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Part 3: Power distribution

Technologie de l'information — Installation et infrastructures de centres de traitement de données —

Partie 3: Distribution de puissance

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability, IT & Data Centres*.

This first edition cancels and replaces the first edition (ISO/IEC TS 22237-3:2018), which has been technically revised.

The main changes are as follows:

— availability requirements have been aligned with ISO/IEC 22237-1 and ISO/IEC 22237-4;

— figures have been updated.

A list of all parts in the ISO/IEC 22237 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

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

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

The implementation of data centres varies in terms of:

a) purpose (enterprise, co-location, co-hosting or network operator facilities);

b) security level;

c) physical size; and

d) accommodation (mobile, temporary and permanent constructions).

NOTE Cloud services can be provided by all data centre types mentioned.

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

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

1) owners, operators, facility managers, ICT managers, project managers, main contractors;

2) consultants, architects, building designers and builders, system and installation designers, auditors and commissioning agents;

3) suppliers of equipment; and

4) installers, maintainers.

At the time of publication of this document, the ISO/IEC 22237 series comprises the following documents:

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

— ISO/IEC TS 22237-2, *Information technology — Data centre facilities and infrastructures — Part 2: Building construction*;

— ISO/IEC 22237-3 (this document), *Information technology — Data centre facilities and infrastructures — Part 3: Power distribution*;

— ISO/IEC 22237-4, *Information technology — Data centre facilities and infrastructures — Part 4: Environmental control*;

— ISO/IEC TS 22237-5, *Information technology — Data centre facilities and infrastructures — Part 5: Telecommunications cabling infrastructure*;

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

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

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

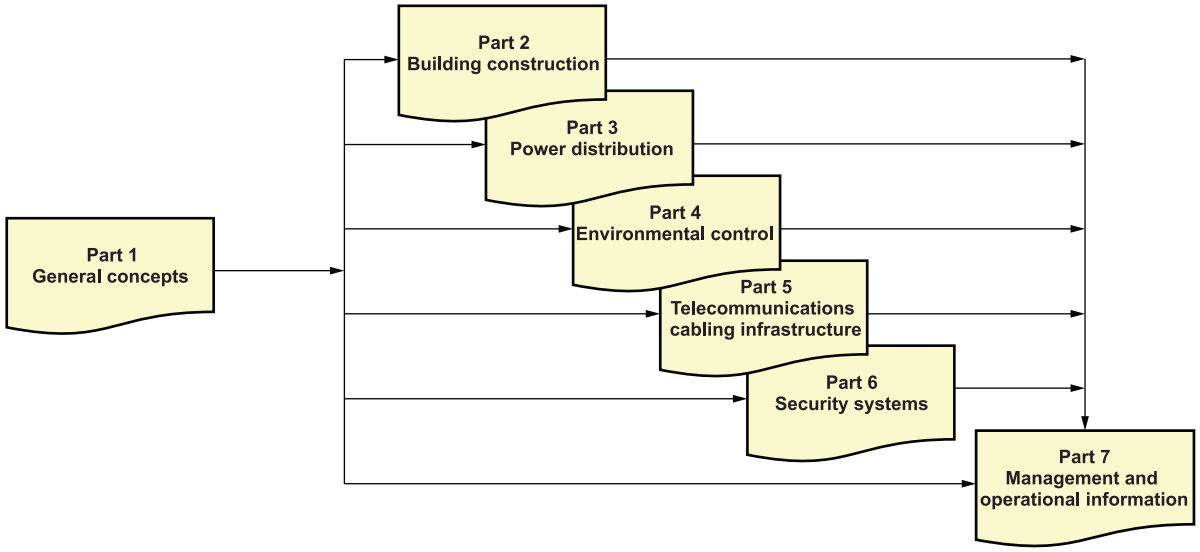


Figure 1 — Schematic relationship between the ISO/IEC 22237 series of documents

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

This document, ISO/IEC 22237-3, addresses facilities and infrastructures for power supplies to, and power distribution within, data centres together with the interfaces for monitoring the performance of those facilities and infrastructures in line with ISO/IEC TS 22237-7 (in accordance with the requirements of ISO/IEC 22237-1). The line diagrams used in certain figures are not intended to replace the more familiar electrical circuit diagrams associated with power supply and distribution systems, which are included where relevant.

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

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

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

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Information technology — Data centre facilities and infrastructures —

Part 3: Power distribution

1 Scope

This document addresses power supplies to, and power distribution within, data centres based upon the criteria and classifications for "availability", "physical security" and "energy efficiency enablement" within ISO/IEC 22237-1.

