

Classification of environmental conditions —

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

Section 3.3 Stationary use at weatherprotected locations

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National foreword

This Section of BS EN 60721 has been prepared by Technical Committee GEL/50 and is the English language version of EN 60721-3-3:1995 *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 3: Stationary use at weatherprotected locations including amendment A1:1997*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 721-3-3:1994 including Amendment 1:1996, published by the International Electrotechnical Commission (IEC).

This British Standard supersedes BS EN 60721-3-3:1993 (formerly BS 7527-3.3:1991), which is withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
EN 60721-3-0:1993 (IEC 721-3-0:1982)	BS EN 60721 <i>Classification of environmental conditions</i> Part 3. <i>Classification of groups of environmental parameters and their severities</i> Section 3.0:1993 <i>Introduction</i>
HD 478.1 S2 (IEC 721-1:1990)	Part 1:1991 <i>Environmental parameters and their severities</i>
HD 478.2.1 S1 (IEC 721-2-1:1982)	Part 2. <i>Environmental conditions appearing in nature</i> Section 1:1991 <i>Temperature and humidity</i>

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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 42, 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.

English version

Classification of environmental conditions
Part 3: Classification of groups of environmental
parameters and their severities
Section 3: Stationary use at weatherprotected locations

(includes amendment A2:1997)
(IEC 721-3-3:1994 + A2:1996)

Classification des conditions d'environnement
Partie 3: Classification des groupements des
agents d'environnement et de leurs sévérités
Section 3: Utilisation à post fixe, protégé contre
les intempéries
(inclut l'amendement A2:1997)
(CEI 721-3-3:1994 + A2:1996)

Klassifizierung von Umweltbedingungen
Teil 3: Klassen von Umwelteinflußgrößen und
deren Grenzwerte
Hauptabschnitt 3: Ortsfester Einsatz
wettergeschützt
(enthält Änderung A2:1997)
(IEC 721-3-3:1994 + A2:1996)

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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

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 75(CO)102A, future amendment to IEC 721-3-3:1987, 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 60721-3-3:1993 on 1994-10-04.

The text of this document, together with that of IEC 721-3-3:1987 and its amendments 1:1991 and 2:1993, was published by IEC as the second edition of IEC 721-3-3 in December 1994.

According to a decision of principle taken by the Technical Board of CENELEC, the approval of EN 60721-3-3:1993/A3 has been converted into the approval of a new EN 60721-3-3.

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) 1995-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1995-12-01

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 A2

The text of document 75/279/FDIS, future amendment 2 to IEC 721-3-3:1994, prepared by IEC TC 75, Classification of environmental conditions, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60721-3-3:1995 on 1996-12-09.

NOTE There is no amendment A1 to EN 60721-3-3:1995.

The following dates were fixed:

- latest date by which the amendment 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 amendment have to be withdrawn (dow) 1997-09-01

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1 Scope

This section of IEC 721-3 classifies groups of environmental parameters and their severities to which products are subjected when mounted for stationary use at weatherprotected locations under use conditions, including periods of erection work, down time, maintenance and repair.

Weatherprotected locations, where products may be mounted for stationary use permanently or temporarily, include land-based and offshore enclosed and sheltered locations. Use in and on vehicles is excepted.

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 products 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 at non-weatherprotected locations, portable and non-stationary use, use in vehicles and ships, conditions of storage and transportation, and microclimates inside products 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*.

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)*.

3 Definitions

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

3.1 stationary use

the product is mounted firmly on the structure or on mounting devices or it is permanently placed at a certain site. It is not intended for portable or non-stationary use, but short periods of handling during erection work, down time, maintenance and repair at the location are included

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 totally excluded.

4 General

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

During periods of erection work, which are often connected with down time, the user should be aware that conditions might differ from those experienced during the period of operation. Therefore the selection of another class may be necessary for this period, unless special precautions have been taken.

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 frequencies of occurrence is given in Amendment No. 1 to 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 for 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) and 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 world-wide 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 classes with lower severity digits.

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

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

3K2/3Z1/3Z4/3B1/3C2/3S1/3M4.

(See also clause 6.)

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 climatograms showing the interdependence of air temperature, relative humidity and absolute humidity for the climatic classes specified in Table 1.

