SIST

# SLOVENSKI STANDARD
# oSIST prEN IEC 60721-2-2:2024

**01-februar-2024**

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**Klasifikacija okoljskih pogojev - 2-2. del: Okoljski pogoji v naravi - Padavine in veter**

Classification of environmental conditions - Part 2-2: Environmental conditions appearing in nature - Precipitation and wind

Klassifizierung von Umgebungsbedingungen - Teil 2-2: Natürliche Umgebungsbedingungen - Niederschlag und Wind

Classification des conditions d'environnement - Partie 2-2: Conditions d'environnement présentes dans la nature - Précipitations et vent



**Ta slovenski standard je istoveten z:** **prEN IEC 60721-2-2:2023**



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**ICS:**

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|---|---|---|
| 19.040 | Preskušanje v zvezi z okoljem | Environmental testing |

**oSIST prEN IEC 60721-2-2:2024** **en**

IEC

# 104/1026/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

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| PROJECT NUMBER:<br>**IEC 60721-2-2 ED3** | |
| DATE OF CIRCULATION:<br>**2023-11-17** | CLOSING DATE FOR VOTING:<br>**2024-02-09** |
| SUPERSEDES DOCUMENTS:<br>**104/975/CD, 104/994A/CC** | |

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|---|---|
| IEC TC 104 : ENVIRONMENTAL CONDITIONS, CLASSIFICATION AND METHODS OF TEST | |
| SECRETARIAT:<br>Sweden | SECRETARY:<br>Mr Henrik Lagerström |
| OF INTEREST TO THE FOLLOWING COMMITTEES: | PROPOSED HORIZONTAL STANDARD:<br>☐<br>Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary. |
| FUNCTIONS CONCERNED:<br>☐ EMC ☐ ENVIRONMENT | ☐ QUALITY ASSURANCE ☐ SAFETY |
| ☒ SUBMITTED FOR CENELEC PARALLEL VOTING<br>**Attention IEC-CENELEC parallel voting**<br>The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.<br>The CENELEC members are invited to vote through the CENELEC online voting system. | ☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING |



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Recipients of this document are invited to submit, with their comments, notification of any relevant "In Some Countries" clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE:

**Classification of environmental conditions - Part 2-2: Environmental conditions appearing in nature - Precipitation and wind**

PROPOSED STABILITY DATE: 2028

NOTE FROM TC/SC OFFICERS:

# Contents

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

## Part 2-2: Environmental conditions appearing in nature – Precipitation and wind

## FOREWORD

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International Standard IEC 60721-2-2 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) The layout of the information provided has been re-organised.

b) The information provided has been extensively enhanced and revised.

c) New information on wind severities has been included.

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

| FDIS | Report on voting |
|---|---|
| xxx | xxx |

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 document using a colour printer.**

# INTRODUCTION

This part of IEC 60721 presents fundamental properties, quantities for characterization, and a classification of environmental conditions dependent on precipitation and wind relevant to electrotechnical products. The information presented is intended to be used as background material when selecting appropriate severities of parameters related to precipitation and wind for product applications.

Precipitation encompasses all forms of hydrometeors, both liquid and solid, which are free in the atmosphere, and which reach the Earth's surface. At altitudes below the freezing level, precipitation may occur as liquid or solid particles but above this level snow or hail will predominate. For this document, the different forms of hydrometeors are addressed separately and under the more commonly referred to meteorological conditions of rain, snow and hail. Also encompassed is icing conditions but only that occurring at ground level.

This document additionally and separately addresses wind.

# CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

# Part 2-2: Environmental conditions appearing in nature – Precipitation and wind

## 1 Scope

This part of IEC 60721 presents fundamental properties, quantities for characterization, and a classification of environmental conditions dependent on precipitation and wind relevant to electrotechnical products.

The information presented within this document is intended to be used as background material when selecting appropriate severities of parameters related to precipitation and wind for product applications.

