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Part 4: Environmental control

*Technologie de l'information — Installation et infrastructures de centres de traitement de données —
Partie 4: Contrôle environnemental*

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34 Foreword

35 ISO (the International Organization for Standardization) and IEC (the International Electrotechnical
36 Commission) form the specialized system for worldwide standardization. National bodies that are
37 members of ISO or IEC participate in the development of International Standards through technical
38 committees established by the respective organization to deal with particular fields of technical activity.
39 ISO and IEC technical committees collaborate in fields of mutual interest. Other international
40 organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the
41 work. In the field of information technology, ISO and IEC have established a joint technical committee,
42 ISO/IEC JTC 1.

43 The procedures used to develop this document and those intended for its further maintenance are
44 described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the
45 different types of document should be noted. This document was drafted in accordance with the
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51 Any trade name used in this document is information given for the convenience of users and does not
52 constitute an endorsement.

53 For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and
54 expressions related to conformity assessment, as well as information about ISO's adherence to the
55 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following
56 URL: www.iso.org/iso/foreword.html. ISO/IEC DIS 22237-4

57 This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*,
58 Subcommittee SC 39, "New title".

59 A list of all parts in the ISO/IEC 22237 (and the ISO/IEC TS 22237) series can be found on the ISO
60 website.

61 This document will supersede ISO/IEC TS 22237-4:2018.

62 The following technical changes have been made:

- 63 a) availability requirements aligned with ISO/IEC 22237-1:201X and ISO/IEC 22237-3:201X;
- 64 b) figures updated;
- 65 c) tbd.

66 Introduction

67 The unrestricted access to internet-based information demanded by the information society has led to
68 an exponential growth of both internet traffic and the volume of stored/retrieved data. Data centres are
69 housing and supporting the information technology and network telecommunications equipment for
70 data processing, data storage and data transport. They are required both by network operators
71 (delivering those services to customer premises) and by enterprises within those customer premises.

72 Data centres need to provide modular, scalable and flexible facilities and infrastructures to easily
73 accommodate the rapidly changing requirements of the market. In addition, energy consumption of data
74 centres has become critical both from an environmental point of view (reduction of carbon footprint)
75 and with respect to economical considerations (cost of energy) for the data centre operator.

76 The implementation of data centres varies in terms of:

- 77 a) purpose (enterprise, co-location, co-hosting or network operator facilities);
- 78 b) security level;
- 79 c) physical size;
- 80 d) accommodation (mobile, temporary and permanent constructions).

81 The needs of data centres also vary in terms of availability of service, the provision of security and the
82 objectives for energy efficiency. These needs and objectives influence the design of data centres in terms
83 of building construction, power distribution, environmental control, telecommunications cabling and
84 physical security. Effective management and operational information is required to monitor
85 achievement of the defined needs and objectives.

86 The ISO/IEC 22237 series specifies requirements and recommendations to support the various parties
87 involved in the design, planning, procurement, integration, installation, operation and maintenance of
88 facilities and infrastructures within data centres. These parties include:

- 89 1) owners, facility managers, ICT managers, project managers, main contractors;
- 90 2) consultants, architects, building designers and builders, system and installation designers;
- 91 3) suppliers of equipment;
- 92 4) installers, maintainers.

