

# INTERNATIONAL STANDARD



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

Document Preview

[IEC 60721-3-1:2018](#)

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



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### 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 corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://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 It also gives information on projects, replaced and withdrawn publications.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](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions 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](http://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.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://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](mailto:sales@iec.ch).

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

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



IEC 60721-3-1

Edition 3.0 2018-02  
REDLINE VERSION

# INTERNATIONAL STANDARD



---

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

Document Preview

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

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

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 19.040

ISBN 978-2-8322-5449-3

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

|  |                  |
|--|------------------|
| FOREWORD .....   | 3                |
| 1 Scope and object .....   | 5                |
| 2 Normative references .....   | 5                |
| 3 <b>Terms and definitions</b> .....   | 5                |
| 4 General .....  | 7                |
| 5 Classification of groups of environmental parameters and their severities .....  | 7                |
| 5.1 <b>General</b> .....   | 8                |
| 5.2 Climatic conditions (K) .....  | 8                |
| 5.3 Special climatic conditions (Z) .....  | 12               |
| 5.4 Biological conditions (B) .....  | 13               |
| 5.5 Chemically active substances (C) .....   | 14               |
| 5.6 Mechanically active substances (S) .....   | 15               |
| 5.7 Mechanical conditions (M) .....  | 15               |
| <del>    Sets of environmental condition class combinations .....</del>  | <del>.....</del> |
| <del>Annex Summary of conditions covered by the classes .....</del>  | <del>.....</del> |
| <del>Annex Summary of conditions covered by the sets of class combinations .....</del>                                     | <del>.....</del> |
| <del>Annex Explanation of the environmental conditions in tropical areas as specified in classes 1K10 and 1K11 .....</del> | <del>.....</del> |
| Annex A (informative) Chemically active substances .....   | 25               |
| Bibliography .....   | 26               |
| <del>Figure Model shock response spectra (first order maximax shock response spectra) .....</del>                          | <del>.....</del> |
| Table 1 – Classification of climatic conditions .....  | 10               |
| Table 2 – Classification of special climatic conditions .....  | 13               |
| Table 3 – Classification of biological conditions .....  | 14               |
| Table 4 – Classification of chemically active substances .....   | 15               |
| Table 5 – Classification of mechanically active substances .....   | 16               |
| Table 6 – Classification of mechanical conditions .....  | 17               |
| <del>Table 7 Sets of environmental class combinations .....</del>  | <del>.....</del> |

IEC 60721-3-1:2018

<https://standards.iteh.ai/>

Document Preview

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

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

## 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.

**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

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.

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.

**IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.**

## 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 ~~may~~ 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.

~~Transfer during storage is not included in the classification.~~

Environmental conditions directly related to fire or explosions ~~and conditions related to ionizing radiation are excluded~~ are not included. ~~Any other unforeseen incidents are also excluded. The possibility of their occurrence should be taken into account in special cases. Offshore locations 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 ~~may~~ can be exposed during storage. ~~Transfer and handling during storage and transport are addressed in IEC 60721-3-2.~~

~~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 intended storage.~~

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

~~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 – 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 — Introduction  
Amendment 1 (1987)~~

~~IEC 60721-3-2: 1997, Classification of environmental conditions — Part 3: Classification of environmental parameters and their severities — Section 2: Transportation~~

~~IEC 721-3-3: 1994, Classification of environmental conditions — Part 3: Classification 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 environmental parameters and their severities — Section 4: Stationary use at non-weatherprotected locations~~

### 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

IEC 60721-3-1:2018

#### 3.2

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

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

#### 3.3

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

location that is unenclosed that provides no protection from meteorological conditions

#### 3.4

##### **storage**

~~The product is placed at a certain site for long periods, but not intended for use during these periods~~

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 ~~weather influences~~ meteorological conditions

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



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

## 4 General

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

~~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 have not been included in this standard, but should be considered for any environmental parameter.~~

~~They should additionally be specified, if applicable. Information on the duration and frequency of occurrence is given, as clause 6, in amendment 1 to IEC 721-3-0.~~

~~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 the presence of chemically or mechanically active substances.~~

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. ~~Specifications for products to be stored under such special conditions are a matter of negotiation between supplier and user.~~

## 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, 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:

1K21/1Z1/1B1/1C2/1S1/1M3  
1K21/1Z1/1B1/1C2/1S10/1M10

~~See also clause 6.~~

~~Annex A contains a summary of the conditions covered by each class.~~

### 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 ~~1K1 to 1K11~~ 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 ~~external (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, etc. The conditions should cover all normal cases, but not exceptional events.

~~Climatic conditions in tropical areas, as specified in classes 1K10 and 1K11, are explained in annex C.~~

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 ~~and its functional parts~~ than at weatherprotected locations. The effects of temperature change, solar radiation, precipitation, air velocity and wind-chill should be particularly considered ~~in this respect~~.

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.

