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Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations —

Part 12:
Construction works and building services

Systèmes industriels, installations et appareils, et produits industriels — Principes de structurations et désignations de référence —

Partie 12: Travaux de construction et services bâtiment

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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

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

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

This document was prepared by Technical Committee ISO/TC 10, *Technical product documentation*, Subcommittee SC 10, *Process plant documentation*, in cooperation with Technical Committee IEC/TC 3, *Information structures and elements, identification and marking principles, documentation and graphical symbols*.

Documents in the 80000 to 89999 range of reference numbers are developed by collaboration between ISO and IEC.

IEC 81346 consists of the following basic parts, under the general title *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations*:

— *Part 1: Basic rules*

— *Part 2: Classification of objects and codes for classes*

A list of all parts in the ISO 81346 series can be found on the ISO website.

Introduction

This document considers and supports the planning, erection, utilization and operation of construction works. The application of a reference designation system for construction works (RDS-CW) may lead to restructuring and reorientation of these activities and thereby offers the potential for increasing efficiency and economization. The following advantages of designation systems will become increasingly important in the future.

— The reference designation system can be applied in several technical fields in the same way and is not designed only for one. So, technical, structural and constructive objects, for example, can be treated in the same way – a basis for company-wide synergy effects.

— The reference designation system allows for integrating any kind of systems and components without changing the once defined designations.

— The reference designation is not bound to a fixed structural pattern. Thus the designation system is vertically and horizontally expansible, which makes the interpretability in some cases quite complex. Therefore an exact and computer-interpretable documentation and description is essential.

— The application of different aspects allows for designation of system elements by function, realizing products or location independently of each other.

— The different aspects in structuring and the possibility of creating relations between objects represented in these structures offer search and filter criteria and information correlations in a much greater variety than before.

Users of this document will be able to manage object occurrences and related properties in a more efficient and consistent way. When implemented, information across various data processing systems can be handled in an unambiguous way. Other well-known information structures besides the reference designation structures in this document are:

— organization structures;

— utilization structures;

— cost structures;

— performance structures;

— real estate structures.

These and other structures can be linked to each other, or to the reference-designation-based structures, so that requirements of flexibility and individuality can be fulfilled.

New three-letter codes are used according to IEC 3/1224A/CD (IEC 81346-2:2009), Table 3.

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Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations —

Part 12:
Construction works and building services

1 Scope

This document establishes rules for structuring of systems and the formulation of reference designations and provides classes for systems in the field of construction works and building services. This document also specifies a classification of objects and corresponding letter codes for use in reference designations of object occurences.

This document is not intended for manufacturers or system-related designations of individuals (e.g. inventory number or serial number) or for product types (e.g. article number or parts number).

2 Normative references

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

ISO 4157-2:1998, *Construction drawings — Designation systems — Part 2: Room names and numbers*

ISO 15519-1, *Specification for diagrams for process industry — Part 1: General rules*

IEC 61082-1, *Preparation of Documents used in electrotechnology — Part 1: Rules*

IEC 81346-1:2009, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 1: Basic rules*

IEC 81346-2:2009, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 2: Classification of objects and codes for classes*

IEC 61175-1, *Industrial systems, installations and equipment and industrial products — Designation of signals*

IEC 61355-1:2008, *Classification and designation of documents for plants, systems and equipment — Part 1: Rules and classification tables*

IEC 61666, *Industrial systems, installations and equipment and industrial products — Identification of terminals within a system*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
aspect
specified way of viewing an object

[SOURCE: IEC 81346-1:2009, 3.3]

3.2
building
construction works that has the provision of shelter for its occupants or contents as one of its main purposes, usually partially or totally enclosed and designed to stand permanently in one place

Note 1 to entry: A building is a type of construction entity.

[SOURCE: ISO 6707-1:2017, 3.1.1.3, modified — Note 1 to entry has been revised.]

3.3
building services
utilities and installations supplied and distributed within a building such as electricity, gas, heating, water and communications

[SOURCE: ISO 16484-2:2004, 3.33, modified — the abbreviated term "BS" has been deleted.]