For the purpose of this document precipitation is considered to encompasses all forms of hydrometeors, both liquid and solid, which are free in the atmosphere, and which reach the Earth's surface. The different forms of hydrometeors are addressed separately and under the more commonly referred to meteorological conditions of rain, snow and hail. Whilst icing conditions are additionally considered, only that occurring at ground level, is addressed.

This document separately addresses the climatic condition of wind and provides methodologies and quantitative information to enable wind severities and frequencies to be estimated worldwide.

The majority of the information presented in this document has been derived and assembled by the UK Met Office from published sources as well as historical and forecasting weather records. The information has been assembled and maintained for the UK Ministry of Defence for equipment design and testing purposes [1]. The historical meteorological data employed for this work meets World Meteorological Organisation criteria for validity. However, such data are only available from a limited number of world-wide locations (typically a few hundred). Forecasting weather records, which were extensively utilised for this work, are available from a significant number of locations (typically tens of thousands) but are not necessarily verified. Whenever the latter information has been used, an appropriate strategy was adopted to remove spurious data.



## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

No terms and definitions are listed in this document.



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

## 4 Rain

### 4.1 General

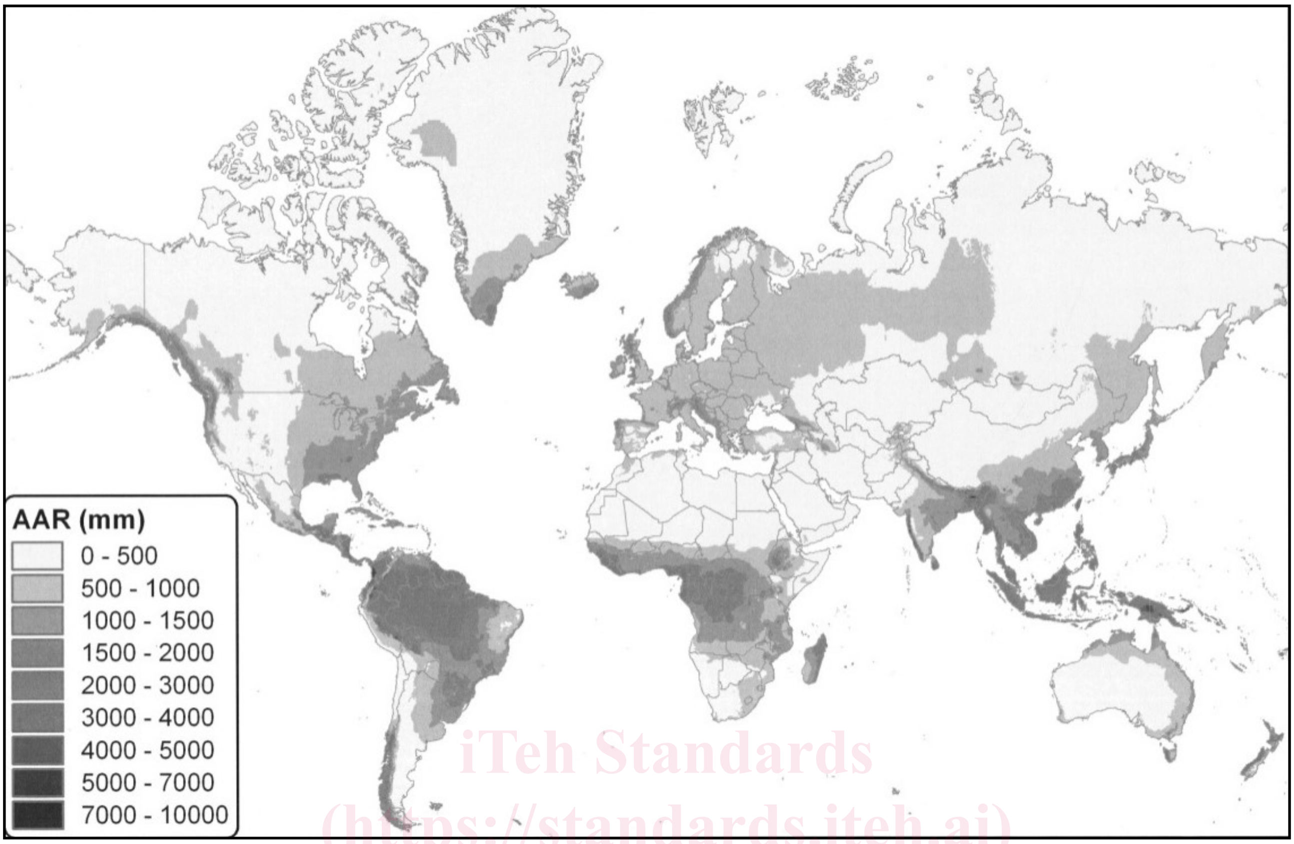
Rain is the primary focus of this clause as it the dominant meteorological condition associated with the wetting of electrotechnical products.

