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*European Standard (Telecommunications series)*

**Environmental Engineering (EE);  
Environmental conditions and environmental tests  
for telecommunications equipment;  
Part 1-1: Classification of environmental conditions;  
Storage**

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Reference

REN/EE-01027-1-1

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## Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document is part 1, sub-part 1 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.

<b>National transposition dates</b>	
Date of adoption of this EN:	19 April 2002
Date of latest announcement of this EN (doa):	31 July 2002
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2003
Date of withdrawal of any conflicting National Standard (dow):	31 January 2003

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# 1 Scope

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

NOTE 1: Temporary storage during transport is included in part 1-2: Transportation.

NOTE 2: If the equipment is stored in its package, the environmental conditions apply to the packaged equipment.

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# 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] IEC 60721-3-1: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 1: Storage".
- [2] IEC 60068-2-27: "Environmental testing. Part 2: Tests. Test Ea and guidance: Shock".
- [3] IEC 60721-2-4: "Classification of environmental conditions. Part 2: Environmental conditions appearing in nature: Solar radiation and temperature".

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# 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 equipment is not protected from direct weather influences

**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

**storage:** certain site where the equipment is placed for long periods but is not intended for use during these periods

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

NOTE 1: Totally weatherprotected location: Direct weather influences are totally excluded.

NOTE 2: Partly weatherprotected location: Direct weather influences are not completely excluded.

## 4 Environmental classes

The classes shown in parentheses, e.g. (1C1), may be selected for special applications.

### 4.1 Class 1.1: Weatherprotected, partly temperature-controlled storage locations

This class is a combination of classes 1K3/1Z2/1B1/1C2(1C1)/1S2/1M2 in IEC 60721-3-1 [1].

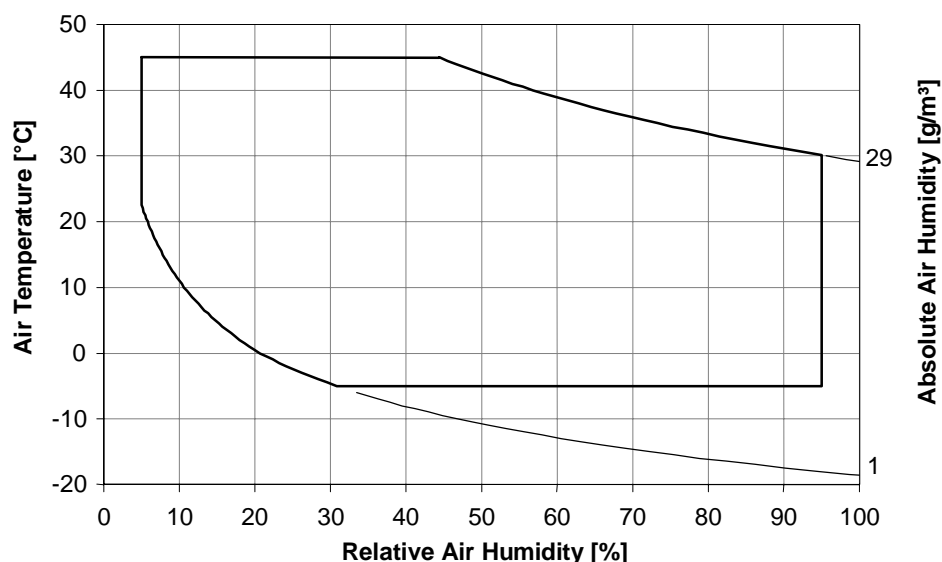
This class applies to weatherprotected partly temperature controlled storage. Humidity is usually not controlled. The climatogram is shown in figure 1.

Heating may be used to raise low temperatures especially where there is a significant 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 storage locations:

- where equipment may be exposed to solar radiation and heat radiation. It may also be exposed to movements of the surrounding air due to draughts in buildings, e.g. through open windows. It is not subjected to precipitation and water from sources other than rain;
- without particular risks by biological attacks. This includes protective measures, e.g. special package design, or storing at locations of such construction that mould growth, 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 minimize the presence of dust or sand, but not situated in proximity to dust or sand sources;
- with vibration of low significance and insignificant shock.

The conditions of this class may occur in ordinary storage rooms for frost-resistant products.



**Figure 1: Climatogram for class 1.1: weatherprotected, partly temperature-controlled storage locations**

## 4.2 Class 1.2: Weatherprotected, not temperature-controlled storage locations

This class is a combination of classes 1K4/1Z2/1Z3/1Z5/1B2/1C2(1C1)/1S3/1M2 in IEC 60721-3-1 [1].

