

# Classification of environmental conditions —

## Part 3: Classification of groups of environmental parameters and their severities —

### Section 3.7 Portable and non-stationary use

The European Standard EN 60721-3-7:1995 has the status of a  
British Standard

ICS 19.040

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/50, Environmental testing of electrotechnical products, to panel GEL/50/-/1, Coordination of IEC/TC 75 work, upon which the following bodies were represented:

Federation of the Electronics Industry  
Society of Motor Manufacturers and Traders Limited

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 February 1996

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The following BSI references relate to the work on this standard:  
Committee reference GEL/50/-/1  
Draft for comment 93/209314 DC

ISBN 0 580 25138 1

## Amendments issued since publication

Amd. No.	Date	Comments
9515	June 1997	Indicated by a sideline in the margin

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# National foreword

This Section of BS EN 60721 has been prepared by panel GEL/50/-/1 and is the English language version of EN 60721-3-7:1995 *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 7: Portable and non-stationary use* including amendment A1:1997, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 721-3-7:1995 including Amendment 1:1996 published by the International Electrotechnical Commission (IEC). This standard supersedes BS EN 60721-3-7:1993 which is withdrawn.

**Cross-references**

Publication referred to	Corresponding British Standard
HD 478.1 S2:1994 <sup>a</sup> (IEC 721-1:1990)	BS EN 60721 <i>Classification of environmental conditions</i> Part 1:1996 <i>Environmental parameters and their severities</i>
HD 478.2.1 S1:1989 (IEC 721-2-1:1982)	BS 7527 <i>Classification of environmental conditions</i> Part 2 <i>Environmental conditions appearing in nature</i> Section 2.1:1991 <i>Temperature and humidity</i> BS EN 60721 <i>Classification of environmental conditions</i> Part 3 <i>Classification of groups of environmental parameters and their severities</i>
EN 60721-3-0:1993 (IEC 721-3-0:1984)	Section 3.0:1993 <i>Introduction</i>
EN 60721-3-2:1993 (IEC 721-3-2:1985)	Section 3.2:1993 <i>Transportation</i>
EN 60721-3-3:1995 (IEC 721-3-3:1994)	Section 3.3:1995 <i>Stationary use at weatherprotected locations</i>
EN 60721-3-4:1995 (IEC 721-3-4:1995)	Section 3.4:1995 <i>Stationary use at non-weatherprotected locations</i>

<sup>a</sup> HD 478.1 S2 has now been converted into EN 60721-1:1995 and this has been implemented as BS EN 60721-1:1996.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Classification of environmental conditions  
Part 3: Classification of groups of environmental  
parameters and their severities  
Section 7: Portable and non-stationary use

(includes amendment A1:1997)  
(IEC 721-3-7:1995 + A1:1996)

Classifications des conditions d'environnement  
Partie 3: Classification des groupements des  
agents d'environnement et de leurs sévérités  
Section 7: Utilisation en déplacement  
(inclut l'amendement A1:1997)  
(CEI 721-3-7:1995 + A1:1996)

Klassifizierung von Umweltbedingungen  
Teil 3: Klassen von Umwelteinflußgrößen und  
deren Grenzwerte  
Hauptabschnitt 7: Ortsveränderlicher Einsatz  
(enthält Änderung A1:1997)  
(IEC 721-3-7:1995 + A1:1996)

This European Standard was approved by CENELEC on 1994-10-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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## CENELEC

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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## Foreword

The text of document 75(CO)105 + 105A, future amendment to IEC 721-3-7, prepared by IEC TC 75, Classification of environmental conditions, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A3 to EN 60721-3-7:1993 on 1994-10-04.

The text of this document, together with that of IEC 721-3-7:1987 and its amendments 1:1991 and 2:1993, was published by IEC as the second edition of IEC 721-3-7 in January 1995. According to a decision of principle taken by the Technical Board of CENELEC, the approval of EN 60721-3-7:1993/A3 has been converted into the approval of a new EN 60721-3-7.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-01-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex ZA is normative and Annex A, Annex B, Annex C and Annex D are informative. Annex ZA has been added by CENELEC.

## Foreword to amendment A1

The text of document 75/283/FDIS, future amendment 1 to IEC 721-3-7:1995, prepared by IEC TC 75, Classification of environmental conditions, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60721-3-7:1995 on 1996-12-09.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-09-01

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## 1 Scope

This standard classifies groups of environmental parameters and their severities to which products are subjected during portable and non-stationary use, including periods of transfer, down time, maintenance and repair.

The environmental conditions covered by these groups include:

- the environmental conditions at locations where the product may be placed or used temporarily;
- the change of environmental parameters due to change of location;
- the environmental conditions related to transfer of the product between different locations.

The environmental conditions classified do not take into account the use profile of the product, i.e. whether the product is used only during a temporary stationary state, during the state of transfer or arbitrarily.

The conditions of portable and non-stationary use to which products may be exposed include land-based and offshore, weatherprotected and non-weatherprotected locations. The conditions further include transfer which is a part of the portable and non-stationary use.

The environmental conditions specified in this standard are limited to those which may directly affect the performance of products. Only environmental conditions as such are considered. No special description of the effects of these conditions on the product is given.

Environmental conditions directly related to fire or explosion hazards and conditions related to ionizing radiation are excluded. Any other unforeseen incidents are also excluded. The possibility of their occurrence should be taken into account in special cases.

Microclimate within a product is not included.

Conditions of stationary use, use in vehicles, and ships, and conditions of storage and transportation are given in other sections of IEC 721-3.

A limited number of classes of environmental conditions is given, covering a broad field of application. The user of this standard should select the lowest classification necessary for covering the conditions of the intended use.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 721-3. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 721-3 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 721-1:1990, *Classification of environmental conditions — Part 1: Environmental parameters and their severities*.

Amendment 1 (1992)

IEC 721-2-1:1982, *Classification of environmental conditions — Part 2: Environmental conditions appearing in nature — Section 1: Temperature and humidity*.

Amendment 1 (1987)

IEC 721-3-0:1984, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 0: Introduction*.

Amendment 1 (1987)

IEC 721-3-2:1985, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 2: Transportation*.

Amendment 1 (1991),

Amendment 2 (1993)

IEC 721-3-3:1994, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 3: Stationary use at weatherprotected locations*.

IEC 721-3-4:1995, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 4: Stationary use at non-weatherprotected locations*.

### 3 Definitions

In addition to the definitions in clause 3 of IEC 721-1, the following definitions apply to this standard:

#### 3.1

##### **portable and non-stationary use**

the product is frequently moved from place to place. During transfer there is no special packaging for the product. The total transfer time may amount to a significant portion of the product's lifetime. The product is not permanently mounted on any structure or placed at a fixed site. The product may be operated while being either in a stationary or in a transfer state

#### 3.2

##### **weatherprotected location**

a location at which the product is protected from weather influences:

— *totally weatherprotected location*  
(enclosed location): direct weather influences are totally excluded;

— *partially weatherprotected location*  
(sheltered location): direct weather influences are not completely excluded.

#### 3.3

##### **non-weatherprotected location**

a location at which the product is not protected from direct weather influences

### 4 General

For further general guidance, see IEC 721-3-0.

Products in portable and non-stationary use are sometimes transferred from one location to another without being switched on. During this transfer the environmental conditions bearing on the product may affect the product in a different way than during operation. If environmental conditions during operation are considered separately from those during transfer, another class, e.g. a lower one, may be selected for this part of the use.

The severities specified are those which will have a low probability of being exceeded. All specified values are maximum or limit values. These values may be reached, but do not occur permanently. Depending on the local situation there may be different frequencies of occurrence related to a certain period of time. Such frequencies of occurrence should be considered for any environmental parameter. They should additionally be specified if applicable. Information on duration and frequency of occurrence is given in IEC 721-3-0 as clause 6.

Attention is drawn to the fact that combinations of the environmental parameters given may increase the effect on a product. This applies especially to the presence of high relative humidity in addition to biological conditions, or to conditions of chemically or mechanically active substances.

The environmental conditions present at a location may be affected by other influences, e.g. heat dissipation sources, special process conditions, etc.

Measurements of the environmental conditions present at a location should be made at a representative point in the vicinity of the product.

It is recognized that extreme or special environmental conditions may exist. Specifications for products to operate under such special conditions are a matter of negotiation between supplier and user.

### 5 Classification of groups of environmental parameters and their severities

A number of classes for climatic conditions (K), special climatic conditions (Z), biological conditions (B), chemically active substances (C), mechanically active substances (S) and mechanical conditions (M) are specified in Table 1 to Table 6.

This classification allows a number of possible combinations of environmental conditions, which bear upon products wherever used. It represents the real situation in respect of worldwide conditions of use, due to local influences of open-air climate, construction of buildings, mounting, process conditions, etc. (See also clause 6.)

