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**Equipment Engineering (EE);
Environmental conditions and environmental tests for
telecommunications equipment
Part 1-7: Classification of environmental conditions
Portable and non-stationary use**

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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 1-7, deals with portable and non-stationary use.

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 during portable and non-stationary use including periods of transfer, down time, maintenance and repair.

2 Normative references

- [1] ETR 035: "Equipment Engineering (EE); Environmental engineering Guidance and terminology".
- [2] IEC Publication 721-3-7: "Portable and non-stationary use".
- [3] IEC Publication 721-2-1: "Temperature and Humidity".
- [4] IEC Publication 68-2-27: "Test Ea: Shock".

3 Definitions

Portable and non-stationary use: the equipment may be moved frequently from place to place. The total transfer time may amount to a significant portion of the equipment's lifetime. The equipment is not permanently mounted on any structure or placed at a fixed site. The equipment may be operating while being either in a stationary or in a transfer state.

Weatherprotected location: a location at which the equipment is protected from direct weather influences.

Totally weatherprotected location: (enclosed location) direct weather influences are totally excluded.

Partly weatherprotected: location (sheltered 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

Two mechanical classes, 7M2 and 7M3, are used and cover all the environmental classes 7.1 to 7.3 E.

The relevant class is determined by consideration of the expected handling, means of transfer and complete use-profile of the equipment.

The special, severe, class 7M3 applies to use only in circumstances where the equipment is exposed to rough handling, severe shocks and vibration e.g. from the means of transfer or rotating machinery.

The severities shown in parentheses, e.g. (7C1), may be selected for special applications.

4.1 Class 7.1: Temperature controlled locations

This class is a combination of classes 7K1/7Z2/7Z4/7B1/7C2(7C1)/7S1/7M2 or 7M3 in IEC publication 721-3-7 [2].

This class applies to use at, and direct transfer between, permanently temperature-controlled and enclosed locations. Humidity is usually not controlled. The climatogram is shown in figure 1.

Heating, cooling or humidification is used, where necessary, to maintain the required conditions, especially where there is a large difference between the internal climate and that open-air climate. Heating or cooling may be switched off for periods but the occurrence of extremely high or low temperatures is prevented.

This class applies to use at, and transfer between, locations:

- where the equipment may be exposed to solar radiation and to heat radiation. It may also be exposed to movements of the surrounding air (e.g. due to draughts in buildings through open windows) and to condensed water. It is not subjected to precipitation, or water from sources other than rain or icing;
- without particular risk of biological attack. This includes protective measures, e.g. special product design, or installation in locations of such construction that mould growth and attacks by animals, etc. are not probable;
- with normal levels of contaminants experienced in urban areas, with industrial activities scattered over the whole area and/or with heavy traffic;
- without special precautions to minimise the presence of sand or dust, but which are not situated in proximity to sources of sand or dust.

The mechanical class shall be determined by reference to Clause 4, "Environmental classes".

The conditions of this class may be found in, and during transfer to, normal living or working areas, e.g.:

- living rooms;
- rooms for general use (theatres, restaurants, etc.);
- offices;
- shops;
- workshops;
- telecommunication centres;
- storage rooms for valuable and sensitive products.

