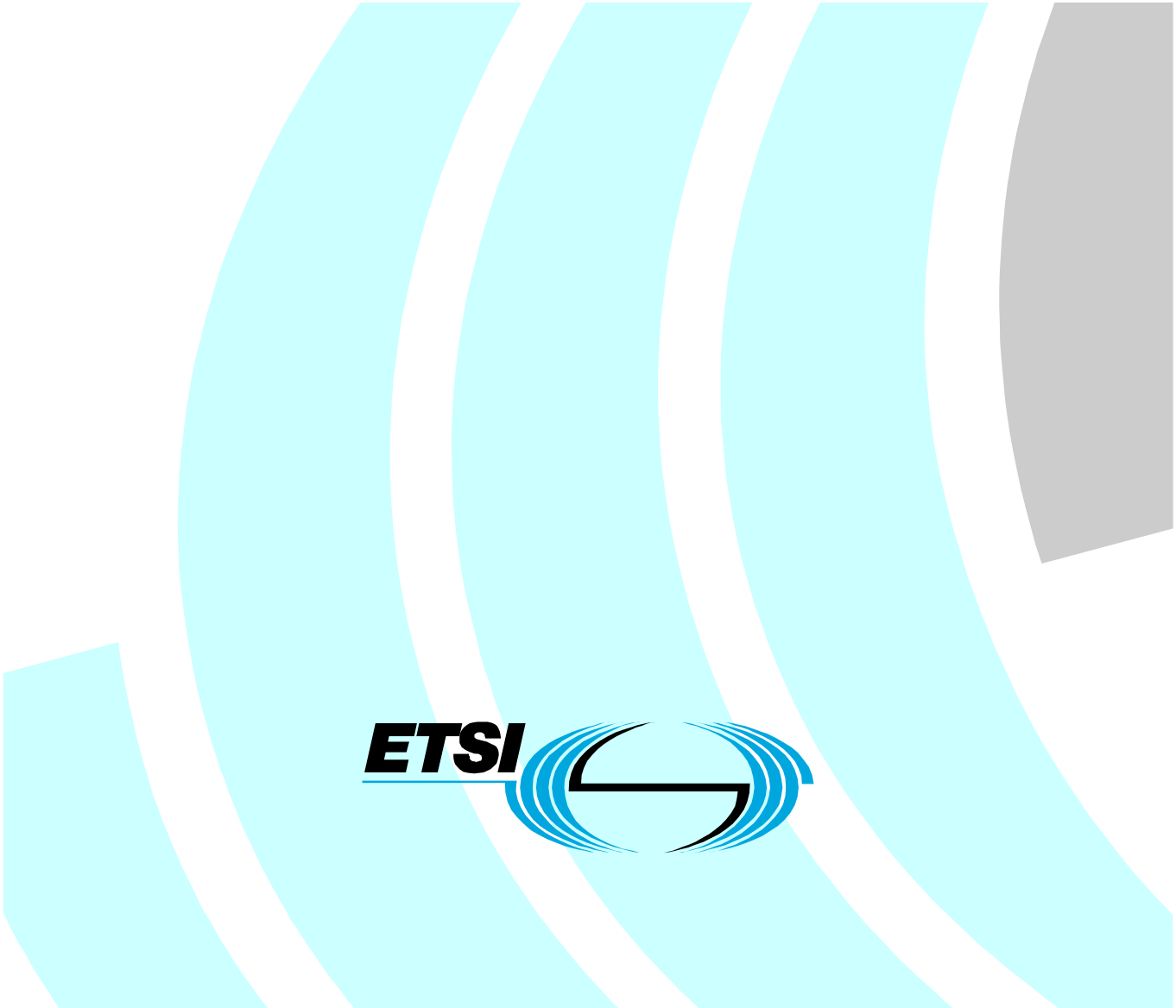
Final draft ETSI EN 300 019-1-7 V2.1.0 (2001-12)

European Standard (Telecommunications series)

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



Reference
REN/EE-01027-1-7

Keywords
environment, equipment practice, testing

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document is part 1, sub-part 7 of a multi-part deliverable covering the classification of environmental conditions and environmental tests for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions";

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 2: "Specification of environmental tests".

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 1-0 forms a general overview of part 1.

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

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

1 Scope

The present document defines classes of environmental conditions and their severities to which telecommunication equipment may be exposed. The severities specified are those which will have a low probability of being exceeded; generally less than 1 %.

