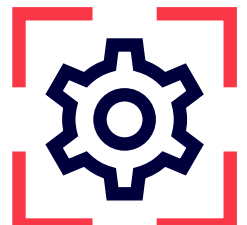


ISO/IEC 22237 Data Center Standard

What you need to know

Table of contents

1. Introduction	3
2. ISO/IEC 22237 – The new standard with global impact	4
3. The ISO/IEC 22237 – ongoing development	5
4. Who is addressed?	6
5. Compliance to the ISO/IEC 22237	7
5.1 Business Risk Analysis	7
5.2 Classification System	8
5.2.1 Availability Classes	9
5.2.2 Protection Classes	9
5.2.3 Granularity Levels	10
6. Evaluation and Certification	11
7. ISO/IEC 22237 vs. EN 50600	12
8. Criteria Catalog TSI.STANDARD	14
9. TSI.STANDARD with ISO/IEC 22237 extension	15
About TÜV NORD CERT	16



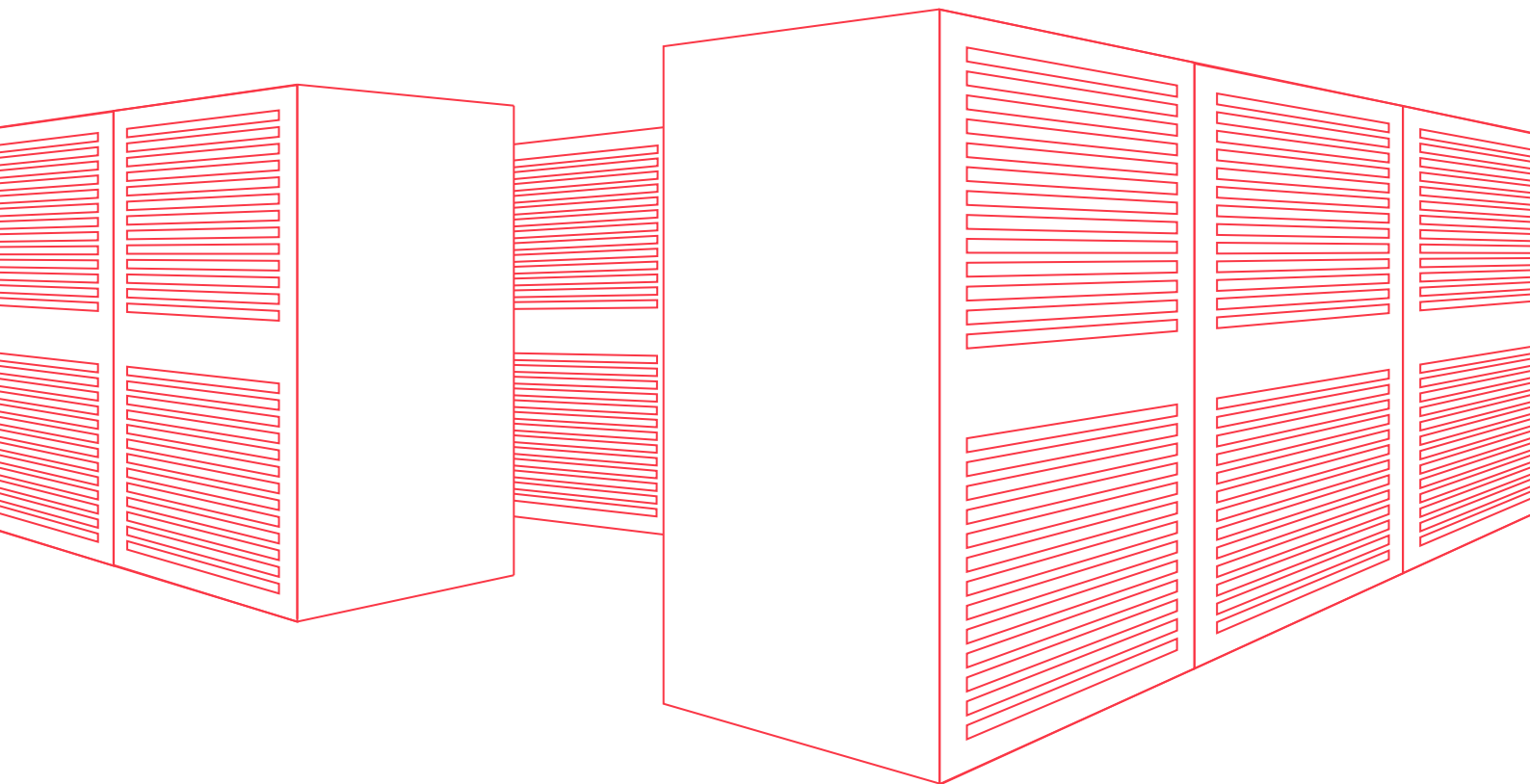
1. Introduction

The data center industry has been historically lacking a universal standard approach for physical security and availability. The EN 50600, on which the ISO/IEC 22237 is based, aimed at closing the gap on a European level. While successful in Europe with many operators aligning with the EN 50600, regions outside of Europe have seen little to no implementation of the standard.

The ISO/IEC 22237 provides a globally accepted approach for data center operators wishing to share comparable information about the physical security and availability of their data centers. Data centers are expected to provide uninterrupted availability to their

customers and their data services. The international standard for data centers ISO/IEC 22237 provides an industry standard for all aspects of data centers such as construction, mission critical infrastructure and operation, ultimately ensuring the reliability of the IT infrastructure.

This whitepaper is focused on providing an overview of the present status of the international standard for data centers ISO/IEC 22237 and how a data center operator can reach a conformity to the standard.



2. ISO/IEC 22237 – The new standard with global impact

In 2018 the ISO committee ISO/IEC JTC 1/SC 39 “Sustainability for and by Information Technology” has decided to take up EN 50600 series to the international level. Based on the EN 50600 documents, seven Technical Specifications (TS) have been decided, to be developed further into International Standards to include North American and Asian input. The committee defines its scope in standardization of assessment methods, design practices, operation and management aspects to support resource ef-

ficiency, resilience and environmental sustainability for and by information technology, data centers and other facilities and infrastructure necessary for service provisioning.

Figure 1 shows the initial structure of the ISO/IEC 22237. The first part of the data center standard was an introductory part for general concepts (ISO/IEC 22237-1) and 6 sections for technical content (see Figure 2 on the next page).