3.4
component
product used as a constituent in an assembled product, system or plant

[SOURCE: IEC 81346-1:2009, 3.7]

3.5
construction element
constituent of a construction entity with a characteristic function, form, or position

Note 1 to entry: ISO 12006-2:2015, Table 1 classifies examples by function or form or position or any combination of these.

[SOURCE: ISO 12006-2:2015, 3.4.3, modified — Note 1 to entry revised.]

3.6
construction entity
independent unit of the built environment with a characteristic form and spatial structure, intended to serve at least one function or user activity

Note 1 to entry: A construction entity is the basic unit of the built environment. It is recognizable as a physically independent construction even though a number of construction entities might be seen as parts of a particular construction complex. Ancillary works such as access roads, landscaping or service connections may be regarded as part of a construction entity. Conversely, when ancillary works are of sufficient scale they may be regarded as construction entities in their own right.

[SOURCE: ISO 12006-2:2015, 3.4.2]

3.7
construction works
everything that is constructed or results from construction operations

Note 1 to entry: In ISO 12006-2:2015, the term "construction result" is used instead of the term "construction works". Construction result is defined as "construction object which is formed or changed in state as the result of one or more construction processes using one or more construction resources."

[SOURCE: ISO 6707-1:2017, 3.1.1.1, modified — Note 1 to entry has been added.]

**3.8
kind of document**
type of document defined with respect to its specified content of information and form of presentation

Note 1 to entry: Sometimes the term 'document type' is used for the same concept.

[SOURCE: IEC 61355-1:2008, 3.6]

**3.9
equipment**
aggregation of functional elements or assembly of components and modules that belong together in one physical unit of a plant or in a functional unit of a system

[SOURCE: ISO 16484-2:2004, 3.73]

**3.10
function**
intended or accomplished purpose or task

[SOURCE: IEC 81346-1:2009, 3.5]

**3.11
functional system**
object with characteristics which predominantly represents an overall inherent function

**3.12
inherent function**
function of an object, independent of any application of the object

Note 1 to entry: Oxford Dictionaries (https://en.oxforddictionaries.com) defines "inherent" as "existing in something as a permanent, essential, or characteristic attribute".

**3.13
object**
entity treated in a process of development, implementation, usage and disposal

Note 1 to entry: The object may refer to a physical or non-physical "thing", i.e. anything that might exist, exists or did exist.

Note 2 to entry: The object has information associated to it.

Note 3 to entry: Object is considered any part of the perceivable or conceivable world in ISO 12006-2:2015, 3.1.1.

[SOURCE: IEC 81346-1:2009, 3.1, modified — Note 3 to entry has been added.]

**3.14
plant**
assembly of different systems on a specific site

[SOURCE: IEC 61355-1:2008, 3.10]

**3.15
point of installation**
system on or in which components are installed

EXAMPLE   Switch built into a wall system or built into a cabinet.

**3.16
product**
intended or accomplished result of labour, or of a natural or artificial process

[SOURCE: IEC 81346-1:2009, 3.6]

3

3.17
site of installation
space in which systems or components are physically located

EXAMPLE   Cabinet located in a technical room.

3.18
space
limited three-dimensional extent defined physically or notionally

[SOURCE: ISO 12006-2:2015, 3.1.8]

3.19
structure
organization of relations among objects of a system describing constituency relations (consist-of/is-a-part-of)

[SOURCE: IEC 81346-1:2009, 3.9]

3.20
system
set of interrelated objects considered in a defined context as a whole and separated from their environment

Note 1 to entry: A system is generally defined with the view of achieving a given objective, e.g. by performing a definite function.

Note 2 to entry: Elements of a system may be natural or man-made material objects, as well as modes of thinking and the results thereof (e.g. forms of organization, mathematical methods, programming languages).

Note 3 to entry: The system is considered to be separated from the environment and from the other external systems by an imaginary surface, which cuts the links between them and the system.

Note 4 to entry: When a system is part of another system, it may be considered as an object as defined in this document.

[SOURCE: IEC 81346-1:2009, 3.2, modified — Note 4 deleted and Note 5 renumbered.]

