IEC 60917-1

Edition 2.0 2019-09
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Modular order for the development of mechanical structures for electrical and electronic equipment practices –
Part 1: Generic standard

IEC 60917-1:2019-09 RLV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MODULAR ORDER FOR THE DEVELOPMENT OF MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT PRACTICES –

Part 1: Generic standard

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60917-1 has been prepared by subcommittee 48D: Mechanical structures for electrical and electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This second edition cancels and replaces the first edition published in 1998 and its Amendment 1:2000. This edition constitutes a technical revision.

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

a) added information on newly developed detail specification standards of mechanical structures for the electrical and electronic equipment practices;
b) added information on newly developed performance test standards for the verifications of environmental performances and safety aspects and issues of the thermal performance and thermal management for the electrical and electronic equipment practices;
c) introduced the relations between the mechanical structure for electrical and electronic system, the verification of environmental performance and safety aspects and issues of the thermal performance and thermal management for the electrical and electronic equipment practices.

The text of this standard is based on the following documents:

FDIS	Report on voting
48D/703/FDIS	48D/708/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

A list of all parts in the IEC 60917 series, published under the general title *Modular order for the development of mechanical structures for electrical and electronic equipment practices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

~~The trend towards constantly increasing functional integration and ever smaller volume and space requirements for electronic components and integrated circuits, as well as the advent of new manufacturing methods, automatic manufacturing and testing equipment and the use of Computer Aided Engineering (CAE) systems offer users considerable technical and economic advantages.~~

~~In order to ensure that, when using newly developed components, manufacturing methods and CAE systems, the advantages can be fully exploited during planning, design, manufacture and testing, it is necessary for equipment practices to meet the following requirements (see *IEC Guide 103*):~~

~~– arrangement of products with a minimum loss of area and space;~~

There is a continuous trend towards higher functional integration and smaller electronic components and integrated circuits. At the same time, new manufacturing methods, automatic manufacturing and testing equipment, and Computer Aided Engineering (CAE) systems have created commercial advantages for their users.

For users to take technical and economic advantage of these new components and technologies during planning, design, manufacturing, and testing, it is necessary for equipment practices to meet the following requirements (see IEC Guide 103): arrangement of products with a minimum loss of area and space;

– dimensional interchangeability of products, e.g. regarding overall dimensions, mounting dimensions (fixing holes, cut-out, etc.);
– dimensional compatibility and determination of interface dimensions of products which:
  - are combined with other products, e.g. instruments, racks, panels and cabinets, etc.;
  - are used in buildings that have been built in accordance with a modular system, e.g. column spacing, room height, door height, etc.

An obstacle arises from the use of two systems of dimensioning (inch – metre) that are not compatible with each other. The use of an interface between both dimensioning systems represents one way around this obstacle. The recommendation is:

– to use only one dimensioning system and to use SI units.

The dimensions given in 5.3 of this document have been taken from System I of IEC Guide 103 in consideration with other documents on dimensional coordination.

In accordance with the above considerations, IEC 60917-1 Ed.1 was published in 1998. This generic standard for mechanical structures for electronic equipment practices has been used to meet advanced requirements for various industrial applications of micro-electronics technology.

After publication of this generic standard, development of dimensional sectional and detail specifications consisting of the metric 25 mm modular standards, IEC 60917-2-X, and 19 inch (in) conventional standards, IEC 60297-3-XXX, was undertaken. In parallel, standards to address environmental performance and safety aspects of the mechanical structures were developed as the IEC 61587 series. All these standards are based on indoor system applications. The next step for the mechanical structure was the developments of the IEC 61969 series for outdoor applications.

In the first decade of the 21st century, the IEC 62194 and IEC 62610 series were developed to define the verification of the thermal performance of enclosures and address thermal management issues of the electrical and electronic equipment practices.

This document describes the relationships between the mechanical structure for electrical and electronic systems, the verification of environmental performance and safety aspects, and the issues of the thermal performance and of the thermal management for the electrical and electronic equipment practices.

MODULAR ORDER FOR THE DEVELOPMENT OF MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT PRACTICES –

Part 1: Generic standard

1 Scope ~~and object~~

~~This International Standard relates to equipment practices. The modular order is applicable to the main structural dimensions of electronic equipment mounted in various installations where dimensional interfaces have to be considered.~~

~~It refers to basic design parameters and is not intended to be used for manufacturing tolerances or clearances.~~

~~In addition, information on interfaces to other technical fields, on technology and advanced design aspects is included.~~

~~This standard also covers standard terms for parts and assemblies of mechanical structures for electronic equipment.~~

~~This generic standard gives the definitions of a modular order for mechanical structures of electronic equipment and provides for dimensional compatibility at mechanical interfaces with related engineering applications, e.g. printed boards, components, instrumentation, furniture, rooms, buildings, etc.~~

~~Furthermore, it supports the introduction and application of the modular order rules considering that:~~

~~– compatibility of interface dimensions is aimed at the electronic field on the basis of the SI unit metre;~~

~~– technical and economic advantages can be achieved when using the rules.~~

~~The terms in this standard should be used in all standards for mechanical structures of electronic equipment and in related technical documents.~~

This part of IEC 60917 specifies the relationships between equipment practices and the modular order which are applicable to the main structural dimensions of electronic and electrical equipment mounted in various installations where dimensional interfaces have to be considered for mechanical compatibility.

This document also established terms for parts and assemblies of mechanical structures for electrical and electronic equipment, to clarify the specific relations between equipment practices and modular order.

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.

IEC 60050-581~~:1978~~, *International Electrotechnical Vocabulary – Part 581: Electromechanical components for electronic equipment*

IEC 60297 (all parts), *Mechanical structures for electronic equipment*

~~IEC 60297-1:1986, *Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 1: Panels and racks*~~

~~IEC 60297-2:1982, *Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 2: Cabinets and pitches of rack structures*~~

~~IEC 60297-3:1984, *Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3: Subracks and associated plug-in units*~~

IEC 60297-3-100, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*

IEC 60297-3-101, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-101: Subracks and associated plug-in units*

IEC 60297-3-102, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-102: Injector/extractor handle*

IEC 60297-3-103, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-103: Keying and alignment pin*

IEC 60297-3-104, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-104: Connector dependent interface dimensions of subracks and plug-in units*

IEC 60297-3-105, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-105: Dimensions and design aspects for 1U high chassis*

IEC 60297-3-106, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-106: Adaptation dimensions for subracks and chassis applicable with metric cabinets or racks in accordance with IEC 60917-2-1*

IEC 60297-3-107, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-107: Dimensions of subracks and plug-in units, small form factor*

IEC 60297-3-108, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-108: Dimensions of R-type subracks and plug-in units*

IEC 60297-3-109, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-109: Dimensions of chassis for embedded computing devices*

IEC 60297-3-110, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-110: Residential racks and cabinets for smart houses*

~~IEC 60297-4:1995, *Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 4: Subracks and associated plug-in units – Additional dimensions*~~

~~IEC 60473:1974, *Dimensions for panel-mounted indicating and recording electrical measuring instruments*~~

~~IEC 60629:1978, *Standard sheets for a modular system (for installation accessories for use in domestic and similar installations)*~~

IEC TR 60668~~:1980~~, *Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments*

IEC 60917-2~~:1992~~, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice*

IEC 60917-2-1~~:1993~~, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 1: Detail specification – Dimensions for cabinets and racks*

IEC 60917-2-2~~:1994~~, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2: Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 60917-2-3, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-3: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Extended detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 60917-2-4, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-4: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Adaptation dimensions for subracks or chassis applicable in cabinets or racks in accordance with IEC 60297-3-100 (19 in)*

IEC 60917-2-5, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-5: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Cabinet interface dimensions for miscellaneous equipment*

IEC 61554, *Panel mounted equipment – Electrical measuring instruments – Dimensions for panel mounting*

IEC 61587 (all parts), *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series*

IEC 61969-1, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 1: Design guidelines*

IEC 61969-2, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 2: Coordination dimensions*

IEC 61969-3, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 3: Environmental requirements, tests and safety aspects*

IEC 62194, *Method of evaluating the thermal performance of enclosures*

IEC TS 62454, *Mechanical structures for electronic equipment – Design guide: Interface dimensions and provisions for water cooling of electronic equipment within cabinets of the IEC 60297 and IEC 60917 series*

IEC 62610 (all parts), *Mechanical structures for electrical and electronic equipment – Thermal management for cabinets in accordance with IEC 60297 and IEC 60917 series*

IEC Guide 103:1980, *Guide on dimensional co-ordination*

~~ISO 31:1992, *Quantities and units*~~

~~ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*~~

ISO 1006~~:1983~~, *Building construction – Modular coordination – Basic module*

ISO 1040~~:1983~~, *Building construction – Modular coordination – Multimodules for horizontal coordinating dimensions*

ISO 1791, *Building construction – Modular co-ordination – Vocabulary*

ISO 2848, *Building construction – Modular coordination – Principles and rules*

~~ISO 3827-1:1977, *Shipbuilding – Coordination of dimensions in ships' accommodation – Part 1: Principles of dimensional coordination*~~

ISO 3394, *Packaging – Complete, filled transport packages and unit loads – Dimensions of rigid rectangular packages*

ISO 3676, *Packaging – Complete, filled transport packages and unit loads – Unit load dimensions*

ISO 6514, *Building construction – Modular coordination – Sub-modular increments*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

ISO 80000-3:2006, *Quantities and units – Part 3: Space and time*

3 Terms~~, terminology~~ and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581 as well as 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 http://www.iso.org/obp

3.1
equipment practice
mechanical structure involved in housing and mounting of electrical, electronic and electromechanical systems

Note 1 to entry: The equipment practice provides for compatibility between mechanical parts, electrical interconnections and electrical and electronic components.

3.2
modular order
set of rules which establishes a relationship between co-ordination dimensions and the base pitch, multiple pitches and mounting pitches to be used in equipment practice

3.3
co-ordination dimension
reference dimension used to co-ordinate mechanical interfaces. This is not a manufacturing dimension with a tolerance.

~~NOTE – An actual outside dimension of a mechanical structure related to a co-ordination dimension can only decrease.~~

3.4
aperture dimension
special co-ordination dimension for the usable space between features (structural parts)

Note 1 to entry: The actual inside dimension of an aperture can only increase.

3.5
n
multiplier having ~~integer~~ values ~~of range continuing~~ in continuous series of integers 1, 2, 3, ...

3.6
pitch
one division step of a regularly subdivided coordinate

SEE: Figure 1.

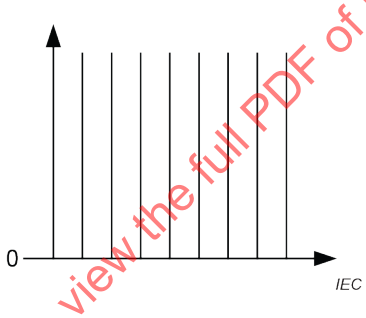


Figure 1 – Pitch

3.7
base pitch
p
smallest distance between adjacent grid lines used in the equipment practices

3.8
multiple pitch
Mp
integer multiple of the base pitch

3.9
mounting pitch
mp
pitch used to arrange parts or assemblies in a given space

Note 1 to entry: The nominal value of a mounting pitch is achieved by using a base or multiple pitch multiplied by a factor F from Table 2.

Note 2 to entry: Actual dimensions used in an equipment practice are created for the nominal mounting pitch and they include manufacturing tolerance.

3.10
reference plane
theoretical plane without thickness or tolerances used to define spaces

3.11
grid
two- or three-dimensional arrangement of pitches used to coordinate a position, complying with the modular order

SEE: Figure 2.

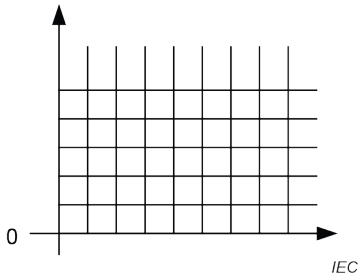


Figure 2 – Grid

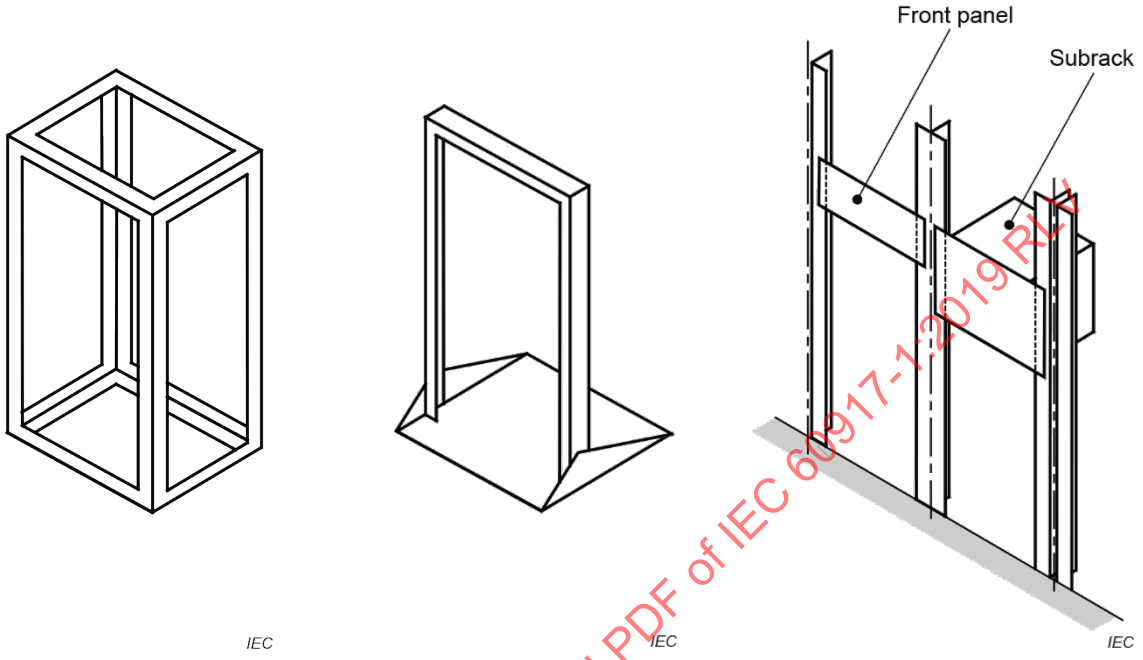
3.12
module
three-dimensional structure where all sides are multiples of whole numbers of the pitch, it ~~could~~ can also be used in a two-dimensional grid.

Note 1 to entry: One dimensional module is often called unit (U) in some documents.

3.13
suite of racks
suite of cabinets
row of racks or cabinets placed side by side

3.14
rack
free-standing or fixed structure for housing electronic or electrical equipment

SEE: Figure 3.



Example 1 **Example 2** **Example 3**

Figure 3 – Rack

3.15
cabinet
free-standing and self-supporting enclosure for housing electronic and/or electrical equipment. It is usually fitted with doors and/or side panels which may or may not be removable

SEE: Figure 4.

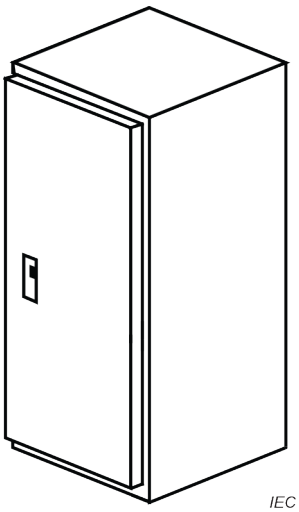


Figure 4 – Cabinet

3.16
case
table, bench or wall mounted enclosure in which electronic and /or electrical equipment can be housed

SEE: Figure 5.