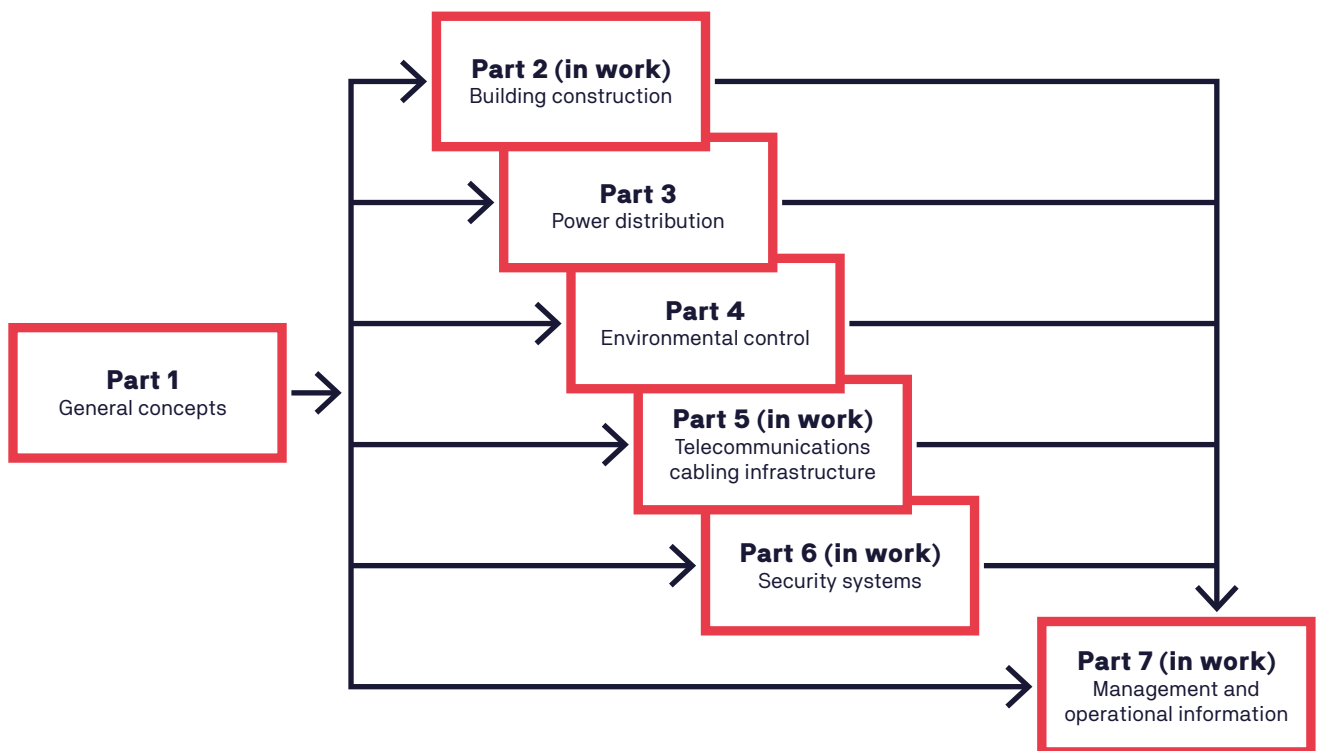






Figure 1: Excerpt from ISO/IEC 22237-1, First edition 2021-10

3. The ISO/IEC 22237 – ongoing development

ISO/IEC 22237		
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	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	
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	


 = ongoing development

Figure 2: The scope of ISO/IEC 22237 today

There is a continuous update and development on the ISO/IEC 22237. This results in an expanded scope. The standard specifies general requirements for all kinds of data centers irrespective of their size and physical construction:

- it describes general aspects of the facilities and infrastructures required to support effective operation of telecommunications within data centers,
- it specifies a classification system, based upon the key criteria of “availability”, “security” and “energy efficiency enablement” over the planned lifetime of the data center, for the provision of effective facilities and infrastructure, and
- it describes the general design principles for data centers upon which the requirements of the ISO/IEC 22237 series are based.

Currently published parts of the ISO/IEC 22237

ISO/IEC 22237-1: General concepts Current version released 2021-10

- Business risk analysis
- Data centre design: Spaces and facilities
- Availability
- Physical security
- Energy efficiency enablement
- Design of data centers

ISO/IEC 22237-3: Power distribution Current version released 2021-10

- Power supply and distribution within data centers
- Availability
- Physical security
- Energy efficiency enablement and power distribution

ISO/IEC 22237-4: Environmental control Current version released 2021-10

- Environmental control within data centers
- Availability
- Physical security
- Energy efficiency enablement

4. Who is addressed?

The ISO/IEC 22237 addresses various parties that are involved in the design, planning, procurement, integration, installation, operation and maintenance of facilities and infrastructures within data centers.

In Part 1: “General Concepts” of the ISO/IEC 22237, these parties include:

MANAGEMENT	DESIGN & CONSTRUCTION	EQUIPMENT
<ul style="list-style-type: none">▪ Owner▪ Operator▪ Facility Management▪ ICT Management▪ Project manager▪ Main contractor	<ul style="list-style-type: none">▪ Consultants▪ Architects▪ Building designers▪ Construction companies▪ System and installation designers▪ Test and commissioning agents	<ul style="list-style-type: none">▪ Suppliers of equipment▪ Maintenance and installation companies

Figure 3: Parties addressed by the ISO/IEC 22237

It should be pointed out that one party in this listing is not included, which are the evaluators/auditors.

The reason is that the ISO/IEC 22237 is designed as a guideline. Therefore, it does not include an evaluation scheme which is necessary for neutral, comparable and consistent third-party assessments.

A lack of an official defined evaluation scheme causes data center evaluators to come up with their own interpretations which result in assessments offered in the market to be different and therefore are not fully comparable.

5. Compliance to the ISO/IEC 22237

The ISO/IEC 22237 has a general setup of how a typical standard is structured. Important to note about the setup is that it includes a conformance clause, which defines what a data center operator needs to fulfill to reach a conformance. The ISO/IEC 22237 generally differentiates between:

- **Recommendations:** are not mandatory for a conformance. They address special aspects which should be taken into account from a best practice perspective. They are usually classified by the words “should” or “should not”.
- **Requirements:** have to be fulfilled for a conformance. They are usually classified by the words “shall be” or “shall not”.
- **Conditional Requirements:** are based on the risk assessment, which needs to be performed when intending to comply with the standard. Requirements have to be fulfilled if risks are identified.

5.1 Business Risk Analysis

Any data center that claims to be compliant with the standard must first complete a business risk analysis according to clause 5 of the ISO/IEC 22237-1.