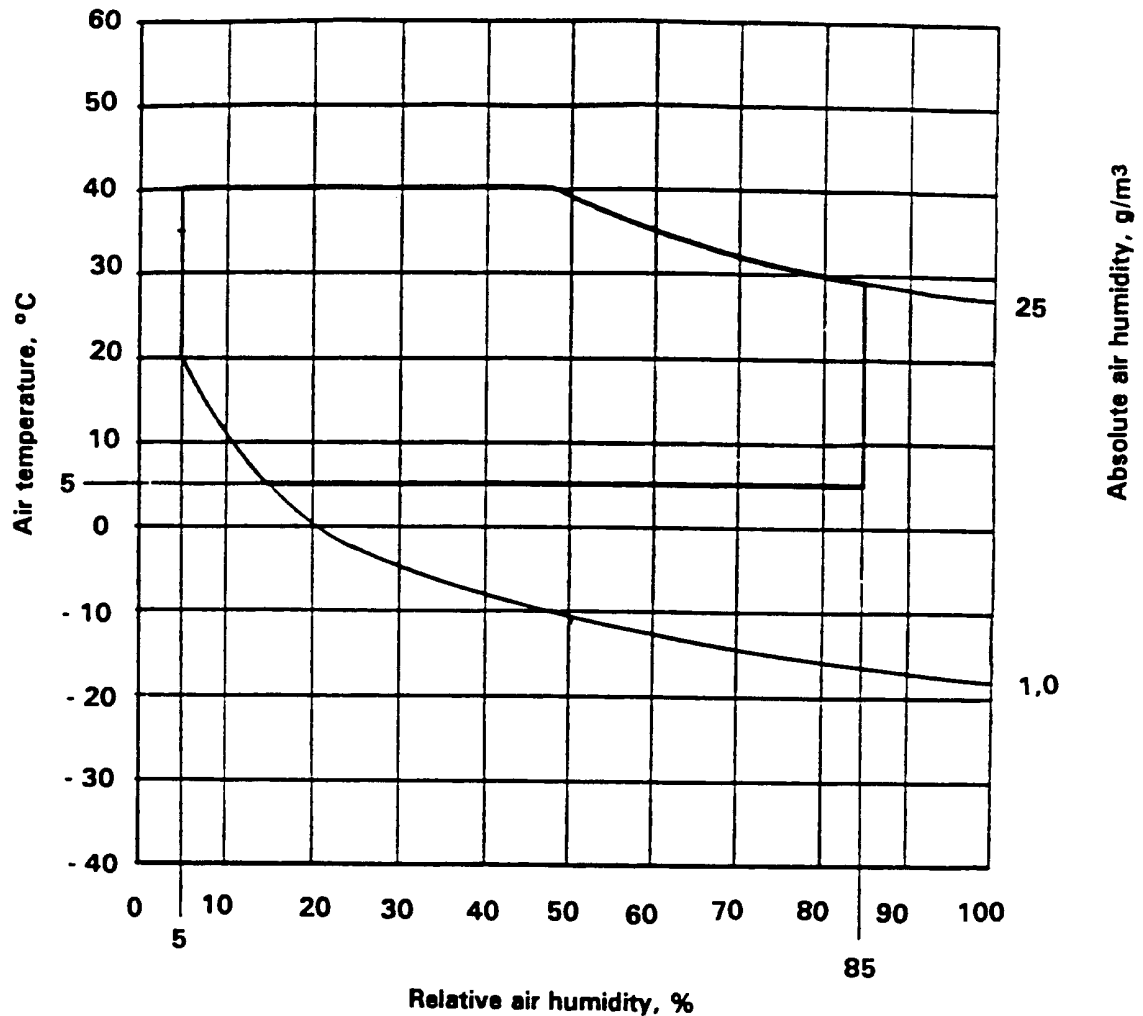


Figure 1: Climatogram for class 7.1: Temperature controlled-locations

4.2 Class 7.2: Partly temperature-controlled locations

This class is a combination of classes 7K2/7Z2/7Z4/7Z9/7B2/7C2(7C1)/7S2/7M2 or 7M3 in IEC publication 721-3-7 [2].

This class applies to use at, and direct transfer between, enclosed locations having neither temperature nor humidity control. The climatogram is shown in figure 2.

Heating may be used to raise low temperatures especially where there is a large difference between the conditions of this class and the open-air climate. Building construction is designed to avoid extremely high temperatures.

This class applies to use at, and direct transfer between, locations:

- where equipment may be exposed to solar radiation and heat radiation. It may also be exposed to movements of the surrounding air (e.g. due to draughts in buildings through open windows). It may be subjected to condensed water, to water from sources other than rain and to icing. It is not subjected to precipitation;
- where mould growth, or attacks by animals except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- in close proximity to sources of sand or dust.

The mechanical class shall be determined by reference to Clause 4, "Environmental classes".

The conditions of this class may be found in, and during transfer to:

- entrances and staircases of buildings;
- in garages;
- cellars;
- certain workshops;
- buildings in factories and industrial process plants;
- unattended equipment stations;
- certain telecommunication buildings;
- ordinary storage rooms for frost resistant products;
- farm buildings etc.

NOTE 2: Underground spaces and manholes, etc.: Class 7.2 can be used in these locations although the distribution and duration of severities are different. The relative humidity exceeds 95 % RH for more than 1 % of the time and may reach 100 %.