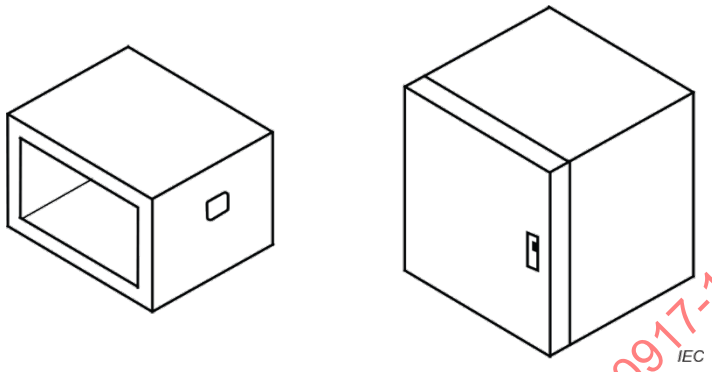


Figure 5 – Case

3.17
swing frame
hinged frame for housing electronic and/or electrical equipment

~~The frame swings to permit access to the reverse side.~~

Note 1 to entry: The hinge frame swings to permit access to the back.

SEE: Figure 6.

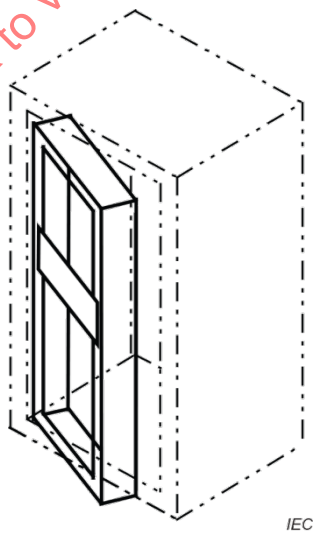


Figure 6 – Swing frame

3.18
subrack
structural unit for housing printed boards with components inserted, and plug-in units

SEE: Figure 7.

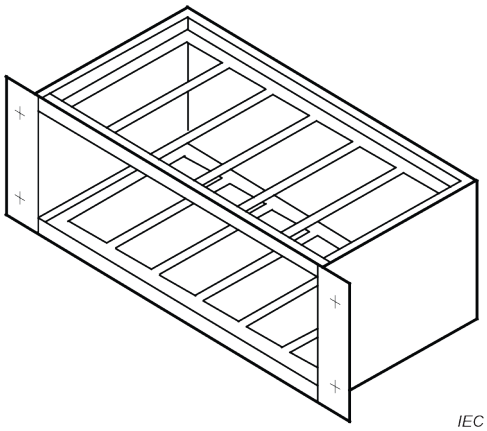


Figure 7 – Subrack

3.19
chassis
mechanical structure designed specifically to support associated electrical and electronic components

SEE: Figure 8.

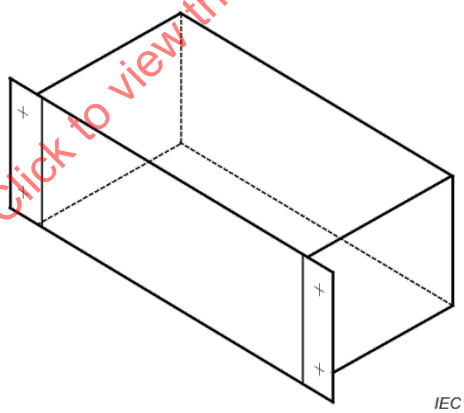


Figure 8 – Chassis

3.20
plug-in unit
unit which plugs into a subrack and is supported by guides

Note 1 to entry: These units can be of various types, ranging from a printed board with components inserted to a frame or box-type unit designed with a plug-in connection.

SEE: Figure 9.

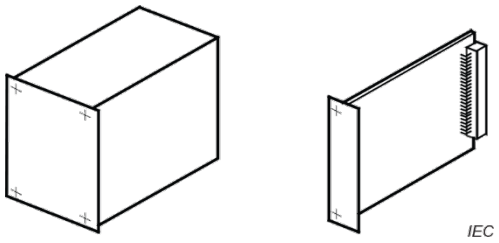


Figure 9 – Plug-in unit

3.21
console
table-mounted or floor-standing enclosure having horizontal, vertical and/or sloping faces to accommodate control, information and monitoring equipment

SEE: Figure 10.

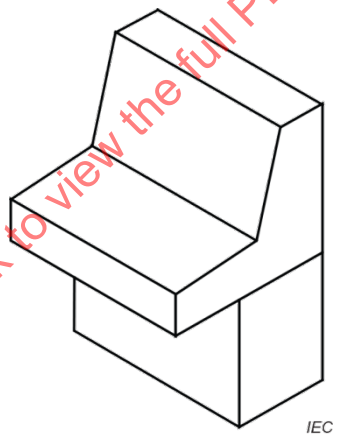


Figure 10 – Console

3.22
plug-in unit guide
device to guide, locate and support plug-in units and printed boards, with components inserted, in subracks

SEE: Figure 11.

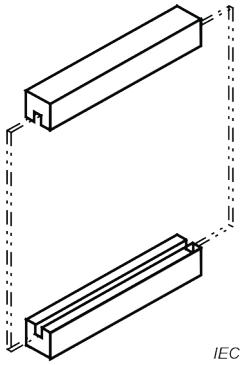


Figure 11 – Plug-in unit guide

3.23
slides
angle-bars on which subracks and chassis may slide and be supported within a rack, cabinet or case

SEE: Figure 12.

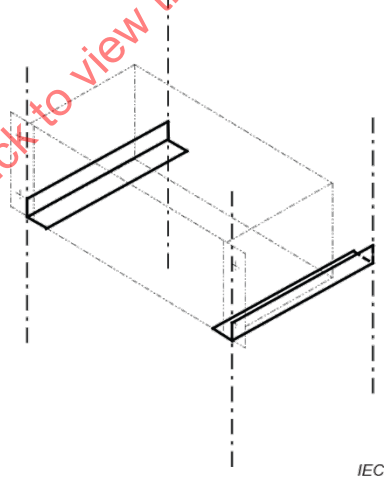


Figure 12 – Slides

3.24
telescopic slides
devices to support withdrawable subracks and chassis in the extended position

SEE: Figure 13.

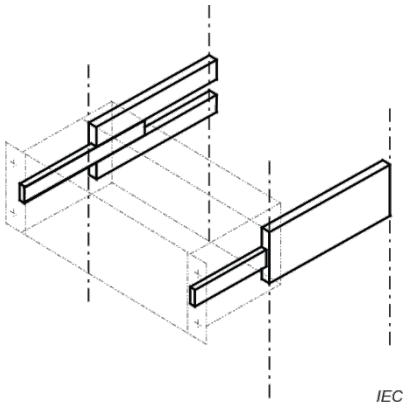


Figure 13 – Telescopic slides

3.25
mounting frame
frame design of profiles for the mounting of electronic/electrical devices. Fixed or movable location within cabinets

SEE: Figure 14.

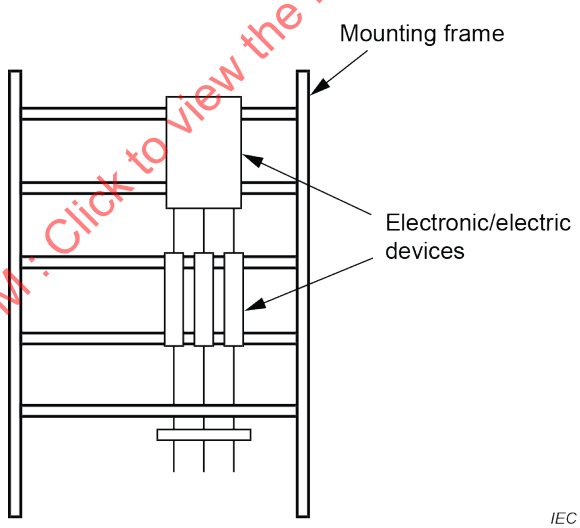


Figure 14 – Mounting frame

3.26
mounting plate
plate for the mounting of electronic/electrical devices, located within e.g. cabinets

SEE: Figure 15.

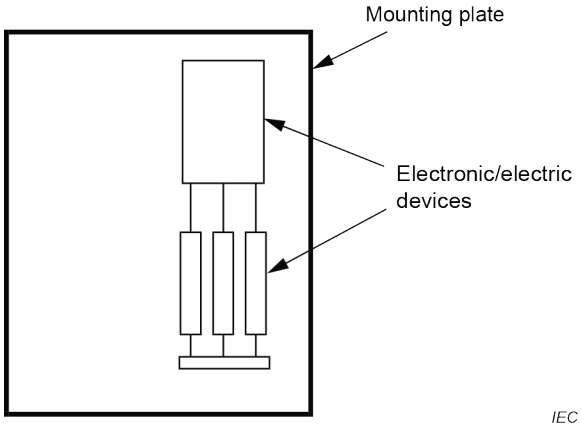


Figure 15 – Mounting plate

3.27
front panel
plane panel allocated to the vertical mounting area of racks and cabinets

SEE: Figure 16.

Figure 16 – Front panel

3.28
backplane
mounting plane of connectors and printed board for the electrical interconnection of plug-in units within a subrack or chassis

SEE: Figure 17.

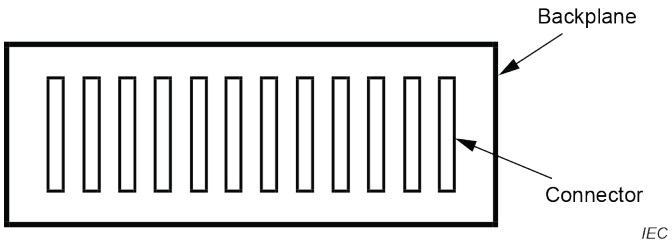


Figure 17 – Backplane

3.29
cabinet panel
design part of a cabinet as protection against incidental touch and environmental influences

SEE: Figure 18.

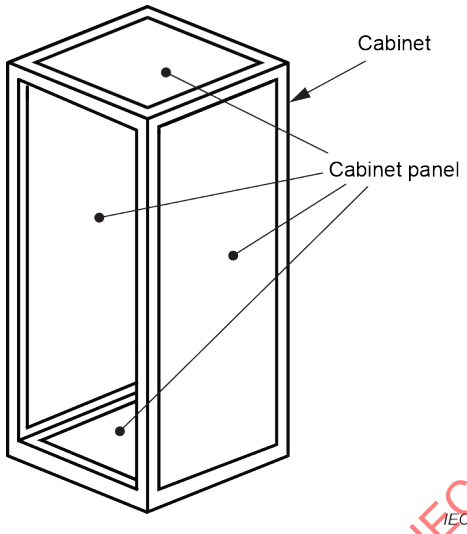


Figure 18 – Cabinet panel

3.30
door
hinged cabinet panel, typically incorporating latching and/or locking devices

SEE: Figure 19.

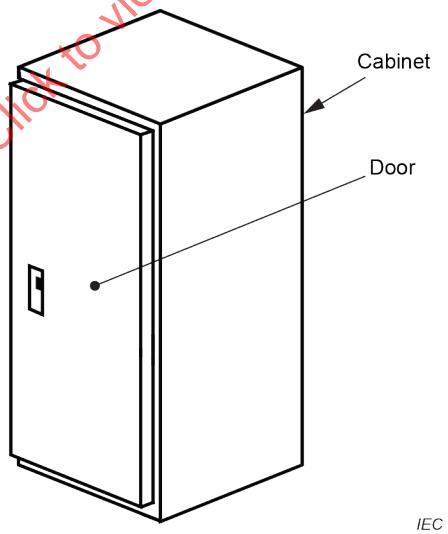


Figure 19 – Door

3.31
mounting section
compartment of a cabinet for the assembly of interior parts

SEE: Figure 20.

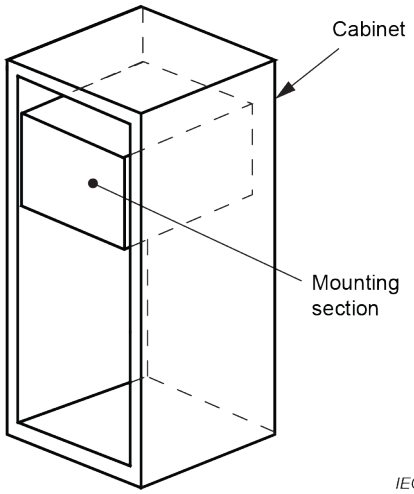


Figure 20 – Mounting section

4 Fundamentals and background information

4.1 General

The basis of the modular order is the basic SI unit of length, the metre according to ~~ISO 1000 and to ISO 31-1~~ ISO 80000-1 and to ISO 80000-3.

For compatibility with other modular orders, see ~~IEC 60473, IEC 60629 and IEC 60668 and ISO 1006, ISO 1040 and ISO 3827-1~~ IEC 61554, IEC TR 60668, ISO 1006 and ISO 1040.

4.2 Structures of electrical and electronic equipment practices

In Figure 21, the four structure levels of presently known electronic equipment practices are outlined.

~~It should be understood that~~ The modular order not only covers this kind of structure, but also any other structure of new electrical and electronic equipment practice designs where a modular grid with metric pitches and co-ordination dimensions can be allocated.

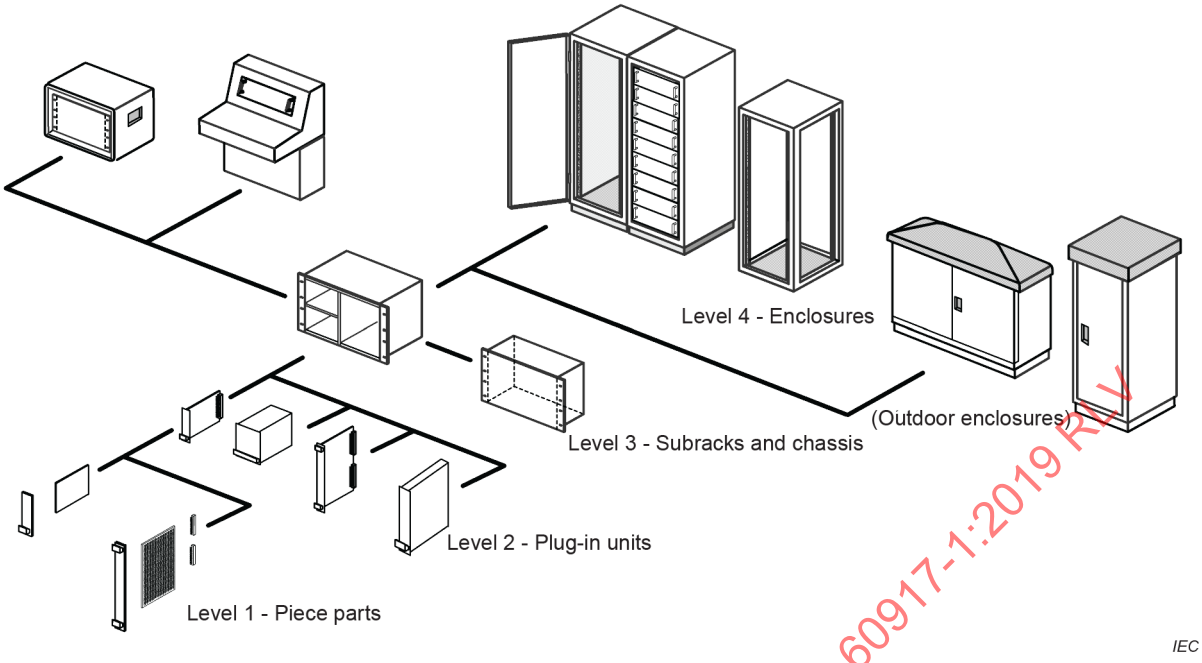


Figure 21 – Structure~~s levels~~ of electrical and electronic equipment practices

4.3 Dimensional co-ordination with adjacent technical fields

Developing a new electrical and/or electronic equipment practice requires the consideration of external and internal interfaces.