This document specifies requirements and recommendations for the following:

a) power supplies to data centres;

b) power distribution systems to all equipment within data centres;

c) telecommunications infrastructure bonding;

d) lightning protection;

e) devices for the measurement of the power consumption and power quality characteristics at points along the power distribution system and their integration within management tools.

Safety and electromagnetic compatibility (EMC) requirements are outside the scope of this document and are covered by other standards and regulations. However, information given in this document can be of assistance in meeting these standards and regulations.

Conformance of data centres to the present document is covered in Clause 4.

The use of the data centre stored energy or alternate sources to be used by the grid is not in the scope of this document and is for consideration in future specifications.

2 Normative references

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

EN 13160 (all parts), *Leak detection systems*

IEC 60076-11, *Power transformers — Part 11: Dry-type transformers*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60947 (all parts), *Low-voltage switchgear and controlgear*

IEC 61000-2-4, *Electromagnetic compatibility (EMC) — Part 2-4: Environment — Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

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IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. — Equipment for testing, measuring or monitoring of protective measures — Part 12: Performance measuring and monitoring devices (PMD)*

IEC 61869-2:2012, *Instrument transformers — Part 2: Additional requirements for current transformers*

IEC 62040 (all parts), *Uninterruptible power systems (UPS)*

IEC 62053-21, *Electricity metering equipment (a.c.) — Particular requirements — Part 21: Static meters for active energy (classes 1 and 2)*

IEC 62053-22, *Electricity metering equipment (a.c.) — Particular requirements — Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)*

IEC 62271-200, *High-voltage switchgear and controlgear — Part 200. AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62305 (all parts), *Protection against lightning*

IEC 62586-1, *Power quality measurement in power supply systems — Part 1: Power quality instruments (PQI)*

IEC 62586-2, *Power quality measurement in power supply systems — Part 2: Functional tests and uncertainty requirements*

IEC 62974-1, *Monitoring and measuring systems used for data collection, gathering and analysis — Part 1: Device requirements*

IEC 88528-11, *Reciprocating internal combustion engine driven alternating current generating sets — Part 11: Rotary uninterruptible power systems — Performance requirements and test methods*

IEC/TS 62749, *Assessment of power quality — Characteristics of electricity supplied by public networks*

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

ISO/IEC 22237-4, *Information technology — Data centre facilities and infrastructures — Part 4: Environmental control*

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

ISO/IEC 30129, *Information technology — Telecommunications bonding networks for buildings and other structures*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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3.1.1
active power
P
under periodic conditions, mean value, taken over one period, *T*, of the instantaneous power, *p*:

$$P = \frac{1}{T}\int_0^T p\,dt$$

Note 1 to entry: Under sinusoidal conditions, the active power is the real part of the complex power *S*, thus $P = \mathrm{Re}\,S$.

Note 2 to entry: The coherent SI unit for active power is watt, W.

[SOURCE: IEC 60050-131:2002, 131-11-42]

3.1.2
additional supply
power supply that provides power in the event of failure of *primary* (3.1.22) and/or *secondary supply* (3.1.24)

3.1.3
apparent power
product of the r.m.s. voltage *U* between the terminals of a two-terminal element or two-terminal circuit and the r.m.s. electric current *I* in the element or circuit $S = UI$

Note 1 to entry: Under sinusoidal conditions, the apparent power is the modulus of the complex power $\underline{S}$, thus $S = |\underline{S}|$.

Note 2 to entry: The coherent SI unit for apparent power is voltampere, VA.

[SOURCE: IEC 60050-131:2002, 131-11-41]

3.1.4
capacitive load
load that is capacitive, so that the alternating current is out of phase with and leads the voltage

3.1.5
catenary
wire hung at a specific tension between supporting structures of power cabling

3.1.6
diverse route
alternative separate pathway intended to provide adequate segregation from another pathway, in order to maintain service provision in the event of physical damage to one of the pathways

3.1.7
dual-corded equipment
equipment served by multiple power supply input interfaces

3.1.8
emergency power off
EPO
designated device to provide emergency switching which disconnects power from one or more data centre facilities, infrastructures or spaces

Note 1 to entry: The configuration and function of emergency power off devices can be subject to national or local regulations.

3.1.9
fire compartment
discrete zone designed to contain a fire within that zone

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3.1.10
high voltage
HV
voltage whose nominal r.m.s. value is 35 kV < U_N ≤ 230 kV

Note 1 to entry: Because of existing network structures, in some countries the boundary between MV and HV can be different.