A class of conditions normally includes all classes with lower severity digits.

For certain parameters it has not yet been possible to specify quantitative severities.

For a given use or product, reference should be made to the total set of classes, e.g.

7K2/7Z1/7Z4/7B1/7C2/7S1/7M4

Annex A explains the basis of the classes. It contains a summary of the conditions covered by each class and gives a survey of conditions affecting the choice of environmental parameters and their severities.

Annex B contains a climatogram showing the interdependence of air temperature, relative humidity and absolute humidity.

Annex C gives three examples for practical application of this classification.

### 5.1 Climatic conditions

The climatic conditions specified for classes 7K1 to 7K5 represent the conditions of portable and non-stationary use of products. They have been experienced worldwide over a long period of time taking into account all the parameters that can influence them, e.g. external (open-air) climatic conditions, type of building construction, temperature/humidity controlling systems, means of transfer and internal conditions, e.g. heat dissipation from other equipment, presence of humans, etc. The conditions should cover all normal cases, but not exceptional events.

Climatic conditions in tropical areas as specified in classes 7K6 and 7K7 are explained in Annex E.

When selecting appropriate classes attention should be paid to the fact that the climatic conditions inside buildings depend on the outside (open-air) conditions, especially air temperature and solar radiation, and the type of building construction. Walls with good thermal insulation or high thermal capacity can consistently smooth the peaks of outside air temperature variation between day and night, or exceptionally for a longer period. Walls with poor thermal insulation or low thermal capacity cannot have that effect, and peaks can be magnified due to the effect of solar radiation during the day and to the effect of building radiation at night. The effect of solar radiation can be increased by either heat-trap or greenhouse effects.

At non-weatherprotected locations the influence from special climatic conditions constitutes a more significant share of the effects bearing upon a product and its functional parts than at weatherprotected locations. Particularly the effects from temperature change, solar radiation, precipitation, air velocity, and wind-chill should be considered in this respect.

The severity of these effects may be influenced e.g. by constructional details (sort and thickness of material, colour of surface, sealing or breathing of casings, product heating, etc.), and by operating details (selection of mounting site, consideration of degree of exposure to prevailing wind and weather, etc.).

### 5.2 Special climatic conditions

As in practice parameters such as heat radiation, movement of surrounding air, water from sources other than rain, high air temperature and low air pressure may occur with any of their severities in combination with any of the other climatic conditions, these special conditions are specified in Table 2. In this case an assumption of the coincidence of events of increasing severity would lead to unnecessary overdesign.

### 5.3 Biological conditions

No quantitative severities have been specified for these conditions. The specified parameters of Table 3 are typical, but may not be complete.

### 5.4 Chemically active substances

Contamination of natural atmosphere is mainly caused by chemical emission from industrial activities, motor-driven vehicles and heating systems. A further chemical influence is caused by aerosols of sea salts. The contamination may affect the function and the materials of products.

The values given in this classification have been experienced in surveys for several years. Maximum values are given, because direct influence of higher concentrations over a short period normally causes more damage to material, which cannot regenerate. Mean values are given additionally, because their influence may be important for the long-term effect on internal parts of the products.

In practice not all contaminants (parameters) classified in this standard are present simultaneously. Furthermore, the probability is low that the concentrations of those contaminants really present increase simultaneously and homogeneously. Depending on the local situation, there are often higher values of one contaminant only. The values specified for class 7C1 will normally be experienced in rural areas and areas with low industrial activities. The values specified for class 7C2 are experienced in urban areas. Therefore the severity of each of these two classes should be considered as the requirements for the combined effect of all parameters stated. The severities of classes 7C3 and 7C4, however, cannot be considered as the requirements for the combined effect of all parameters stated in order to avoid any uneconomical overdesign. For these classes it is possible to select only the severities of those single parameters which might be relevant in the case of application. If single parameters of the classes 7C3 and 7C4 are selected for the description of the chemically active substances present at a location, for all other parameters which are not specially named, the severities of class 7C2 are valid.

NOTE Chemically active liquids and chemically active solids other than sea salts or road salts are not considered in this standard.

### 5.5 Mechanically active substances

Sand and dust are classified together, as the effects caused by these environmental conditions are similar.

### 5.6 Mechanical conditions

The conditions of vibration (sinusoidal) are classified by severity levels of acceleration and displacement amplitudes in high and low frequency ranges respectively.

Random vibration is classified by severity levels of acceleration spectral density in frequency ranges.

Non-stationary vibration including shock is classified by using the first order undamped maximax shock response spectrum. See **6.1.3** of IEC 721-1.

The conditions of free fall are classified by severity levels of fall heights depending on the mass of the product.

## 6 Sets of environmental condition class combinations

As indicated in clause **5** the classification allows a number of possible combinations of environmental conditions bearing on products wherever used. The number of possibilities, and thus the flexibility, is therefore very great. In practice, however, this flexibility is not always an advantage when, for instance, environmental condition specifications for a certain location are drawn up by different parties, invariably producing small but disturbing divergences.

In order to limit the possibilities to general cases, standard sets of class combinations may be selected from Table 7. For a given location or product, reference may then be made to this standard, for example IE72. Only when conditions are not considered to be covered by this specification, is reference made to each class as indicated in clause **5**. Alternatively, if some severities of parameters deviate from that or those of the class combination, this should be expressed by the addition to the set designation of the following phrase: “but ... (parameter) ... (severity and unit)”, for example IE72 but sand 300 mg/m<sup>3</sup>.

Annex D gives a summary of conditions covered by the sets of class combinations.

Table 1 — Classification of climatic conditions

Environmental parameter	Unit	Class <sup>f</sup>						
		7K1	7K2	7K3	7K4	4K5	7K6 <sup>h</sup>	7K7 <sup>h</sup>
a) <i>Low air temperature</i>	°C	+ 5	– 5	– 25	– 40	– 65	+ 5	– 20
b) <i>High air temperature</i>	°C	+ 40 <sup>g</sup>	+ 45 <sup>g</sup>	+ 70	+ 70	+ 85	+ 40	+ 55
c) <i>Low relative humidity</i> <sup>a</sup>	%	5	5	5	5	4	30	4
d) <i>High relative humidity</i> <sup>a</sup>	%	85	95	100	100	100	100	100
e) <i>Low absolute humidity</i> <sup>a</sup>	g/m <sup>3</sup>	1	1	0,5	0,1	0,003	6	0,9
f) <i>High absolute humidity</i> <sup>a</sup>	g/m <sup>3</sup>	25	29	48	62	78	36	27
g) <i>Rapid change of air temperature</i>	°C/°C	+ 5/+ 25	– 5/+ 25	– 25/+ 30	– 40/+ 30	– 65/+ 30	+ 5/+ 30	– 20/+ 30
h) <i>Low air pressure</i> <sup>b</sup>	kPa	70	70	70	70	30	70	70
i) <i>High air pressure</i> <sup>c</sup>	kPa	106	106	106	106	106	106	106
j) <i>Rate of change of air pressure</i>	kPa/min	Negligible	Negligible	Negligible	Negligible	6	6	6
k) <i>Solar radiation</i>	W//m <sup>2</sup>	700	700	1 120	1 120	1 120	1 120	1 120
l) <i>Heat radiation</i>	None	e	e	e	e	e	e	e
m) <i>Movement of surrounding air</i>	m/s	e	e	e	e	e	e	e
n) <i>Condensation</i>	None	Yes	Yes	Yes	Yes	Yes	Yes	Yes
o) <i>Precipitation (rain, snow, hail, etc.)</i>	None	No	No	Yes	Yes	Yes	Yes	Yes
p) <i>Rain intensity</i>	mm/min	None	None	6	6	15	15	15
q) <i>Low rain temperature</i> <sup>d</sup>	°C	None	None	+ 5	+ 5	+ 5	+ 5	+ 5
r) <i>Water from sources other than rain</i>	None	e	e	e	e	e	e	e
s) <i>Ice and frost formation</i>	None	No	Yes	Yes	Yes	Yes	Yes	Yes
<sup>a</sup> The low and high relative humidities are limited by the low and high absolute humidities, so that for environmental parameters a) and c), or b) and d), the severities given in Table 1 do not occur simultaneously. See Annex B for the relationship between air temperature and humidity. <sup>b</sup> The value of 70 kPa represents a limit for open-air conditions, normally at an altitude of 3 000 m. In some geographical areas products may be used at higher altitudes. For some restricted applications at lower altitudes, a value may be selected from Table 2. <sup>c</sup> Conditions in mines are not considered. <sup>d</sup> This rain temperature should be considered together with high air temperature b) and solar radiation k). The cooling effects of the rain has to be considered in connection with the surface temperature of the product. <sup>e</sup> Conditions occurring at the location concerned to be selected from Table 2. <sup>f</sup> The climatic classes of this standard include and over climatic classes of IEC 721-3-2, IEC 721-3-3 and CEI 721-3-4 as follows: <div> <div>7K1 covers 2K1 and 3K3</div> <div>7K3 covers 2K3 and 3K6 and 4K1</div> <div>7K5 covers 2K5 and 3K8 and 4K4</div> <div>7K7 covers 1K11, 3K10 and 4K6</div> <div>7K2 covers 2K1 and 3K5</div> <div>7K4 covers 2K4 and 3K7 and 4K2</div> <div>7K6 covers 1K10, 3K9 and 4K5</div> </div> <sup>g</sup> If applicable, a special value may be selected from Table 2. <sup>h</sup> Further information on classes 7K6 (tropical damp) and 7K7 (tropical dry) is given in Annex E								