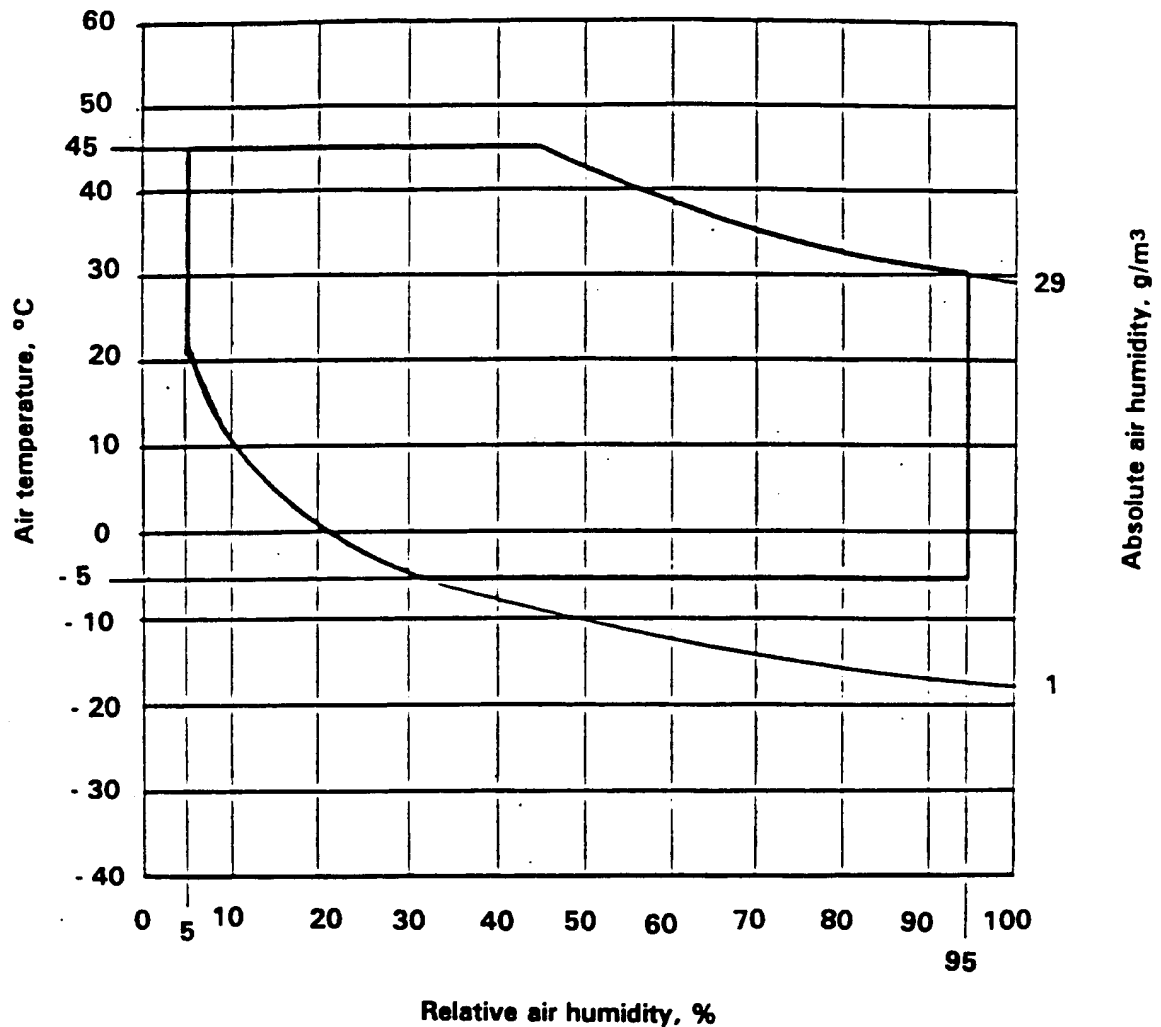


Figure 2: Climatogram for class 7.2: Partly temperature controlled locations

4.3 Class 7.3: Partly weatherprotected and non-weatherprotected locations

This class is a combination of classes 7K3/7Z2/7Z6/7Z9/7B2/7C2/7S2/7M2 or 7M3 in IEC publication 721-3-7 [2].

This class applies to use at partly weatherprotected locations in buildings of such a construction that extremely low temperatures are avoided. This class also applies to use at non-weatherprotected locations in a Warm Temperate climate and to transfer between these locations. During cold seasons non-weatherprotected use and transfer is limited). The climatogram is shown in figure 3.