The present document applies to equipment during portable and non-stationary use including periods of transfer, down time, maintenance and repair at locations defined in clauses 3 to 5.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

[2] IEC 60721-3-7: "Classification of Environmental conditions. Part 3: Classification of groups of Environmental parameters and their severities. Section 7: Portable and non-stationary use".

[3] IEC 60721-2-1: "Classification of Environmental conditions. Part 2: Environmental conditions appearing in nature. Temperature and humidity".

[4] IEC 60068-2-27: "Environmental testing. Part 2: Test Ea and guidance: Shock".

[5] ETSI EN 300 019-1-8: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-8: Classification of environmental conditions; Stationary use at underground locations".

3 Definitions

For the purposes of the present document, the following terms and definitions apply:

absolute humidity: mass of water vapour in grammes which is associated with one cubic metre of dry air in an air/water vapour mixture

non-weatherprotected location: location at which the equipment is not protected from direct weather influences

portable and non-stationary use: equipment which may be moved frequently from place to place

NOTE: 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.

relative humidity: ratio of the partial pressure of the water vapour in moist air at a given temperature, to the partial pressure of the water vapour in saturated air at the same temperature

weatherprotected location: location at which the equipment is protected from direct weather influences

NOTE 1: Partly weatherprotected location (sheltered location): direct weather influences are not completely excluded.

NOTE 2: Totally weatherprotected location (enclosed location): direct weather influences are totally excluded.

4 Environmental classes

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

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 classes 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 60721-3-7 [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;

  NOTE: For long term exposure to simultaneous occurrence of several contaminants a special chemical class 7C1 should be chosen.

- without special precautions to minimize 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 working or living areas, e.g.:

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

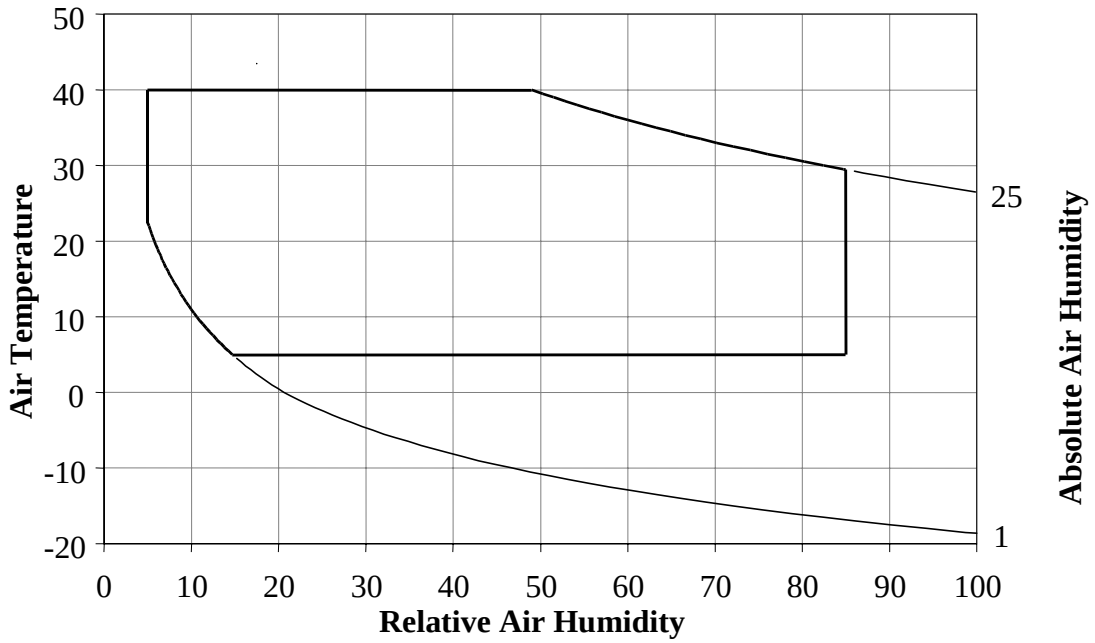

Figure 1: Climatogram for class 7.1: temperature controlled-locations

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 60721-3-7 [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;

  NOTE 1: For long term exposure to simultaneous occurrence of several contaminants a special chemical class 7C1 should be chosen.

- 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:

- certain telecommunication buildings;
- unattended equipment stations;
- certain workshops;
- buildings in factories and industrial process plants;
- in garages;

- entrances and staircases of buildings;
- cellars;
- 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 if extreme climatic conditions can be deliberately avoided. Class 8.1 conditions in EN 300 019-1-8 [5] shall be considered if no control of the climatic conditions during exposure is possible.