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

5.1 Climatic conditions

The climatic conditions specified for classes 3K1 to 3K8 represent the conditions at weatherprotected locations. They have been experienced world-wide over long periods 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 and internal conditions, e.g. heat dissipation from mounted equipment, presence of humans, etc. The conditions should cover all normal cases, but not exceptional events, e.g. failure of air-conditioning systems.

Climatic conditions in tropical areas as specified in classes 3K9 and 3K10 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 variations 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 the effect of building radiation at night. The effect of solar radiation can be increased by either heat-trap or greenhouse effects.

The actual interdependence of air temperature and humidity cannot be shown by stating severities only. Therefore climatograms are given in Annex B.

5.2 Special climatic conditions

As the parameters heat radiation, movement of surrounding air, water from sources other than rain, high air temperature, and low air pressure may in practice 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 emissions 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 the 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 3C1 will normally be experienced in rural areas and areas with low industrial activities. The values specified for class 3C2 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 3C3 and 3C4, 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 to the case of application. If single parameters of the classes 3C3 or 3C4 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 3C2 are valid.

NOTE Chemically active liquids and chemically active solids other than sea 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 vibrations (sinusoidal) are classified by severity levels of acceleration and displacement amplitude in high and low frequency ranges respectively.

Random vibration is not considered in this standard. It may be included when sufficient information is available.

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.

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 divergencies.

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 IE32. 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 IE32 but sand 30 mg/m³.

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

Table 1 — Classification of climatic conditions

Environmental parameter	Unit	Class												
		3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L	3K9 ^h	3K10 ^h
a) <i>Low air temperature</i>	°C	+ 20 ^c	+ 15	+ 5	+ 5	− 5	− 25	− 40	− 40	− 55	− 25	− 55	+ 5	− 20
b) <i>High air temperature^e</i>	°C	+ 25 ^c	+ 30	+ 40	+ 40 ^e	+ 45 ^e	+ 55	+ 70	+ 40	+ 70	+ 70	+ 55	+ 40	+ 55
c) <i>Low relative humidity</i>	%	20	10	5	5	5	10	10	10	10	10	10	30	4
d) <i>High relative humidity</i>	%	75	75	85	95	95	100	100	100	100	100	100	100	100
e) <i>Low absolute humidity</i>	g/m ³	4	2	1	1	1	0,5	0,1	0,1	0,02	0,5	0,02	6	0,9
f) <i>High absolute humidity</i>	g/m ³	15	22	25	29	29	29	35	35	35	35	29	36	27
g) <i>Rate of change of temperature^a</i>	° C/ min	0,1	0,5	0,5	0,5	0,5	0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0
h) <i>Low air pressure^g</i>	kPa	70	70	70	70	70	70	70	70	70	70	70	70	70
i) <i>High air pressure^b</i>	kPa	106	106	106	106	106	106	106	106	106	106	106	106	106
j) <i>Solar radiation</i>	W/m ²	500	700	700	700	700	1 120	1 120	None	1 120	1 120	1 120	1 120	1 120
k) <i>Heat radiation</i>	None	No	f	f	f	f	f	f	f	f	f	f	f	f
l) <i>Movement of surrounding air^d</i>	m/s	0,5	1,0 ^e	1,0 ^e	1,0 ^e	1,0 ^e	1,0 ^e	5,0 ^e	5,0 ^e	5,0 ^e	5,0 ^e	5,0 ^e	5,0 ^e	5,0 ^e
m) <i>Condensation</i>	None	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
n) <i>Wind-driven precipitation (rain, snow, hail, etc.)</i>	None	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
o) <i>Water from sources other than rain</i>	None	No	No	No	f	f	f	f	f	f	f	f	f	f
p) <i>Formation of ice</i>	None	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

