

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Classification des conditions d'environnement –
Partie 3-3: Classification des groupements des agents d'environnement et de
leurs sévérités – Utilisation à poste fixe, protégé contre les intempéries**



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IEC 60721-3-3:2019

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

**Part 3-3: Classification of groups of environmental parameters
and their severities – Stationary use at weatherprotected locations**

FOREWORD

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International Standard IEC 60721-3-3 has been prepared by IEC technical committee 104: Environmental conditions, classification, and methods of test.

This third edition cancels and replaces the second edition published in 1994, Amendment 1: 1995 and Amendment 2:1996. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Clause 3: definitions aligned with IEC 60721-3-1.
- b) Clause 4: aligned with IEC 60721-3-1.
- c) Clause 5: Clause A.3 has been incorporated into Clause 5.

- d) Subclause 5.2: all existing climate classes have been replaced by completely new classes. The new classes are divided into two groups. The reason for the new classes is the latest revision of IEC 60721-2-1 which incorporates new climate types.
- e) Subclause 5.3: addition of a new class for low air pressure.
- f) Defined values of chemically active substances are now by reference to ISO 9223.
- g) Subclause 5.6: all existing classes for mechanically active substances have been replaced by completely new classes, in alignment with IEC 60721-3-1.
- h) Subclause 5.7: all existing classes for mechanical conditions have been replaced by completely new classes, in alignment with IEC 60721-3-1.
- i) Table 1: new climatic classes with new severities.
- j) Table 2: new class for low air pressure.
- k) Table 4: new mechanically active substances classes.
- l) Table 5: new mechanical conditions classes.
- m) Annex A: revised and includes a clean climatogram.
- n) Annex B: revised and includes the definition of seismic environment.
- o) All classes regarding fire, all combined classes, all chemically active substances classes, Clause A.2, Annexes C, D and E have been removed.

The text of this International Standard is based on the following documents:

FDIS 104/829/FDIS	Report on voting 104/837/RVD
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Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

<https://standards.iteh.ai/catalog/standards/sist/3d612aaa-6837-4b17-bfa3-9d489eb9ed/iec-60721-3-3-2019>

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60721 series, published under the general title *Classification of environmental conditions*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

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

1 Scope

This part of IEC 60721 classifies groups of environmental parameters and their severities to which products are subjected when installed for stationary use at weatherprotected locations.

The environmental conditions specified in this document are limited to those which can 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 provided.

Environmental conditions directly related to explosion hazards, microclimate within a product, fire extinction and ionizing radiation are excluded. Any other unforeseen incidents are also excluded. The possibility of their occurrence can be considered as special cases. This document does not cover equipment covered by building standards, codes or regulations.

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 parts of the IEC 60721-3 series.

A limited number of classes of environmental conditions is given, covering a broad field of applications.

<https://standards.iteh.ai/catalog/standards/sist/3d612aaa-6837-4b17-bfa3-9d4f89ebcced/iec-60721-3-3-2019>

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60721-3-0, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Introduction*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60721-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

stationary use

use of a product mounted firmly on a structure, or permanently placed at a certain site

3.2

weatherprotected location

location at which a product is protected from direct exposure to meteorological conditions

4 General

A product may be subjected to a range of environmental conditions during its lifetime. These conditions have been separated into classes described in IEC 60721-3-0. The classes given may be used for defining the maximum short-term environmental stresses of a product. However, they do not provide information regarding the long-term or total lifetime environmental stresses a product may experience. This means that no reliability or lifetime assessment is possible based on these classes alone. Refer to IEC 60721-2 (all parts) and applicable technical reports (IEC TR 62130 and IEC TR 62131-5) for further information on actual environmental conditions.

A product will be simultaneously exposed to a number of environmental parameters, for example, low air pressure and temperature, temperature and humidity, as well as vibration and temperature change. Combinations of the environmental parameters given may increase the effect on a product. Therefore, combined conditions should be considered in the design and evaluation of a product.

Products should be designed to survive and operate in different environments. Basically, they will be affected by the environmental influences in two ways:

- by the effects of short-term extreme environmental conditions which may directly cause malfunction or destroy the product,
- by the effect of long-term subjection to non-extreme environmental stresses which may slowly degrade the product and finally cause malfunction or destruction of the product.

Short-term extreme environmental conditions may occur at any time in the product's life. A product may be unaffected by an extreme condition when it is new but fail when it is subjected to the same condition after being used for a long period of time due to the effect of ageing. The order in which the environmental conditions are applied may affect the results of an evaluation.

