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Contents

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Foreword

This multi-part European Telecommunication Standard (ETS) has been produced by the Equipment Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This standard is concerned with environmental conditions and environmental tests for telecommunications equipment and comprises two main parts, each with subdivisions:

- ETS 300 019-1: "Classification of environmental conditions".

  This part of the standard, Part 1, specifies different standardised environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use.

- ETS 300 019-2: "Specification of environmental tests".

  This part of the standard will specify the test requirements for the different environmental classes.

Each part of the standard is divided into sub-parts. Sub-part 1-0 will form a general overview of Part 1. This sub-part, Sub-part 1-6, deals with ship environments.

This part of the standard (Part 1) was submitted to Public Enquiry as prETS 300 019 Part B. The original Part A is to be published as ETSI Technical Report ETR 035 entitled: "Equipment Engineering (EE); Environmental engineering Guidance and terminology".

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1 Scope

The purpose of this sub-part of this standard is to define the classes of environmental conditions and their severities to which equipment may be exposed. Only severe conditions, which may be harmful to the equipment, are included. The severities specified are those which will have a low probability of being exceeded; generally less than 1 %.

This sub-part applies to equipment designed principally for maritime use. Conditions of use vary significantly in relation to the size of the vessel and the function for which it was designed. The reader should ensure that the relevant classes are chosen to suit this particular application.

This sub-part covers the following types of vessel:

- vessel propelled by mechanical means, including offshore units;

- vessel not propelled by mechanical means, including sailing boats and life rafts.

The classes defined apply to all sizes of vessel from pleasure craft to trawlers, ferry boats, icebreakers and cargo ships including tankers.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETR 035: "Equipment Engineering (EE); Environmental engineering Guidance and terminology".

[2] IEC Publication 721-3-6: "Ship environment".

[3] IEC Publication 721-2-1: "Temperature and humidity".

[4] IEC Publication 68-2-27: "Test Ea: Shock".

[5] IEC Publication 92-502: "Special features - Tankers".

[6] ISO Publication 2041: "Vibration and Shock - Vocabulary".

3 Definitions

In this sub-part of this standard, the following definitions apply:

Totally weatherprotected location: direct weather influences are totally excluded.

Partly weatherprotected location: direct weather influences are not completely excluded.

Non-weatherprotected location: A location at which the equipment is not protected from direct weather influences.

4 Environmental classes

4.1 Class 6.1: Totally weatherprotected locations

This class is a combination of classes 6K1/6B1/6C1/6S1/6M3 in IEC publication 721-3-6 [2].

This class applies to equipment 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.

NOTE: Climatic conditions for different areas are defined in IEC publication 721-2-1 [3].

This class applies to:

- equipment which is not exposed to heat radiation from adjacent equipment, heating elements or to solar radiation through glass or transparent materials;

- installations on board vessels operating in areas without particular risk of attack by flora or fauna. It also covers other vessels where the installations are located in compartments of such construction that mould growth and attacks by animals are unlikely;

- totally weatherprotected installations which are not subjected to salt mist, engine exhausts or emissions from nearby industrial sources;

- installations protected from sand, dust and ingress of soot;

- installations on board engine-powered vessels of all sizes.

4.2 Class 6.2: Partly weatherprotected locations

This class is a combination of classes 6K4/6B2/6C3/6S2/6M3 or 6M4 in IEC publication 721-3-6 [2].

This class applies, depending on 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 the NOTE to subclause 4.1).

This class applies to:

- equipment which is subjected to direct solar radiation, to considerable heat dissipation from boilers, engines etc., to rain and water jets. The equipment may be connected to wet surfaces;

- non-protected installations on board vessels operating in areas where mould growth and attacks by animals may occur;

- non-weatherprotected installations on board vessels operating close to industrial areas with considerable air pollution emissions. Salt mist and exposure to engine exhausts are included;

- all installations where sweeping of dusty decks may take place. It also covers locations subject to emissions from boiler exhausts (e.g. soot, acid, etc.). Non-weatherprotected installations on board vessels operating close to sand deserts are not covered;

- class 6M3: installations on board engine-powered vessels of all sizes but excluding equipment connected directly to reciprocating types of machinery. Equipment connected directly to loading systems, container guides, cranes and installations in dredgers are included;

- class 6M4: all installations on board engine-powered vessels of all sizes including equipment connected directly to reciprocating types of machinery.