The most important interfaces to electronic and electrical equipment practice are:

a) External interfaces
   - buildings with their room facilities, for example doors, elevators, tiles on floor and ceiling, etc.;
   - packaging and transport, for example, pallets and containers for lorries, ships and aircraft;
   - joint installation of various equipment, for example switching and transmission, power supply, industrial process equipment, etc.

b) Internal interfaces
   - printed circuits, connectors, electromechanical components, electrical components;
   - semiconductor components;
   - wiring and cables;
   - functional units such as a.c./d.c. convertor, measure and control instruments, fuses, etc.

Many of these interfaces have to be considered when specifying the requirements of any equipment practice for electronic and /or electrical systems. For such interfaces co-ordination dimensions should be used as means to reach dimensional compatibility with adjacent technical fields.

Table 1 gives an overview of ISO and IEC publications that should be considered when relevant co-ordination dimensions for common interfaces have to be determined.

Table 1 – Publications containing standardized modular dimensions and/or related documents

Publication	Title	Co-ordination dimensions mm
ISO 2848	Building construction – Modular co-ordination – Principles and rules (1984)	----
ISO 1791	Building construction – Modular co-ordination – Vocabulary (1983)	-----
ISO 1006	Building construction – Modular co-ordination – Basic module (1983)	100
ISO 6514	Building construction – Modular co-ordination – Sub-modular increments (1982)	20; 25; 50
ISO 1040	Building construction – Modular co-ordination – Multimodules for horizontal co-ordinating dimensions (1983)	300; 600; 1 200; 1 500; 3 000; 6 000
ISO 3394	Dimensions for rigid rectangular packages – Transport packages (1984)	600 × 400 .... 1 200 × 800 ....
ISO 3676	Packaging – Unit load sizes – Dimensions (1983)	1 200 × 800 ....
ISO 3827-1	Shipbuilding – Co-ordination of dimensions in ships' accommodation – Part 1: Principles of dimensional co-ordination (1977)	50; 100; 300
IEC Guide 103	Guide on dimensional co-ordination (1980)	0,5; 1; 2,5 (system I)
IEC 60097	Grid systems for printed circuits (1991)	0,05; 0,5
IEC 60255-18	Electrical relays – Part 18: Dimensions for general purpose all-or-nothing relays (1982)	2,5 and 5
IEC 60629	Standard sheets for a modular system (for installation accessories for use in domestic and similar installations) (1978)	12,5
IEC 60473	Dimensions for panel-mounted indicating and recording electrical measuring instruments (1974)	12,5
IEC 60668	Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments (1980)	12,5
IEC 60297-2	Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 2: Cabinets and pitches of rack structures (1982)	100

Publication	Title	Co-ordination dimensions mm
ISO 2848	Building construction – Modular coordination – Principles and rules	---
ISO 1791	Building construction – Modular co-ordination – Vocabulary	---
ISO 1006	Building construction – Modular coordination – Basic module	100
ISO 6514	Building construction – Modular coordination – Sub-modular increments	20; 25; 50
ISO 1040	Building construction – Modular coordination – Multimodules for horizontal coordinating dimensions	300; 600; 1 200; 1 500; 3 000; 6 000
ISO 3394	Packaging – Complete, filled transport packages and unit loads – Dimensions of rigid rectangular packages	600 x 400 1 200 x 800
ISO 3676	Packaging – Complete, filled transport packages and unit loads – Unit load dimensions	1 200 x 800
IEC GUIDE 103	Guide on dimensional co-ordination	0,5; 1; 2,5 (system I)
IEC TR 60668	Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments	12,5

IEC 60297-3-100	Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets	100
IEC 61969-2	Mechanical structures for electronic equipment – Outdoor enclosures – Part 2: Coordination dimensions	25

4.4 Preparation of standards for new equipment practices

IEC standards for equipment practices to be prepared in accordance with this standard ~~should~~ shall be based on the following structure (See Figure 22).

a) Generic standard

All new equipment practices ~~should~~ shall comply with this document.

b) Sectional specification standards

They describe particular equipment practices within the scope of the generic standard. In a sectional standard, co-ordination dimensions (selected from the generic standard) shall be specified as standard dimensions, for example for height, width, depth, and so on. There may be more than one sectional standard based on different multiple pitches.

c) Detail specification standards

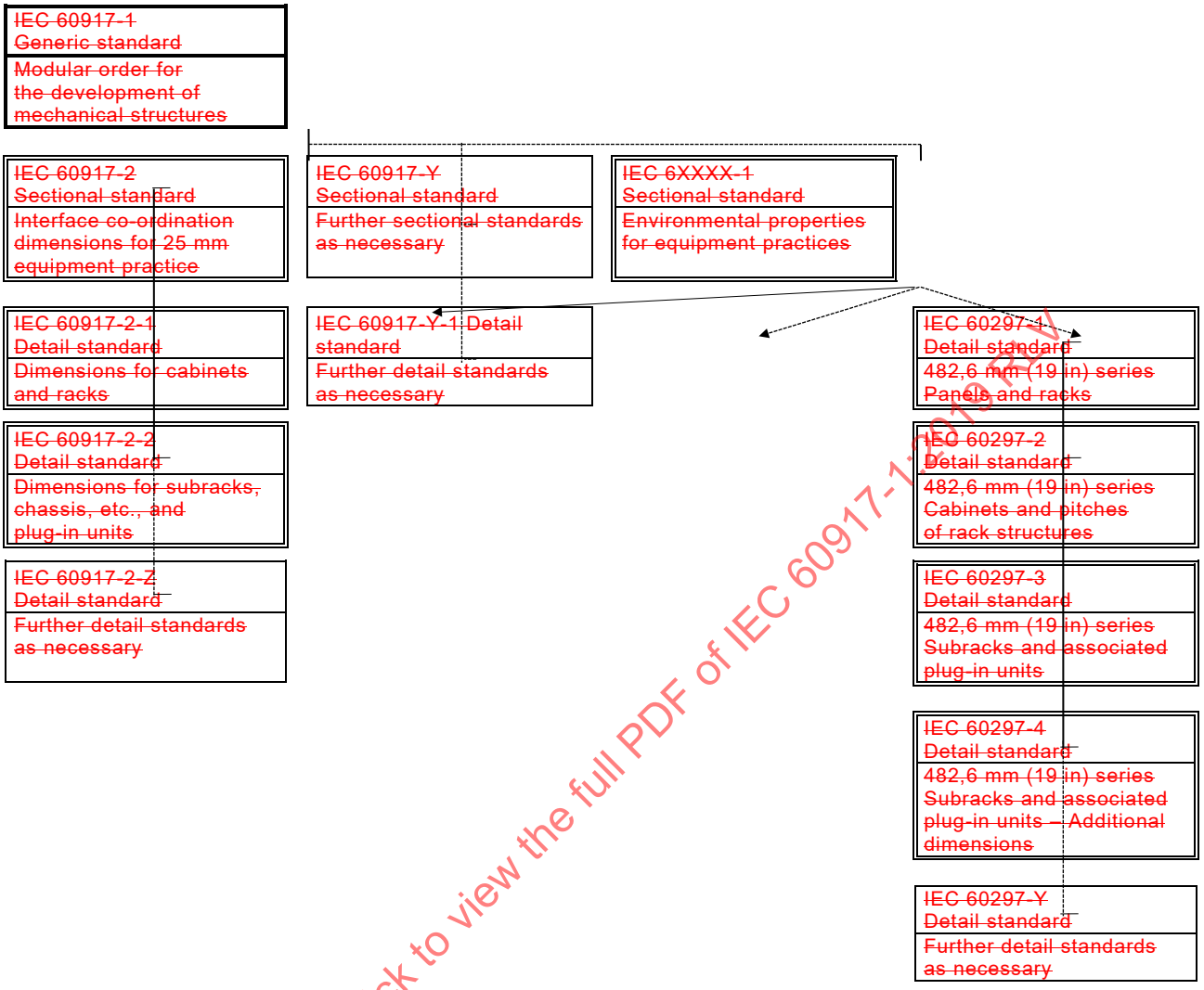
They standardize units or subunits of equipment practice described in a sectional standard. These units could be such as cabinets, racks, subracks, chassis, backplanes, front panels and plug-in units, etc., and the details can be dimensions, tolerances, requirements, etc., under the condition that mechanical compatibility is maintained.

NOTE Related with the mechanical structure for equipment practices, Figure 22 contains categorised standards and technical specifications.

a) Conventional standard (Legacy system): IEC 60297 series, Dimensions of mechanical structures of the 482,6 mm (19 in) series, defines the detail dimensions of the structure levels through the level 1 to the level 4 as the same as the structure levels shown in Figure 21, and the level 4 of IEC 60297 series can be adaptable to the 25 mm co-ordination dimensions of IEC 60917-2. Standards in the IEC 60297 series are treated as detail specification standards in Figure 22.

b) Outdoor enclosures: IEC 61969 series defines dimensions, environmental requirements of the protective outer-shells for outdoor applications (stationary uses at non-weather protected locations) of the mechanical structures in accordance with IEC 60917 series and IEC 60297 series and other equipment practices.

c) Performance test standards: IEC 61587 series, IEC 62610 series and IEC TS 62454 provide specifications and requirements for verifications of environmental issues and thermal managements related with equipment practices applying mechanical structures in accordance with IEC 60917 series and IEC 60297 series. IEC 62194 specifies the test method for thermal performance of outdoor enclosures.



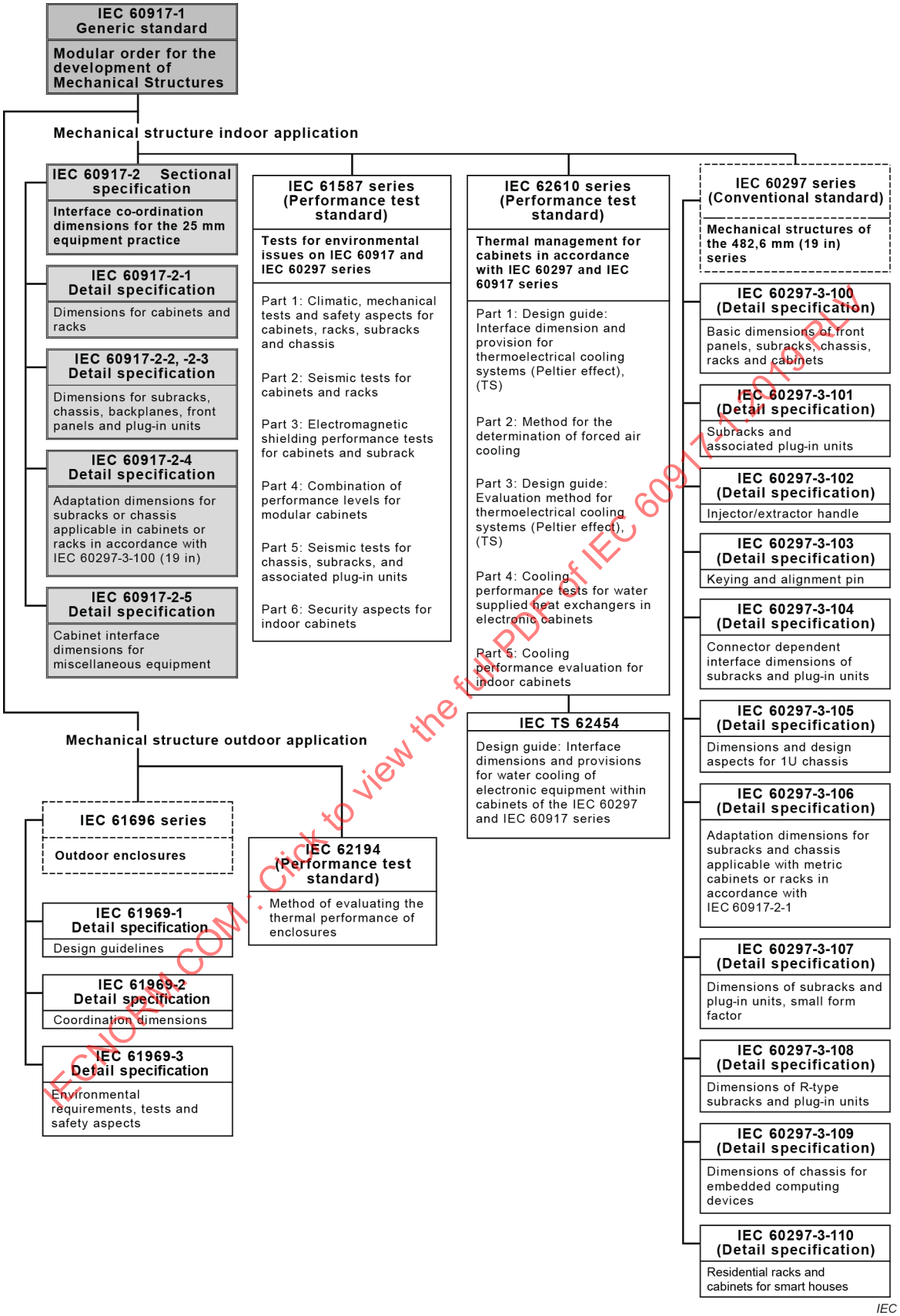


Figure 22 – Structures of equipment practice standards

5 Modular order details

5.1 Modular grid

The correlation between the base pitch and the multiple pitches is explained in Figure 23 which shows the three-dimensional modular grid for equipment practices. Sometimes only a two-dimensional grid or a pitch in one axis is needed. The values of the pitches are specified in 5.2. The choice of pitch is dependent on the size of the mechanical structure as outlined in the following subclauses.

