TECHNICAL SPECIFICATION

ISO/IEC TS 22237-3

First edition
2018-05

Information technology — Data centre facilities and infrastructures —

Part 3: Power distribution

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

Partie 3: Distribution de puissance



Reference number
ISO/IEC TS 22237-3:2018(E)

© ISO/IEC 2018



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions and abbreviated terms **2**
3.1 Terms and definitions 2
3.2 Abbreviated terms 5

4 Conformance **6**

5 Power supply and distribution within data centres **6**
5.1 General 6
5.2 Dimensioning of power distribution systems 8

6 Availability **9**
6.1 General requirements 9
6.2 Power supply 9
6.2.1 Capacity planning 9
6.2.2 Availability of the utility supply 11
6.2.3 Power quality 12
6.2.4 Load presented to the utility supply 12
6.2.5 Equipment 13
6.2.6 Availability Class design options 14
6.3 Power distribution 17
6.3.1 Capacity planning 17
6.3.2 Power quality 19
6.3.3 Equipment 19
6.3.4 Availability Class design options 20
6.4 Incorporation of LVDC distribution 22
6.5 Additional considerations 22
6.5.1 Lightning and surge protection 22
6.5.2 Segregation of power distribution cabling and information technology cabling 22
6.6 Emergency power off 22
6.6.1 Requirements 22
6.6.2 Recommendations 22

7 Physical security **22**
7.1 General 22
7.2 Access 22
7.2.1 Power supply 22
7.2.2 Power distribution 23
7.2.3 Attachment of unauthorised end-equipment 23
7.2.4 Cabling infrastructure to support access control 23
7.3 Internal environmental events 23
7.3.1 Power supply 23
7.3.2 Power distribution 23
7.4 External environmental events 23

8 Energy efficiency enablement and power distribution **23**
8.1 General 23
8.2 Granularity Level 1 24
8.2.1 Requirements 24
8.2.2 Recommendations 24
8.3 Granularity Level 2 25
8.3.1 Requirements 25
8.3.2 Recommendations 25

© ISO/IEC 2018 – All rights reserved

8.4 Granularity Level 3 25
8.4.1 Requirements 25
8.4.2 Recommendations 25
8.5 Cabling infrastructure to support energy efficiency enablement 25
Annex A (informative) **Example implementations of power distribution** **26**
Bibliography **29**

 © ISO/IEC 2018 – All rights reserved

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability for and by Information Technology.*

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

© ISO/IEC 2018 – All rights reserved

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 economical 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;

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

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 and physical security. Effective management and operational information is required to monitor achievement of the defined needs and objectives.

The ISO/IEC TS 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, facility managers, ICT managers, project managers, main contractors;

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

3) facility and infrastructure integrators, suppliers of equipment;

4) installers, maintainers.

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

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

— ISO/IEC TS 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*;

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

 © ISO/IEC 2018 – All rights reserved

— 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 TS 22237 series is shown in Figure 1.