3.1.11
inductive load
load that is inductive, so that the alternating current is out of phase with and lags behind the voltage

3.1.12
IT load
electrical consumption of all the information technology equipment, providing data storage, processing and transport services, measured at its input terminals including all on-board integrated power supplies and cooling fans

3.1.13
load factor
ratio, expressed as a numerical value or as a percentage, of the consumption within a specified period (year, month, day, etc.), to the consumption that would result from continuous use of the maximum or other specified demand occurring within the same period

Note 1 to entry: This term should not be used without specifying the demand and the period to which it relates.

Note 2 to entry: The load factor for a given demand is also equal to the ratio of the utilization time to the time in hours within the same period.

[SOURCE: IEC 60050-691:1973, 691-10-02]

3.1.14
locally protected socket
sockets (3.1.26) which continue to deliver power to connected equipment for a defined period following failure of power supply and distribution equipment by means of a battery supply or UPS adjacent to, or co-located with, those sockets (e.g. emergency lighting)

3.1.15
low voltage
LV
voltage whose nominal r.m.s. value is U_N ≤ 1 kV

3.1.16
Main-Tie-Tie-Main
electrical connection between two power supply or power distribution circuits which allows current to flow in either direction and containing two circuit breakers enabling maintenance while one of the circuits is active

3.1.17
medium voltage
MV
voltage whose nominal r.m.s. value is 1 kV < U_N ≤ 35 kV

Note 1 to entry: Because of existing network structures, in some countries the boundary between MV and HV can be different.

3.1.18
pathway
<cable route, cable way> defined route for cables between termination points

[SOURCE: ISO/IEC 14763-2:2019, 3.1.34]

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3.1.19
power factor
λ
under periodic conditions, ratio of the absolute value of the *active power* (3.1.1), *P*, to the *apparent power* (3.1.3), *S*: $\lambda = |P|/S$

Note 1 to entry: This is the ratio of the active (real) power flowing to the load to the apparent power (as a result of the capacitive or inductive nature of the load) and is a dimensionless number between 0 and 1.

[SOURCE: IEC 60050-131:2002, 131-11-46, modified — new Note 1 to entry added.]

3.1.20
protected socket
socket (3.1.26) which continues to deliver power to connected equipment for a defined period following failure of power supply and distribution equipment

3.1.21
primary distribution equipment
equipment which is required to manage, control and convert incoming power supplies *(primary, secondary* and, where appropriate, *additional)* (3.1.22, 3.1.24, 3.1.2) in a form suitable for distribution by *secondary distribution equipment* (3.1.23)

3.1.22
primary supply
principal power supply that provides power to the data centre under normal operating conditions

3.1.23
secondary distribution equipment
equipment which is required to manage, control and distribute the power provided by the *primary distribution equipment* (3.1.21) to the *short-break*, *protected* and *unprotected sockets* (3.1.25, 3.1.20, 3.1.30) within the data centre and to the *tertiary distribution equipment* (3.1.27)

Note 1 to entry: The power supply can be single-phase AC, three-phase AC or DC. If there is a change from 3-phase to 1-phase supply, this is generally achieved at the secondary distribution equipment that is served directly from the primary distribution equipment.

3.1.24
secondary supply
power supply independent from, and that is continuously available to be used to provide power to the data centre following the disruption of, the primary power supply

Note 1 to entry: A second feed to a separate transformer from the same grid is not a secondary supply.

3.1.25
short-break socket
sockets (3.1.26) which, upon failure of power supply and distribution equipment, will be provided with power from an *additional supply* (3.1.2) after a defined period

3.1.26
socket
connection enabling the supply of power to attached equipment

Note 1 to entry: This can be a de-mateable or a hardwired connection.

3.1.27
tertiary distribution equipment
power supply equipment, typically accommodated within the cabinets, frames and racks of the data centre spaces, which directly feeds the *protected sockets* (3.1.20) therein

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3.1.28
total harmonic distortion of current
THD_i
measurement of the harmonic distortion present on a current level, defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency

3.1.29
total harmonic distortion of voltage
THD_u
measurement of the harmonic distortion present on a voltage level, defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency

3.1.30
unprotected socket
sockets (3.1.26) which fail to deliver power to connected equipment following failure in power supply or distribution equipment

3.2 Abbreviated terms

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

AC	alternating current
DC	direct current
EPO	emergency power off
HV	high voltage
KPI	key performance indicator
LV	low voltage
MV	medium voltage
PMD	power metering and monitoring device
PSU	power supply unit
r.m.s.	root mean square
SPD	surge protective device
THD_i	total harmonic distortion of current
THD_u	total harmonic distortion of voltage

3.3 Symbols

λ	power factor
P	real or active power
$\underline{S}$	complex power
S	apparent power, the magnitude, or modulus, of complex power
T	one time period

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