### 4.2 Global Distribution of Rainfall

Compared with meteorological air temperature which, at any particular time is often substantially the same (±5 °C) over relatively large regions, rainfall is a much more spatially variable climatic condition. In particular, the precipitation intensity that constitutes a near extreme value is peculiar to the highly localised area. Even a relatively short distance away, the intensity may differ by a factor of two or more. Thus, it is impracticable to relate precipitation intensity to specific geographical areas of the world, as is the case with temperature.

Precipitation intensity is defined as the rate at which precipitation falls. Although values of precipitation intensity may be considered as instantaneous rates, in practice they are averages taken over periods of one minute or longer. When using any rainfall data, it should be remembered that as the pattern of rainfall is infinitely variable both in time and space, only general information can be given by means of maps or diagrams.

For most places, readily available rainfall data are limited to observations of the rainfall catch made once daily. Where precipitation is of snow, the observations record the rainfall equivalent of that snow. The daily observations may be summarised to provide average monthly, seasonal or annual amounts. Figure 1 represents such a summary for annual amounts, based on observations from 27075 locations worldwide over the period 1961 to 1990.






NOTE At higher latitudes, an increasing proportion of this "rainfall" will fall as snow.

**Figure 1 -- Average Annual Rainfall (AAR) for global land areas, based on 1961 to 1990 data [1]**

The fundamental requirements for precipitation to fall in significant amounts are high atmospheric moisture content and a mechanism for the uplift of air. Ascending air cools by expansion due to the decreasing atmospheric pressure with height. Given that the lower the temperature the less moisture the air can retain in vapour state, then if cooling and moisture content are sufficient, precipitation is the result. As a generalisation, the wetter land regions of the world belong to one of the following three broad geographical categories:

a. Along the equator ±15 ° of latitude e.g., Indonesia, equatorial Africa, and the Amazon rain forest. The high rainfall of these regions is primarily due to convection, triggered by solar heating and accentuated by the convergence of the northern hemisphere tropic's north-easterly winds and the southern hemisphere tropic's south-easterly winds along the 'inter-tropical convergence zone'. Here, copious moisture is provided by either rain forest or warm, tropical ocean.

b. The western side of continents in mid latitudes e.g., UK, Western Europe, the north-western coastal fringe of North America and the south-western coastal fringe of South America (southern Chile). At these latitudes, winds blow predominantly from the west and therefore reach the western side of continents having picked up moisture over a long ocean track. The lifting mechanisms are varied and include convection and orographic uplift, but the dominant lifting mechanism is cyclonic/frontal uplift in weather disturbances that develop on, and move eastwards along, the boundary between polar and tropical air masses. In North and South America, the inland penetration of high rainfall is severely limited by the high, north-south aligned mountain chains of the American Cordillera. By contrast, the western fringe of Europe has no north-south aligned barrier of such proportion, so that moderate rainfall is able to penetrate well inland across the European plain. Iceland, the Falkland Islands, Tasmania, and the exposed west of South Island New Zealand also belong to this regime.

c. Extending polewards from the equatorial regions along the eastern seaboard of continents e.g., Eastern Asia from India to Kamchatka, North America from the Gulf of Mexico to Quebec (including the southern extremity of Greenland), South America from southern Brazil to north-eastern Argentina, the east of South Africa and the eastern fringe of Australia. The reasons for high rainfall in these areas are complex but include the predominantly easterly moist onshore winds of tropical latitudes and, at sub-tropical latitudes, the drawing of moist summer monsoon winds of tropical ocean origin inland towards a heat-generated continental low-pressure area, as in the Indian and south-east Asian summer monsoons. Further poleward, at mid latitudes, the prevailing wind is from the west, blowing offshore; however, the eastern seaboards of both North America and Asia are favoured regions for the development of precipitation-bearing cyclonic weather systems which then move north-eastwards close to the mid-latitude coastline.