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

This class applies to use at, and direct transfer between, locations:

- where the equipment may be exposed to direct solar radiation, heat radiation, movement of the surrounding air, condensed water, precipitation, water from sources other than rain and icing;
- where mould growth, or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- in close proximity to sources of sand or dust.

The mechanical class shall be determined by reference to Clause 4, "Environmental classes".

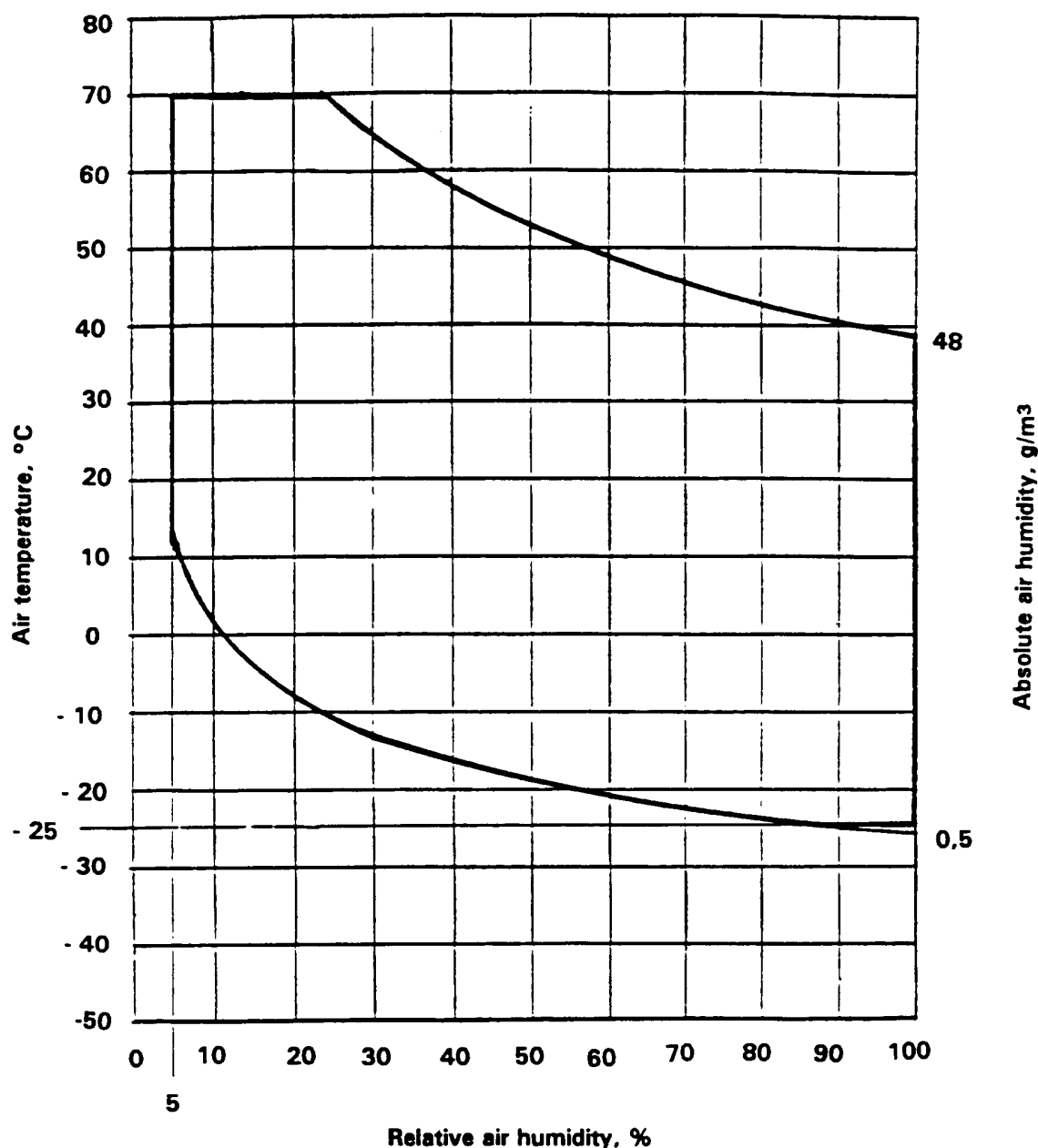


Figure 3: Climatogram for class 7.3: Partly weatherprotected and non-weatherprotected locations

4.4 Class 7.3 E: Partly weatherprotected and non-weatherprotected locations - extended

This class is a combination of classes 7K4/7Z2/7Z6/7Z9/7B2/7C2/7S2/7M2 or 7M3 in IEC publication 721-3-7 [2].

