

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Classification of environmental conditions –  
Part 3-1: Classification of groups of environmental parameters and their  
severities – Storage**

**Classification des conditions d'environnement –  
Partie 3-1: Classification des groupements des agents d'environnement et de  
leurs sévérités – Stockage**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

**Part 3-1: Classification of groups of environmental parameters and their severities – Storage**

## FOREWORD

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International Standard IEC 60721-3-1 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 1997, and constitutes a technical revision.

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

- a) Clause 3: reworded and simplified.
- b) Clause 4: reworded and simplified.
- c) Clause 5: Annex C has been incorporated in Clause 5.

- d) 5.2: all existing climate classes have been replaced by completely new classes. The new classes are divided into 3 groups. The reason for the new classes is the latest revision of IEC 60721-2-1 which incorporated new climate types.
- e) 5.3: new classes for solar radiation and snow load.
- f) 5.6: all existing classes for mechanically active substances have been replaced by completely new classes.
- g) 5.7: all existing classes for mechanical conditions have been replaced by completely new classes.
- h) Table 1: new climatic classes with new severities.
- i) Table 2: new classes for solar radiation and snow load.
- j) Table 5 new mechanically active substances classes.
- k) Table 6: new mechanical conditions classes.

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

FDIS	Report on voting
104/772/FDIS	104/782/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.

[IEC 60721-3-1:2018](http://standards.iteh.ai/standards/iec/60721-3-1-2018)

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 3-1: Classification of groups of environmental parameters and their severities – Storage

#### 1 Scope and object

This part of IEC 60721 classifies the groups of environmental parameters and their severities to which products together with their packaging, if any, are subjected when stored.

The environmental conditions specified in this document are limited to those which can directly affect the products or their ultimate performance. 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 explosions are not included.

Conditions of stationary use, portable and non-stationary use, use in vehicles and ships, and conditions of transportation are given in other subparts of the IEC 60721-3 series.

The object of this document is to classify environmental parameters and their severities to which a product can be exposed during storage. Transfer and handling during storage and transport are addressed in IEC 60721-3-2.

#### 2 Normative references

[IEC 60721-3-1:2018](https://standards.iteh.ai/catalog/standards/sist/2a617ea1-3a8b-486f-99d2-aeb130a210fa/iec-60721-3-1-2018)

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[aeb130a210fa/iec-60721-3-1-2018](https://standards.iteh.ai/catalog/standards/sist/2a617ea1-3a8b-486f-99d2-aeb130a210fa/iec-60721-3-1-2018)

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 60721-1, *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

##### enclosed location

location or structure that is covered on all sides in such a manner as to provide a degree of protection

### 3.2

#### **non-weather-protected location**

location at which the product is not protected from direct meteorological conditions

### 3.3

#### **open-air location**

location that is unenclosed that provides no protection from meteorological conditions

### 3.4

#### **storage**

a product kept in a place when not being operated

### 3.5

#### **sheltered location**

location or structure that provides limited protection from direct meteorological conditions such as rain and wind

### 3.6

#### **weather-protected location**

location at which the product is protected from 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, solar radiation 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 as a means 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 by this document.

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

### 5.1 General

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.

This classification allows a number of possible combinations of environmental conditions which bear upon products wherever stored. It represents the real situation concerning worldwide conditions of storage, for example, due to local influences of open-air climate.

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

<https://standards.iteh.ai/catalog/standards/sist/2a617ea1-3a8b-486f-99d2-aeb130a210fa/iec-60721-3-1-2018>

For a given location or product, reference should be made to the total set of classes, for example:

1K21/1Z1/1B1/1C2/1S10/1M10

### 5.2 Climatic conditions (K)

NOTE All old classes have been replaced with new classes. The new classes were chosen to reflect 3 different storage condition: enclosed, sheltered and open-air locations.

The climatic conditions specified for classes 1K20 to 1K29 refer to the conditions of storage of products. These conditions have been experienced worldwide 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 and presence of humans. The conditions should cover all normal cases, but not exceptional events.

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.

At non-weather-protected locations, the influence from special climatic conditions constitutes a more significant share of the effects bearing upon a product than at weather-protected locations. The effects of temperature change, solar radiation, precipitation, air velocity and wind-chill should be particularly considered.

The severity of these effects may be influenced, for example by constructional details (type and thickness of material, colour of surfaces, sealing or breathing of casings, etc.), and by storage details (selection of storage site, consideration of degrees of exposure to prevailing wind and weather, etc.).

#### Enclosed storage

- 1K20 applies to fully air conditioned enclosed storage locations. Air temperature and humidity control is used continuously to maintain the required conditions.
- 1K21 applies to enclosed storage locations with limited temperature control and no humidity control.
- 1K22 applies to enclosed storage locations having no temperature or humidity control.

#### Sheltered storage

- 1K23 applies to sheltered storage locations in tropical, arid, temperate, and cold climatic classification with the thermal effects from solar radiation encompassed in the temperature.
- 1K24 applies to sheltered storage locations in the polar climate type with the thermal effects from solar radiation encompassed in the temperature.