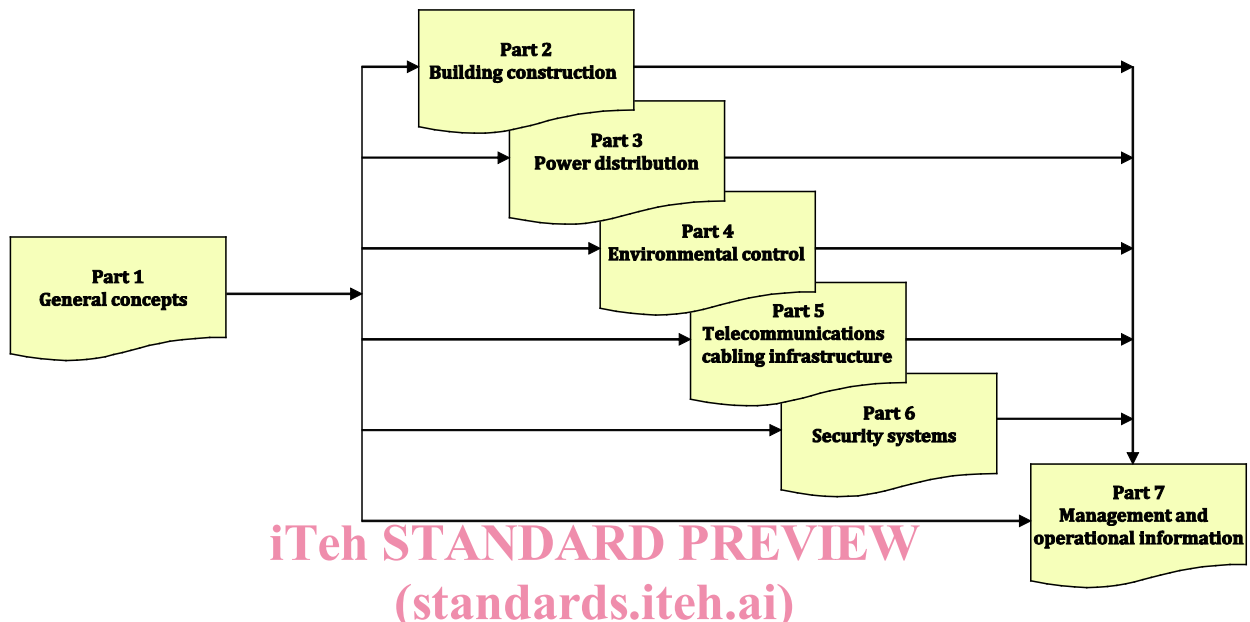
93 At the time of publication of this document, the ISO/IEC 22237 series will comprise the following
94 documents:

- 95 — ISO/IEC 22237-1, *Information technology — Data centre facilities and infrastructures — Part 1:*
96 *General concepts;*
- 97 — ISO/IEC 22237-2, *Information technology — Data centre facilities and infrastructures — Part 2:*
98 *Building construction;*
- 99 — ISO/IEC 22237-3, *Information technology — Data centre facilities and infrastructures — Part 3:*
100 *Power distribution;*
- 101 — ISO/IEC 22237-4, *Information technology — Data centre facilities and infrastructures — Part 4:*
102 *Environmental control;*
- 103 — ISO/IEC 22237-5, *Information technology — Data centre facilities and infrastructures — Part 5:*
104 *Telecommunications cabling infrastructure;*

105 — ISO/IEC 22237-6, *Information technology — Data centre facilities and infrastructures — Part 6:*
106 *Security systems;*

107 — ISO/IEC 22237-7: *Information technology — Data centre facilities and infrastructures — Part 7:*
108 *Management and operational information.*

109 The inter-relationship of the specifications within the ISO/IEC 22237 series is shown in Figure 1.



110

111 **Figure 1 — Schematic relationship between the ISO/IEC 22237 series of documents**

112 ISO/IEC 22237-2 to ISO/IEC 22237-6 specify requirements and recommendations for particular
113 facilities and infrastructures to support the relevant classification for “availability”, “physical security”
114 and “energy efficiency enablement” selected from ISO/IEC 22237-1.

115 This document, ISO/IEC 22237-4, addresses the environmental control facilities and infrastructure
116 within data centres together with the interfaces for monitoring the performance of those facilities and
117 infrastructures in line with ISO/IEC 22237-7 (in accordance with the requirements of
118 ISO/IEC 22237-1).

119 ISO/IEC 22237-7 addresses the operational and management information (in accordance with the
120 requirements of ISO/IEC 22237-1).

121 This document is intended for use by and collaboration between architects, building designers and
122 builders, system and installation designers.

123 The ISO/IEC 22237 series does not address the selection of information technology and network
124 telecommunications equipment, software and associated configuration issues.

125 **1 Scope**

126 This document addresses environmental control within data centres based upon the criteria and classifications
127 for “availability”, “security” and “energy efficiency enablement” within ISO/IEC 22237-1.

128 This document specifies requirements and recommendations for the following:

- 129 a) temperature control;
- 130 b) fluid movement control;
- 131 c) relative humidity control;
- 132 d) particulate control;
- 133 e) vibration;
- 134 f) physical security of environmental control systems.

135 **2 Normative references**

136 The following documents are referred to in the text in such a way that some or all of their content constitutes
137 requirements of this document. For dated references, only the edition cited applies. For undated references,
138 the latest edition of the referenced document (including any amendments) applies.