As mentioned before some requirements are placed in the context of this risk analysis. This allows the topics to be applied more universally to a wide variety of circumstances. However, this comes at the price that ultimately the user of the standard must first determine the risk in detail in order to then draw the correct conclusions – the ISO/IEC 22237 greatly increases the challenge for data center designers and consultants.

The requirements of the availability of the mission critical infrastructure (electrical and mechanical system) and cabling infrastructures and the overall availability of the data center are derived from the conclusions of the business risk analysis. If the conclusions are misinterpreted, the availability will not match the business requirements.

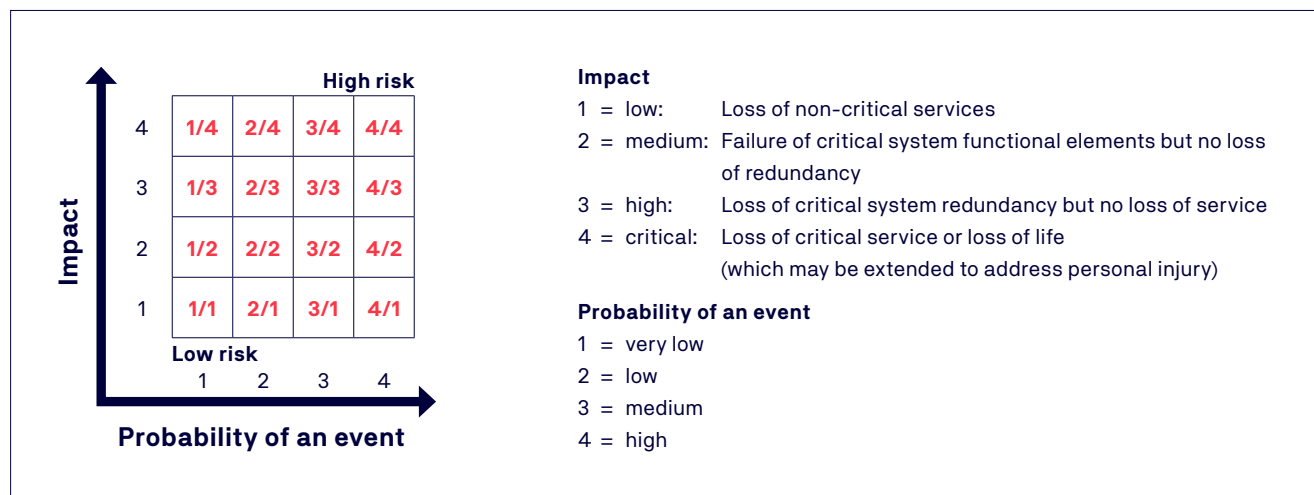


Figure 4: Source: ISO/IEC 22237, clause 5

5.2 Classification System

The ISO/IEC 22237 provides three classifications of Availability Class, Protection Class and Energy Efficiency Enablement Level for data centers.

These three classifications play a role in conformance clause of Part 1 of the ISO/IEC 22237.

The conformance clause demands that first of all, a business risk analysis has to be conducted and accordingly an appropriate availability class shall be selected, depending on how critical the data center is for the organization. Different protection classes are applied and an appropriate energy efficiency enablement level has to be selected.

AVAILABILITY CLASSES (AVAILABILITY)	PROTECTION CLASSES (SECURITY)	GRANULARITY LEVELS (ENERGY EFFICIENCY)
<ul style="list-style-type: none">4 different availability classesAvailability classes deal with technical redundancies in single to multiple paths	<ul style="list-style-type: none">3 different protection classesProtection classes deal with physical protection against unauthorized access, intrusion, internal and external environmental events.	<ul style="list-style-type: none">3 different granularity levels for the monitoring and measurement of energy efficiency

Figure 5: The three classifications of the ISO/IEC 22237

5. Compliance to the ISO/IEC 22237

5.2.1 Availability Classes

Four different grades of availability classes are defined for

- ISO/IEC 22237-3 (power distribution)
- ISO/IEC 22237-4 (environmental control)
- ISO/IEC 22237-5 (telecommunications cabling infrastructure)

The higher the availability class (AC), the more component and path redundancy is provided. AC 1–2 are built upon a single path layout, AC 2 with critical component redundancy, while AC 3–4 have at least a dual path, sometimes a multi path design, with component and path redundancies.