NOTE: The proper mechanical IEC class 6M3 or 6M4 shall be chosen according to the expected installations and use of the equipment.

4.3 Class 6.3: Non-weatherprotected locations

This class is a combination of classes 6K5/6B2/6C3/6S2/6M3 or 6M4 in IEC publication 721-3-6 [2].

This class applies, depending on the mechanical class chosen, 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. (See the note to subclause 4.1).

This class applies to:

- equipment which is subjected to direct solar radiation, to considerable heat dissipation from boilers, engines etc., to abnormal rain, heavy seas and water jets. The equipment may be connected to wet surfaces;

- non-weatherprotected installations on board vessels operating in areas where mould growth and attacks by animals may occur;

- non-weatherprotected installations on board vessels operating close to industrial areas with considerable air pollution emissions. Salt mist and exposure to engine exhausts are included;

- all installations where sweeping of dusty decks may take place. It also covers locations subject to emissions from boiler exhausts (e.g. soot, acid, etc.). Non-weatherprotected installations on board vessels operating close to sand deserts are not covered;

- class 6M3: installations on board engine-powered vessels of all sizes but excluding equipment connected directly to reciprocating types of machinery. Equipment connected directly to loading systems, container guides, cranes and installations in dredgers are included;

- class 6M4: all installations on board engine-powered vessels of all sizes including equipment connected directly to reciprocating types of machinery (see the NOTE to subclause 4.2).

5 Environmental c onditions

5.1 Climatic conditions

Table 1: Climatic conditions for environmental classes 6.1 to 6.3

Environmental parameter	Unit	Class		
		6.1	6.2	6.3
a) Low temperature, air	°C	+ 5	- 25	- 40 (NOTE 1)
b) Low temperature, water	°C	none	Freezing-point of water (NOTE 2)	
c) High temperature, air	°C	+ 40	+ 70	+ 70
d) High temperature, surfaces (NOTE 3)	°C	none	+ 70	+ 70
e) High temperature, water	°C	+ 30	+ 35	+ 35
f) Gradual change of temperature, air, air	°C °C/minute	none	- 25/+ 40 3	- 25/+ 40 3
g) Change of temperature, air/water	°C	none	+ 40/+ 5	+ 40/+ 5
h) Humidity, not combined with rapid temperature changes	% °C	95 + 30	95 + 45	95 + 45
i) Humidity, combined with rapid temperature changes, air/air at high relative humidities	% °C	none	95 - 25/+ 35	95 - 25/+ 35
j) Humidity combined with rapid temperature changes, air/air at high water content (NOTE 4)	g/m^3 °C	none	60 + 70/+ 15	60 + 70/+ 15
k) Low relative humidity	% °C	10 + 30	10 + 30	10 + 30
l) Movement of the surrounding medium, air	m/s	negligible	30	50
m) Precipitation, rain	mm/min	none	6	15
n) Solar radiation	W/m^2	negligible	1120	1120
o) Heat radiation	W/m^2	negligible	1200	1200
p) Water from sources other than rain	m/s	none	3	10
q) Wetness	none	no	w e t s u r f a c e s	

NOTE 1: Vessels will normally not navigate when air temperatures are below – 40 °C. Equipment may, however, be left unprotected on board vessels which are temporarily laid–up in harbour during the coldest period of the year. In such instances equipment, in the non–operational state, may have to withstand temperatures down to – 55 °C. In exceptional circumstances in inland waterways vessels may also navigate when temperatures are below – 40 °C.

NOTE 2: The freezing–point may be lower than 0 °C due to presence of salt or pollution, etc.

NOTE 3: Surface temperatures refer to hot parts to which the equipment may be attached. More extreme surface temperatures can exist, for instance on machines, and may have to be considered.

NOTE 4: The equipment is assumed to be subjected to a rapid decrease of temperature only (no rapid increase). The figure for water content applies to temperatures down to the dew–point. At lower temperatures the relative humidity is assumed to be approximately 100 %.