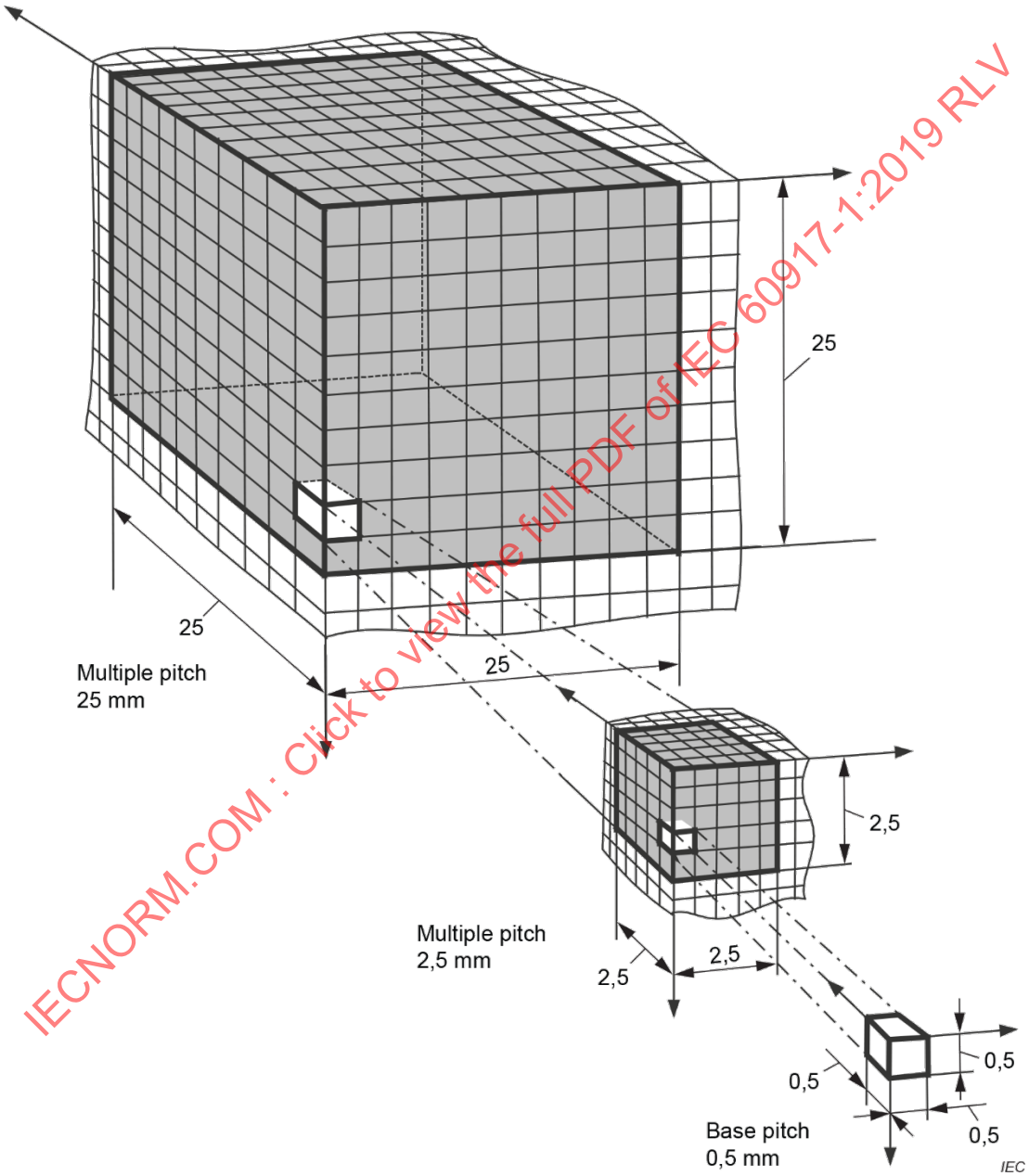


Figure 23 – Modular grid

5.2 Pitches

5.2.1 Base and multiple pitches for equipment practice

Base pitch: a value of 0,5 mm shall be used. It shall not be further subdivided.

Multiple pitches: the values 2,5 mm and 25 mm have been used in Figure 23 to create the coordination dimensions in Table 1. According to the rules of the modular order other values for Mp are allowed, for example 2,0 mm and 20 mm.

~~NOTE – In IEC 60097, a value of 0,05 mm has been used.~~

5.2.2 Mounting pitches example

The relations between mounting pitches mp_i, the pitches p (base or multiple) and co-ordination dimensions C_i are shown in Figure 24. Mounting pitches shall fulfil the following conditions:

$$mp_i = F \times p$$

where

mp_i is the nominal value of mounting pitch;

p is the pitch (base or multiple as applicable);

F is the factor from Table 2.

$$mp_i = \frac{C_i}{n_i}$$

where

n_i is an integer;

C_i is the co-ordination dimension from Table 2.

$$C_i = n_i \times mp_i$$

$$C_0 = C_1 + C_2 + C_3 + \ldots$$

where

C_0 is the overall co-ordination dimension.

In the example of Figure 24, the overall co-ordination dimension C_0 contains four co-ordination dimensions C_1, C_2, C_3 and C_4 and only one mp with the conditions (all dimensions in millimetres).

$$mp = F \times p = 2 \times 25 = 50$$

$$C_0 = C_1 + C_2 + C_3 + C_4$$

$$= n_1 \times mp + n_2 \times mp + n_3 \times mp + n_4 \times mp$$

$$= 2 \times 50 + 3 \times 50 + 5 \times 50 + 6 \times 50$$

$$= 100 + 150 + 250 + 300$$

$$= 800$$

The mounting pitch mp_i as well as the co-ordination dimensions C_i shall coincide with the values in Table 2. Dimension C_i may have equal or different values.

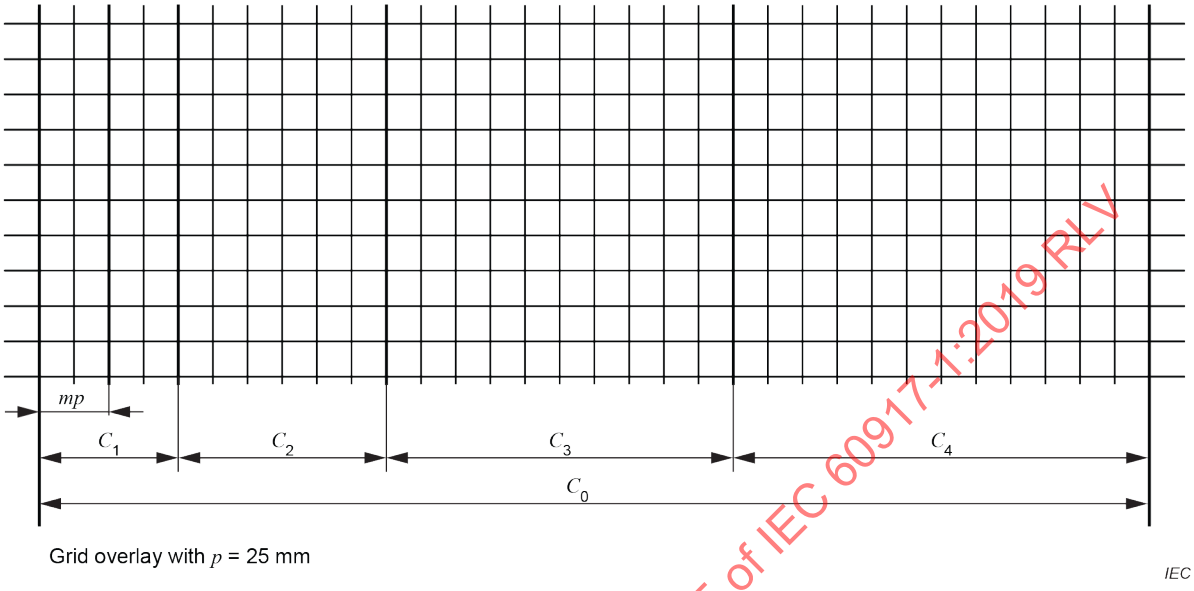


Figure 24 – Partitioning of co-ordination dimensions C_0 with the same mounting pitch mp

5.3 Co-ordination dimensions

Preferred co-ordination dimensions C_i for mechanical structures of equipment practices are listed in Table 2. The dimensions are mainly taken from Table 1 of IEC Guide 103:1980.

Table 2 – Co-ordination dimensions C_i

Co-ordination dimensions C_i mm $C_i = p \times F$			Factor F
Base pitch p = 0,5 mm	Multiple pitch Mp		
	p = 2,5 mm	p = 25 mm	
40,0	200	2 000	80
36,0	180	1 800	72
32,0	160	1 600	64
30,0	150	1 500	60
25,0	125	-----	50
24,0	120	1 200	48
20,0	100	1 000	40
16,0	80,0	800	32
15,0	75,0	----	30
12,5	----	----	25
12,0	60,0	600	24
10,0	50,0	500	20
8,0	40,0	400	16

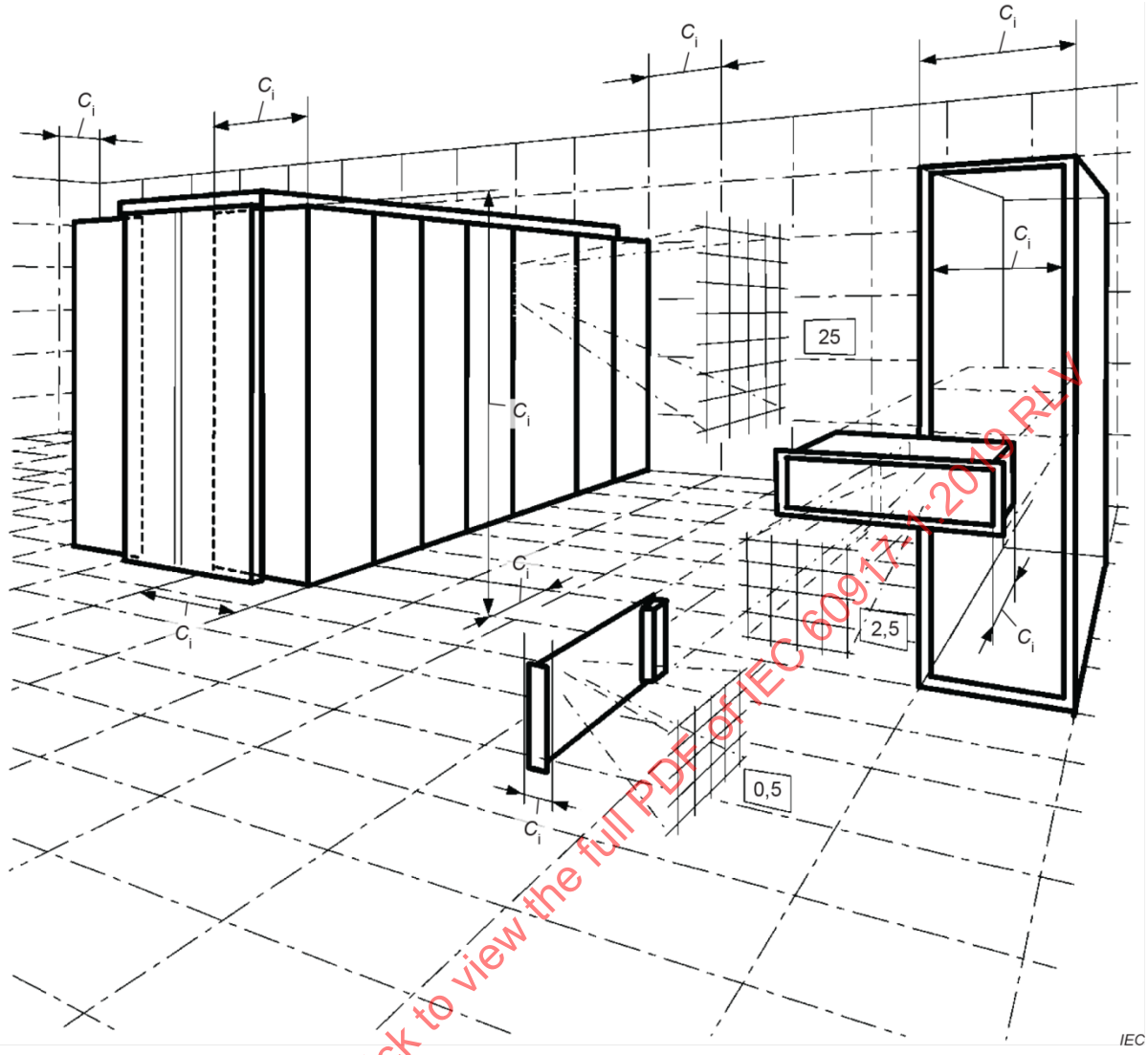
Co-ordination dimensions C_i mm $C_i = p \times F$			Factor F
Base pitch p = 0,5 mm	Multiple pitch Mp		
	p = 2,5 mm	p = 25 mm	
7,5	----	----	15
6,0	30,0	300	12
5,0	25,0	250	10
4,0	20,0	200	8
3,0	15,0	150	6
2,5	12,5	125	5
2,0	10,0	100	4
1,5	7,5	75	3
1,0	5,0	50	2
0,5	2,5	25	1
NOTE The series C_i = 25 x F ~~could~~ can be extended to cover greater values, e.g. 2 200 mm, 2 400 mm if necessary.			

Examples of the application of co-ordination dimensions:

– outside dimensions of racks, cabinets, cases, etc.;
– mounting spaces for assemblies, sub-assemblies and piece parts, wiring, cabling, etc.;
– mounting pitches of piece parts and assemblies.

5.4 Illustration of the modular order

Figure 25 illustrates the indoor application of modular order for electrical and electronic equipment practices.



NOTE Pitches "p" are presented in the frames, see 5.2.1.

Figure 25 – Examples of the application of the modular order

IEC 60917-1

Edition 2.0 2019-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Modular order for the development of mechanical structures for electrical and electronic equipment practices – Part 1: Generic standard

Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électriques et électroniques – Partie 1: Norme générique

IEC 60917-1:2019-09(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

MODULAR ORDER FOR THE DEVELOPMENT OF MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT PRACTICES –

Part 1: Generic standard

FOREWORD

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 60917-1 has been prepared by subcommittee 48D: Mechanical structures for electrical and electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This second edition cancels and replaces the first edition published in 1998 and its Amendment 1:2000. This edition constitutes a technical revision.

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

a) added information on newly developed detail specification standards of mechanical structures for the electrical and electronic equipment practices;
b) added information on newly developed performance test standards for the verifications of environmental performances and safety aspects and issues of the thermal performance and thermal management for the electrical and electronic equipment practices;

c) introduced the relations between the mechanical structure for electrical and electronic system, the verification of environmental performance and safety aspects and issues of the thermal performance and thermal management for the electrical and electronic equipment practices.

The text of this standard is based on the following documents:

FDIS	Report on voting
48D/703/FDIS	48D/708/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

A list of all parts in the IEC 60917 series, published under the general title *Modular order for the development of mechanical structures for electrical and electronic equipment practices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

There is a continuous trend towards higher functional integration and smaller electronic components and integrated circuits. At the same time, new manufacturing methods, automatic manufacturing and testing equipment, and Computer Aided Engineering (CAE) systems have created commercial advantages for their users.

For users to take technical and economic advantage of these new components and technologies during planning, design, manufacturing, and testing, it is necessary for equipment practices to meet the following requirements (see IEC Guide 103): arrangement of products with a minimum loss of area and space;

– dimensional interchangeability of products, e.g. regarding overall dimensions, mounting dimensions (fixing holes, cut-out, etc.);
– dimensional compatibility and determination of interface dimensions of products which:
  - are combined with other products, e.g. instruments, racks, panels and cabinets, etc.;
  - are used in buildings that have been built in accordance with a modular system, e.g. column spacing, room height, door height, etc.

An obstacle arises from the use of two systems of dimensioning (inch – metre) that are not compatible with each other. The use of an interface between both dimensioning systems represents one way around this obstacle. The recommendation is:

– to use only one dimensioning system and to use SI units.

The dimensions given in 5.3 of this document have been taken from System I of IEC Guide 103 in consideration with other documents on dimensional coordination.

In accordance with the above considerations, IEC 60917-1 Ed.1 was published in 1998. This generic standard for mechanical structures for electronic equipment practices has been used to meet advanced requirements for various industrial applications of micro-electronics technology.