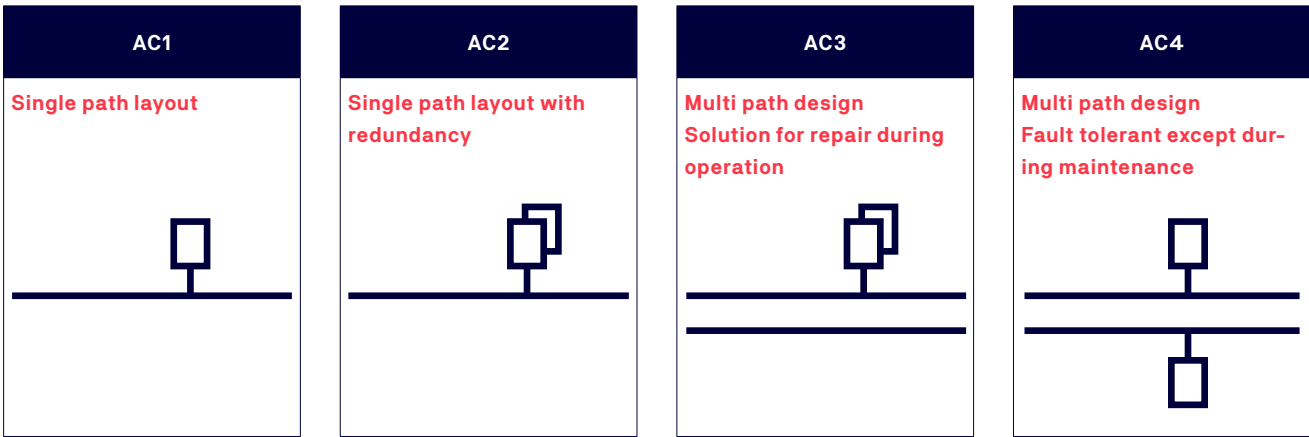


Figure 6: The path layouts of the different availability classes

5.2.2 Protection Classes

The ISO/IEC 22237 defines four different areas of protection for data center spaces against the following events, also shown in Figure 7 (here internal and external environmental events are shown combined) below.

Protection against unauthorized access applies to all areas of the data center. The protection classes for the electrical and mechanical rooms are defined in parts 3

and 4 of the ISO/IEC 22237, which specify the rooms to be assigned to protection class 3.

For protection against intrusion, all areas of the data center are considered together with the intrusion delay and reaction times.

Protection against internal and external environmental events has to comply with the desired availability class and is also dependent on the risk analysis.

PROTECTION CLASSES UNAUTHORIZED ACCESS	PROTECTION AGAINST INTRUSION	PROTECTION AGAINST ENVIRONMENTAL EVENTS
<ul style="list-style-type: none">■ At least three protection classes must be implemented■ ISO/IEC 22237-3 and ISO/IEC 22237-4 define the requirements regarding electrical and mechanical spaces	<ul style="list-style-type: none">■ Intrusion protection measures dependent on the purpose of the data center■ Intrusion delay time > time to stop intruder, multiple barriers increase intrusion delay time■ Construction in ISO/IEC TS 22237-2■ Security systems in ISO/IEC 22237-6	<ul style="list-style-type: none">■ Overheating, fire■ Water, flood■ EMI, lightning■ Earthquake, explosion■ Other natural disasters

Figure 7: Protection classes of the ISO/IEC 22237

5.2.3 Granularity Levels

The granularity levels (GL) define to which extent the technical infrastructure is monitored and how the measurement of the energy consumption is performed. Higher levels require increased levels of measurement and monitoring of the infrastructure. The three levels are listed below in Figure 8, for the illustration of the granularity level for the electrical system see Figure 9.

GL 1	GL 2	GL 3
A measuring concept that provides simple, general information for the entire data center.	A measuring concept that provides detailed information for specific facilities and infrastructure within the data center.	A measuring concept that provides granular data for the systems within the areas and supply paths of the data center.

Figure 8: Granularity levels of the ISO/IEC 22237

- In GL 1, the operator can distinguish on how much energy is consumed by the facility and how much energy is used for the IT.
- In GL 2, the operator needs a more detailed measurement energy concept with an in-depth overview of his distribution systems.
- In GL 3, the operator has to provide measurement for the energy consumption down to the individual electrical outlet level.