It is important for the product specification, when referring to a certain class in IEC 60721-3 (all parts), to define whether the product is required to be capable of operating or only to survive without permanent damage when being exposed to the conditions described by the class.

The environmental classes may be used as a basis for the selection of design and test severities with respect to the consequence of failure. Information contained in IEC 60721-3 (all parts) may be used to help establish expected requirements for use, storage, transportation, etc., and in the development of relevant specifications. The selected severities used for testing should attempt to produce the effects of the actual environment.

EXAMPLE 1 A high temperature test on a heat dissipating product is designed to simulate the thermal effect of subjecting a product to conditions of high air temperature, solar radiation and other possible heat sources dependent on the application.

EXAMPLE 2 In a mechanical shock test, the product can be subjected to mechanical shocks of simple pulse shapes (e.g., half-sine), while the actual conditions cannot be described by such simple pulses.

It is recognized that extreme or special environmental conditions may exist which require consideration of severities that are not addressed in this document. The user of this document should select the lowest classification necessary for covering the conditions of the intended use.

5 Classification of groups of environmental parameters and their severities

5.1 General

Several classes for climatic conditions (K), special climatic conditions (Z), biological conditions (B), mechanically active substances (S), and mechanical conditions (M) are specified.

This classification allows for several possible combinations of environmental conditions which bear upon products wherever in use. 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.

For certain environmental 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, for example:

3K21/3Z1/3B1/3S6/3M11

5.2 Climatic conditions (K)

The classes defined in previous versions of this document have been replaced with new classes as a result of recent efforts at collecting information regarding climatic conditions. Those results are contained in technical reports referenced in this document.

When selecting appropriate classes, attention should be paid to the fact that the climatic conditions inside buildings may 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, those produced over a longer period of time. Walls with poor thermal insulation or low thermal capacity cannot have this 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.

The climatic conditions specified for classes 3K20 to 3K24 refer to the conditions in use of the products. These conditions have been experienced world-wide over a long period of time taking into account all the parameters that can influence them, such as open-air climatic conditions, type of building construction, temperature/humidity controlling systems, and internal conditions, for example heat dissipation from other equipment, presence of humans. The conditions should cover all normal cases, but not exceptional events. These conditions are specified in Table 1. The interdependence of temperature to relative humidity is shown in Annex A.

Enclosed locations

- 3K20 applies to fully air-conditioned enclosed locations. Air temperature and humidity control is used continuously to maintain the required conditions.
- 3K21 applies to continuously temperature-controlled enclosed locations. Humidity is not normally controlled.

Heating, cooling or humidification is used where necessary to maintain the required conditions, especially where there is a large difference between them and the open-air climate. Installed products may be exposed to secondary effects of solar radiation due to increased ambient temperature and to heat radiation. They may also be exposed to movements of surrounding air due to draughts in buildings, for example through open windows, or due to special process conditions.

The conditions of this class may be found in continuously manned offices, workshops, data centres and other rooms for special applications.

- 3K22 applies to 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.

The conditions of this class may be found in normal living or working areas, for example living rooms, rooms for general use (theatres, restaurants, etc.), offices, shops, workshops for electronic assemblies and other electrotechnical products, telecommunication centres, storage rooms for valuable and sensitive products.

- 3K23 applies to enclosed locations having no temperature or 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.

Installed products may be subjected to formation of ice.

The conditions of this class may be found in some entrances and staircases of buildings, in garages, cellars, certain workshops, buildings in factories and industrial process plants, unattended equipment stations, certain telecommunication buildings, ordinary storage rooms for frost-resistant products, farm buildings, etc.

- 3K24 applies to locations having neither temperature nor humidity control.

The location may have openings directly to the open air. The climatic conditions of this class may be affected to a varying extent by the conditions of the open-air climate and the construction of the building.

Installed products may be subjected to formation of ice.

The conditions of this class may be found in entrances to buildings, in garages, shacks, unattended buildings, etc.

5.3 Special climatic conditions (Z) IEC 60721-3-3:2019

Parameters such as heat radiation, and air pressure may occur with any severity in combination with any of the other climatic conditions. These conditions are specified in Table 2.

5.4 Biological conditions (B)

No quantitative severity has been specified for these conditions. These conditions are specified in Table 3. The specified parameters are typical but may not be complete.

- 3B1 applies to locations with environmental controls in place to prevent the growth of mould and physical controls are in place to prevent attacks by animals.
- 3B2 applies to locations without environmental or physical controls in place to prevent mould growth or attacks by animals, except termites.
- 3B3 applies to locations where attacks by termites or similar fauna may occur.