After publication of this generic standard, development of dimensional sectional and detail specifications consisting of the metric 25 mm modular standards, IEC 60917-2-X, and 19 inch (in) conventional standards, IEC 60297-3-XXX, was undertaken. In parallel, standards to address environmental performance and safety aspects of the mechanical structures were developed as the IEC 61587 series. All these standards are based on indoor system applications. The next step for the mechanical structure was the developments of the IEC 61969 series for outdoor applications.

In the first decade of the 21st century, the IEC 62194 and IEC 62610 series were developed to define the verification of the thermal performance of enclosures and address thermal management issues of the electrical and electronic equipment practices.

This document describes the relationships between the mechanical structure for electrical and electronic systems, the verification of environmental performance and safety aspects, and the issues of the thermal performance and of the thermal management for the electrical and electronic equipment practices.

MODULAR ORDER FOR THE DEVELOPMENT OF MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT PRACTICES –

Part 1: Generic standard

1 Scope

This part of IEC 60917 specifies the relationships between equipment practices and the modular order which are applicable to the main structural dimensions of electronic and electrical equipment mounted in various installations where dimensional interfaces have to be considered for mechanical compatibility.

This document also established terms for parts and assemblies of mechanical structures for electrical and electronic equipment, to clarify the specific relations between equipment practices and modular order.

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.

IEC 60050-581, *International Electrotechnical Vocabulary – Part 581: Electromechanical components for electronic equipment*

IEC 60297 (all parts), *Mechanical structures for electronic equipment*

IEC 60297-3-100, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*

IEC 60297-3-101, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-101: Subracks and associated plug-in units*

IEC 60297-3-102, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-102: Injector/extractor handle*

IEC 60297-3-103, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-103: Keying and alignment pin*

IEC 60297-3-104, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-104: Connector dependent interface dimensions of subracks and plug-in units*

IEC 60297-3-105, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-105: Dimensions and design aspects for 1U high chassis*

IEC 60297-3-106, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-106: Adaptation dimensions for subracks and chassis applicable with metric cabinets or racks in accordance with IEC 60917-2-1*

IEC 60297-3-107, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-107: Dimensions of subracks and plug-in units, small form factor*

IEC 60297-3-108, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-108: Dimensions of R-type subracks and plug-in units*

IEC 60297-3-109, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-109: Dimensions of chassis for embedded computing devices*

IEC 60297-3-110, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-110: Residential racks and cabinets for smart houses*

IEC TR 60668, *Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments*

IEC 60917-2, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice*

IEC 60917-2-1, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 1: Detail specification – Dimensions for cabinets and racks*

IEC 60917-2-2, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2: Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 60917-2-3, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-3: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Extended detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 60917-2-4, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-4: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Adaptation dimensions for subracks or chassis applicable in cabinets or racks in accordance with IEC 60297-3-100 (19 in)*

IEC 60917-2-5, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-5: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Cabinet interface dimensions for miscellaneous equipment*

IEC 61554, *Panel mounted equipment – Electrical measuring instruments – Dimensions for panel mounting*

IEC 61587 (all parts), *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series*

IEC 61969-1, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 1: Design guidelines*

IEC 61969-2, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 2: Coordination dimensions*

IEC 61969-3, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 3: Environmental requirements, tests and safety aspects*

IEC 62194, *Method of evaluating the thermal performance of enclosures*

IEC TS 62454, *Mechanical structures for electronic equipment – Design guide: Interface dimensions and provisions for water cooling of electronic equipment within cabinets of the IEC 60297 and IEC 60917 series*

IEC 62610 (all parts), *Mechanical structures for electrical and electronic equipment – Thermal management for cabinets in accordance with IEC 60297 and IEC 60917 series*

IEC Guide 103:1980, *Guide on dimensional co-ordination*

ISO 1006, *Building construction – Modular coordination – Basic module*

ISO 1040, *Building construction – Modular coordination – Multimodules for horizontal coordinating dimensions*

ISO 1791, *Building construction – Modular co-ordination – Vocabulary*

ISO 2848, *Building construction – Modular coordination – Principles and rules*

ISO 3394, *Packaging – Complete, filled transport packages and unit loads – Dimensions of rigid rectangular packages*

ISO 3676, *Packaging – Complete, filled transport packages and unit loads – Unit load dimensions*

ISO 6514, *Building construction – Modular coordination – Sub-modular increments*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

ISO 80000-3:2006, *Quantities and units – Part 3: Space and time*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581 as well as 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 http://www.iso.org/obp

3.1
equipment practice
mechanical structure involved in housing and mounting of electrical, electronic and electromechanical systems

Note 1 to entry: The equipment practice provides for compatibility between mechanical parts, electrical interconnections and electrical and electronic components.

3.2
modular order
set of rules which establishes a relationship between co-ordination dimensions and the base pitch, multiple pitches and mounting pitches to be used in equipment practice

3.3
co-ordination dimension
reference dimension used to co-ordinate mechanical interfaces. This is not a manufacturing dimension with a tolerance.

3.4
aperture dimension
special co-ordination dimension for the usable space between features (structural parts)

Note 1 to entry: The actual inside dimension of an aperture can only increase.

3.5
n
multiplier having values in continuous series of integers 1, 2, 3, ...

3.6
pitch
one division step of a regularly subdivided coordinate

SEE: Figure 1.

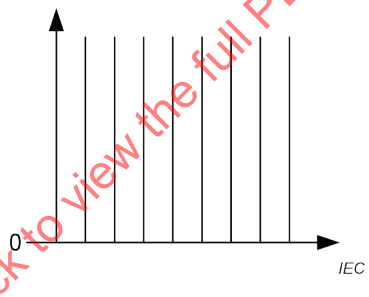


Figure 1 – Pitch

3.7
base pitch
p
smallest distance between adjacent grid lines used in the equipment practices

3.8
multiple pitch
Mp
integer multiple of the base pitch

3.9
mounting pitch
mp
pitch used to arrange parts or assemblies in a given space

Note 1 to entry: The nominal value of a mounting pitch is achieved by using a base or multiple pitch multiplied by a factor F from Table 2.

Note 2 to entry: Actual dimensions used in an equipment practice are created for the nominal mounting pitch and they include manufacturing tolerance.

3.10
reference plane
theoretical plane without thickness or tolerances used to define spaces

3.11
grid
two- or three-dimensional arrangement of pitches used to coordinate a position, complying with the modular order

SEE: Figure 2.

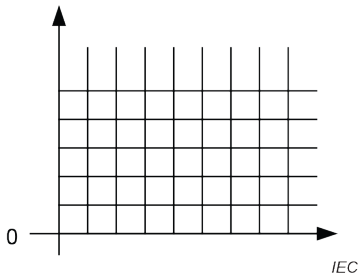


Figure 2 – Grid

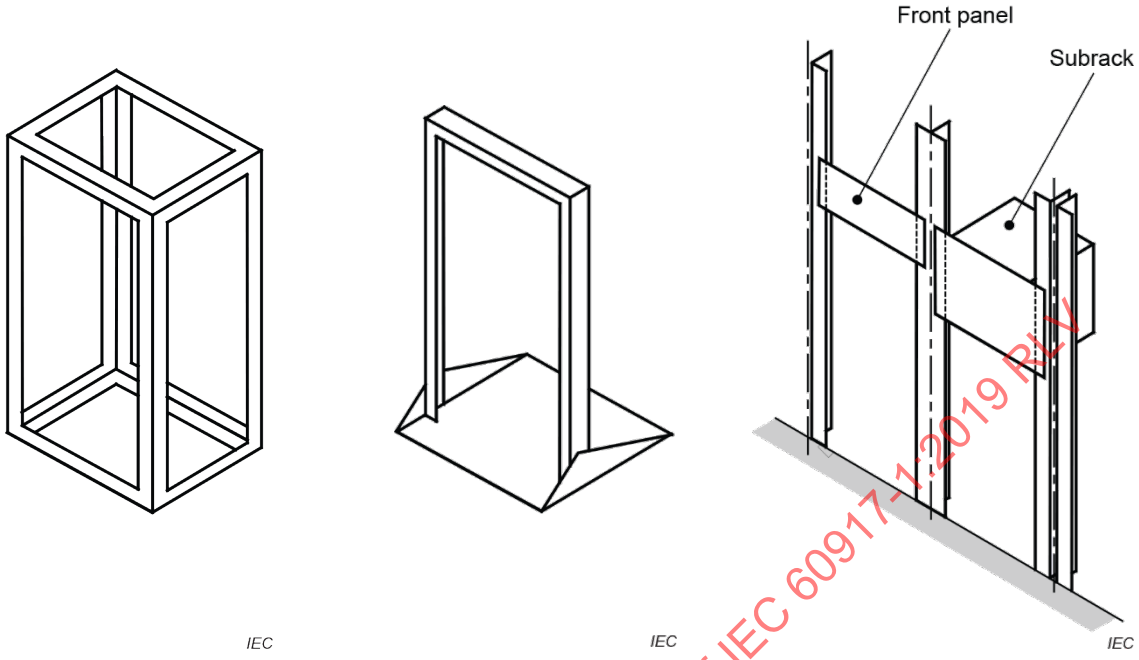
3.12
module
three-dimensional structure where all sides are multiples of whole numbers of the pitch, it can also be used in a two-dimensional grid.

Note 1 to entry: One dimensional module is often called unit (U) in some documents.

3.13
suite of racks
suite of cabinets
row of racks or cabinets placed side by side

3.14
rack
free-standing or fixed structure for housing electronic or electrical equipment

SEE: Figure 3.



Example 1 **Example 2** **Example 3**

Figure 3 – Rack

3.15
cabinet
free-standing and self-supporting enclosure for housing electronic and/or electrical equipment. It is usually fitted with doors and/or side panels which may or may not be removable

SEE: Figure 4.

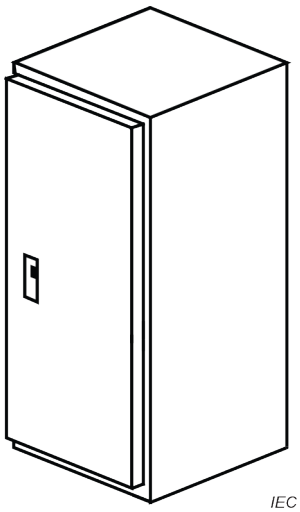


Figure 4 – Cabinet

3.16
case
table, bench or wall mounted enclosure in which electronic and /or electrical equipment can be housed

SEE: Figure 5.

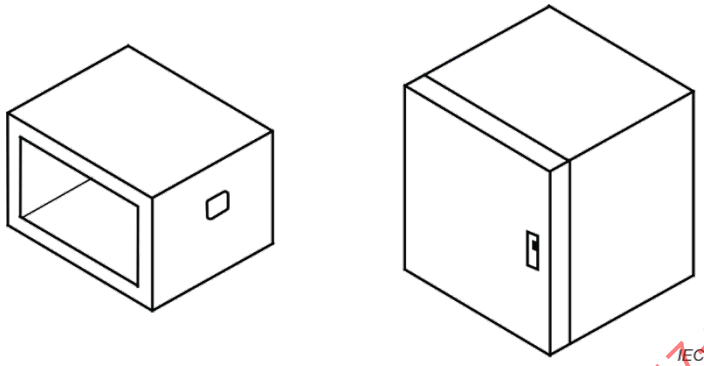


Figure 5 – Case

3.17
swing frame
hinged frame for housing electronic and/or electrical equipment

Note 1 to entry: The hinge frame swings to permit access to the back.

SEE: Figure 6.

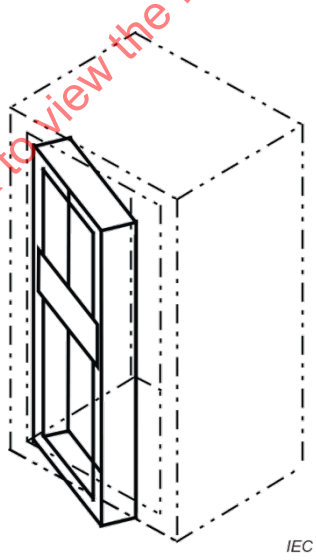


Figure 6 – Swing frame

3.18
subrack
structural unit for housing printed boards with components inserted, and plug-in units

SEE: Figure 7.

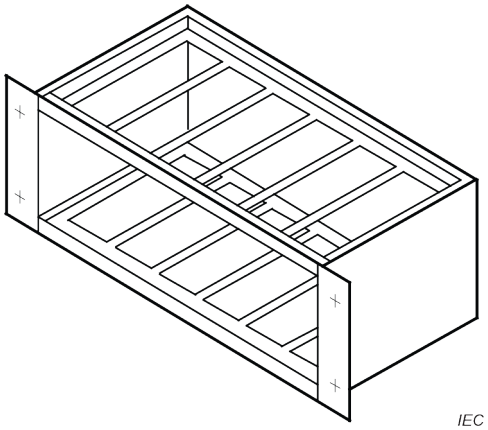


Figure 7 – Subrack

3.19
chassis
mechanical structure designed specifically to support associated electrical and electronic components

SEE: Figure 8.

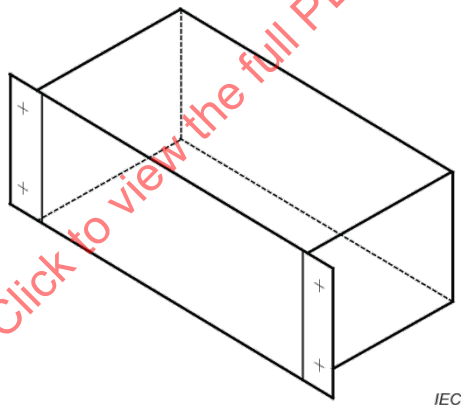


Figure 8 – Chassis

3.20
plug-in unit
unit which plugs into a subrack and is supported by guides

Note 1 to entry: These units can be of various types, ranging from a printed board with components inserted to a frame or box-type unit designed with a plug-in connection.

SEE: Figure 9.

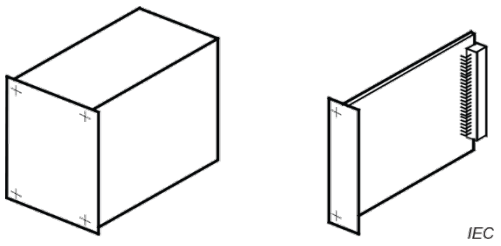


Figure 9 – Plug-in unit

3.21
console
table-mounted or floor-standing enclosure having horizontal, vertical and/or sloping faces to accommodate control, information and monitoring equipment

SEE: Figure 10.

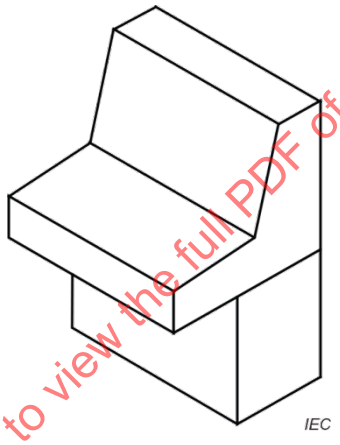


Figure 10 – Console

3.22
plug-in unit guide
device to guide, locate and support plug-in units and printed boards, with components inserted, in subracks

SEE: Figure 11.