**Table 2 — Classification of special climatic conditions**

Environmental parameter	Class	Unit	Special condition Z
b) <i>High air temperature</i>	7Z14	°C	+ 55
h) <i>Low air pressure<sup>c</sup></i>	7Z15	kPa	84
l) <i>Heat radiation</i>	7Z1	None	Negligible
	7Z2	None	Heat radiation, e.g. in the vicinity of heating systems
	7Z3	None	Heat radiation, e.g. in the vicinity of heating systems, commercial ovens or industrial furnaces
m) <i>Movement of surrounding air<sup>a</sup></i>	7Z4	m/s	5
	7Z5	m/s	10
	7Z6	m/s	30
	7Z7	m/s	50
o) <i>Water from sources other than rain<sup>b</sup></i>	7Z8	None	Negligible
	7Z9	None	Dripping water
	7Z10	None	Spraying water
	7Z11	None	Splashing water
	7Z12	None	Water jets
	7Z13	None	Water waves
<sup>a</sup> A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.			
<sup>b</sup> Underwater conditions are not considered.			
<sup>c</sup> Class 7Z15 corresponds to an altitude of approximately 1 400 m.			

**Table 3 — Classification of biological conditions**

Environmental parameter	Unit	Class		
		7B1	7B2	7B3
a) <i>Flora</i>	None	Negligible	Presence of mould, fungus, etc.	Presence of mould, fungus, etc.
b) <i>Fauna</i>	None	Negligible	Presence of rodents and other animals harmful to products, excluding termites	Presence of rodents and other animals harmful to products, including termites

Table 4 — Classification of chemically active substances

Environmental parameter	Unit <sup>a</sup>	Class <sup>b,e</sup>									
		7C1R	7C1L	7C1	7C2		7C3 <sup>c</sup>		7C4 <sup>c</sup>		
		Maximum value	Maximum value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	
a) <i>Sea salts</i>	None	Negligible	Negligible	Negligible <sup>d</sup>	Salt mist		Salt mist		Salt mist		
b) <i>Sulphur dioxyde</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,01 0,0037	0,1 0,037	0,1 0,037	0,3 0,11	1,0 0,37	5,0 1,85	10 3,7	13 4,8	40 14,8	
c) <i>Hydrogen sulphide</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,0015 0,001	0,01 0,0071	0,01 0,0071	0,1 0,071	0,5 0,36	3,0 2,1	10 7,1	14 9,9	70 49,7	
d) <i>Chlorine</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,001 0,00034	0,01 0,0034	0,1 0,034	0,1 0,034	0,3 0,1	0,3 0,1	1,0 0,34	0,6 0,2	3,0 1,0	
e) <i>Hydrogen chloride</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,001 0,00066	0,01 0,0066	0,1 0,066	0,1 0,066	0,5 0,33	1,0 0,66	5,0 3,3	1,0 0,66	5,0 3,3	
f) <i>Hydrogen fluoride</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,001 0,0012	0,003 0,0036	0,003 0,0036	0,01 0,012	0,03 0,036	0,1 0,12	2,0 2,4	0,1 0,12	2,0 2,4	
g) <i>Ammonia</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,03 0,042	0,3 0,42	0,3 0,42	1,0 1,4	3,0 4,2	10 14	35 49	35 49	175 247	
h) <i>Ozone</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,004 0,002	0,01 0,005	0,01 0,005	0,05 0,025	0,1 0,05	0,1 0,05	0,3 0,15	0,2 0,1	2,0 1,0	
i) <i>Nitrogen oxides (expressed in the equivalent values of nitrogen dioxide)</i>	mg/m <sup>3</sup> cm <sup>3</sup> /m <sup>3</sup>	0,01 0,005	0,1 0,052	0,1 0,052	0,5 0,26	1,0 0,52	3,0 1,56	9,0 4,68	10 5,2	20 10,4	

<sup>a</sup> 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.

<sup>b</sup> Mean values are expected long-term values. Maximum values are limit or peak values, occurring over a period of time of not more than 30 min per day.

<sup>c</sup> It is not mandatory to consider each of classes 7C3 and 7C4 as a requirement for the combined effect of all parameters stated. If applicable, values of single parameters may be selected from these classes. In this case the severities of class 7C2 are valid for all parameters not especially named.

<sup>d</sup> Salt mist may be present in sheltered location of coastal areas and in offshore sites.

<sup>e</sup> 7C1R covers 3C1R, 7C1L covers 3C1L, 7C1 covers 3C1 and 4C1, 7C2 covers 3C2 and 4C2, 7C3 covers 3C3 and 4C3, 7C4 covers 3C4 and 4C4.

Table 5 — Classification of mechanically active substances

Environmental parameter	Unit	Class		
		7S1	7S2	7S3
a) <i>Sand</i>	mg/m <sup>3</sup>	30	300	10 000
b) <i>Dust (suspension)</i>	mg/m <sup>3</sup>	0,2	5,0	20
c) <i>Dust (sedimentation)</i>	mg/(m <sup>2</sup> · h)	1,5	20	80

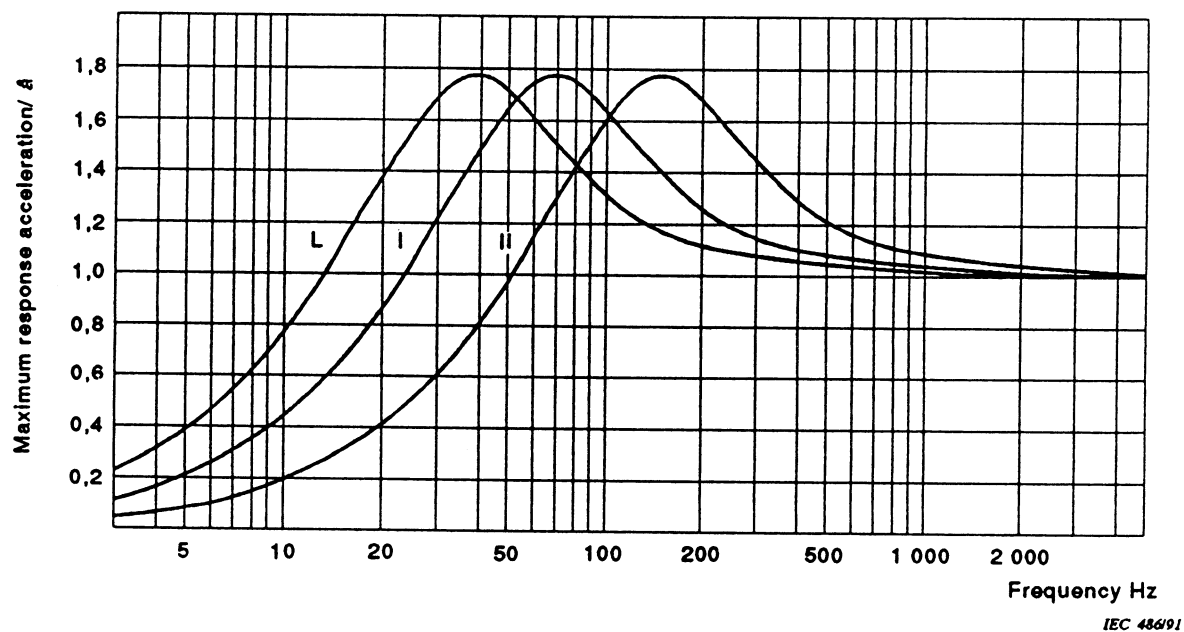
Table 6 — Classification of mechanical conditions

Environmental parameter	Unit	Class								
		7M1			7M2			7M3		
a) <i>Stationary vibration, sinusoidal:</i> displacement amplitude acceleration amplitude frequency range	mm m/s <sup>2</sup> Hz	3,5 10 2-9	15 9-200	200-500	3,5 10 2-9	15 9-200	200-500	7,5 20 2-8	40 8-200	200-500
b) <i>Stationary vibration, random:</i> acceleration spectral density frequency range	m <sup>2</sup> /s <sup>3</sup> Hz	1 10-200	0,3 200-2 000		1 10-200	0,3 200-2 000		3 10-200	1 200-2 000	
c) <i>Non-stationary vibration, including shock (see Figure 1)</i> shock response spectrum type I peak acceleration $\hat{a}$ shock response spectrum type II peak acceleration $\hat{a}$	m/s <sup>2</sup> m/s <sup>2</sup>	100 None			100 300			300 1 000		
d) <i>Free fall:</i> mass less than 1 kg fall height mass between 1 kg and 10 kg fall height mass between 10 kg and 50 kg fall height <i>mass more than 50 kg</i> <i>fall height</i>	m m m m	0,025 0,025 0,025			0,25 0,1 0,05			1,0 0,5 0,25		
	m	The severity is matter of negotiation between supplier and user.								

