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Classification of environmental conditions - Part 2: Environmental conditions appearing in nature - Section 5: Dust, sand, salt mist

Klassifizierung von Umweltbedingungen - Teil 2: Natürliche Umweltbedingungen - Hauptabschnitt 5: Staub, Sand, Salznebel

Classification des conditions d'environnement - Partie 2: Conditions d'environnement présentes dans la nature - Section 5: Poussière, sable, brouillard salin

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SECRETARIAT: Sweden	SECRETARY: Mr Henrik Lagerström
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
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TITLE:

Classification of environmental conditions - Part 2: Environmental conditions appearing in nature - Section 5: Dust, sand, salt mist

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62 INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

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**Part 2-5: Environmental conditions appearing in nature –
Dust, sand and salt mist**

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FOREWORD

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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.

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International Standard IEC 60721-2-5 has been prepared by IEC technical committee 104: Environmental conditions, classification, and methods of test.

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This second edition cancels and replaces the first edition, published in 1997, and constitutes a technical revision.

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

110

a) The Information provided in previous issue has been extensively enhanced and revised.

111

112

b) New information on methodologies for deriving dust and sand severities has been included.

113 c) Annex A has been removed because, despite extensive investigation, the source and
 114 accuracy of the severities could not be verified. Equivalent information is now provided
 115 within the text.

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

FDIS	Report on voting
xxx	xxx

117 Full information on the voting for the approval of this International Standard can be found in
 118 the report on voting indicated in the above table.

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

120 A list of all parts in the IEC 60721 series, published under the general title *Classification of*
 121 *environmental conditions*, can be found on the IEC website.

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

- 125 • reconfirmed,
- 126 • withdrawn,
- 127 • replaced by a revised edition, or
- 128 • 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.

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131

INTRODUCTION

132 This section of IEC 60721-2 is intended to be used as part of the background information when selecting
133 appropriate severities of parameters relating to dust, sand and salt mist for product application.

134 This document presents information related to the occurrence and characteristics of dust, sand and salt
135 mist. It describes the influences from these environmental factors to which products are liable to be
136 exposed during storage, transportation and use.

137 The effects of dust, sand and salt mist can be enhanced by precipitation and wind. Information related
138 to the occurrence and characteristics of precipitation and wind is provided in IEC 60721-2-2 [1].

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140 CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

141 Part 2-5: Environmental conditions appearing in nature – 142 Dust, sand and salt mist

143 1 Scope

144 This part of IEC 60721 presents information related to the occurrence and characteristics of dust, sand
145 and salt mist. It describes the influences from these environmental factors to which products are liable
146 to be exposed during storage, transportation and use. The effects of dust, sand and salt mist can be
147 enhanced by precipitation and wind.

148 Information related to the occurrence and characteristics of precipitation and wind is provided in
149 IEC 60721-2-2 [1].

150 2 Normative references

151 There are no normative references in this document.

152 3 Terms and definitions

153 No terms and definitions are listed in this document.

154 ISO and IEC maintain terminological databases for use in standardization at the following addresses:

155 IEC Electropedia: available at <http://www.electropedia.org/>

156 ISO Online browsing platform: available at <http://www.iso.org/obp>

157 4 Dust and sand

158 4.1 Classification of dust and sand

159 'Dust' and 'Sand' are terms for solid non-cohesive particulate matter, usually of mineral origin, found on
160 the surface of the earth or suspended in the atmosphere. The range of particle diameters of dust and
161 sand together extends from about 0.1 µm to 2 000 µm. The 2 000 µm value is generally considered as
162 the lower limit for very fine pebbles. Conversely, particles below 1 µm are usually termed smoke and
163 fumes. Although dust and sand are normally differentiated on the basis of particle diameters, no
164 universally accepted demarcation value exists.