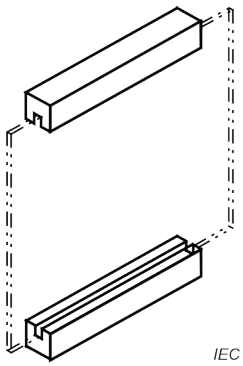


Figure 11 – Plug-in unit guide

3.23
slides
angle-bars on which subracks and chassis may slide and be supported within a rack, cabinet or case

SEE: Figure 12.

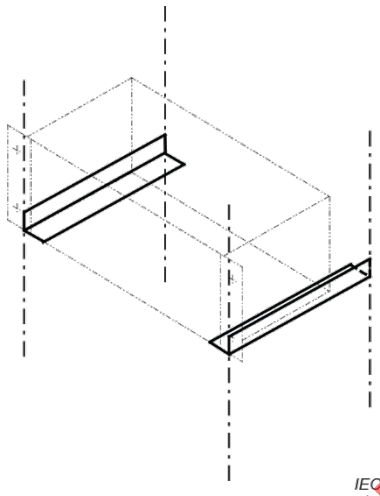


Figure 12 – Slides

3.24
telescopic slides
devices to support withdrawable subracks and chassis in the extended position

SEE: Figure 13.

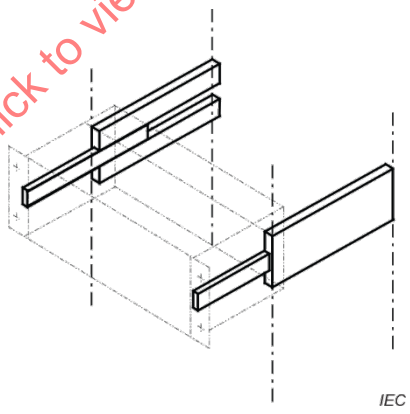


Figure 13 – Telescopic slides

3.25
mounting frame
frame design of profiles for the mounting of electronic /electrical devices. Fixed or movable location within cabinets

SEE: Figure 14.

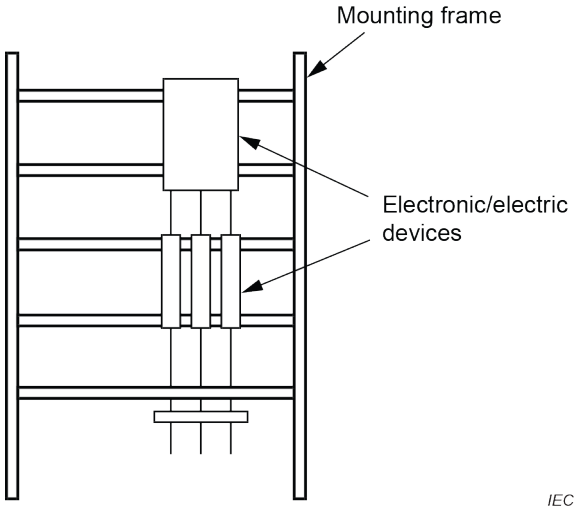


Figure 14 – Mounting frame

3.26
mounting plate
plate for the mounting of electronic/electrical devices, located within e.g. cabinets

SEE: Figure 15.

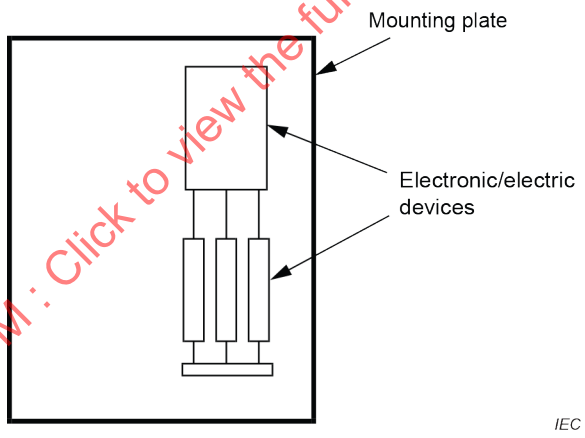


Figure 15 – Mounting plate

3.27
front panel
plane panel allocated to the vertical mounting area of racks and cabinets

SEE: Figure 16.

Figure 16 – Front panel

3.28
backplane
mounting plane of connectors and printed board for the electrical interconnection of plug-in units within a subrack or chassis

SEE: Figure 17.

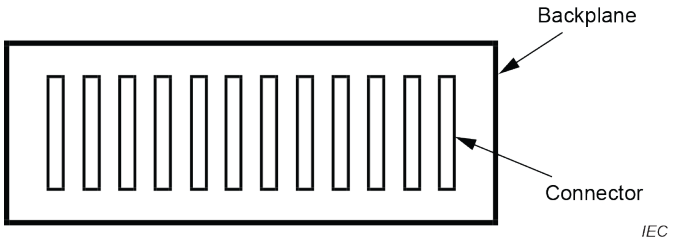


Figure 17 – Backplane

3.29
cabinet panel
design part of a cabinet as protection against incidental touch and environmental influences

SEE: Figure 18.

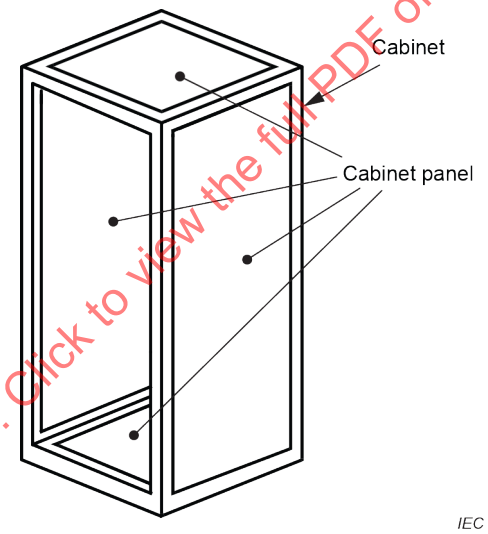


Figure 18 – Cabinet panel

3.30
door
hinged cabinet panel, typically incorporating latching and/or locking devices

SEE: Figure 19.

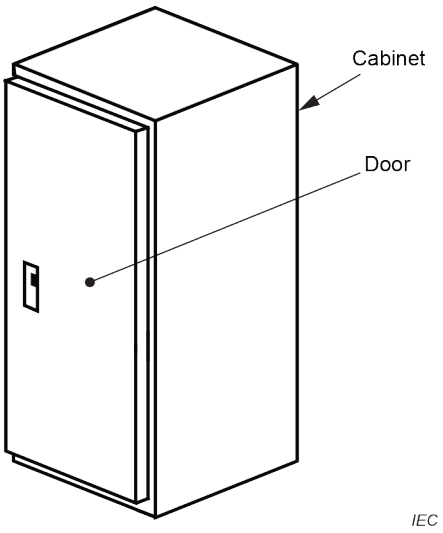


Figure 19 – Door

3.31
mounting section
compartment of a cabinet for the assembly of interior parts

SEE: Figure 20.

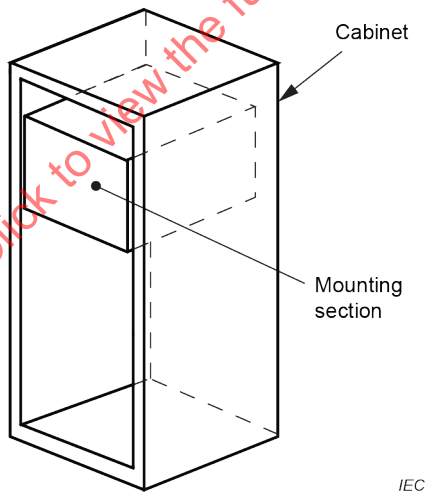


Figure 20 – Mounting section

4 Fundamentals and background information

4.1 General

The basis of the modular order is the basic SI unit of length, the metre according to ISO 80000-1 and to ISO 80000-3.

For compatibility with other modular orders, see IEC 61554, IEC TR 60668, ISO 1006 and ISO 1040.

4.2 Structures of electrical and electronic equipment practices

In Figure 21, the four structure levels of presently known electronic equipment practices are outlined.

The modular order not only covers this kind of structure, but also any other structure of new electrical and electronic equipment practice designs where a modular grid with metric pitches and co-ordination dimensions can be allocated.

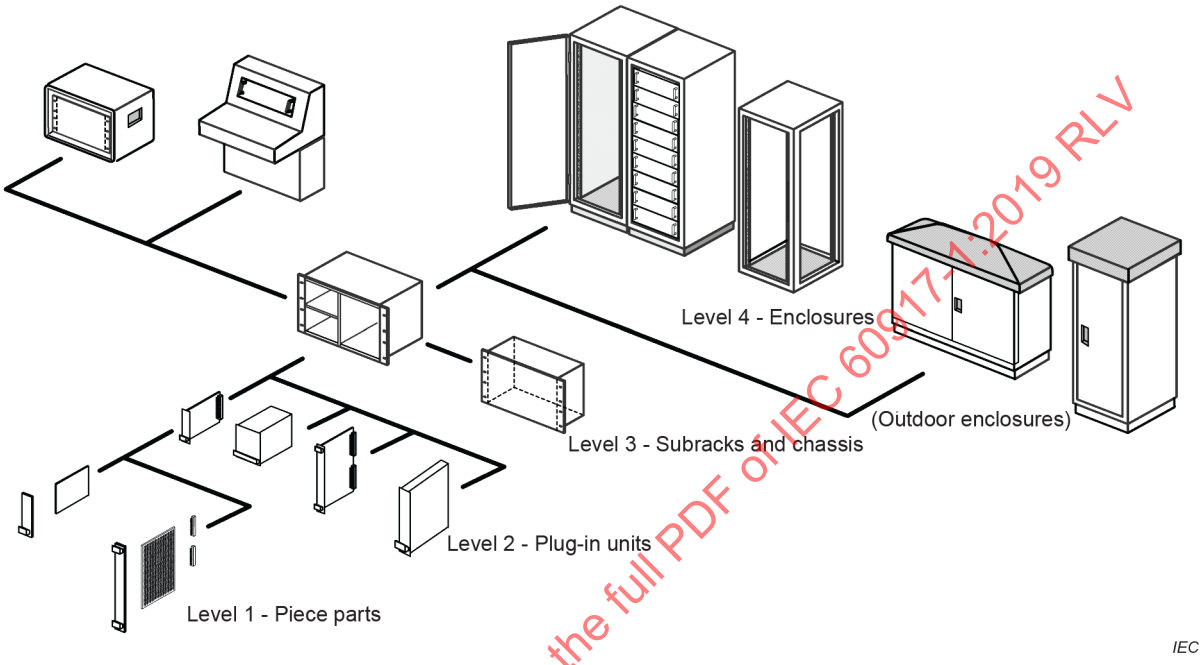


Figure 21 – Structures of electrical and electronic equipment practices

4.3 Dimensional co-ordination with adjacent technical fields

Developing a new electrical and/or electronic equipment practice requires the consideration of external and internal interfaces.

The most important interfaces to electronic and electrical equipment practice are:

a) External interfaces
   - buildings with their room facilities, for example doors, elevators, tiles on floor and ceiling, etc.;
   - packaging and transport, for example, pallets and containers for lorries, ships and aircraft;
   - joint installation of various equipment, for example switching and transmission, power supply, industrial process equipment, etc.

b) Internal interfaces
   - printed circuits, connectors, electromechanical components, electrical components;
   - semiconductor components;
   - wiring and cables;
   - functional units such as a.c./d.c. convertor, measure and control instruments, fuses, etc.

Many of these interfaces have to be considered when specifying the requirements of any equipment practice for electronic and /or electrical systems. For such interfaces co-ordination dimensions should be used as means to reach dimensional compatibility with adjacent technical fields.

Table 1 gives an overview of ISO and IEC publications that should be considered when relevant co-ordination dimensions for common interfaces have to be determined.

Table 1 – Publications containing standardized modular dimensions and/or related documents

Publication	Title	Co-ordination dimensions mm
ISO 2848	Building construction – Modular coordination – Principles and rules	---
ISO 1791	Building construction – Modular co-ordination – Vocabulary	---
ISO 1006	Building construction – Modular coordination – Basic module	100
ISO 6514	Building construction – Modular coordination – Sub-modular increments	20; 25; 50
ISO 1040	Building construction – Modular coordination – Multimodules for horizontal coordinating dimensions	300; 600; 1 200; 1 500; 3 000; 6 000
ISO 3394	Packaging – Complete, filled transport packages and unit loads – Dimensions of rigid rectangular packages	600 x 400 1 200 x 800
ISO 3676	Packaging – Complete, filled transport packages and unit loads – Unit load dimensions	1 200 x 800
IEC GUIDE 103	Guide on dimensional co-ordination	0,5; 1; 2,5 (system I)
IEC TR 60668	Dimensions of panel areas and cut-outs for panel and rack-mounted industrial-process measurement and control instruments	12,5
IEC 60297-3-100	Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets	100
IEC 61969-2	Mechanical structures for electronic equipment – Outdoor enclosures – Part 2: Coordination dimensions	25

4.4 Preparation of standards for new equipment practices

IEC standards for equipment practices to be prepared in accordance with this standard shall be based on the following structure (See Figure 22).

a) Generic standard

All new equipment practices shall comply with this document.

b) Sectional specification standards

They describe particular equipment practices within the scope of the generic standard. In a sectional standard, co-ordination dimensions (selected from the generic standard) shall be specified as standard dimensions, for example for height, width, depth, and so on. There may be more than one sectional standard based on different multiple pitches.

c) Detail specification standards

They standardize units or subunits of equipment practice described in a sectional standard. These units could be such as cabinets, racks, subracks, chassis, backplanes, front panels and plug-in units, etc., and the details can be dimensions, tolerances, requirements, etc., under the condition that mechanical compatibility is maintained.

NOTE Related with the mechanical structure for equipment practices, Figure 22 contains categorised standards and technical specifications.

a) Conventional standard (Legacy system): IEC 60297 series, Dimensions of mechanical structures of the 482,6 mm (19 in) series, defines the detail dimensions of the structure levels through the level 1 to the level 4 as the same as the structure levels shown in Figure 21, and the level 4 of IEC 60297 series can be adaptable to the 25 mm co-ordination dimensions of IEC 60917-2. Standards in the IEC 60297 series are treated as detail specification standards in Figure 22.

b) Outdoor enclosures: IEC 61969 series defines dimensions, environmental requirements of the protective outer-shells for outdoor applications (stationary uses at non-weather protected locations) of the mechanical structures in accordance with IEC 60917 series and IEC 60297 series and other equipment practices.

c) Performance test standards: IEC 61587 series, IEC 62610 series and IEC TS 62454 provide specifications and requirements for verifications of environmental issues and thermal managements related with equipment practices applying mechanical structures in accordance with IEC 60917 series and IEC 60297 series. IEC 62194 specifies the test method for thermal performance of outdoor enclosures.