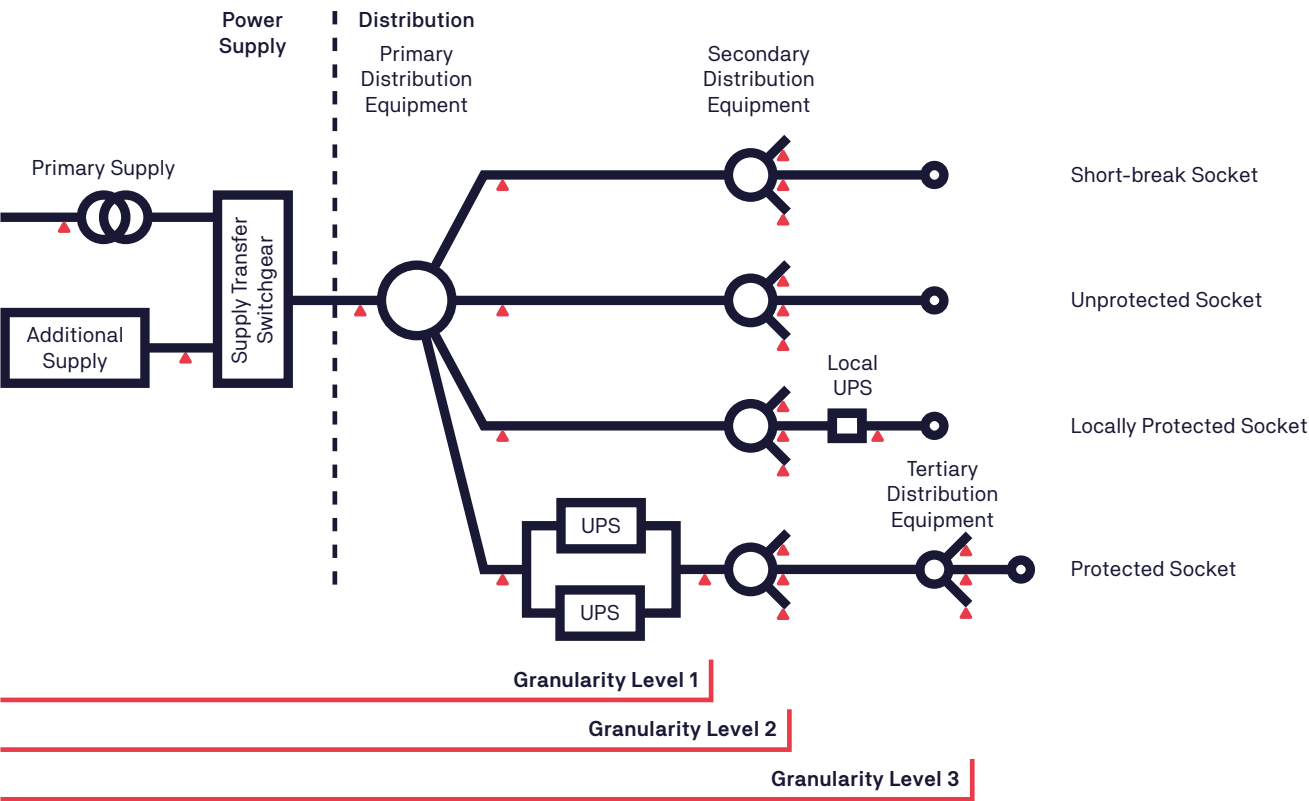


Figure 9: Source: ISO/IEC 22237 3:2021-10

6. Evaluation and Certification

The ISO/IEC 22237 has been developed as a technical guideline. It is intended to provide assistance to all parties directly or indirectly involved in the design, development and operation of data centers. For this purpose, a holistic approach is chosen, which explains all relevant trades and organizational necessities and provides requirements as well as recommendations.

Furthermore, the requirements are partly placed in the context of a risk analysis. This means that the topics can be applied more universally to a wide range of circumstances. However, this comes at the price that ultimately the user of the standard must first determine the specific risks in detail in order to then draw the correct conclusions. The assistance essentially consists of the fact that ISO/IEC 22237 outlines many considerations and names potential risks, but it does not provide any guidance as to which concrete measures are required under which risks and which requirements are to be fulfilled in the case.

The standard requires the user to perform a business risk analysis (see 5.1) not only to derive security measures with basic requirements, but also to causally explain the design of individual measures.