#### Open-air storage

- 1K25 applies to open-air storage in the tropical climatic classification.
- 1K26 applies to open-air storage in the arid and temperate climatic classifications.
- 1K27 applies to open-air storage in the cold and polar climatic classifications.

These conditions are specified in Table 1.

**Table 1 – Classification of climatic conditions**

		Enclosed			Sheltered		Open-air		
Environmental Parameter	Unit	1K20	1K21	1K22	1K23	1K24	1K25	1K26	1K27
a) Low air temperature	°C	+20 <sup>6)</sup>	+5	–25	–45	–50	+5	–20	–50
b) High air temperature	°C	+25 <sup>6)</sup>	+40	+55	+70	+70	+45 <sup>11)</sup>	+50 <sup>11)</sup>	+45 <sup>11)</sup>
c) Low relative humidity <sup>1)</sup>	%	20	5	10	4	4	30	4	10
d) High relative humidity <sup>1)</sup>	%	75	85	100	100	100	100	100	100
e) Low absolute humidity <sup>1)</sup>	g/m <sup>3</sup>	4	1	0,5	0,2	0,003	6	0,1	0,003
f) High absolute humidity <sup>1)</sup>	g/m <sup>3</sup>	15	25	29	35	20	35	30	25
g) Rate of change of temperature <sup>2)</sup>	°C/min	0,1	0,5	0,5	1,0	1,0	1,0	1,0	1,0
h) Low air pressure <sup>3)</sup>	kPa	70	70	70	70	70	70	70	70
i) High air pressure <sup>3)</sup>	kPa	106	106	106	106	106	106	106	106
j) Solar radiation	W/m <sup>2</sup>	7)	7)	10)	10)	10)	1090	1090	1090
k) Heat radiation	Not specified	No	7)	7)	7)	7)	No	No	No
l) Movement of surrounding air <sup>4)</sup>	m/s	0,5	1,0	1,0	5,0 <sup>8)</sup>	5,0 <sup>8)</sup>	8)	8)	8)
m) Condensation	Not specified	No	No	Yes	Yes	Yes	Yes	Yes	Yes
n) Precipitation (rain, snow, hail, etc.)	Not specified	No	No	No	Yes <sup>9)</sup>	Yes <sup>9)</sup>	Yes	Yes	Yes
o) Rain intensity	mm/min	None	None	None	None <sup>9)</sup>	None <sup>9)</sup>	15	15	15
p) Driving rain	m/s	None	None	None	None	None	18	18	18
q) Snow load	kg/m <sup>2</sup>	None	None	None	None	None	None	8)	8)
r) Low rain temperature <sup>5)</sup>	°C	None	None	None	None <sup>9)</sup>	None <sup>9)</sup>	+5	+5	+5
s) Water from sources other than rain	L/m <sup>2</sup> /min	No	No	Dripping Water	Dripping Water	Dripping Water	12)	12)	12)
t) Formation of ice and frost (including freeze-thaw)	Not specified	No	No	Yes	Yes	Yes	No	Yes	Yes

Notes to Table 1

- 1) The low and high relative humidity levels are limited by the low and high absolute humidities, so that, for example, for environmental parameters a) and c), or b) and d), the severities given in Table 1 do not occur simultaneously.
- 2) Averaged over a period of time of 5 min.
- 3) 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.
- 4) A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.
- 5) This rain temperature should be considered together with high air temperature b) and solar radiation j). The cooling effect of the rain has to be considered in connection with the surface temperature of the product.
- 6) These are air-conditioned locations with a tolerance of  $\pm 2$  °C on stated temperature value.
- 7) Conditions occurring at the location concerned to be selected from Table 2.
- 8) If applicable, a special value may be selected from Table 2.
- 9) Applies only to wind-driven precipitation at sheltered locations.
- 10) Thermal effect of solar radiation is included in the temperature.
- 11) Thermal effect of solar radiation is not included in the temperature.
- 12) Sources of water other than rain are encompassed by driving rain.

### 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. These conditions are specified in Table 2.

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

Environmental parameter	Class	Unit	Special condition Z
k) Heat radiation	1Z1	None	Negligible
	1Z2	None	Conditions of heat radiation, e.g. in the vicinity of room heating systems
l) Movement of surrounding air	1Z3	m/s	30
	1Z4	m/s	50
s) Water from sources other than rain	1Z5	None	Dripping water
j) Solar radiation	1Z8	W/m <sup>2</sup>	500
	1Z9	W/m <sup>2</sup>	700
q) Snow load	1Z10	kg/m <sup>2</sup>	100 (single snow storm)
	1Z11	kg/m <sup>2</sup>	240 (whole season)

### 5.4 Biological conditions (B)

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

- 1B1 applies to storage locations with environmental controls in place to prevent the growth of mould and physical controls to prevent attack by animals.
- 1B2 applies to storage locations without environmental or physical controls in place to prevent mould growth or attacks by animals, except termites.
- 1B3 applies to locations where attacks by termites may occur.