5.5 Chemically active substances (C)

The contamination of the 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 and road salts. Contamination may affect the function and materials of products. Additional details regarding the categorization of these conditions may be found in ISO 9223.

5.6 Mechanically active substances (S)

Dust and sand are classified together, as the effects caused by these environmental conditions are similar. These conditions are specified in Table 4.

- 3S5 applies to locations where precautions have been taken to minimize the presence of dust and sand. Ingress of sand is prevented.

- 3S6 applies to locations not situated in proximity to dust or sand sources and with no special precautions to minimize the ingress of dust or sand.
- 3S7 applies to enclosed locations in close proximity to sand or dust sources, including urban areas and with no special precautions to minimize the ingress of dust or sand.

5.7 Mechanical conditions (M)

Mechanical conditions relate to the levels of vibration and shock that may exist at the location, for example as a result of normal operations, nearby vehicular movement. These conditions are specified in Table 5. See Annex B for the definition of seismic environment.

- 3M10 applies to locations experiencing insignificant levels of vibration and shock.
- 3M11 applies to locations experiencing low levels of vibration and insignificant levels of shock, such as those transmitted from air conditioning, machines or passing vehicles in the vicinity.
- 3M12 applies to locations experiencing significant levels of vibration and shock, such as those close to heavy machines and conveyor belts.

Table 1 – Classification of climatic conditions

Environmental parameter	Unit					
		3K20	3K21	3K22	3K23	3K24
Low air temperature	°C	+20 ^d	+15	+5	–5	–25
High air temperature	°C	+25 ^d	+32	+40	+55	+55
Low relative humidity ^a	%	20	10	5	10	5
High relative humidity ^a	%	75	75	85	100	100
Low absolute humidity ^a	g/m ³	4	2	1	0,5	0,5
High absolute humidity ^a	g/m ³	15	22	25	29	29
Rate of change of temperature ^b	°C/min	0,1	0,5	0,5	0,5	0,5
Low air pressure ^f	kPa	70	70	70	70	70
High air pressure ^f	kPa	106	106	106	106	106
Solar radiation ^g	W/m ²	No	500	700	700	700
Heat radiation	Not specified	No	^e	^e	^e	^e
Movement of surrounding air ^c	m/s	0,5	1,0	1,0	1,0	5,0
Condensation	Not specified	No	No ^h	No ^h	Yes	Yes
Water from sources other than rain	Not specified	No	No	No	Dripping water	Dripping water
Formation of ice and frost (including freeze-thaw)	Not specified	No	No	No	Yes	Yes

^a The low and high relative humidity severities are limited by the low and high absolute humidity and high and low temperature. The extreme severities of relative humidity, absolute humidity and temperature cannot occur simultaneously. See Annex A.

^b Averaged over a period of time of 5 min.

^c A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

^d These are air-conditioned locations with a tolerance of ± 2 °C on the stated temperature value.

^e Conditions occurring at the location concerned to be selected from Table 2.

^f If applicable, a special value may be selected from Table 2.

^g Secondary effects from the solar radiation behave as heating effect.

^h Limited to no occurrence of condensation.

Table 2 – Classification of special climatic conditions

Environmental parameter	Class	Unit	Special condition Z
Low air pressure	3Z12	kPa	84 (approx. 1 500 m above sea level)
	3Z13		62 (approx. 4 000 m above sea level)
High air pressure ^a	3Z14		114
Heat radiation	3Z1	No	Negligible
	3Z2		Heat radiation, for example in the vicinity of room heating systems
	3Z3		Heat radiation, for example in the vicinity of room heating systems or commercial ovens or industrial furnaces

^a Conditions in pressurised rooms, for example clean rooms, operation theatres.

Table 3 – Classification of biological conditions

Units	Class		
	3B1	3B2	3B3
No	Negligible	Presence of mould, fungus, etc. Presence of rodents and other animals harmful to products excluding termites	including termites

Table 4 – Classification of mechanically active substances

Environmental parameter	Unit	Class		
		3S5	3S6	3S7
Setting (sedimentary) dust	mg/(m ² ·d)	No	6	Note
Turbulent (suspended) dust	mg/(m ² ·h)	No	No	600
Windblown dust	mg/m ³	No	No	No
	m/s			

NOTE Encompassed within turbulent (suspended) dust.

Table 5 – Classification of mechanical conditions

Environmental parameter	Unit	Class		
		3M10	3M11	3M12
Stationary vibration, random: acceleration spectral density	(m/s ²) ² /Hz	No	0,01	0,1
Frequency range	Hz		5 to 200	5 to 200
Shock	m/s ²	No	No	20