This methodology raises the question of how conformity confirmations can be made, because there are no evaluation instructions – after all, the ISO/IEC 22237 primarily wants to be a guideline. This is also the reason why the market requires additional measures for the ISO/IEC 22237 to serve as a suitable basis for assessment and certification.

The problems for a neutral, independent evaluation are:


- Risk assessment of the operator with regards to the necessity of an implementation of a measure
- No clear requirements depending on the degree of risk
- No evaluation instructions and specifications for the scope of an assessment
- No coordination body for the auditors





These problems are accompanied by the fact that the certificates issued are difficult to compare. The evaluation market is not regulated here. The disadvantages can be minimized by deriving a well founded evaluation criteria catalog. This approach is followed by TÜV NORD with its established “TSI. STANDARD” criteria catalog which defines the requirements extracted from the standard in detail and the scope of inspections. For the operator and for the evaluation body the scope of the required inspections is therefore clearly defined.

The catalog also ensures that the certificates are comparable, because the TSI.STANDARD criteria catalog also contains instructions and interpretations for the evaluation body. The goal is to achieve a uniform evaluation. Assessments based solely on the ISO/IEC 22237 without a criteria catalog are therefore not recommended.

7. ISO/IEC 22237 vs. EN 50600

The new ISO/IEC 22237 standard is the international data center standard consisting of seven parts. The parts 1, 3 and 4 were published in October 2021. The structure is based on the EN 50600 as shown below.

The other parts (here marked by ) are only available as Technical Specifications, while technical committees in the background are working on the adaptation, mainly the integration of data center concepts from North America and Asia.

ISO/IEC 22237	EN 50600
ISO/IEC 22237-1: General concepts	EN 50600-1: General concepts
ISO/IEC TS 22237-2: Building construction 	EN 50600-2-1: Building construction
ISO/IEC 22237-3: Power distribution	EN 50600-2-2: Power distribution
ISO/IEC 22237-4: Environmental control	EN 50600-2-3: Environmental control
ISO/IEC TS 22237-5: Telecommunication cabling 	EN 50600-2-4: Telecommunication cabling
ISO/IEC TS 22237-6: Security systems 	EN 50600-2-5: Security systems
ISO/IEC TS 22237-7: Management and operational information 	EN 50600-2-6: Management and operational information

Within the published parts of the ISO/IEC 22237 the following specific differences to the EN 50600 can be noted:

1. For certifications according to the standards the following differences apply:

ISO/IEC 22237	EN 50600
<ul style="list-style-type: none">■ Certificates according to ISO/IEC 22237 can presently be issued only based on the published parts 1, 3 and 4 of the standard.	<ul style="list-style-type: none">■ Certificates according to EN 50600 are issued based on all parts of the standard.



The certification scope of ISO/IEC 22237 is therefore presently limited technically and normatively whereas EN 50600 allows certifications of the full scope. These limitations have to be considered for the choice of the evaluation and certification body as well as for the comparison of certificates.

2. For availability class 4 the minimal requirements for computer room air conditioning units are:

ISO/IEC 22237	EN 50600
<ul style="list-style-type: none">■ Component redundancy of at least N+1 with each unit connected redundantly to redundant cooling supply circuits (piping) and automatic changeover switching in ISO/IEC 22237-4.	<ul style="list-style-type: none">■ System redundancy of 2N located in separate spaces and supplied from redundant cooling supply systems in the EN 50600-2-3.



Here EN 50600-2-3 has stricter requirements than ISO/IEC 22237-4 so that currently for many data center operators this is a high obstacle to achieve an EN 50600 certification whereas the ISO/IEC 22237-4 requirements provide here an easier access to certification.

7. ISO/IEC 22237 vs. EN 50600

3. For Availability Class 4 differences in the secure electrical supply of air conditioning components exist:

ISO/IEC 22237	EN 50600
<ul style="list-style-type: none">Redundant cooling supply systems receive power supply from redundant power distribution systems in ISO/IEC 22237-4. Every commonly used component of the distribution and consumer side has to be supplied from both power distribution paths via dedicated automatic power switching units.	<ul style="list-style-type: none">Redundant cooling supply systems receive power supply from redundant power distribution systems in EN 50600-2-3 without consideration of details in the connections.



The advantage of the ISO/IEC 22237-4 requirement is that automatic power switching units which inherently represent a single point of failure will be installed at finer level so that a single failure of such a unit will not result in broader or system wide cooling supply loss.