NOTE Vibration levels and the frequency ranges stated in Table 6 refer to the structural parts of the location. Products for portable and non-stationary use are not normally rigidly connected to these, and the nature of the specific product and location must be considered if these data are used for the design of a test specification.

Table 7 — Sets of environmental class combinations

Condition	Set of class combination				
	IE71	IE72	IE73	IE74	IE75
Climatic	7K1	7K1	7K2	7K3	7K4
Special climatic	7Z2	7Z2	7Z2	7Z2	7Z2
	7Z4	7Z4	7Z4	7T6	7Z6
	—	—	7Z9	7Z9	7Z9
Biological	7B1	7B1	7B2	7B2	7B2
Chemically active substances	7C2	7C2	7C2	7C2	7C2
Mechanically active substances	7S1	7S1	7S2	7S2	7S2
Mechanical	7M1	7M2	7M2	7M3	7M3



*Example of durations for half-sine pulse:*

Spectrum type L: duration 22 ms

Spectrum type I: duration 11 ms

Spectrum type II: duration 6 ms

**Figure 1 — Model shock response spectra  
(first order maximax shock response spectra)**  
For explanation see note 6 relating to Table 1 of IEC 721-1

## Annex A (informative)

### Survey of conditions affecting the choice of environmental parameters and their severities

#### A.1 General

In this annex the basis of the classes is explained. It gives a survey of conditions affecting the choice of environmental parameters and their severities, and it contains a summary of the conditions covered by each class.

#### A.2 Survey of conditions

For each environmental parameter, the various possible conditions which will result in different levels of environmental conditions, are presented. The conditions are arranged in order of increasing severities.

The first column of **A.2.1** to **A.2.5** describes the conditions. In the vertical columns headed “Class”, an x indicates the conditions covered by the class. The lowest class covering a certain condition may be found by reading horizontally from that condition to the first x encountered.

The procedure for finding an appropriate class as described above is valid for all the subclauses, but **A.2.1.1** contains the additional factor of type of climate, given in column 2 to 10, which must be considered.

The lowest class covering a certain condition can thus be found by reading vertically down the relevant type of climate column to the first x in the horizontal line of the relevant condition, then reading horizontally to the right to the first x encountered as previously described.

The types of climate are described in IEC 721-2-1, and are:

Extremely Cold (except the Central Antarctic)

Cold

Cold Temperate

Warm Temperate

Warm Dry

Mild Warm Dry

Extremely Warm Dry

Warm Damp

Warm Damp, Equable

It should be noted that, if a certain condition referred to in this annex is covered by a certain class, it does not necessarily mean that the class describes, for each single parameter, the lowest environmental severity needed to cover the condition.

## A.2.1 K. Climatic conditions

Condition of use	Type of climate									Class				
	Extremely Cold	Cold	Cold Temperate	Warm Temperate	Warm Dry	Mild Warm Dry	Extremely Warm Dry	Warm Damp	Warm Damp, Equable	7K1	7K2	7K3	7K4	7K5
a) <i>Low air temperature</i> °C										+ 5	− 5	− 25	− 40	− 65
Temperature controlled, weatherprotected locations. Heating or cooling may be switched off for periods, but occurrence of extremely low temperatures is prevented	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Weatherprotected locations without temperature control. Heating may be used, where necessary, to avoid extremely low temperatures	×	×	×	×	×	×	×	×	×		×	×	×	×
Locations directly exposed to open-air climate. Locations in all types of buildings. Locations in compartments of means of ground transport. Locations in heated compartments of aircraft	×	×	×	×	×	×	×	×	×			×	×	×
b) <i>High air temperature</i> (see Table 2) °C										+ 40 Z	+ 45 Z	+ 70	+ 70	+ 85
Temperature controlled, weatherprotected locations. Heating or cooling may be switched off for periods, but occurrence of extremely high temperatures is prevented	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Weatherprotected locations without temperature control. The building construction is designed, where necessary, to avoid extremely high temperatures	×	×	×	×	×	×	×	×	×		×	×	×	×
Weatherprotected locations without temperature control. The building construction provides protection from daily variations in outside (e.g. open-air) climate	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Locations in all types of buildings. Locations in ventilated enclosures of means of transport	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Locations directly exposed to open-air climate. Locations in unventilated enclosures of means of transport	×	×	×	×	×	×	×	×	×			×	×	×
c) <i>Low relative humidity</i> %										5	5	5	5	4
Any location	×	×	×	×	×	×	×	×	×	×	×	×	×	×
d) <i>High relative humidity</i> %										85	95	100	100	100
Continuously temperature controlled weatherprotected locations. Dehumidification may be used, where necessary, to avoid extremely humid conditions	×	×	×	×	×	×	×	×	×	×	×	×	×	×

Condition of use	Type of climate									Class				
	Extremely Cold	Cold	Cold Temperate	Warm Temperate	Warm Dry	Mild Warm Dry	Extremely Warm Dry	Warm Damp	Warm Damp, Equable	7K1	7K2	7K3	7K4	7K5
Temperature controlled weatherprotected locations. Heating or cooling may be switched off for periods. Weatherprotected locations without temperature control. The building construction provides protection from daily variations in outside (e.g. open-air) climate. Locations in ventilated enclosures of means of transport for a limited time (not overnight)	x x	x x	x x	x x	x x	x x	x x	x x	x x		x	x x	x x	x x
Locations directly exposed to open-air climate. Locations in all types of buildings. Locations in all means of transport	x	x	x	x	x	x	x	x	x			x	x	x
e) <i>Low absolute humidity</i> g/m <sup>3</sup>										1	1	0,5	0,1	0,003
Temperature controlled weatherprotected locations. Heating or cooling may be switched off for periods. Additional humidification may be used, where necessary, to avoid extremely dry conditions	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Locations directly exposed to open-air climate. Locations in all types of buildings. Locations in all means of transport	x	x	x	x	x	x	x	x	x			x	x x	x x x
f) <i>High absolute humidity</i> g/m <sup>3</sup>										25	29	48	62	78
Temperature controlled weatherprotected locations. Weatherprotected locations without temperature control. The building construction provides protection from daily variations in outside (e.g. open-air) climate. Locations in ventilated enclosures of means of transport for a limited time (not overnight)	x x x	x x x	x x x	x x x	x x x	x x x	x x x	x x x	x	x	x x	x x x	x x x	x x x
Locations in all types of buildings. Locations in ventilated enclosures of means of transport	x x x	x x x	x x x	x x x	x x x	x x x	x x x	x x x	x	x	x	x x x	x x x	x x x
Locations directly exposed to open-air climate	x	x	x	x	x	x	x	x	x			x	x	x
Locations in unventilated enclosures of means of transport	x x	x x	x x	x x	x x	x x	x x	x x	x x				x	x x
g) <i>Rapid change of air temperature</i> °C										+5 + 25	−5 +25	−25 +30	−40 +30	−65 +30
Temperature controlled weatherprotected locations. Heating or cooling may be switched off for periods, but occurrence of extreme temperatures is prevented. Transfer directly between such locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Condition of use	Type of climate									Class				
	Extremely Cold	Cold	Cold Temperate	Warm Temperate	Warm Dry	Mild Warm Dry	Extremely Warm Dry	Warm Damp	Warm Damp, Equable	7K1	7K2	7K3	7K4	7K5
Weatherprotected locations without temperature control. Where necessary, heating may be used or building construction is designed to avoid extreme temperatures. Transfer directly between such locations	x	x	x	x	x	x	x	x	x		x	x	x	x
Locations directly exposed to open-air climate. Locations in ventilated enclosures of means of ground transport or heated compartments of aircraft. Locations in all types of buildings. Transfer directly between such locations	x	x	x	x	x	x	x	x	x			x	x	x
Locations in unventilated compartments of means of transport including unheated aircraft holds. Transfer directly between such locations	x	x	x	x	x	x	x	x	x					x
h) <i>Low air pressure</i> (see Table 2) kPa										70 Z	70 Z	70 Z	70 Z	30
Any location, excluding unpressurized aircraft compartments	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Any location, including unpressurized aircraft compartments	x	x	x	x	x	x	x	x	x					x
i) <i>High air pressure</i> kPa										106	106	106	106	106
Locations on surfaces vented to the surrounding atmosphere. Locations in pressurized compartments of aircraft	x	x	x	x	x	x	x	x	x	x	x	x	x	x
j) <i>Rate of change of air pressure</i> kPa/min										Negligible	Negligible	Negligible	Negligible	6
Any location, excluding unpressurized aircraft compartments	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Any location, including unpressurized aircraft compartments	x	x	x	x	x	x	x	x	x					x
k) <i>Solar radiation</i> W/m <sup>2</sup>										700	700	1 120	1 120	1 120
Totally weatherprotected locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Locations directly exposed to open-air climate. Partially weatherprotected locations	x	x	x	x	x	x	x	x	x			x	x	x
l) <i>Heat radiation</i> (see Table 2)										Z	Z	Z	Z	Z
Any location	x	x	x	x	x	x	x	x	x	x	x	x	x	x
m) <i>Movement of surrounding air</i> (see Table 2)										Z	Z	Z	Z	Z
Any location	x	x	x	x	x	x	x	x	x	x	x	x	x	x
n) <i>Condensation</i>										Yes	Yes	Yes	Yes	Yes
Any location	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Condition of use	Type of climate									Class				
	Extremely Cold	Cold	Cold Temperate	Warm Temperate	Warm Dry	Mild Warm Dry	Extremely Warm Dry	Warm Damp	Warm Damp, Equable	7K1	7K2	7K3	7K4	7K5
o) <i>Precipitation (rain, snow, hail etc.)</i>										No	No	Yes	Yes	Yes
Weatherprotected locations	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Non-weatherprotected locations	×	×	×	×	×	×	×	×	×			×	×	×
p) <i>Rain intensity</i> mm/min										None	None	6	6	15
Weatherprotected locations	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Non-weatherprotected locations	×	×	×	×	×	×	×	×	×			×	×	×
q) <i>Low rain temperature</i> °C										None	None	+ 5	+ 5	+ 5
Weatherprotected locations	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Non-weatherprotected locations	×	×	×	×	×	×	×	×	×			×	×	×
r) <i>Water from sources other than rain</i> (see Table 2)										Z	Z	Z	Z	Z
Any location	×	×	×	×	×	×	×	×	×	×	×	×	×	×
s) <i>Ice and frost formation</i>										No	Yes	Yes	Yes	Yes
Temperature controlled weatherprotected locations. Heating or cooling may be switched off for periods, but occurrence of low temperatures is prevented	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Any location	×	×	×	×	×	×	×	×	×		×	×	×	×