^a Averaged over a period of time of 5 min.^b Conditions in mines are not considered.^c These are air-conditioned locations with a tolerance of ± 2 °C on stated temperature values.^d A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.^e If applicable, a special value may be selected from Table 2.^f Conditions occurring at the locations concerned to be selected from Table 2.^g Severity value of 70 kPa covers worldwide application (altitudes up to 3 000 m). For some restricted applications, a value may be selected from Table 2.^h Further information on classes 3K9 (tropical damp) and 3K10 (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>	3Z11	°C	+ 55
h) <i>Low air pressure</i> ^c	3Z12	kPa	84
k) <i>Heat radiation</i>	3Z1	None	Negligible
	3Z2	None	Heat radiation, e.g. in the vicinity of room heating systems
	3Z3	None	Heat radiation, e.g. in the vicinity of room heating systems or commercial ovens or industrial furnaces
l) <i>Movement of surrounding air</i> ^a	3Z4	m/s	5
	3Z5	m/s	10
	3Z6	m/s	30
o) <i>Water from sources other than rain</i> ^b	3Z7	None	Dripping water
	3Z8	None	Spraying water
	3Z9	None	Splashing water
	3Z10	None	Water jets
^a A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.			
^b Underwater conditions are not included.			
^c Class 3Z12 corresponds to an altitude of approximately 1 400 m.			

Table 3 — Classification of biological conditions

Environmental parameter	Unit	Class		
		3B1	3B2	3B3
a) <i>Flora</i>	None	No	Presence of mould, fungus etc.	Presence of mould, fungus, etc.
b) <i>Fauna</i>	None	No	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 ^a	Class ^b									
		3C1R	3C1L	3C1	3C2		3C3 ^c		3C4 ^c		
		Maximum value	Maximum value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	
a) <i>Sea salts</i>	None	No	No	No ^d	Salt mist		Salt mist		Salt mist		
b) <i>Sulphur dioxide</i>	mg/m ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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 ³ cm ³ /m ³	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	

^a The values given in cm³/m³ have been calculated from the values given in mg/m³ and refer to a temperature of 20 °C and a pressure of 101,3 kPa. The table uses rounded values.

^b 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.

^c It is not mandatory to consider each of classes 3C3 and 3C4 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 3C2 are valid for all parameters not especially named.

^d Salt mist may be present in sheltered locations of coastal areas and in offshore sites.

Table 5 — Classification of mechanically active substances

Environmental parameter	Unit	Class			
		3S1	3S2	3S3	3S4
a) <i>Sand</i>	mg/m ³	None	30	300	3 000
b) <i>Dust (suspension)</i>	mg/m ³	0,01	0,2	0,4	4,0
c) <i>Dust (sedimentation)</i>	mg/(m ² · h)	0,4	1,5	15	40

Table 6 — Classification of mechanical conditions

Environmental parameter	Unit	Class							
		3M1	3M2	3M3	3M4	3M5	3M6	3M7	3M8
a) <i>Stationary vibration, sinusoidal:</i> displacement amplitude acceleration amplitude frequency range	mm m/s ² Hz	0,3 1 2-9 9-200	1,5 5 2-9 9-200	1,5 5 2-9 9-200	3,0 10 2-9 9-200	3,0 10 2-9 9-200	7,0 20 2-9 9-200	10 30 2-9 9-200	15 50 2-9 9-200
b) <i>Non-stationary vibration including shock:</i> (see Figure 1) shock response spectrum type I, peak acceleration $\dot{a}$ shock response spectrum type I, peak acceleration $\dot{a}$ shock response spectrum type II, peak acceleration $\dot{a}$	m/s ² m/s ² m/s ²	40 None None	40 None None	70 None None	None 100 None	None None 250	None None 250	None None 250	None None 250

Table 7 — Sets of environmental class combinations

Condition	Set of class combinations						
	IE31	IE32	IE33	IE34	IE35	IE36	IE37
Climatic	3K2	3K3	3K3	3K4	3K5	3K6	3K7
Special climatic	—	3Z2	3Z2	3Z2	3Z2	3Z2	3Z2
	—	3Z4	3Z4	3Z4	3Z4	3Z5	3Z5
	—	—	—	3Z8	3Z8	3Z8	3Z8
Biological	3B1	3B1	3B1	3B2	3B2	3B2	3B2
Chemically active substances	3C1	3C1	3C2	3C2	3C2	3C2	3C2
Mechanically active substances	3S1	3S1	3S2	3S2	3S3	3S3	3S3
Mechanical	3M1	3M1	3M2	3M2	3M3	3M3	3M3