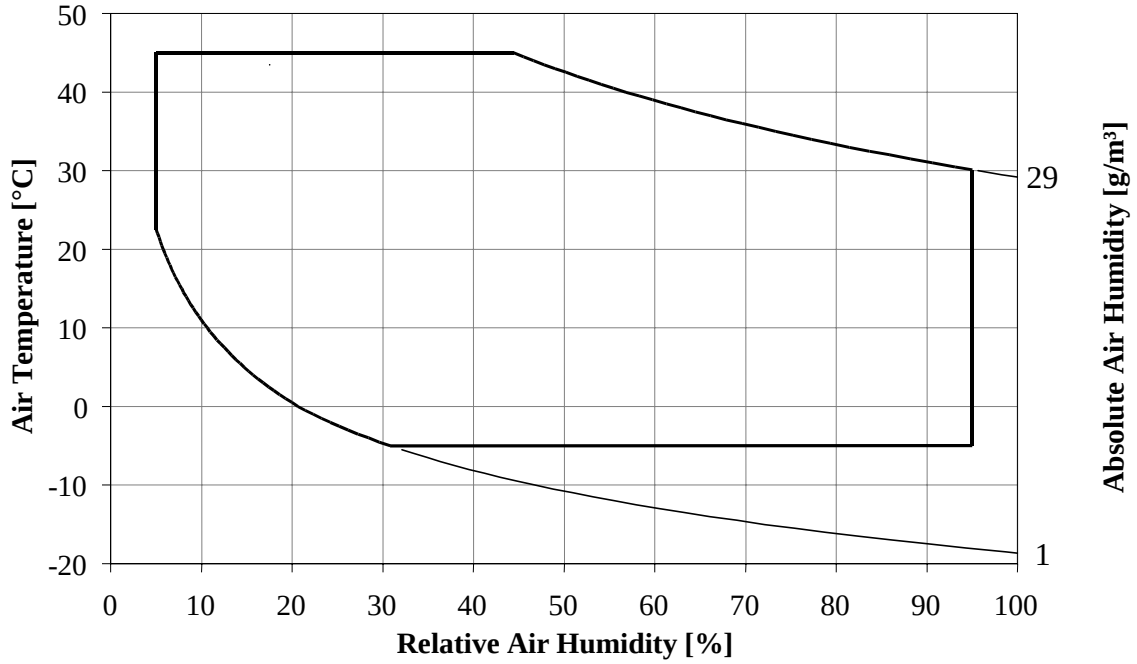

Figure 2: Climatogram for class 7.2: partly temperature controlled locations

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 60721-3-7 [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 60721-2-1 [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".