This class applies to weatherprotected storage having neither temperature nor humidity control. The location may have openings directly to the open air, i.e. it may be only partly weatherprotected. The climatogram is shown in figure 2.

This class applies to storage locations:

- where equipment may be exposed to solar radiation and temporarily to heat radiation. They may also be exposed to movements of the surrounding air due to draughts, e.g. through doors, windows or other openings. They may be subjected to condensed water, dripping water and to icing. They may also be subjected to limited wind-driven precipitation including snow;
- 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 areas with sources of sand or dust, including urban areas;
- with vibration of low significance and insignificant shock.

The conditions of this class may occur in:

- unattended buildings;
- some entrances of buildings;
- some garages and shacks.

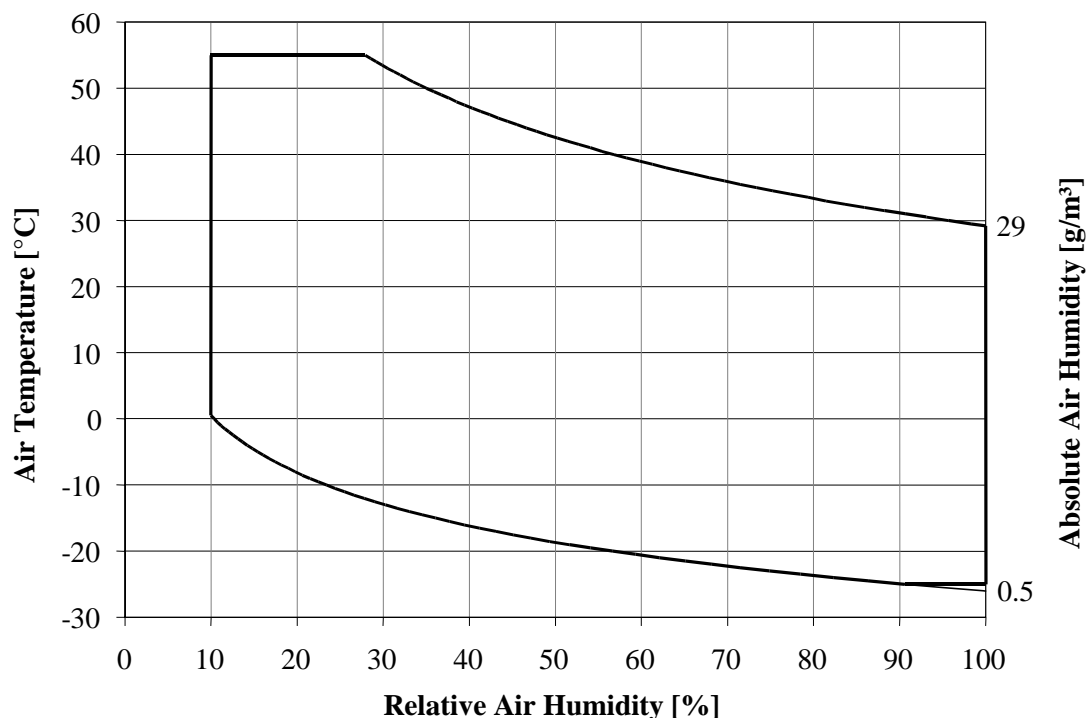


Figure 2: Climatogram for class 1.2: weatherprotected, not temperature-controlled storage locations