3.21
technical system
object with characteristics which predominantly represents a coherent technical solution with an inherent function

4   Structuring

4.1   General

To administer a (technical) system and its information in the various life cycle phases (e.g. basic data collection, planning, construction, operation, dismantling and disposal), it is necessary to divide the system into several (sub)systems (objects) – that is to structure it. The structuring is performed stepwise, either in a top-down or bottom-up manner, resulting in a tree-like structure (see also IEC 81346-1:2009, 5.1 and 5.2).

The process of structuring is carried out according to the following aspects:

— the function aspect – what an object is intended to do or what it actually does;

— the product aspect – by which means an object does what it is intended to do;

— the location aspect – intended or actual space of the object;

— the type aspect – to which group with identical properties an object belongs.

Because of the different information contents, a separate structure for each aspect may be needed – especially if the application of aspects should be consequent.

By building relations between the above named structures, characteristic information can be assembled and task-related conclusions on an object stated, such as information about the location of the object or a product that implements two different functions.

To differentiate between the different aspects, the following prefixes shall be used according to IEC 81346-1:

— "=" (equal) when relating to the function aspect;

— "–" (minus) when relating to the product aspect;

— "+" (plus) when relating to the location aspect;

— "%" (percent) when relating to the type aspect.

4.2 Function-oriented structure

The function-oriented consideration is important for the full life cycle of a system, for example system design, design of process and control functions, commissioning and also for locating failures of function, service operations and optimization works during system operation.

The function-oriented structure is based on the purpose of a system and helps to understand and to structure any system without taking the physical solution or location of the object into consideration. The functional reference designation (=) can be shown in any kind of document, but is typically applied in schematic and non-scaled documents, for example overview diagram, process diagram, function diagram, and circuit diagram.

4.3 Product-oriented structure

The product-oriented structure describes how a system is implemented and assembled. The structure shows the partitioning of a system into single objects with regard to the product aspect independently of where the product is located and which function it fulfils.

In the context of the product aspect, terms of tangible products include plant complex, plant, technical equipment, component, wall, column and slab.

A product can realize one or more functions, for example a heat exchanger can heat or cool, and an ornament can be used for covering and for providing a presentation of some artwork. Several control functions can be implemented in one control system unit.

A product can, alone or together with others, be located at one or more locations, for example a measuring system with location of measuring unit and displaying unit or a duct system extended to several different locations.

With regard to the structuring and assessment of objects in planning and implementation as preparation of the operation phase, the product-oriented aspect is important, for example for assembling and maintenance.

The product reference designation (-) can be shown in any kind of document, but is typically applied in scaled documents and descriptions, for example product description, construction drawing assembly drawing, explosion drawing, network part drawing and maintenance instruction.

In the building industry a further distinction is made between construction products (e.g. ceilings, walls or columns) and products of the building services (e.g. filters, pumps, chillers or boilers).

4.4   Location-oriented structure

The location-oriented structure is based on the topographical structure of a system and/or the environment where the system is located. The structure shows the partitioning of a system with regard to the location aspect. An object in a location-oriented structure can incorporate any number of products and functions.

An object represented in the location-oriented structure can be, for example, a site, a construction complex, a construction entity (a building), a part of a building, a storey or a room as well as an outside areas such as a green area, a park area, a parking area, a street or a sidewalk. For a product composed of a row of cabinets, a cabinet or a row inside a cabinet, each of these may be considered as a location.

The location-oriented structure will be used in planning, erecting and managing of buildings, rooms or areas as well as for locating objects to be assembled or maintained.

The location reference designation (+) can be shown in any kind of document, but is typically applied in scaled documents and descriptions, for example a site plan, floor plan, sectional drawing, elevation drawing, ground plan, arrangement drawing or installation drawing.

4.5   Type-oriented structure

The type aspect enables creation of user-specific types of objects, classified according to IEC 81346-2 or ISO 81346-12.

The type designation designates a group of objects and not a specific single occurrence. However, a group of type objects is also considered to be an occurrence in accordance with IEC 81346-1, and can be designated by the type aspect.