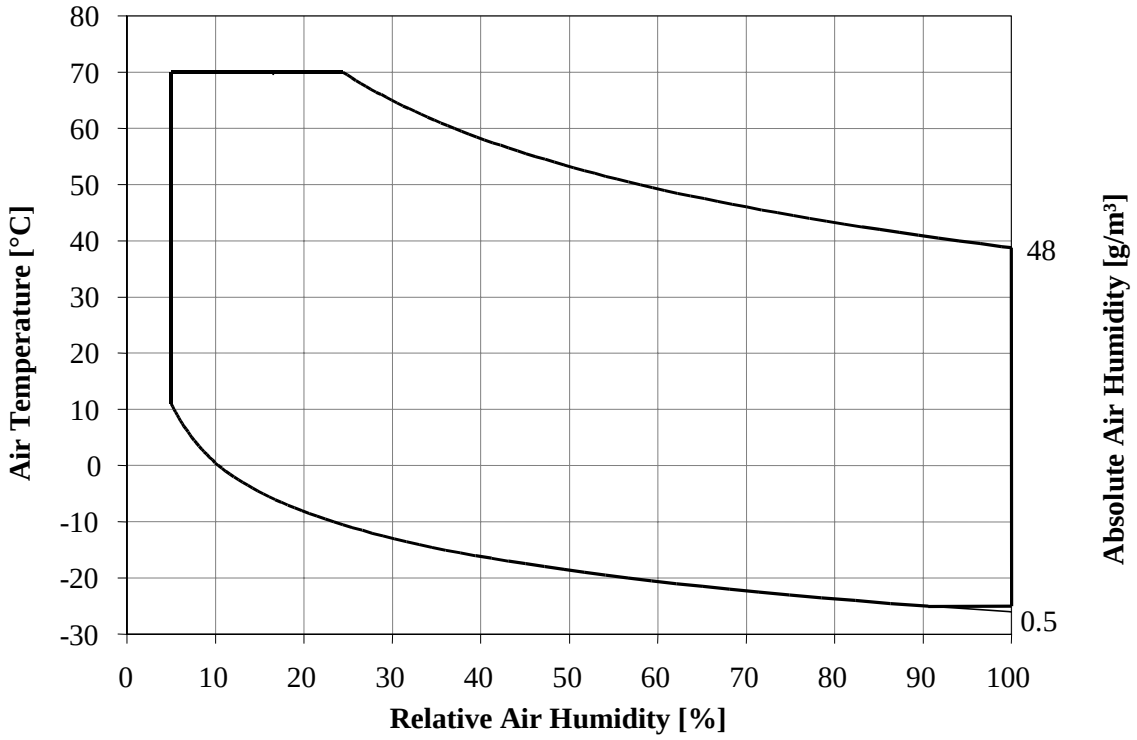

Figure 3: Climatogram for class 7.3: partly weatherprotected and non-weatherprotected locations

4.4 Class 7.3E: 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 60721-3-7 [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 60721-2-1 [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".

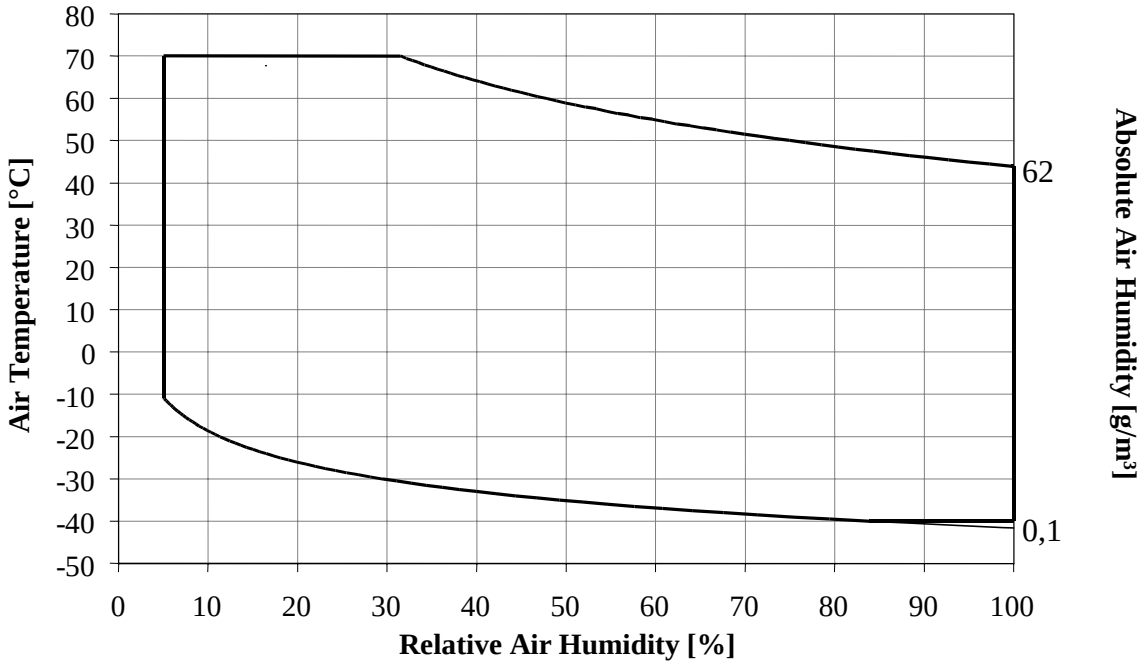

Figure 4: Climatogram for class 7.3E: partly weatherprotected and non-weatherprotected locations-extended

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**	**7.3E**
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	0,5
f)	high absolute humidity	g/m^3	25	29	48	62
g)	rapid change of temperature	°C/°C	+5/+25	-5/+25	-25/+30	-40/+30
h)	low air pressure (see note 1)	kPa	70	70	70	70
i)	high air pressure (see note 2)	kPa	106	106	106	106
j)	rate of change of air pressure	kPa/min	negligible	negligible	negligible	negligible
k)	solar radiation	W/m^2	700	700	1 120	1 120
l)	heat radiation	W/m^2	600	600	600	600
m)	movement of surrounding air	m/s	5	5	30	30
n)	condensation	--	yes	yes	yes	yes
o)	precipitation (rain, snow, hail, etc.)	--	no	no	yes	yes
p)	rain intensity	mm/min	--	--	6	6
q)	low rain temperature (see note 3)	°C	--	--	5	5
r)	water from sources other than rain	--	no	no	dripping water	
s)	ice and frost formation	--	no	yes	yes	yes

NOTE 1: 70 kPa represents the low limit value for use in the open air. This pressure normally equates to an altitude of about 3 000 m. In some geographical areas open-air use may occur at higher altitudes.
NOTE 2: Conditions in mines are not considered.
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.