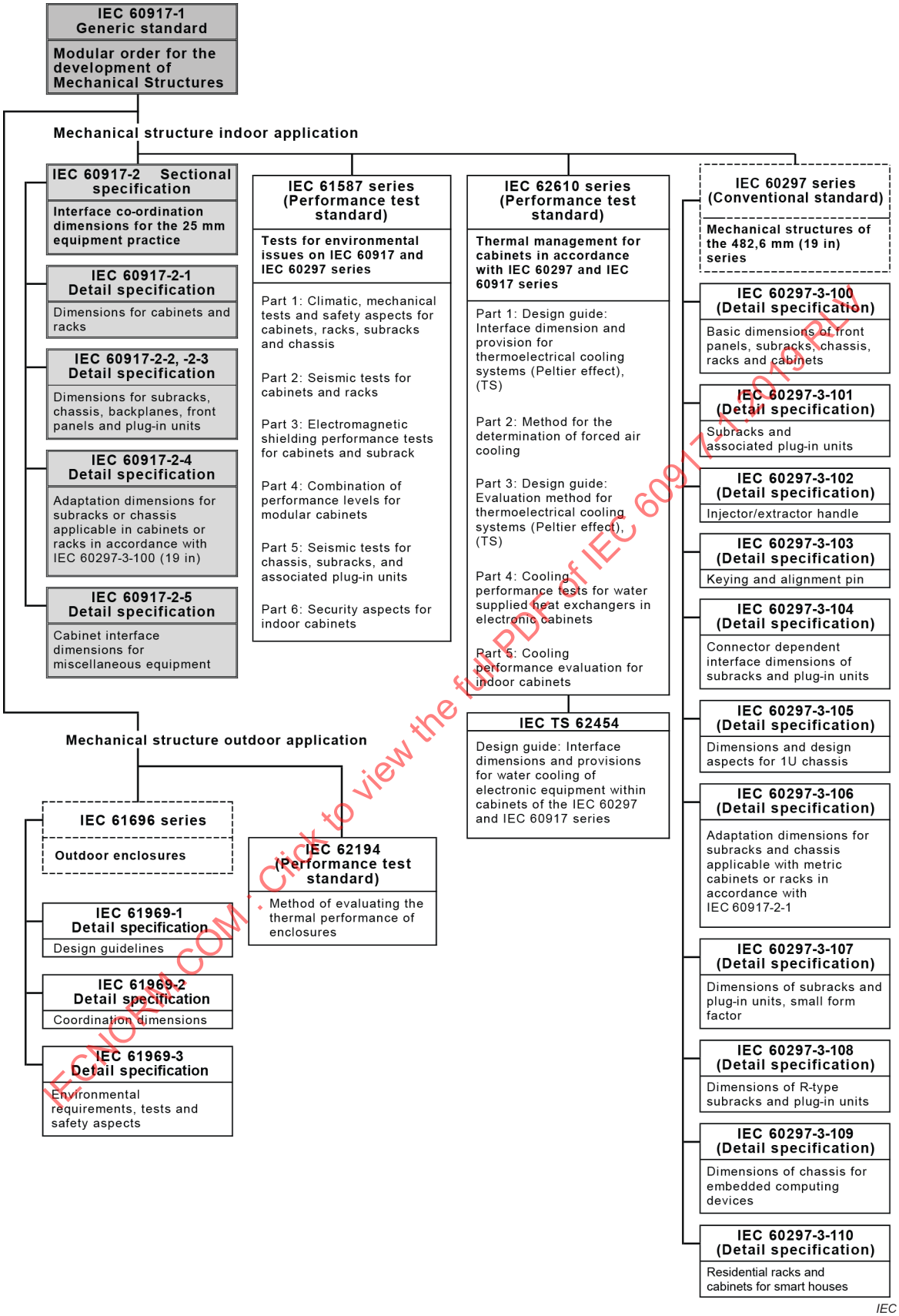


Figure 22 – Structure of equipment practice standards

5 Modular order details

5.1 Modular grid

The correlation between the base pitch and the multiple pitches is explained in Figure 23 which shows the three-dimensional modular grid for equipment practices. Sometimes only a two-dimensional grid or a pitch in one axis is needed. The values of the pitches are specified in 5.2. The choice of pitch is dependent on the size of the mechanical structure as outlined in the following subclauses.

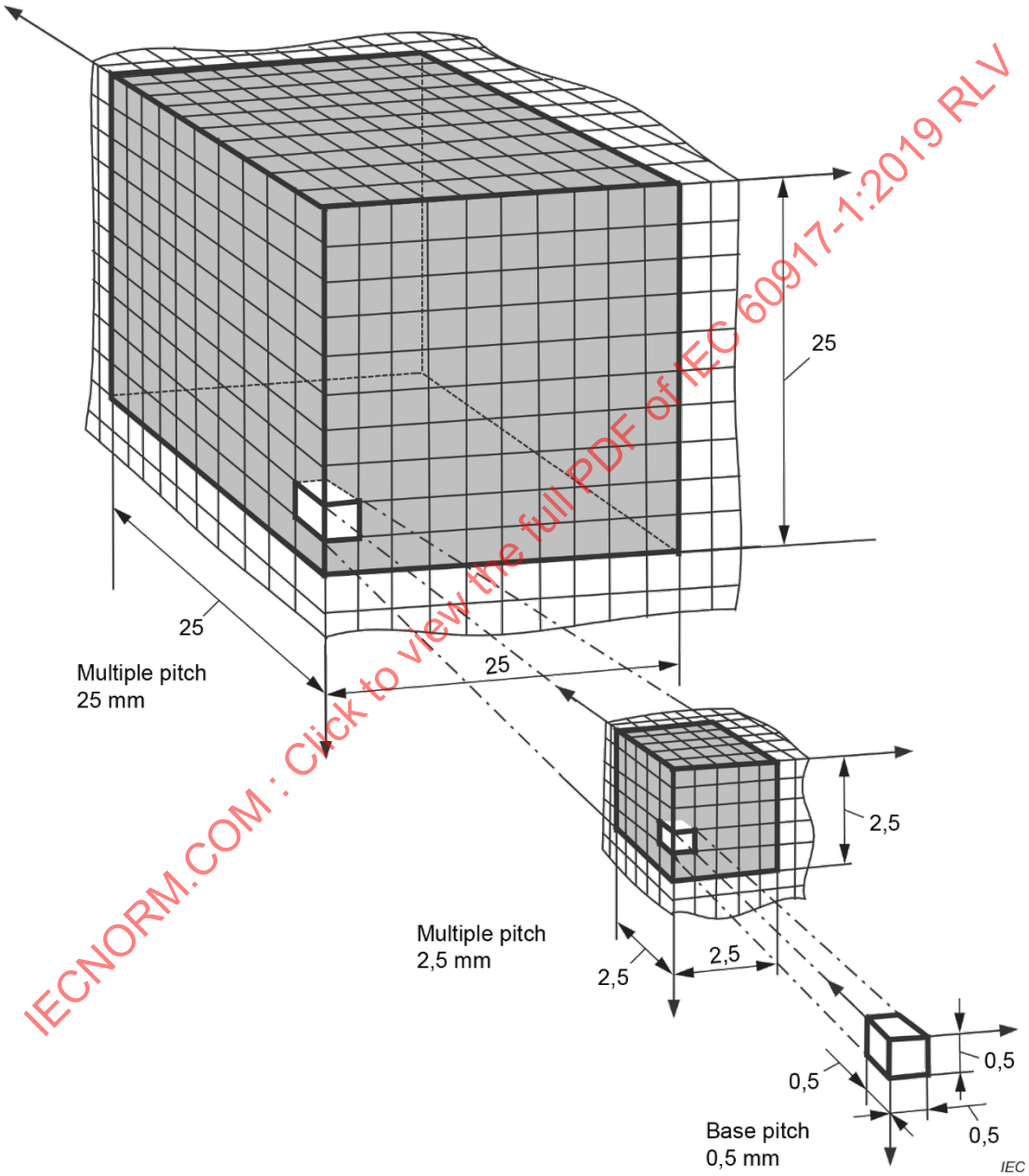


Figure 23 – Modular grid

5.2 Pitches

5.2.1 Base and multiple pitches for equipment practice

Base pitch: a value of 0,5 mm shall be used. It shall not be further subdivided.

Multiple pitches: the values 2,5 mm and 25 mm have been used in Figure 23 to create the coordination dimensions in Table 1. According to the rules of the modular order other values for Mp are allowed, for example 2,0 mm and 20 mm.

5.2.2 Mounting pitches example

The relations between mounting pitches mp_i, the pitches p (base or multiple) and co-ordination dimensions C_i are shown in Figure 24. Mounting pitches shall fulfil the following conditions:

$$mp_i = F \times p$$

where

mp_i is the nominal value of mounting pitch;

p is the pitch (base or multiple as applicable);

F is the factor from Table 2.

$$mp_i = \frac{C_i}{n_i}$$

where

n_i is an integer;

C_i is the co-ordination dimension from Table 2.

$$C_i = n_i \times mp_i$$

$$C_0 = C_1 + C_2 + C_3 + \ldots$$

where

C_0 is the overall co-ordination dimension.

In the example of Figure 24, the overall co-ordination dimension C_0 contains four co-ordination dimensions C_1, C_2, C_3 and C_4 and only one mp with the conditions (all dimensions in millimetres).

$$mp = F \times p = 2 \times 25 = 50$$

$$C_0 = C_1 + C_2 + C_3 + C_4$$

$$= n_1 \times mp + n_2 \times mp + n_3 \times mp + n_4 \times mp$$

$$= 2 \times 50 + 3 \times 50 + 5 \times 50 + 6 \times 50$$

$$= 100 + 150 + 250 + 300$$

$$= 800$$

The mounting pitch mp_i as well as the co-ordination dimensions C_i shall coincide with the values in Table 2. Dimension C_i may have equal or different values.

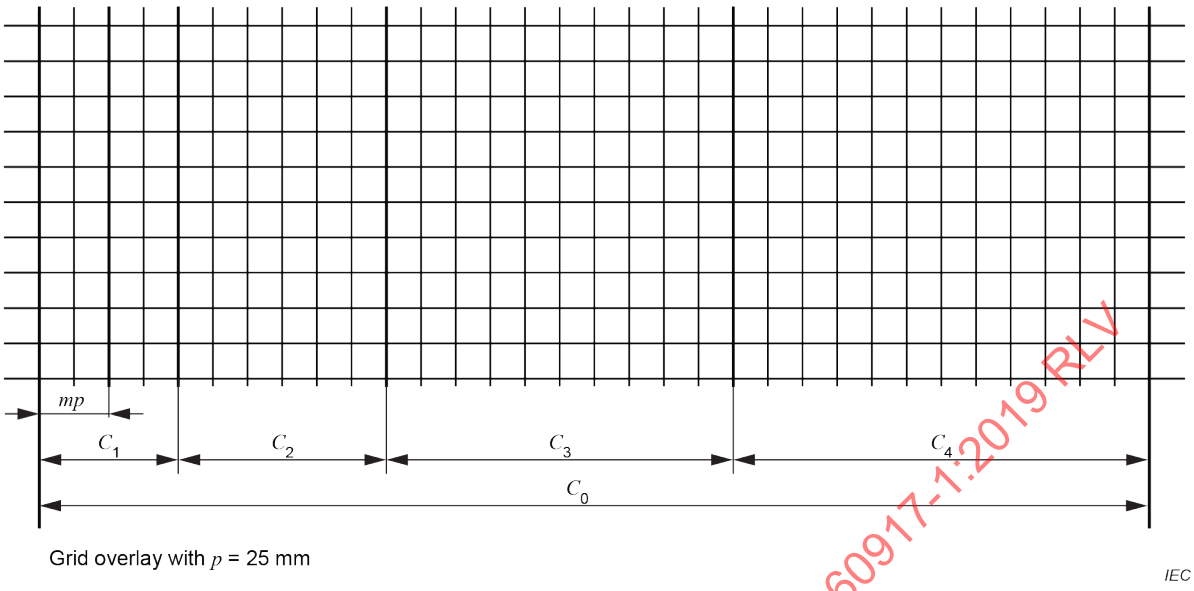


Figure 24 – Partitioning of co-ordination dimensions C_0 with the same mounting pitch mp

5.3 Co-ordination dimensions

Preferred co-ordination dimensions C_i for mechanical structures of equipment practices are listed in Table 2. The dimensions are mainly taken from Table 1 of IEC Guide 103:1980.

Table 2 – Co-ordination dimensions C_i

Co-ordination dimensions C_i mm $C_i = p \times F$			Factor F
Base pitch	Multiple pitch Mp		
p = 0,5 mm	p = 2,5 mm	p = 25 mm	
40,0	200	2 000	80
36,0	180	1 800	72
32,0	160	1 600	64
30,0	150	1 500	60
25,0	125	-----	50
24,0	120	1 200	48
20,0	100	1 000	40
16,0	80,0	800	32
15,0	75,0	----	30
12,5	----	----	25
12,0	60,0	600	24
10,0	50,0	500	20
8,0	40,0	400	16
7,5	----	----	15
6,0	30,0	300	12
5,0	25,0	250	10

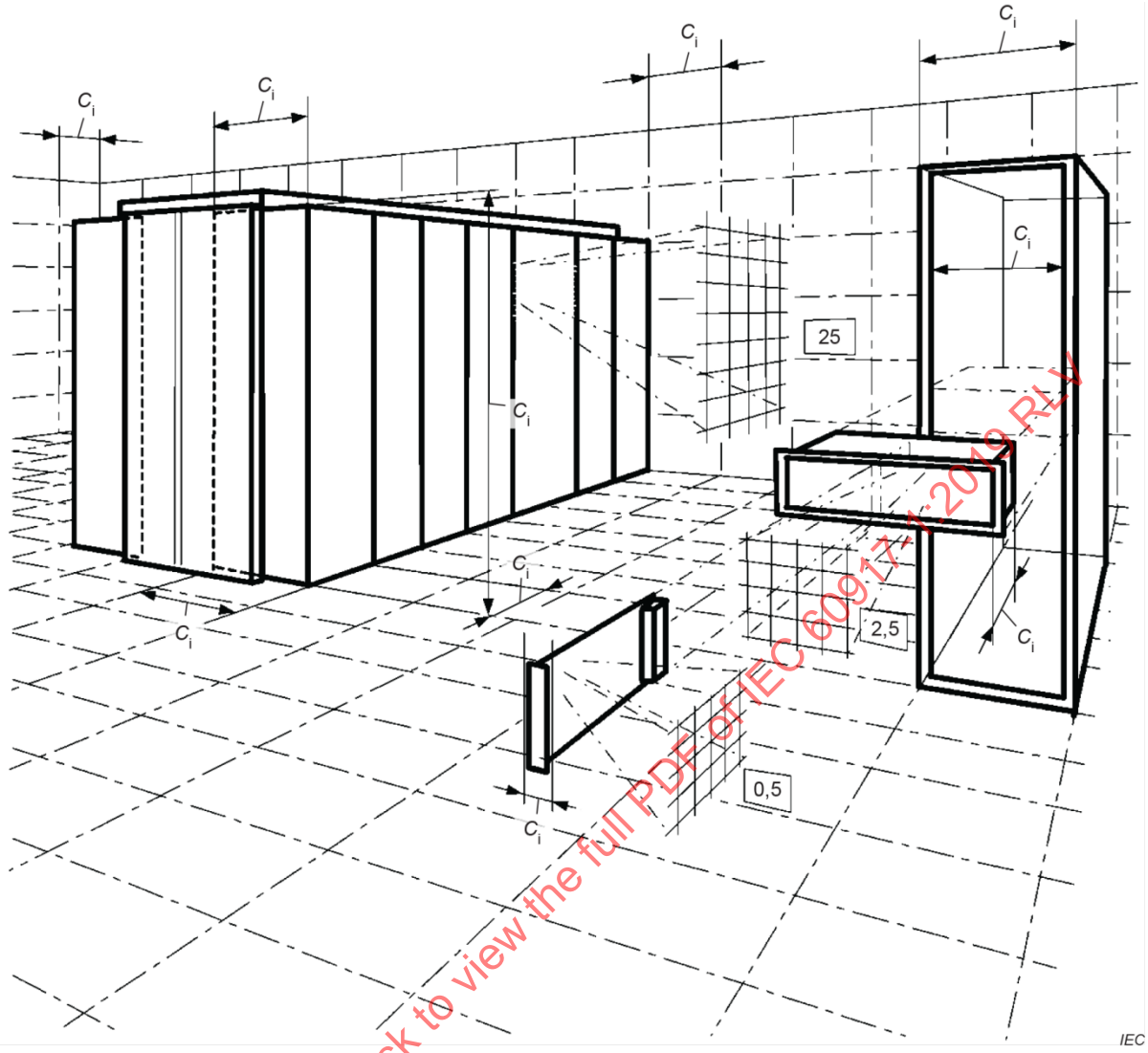
Co-ordination dimensions C_i mm $C_i = p \times F$			**Factor F**
Base pitch	**Multiple pitch Mp**		
p = 0,5 mm	**p = 2,5 mm**	**p = 25 mm**	
4,0	20,0	200	8
3,0	15,0	150	6
2,5	12,5	125	5
2,0	10,0	100	4
1,5	7,5	75	3
1,0	5,0	50	2
0,5	2,5	25	1
NOTE The series C_i = 25 x F can be extended to cover greater values, e.g. 2 200 mm, 2 400 mm if necessary.			