The important influence of topography on rainfall is demonstrated by the heavier rainfall in mountainous regions, particularly where a mountain range runs parallel to the coast and intercepts moisture laden winds as they blow onshore. Mountains also usually reduce rainfall downwind – the 'rain-shadow' effect.

Many of the great deserts of the world lie within or close to latitudes 20 degrees to 30 degrees of latitude, where relatively high atmospheric pressure dominates. e.g., the Sahara Desert and Saudi Arabia, the deserts of California and Arizona, the Atacama Desert in Chile, the Namibian, and Kalahari Deserts of southern Africa and much of interior and western Australia. The dryness of some deserts is accentuated by the rain-shadow effect of adjacent mountain barriers (e.g., the inland deserts of California and Arizona). An additional factor in some coastal deserts is a cold ocean current offshore that suppresses convection e.g., the narrow Atacama Desert of Chile is trapped between high mountains to the east and a cool ocean current offshore.

In Asia the circum-global belt of high pressure at sub-tropical latitudes is displaced by the Asian monsoon, which blows outwards from intense high pressure over Siberia in winter and blows into low pressure over southern interior Asia in summer. This effectively transfers the latitudinal desert belt by ~15 degrees of latitude poleward to lie north and inland of the areas reached by the Indo-Asian monsoon e.g., the Gobi Desert of Mongolia and China.

Precipitation in polar regions is generally not particularly high on account of the reduced amount of water vapour in the air at low temperatures.

## 4.3 Characteristics of rain



### 4.3.1 Formation

Clouds are formed when air is cooled below its dewpoint, usually as a result of lifting and consequent expansion. At first the cloud droplets grow by the condensation of water on to them, but it can be shown that this process alone cannot produce drops of the size found in rain. Two mechanisms are thought to be important in the formation of raindrops.

Firstly, droplets which are slightly larger than the average will fall, relative to the air, and towards neighbouring smaller droplets, and so may collide and coalesce with some of them to become larger still. This process may continue until a droplet eventually falls out of the base of the cloud. This mechanism is confined mainly, but not exclusively, to the tropics, where clouds can remain devoid of solid precipitation throughout their depth. Theoretical studies have shown that a significant amount of rain can be produced in this way, provided the cloud is several kilometres deep.

Secondly, when a cloud top becomes appreciably colder than 0 °C, it contains a mixture of ice crystals and supercooled water drops. At first the crystals grow by direct sublimation of water vapour on to them, but as they become larger, they may collide with the supercooled droplets and other ice crystals to form snowflakes, and when these snowflakes have fallen below the level at which the temperature is 0 °C they will melt to form raindrops. This is the dominant mechanism in middle and high latitudes, but it also occurs within the tropics and applies to clouds with a top colder than about -10 °C. In convective (cumuliform) cloud, graupel or small hail, rather than snowflakes, may be produced.

### 4.3.2 Types of rain

Rainfall is often classified according to the process causing the uplift of air initiating the rain formation; there are three main types of rain which are not mutually exclusive, and these are known as orographic, cyclonic, and convective.

Orographic rain is caused by one, or sometimes both, of two primary mechanisms. The most commonly known mechanism is the forced ascent of a moist airstream over the physical barrier of the high ground. The ascending airstream cools by expansion, often to the temperature at which saturation occurs, above which altitude cloud forms. This may result in drizzle or rain over the high ground when there is none on the adjacent low ground, but more often it enhances cyclonic cloud and rain that are also affecting adjacent low ground. This enhancement is often due primarily to raindrops scavenging additional water as they fall through the