This class applies to use at partly weatherprotected locations in buildings of any construction - except in extremely cold and cold climates - where extremely low temperatures shall be avoided. This class also applies at non-weatherprotected locations in moderate open-air climates and to transfer between these conditions. (during extremely cold days use and transfer is limited). The climatogram is shown in figure 4.

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

This class applies to use at, and direct transfer between, locations:

- where the equipment may be exposed to direct solar radiation, heat radiation, movements of the surrounding air, condensed water, precipitation, water from sources other than rain and icing;
- where mould growth, or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas;
- with industrial activities scattered over the whole area and/or with heavy traffic;
- in close proximity to sources of sand or dust.

The mechanical class shall be determined by reference to Clause 4, "Environmental conditions".

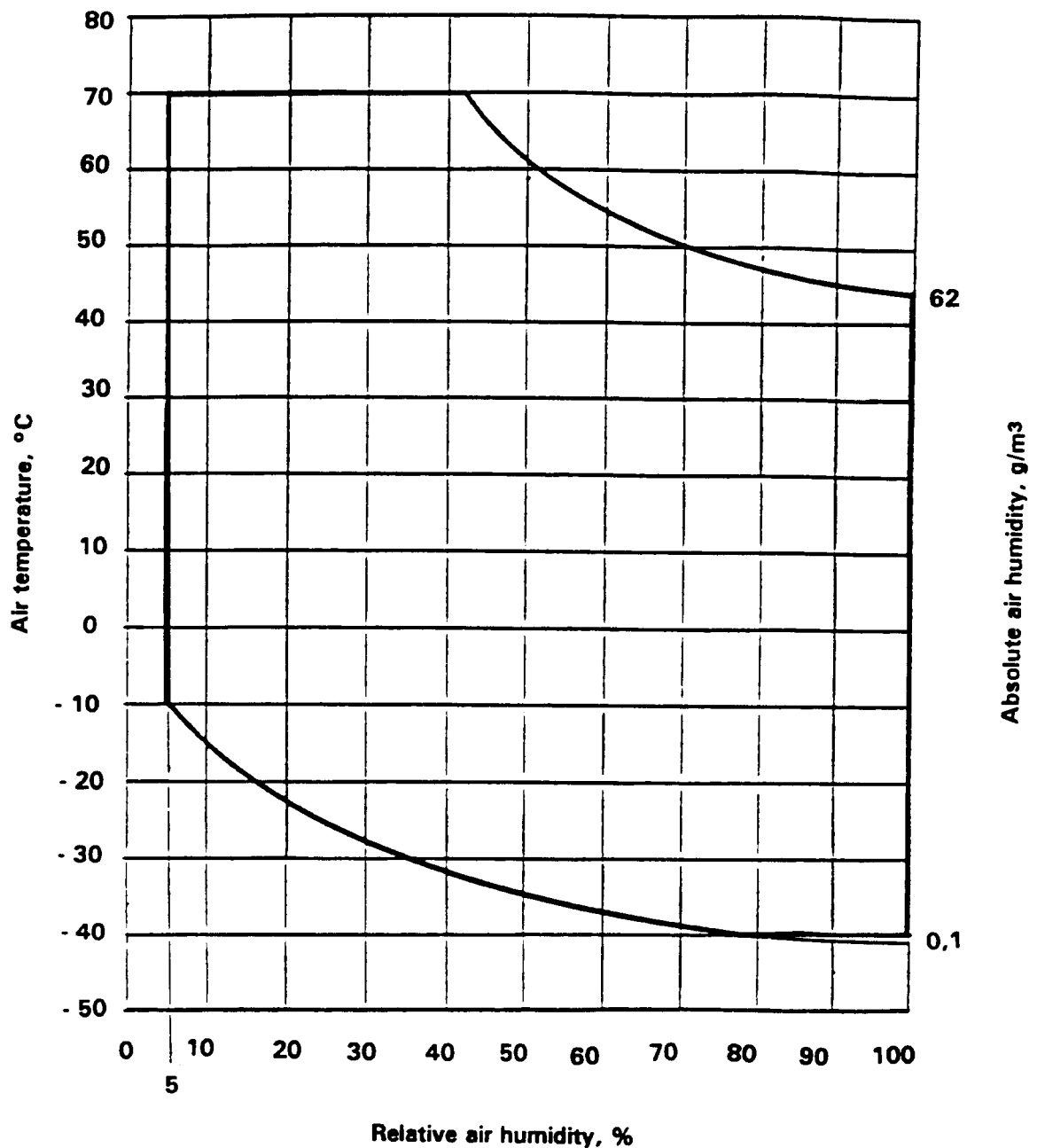


Figure 4: Climatogram for class 7.3 E: Partly weatherprotected and non-weatherprotected locations - extended