Examples of the application of co-ordination dimensions:

– outside dimensions of racks, cabinets, cases, etc.;
– mounting spaces for assemblies, sub-assemblies and piece parts, wiring, cabling, etc.;
– mounting pitches of piece parts and assemblies.

5.4 Illustration of the modular order

Figure 25 illustrates the indoor application of modular order for electrical and electronic equipment practices.



NOTE Pitches "p" are presented in the frames, see 5.2.1.

Figure 25 – Examples of the application of the modular order

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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ORDRE MODULAIRE POUR LE DÉVELOPPEMENT DES STRUCTURES MÉCANIQUES POUR LES INFRASTRUCTURES ÉLECTRIQUES ET ÉLECTRONIQUES –

Partie 1: Norme générique

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La Norme internationale IEC 60917-1 a été établie par le sous-comité 48D: Structures mécaniques pour les équipements électriques et électroniques, du comité d'études 48 de l'IEC: Connecteurs électriques et structures mécaniques pour les équipements électriques et électroniques.

Cette deuxième édition annule et remplace la première édition publiée en 1998, ainsi que son Amendement 1:2000. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) informations ajoutées sur les nouvelles normes de spécification particulière de structures mécaniques pour les infrastructures électroniques et électriques;

b) informations ajoutées sur les nouvelles normes d'essai de performances destinées à la vérification des performances environnementales, les aspects de la sécurité et le sujet des performances thermiques et de la gestion thermique pour les infrastructures électroniques et électriques;

c) introduction des relations entre la structure mécanique pour les systèmes électriques et électroniques, la vérification des performances environnementales, les aspects de la sécurité et le sujet des performances thermiques et de la gestion thermique pour les infrastructures électroniques et électriques.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
48D/703/FDIS	48D/708/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de la présente norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Les prochaines normes de cette série porteront le nouveau titre général nommé ci-dessus. Les titres des normes existantes de la série seront mis à jour lors de leur prochaine édition.

Une liste de toutes les parties de la série IEC 60917, publiées sous le titre général *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électriques et électroniques*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconfirmée,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

INTRODUCTION

Il existe une tendance constante vers une intégration plus fonctionnelle, des composants électroniques et des circuits intégrés plus petits. Dans le même temps, l'arrivée de nouvelles méthodes de fabrication, d'équipements automatiques de fabrication, d'essai, de l'utilisation de systèmes d'ingénierie assistée par ordinateur (IAO), offre des avantages commerciaux aux utilisateurs.

Afin que les utilisateurs exploitent les avantages techniques et économiques des composants et des technologies récemment développés durant la planification, la conception, la fabrication et les essais, il est nécessaire que les infrastructures satisfassent aux exigences suivantes (voir Guide IEC 103): arrangement des produits avec le minimum de perte d'espace et de place;

– interchangeabilité dimensionnelle des produits en tenant compte par exemple des dimensions hors-tout, des dimensions de montage (trous de fixation, découpes, etc.);
– compatibilité dimensionnelle et détermination des interfaces des produits qui:
  - sont combinés à d'autres produits, par exemple instruments de mesure, armoires, panneaux, bâtis, etc.;
  - sont utilisés dans des immeubles construits selon un ordre modulaire, par exemple pour l'espacement des colonnes, la hauteur des pièces, des portes, etc.

L'obstacle principal provient de la nécessité fréquemment rencontrée de se servir de deux systèmes de référence pour les dimensions (pouce-mètre) qui ne sont pas compatibles. L'utilisation d'une interface entre les deux systèmes représente une solution qui, en fait, n'est pas satisfaisante. La solution qui s'impose est:

– l'utilisation d'un seul système de référence pour les dimensions, et du système d'unités SI.

Les dimensions indiquées en 5.3 du présent document ont été extraites du Système I du Guide IEC 103, en considération d'autres documents sur les dimensions de coordination.

Conformément aux considérations ci-dessus, l'IEC 60917-1 Ed.1 est parue en 1998. La présente norme générique pour le développement des structures mécaniques pour les infrastructures électroniques a été utilisée pour satisfaire aux exigences spécifiques des diverses applications industrielles de la technologie microélectronique.

Après la publication de la présente norme générique, le développement de spécifications particulières et intermédiaires de dimensions, constituées des normes modulaires, IEC 60917-2-X, avec une métrique de 25 mm et les normes conventionnelles, IEC 60297-3-XXX, avec une métrique de 19 pouces, a été réalisé. En parallèle, des normes visant à traiter les performances environnementales et les aspects de la sécurité des structures mécaniques ont été développées, comme la série IEC 61587. Toutes ces normes sont basées sur des applications de système intérieures. L'étape suivante pour la structure mécanique fut le développement de la série IEC 61969 pour les applications de plein air.

Au cours de la première décennie du 21e siècle, les séries IEC 62194 et IEC 62610 ont été développées afin de définir la vérification des performances thermiques des enveloppes et de s'occuper du sujet de la gestion thermique pour les infrastructures électroniques et électriques.

Le présent document décrit les relations entre la structure mécanique pour les systèmes électriques et électroniques, la vérification des performances environnementales, les aspects de la sécurité et le sujet des performances thermiques et de la gestion thermique pour les infrastructures électroniques et électriques.

ORDRE MODULAIRE POUR LE DÉVELOPPEMENT DES STRUCTURES MÉCANIQUES POUR LES INFRASTRUCTURES ÉLECTRIQUES ET ÉLECTRONIQUES –

Partie 1: Norme générique

1 Domaine d'application

La présente partie de l'IEC 60917 spécifie les relations entre les infrastructures et l'ordre modulaire qui sont applicables aux dimensions structurelles principales de l'équipement électronique et électrique monté au sein de diverses installations où des interfaces dimensionnelles doivent être considérées pour une compatibilité mécanique.

Le présent document établit également les termes pour les composants et les ensembles des structures mécaniques pour l'équipement électrique et électronique, afin de clarifier les relations spécifiques entre les infrastructures et l'ordre modulaire.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050-581, *Vocabulaire Electrotechnique International – Partie 581: Composants électromécaniques pour équipements électroniques*

IEC 60297 (toutes les parties), *Structures mécaniques pour équipements électroniques*

IEC 60297-3-100, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-100: Dimensions de base des panneaux avant, des bacs, des châssis, des bâtis et des baies*

IEC 60297-3-101, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-101: Bacs et blocs enfichables associés*

IEC 60297-3-102, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-102: Poignée d'injecteur/d'extracteur*

IEC 60297-3-103, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-103: Codage et broche d'alignement*

IEC 60297-3-104, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-104: Dimensions de l'interface des bacs et blocs enfichables en fonction du connecteur*

IEC 60297-3-105, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-105: Dimensions et aspects de conception pour les châssis d'une hauteur de 1U*

IEC 60297-3-106, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-106: Dimensions d'adaptation des bacs et des châssis, applicables aux baies ou aux bâtis dimensionnés selon le système métrique, conformément à l'IEC 60917-2-1*

IEC 60297-3-107, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-107: Dimensions des bacs et blocs enfichables de petit facteur de forme*

IEC 60297-3-108, *Structures mécaniques pour équipements électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces) – Partie 3-108: Dimensions des bacs de type R et des blocs enfichables*

IEC 60297-3-109, *Structures mécaniques pour équipements électriques et électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces)- Partie 3-109: Dimensions des châssis pour dispositifs informatiques intégrés*

IEC 60297-3-110, *Structures mécaniques pour équipements électriques et électroniques – Dimensions des structures mécaniques de la série 482,6 mm (19 pouces)- Partie 3-110: Bâtis et baies domestiques pour maisons intelligentes*

IEC TR 60668, *Dimensions des surfaces et des ajourages à prévoir pour les appareils de mesure et de commande montés en tableaux ou en tiroirs dans les processus industriels*

IEC 60917-2, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm*

IEC 60917-2-1, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm – Section 1: Spécification particulière – Dimensions pour baies et bâtis*

IEC 60917-2-2, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm – Section 2: Spécification particulière – Dimensions pour bacs, châssis, fonds de paniers, faces avant et unités enfichables*

IEC 60917-2-3, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2-3: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm – Spécification particulière étendue – Dimensions pour bacs, châssis, fonds de panier, faces avant et unités enfichables*

IEC 60917-2-4, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2-4: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm – Dimensions d'adaptation des bacs ou des châssis, applicables dans les baies ou les bâtis, conformément à l'IEC 60297-3-100 (19 pouces)*

IEC 60917-2-5, *Ordre modulaire pour le développement des structures mécaniques pour les infrastructures électroniques – Partie 2-5: Spécification intermédiaire – Dimensions de coordination pour les interfaces des infrastructures au pas de 25 mm – Dimensions pour les interfaces des baies pour équipements divers*

IEC 61554, *Appareils montés en tableaux – Instruments de mesure électriques – Dimensions pour le montage en tableaux*

IEC 61587 (toutes les parties), *Structures mécaniques pour équipement électronique – Essais pour les séries IEC 60917 et IEC 60297*

IEC 61969-1, *Structures mécaniques pour équipement électronique – Enveloppes de plein air – Partie 1: Lignes directrices pour la conception*

IEC 61969-2, *Structures mécaniques pour équipement électronique – Enveloppes de plein air – Partie 2: Dimensions de coordination*

IEC 61969-3, *Structures mécaniques pour équipement électronique – Enveloppes de plein air – Partie 3: Exigences environnementales, essais et aspects de la sécurité*

IEC 62194, *Méthode d'évaluation de la performance thermique des enveloppes*

IEC TS 62454, *Structures mécaniques pour équipement électronique – Guide de conception: Dimensions d'interface et dispositions relatives au refroidissement par l'eau des équipements électroniques dans les armoires des séries IEC 60297 et IEC 60917*

IEC 62610 (toutes les parties), *Structures mécaniques pour équipements électriques et électroniques – Gestion thermique pour les armoires conformes aux séries IEC 60297 et IEC 60917*

Guide IEC 103:1980, *Guide pour la coordination dimensionnelle*

ISO 1006, *Construction immobilière – Coordination modulaire – Module de base*

ISO 1040, *Construction immobilière – Coordination modulaire – Multimodules pour dimensions de coordination horizontale*

ISO 1791, *Construction immobilière – Coordination modulaire – Vocabulaire*

ISO 2848, *Construction immobilière – Coordination modulaire – Principes et règles*

ISO 3394, *Emballages – Emballages d'expédition complets et pleins et charges unitaires – Dimensions des emballages rectangulaires rigides*

ISO 3676, *Emballages – Emballages d'expédition complets et pleins et charges unitaires – Dimensions d'unité de charge*

ISO 6514, *Construction immobilière – Coordination modulaire – Accroissements inframodulaires*

ISO 80000-1:2009, *Grandeurs et unités – Partie 1: Généralités*

ISO 80000-3:2006, *Grandeurs et unités – Partie 3: Espace et temps*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 60050-581 ainsi que les suivants, s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
infrastructure
structure mécanique utilisée dans le boîtier et le montage des systèmes électriques, électroniques et électromécaniques

Note 1 à l'article: L'infrastructure est prévue pour la compatibilité entre les parties mécaniques, les interconnexions électriques et les composants électriques et électroniques.

3.2
ordre modulaire
ensemble de règles qui établissent une relation entre les dimensions de coordination et le pas de base, les pas multiples et les pas de montage à utiliser dans l'infrastructure

3.3
dimension de coordination
dimension de référence utilisée pour coordonner les interfaces mécaniques. Ce n'est pas une dimension de fabrication assortie de tolérances

3.4
dimension d'ouverture
dimension de coordination utilisée pour désigner l'espace utile entre deux éléments de structure

Note 1 à l'article: Une dimension d'ouverture peut uniquement être augmentée.

3.5
n
multiplicateur issu de la suite des entiers 1, 2, 3, ...

3.6
pas
distance entre deux divisions d'un espace modulaire à une dimension

VOIR: Figure 1.

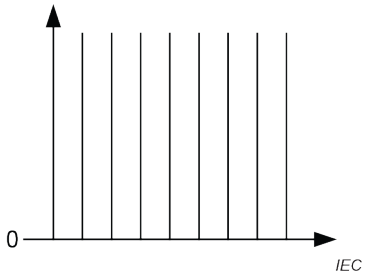

Figure 1 – Pas

3.7
pas de base
p
plus petite distance entre deux lignes successives de la grille utilisée dans les infrastructures

3.8
pas multiple
Mp
multiple entier du pas de base

3.9
pas de montage
mp
pas utilisé pour disposer des pièces ou des ensembles dans un espace donné

Note 1 à l'article: La valeur nominale d'un pas de montage s'obtient en multipliant un pas de base ou un pas multiple par un facteur F, tiré du Tableau 2.

Note 2 à l'article: Les dimensions réelles utilisées dans les infrastructures sont créées à partir de pas de montage additionnés de tolérances de fabrication.

3.10
plan de référence
plan théorique, sans dimensions ni tolérances, utilisé pour délimiter des espaces

3.11
grille
disposition à deux ou trois dimensions de pas utilisée pour coordonner une position selon les règles de l'ordre modulaire

VOIR: Figure 2.

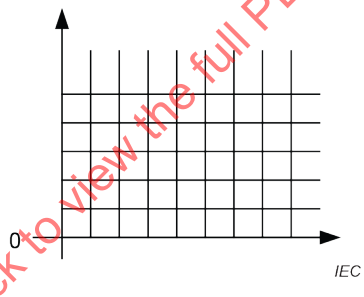

Figure 2 – Grille

3.12
module
structure tridimensionnelle dont les dimensions extérieures sont des multiples entiers du pas. Il peut être également utilisé dans une grille à deux dimensions

Note 1 à l'article: Un module unidimensionnel est souvent appelé unité (U) dans certains documents.

3.13
rangée de baies
ensemble de baies ou de bâtis disposés côte à côte

3.14
bâti
structure ouverte indépendante ou fixée destinée à loger du matériel électrique ou électronique