### 4.3 Class 1.3: Non-weatherprotected storage locations; class 1.3E: non-weatherprotected storage locations-extended

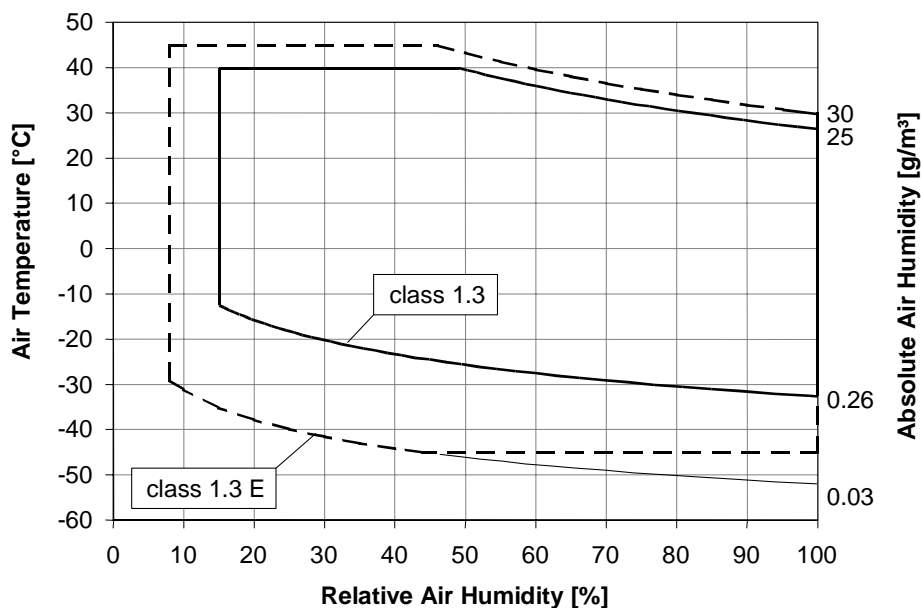
Class 1.3 is a combination of classes 1K8/1Z1/1Z4/1B2/1C2/1S3/1M3(1M4) in IEC 60721-3-1 [1]. Class 1.3E is a combination of classes 1Z1/1Z4/1B2/1C2/1S3/1M3(1M4) in IEC 60721-3-1 [1] and the severities given in clause 5.1.

NOTE: If more severe mechanical conditions are expected, IEC class 1M4 may be chosen.

This class applies to storage which is not protected from direct weather influences. The climatogram is shown in figure 3.

This class applies to storage locations:

- which are directly exposed to an open-air climate including solar radiation, movement of the surrounding air, precipitation and water jets;
- where mould growth, or attacks by animals but excluding 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 areas with sources of sand or dust, including urban areas;
- with significant vibration and shock, e.g. transmitted from machines or passing vehicles in the vicinity, etc.



"-----": Climatic limits for class 1.3

"-----": Climatic limits for class 1.3 E

**Figure 3: Climatogram for class 1.3 and 1.3E: non-weatherprotected storage locations**



## 5 Environmental conditions

### 5.1 Climatic conditions

**Table 1: Climatic conditions for environmental classes 1.1 to 1.3E**

Environmental parameter		Unit	Class			
			1.1	1.2	1.3	1.3E
a)	Low air temperature (see note 1)	°C	-5 (see note 8)	-25	-33 (see note 9)	-45 (see note 9)
b)	High air temperature (see note 1)	°C	45	55	40	45
c)	Low relative humidity (see note 1)	%	5	10	15	8
d)	High relative humidity (see note 1)	%	95	100	100	100
e)	Low absolute humidity (see note 1)	g/m <sup>3</sup>	1	0,5	0,26	0,03
f)	High absolute humidity (see note 1)	g/m <sup>3</sup>	29	29	25	30
g)	Rain intensity	mm/min	no	no	6	15
h)	Rate of change of temp. (see note 2)	°C/min	0,5	0,5	0,5	0,5
i)	Low air pressure (see note 3)	kPa	70	70	70	70
j)	High air pressure (see note 4)	kPa	106	106	106	106
k)	Solar radiation	W/m <sup>2</sup>	700	1 120	1 120	1 120
l)	Heat radiation	W/m <sup>2</sup>	(see note 7)	(see note 7)	negligible	negligible
m)	Movement of the surrounding air	m/s	1,0	30	50	50
n)	Conditions of condensation	none	yes	yes	yes	yes
o)	Conditions of precipitation (rain, snow, hail, etc.)	none	no	(see note 6) yes	yes	yes
p)	Low rain temperature (see note 5)	°C	no	no	5	5
q)	Conditions from water from sources other than rain	none	no	dripping water	splashing water	splashing water
r)	Conditions of icing and frosting	none	yes (see note 8)	yes	yes	yes
Climatogram figure number			1	2	3	3

NOTE 1: For simultaneous occurrence of parameters a) to f) see figures 1 to 3.  
 NOTE 2: Averaged over a period of 5 minutes.  
 NOTE 3: 70 kPa represent a limit value for open-air storage, normally at about 3 000 m.  
 NOTE 4: Conditions in mines are not considered.  
 NOTE 5: 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.  
 NOTE 6: Applies to wind-driven precipitation.  
 NOTE 7: Conditions of heat radiation, e.g. in the vicinity of room heating systems.  
 NOTE 8: For certain items storage conditions must be maintained above 5°C.  
 NOTE 9: On cloudless nights an object exposed to atmospheric radiation will radiate more heat than it receives off the surface, compared to the ambient air temperature. In practice (under extreme conditions) the surface may come down to a temperature in the order of 10°C to 20°C below ambient air temperature, when the ambient air temperature ranges from +20°C to -30°C (see IEC 60721-2-4 [3]).