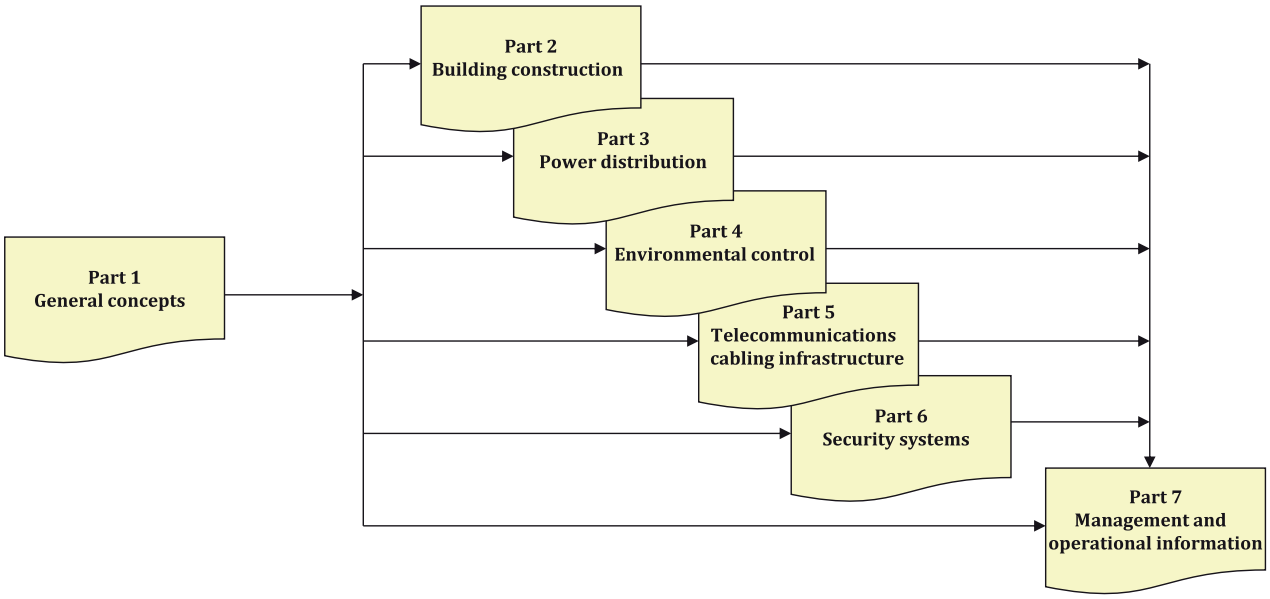


Figure 1 — Schematic relationship between the ISO/IEC TS 22237 series of documents

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 TS 22237-1.

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

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

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

© ISO/IEC 2018 – All rights reserved

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 TS 22237-1.

This document specifies requirements and recommendations for the following:

a) power supplies to data centres;

b) power distribution systems within data centres;

c) facilities for both normal and emergency lighting;

d) equipotential bonding and earthing;

e) lightning protection;

f) devices for the measurement of the power consumption 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 may be of assistance in meeting these standards and regulations.

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

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.

ISO/IEC TS 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 TS 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*

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

© ISO/IEC 2018 – All rights reserved

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

IEC 60044-1:1996, *Instrument transformers — Part 1: Current transformers*

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

IEC 61000-2-4:2002, *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*

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

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

IEC 62305-4, *Protection against lightning — Part 4: Electrical and electronic systems within structures*

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

EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*

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 TS 22237-1 and the following apply.

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 https://www.iso.org/obp

3.1.1
active power
real power
product of r.m.s. voltage, r.m.s. current and power factor

Note 1 to entry: Expressed as W.

3.1.2
additional supply
backup supply
power supply that provides power in the event of failure of primary and/or secondary supply

3.1.3
apparent power
product of r.m.s. voltage and r.m.s current

Note 1 to entry: Expressed as VA.

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

© ISO/IEC 2018 – All rights reserved

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

3.1.7
emergency power off
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.

3.1.8
fire compartment
discrete zone designed to contain a fire within that zone

3.1.9
high voltage
voltage whose nominal r.m.s. value is 36 kV < U_n ≤ 150 kV

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

[SOURCE: EN 50160:2010, 3.7]

3.1.10
inductive load
load that is inductive, so that the alternating current is out of phase with and lags behind the voltage

3.1.11
information technology equipment
equipment providing data storage, processing and transport services together with equipment dedicated to providing direct connection to core and/or access networks

3.1.12
IT load
electrical consumption of all the information technology equipment measured at its input terminals including all on-board integrated power supplies and cooling fans

3.1.13
load factor
ratio of the average load to the peak load over a period of time

3.1.14
locally protected supply provision
sockets 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
voltage whose nominal r.m.s. value is U_n ≤ 1 kV

[SOURCE: EN 50160:2010, 3.9]

3.1.16
mechanical cooling load
electrical consumption of all the plant and components used to provide environmental control within the data centre, generally comprising compressors, controls, fans, pumps and humidifiers