**A.2.2 B. Biological conditions**

Condition of use	Class		
	7B1	7B2	7B3
a) <i>Flora</i>	Negligible	Presence of mould, fungus, etc.	Presence of mould, fungus, etc.
Locations with negligible risks of growth of mould, fungus, etc., or protected from growth of mould, fungus, etc.	×	×	×
Locations with risks of growth of mould, fungus, etc., and not protected from growth of mould, fungus, etc.		×	×
b) <i>Fauna</i>	Negligible	Presence of rodents and other animals harmful to products, excluding termites	Presence of rodents and other animals harmful to products, including termites
Locations with negligible risks of attacks by rodents and other animals, including termites, or protected from animals	×	×	×
Locations with risks of attacks by rodents and other animals, excluding termites, and not protected from animals		×	×
Locations with risks of attacks by rodents and other animals, including termites, and not protected from animals			×

## A.2.3 C. Chemically active substances

Condition of stationary use		Class									
		7C1R	7C1L	7C1	7C2		7C3		7C4		
		Maximum value	Maximum value	Maximum value	Mean value	Maximum value	Mean value	Mean value	Mean value	Maximum value	
a) <i>Salts</i>		Negligible	Negligible	Negligible	Salt mist		Salt mist		Salt mist		
b) <i>Sulphur dioxide</i>	mg/m <sup>3</sup>	0,01	0,1	0,1	0,3	1,0	5,0	10	13	40	
c) <i>Hydrogen sulphide</i>	mg/m <sup>3</sup>	0,0015	0,01	0,01	0,1	0,5	3,0	10	14	70	
d) <i>Chlorine</i>	mg/m <sup>3</sup>	0,001	0,01	0,1	0,1	0,3	0,3	1,0	0,6	3,0	
e) <i>Hydrogen chloride</i>	mg/m <sup>3</sup>	0,001	0,01	0,1	0,1	0,5	1,0	5,0	1,0	5,0	
f) <i>Hydrogen fluoride</i>	mg/m <sup>3</sup>	0,001	0,003	0,003	0,01	0,03	0,1	2,0	0,1	2,0	
g) <i>Ammonia</i>	mg/m <sup>3</sup>	0,03	0,3	0,3	1,0	3,0	10	35	35	175	
h) <i>Ozone</i>	mg/m <sup>3</sup>	0,004	0,01	0,01	0,05	0,1	0,1	0,3	0,2	2,0	
i) <i>Nitrogen oxides</i>	mg/m <sup>3</sup>	0,01	0,1	0,1	0,5	1,0	3,0	9,0	10	20	
Locations with stringently monitored and controlled atmosphere (clean room category)		×	×	×	×		×		×		
Locations with continuously controlled atmosphere			×	×	×		×		×		
Locations in rural and some urban areas with low industrial activities and moderate traffic				×	×		×		×		
Locations in urban areas with industrial activities or with heavy traffic					×		×		×		
Locations in immediate neighbourhood of industrial sources with chemical emissions							×		×		
Locations within industrial plants. Emissions of chemical pollutants in high concentration									×		
NOTE It is not mandatory to consider each of the classes 7C3 and 7C4 as a requirement for the combined effect of all parameters stated. If applicable, values of single parameters may be selected from these classes. In this case the severities of class 7C2 are valid for all parameters not specially named.											

## A.2.4 Mechanically active substances

Condition of use	Class		
	7S1	7S2	7S3
a) <i>Sand</i> mg/m <sup>3</sup>	30	300	10 000
b) <i>Dust (suspension)</i> mg/m <sup>3</sup>	0,2	5,0	20
c) <i>Dust (sedimentation)</i> mg/(m <sup>2</sup> · h)	1,5	20	80
Location without special precautions to minimize the presence of sand and dust	×	×	×
Locations in proximity to sand and dust sources		×	×
Locations with processes producing sand or dust, or in geographical areas with high proportion of wind-driven sand or dust in air			×

## A.2.5 M. Mechanical conditions

Condition of use	Class								
	7M1			7M2			7M3		
a) <i>Stationary vibration, sinusoidal:</i> displacement amplitude mm acceleration amplitude m/s <sup>2</sup> frequency range Hz	3,5	10	15	3,5	10	15	7,5	20	40
	2-9	9-200	200-500	2-9	9-200	200-500	2-8	8-200	300-500
Locations with e.g. vibrations from machines placed or mounted on the same structure. Careful handling and transfer by humans (humans with low physical activities or not using other tools with high mechanical input at the same time). Transfer means are e.g. well-cushioned trolleys and carts, road vehicles in areas with well developed roads, trains with soft suspension, ships, aircraft	×			×			×		
Locations with e.g. vibrations from machines placed or mounted on the same structure. Rough handling and transfer by humans (humans with high physical activities or using tools with high mechanical input at the same time). Transfer means are e.g. uncushioned trolleys and carts, road vehicles in areas without well developed road systems, trailers, trains with hard suspension							×		
b) <i>Stationary vibration, random:</i> acceleration spectral density m <sup>2</sup> /s <sup>3</sup> frequency range Hz	1	0,3		1	0,3		3	1	
	10-200	200-2 000		10-200	200-2 000		10-200	200-2 000	
Transfer by jet aircraft, air cushioned road vehicles, air cushioned trailers, other road vehicles in areas with well developed road systems, trains with soft suspension, forklift trucks (only 10 Hz to 500 Hz), etc.	×			×			×		
Transfer by road vehicles in areas without well developed road systems, trailers, trains with hard suspension (only 10 Hz to 500 Hz), etc.							×		
c) <i>Non stationary vibration, including shock:</i> shock response spectrum type I peak acceleration $\hat{a}$ m/s <sup>2</sup> shock response spectrum type II peak acceleration $\hat{a}$ m/s <sup>2</sup>	100			100			300		
	None			300			1 000		

