IEC 60721-3-4

Edition 3.0 2019-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Classification of environmental conditions – Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weatherprotected locations

Classification des conditions d'environnement – Partie 3-4: Classification des groupements des agents d'environnement et de leurs sévérités – Utilisation à poste fixe, non protégé contre les intempéries

IEC 60721-3-4:2019-05(en-fr)

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

IEC 60721-3-4

Edition 3.0 2019-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Classification of environmental conditions –
Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weatherprotected locations

Classification des conditions d'environnement –
Partie 3-4: Classification des groupements des agents d'environnement et de leurs sévérités – Utilisation à poste fixe, non protégé contre les intempéries

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 19.040

ISBN 978-2-8322-6956-5

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weatherprotected locations

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60721-3-4 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 1995 and Amendment 1:1996. This edition constitutes a technical revision.

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

a) Clause 1: reworded.
b) Clause 2: normative references have been updated.
c) Clause 3: definitions have been updated.
d) Clause 4: reworded and simplified.

e) Clause 5: revised and updated. Several classes have been replaced by completely new classes based on the use of new information obtained from referenced technical reports.

f) Defined values of chemically active substances are now by reference to ISO 9223.

g) Tables 1 through 5: updated.

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

FDIS	Report on voting
104/828/FDIS	104/836/RVD

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.

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 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-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 non-weatherprotected locations. Weatherprotected locations where products can be mounted for stationary use permanently or temporarily are addressed in IEC 60721-3-3.

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 fire or explosion hazards, microclimate within a product, and conditions related to effects from ionizing radiation are excluded. Any other unforeseen incidents are also excluded.

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

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
non-weatherprotected location
location at which a product is not protected from meteorological conditions

3.3
sheltered location
location at which a product is covered by a structure to protect it from direct meteorological conditions, i.e. direct sunlight, heavy rain

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 (all parts). The classes given may be used for defining the maximum short-term environmental stresses on 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, IEC TR 62131-2, IEC TR 62131-3, IEC TR 62131-4 and IEC TR 62131-5) for further information on actual environmental conditions.

A product may be simultaneously exposed to several environmental parameters, for example, solar radiation and temperature, temperature and humidity, as well as vibration and temperature change. Combinations of the environmental parameters given may increase the stress 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 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 a 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 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), chemically active substances (C), mechanically active substances (S), and mechanical conditions (M) are specified.

This classification allows for several possible combinations of environmental conditions which bear upon products when installed in non-weatherprotected locations. It represents the real situation concerning world-wide conditions of use due to local influences of open-air climate, 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 as defined in 5.2 through 5.7, for example:

4K26/4Z3/4B3/4C2/4S12/4M10

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.

At non-weatherprotected locations, the influence of 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 of temperature change, solar radiation, precipitation, air velocity and wind-chill should be considered in this respect.

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

The climatic conditions specified for classes 4K23 to 4K27 refer to the non-weatherprotected conditions where products may be used. These conditions have been experienced world-wide over a long time period. 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.

Sheltered non-weatherprotected locations

4K23 applies to sheltered non-weatherprotected locations in tropical, arid, temperate, and cold climatic classification with the thermal effects from solar radiation encompassed in the temperature.

4K24 applies to sheltered non-weatherprotected locations in the polar climate type with the thermal effects from solar radiation encompassed in the temperature.

Open-air non-weatherprotected locations

4K25 applies to open-air locations in the tropical climatic classification.

4K26 applies to open-air storage in the arid and temperate climatic classifications.

4K27 applies to open-air storage in the cold and polar climatic classifications.

5.3 Special climatic conditions (Z)

Parameters such as heat radiation, movement of the surrounding air, solar radiation, snow load, and water from sources other than rain may occur with any severity in combination with any of the other climatic conditions. Recommended values for these conditions are shown in Table 2.

5.4 Biological conditions (B)

No quantitative severity has been specified for the following conditions. The specified parameters of Table 3 are typical, but may not be complete.

4B1 applies to locations where mould growth is prevented, and physical controls are in place to prevent attack by animals.

4B2 applies to locations where no controls are in place to prevent mould growth or attacks by animals, except termites.

4B3 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.

4S10 applies to locations where precautions have been taken to minimize the presence of dust and sand.

4S11 applies to locations not situated in proximity to dust or sand sources and with no precautions to minimize the ingress of dust or sand.

4S12 applies to locations near sand or dust sources, including urban areas and with no precautions to minimize the ingress of dust or sand. It also applies to locations situated in areas not subject to natural dust storms or significant industrial activity.

4S13 applies to locations which may be exposed to wind-driven dust and sand either due to natural conditions or due to industrial activity producing blown sand or dust.

These conditions are specified in Table 4.

