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CLASSIFICATION OF ENVIRONMENTAL CONDITIONS
PART 2: ENVIRONMENTAL CONDITIONS APPEARING IN NATURE TEMPERATURE AND HUMIDITY

Classification des conditions d'environnement
Deuxième partie: Conditions d'environnement présentes dans la nature
Température et humidité

Klassifizierung von Umweltbedingungen
Teil 2: Natürliche Einflüsse
Temperatur und Luftfeuchte

BODY OF THE HD

The Harmonization Document consists of:

- IEC 721-2-1 (1982) ed 1 + Amdt 1 (1987); IEC/TC 75, not appended

This Harmonization Document was approved by CENELEC on 1989-12-05.

The English and French versions of this Harmonization Document are provided by the text of the IEC publication and the German version is the official translation of the IEC text.

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level by or before 1990-03-01

to publish their new harmonized national standard by or before 1990-09-01

to withdraw all conflicting national standards by or before 1990-09-01.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC Central Secretariat.

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Classification des conditions d'environnement

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Temperature and humidity

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Révision de la présente publication

Le contenu technique des publications de la CEI est constamment revu par la Commission afin d'assurer qu'il reflète bien l'état actuel de la technique.

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- **Bulletin de la CEI**
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Terminologie

En ce qui concerne la terminologie générale, le lecteur se reportera à la Publication 50 de la CEI: Vocabulaire Electrotechnique International (V.E.I.), qui est établie sous forme de chapitres séparés traitant chacun d'un sujet défini, l'Index général étant publié séparément. Des détails complets sur le V.E.I. peuvent être obtenus sur demande.

Les termes et définitions figurant dans la présente publication ont été soit repris du V.E.I., soit spécifiquement approuvés aux fins de cette publication.

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Pour les symboles graphiques, symboles littéraux et signes d'usage général approuvés par la CEI, le lecteur consultera:

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IEC publications prepared by the same Technical Committee

The attention of readers is drawn to the inside of the back cover, which lists IEC publications issued by the Technical Committee which has prepared the present publication.

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FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by IEC Technical Committee No. 75: Classification of Environmental Conditions.

A first draft was discussed at the meeting held in Baden-Baden in 1974, and a further draft was discussed at the meeting held in Stockholm in 1977. As a result of this latter meeting, a draft, Document 75(Central Office)4, was submitted to the National Committees for approval under the Six Months' Rule in January 1979.

Amendments, Document 75(Central Office)8, were submitted to the National Committees for approval under the Two Months' Procedure in September 1980.

The National Committees of the following countries voted explicitly in favour of publication:

Australia	Hungary
Belgium	Netherlands
Brazil	Norway
Bulgaria	Poland
Denmark	Romania
Egypt	Sweden
France	Turkey
German Democratic Republic	United Kingdom
Germany	United States of America

It should be noted that this standard forms one part of a series intended to deal with the following subjects:

- Classification of environmental parameters and their severities (Publication 721-1).
- Environmental conditions appearing in nature (Publication 721-2).
- Application of classified environmental parameters and their severities (Publication 721-3).

Other IEC publication quoted in this standard:

Publication No. 721-1: Classification of Environmental Conditions,
Part 1: Classification of Environmental Parameters and their Severities.

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS

Part 2: Environmental conditions appearing in nature

Temperature and humidity

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1. Scope

This part of the standard presents types of open-air climate 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 applications.

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.

When selecting temperature and humidity severities for product applications, the values given in IEC Publication 721-1: Part 1: Classification of Environmental Parameters and Their Severities, should be applied.

2. Object

To define a limited number of types of open-air climate, in terms of temperature and humidity, which satisfactorily represent the conditions most frequently met by products while being transported, stored, installed and used.

3. General

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

Data on open-air temperature and humidity have been collected and statistically processed for many years throughout the whole world. Such data can be conveniently represented in climatograms.

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

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

In many cases the extremes of temperature and humidity are of great importance even if they occur a short time only during the day. 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 have to be taken into account, the absolute extreme temperatures and humidities, observed over a period of many years, have also been presented.

This standard does not take into account reliability aspects and therefore only the extreme values of temperatures and humidities and combinations thereof are given. For reliability purposes it is also necessary to have information on the total statistical distribution on temperatures and humidities. Such data may also be needed when considering the diffusion of moisture through materials.

4. Principles behind the presentation of statistical data of temperature and humidity

4.1 *Statistical open-air climates*

For the application of a product in a locally restricted geographical area, the open-air temperature and humidity can be taken from the statistical climatogram for that area. This permits the product to be designed for its application in this climate.

The different open-air temperature and humidity conditions of the world are therefore presented by defining a limited number of climatic types, hereinafter referred to as "statistical open-air climates", covering the climatic conditions of the world.

4.2 *Groups of statistical open-air climates*

For the application of a product in several geographical areas with different climatic types, the appropriate statistical open-air climates are brought together in four main groups.

The restriction to four groups is made in order to limit the temperature and humidity classes applied to products intended for a more general use.

5. Presentation of statistical open-air climates

5.1 *Environmental parameters*

In this presentation, statistical open-air climates are defined by the values of the following environmental parameters:

- air temperature;
- relative air humidity.