5.2 Biological conditions

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

Environmental parameter		Unit	Class	
			7.1	**7.2, 7.3 and 7.3E**
a)	flora	--	no	presence of mould, fungus, etc.
b)	fauna	--	no	presence of rodents and other animals harmful to products, excluding termites

5.3 Chemically active substances

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

Environmental parameter		Unit (see note 1)	Class		
			7.1 to 7.3E		7.1 and 7.2 only Special (7C1) (see note 5)
			mean value (see note 2)	max. value (see note 3)	max. value (see note 3)
a)	sea salts and road salts	--	conditions of salt mist		negligible
b)	sulphur dioxide	mg/m^3 cm^3/m^3	0,3 0,11	1,0 0,37	0,1 0,037
c)	hydrogen sulphide	mg/m^3 cm^3/m^3	0,1 0,071	0,5 0,36	0,01 0,0071
d)	chlorine	mg/m^3 cm^3/m^3	0,1 0,034	0,3 0,1	0,1 0,034
e)	hydrochloric acid	mg/m^3 cm^3/m^3	0,1 0,066	0,5 0,33	0,1 0,066
f)	hydrofluoric acid	mg/m^3 cm^3/m^3	0,01 0,012	0,03 0,036	0,003 0,0036
g)	ammonia	mg/m^3 cm^3/m^3	1,0 1,4	3,0 4,2	0,3 0,42
h)	ozone	mg/m^3 cm^3/m^3	0,05 0,025	0,1 0,05	0,01 0,005
i)	nitrogen oxides (see note 4)	mg/m^3 cm^3/m^3	0,5 0,26	1,0 0,52	0,1 0,052

NOTE 1: The values given in cm^3/m^3 have been calculated from the values given in mg/m^3 and refer to a temperature of +20°C and a pressure of 101,3 kPa. The table uses round values.
NOTE 2: Mean values are the average values (long term values) to be expected.
NOTE 3: Maximum values are limit or peak values, occurring over a period of not more than 30 minutes per day.
NOTE 4: Expressed in the equivalent values of nitrogen dioxide.
NOTE 5: 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.

5.4 Mechanically active substances

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

Environmental parameter		Unit	Class	
			7.1	7.2 to 7.3E
a)	sand	mg/m^3	30	300
b)	dust (suspension)	mg/m^3	0,2	5,0
c)	dust (sedimentation)	$mg/(m^2h)$	1,5	20

5.5 Mechanical conditions

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

	Environmental parameter	Unit	Class					
			5M2 (see note 1)			5M3 (see note 1)		
a)	Stationary vibration, sinusoidal: (see note 1)							
	displacement amplitude	mm	3,5			7,5		
	acceleration amplitude	m/s^2		10	15		20	40
	frequency range (see note 2)	Hz	2 to 9	9 to 200	200 to 500	2 to 8	8 to 200	200 to 500
b)	Stationary vibration, random:							
	acceleration spectral density (note 3)	m^2/s^3	1		0,3	3		1
	frequency range	Hz	10 to 200		200 to 2 000	10 to 200		200 to 2 000
c)	Non-stationary vibration, including shock: (see note 4)							
	shock response spectrum type I peak acceleration (â)	m/s^2	100			300		
	duration	ms	11			11		
	shock response spectrum type II peak acceleration (â)	m/s^2	300			1 000		
	duration	ms	6			6		
d)	Free fall							
	mass up to 1 kg	m	0,25			1,0		
	mass up to 10 kg	m	0,1			0,5		
	mass up to 50 kg	m	0,05			0,25		

NOTE 1: Units are peak displacement amplitude (mm) and peak acceleration amplitude (m/s^2).
NOTE 2: The frequency range may be limited to 200 Hz during transfer, whenever the equipment is transferred by means of a system that has high internal damping. The cross-over frequency is a rounded value.
NOTE 3: ASD means Acceleration Spectral Density.
NOTE 4: Model Shock Response Spectra of types I and II are given in IEC 60721-3-7 [2] and the definition in IEC 60068-2-27 [4].

History

Document history		
Edition 1	February 1992	Publication as ETS 300 019-1-7
V2.1.0	December 2001	One-step Approval Procedure OAP 20020419: 2001-12-19 to 2002-04-19