139 ISO/IEC 22237-1, *Information technology - Data centre facilities and infrastructures - Part 1: General concepts*

140 ISO/IEC 22237-3:201X, *Information technology - Data centre facilities and infrastructures - Part 3: Power*
141 *distribution*

142 ISO/IEC TS 22237-6, *Information technology - Data centre facilities and infrastructures - Part 6: Security*
143 *systems*

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144 IEC 61439-1, *Low-voltage switchgear and controlgear assemblies - Part 1: General rules*

145 IEC 62040-3, *Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test*
146 *requirements*

147 ISO 14644-8, *Cleanrooms and associated controlled environments - Part 8: Classification of air cleanliness by*
148 *chemical concentration (ACC)*

149 ISO 16890-1, *Air filters for general ventilation - Part 1: Technical specifications, requirements and classification*
150 *system based upon particulate matter efficiency (ePM)*

151 **3 Terms, definitions and abbreviated terms**

152 **3.1 Terms and definitions**

153 For the purposes of this document, the terms and definitions in ISO/IEC 22237-1 and the following apply.

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 **3.1.1**

158 **access floor**

159 system consisting of completely removable and interchangeable floor panels that are supported on adjustable
160 pedestals connected by stringers to allow the area beneath the floor to be used by building services

161 Note 1 to entry: Also known as raised floor.

162 [SOURCE: ISO/IEC TS 22237-2:2018, 3.1.1 – modified: added note 1 to entry]

163 **3.1.2**

164 **adiabatic cooling**

165 adiabatic cooling is a system which uses the principle of evaporative cooling to reduce the temperature of a
166 given medium (usually air).

167 **3.1.3**

168 **common cause failure**

169 failures in multiple parts of a system or systems due to a single cause

170 Note 1 to entry: Examples are fire and flood.

171 **3.1.4**

172 **comfort environmental controls**

173 controls which produce an environment which is appropriate for the effective performance of personnel in a
174 given space

175 **3.1.5**

176 **dew point**

177 temperature at which the water vapour in a gas begins to deposit as a liquid or ice, under standardized
178 conditions

179 **3.1.6**

180 **direct fresh air cooling**

181 cooling system that uses the external air that can be filtered to cool the IT equipment in the data centre

182 **3.1.7**

183 **DRUPS**

184 the output waveform is produced by a rotating machine that is mechanically connected to a flywheel stored
185 energy source, and the flywheel stored energy source is coupled to a backup engine with an electro-magnetic
186 clutch

187 **3.1.8**

188 **exhaust air temperature**

189 temperature of the air leaving the data centre building

190 **3.1.9**

191 **heat load**

192 thermal power that is produced

193 **3.1.10**

194 **indirect fresh air cooling**

195 cooling system that uses the external air to cool the data centre. The external air is passed through a heat
196 exchanger to separate the external from the internal air which passes by the IT equipment

197 **3.1.11**

198 **information technology equipment**

199 equipment providing data storage, processing and transport services together with equipment dedicated to
200 providing direct connection to core and/or access networks

201 **3.1.12**

202 **inlet air temperature**

203 temperature of the (cold) air entering the rack or IT equipment

- 204 **3.1.13**
205 **outdoor air temperature**
206 temperature of the air measured outside of the data centre building
- 207 **3.1.14**
208 **outlet air temperature**
209 temperature of the (warm) air leaving the rack or IT equipment
- 210 **3.1.15**
211 **relative humidity**
212 ratio, expressed as a percentage, of the vapour pressure of water vapour in moist air to the saturation vapour
213 pressure with respect to water or ice at the same temperature
- 214 [SOURCE: IEC 60050-705:1995, 705-05-09]
- 215 **3.1.16**
216 **return air temperature**
217 temperature of the (warm) air re-entering the environmental control system e.g. the air handling unit
- 218 **3.1.17**
219 **rotary UPS**
220 the output waveform is produced by a rotating machine, using either batteries or flywheel as stored energy
221 source
- 222 **3.1.18**
223 **static UPS**
224 the output waveform is produced by electronic circuits, using either batteries or flywheel as stored energy
225 source
- 226 **3.1.19**
227 **supply air temperature**
228 temperature of the (cold) air leaving the environmental control system e.g. the air handling unit
- 229 **3.1.20**
230 **ventilation**
231 supply of air motion in a space by circulation or by moving air through the space
- 232 Note 1 to entry: Ventilation can be produced by any combination of natural or mechanical supply and exhaust.
- 233 Note 2 to entry: Such systems can include partial treatment such as heating, relative humidity control, filtering or
234 purification, and, in some cases, evaporative cooling.