The type aspect is used to designate a collection of objects within a specific class which have specific properties in common. The common properties are selected by the user, and may be one, two or multiple properties. Table 6 and Annex B show examples of designations made with the type aspect.

The specific meaning of any type designation shall be explained within the supporting documents of a project.

The type-oriented reference designation (%) can be shown in any kind of document, but is typically applied in object libraries and bill of quantities.

5   Reference designation

5.1   General

System models are often partitioned according to part-of relations in a tree-like structure. To address any sub-system within such a model, a reference designation in accordance with IEC 81346-1 shall be provided.

A single-level reference designation shall consist of a prefix followed by either:

— a letter code followed by a number;

— a letter code; or

— a number.

The letter code shall represent the class of the object designated. The number shall distinguish between occurrences of the same class.

For designation of objects within a type-, function- or product-oriented structure, the single level reference designation shall consist of a prefix followed by a letter code followed by a number.

By means of classifying, objects are assigned to a class of objects, but no properties are described or a detailed typecast carried out. Letter codes for object classes are given in Tables A.1 to A.2 in Annex A and in IEC 81346-2.

If the number of characters in a reference designation needs to be limited due to project or IT-system-related circumstances, such limitations shall not impair the possibility for design of systems-of-systems.

For the presentation of reference designations, the requirement in IEC 81346-1:2009, 9.1 shall be followed.

For presentation techniques within documents, including simplification methods, the requirements in ISO 15519-1 and IEC 61082-1 apply. For labelling, the requirements in IEC 81346-1:2009, Clause 10 apply.

If other presentation methods are needed, the method applied shall be described in the supporting documentation.

5.2   Systems

The concept of system shall not be linked to any specific domain, but is to be used in a broad sense. In the context of this document, all objects are seen as systems.

The system approach allows a designer to handle wholes (as distinct from parts). By identifying related systems, the relationships among these can be determined and monitored, for example to ensure that all systems operate correctly.

A system-of-systems brings together a set of systems for a task that none of the systems can accomplish on its own. This is reflected in a multi-level reference designation.

NOTE   Further information on systems can be found in ISO 12006-2 and ISO/IEC/IEEE 15288.

5.3   Identification of top nodes

In the context of this document, each domain within construction works shall be considered as an independent system.

If there is a need to recognize the different domains with respect to reference designations, the concept of the top node identifier as specified in IEC 81346-1:2009, 9.3 shall be applied.

For the identification of the different domains within construction works, the letter codes provided in Table 1 shall be applied.

Table 1 — Letter codes for domains to be applied as top node identifiers

Letter code (abbreviation)	Domain
A	Activity space
B	Built space
C	Construction complex
D	Construction aid
E	Construction entity
G	Construction agent
L	Construction element
P	Construction product
R	Construction process
S	Storey
Z	Zone
NOTE The terms for the domains are taken from ISO 12006-2:2015.	

If a top node identifier is to be presented together with a reference designation, it shall be presented within "< ... >" (angle-brackets), preceding the reference designations within the system the top node represents. See Figure 1.
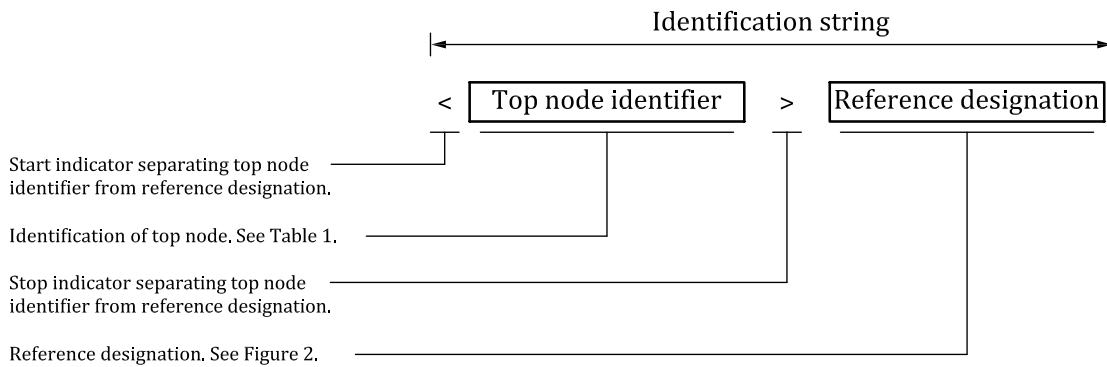

Figure 1 — Appliance of top node identifier

Examples of application of top node identifiers are illustrated in Table 2.

