

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Classification of environmental conditions –
Part 2-1: Environmental conditions appearing in nature – Temperature and
humidity**

**Classification des conditions d'environnement –
Partie 2-1: Conditions d'environnement présentes dans la nature – Température
et humidité**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –**Part 2-1: Environmental conditions appearing in nature –
Temperature and humidity**

FOREWORD

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International Standard IEC 60721-2-1 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This second edition cancels and replaces the first edition published in 1982 and its amendment 1 (1987), and constitutes a technical revision.

The main changes with respect to the previous edition are in the definitions of climate types.

The text of this standard is based on the following documents:

FDIS	Report on voting
104/610/FDIS	104/617/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

A list of all the parts in the IEC 60068 series, under the general title *Classification of environmental conditions*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

Electrotechnical products are used in almost all areas of the world under varying climatic conditions and have to meet the stresses imposed by these climatic conditions with the necessary reliability. A detailed knowledge of the climatic conditions to which the product will be subjected is necessary in the design stage to ensure that reliability is met.

Data on open-air temperature and humidity have been collected and statistically processed for many years throughout the world. Such data is represented in this part of IEC 60721.

In addition to open-air temperature, temperature stresses on a product depend on a number of other environmental parameters, for example solar radiation, air velocity or heating from adjacent equipment.

The effects of humidity depend on temperature, temperature changes and impurities in the humid air.

In many cases the extremes of temperature and humidity are of great importance even if they occur for a short time. In other cases, where large time constants for heat or water penetration are involved, the mean values of temperature and humidity over a certain period may be more important.

It has therefore been considered useful to present here both the mean value over many years of the annual extreme values of temperature and humidity, which will occur only for short periods (a few hours), and the mean value over many years of the extreme daily mean values of temperature and humidity, which will occur for longer periods.

In order to cover cases where rare events need to be taken into account, the absolute extreme temperatures and humidity levels, observed over a period of many years, have also been presented.

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 2-1: Environmental conditions appearing in nature – Temperature and humidity

1 Scope

This part of IEC 60721 presents classifications of open-air climates in terms of temperature and humidity. It is intended to be used as part of the background material when selecting appropriate temperature and humidity severities for product testing and application.

The climates cover all areas of the world, excluding the central Antarctic and high altitudes (above 5 000 m).

This presentation may be used as background material when issuing climatic environmental classes for product applications.

This standard defines a limited number of open-air climate classifications, in terms of temperature and humidity, which represent the conditions most frequently met by products while being transported, stored, installed and used.

2 Normative references (standards.iteh.ai)

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60721-1:1990, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC/TR 62130, *Climatic field data including validation*

MIL210 *Extreme and Percentile Environmental Reference Tables (ExPERT) database* (Version 1.0 July 1997)

PEARCE, E.A., and SMITH, C.G., *The Hutchinson World Weather Guide* by Helicon Publishing Ltd (ISBN 1-85986-342-6, 2000)

KOTTEK, M., GRIESER, J., BECK, C., RUDOLF, B. and RUBEL, F., *World Map of the Köppen-Geiger climate classification updated: 2006*, Meteorol. Z., 15, 259-263

3 Terms and definitions, abbreviations, quantities and units

Terms and definitions are defined, in context, throughout the present standard.

4 General information regarding data collection and analysis

Climatic data was collected and validated in IEC/TR 62130. The two principle data sources were the MIL210 ExPERT and The Hutchinson World Weather Guide.

The MIL210 ExPERT database contained daily temperature and humidity data that were collected during 1973–1992. Measurement locations were mainly from airports and major cities worldwide. The total number of sites/stations was 289. The uncertainty of measurements was not documented and the data source contained no data about highest temperature with relative humidity (RH) >95 %.

The Hutchinson World Weather Guide used data provided by the British Meteorological Office. The length of the measured period differed from location to location varying from 2 years to 105 years. Detailed locations and uncertainty of measurement were not documented in the book and there were no data relating to highest temperature with RH >95 %.

As stated in IEC 60721-1, other references were used for comparison purposes of both the climatic classes and the map of climatic classes.

5 General validation process

The high level process for validating the data used to update this standard is given in Figure 4 of IEC 60721-1:1990.

The process has three main phases:

- identify and collect data;
- analyse data and compare to current values;
- update data as appropriate.

As a result of the data collection and analysis, open-air climates have been simplified and revised as shown in Table 1.

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Table 1 – Climate classifications

New classifications	Previous IEC 60721-2-1 classes when combined
Tropical	Warm damp and Warm damp, Equable
Arid	Mild warm dry and Extremely warm dry
Temperate	Warm temperate and Warm dry
Cold	Cold temperate
Polar	Extremely cold and Cold

Further details regarding each climate classification are provided in Table 2.

Table 2 – Climate classification definitions

Climate classification	Definition
Tropical	Tropical rain climates where the mean temperature of the coldest month exceeds +18 °C
Arid	Arid climates with rainfall less than 500 mm
Temperate	Temperate rain climates where the mean temperature of the coldest month is between –3 °C and +18 °C
Cold	Boreal forest and snow climates. Mean temperature of the warmest month exceeding 10 °C and a mean temperature of the coldest month below –3 °C
Polar	Cold snow climates. Mean temperature of the warmest month below 10 °C

6 Open air climates

6.1 General

The different open-air temperature and humidity conditions of the world are presented by defining a limited number of climate classifications, hereinafter referred to as "open-air climates". For the application of a product in a geographical area, the open-air temperature and humidity can be taken from climatic data for that area. This helps ensure that the product is designed for application in this climate.

6.2 Environmental parameters

For this standard, open-air climates are defined by the air temperature and relative humidity values. The relative humidity at a certain temperature is defined as the ratio between the actual vapour pressure and the saturation vapour pressure at the same temperature. The absolute air humidity is defined as the mass of water vapour per cubic meter of air.

The annual extreme value of low temperature normally occurs for a period of approximately 10 h, while the annual extreme value of high temperature normally occurs for approximately 5 h.

6.3 Identification of statistical open-air climates

The following tables present the climate classifications defined as open-air climates.

In Table 3 the mean value of the annual extreme daily mean values of temperature and humidity is given for each climate classification. Table 4 provides the mean value of annual extreme values of temperature and humidity is given for each classification. In Table 5, the absolute extreme value of temperature and humidity is given for each climate classification.

Table 3 – Classification of climates by extreme daily mean values

Climate classification	Mean value of the annual extreme daily mean values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity g × m ⁻³
Tropical	10	40	30
Arid	0	45	25
Temperate	-15	40	25
Cold	-25	35	25
Polar	-40	25	15

Table 4 – Classification of climates by annual extreme values

Climate classification	Mean value of the annual extreme values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity g × m ⁻³
Tropical	5	45	35
Arid	-10	50	30
Temperate	-20	40	30
Cold	-45	45	25
Polar	-50	30	20

Table 5 – Classification of climates by absolute extreme value

Climate classification	Absolute extreme values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity g × m ⁻³
Tropical	0	50	40
Arid	–20	55	35
Temperate	–30	50	35
Cold	–50	45	30
Polar	–60	35	25

6.4 Map of open-air climates

A map of open-air climates in geographical areas of the world is presented in Annex A.

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