235 **3.2 Abbreviated terms**

236 For the purposes of this document, the abbreviated terms given in ISO/IEC 22237-1 and the following apply.

CRAC	Computer Room Air Conditioning (Unit)
CRAH	Computer Room Air Handler
DRUPS	Diesel Rotary Uninterruptible Power System
IT	Information Technology
ITE	Information Technology Equipment
UPS	Uninterruptible Power System

237 **4 Conformance**

238 For a data centre to conform to this document:

- 239 a) it shall feature an environmental control solution that meets the requirements of Clauses 5 and 6;
- 240 b) it shall feature an approach to physical security in relation to the environmental control solution that meets
241 the requirements of Clause 7;
- 242 c) it shall feature an energy efficiency enablement solution that meets the requirements of the relevant
243 Granularity Level of Clause 8;
- 244 d) local regulations, including safety, shall be met.
- 245 The required Class of the Environmental Control system of a data centre is based on the required Availability
246 Class of the data centre.

247 5 Environmental control within data centres

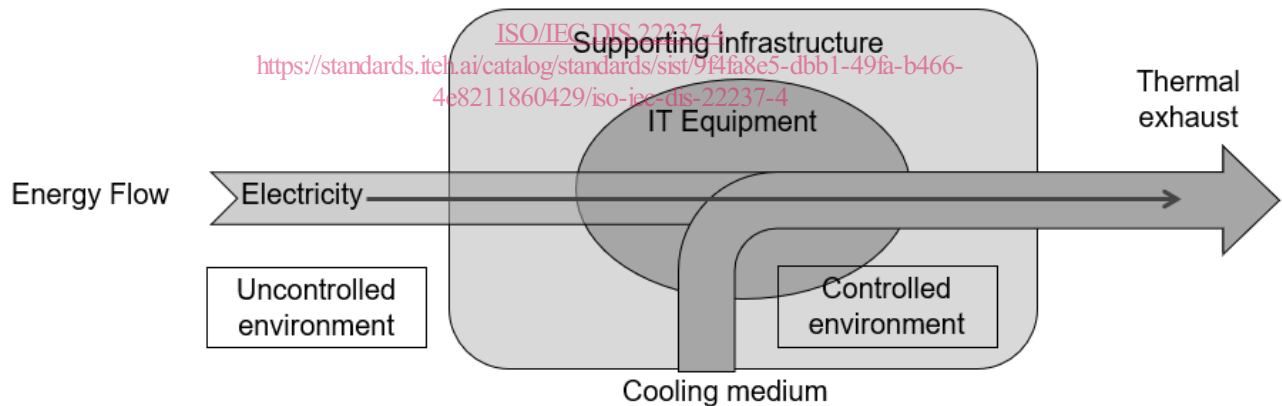
248 5.1 General

249 5.1.1 Design input

250 Power supply and distribution and environmental control are important primary facilities and infrastructures of
251 a data centre and have inter-related design aspects:

- 252 a) power supplied to IT equipment which is converted to heat output;
- 253 b) power supplied to the environmental control system to remove the heat output

254



255 **Figure 2 – Logical representation of environmental control of data centre spaces**

256 5.1.2 Functional Elements

257 The environmental control system is one of the most important parts of the data centre infrastructure.
258 Excessive variations of temperature or relative humidity can directly affect the functional capability of the data
259 centre and its infrastructures.

260 The functional elements of the environmental control system are divided into supply and distribution elements.
261 The division of environmental control systems into supply and distribution reflects energy efficiency where data
262 centres use multiple cooling sources in various combinations (e.g. cold water from public grids, non- dedicated
263 central cooling plants, geothermal systems, rivers, and compressor systems)

264 Supply elements relate to the generation of temperature controlled fluids. Distribution elements relate to the
265 distribution of fluids generated by the supply elements. Distribution elements are differentiated in devices
266 (units) and paths. See Table 1 for examples of these elements.

267 It should be noted that for environmental control systems the electrical energy flow is into the system and the
268 thermal flow is from within the controlled environment outwards to the uncontrolled environment (exhausted
269 from the building).

270 Some environmental systems combine the function of supply and distribution elements.

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