5.7 Mechanical conditions (M)

Mechanical conditions relate to the levels of vibration and shock that may exist at a usage 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.

4M10 applies to locations experiencing insignificant levels of vibration and shock.

4M11 applies to non-weatherprotected locations experiencing low levels of vibration and shock, such as those transmitted from air conditioning, machines or passing vehicles in the vicinity.

4M12 applies to non-weatherprotected locations experiencing significant levels of vibration and shock, such as those close to heavy machines or conveyor belts.

Table 1 – Classification of climatic conditions

Environmental parameter	Unit	Classification				
		Sheltered		Open-air		
		4K23	4K24	4K25	4K26	4K27
Low air temperature	°C	–45	–50	+5	–20	-50
High air temperature	°C	+70	+70	+45[i]	+50[i]	+45[i]
Low relative humidity [a]	%	4	4	30	4	10
High relative humidity [a]	%	100	100	100	100	100
Low absolute humidity [a]	g/m^3	0,2	0,003	6	0,1	0,003
High absolute humidity [a]	g/m^3	35	20	35	30	25
Rate of change of temperature [b]	°C/min	1,0	1,0	1,0	1,0	1,0
Low air pressure [c]	kPa	70	70	70	70	70
High air pressure [c]	kPa	106	106	106	106	106
Solar radiation	W/m^2	[h]	[h]	1 090[l]	1 090[l]	1 090[l]
Heat radiation	Not specified	[f]	[f]	No	No	No
Movement of surrounding air [d]	m/s	5,0 [d, f]	5,0 [d, f]	22[f]	22[f]	22[f]
Condensation	Not specified	Yes	Yes	Yes	Yes	Yes
Precipitation (rain, snow, hail, etc.) [m]	Not specified	Yes [g]	Yes [g]	Yes	Yes	Yes
Rain intensity	mm/min	No [g]	No [g]	15	15	15
Driving rain	m/s	No	No	18	18	18
Snow load	kg/m^2	No	No	No	[g]	[g]
Low rain temperature [e]	°C	No [g]	No [g]	+5	+5	+5
Water from sources other than rain	Not specified	Dripping water	Dripping water	[j]	[j]	[j]
Formation of ice and frost	Not specified	Yes	Yes	Yes [k]	Yes [k]	Yes [k]

[a] The low and high relative humidity levels are limited by the low and high absolute humidity. See Annex A.

[b] Averaged over a period of 5 min.

[c] The value of 70 kPa represents a limit for open-air conditions, normally at an altitude of 3 000 m. In some geographical areas, open-air conditions may occur at higher altitudes. Conditions in mines are not considered. If applicable, a special value may be selected from Table 2.

[d] A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

[e] This rain temperature should be considered together with high air temperature and solar radiation. The cooling effect of the rain should be considered in connection with the surface temperature of the product.

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

[g] Applies only to wind-driven precipitation at sheltered locations.

[h] Thermal effect of solar radiation is included in the temperature.

[i] Thermal effect of solar radiation is not included in the temperature.

[j] Sources of water other than rain are encompassed in driving rain.

[k] Formation of frost can occur due to heat radiation to a clear sky.

[L] From sea level.

[M] See IEC 60721-2-2 for additional information.

Table 2 – Classification of special climatic conditions

Environmental parameter	Class	Unit	Special condition Z
Heat radiation	4Z1	No	Negligible
	4Z2	No	Conditions of heat radiation, for example, near heating systems
Wind, steady state [a]	4Z4	m/s	30
	4Z5	m/s	50
	4Z11	m/s	67
Water from sources other than rain	4Z12	No	Dripping water
	4Z13	No	Spraying water
	4Z14	No	Splashing water
Solar radiation	4Z15	W/m^2	500
	4Z16	W/m^2	700
Snow load	4Z17	kg/m^2	100 (single snow storm)
	4Z18	kg/m^2	240 (whole season)
Air pressure	4Z10	kPa	84 (approx. 1 500 m above sea level)
	4Z19	kPa	62 (approx. 4 000 m above sea level)
[a] Velocities are 10-min averages taken at a height of 10 m above ground.			

Table 3 – Classification of biological conditions

Biological parameter	Class		
	4B1	4B2	4B3
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			
		4S10	4S11	4S12	4S13
Setting (sedimentary) dust	$mg/(m^2 \cdot d)$	6	6	Note 1	Note 2
Turbulent (suspended) dust	$mg/(m^2 \cdot h)$	No	No	600	Note 2
Windblown dust	mg/m^3	No	0,04 mg/m^3	1 mg/m^3	18
	m/s				13
Windblown sand	mg/m^3	No	0,04 mg/m^3	1 mg/m^3	18
	m/s				13
NOTE 1 Encompassed within turbulent (suspended) dust. NOTE 2 Encompassed within windblown dust.					