5 Environmental conditions

5.1 Climatic conditions

Table 1: Climatic conditions for environmental classes 7.1 to 7.3E

Environmental parameter	Unit	Class			
		7.1	7.2	7.3	7.3 E
a) Low air temperature	°C	5	- 5	- 25	- 40
b) High air temperature	°C	40	45	70	70
c) Low relative humidity	%	5	5	5	5
d) High relative humidity	%	85	95	100	100
e) Low absolute humidity	g/m ³	1	1	0.5	0.1
f) High absolute humidity	g/m ³	25	29	48	62
g) Limits for sudden change of air temperature	°C/°C	+ 5/+ 25	-5/+25	-25/+30	-40/+30
h) Low air pressure (NOTE 1)	kPa	70	70	70	70
i) High air pressure (NOTE 2)	kPa	106	106	106	106
j) Rate of change of air pressure	kPa/min	--	--	--	--
k) Solar radiation	W/m ²	700	700	1120	1120
l) Heat radiation	W/m ²	600	600	600	600
m) Movement of the surrounding air	m/s	5	5	30	30
n) Conditions of condensation	--	yes	yes	yes	yes
o) Conditions of precipitation (rain, snow, hail, etc.)	--	--	--	yes	yes
p) Rain intensity	mm/min	--	--	6	6
q) Low rain temperature (NOTE 3)	°C	--	--	5	5
r) Conditions of water from sources other than rain	--	--	Conditions of dripping water		
s) Conditions of icing and frosting	--	no	yes	yes	yes
<p>NOTE 1: 70 kPa represents the low limit value for use in the open air. This pressure normally equates to an altitude of about 3000 m. In some geographical areas open-air use may occur at higher altitudes.</p> <p>NOTE 2: Conditions in mines are not considered.</p> <p>NOTE 3: This rain temperature should be considered together with high air temperature b) and solar radiation k). The cooling effect of the rain has to be considered in connection with the surface temperature of the equipment.</p>					

5.2 Biological conditions

Table 2: Biological conditions for environmental classes 7.1 to 7.3 E.

Environmental parameter	Unit	Classes	
		7.1	7.2 to 7.3 E
a) Flora	none	--	Presence of mould, fungus etc.
b) Fauna	none	--	Presence of rodents and other animals harmful to equipment but excluding termites.

5.3 Chemically active substances

Table 3: Chemically active substances for environmental classes 7.1 to 7.3 E.

Environmental parameter	Unit	Class 7.1 to 7.3 E mean value (NOTE 2) max. value (NOTE 3)		Special (7C1) for classes 7.1 and 7.2 only (NOTE 1)
a) Sea salts road salts	--	conditions of salt mist		negligible
b) Sulphur	mg/m ³	0,3	1,0	0,1
dioxide	cm ³ /m ³	0,11	0,37	0,037
c) Hydrogen	mg/m ³	0,1	0,5	0,01
sulphide	cm ³ /m ³	0,071	0,36	0,0071
d) Chlorine	mg/m ³	0,1	0,3	0,1
	cm ³ /m ³	0,034	0,1	0,034
e) Hydrogen	mg/m ³	0,1	0,5	0,1
chloride	cm ³ /m ³	0,066	0,33	0,066
f) Hydrogen	mg/m ³	0,01	0,03	0,003
fluoride	cm ³ /m ³	0,012	0,036	0,0036
g) Ammonia	mg/m ³	1,0	3,0	0,3
	cm ³ /m ³	1,4	4,2	0,42
h) Ozone	mg/m ³	0,05	0,1	0,01
	cm ³ /m ³	0,025	0,05	0,005
i) Nitrogen	mg/m ³	0,5	1,0	0,1
oxides (4)	cm ³ /m ³	0,26	0,52	0,052
<p>NOTE 1: Because of the low probability of simultaneous occurrence of these gases at the levels of IEC class 7C2, the values of 7C1 are considered more appropriate to describe the long term environmental conditions.</p> <p>NOTE 2: Mean values are the average values (long-term values) to be expected.</p> <p>NOTE 3: Maximum values are limit or peak values occurring over a period of not more than 30 minutes per day.</p> <p>NOTE 4: Expressed as the equivalent values of nitrogen dioxide.</p>				