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

#### 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**

| Environmental parameter                        | Unit             | Class <sup>10)</sup> |                   |                   |                    |                    |                    |      |      |       |                     |                     |
|--|------------------|----------------------|-------------------|-------------------|--------------------|--------------------|--------------------|------|------|-------|---------------------|---------------------|
|  |                  | 1K1                  | 1K2               | 1K3               | 1K4                | 1K5                | 1K6                | 1K7  | 1K8  | 1K9   | 1K10 <sup>11)</sup> | 1K11 <sup>11)</sup> |
| a) Low air temperature                         | °C               | +20 <sup>6)</sup>    | +5                | –5                | –25                | –40                | –55                | –20  | –33  | –65   | +5                  | –20                 |
| b) High air temperature                        | °C               | +25 <sup>6)</sup>    | +40               | +45               | +55                | +70                | +70                | +35  | +40  | +55   | +40                 | +55                 |
| c) Low relative humidity <sup>4)</sup>         | %                | 20                   | 5                 | 5                 | 10                 | 10                 | 10                 | 20   | 15   | 4     | 30                  | 4                   |
| d) High relative humidity <sup>4)</sup>        | %                | 75                   | 85                | 95                | 100                | 100                | 100                | 100  | 100  | 100   | 100                 | 100                 |
| e) Low absolute humidity <sup>4)</sup>         | g/m <sup>3</sup> | 4                    | 1                 | 1                 | 0,5                | 0,1                | 0,02               | 0,9  | 0,26 | 0,003 | 6                   | 0,9                 |
| f) High absolute humidity <sup>4)</sup>        | g/m <sup>3</sup> | 15                   | 25                | 29                | 29                 | 35                 | 35                 | 22   | 25   | 36    | 36                  | 27                  |
| g) Rate of change of temperature <sup>2)</sup> | °C/min           | 0,1                  | 0,5               | 0,5               | 0,5                | 1,0                | 1,0                | 0,5  | 0,5  | 0,5   | 0,5                 | 0,5                 |
| h) Low air pressure <sup>3)</sup>              | kPa              | 70                   | 70                | 70                | 70                 | 70                 | 70                 | 70   | 70   | 70    | 70                  | 70                  |
| i) High air pressure <sup>3)</sup>             | kPa              | 106                  | 106               | 106               | 106                | 106                | 106                | 106  | 106  | 106   | 106                 | 106                 |
| j) Solar radiation                             | W/m <sup>2</sup> | 500                  | 700               | 700               | 1120               | 1120               | 1120               | 1120 | 1120 | 1120  | 1120                | 1120                |
| k) Heat radiation                              | None             | No                   | 7)                | 7)                | 7)                 | 7)                 | 7)                 | 7)   | 7)   | 7)    | 7)                  | 7)                  |
| l) Movement of surrounding air <sup>4)</sup>   | m/s              | 0,5                  | 1,0 <sup>8)</sup> | 1,0 <sup>8)</sup> | 1,0 <sup>8)</sup>  | 5,0 <sup>8)</sup>  | 5,0 <sup>8)</sup>  | 8)   | 8)   | 8)    | 50 <sup>8)</sup>    | 50                  |
| m) Condensation                                | None             | No                   | No                | Yes               | Yes                | Yes                | Yes                | Yes  | Yes  | Yes   | Yes                 | Yes                 |
| n) Precipitation (rain, snow, hail, etc.)      | None             | No                   | No                | No                | Yes <sup>9)</sup>  | Yes <sup>9)</sup>  | Yes <sup>9)</sup>  | Yes  | Yes  | Yes   | Yes                 | Yes                 |
| o) Rain intensity                              | mm/min           | None                 | None              | None              | None <sup>9)</sup> | None <sup>9)</sup> | None <sup>9)</sup> | 6    | 6    | 15    | 15                  | 15                  |
| p) Low rain temperature <sup>5)</sup>          | °C               | None                 | None              | None              | None <sup>9)</sup> | None <sup>9)</sup> | None <sup>9)</sup> | +5   | +5   | +5    | +5                  | +5                  |
| q) Water from sources other than rain          | None             | No                   | No                | 7)                | 7)                 | 7)                 | 7)                 | 7)   | 7)   | 7)    | 7)                  | 7)                  |
| r) Formation of ice and frost                  | None             | No                   | No                | Yes               | Yes                | Yes                | Yes                | Yes  | Yes  | Yes   | No                  | Yes                 |

| Environmental Parameter                               | Unit                  | Enclosed          |      |                | Sheltered          |                    | Open-air           |                    |                    |
|---|-----------------------|-------------------|------|----------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|   |                       | 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 ~~humidities~~ **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 ~~partially weather protected~~ **sheltered** locations.
- ~~10) The classes of climatic conditions of this standard include the classes of IEC 721-3-3 and IEC 721-3-4 as follows:  
 1K1 covers 3K1 1K3 covers 3K5 1K5 covers 3K7 1K7 covers 4K1 1K9 covers 4K4 1K11 covers 4K6  
 1K2 covers 3K3 1K4 covers 3K6 1K6 covers 3K8 1K8 covers 4K2 1K10 covers 4K5~~
- 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.**

(<https://standards.iteh.ai>)  
 Document Preview

**5.3 Special climatic conditions (Z)**

~~As, in practice,~~ 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 ~~special~~ conditions are specified in Table 2. ~~In those cases, an assumption of the coincidence of events of increasing severity would lead to unnecessary overdesign.~~