© ISO/IEC 2018 – All rights reserved

3.1.17
medium voltage
voltage whose nominal r.m.s. value is 1 kV < U_n ≤ 36 kV

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

[SOURCE: EN 50160:2010, 3.11]

3.1.18
pathway
defined route for cables between termination points

[SOURCE: ISO/IEC 14763-2:2012, 3.1.43]

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

Note 1 to entry: 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]

3.1.20
protected supply provision
no break protected supply provision
sockets which continue 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) in a form suitable for distribution by secondary distribution equipment

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

3.1.23
resistive load
load in which the alternating current is in phase with the voltage

Note 1 to entry: The total reactance is zero.

3.1.24
secondary distribution equipment
equipment which is required to manage, control and distribute the power provided by the primary distribution equipment to the short-break and unprotected sockets within the data centre and to the tertiary distribution equipment

Note 1 to entry: The power supply may 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.

3.1.25
secondary supply
power supply that provides power to the data centre in conjunction with the primary supply under normal operating conditions

© ISO/IEC 2018 – All rights reserved

3.1.26
short-break supply provision
back-up supported supply provision
sockets which, upon failure of power supply and distribution equipment, will be provided with power from an additional power supply after a defined period

3.1.27
socket
connection enabling supply of power to attached equipment

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

3.1.28
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 therein

3.1.29
total harmonic current distortion
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

3.1.30
total harmonic voltage distortion
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

3.1.31
unprotected supply provision
sockets which fail to deliver power to connected equipment following failure in power supply and distribution equipment

3.2 Abbreviated terms

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

AC	Alternating Current
DC, dc	Direct Current
EPO	Emergency Power Off
HV	High Voltage
ITE	Information technology equipment
LV	Low Voltage
MV	Medium Voltage
r.m.s.	root mean square
SPD	Surge Protective Device
THCD	Total Harmonic Current Distortion

© ISO/IEC 2018 – All rights reserved

THVD Total Harmonic Voltage Distortion

TVSS Transient Voltage Surge Suppression

UPS Uninterruptible Power Supply

4 Conformance

For a data centre to conform to this document:

a) it shall feature a power supply and distribution design solution that meets the required Availability Class of Clause 6 (and is predicted to meet the relevant availability requirements of that clause);

b) the environmental controls applied to the spaces accommodating the power supply and distribution system within the premises and serving the data centre shall be in accordance with ISO/IEC TS 22237-4;

c) it shall feature an approach to physical security in relation to the power supply and distribution solution that meets the requirements of Clause 7;

d) it shall feature an energy efficiency enablement solution that meets the requirements of the relevant Granularity Level of Clause 8;

e) the equipotential bonding system within the data centre shall be in accordance with the local mesh earthing requirements of ISO/IEC 30129;

f) where lightning protection is required, it shall be in accordance with IEC 62305 (all parts) applied with reference to ISO/IEC 30129;

g) local regulations, including safety, shall be met.

5 Power supply and distribution within data centres

5.1 General

The distribution of electrical power is one of the most important aspects of data centre infrastructure. Disturbances of power supply voltage, current and frequency have a direct effect on the operational safety of the data centre infrastructure and its availability.

The functional elements of power supply to and distribution within data centres are described in Table 1. The requirements and recommendations for the provision of physical security to the spaces accommodating the functional elements are described in Clause 7.

The primary and secondary supplies are typically provided from a transformer which may either be:

a) within the premises containing the data centre (and may be owned by either the utility or the data centre premises owner), or

b) external and owned by the utility (and not considered to be a functional element).

The primary and secondary distribution equipment may also contain transformers.

The supply area is shown schematically in Figure 2 and indicates two implementations. The upper diagram shows the minimum implementation comprising a primary power supply only. The lower diagram includes a secondary supply and also an additional supply that provides power to relevant equipment in the data centre, if required, following a failure of the primary and/or secondary power supply.

 © ISO/IEC 2018 – All rights reserved