5.4 Mechanically active substances

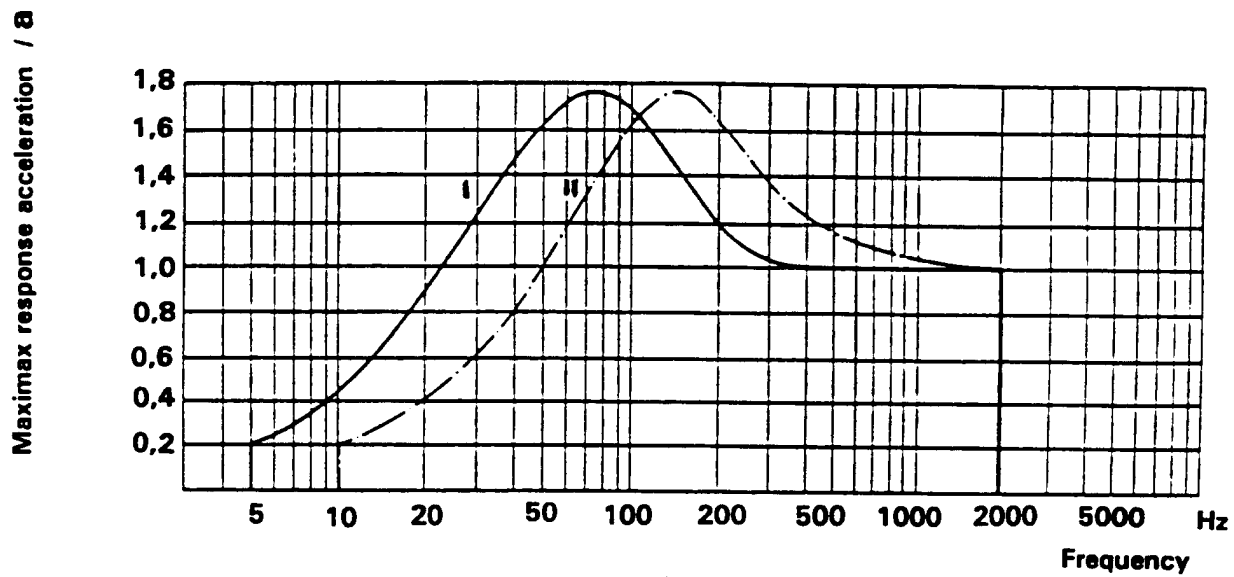
Table 4: Mechanically active substances for environmental classes 7.1 to 7.3 E.

Environmental parameter	Unit	Class	
		7.1	7.2 to 7.3 E
a) Sand	mg/m ³	30	300
b) Dust (suspension)	mg/m ³	0,2	5,0
c) Dust (Sedimentation)	mg/(m ² h)	1,5	20

5.5 Mechanical conditions

Table 5: Mechanical conditions for environmental classes 7.1 to 7.3 E.

Environmental parameter	Unit	Class	
		7.1 to 7.3 E	Special (7M3)
a) Stationary vibration, sinusoidal (NOTE 1) displacement amplitude acceleration amplitude frequency range	mm m/s ² Hz	3,5 10 15 2-9 9-200 200-500	7,5 20 40 2-8 8-200 200-500
b) Stationary vibration, random acceleration spectral density frequency range	m ² /s ³ Hz	1 10-200 0,3 200-2000	3 10-200 1 200-2000
c) Non-stationary vibration, including shock shock response spectrum I peak acceleration \dot{a} shock response spectrum II peak acceleration \dot{a}	m/s ² m/s ²	100 300	300 1000
d) Free fall mass up to 1 kg mass up to 10 kg mass up to 50 kg	m m m	0,25 0,1 0,05	1,0 0,5 0,25
NOTE 1: The frequency range may be limited to 200 Hz during transfer, whenever the equipment is transferred by means of a system which has high internal damping.			



Spectrum type I: Duration: 11 ms.

Spectrum type II: Duration: 6 ms.

Figure 5: Model Shock Response Spectra (First Order Maximax Shock Response Spectra, see IEC Publication 721-3-7 [2]). For definition of Maximax see IEC Publication 68-2-27 [4].

History

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