Condition of use	Class		
	7M1	7M2	7M3
Locations with e.g. shocks from other machines in the vicinity or mounted on the same structure, from ground blasting or pile-driving in the neighbourhood, slamming of doors, starting and stopping of machines. Careful handling and transfer by humans. Transfer means e.g. well-cushioned trolleys and carts, aircraft, ships, well-cushioned road vehicles	×	×	×
Locations with e.g. shocks from blasting or pile-driving, slamming of doors, starting and stopping of machines. Less careful handling and transfer by humans. Transfer means are e.g. trolleys and carts, road vehicles in areas with well developed road systems, trains with soft suspension		×	×
Locations with e.g. shocks from starting and stopping of machines. Rough handling and transfer by humans. Transfer means are e.g. uncushioned trolleys and carts, road vehicles in areas without well developed road systems (trailers excepted), trains with hard suspension			×
d) <i>Free fall</i> : mass less than 1 kg fall height m 0,025 mass between 1 kg and 10 kg fall height m 0,025 mass between 10 and 50 kg fall height m 0,025 mass more than 50 kg fall height m	0,025 0,025 0,025	0,25 0,1 0,05	1,0 0,5 0,25
	The severity is a matter of negotiation between supplier and user.		
Careful handling and transfer, e.g. in laboratories, handling of sensitive products, etc.	×	×	×
Handling and transfer without special care, e.g. in workshops, offices, kitchens, etc.		×	×
Rough handling and transfer, e.g. in factories, process plants, construction works, use by handicapped persons, etc.			×

### A.3 Summary of conditions covered by the classes

This summary contains a description of the complete classification.

#### A.3.1 K. Climatic conditions

These are covered by five class notations as follows. For types and groups of climates, see IEC 721-2-1.

- 7K1** This class applies to use at, and direct transfer between temperature controlled enclosed locations. Humidity is not controlled.
- Heating or cooling is used to maintain the required conditions, especially where there is a large difference between them and the open-air climate.
- Products may be exposed to solar radiation, heat radiation, movements of surrounding air (e.g. due to draughts in buildings, process conditions, etc.), condensed water, and from sources other than rain. They are not subjected to precipitation or formation of ice.
- The conditions of this class may be found in, and during transfer to normal living and 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.
- 7K2** In addition to the conditions covered by class 7K1, the class 7K2 applies to use at, and direct transfer between enclosed locations having neither temperature nor humidity control.
- 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.
- Products may be subjected to formation of ice.
- The conditions of this class may be found in, and during transfer to e.g. entrances and staircases of buildings, 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.
- 7K3** In addition to the conditions covered by class 7K2, the class 7K3 applies to:
- use at totally or partially weatherprotected locations in buildings of any construction, situated in geographical areas with Warm Temperate, Warm Dry, Mild Warm Dry, Extremely Warm Dry, Warm Damp, and Warm Damp, Equable types of climates,
  - use at non-weatherprotected locations which are directly exposed to an open-air climate covered by the Restricted Group of Open-Air Climates,
  - transfer between any of these locations.
- 7K4** In addition to the conditions covered by class 7K3, the class 7K4 applies to:
- use at totally or partially weatherprotected locations in buildings of any construction, situated in geographical areas with Cold Temperate, Warm Temperate, Warm Dry, Mild Warm Dry, Extremely Warm Dry, Warm Damp, and Warm Damp, Equable types of climate,
  - use at non-weatherprotected locations which are directly exposed to an open-air climate covered by the Moderate Group of Open-Air Climates,
  - transfer between any of these locations.
- 7K5** In addition to the conditions covered by class 7K4, the class 7K5 applies to:
- use at locations situated in geographical areas with open-air climates covered by the Worldwide Group of Open-Air Climates:
    - totally or partially weatherprotected in buildings of any construction,
    - non-weatherprotected directly exposed to the open-air climate,
  - transfer between any of these locations, by any means, including transportation in unpressurized aircraft compartments.
- 7K6** Class 7K6 represents the conditions covered by the Warm Damp and Warm Damp Equable types of Open-Air Climate (tropical damp type of climate, in areas with tropical rainforests).
- 7K7** Class 7K7 represents the conditions covered by the Warm Dry, Mild Warm Dry and Extremely Warm Dry types of Open-Air Climate (tropical dry type of climate, in areas near the tropics such as deserts).

**A.3.2 B. Biological conditions**

These are covered by three class notations as follows:

- 7B1 This class applies to use at, and direct transfer between locations without particular risks of biological attacks. This includes protective measures, e.g. special product design, or installations in locations of such construction that mould growth, attacks by animals, etc., are not probable.
- 7B2 In addition to the conditions covered by class 7B1, the class 7B2 applies to use at, and direct transfer between locations where mould growth, or attacks by animals, except termites, may occur.
- 7B3 In addition to the conditions covered by class 7B2, the class 7B3 applies to use at, and direct transfer between locations where termites may occur.

**A.3.3 C. Chemically active substances**

These are covered by six class notations as follows:

- 7C1R This class applies to use at, and direct transfer between locations with stringently monitored and controlled atmosphere (clean room category).
- 7C1L In addition to the conditions covered by class 7C1R, this class applies to use at, and direct transfer between locations where the atmosphere is continuously controlled.
- 7C1 In addition to the conditions covered by class 7C1L, this class applies to use at, and direct transfer between locations in rural and urban areas with low industrial activities and moderate traffic. In winter, heating methods in concentrated urban areas may cause increased contamination. Salt mist may be present in sheltered locations of coastal areas and in offshore sites.
- 7C2 In addition to the conditions covered by class 7C1, the class 7C2 applies to use at, and direct transfer between locations with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area, or with heavy traffic.
- 7C3 In addition to the conditions covered by class 7C2, the class 7C3 applies to use at, and direct transfer between locations in the immediate neighbourhood of industrial sources with chemical emissions.
- 7C4 In addition to the conditions covered by class 7C3, the class 7C4 applies to use at, and direct transfer between locations within industrial process plants. Emissions of chemical pollutants in high concentrations may occur.

**A.3.4 S. Mechanically active substances**

These are covered by three class notations as follows:

- 7S1 This class applies to use at, and direct transfer between locations without special precautions to minimize the presence of sand or dust.
- 7S2 In addition to the conditions covered by class 7S1, the class 7S2 applies to use at, and direct transfer between locations in close proximity to sand or dust sources.
- 7S3 In addition to the conditions covered by class 7S2, the class 7S3 applies to use at, and direct transfer between locations with processes producing sand or dust, or in geographical areas with high proportion of wind-driven sand or dust in air.

**A.3.5 M. Mechanical conditions**

These are covered by three class notations as follows:

- 7M1 This class applies to use at, and direct transfer between locations with only low level vibrations, or with medium level shocks. The handling and transfer of products is with care.
- 7M2 In addition to the conditions covered by class 7M1, the class 7M2 applies to use at, and direct transfer between locations with high level shocks. The handling and transfer of products is with less care.
- 7M3 In addition to the conditions covered by class 7M2, the class 7M3 applies to use at, and direct transfer between locations with significant vibrations, or with high level shocks. The handling and transfer of products is rough.

## Annex B (informative)

### Interdependence of air temperature, relative humidity and absolute humidity

#### B.1 General

This annex contains a climatogram (see Figure B.1) showing the interdependence of air temperature, relative air humidity and absolute air humidity by curves for constant absolute humidity and lines for temperature and relative humidity.

For a given value of absolute humidity, the corresponding value of relative air humidity at a certain air temperature within the temperature range of a class may be found at the point where the curve for constant absolute air humidity cuts the straight line for air temperature.

#### B.2 Example

In class 7K3, the severity (limit value) for high absolute humidity is  $48 \text{ g/m}^3$ . This means:

- 24 % relative humidity at  $70^\circ\text{C}$ ;
- 38 % relative humidity at  $60^\circ\text{C}$ ;
- 59 % relative humidity at  $50^\circ\text{C}$ ;
- 94 % relative humidity at  $40^\circ\text{C}$ ;
- 100 % relative humidity at  $38^\circ\text{C}$ .

