is reduced to 3.

Table 5: Mechanical tests - Alternative for Classes 6.2 and 6.3 (IEC Class 6M4)

Environmental parameter			Environmental Class 6.2 to 6.3	Environmental test specification T 6.2 and 6.3: Ship locations Alternative test (IEC Class 6M4)					
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Performance criterion**	**Notes**
Vibration	sinusoidal	displacement (mm) acceleration (m/s^2) frequency range (Hz) axes of vibration	1,5 50 2 to 28 28 to 200	1,5 49 5 to 28 28 to 150 3 axes	3 x 10 sweep cycles	IEC 60068-2-6 [8]	Fc: vibration (sinusoidal)	A	1
Shocks	shocks	shock spectrum type duration (ms) acceleration (m/s^2) mass (kg) shocks directions of shocks	I II III 11 6 2,3 100 300 500	half sine 6 300 ≥ 100 6	3 shocks in each direction	IEC 60068-2-27 [9]	Ea: Shock	A	2
	bump	acceleration (m/s^2) mass (kg) duration (ms) bumps direction of bumps		400 < 100 6 6	100 bumps in each direction	IEC 60068-2-27 [9]	Ed: Bump	A	2
Acceleration, steady state		x-direction (surge) (m/s^2) y-direction (sway) (m/s^2) z-direction (heave) (m/s^2)	5 6 10	none none none					
Angular motion	static	rotation around x-axis (list) (deg)	15	none					
		rotation around y-axis (trim) (deg)	10	none					
	dynamic	rotation around x-axis (roll) (deg) (Hz)	22,5 0,14	none					
		rotation around y-axis (pitch) (deg) (Hz)	10 0,2	none					
		rotation around z-axis (yaw) (deg) (Hz)	4 0,05	none					

no: This condition does not occur in this class.
none: See note for detail on why test severity is not required.
NOTE 1: (Vibration, sinusoidal).
Test severity covers all types of vessels in any condition.
The severities are given as peak values. Test severity values not specified in IEC 60068-2 [i.2]. The test severity is the same as the characteristic severity. In class 6M4 the maximum test frequency has been reduced because between 150 Hz and 200 Hz the contribution is insignificant. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
A 30-minute endurance test shall be carried out at any significant resonant frequencies.
NOTE 2: (Shocks).
Shock to a hull is most likely to be perceived by the equipment as a bump. A shock test is specified for equipment ≥ 100 kg as this is the most practical test.
The severities are given as peak values. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
If the normal attitude is specified, then the number of directions is reduced to 3.

Annex A (informative): Bibliography

- ETSI ETR 035: "Equipment Engineering (EE); Environmental engineering; Guidance and terminology".
- IEC 60068-1: "Environmental testing. Part 1: General and guidance".

History

Document history		
Edition 1	May 1994	Publication as ETSI ETS 300 019-2-6
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