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.

At a fixed air pressure the absolute air humidity, defined as the actual mass of water per unit of air volume, is given by the air temperature and the relative air humidity.

5.2 *Climatograms*

5.2.1 *General*

The climatograms presented in Figures 1 to 9, pages 18 to 26, define limits of statistical open-air climates. Three boundary lines are given in the diagrams, one defining the mean value of the annual extreme daily mean values, the second defining the mean value of annual extreme values and the third defining the absolute extreme value.

5.2.2 *Boundary lines representing the mean value of the annual extreme daily mean values of temperature and humidity*

The boundary lines representing the mean value of the annual extreme daily mean values are obtained by plotting for each day the mean value of air temperature and associated relative humidity occurring at one place representative of the geographical area, in a diagram with air temperature on the x-axis and relative air humidity on the y-axis. A boundary line is then drawn through the extreme plots appearing in the diagram.

The boundary line in a climatogram is the mean line between the boundary lines obtained by the procedure for each of many years (at least ten years). The boundaries have been slightly simplified so that they are kept parallel to constant air temperature, constant relative air humidity or constant absolute air humidity.

The probability is rather high (about 5%) that a product will, for short periods (a few hours per occasion), be subjected to temperatures and humidities and combinations thereof which are more extreme than those represented by the boundary lines. However, if a long-term exposure is needed for the product to attain the temperature of the surrounding air, it is unlikely that the product will be affected by these short-period exposures to more severe temperature conditions than those represented by the boundary lines.

5.2.3 *Boundary lines representing the mean value of annual extreme values of temperature and humidity*

The boundary lines representing the mean value of annual extreme values are obtained by plotting all values of air temperature and associated relative humidity during one year, occurring at one place representative of the geographical area, in the same diagram as in Subclause 5.2.2. A boundary line is then drawn through the extreme plots appearing in the diagram.

The boundary line in a climatogram is the mean line between the boundary lines obtained by the procedure for each of many years (at least ten years). The boundaries have been slightly simplified so that they are kept parallel to constant air temperature, constant relative air humidity or constant absolute air humidity.

Although the extreme boundary values of air temperature, relative air humidity and absolute air humidity, which can be read from the diagrams, do not exactly represent the mean value of the annual extreme values, this can be assumed for the practical use of the climatograms.

The probability of a product being exposed to combinations of air temperatures and relative air humidities outside the boundary line depends on for how long the product is exposed to open-air conditions. A product which is permanently placed outdoors for several years can be expected to be temporarily exposed to more extreme air temperatures and more extreme combinations of air temperatures and relative humidities than those indicated by the boundary line.

If a product is exposed to open-air conditions for shorter periods only, the probability is small that the product will be subjected to more extreme air temperatures and humidities than those given by the boundary lines.

The annual extreme value of low temperature normally occurs for a period of approximately 10 h, whilst the annual extreme value of high temperature normally occurs for a shorter period, approximately 5 h. The statistical occurrence could therefore be taken as approximately 0.1% for the low temperature value and approximately 0.05% for the high temperature value.

5.2.4 *Boundary lines representing the absolute extreme value of temperature and humidity*

The boundary lines representing the absolute extreme value are obtained by plotting all values of air temperature and associated relative humidity during many years (more than ten years), occurring at one place representative of the geographical area, in the same diagram as in Sub-clause 5.2.2. A boundary line is then drawn through the extreme plots appearing in the diagram. The boundary line in a climatogram representing the absolute extreme value is then identical to this line.

The boundaries have been simplified so that they are kept parallel to constant air temperature, constant relative air humidity or constant absolute air humidity.

The absolute extreme values which occur very seldom and for short periods only are included for special applications, for example, the efficient operating of devices for telecommunication under worst-case conditions.

5.3 *Identification of the statistical open-air climates*

The following tables present the types of climate defined as the statistical open-air climates.

In Table I the mean value of the annual extreme daily mean values of temperature and humidity is given for each type of climate. In Table II the mean value of annual extreme values of temperature and humidity is given for each type of climate. In Table III the absolute extreme value of temperature and humidity is given for each type of climate.

All figures are based on observations over a period of not less than ten years. An increase in the observation period may result in wider extremes in Table III.

TABLE I

Types of climate by extreme daily mean values

Type of climate	Mean value of the annual extreme daily mean values of temperature and humidity				Climatograms are given in Figure
	Low temperature (°C)	High temperature (°C)	Highest temperature with r.h. ≥ 95% (°C)	Highest absolute humidity ($g \cdot m^{-3}$)	
Extremely Cold (except the Central Antarctic)	−55	+26	+18	14	1
Cold	−45	+25	+13	12	2
Cold Temperate	−29	+29	+18	15	3
Warm Temperate	−15	+30	+20	17	4
Warm Dry	−10	+35	+23	20	5
Mild Warm Dry	0	+35	+24	22	6
Extremely Warm Dry	+8	+43	+26	24	7
Warm Damp	+12	+35	+28	27	8
Warm Damp, equable	+17	+33	+31	30	9