165 In this document, a classification based on their different aerodynamic behaviour is adopted. Particles
166 of less than 75 µm diameter can remain suspended in the atmosphere by natural turbulence of the air
167 for very long periods, even years. These are termed 'dust' by most authorities. Conversely, those
168 greater than 150 µm diameter are unable to remain airborne unless continually subjected to strong
169 natural winds, powerful air flows or the turbulence which may be caused, for example, by aircraft,
170 helicopter or convoys of land vehicles. These particles are termed 'sand'. Over the intermediate range
171 of diameters from 75 µm to 150 µm, there is a gradual transition in settling times and the particles are
172 variously referred to as 'dust' or 'sand' in different documents.

173 For the purposes of laboratory simulation, the default demarcation value for distinguishing sand from
174 dust is typically 149 µm, which is the diameter of the smallest particles retained by a No 100 standard
175 sieve.

176 4.2 Sand – distribution, hardness and angularity

177 4.2.1 Distribution

178 Sand is distributed widely over the Earth's surface. There are vast sandy regions in the Sahara and in
179 Saudi Arabia as well as significant areas in most the world's deserts. All the continents have sandy
180 beaches of various widths and there are large deposits at or near the surface in mainly inland areas
181 formerly covered by water. On account of this widespread occurrence of sand, it should be assumed

182 that most unprotected products have the potential to be exposed to sandy conditions at some time
183 during their life.

184 4.2.2 Hardness and angularity

185 Hardness of the individual particles can determine their ability to scratch objects upon contact. Sand
186 which consists mainly of tiny broken chips of crystalline quartz or other mineral is generally harder than
187 most fused silica glass compositions. Consequently, sand can scratch the surface of most glass optical
188 devices. Table 1 lists a few common substances and hardness levels according to the Mohs scale.
189 Substances with a higher number can scratch any substance with a lower number.

190

Table 1 -- Hardness scale

Mohs scale	Typical materials
1 - Talc	Graphite, Soapstone
2 - Gypsum	Kaolinite, Alabaster, Mica (muscovite)
3 - Calcite	Limestone, Marble
4 - Fluorite	-
5 - Apatite	Turquoise, Titanite, Hornblende, glass
6 - Orthoclase	Magnetite, Feldspar, Opal, Pyrite
7 - Quartz	Flint, Fused Silica, Olivine, Andalusite, Agate, Tourmaline
8 - Topaz	Emery
9 - Corundum	Sapphire, Silicon Carbide, Tungsten Carbide
10 - Diamond	-

191 Hardness and angularity are usually the most important characteristics of sand grains. On a world-wide
192 basis, the majority of sands are composed of quartz (SiO_2), which, in its most common form, has a
193 hardness of 7 on the Mohs scale. Other minerals which may be found in sand range from hardness 2
194 for white gypsum, to hardness 9 for corundum. Table 2 shows the main constituents of natural dusts
195 and sand, and the relative hardness of the particles. Minute quantities of other minerals such as zircon,
196 garnet, mica, magnetite, etc. may also be found. In addition, particulates resulting from industrial
197 processes, as well as microscopic vegetable and microbiological entities, may be present in dust. On a
198 world-wide basis, the majority of sands are composed of quartz.

199

Table 2 -- Constituents of natural sands

Constituent	Composition	Hardness (Mohs scale)
Quartz	SiO_2	7
Feldspars	K Al Si_3O_8 or Na Al Si_3O_8 or Ca $\text{Al}_2\text{Si}_2\text{O}_8$	6
Limestone	Ca CO_3 and Mg CO_3	2 to 4

200 Although in time, grains of sand become rounded by mutual abrasion; those having angular shape are
201 found in substantial proportion in most samples of sand. The latter arise from the tendency of some
202 rock-forming minerals, particularly quartz, to fracture along cleavage planes through impact action.

203 In general, the movement of sand by wind pressure is confined to the air layer within the first metre
204 above the ground. Even within this layer, about half the sand grains (by weight) move within the first
205 10 mm above the surface and most of the remainder are within the first 100 mm. As a consequence of
206 the low elevation at which the majority of sand grains move, most abrasion damage caused by sand
207 outside high wind periods is at or near ground level.