5.2 Biological conditions

Table 2: Biological conditions for environmental classes 6.1 to 6.3

Environmental parameter	Unit	Classes	
		6.1	6.2 and 6.3
a) Flora	None	Negligible	Presence of mould, fungus, etc.
b) Fauna	None	Negligible	Presence of rodents and other animals harmful to equipment.

5.3 Chemically active substances

Table 3: Chemically active substances for environmental classes 6.1 to 6.3

Environmental parameter	Unit	Class (NOTE 1)	
		6.1	6.2 and 6.3
Substances in air:			
a) Salts (NOTES 2,3)	none	no	yes (NOTE 4)
b) Sulphur dioxide	mg/m^3 cm^3/m^3	0,1 0,037	1,0 0,37
c) Hydrogen sulphide	mg/m^3 cm^3/m^3	0,01 0,0071	0,5 0,36
d) Nitrogen oxides (expressed as the equivalent values of nitrogen dioxide)	mg/m^3 cm^3/m^3	0,1 0,052	1,0 0,52
e) Ozone	mg/m^3 cm^3/m^3	0,01 0,005	0,1 0,05
f) Hydrogen chloride	mg/m^3 cm^3/m^3	0,1 0,066	0,5 0,33
g) Hydrogen fluoride	mg/m^3 cm^3/m^3	0,003 0,0036	0,03 0,036
h) Ammonia	mg/m^3 cm^3/m^3	0,3 0,42	3,0 4,2
Substances in water: (NOTE 5) i) Sea salts	kg/m^3	negligible	30

NOTE 1: The values given are maximum values.

NOTE 2: Other substances and severities may occur due to a specific cargo carried. For tankers, reference is made to IEC publication 92–502 [5].

NOTE 3: Explosive atmospheres are outside the scope of this document and therefore not included.

NOTE 4: No value at present.

NOTE 5: Substances in water, other than sea salts, are not included. These substances are considered to have a negligible effect on telecommunications equipment which is already protected from the effect of sea salts.

5.4 Mechanically active substances

Table 4: Mechanical active substances for environmental classes 6.1 to 6.3

Environmental parameter	Unit	Class (NOTE 1)	
		6.1	6.2 and 6.3
a) Sand in air (NOTE 2)	mg/m^3	none	0,1 (NOTE 3)
b) Dust (Sedimentation) (NOTE 2)	$mg/(m^2h)$	negli-gible	3,0
c) Soot deposit	none	none	Presence of soot

NOTE 1: Droplets of oil may be present in the air in machinery spaces. A concentration of 3 mg/m^3 air may occur. Higher concentrations of up to 20 mg/m^3 air may be present close to diesel engines or in oil separator rooms.

NOTE 2: Other severities of dust and sand may occur due to specific cargoes which may contain dusty materials and sand (including abrasive substances). The distribution of particle size and chemical composition is important as well as the quantity of the particles (no values at present).

NOTE 3: Near sand deserts the amount of sand in air may be 100 times greater.

5.5 Mechanical conditions

Table 5: Mechanical conditions for environmental classes 6.1 to 6.3

Environmental parameter	Unit	Class (NOTE 1)	
		6M3	6M4
a) Stationary vibration, sinusoidal (NOTES 2,3)			
displacement amplitude	mm	1,5	1,5
acceleration amplitude	m/s^2	20	50
frequency range	Hz	2-18 18-200	2 -28 28-200
b) Non-stationary vibration, including shock (NOTE 3)			
shock response spectrum I			
peak acceleration (â)	m/s^2	100	100
shock response spectrum II (NOTE 4)			
peak acceleration (â)	m/s^2	300	300
shock response spectrum III			
peak acceleration (â)	m/s^2	500	500
c) Angular deviation, static condition: (NOTE 5)			
rotation around X-axis (list), angle	degree	15	15
rotation around Y-axis (trim), angle	degree	10	10
d) Angular motion, dynamic condition: (NOTE 5)			
rotation around X-axis (roll), angle	degree	22,5	22,5
frequency	Hz	0,14	0,14
rotation around Y-axis (pitch), angle	degree	10	10
frequency	Hz	0,2	0,2
rotation around Z-axis (yaw), angle	degree	4	4
frequency	Hz	0,05	0,05
e) Steady-state acceleration: (NOTE 5)			
X-direction (surge)	m/s^2	5	5
Y-direction (sway)	m/s^2	6	6
Z-direction (heave)	m/s^2	10	10

NOTE 1: The choice of class 6M3 or 6M4 depends on the installation and use.