4. For energy efficiency enablement on Granularity Level 2 the following differences in the measurement points are noteworthy:

ISO/IEC 22237	EN 50600
<ul style="list-style-type: none">In ISO/IEC 22237-4 measurements of the inlet air temperature require one sensor every 5 cabinets in a cold aisle.	<ul style="list-style-type: none">In EN 50600-2-3 measurements of the inlet air temperature require one sensor per cold aisle.



The stricter measurement regime required in the current ISO/IEC 22237-4:2021-10 was also included in the previous EN 50600-2-3:2014 but has been omitted in the current EN 50600-2-3:2019-08. In the current EN 50600-2-3 this higher measurement density is only required for Granularity Level 3.

Therefore data center operators which already fulfill a measurement density of Granularity Level 3 will automatically comply with Granularity Level 2 of ISO/IEC 22237-4 so that in these cases the efforts by the operator to obtain an additional ISO/IEC 22237 certification are indeed minimal.

In other cases the setup of the measurement systems and the number of cold aisles included in the data center will determine the operator's efforts in preparation of a ISO/IEC 22237 certification.

This difference might be due to the development history of the current ISO/IEC 22237-4 and might be omitted in a future revised version of the standard.

Overall the extend of differences in the published parts of ISO/IEC 22237 are limited but the effect on certifications according to ISO/IEC 22237 or EN 50600 is dependent of specific installations.

8. Criteria Catalog TSI.STANDARD

The TSI.STANDARD has been available to the market since 2001. The goal of the TSI.STANDARD is to cover all relevant regulations and international standards, such as the EN 50600 and the ISO/IEC 22237, but also best practices adapted by sophisticated data centers. As it is becoming increasingly difficult to keep up to date with the latest developments in the data center industry for DC operators, the TSI.STANDARD is a great tool operators may use to represent current state of art by

fulfilling the requirements, as the TSI.STANDARD is regularly updated. With over 1750 data center projects since 2001, the TSI.STANDARD method has a well-established position in the market.

To make the standard ISO/IEC 22237 assessable, a much needed evaluation scheme has been adapted by TÜV NORD. The result of this is defined in the criteria catalog TSI.STANDARD (V4.5 from 1st July 2023).

The relevant and published parts of the ISO/IEC 22237 that have been integrated (to date) are:

- ISO/IEC 22237-1
- ISO/IEC 22237-3
- ISO/IEC 22237-4



Figure 10: Criteria Catalog TSI.STANDARD V4.5

9. TSI.STANDARD with ISO/IEC 22237 extension

With the TSI.STANDARD including ISO/IEC 22237 extension a proper understanding of how the requirements are intended on being implemented is provided. With the criteria catalog, all relevant requirements are identified and summarized. They have to be fulfilled by a DC operator in order to gain a conformance confirmation in the form of a certificate.

TÜV NORD provides its assessments and certifications of the ISO/IEC 22237 based on that criteria catalog. Based on the comparative analysis of the ISO/IEC 22237 published parts vs. EN 50600 the changes applied to the catalog are very few and operators which hold an EN 50600 certificate can achieve an additional ISO/IEC 22237 based on the currently published parts with only minimal efforts under specific conditions.

The criteria catalog addresses 9 major criteria aspects:



Figure 11: Illustration of the criteria aspects covered in the TSI.STANDARD

About TÜV NORD CERT

Our know-how for your success

TÜV NORD CERT is a well-established and reliable partner for inspection and certification services throughout the world. Our experts and auditors have extensive knowledge based on experience and are in general permanently employed by TÜV NORD. This guarantees independence and neutrality and also means that we can offer continuity in supporting our clients. The benefit to you is clear: our auditors accompany and support the development of your company and provide you with objective feedback.

TSI – Trusted Site Infrastructure

We have been carrying out evaluations and certifications of data centers within the TÜV NORD GROUP since 2001. With our unique TSI methodology, we offer companies an established tool for evaluating the physical security, availability and reliability of technical infrastructures. Our TSI.STANDARD has long since become the benchmark in the data center industry in Germany and is also increasingly in demand on the international market. The underlying criteria catalog is consistently analyzed and further developed by our experts in order to always represent to the current state of technology and standardization. Since its market launch, over 2,000 customer projects have already been successfully completed based on this TÜV NORD owned standard.



TÜV NORD CERT GmbH
Am TÜV 1
45307 Essen

T 0800 245-7457
F 0511 9986 69-1900

tuev-nord-cert.com