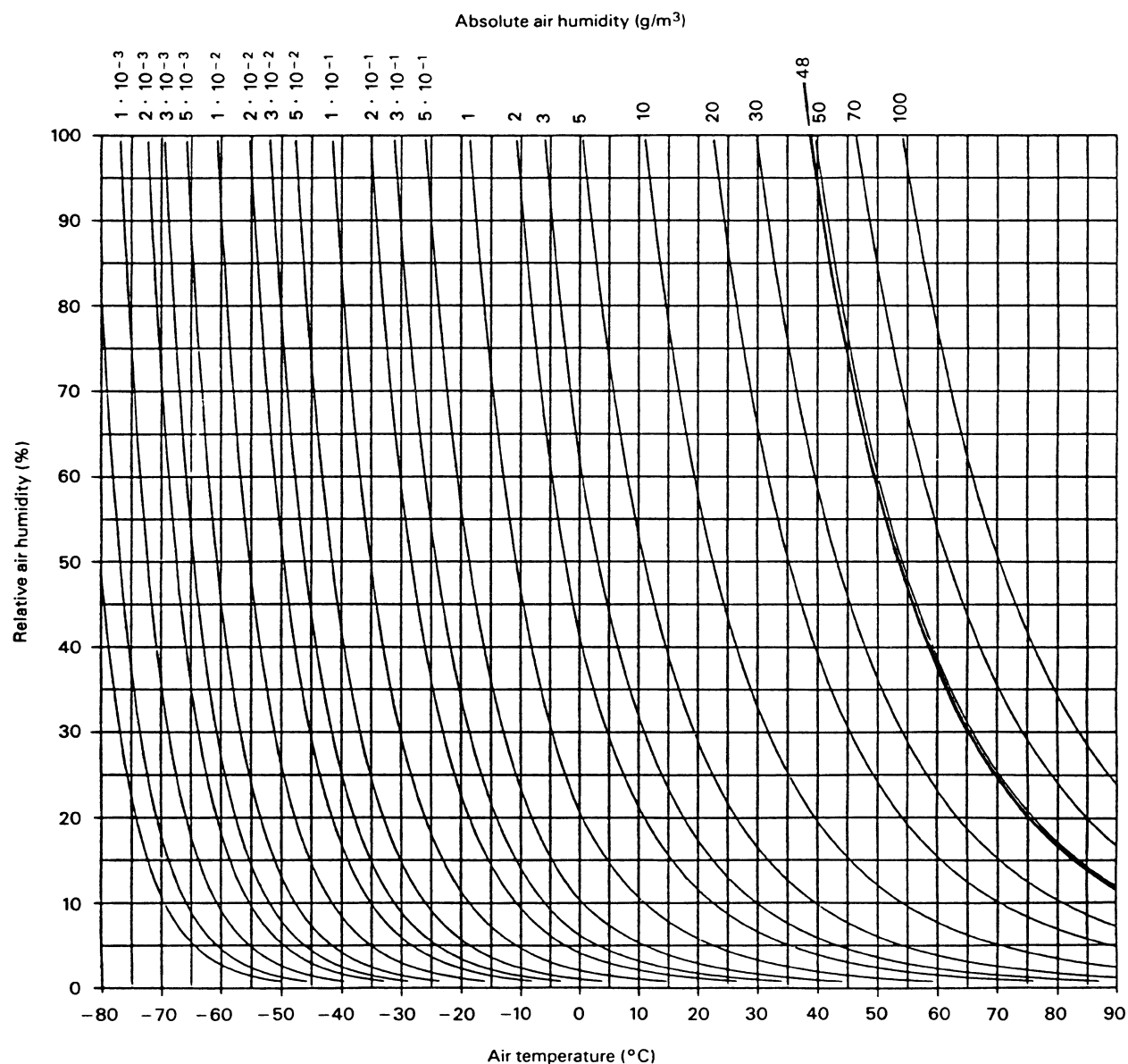


Figure B.1 — Climatogram. Interdependence of air temperature, relative air humidity and absolute air humidity

## Annex C (informative)

### Examples for practical application of the classification specified in this standard

#### C.1 General

These are examples of how to classify use conditions, or a product for use under certain conditions, in accordance with the classification given in this standard.

#### C.2 Examples

Three examples are given to show how the user of a product may inform the supplier of a product about the environmental conditions under which the product is supposed to be operated. For types and groups of climates see IEC 721-2-1.

**C.2.1 Brief description of use conditions****Product:**

Laboratory instrument for reference measurements (high-precision voltmeter).

**Portable and non-stationary use:**

At totally weatherprotected locations with temperature control, situated in areas with open-air climatic conditions according to the Worldwide Group of Open-Air Climates.

Direct influence of open-air climatic conditions during use and transfer excluded.

Careful handling and transfer of product.

**Classification:**

The classes appropriate for the intended use are underlined in the table below:

K	Climatic conditions	<u>7K1</u> 7K2 7K3 7K4 7K5
Z	Special climatic conditions	<u>7Z1</u> 7Z2 7Z3 <u>7Z4</u> 7Z5 7Z6 7Z7 <u>7Z8</u> 7Z9 7Z10 7Z11 7Z12 7Z13 7Z14 7Z15
B	Biological conditions	<u>7B1</u> 7B2 7B3
C	Chemically active substances	7C1 <u>7C2</u> 7C3 7C4
S	Mechanically active substances	<u>7S1</u> 7S2 7S3
M	Mechanical conditions	<u>7M1</u> 7M2 7M3
<i>Summary:</i> 7K1/7Z1/7Z4/7Z8/7B1/7C2/7S1/7M1.		

**C.2.2 Brief description of use conditions****Product:** Hair dryer**Portable and non-stationary use:**

a) At weatherprotected locations with temperature control, situated in areas with open-air climatic conditions according to the Worldwide Group of Open-Air Climates, heat radiation from heating systems may occur.

b) At weatherprotected locations without temperature control, situated in areas with Warm Temperate, Warm Dry, Mild Warm Dry, Warm Damp, and Warm Damp, Equable types of climate.

c) In open-air, in areas with Warm Temperature type of climate.

For a) and b), temporary direct influence of open-air climatic conditions is included (e.g. transfer between two weatherprotected locations).

For a), b), and c), handling and transfer of product without special care.

**Classification:**

The classes appropriate for the intended use are underlined in the table below:

K	Climatic conditions	7K1 7K2 <u>7K3</u> 7K4 7K5
Z	Special climatic conditions	7Z1 <u>7Z2</u> 7Z3 <u>7Z4</u> 7Z5 7Z6 7Z7 <u>7Z8</u> 7Z9 7Z10 7Z11 7Z12 7Z13 7Z14 7Z15
B	Biological conditions	7B1 <u>7B2</u> 7B3
C	Chemically active substances	7C1 <u>7C2</u> 7C3 7C4
S	Mechanically active substances	<u>7S1</u> 7S2 7S3
M	Mechanical conditions	7M1 <u>7M2</u> 7M3
<i>Summary:</i> 7K3/7Z2/7Z4/7Z8/7B2/7C2/7S1/7M2		

**C.2.3 Brief description of use conditions**

*Product:* Walkie-talkie (hand-held) for professional use.

*Portable and non-stationary use:*

a) At weatherprotected locations (with or without temperature control), situated in areas with open-air climatic conditions according to the Worldwide Group of Open-Air Climates. Temporary direct influence of open-air climatic conditions is included (e.g. during transfer between two weatherprotected locations). Where applicable, heat radiation from heating systems may occur,

b) In open-air, in areas with open-air climatic conditions according to the Moderate Group of Open-Air Climates and with Extremely Warm Dry, Warm Damp, and Warm Damp, Equable types of climate.

For a) and b), increased movement of surrounding air, and water from sources other than rain (e.g. spraying water) may occur.

Handling and transfer of product without special care, rough use conditions included.

*Classification:*

The classes appropriate for the intended use are underlined in the table below:

K	Climatic conditions	7K1 7K2 7K3 <u>7K4</u> 7K5
Z	Special climatic conditions	7Z1 <u>7Z2</u> 7Z3 7Z4 7Z5 <u>7Z6</u> 7Z7 7Z8 7Z9 <u>7Z10</u> 7Z11 7Z12 7Z14 7Z15
B	Biological conditions	7B1 <u>7B2</u> 7B3
C	Chemically active substances	7C1 7C2 <u>7C3</u> 7C4
S	Mechanically active substances	7S1 7S2 <u>7S3</u>
M	Mechanical conditions	7M1 7M2 <u>7M3</u>
<i>Summary:</i> 7K4/7Z2/7Z6/7Z10/7B2/7C3/7S3/7M3		

**Annex D (informative)****Summary of conditions covered by sets of class combinations**

This summary contains a condensed description of the complete classification for five standardized environmental condition cases and in some instances, refers to examples of application.

For a more detailed description see Annex A.

The general environmental conditions are covered by five set notations as follows:

- IE71 IE71 applies to use at, and direct transfer between temperature-controlled, enclosed locations exposed to the Worldwide Group of Open-Air Climates, with no humidity control but where heating or cooling may be used to maintain required conditions especially where there is a large difference between these and the open-air climate, exposed to some solar and heat radiation, to movements of surrounding air due to draughts through open windows or due to special processes, exposed to condensation and normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area or with heavy traffic, no special precautions to minimize presence of dust or sand, exposed to low-level vibration or medium-level shocks, handling and transfer of products with care. These conditions are found in normal living and working rooms, for example living-rooms, rooms for general use, offices, shops, workshops, telecommunication centres.
- IE72 In addition to the conditions covered by IE71, IE72 applies to use at and transfer between locations with high-level shocks, handling and transfer of products with less care.
- IE73 In addition to the conditions covered by IE72, IE73 applies to the use at and transfer between locations having neither temperature nor humidity control but where heating may be used to raise low temperatures, to locations exposed to dripping water. Products may be subjected to formation of ice. These conditions are found in entrances and staircases, garages, certain workshops, buildings in factories and industrial process plants, unattended equipment stations.