NOTE 2: Vibration generated by conventional marine engines is mainly of a sinusoidal nature with a pronounced low frequency content. High-frequency vibration of up to 2000 Hz and of intensities up to 50 m/s^2 will, however, be present in icebreakers. Random vibration is also present in vessels due to forces produced by contact between the hull, or the propeller, and the water. The levels are normally low and therefore random vibration has not been included.

NOTE 3: Special attention should be given to the frequency of occurrence of vibration and shock when considering the mechanical conditions for hovercraft and hydrofoils.

NOTE 4: Shock response spectra are illustrated in figure 1. The concept of shock response spectrum (shock spectrum) is described in detail in IEC publication 68-2-27 [4], Appendix A: Shock spectra and other characteristics of pulse shape. A reference is also made to ISO publication 2041 [6]. The classification is related to three model spectra:

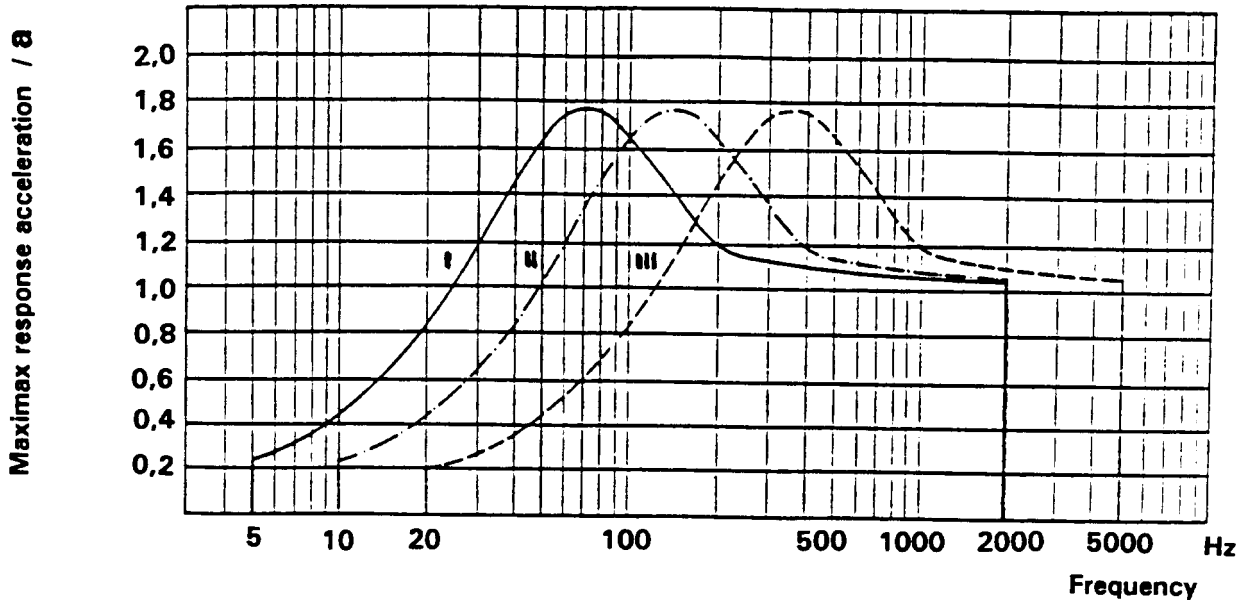
I One spectrum typical for shocks with long duration and relatively low peak acceleration.

II One Spectrum typical for shocks with medium duration and medium peak acceleration.

III One spectrum typical for shocks with short duration and high peak acceleration.

NOTE 5: The three orthogonal axes related to the vessel are:

- X - fore and aft;
- Y - athwart;
- Z - vertical.



Spectrum type I: Duration: 11 ms.

Spectrum type II: Duration: 6 ms.

Spectrum type III: Duration: 2.3 ms.

Figure 1: Model Shock Response Spectra (First Order Maximax Shock Response Spectra, see IEC Publication 721-3-6 [2]). For definition of Maximax see IEC Publication 68-2-27 [4].

History

Document history	
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