Table 2 — Examples of application of top node identifiers

Object	Reference designation including top node
Construction element: [L] Door no. 5: QQC5[a]	<L>=QQC5
Built space: [B] Control equipment space no. 3: DBA03[b]	<B>=DBA03
Activity space: [A] Office no. 12: BAA12[b]	<A>=BAA12
[a] Class code according to IEC 81346-2:2009, Table 3.	
[b] Class code according to IEC 81346-2:2009, Table 4.	

5.4 Designation of objects

With the reference designation, the designation of the object-of-interest is given within an aspect of the system-of-interest.

In the context of this document, the following apply.

— For the designation of objects recognized as functional systems, letter codes in accordance with Annex A, Table A.1, shall be applied.

— For the designation of objects recognized as technical systems, letter codes in accordance with Annex A, Table A.2, shall be applied.

— For all other objects the letter codes provided in IEC 81346-2:2009, Table 3 shall be applied.

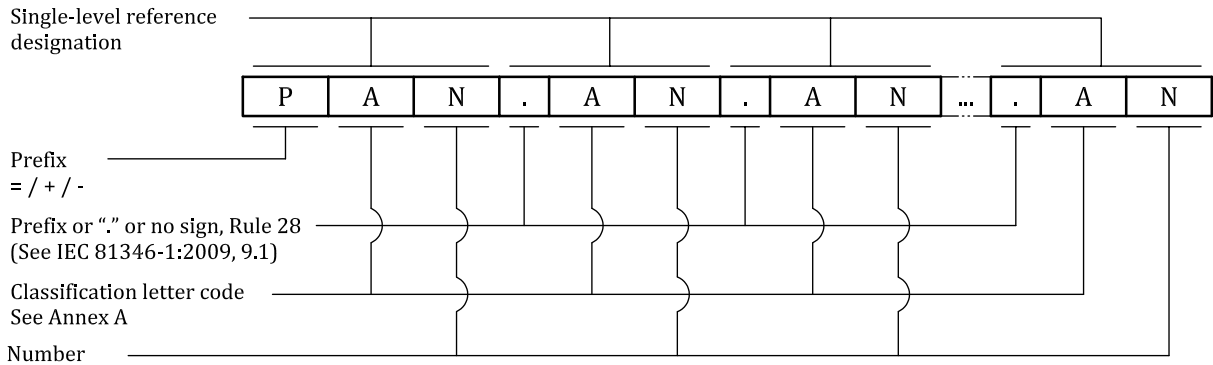Figure 2 illustrates the reference designation layout.

Figure 2 — Reference designation layout

When using numbers, appliance of preceding zeros (e.g. "01" or "001") shall have no specific meaning if applied.

Letter codes shall be one, two or three letters, representing a class of a functional system (one letter), a class of a technical system (two letters) or a construction element (three letters), depending on the object designated. The designation of any system and its constituents depends on the complexity of the system, which is reflected within the reference designation. If the design is simple (e.g. just a collection of doors), a designation for the component shall be sufficient to designate the object unambiguously (single-level reference designation). If the complexity increases (e.g. systems containing subsystems), the system and its constituents is designated (multi-level reference designation). See examples in Table 3.

Table 3 — Examples of objects/object systems

Object (system)	Reference designation
Stairway construction no. 1	−AF1
Door no. 5	−QQC5
Wall construction no. 1	−B1.AD1
Part of wall system no. 1	or −B1−AD1
	or −B1AD1
Door no. 2	−B1.AD3.QQC2
Part of wall construction no. 3	or −B1−AD3−QQC2
Part of wall system no. 1	or −B1AD3QQC2
Ventilation plant no. 4	=J1.HF4
Part of ventilation system no. 1	or =J1=HF4
	or =J1HF4