- IE74 In addition to the conditions covered by IE73, IE74 applies to:
- use at totally or partially weatherprotected locations in buildings of any construction exposed to the Warm Temperate, Warm Dry, Mild Warm Dry, Extremely Warm Dry, Warm Damp, and Equable Warm Damp, Equable types of Open-Air Climates;
  - use at non-weatherprotected locations which are directly exposed to the Warm Temperate type of Open-Air Climate;
  - transfer between any of these locations.
- IE75 In addition to the conditions covered by IE74, IE75 applies to:
- use at totally or partially weatherprotected locations in buildings of any construction exposed to the Cold Temperate Type of Open-Air Climates;
  - use at non-weatherprotected locations exposed to the Moderate Group of Open-Air climates;
  - transfer between any of these locations;
  - exposure to significant vibration or high-level shocks, rough handling and transfer of products.

## Annex E (informative)

### Explanation of the environmental conditions in tropical areas as specified in classes 7K6 and 7K7

#### E.1 General

The tropics are the areas within the Northern and Southern tropics (between 23° 27' south and 23° 27' north).

In tropical areas the following types of Open-Air Climate, as specified in IEC 721-2-1, apply:

- Warm Dry (WDr)
- Mild Warm Dry (MWDr)
- Extremely Warm Dry (EWDr)
- Warm Damp (WDa)
- Warm Damp Equable (WDaE)

The tropics are the zones of the earth in which during daytime, high temperatures, frequently combined with high precipitation, prevail. In these areas seasonal changes are scarcely pronounced.

The tropical climate extends from Warm Damp climate conditions in tropical rainforests at the equator to the Warm Dry climate in the deserts near the tropics. Consequently, two types of tropical climate should be distinguished:

- *tropical dry* as a combination of the Warm Dry, Mild Warm Dry and Extremely Warm Dry types of climate, and
- *tropical damp* as a combination of the Warm Damp and Warm Damp Equable types of climate.

There are also regions where the climate, owing to the particular altitude, deviates considerably from the usual conditions of these latitudes, for example solar radiation and air pressure or ice and snow on mountain summits. In many areas in the tropics, environmental conditions are identified by uniform conditions and in other regions by very extreme climatic conditions:

Balanced conditions:

- minimum daily temperature fluctuations of less than 1 °C and annual temperature fluctuations of maximum 6 °C;
- balanced duration of daylight periods between 10,5 h and 13,5 h;
- uniform intensity of solar radiation;
- balanced conditions for an abundant fauna.

Extreme conditions:

- precipitation: rainfall the whole year round near the equator, heavy rainfall during certain periods of the year near the tropics;
- tropical cyclones in sea areas: wind velocities of 30 m/s with peaks attaining more than 60 m/s, for example in typhoons in the Western Pacific and in hurricanes in the Caribbean Sea;

- unfavourable soil conditions: erosion of humus and minerals in areas with heavy rainfalls;
- rapid drying of soil in the desert as a result of high temperatures and strong winds;
- lush vegetation in tropical rainforests, less dense vegetation in mountain forests;
- grass areas of savannahs and steppes, absence of vegetation in the desert.

## **E.2 Climatograms**

Climatograms for the two classes describing climatic conditions in tropical areas are given in Figure E.1. They are based on the mean value of annual extreme values of air temperature and humidity for the types of climate specified in **E.1** above.

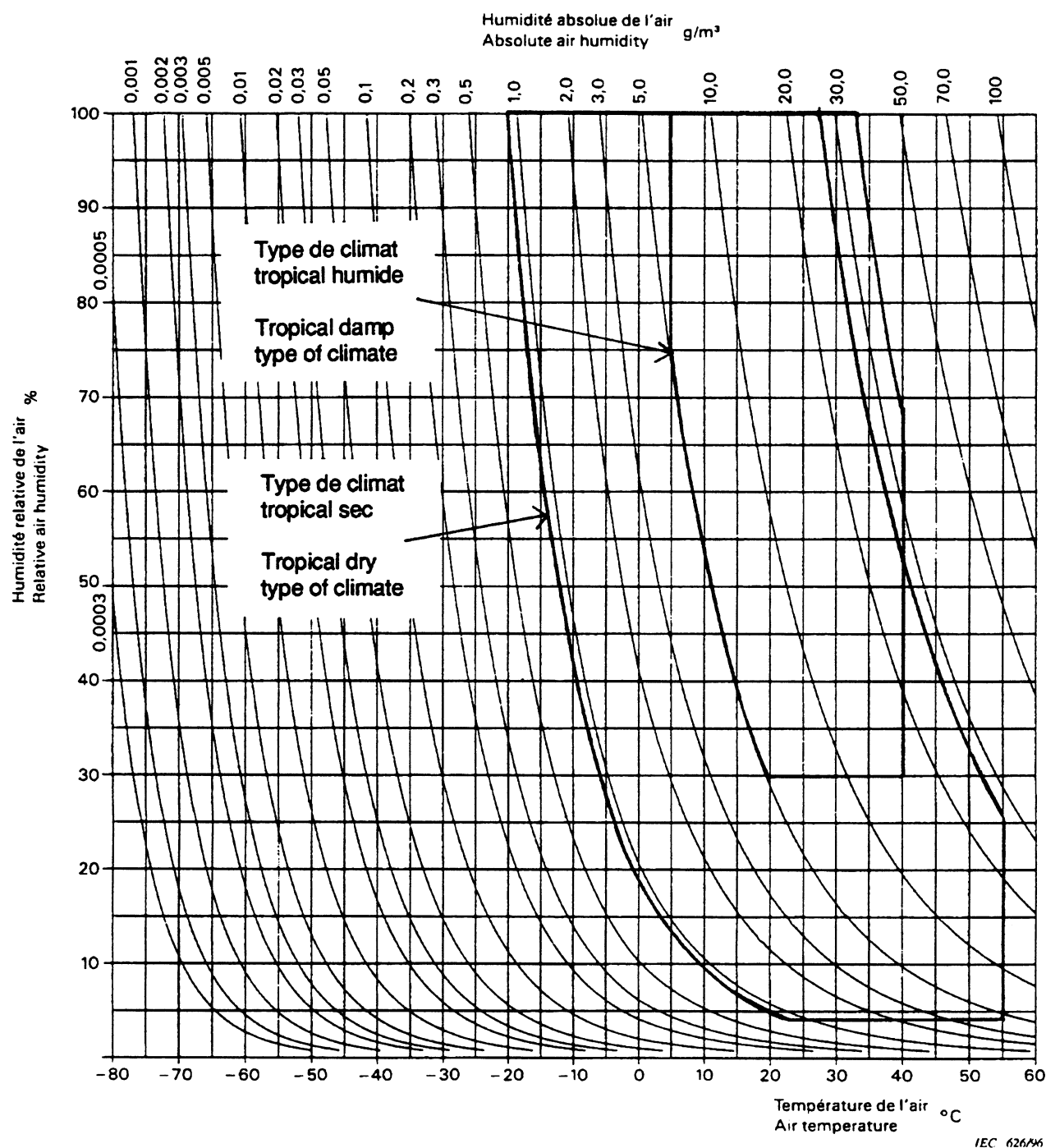


Figure E.1 — Climatograms for tropical damp type of climate and tropical dry type of climate

Annex ZA (normative)  
Other international publications quoted in this standard with the references of the relevant European publications

This European Standard 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

NOTE When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
721-1	1990	<i>Classification of environmental conditions —</i>	HD 478.1 S2	1994
A1	1992	<i>Part 1: Environmental parameters and their severities</i>		
721-2-1	1982	<i>Part 2: Environmental conditions appearing in nature</i>	HD 478.2.1 S1	1989
A1	1987	<i>Section 1: Temperature and humidity</i>		
721-3-0	1984	<i>Classification of environmental conditions —</i>	EN 60721-3-0	1993
A1	1987	<i>Part 3: Classification of groups of environmental parameters and their severities</i> <i>Section 0: Introduction</i>		
721-3-2	1985	<i>Section 2: Transportation</i>	EN 60721-3-2	1993
A1	1991		A2	1994
A2	1993			
721-3-3	1994	<i>Section 3: Stationary use at weatherprotected locations</i>	EN 60721-3-2	1993
721-3-4	1995	<i>Section 4: Stationary use at non-weatherprotected locations</i>	EN 60721-3-4	1995

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## List of references

See national foreword.

**BS EN**  
**60721-3-7:**  
**1996**  
**IEC 721-3-7:**  
**1995**

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