### 5.2 Biological conditions

**Table 2: Biological conditions for environmental classes 1.1 to 1.3E**

Environmental parameter	Unit	Class	
		1.1	1.2, 1.3, 1.3E
a) Flora	none	negligible	Presence of mould, fungus, etc.
b) Fauna	none	negligible	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 1.1 to 1.3E**

Environmental parameter		Unit (see note 2)	Class 1.1 to 1.3E		Special (1C1) (see note 1) for classes 1.1 and 1.2
			Mean value (see note 3)	Maximum value (see note 4)	Maximum value (see note 4)
a)	Salts	none	sea (see note 5) and road salt mist		
b)	Sulphur dioxide	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,3 0,11	1,0 0,37	0,1 0,037
c)	Hydrogen sulphide	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,1 0,071	0,5 0,36	0,01 0,0071
d)	Chlorine	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,1 0,034	0,3 0,1	0,1 0,034
e)	Hydrogen chloride	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,1 0,066	0,5 0,33	0,1 0,066
f)	Hydrogen fluoride	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,01 0,012	0,03 0,036	0,003 0,0036
g)	Ammonia	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	1,0 1,4	3,0 4,2	0,3 0,42
h)	Ozone	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,05 0,025	0,1 0,05	0,01 0,005
i)	Nitrogen oxides (see note 6)	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,5 0,26	1,0 0,52	0,1 0,052

NOTE 1: Because of the low probability of simultaneous occurrence of these gases at the levels of IEC class 1C2, the values of 1C1 are considered more appropriate to describe the long-term environmental conditions.

NOTE 2: The values given in cm<sup>3</sup>/m<sup>3</sup> have been calculated from the values given in mg/m<sup>3</sup> and refer to a temperature of 20°C and a pressure of 101,3 kPa. The table uses rounded values.

NOTE 3: Mean values are the average values (long term values) to be expected.

NOTE 4: Maximum values are limit or peak values, occurring over a period of time of not more than 30 minutes per day.

NOTE 5: Sea salt mist may be present at sheltered locations in coastal areas.

NOTE 6: Expressed as equivalent values of nitrogen dioxide.

## 5.4 Mechanically active substances

**Table 4: Mechanically active substances for environmental classes 1.1 to 1.3E**

Environmental parameter		Unit	Class	
			1.1	1.2, 1.3, 1.3E
a)	Sand	mg/m <sup>3</sup>	30	300
b)	Dust (Suspension)	mg/m <sup>3</sup>	0,2	5,0
c)	Dust (Sedimentation)	mg/(m <sup>2</sup> h)	1,5	20

## 5.5 Mechanical conditions

**Table 5: Mechanical conditions for environmental classes 1.1 to 1.3E**

Environmental parameter		Unit	Classes 1.1 and 1.2		Class 1.3 and 1.3E		Special (1M4)	
a)	Stationary vibration, sinusoidal:							
	displacement amplitude (see note 1)	mm	1,5		3,0		7,0	
	acceleration amplitude (see note 1)	m/s <sup>2</sup>		5		10		20
	frequency range	Hz	2 to 9 (note 3)	9 to 200	2 to 9 (note 3)	9 to 200	2 to 9 (note 3)	9 to 200
b)	Non-stationary vibration, including shock: (see note 2)							
	shock response spectrum type I, peak acceleration ( $\hat{a}$ )	m/s <sup>2</sup>			100			
	duration	ms			11			
	shock response spectrum type II, peak acceleration ( $\hat{a}$ )	m/s <sup>2</sup>					250	
	duration	ms					6	
	shock response spectrum type L, peak acceleration ( $\hat{a}$ )	m/s <sup>2</sup>	40					
	duration	ms	22					
c)	Static load	kPa	5		5		5	
NOTE 1: Peak values.								
NOTE 2: For definition of Model Shock Response Spectra (First Order Maximax Shock Response Spectra) see IEC 60721-3-1 [1], and Maximax see IEC 60068-2-27 [2].								
NOTE 3: Cross-over frequency is a rounded value.								

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## Annex A (informative): Bibliography

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

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## History

<b>Document history</b>		
Edition 1	February 1992	Publication as ETS 300 019-1-1
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