

SLOVENSKI STANDARD oSIST prEN ISO 16757-2:2018

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Podatkovne strukture za kataloge elektronskih izdelkov za gradbene storitve - 2. del: Geometrija (ISO 16757-2:2016)

Data structures for electronic product catalogues for building services - Part 2: Geometry (ISO 16757-2:2016)

Datenstrukturen für elektronische Produktkataloge der Technischen Gebäudeausrüstung - Teil 2: Geometrie (ISO 16757-2:2016)

Structures de données pour catalogues électroniques de produits pour les services du bâtiment - Partie 2: Géométrie (ISO 16757-2:2016)

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INTERNATIONAL STANDARD

ISO 16757-2

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Data structures for electronic product catalogues for building services —

Part 2: Geometry

Structures de données pour catalogues électroniques de produits pour les services du bâtiment —

Partie 2: Géométrie iTeh Standards

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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 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: <u>www.iso.org/iso/foreword.html</u>.

The committee responsible for this document is ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization of information about construction works*.

A list of all the parts in the ISO 16757 series can be found on the ISO website.

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Introduction

There is a growing need for electronic, machine-readable, digital information about building services. The designers in building services have to execute detailed calculations and simulations to ensure saving of energy and to satisfy hygienic and comfort criteria in heating, ventilation, air conditioning, and sanitary plants. Designers must have access to more complete and more accurate documentation to address these needs. The resulting designs have to describe the complete building services system without internal interference to avoid collision with other systems and components and the building structure.

These requirements can only be achieved with modern building services applications such as computeraided design (CAD) and computer-aided engineering (CAE) systems, calculation programmes, BIM tools, and management software. The software systems need exact data of the used plant components because each component contributes to the performance of the whole building.

Thus, an international standard is required to provide the models and definitions for product catalogue data exchange.

Such a standard eliminates the need to manage different data formats or to use different manufacturerspecific software systems to deal with products of different manufacturers. The standard will lead to a significant reduction of costs for manufacturers and users. Integrating this data into building information modelling (BIM) systems allows data interchange between information technology (IT) systems. In addition to the benefits of planning, there will be further advantages for other software solutions, such as facility management and life-cycle management.

This part of ISO 16757 offers for the first time an interface which allows the uniform handling of data about technical, maintenance and service, as well as geometry, images, video and text information.

The objectives of this part of ISO 16757 are to facilitate

- automatic integration of catalogue data of all manufacturers in engineering applications such as CAD, CAE, dimensioning and calculation systems,
- uniform product selection across manufacturers,
- dimensioning of products using manufacturers' algorithms,

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- possibility to recalculate and re-simulate the whole system with data of all building services components as often as required, and
- standardized representation of technical data for data exchange and life-cycle management.

This part of ISO 16757 specifically provides definitions and specifications for modelling and exchanging geometric information of building services components.

ISO 16757-1 gives the overview about the standard and the rationale for its elements and organization. This document defines the geometric elements which are used to represent the products in ISO 16757 catalogues. ISO 16757-3 defines the script language used in ISO 16757 (all parts) for various purposes. ISO 16757-4 contains IDM descriptions for ISO 16757 (all parts), including process descriptions for those processes which are to be supported by the standard and it comprises the rules for mapping of product and the property descriptions to IFC and for defining properties semantically with IFD. ISO 16757-5 defines an exchange format in XML by which electronic catalogues can be exchanged according to the definitions of ISO 16757 (all parts). The exchange format will be specified as an XML Schema Definition (XSD). The content parts of ISO 16757 will define standardized properties for the product groups and the composition of the technical data model. Furthermore, the content parts of ISO 16757 determine the specific programming function-interfaces to layout, calculate and simulate the products.

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Data structures for electronic product catalogues for building services —

Part 2: Geometry

1 Scope

This part of ISO 16757 describes the modelling of building services product geometry. The description is optimized for the interchange of product catalogue data and includes

- shapes for representing the product itself,
- symbolic shapes for the visualization of the product's function in schematic diagrams,
- spaces for functional requirements,
- surfaces for visualization, and
- ports to represent connectivity between different objects.

The shape and space geometry is expressed as Constructive Solid Geometry (CSG) based on geometric primitives concatenated to boundary representations by Boolean operations. This part of ISO 16757 uses the applicable primitives from ISO 10303-42 and from ISO 16739 and adds primitives which are required for the special geometry of building services products. For symbolic shapes, line elements are also used.

This part of ISO 16757 neither describes the inner structure and internal functionality of the product nor the manufacturing information because this is typically not published within a product catalogue.

Building services products can have millions of variant dimensions. To avoid the exchange of millions of geometries, a parametric model is introduced which allows the derivation of variant-specific geometries from the generic model. This is necessary to reduce the data to be exchanged in a catalogue to a manageable size. The parametric model will result in smaller data files, which can be easier transmitted during data exchanges.

The geometry model used does not contain any drawing information such as views, line styles or hatching.

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 16757-1, Data structures for electronic product catalogues for building services — Part 1: Concepts, architecture and model

ISO 6707-1, Buildings and civil engineering works — Vocabulary — Part 1: General Terms

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16757-1 and ISO 6707-1 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1

product shape

geometric representation of the space defined by the product's external boundaries

3.2

product surface

coloured and textured outer boundary of the product's shape whose rendered appearance responds to relative lighting and viewing angles

3.3

port

located, oriented and directed feature of the product's geometry model (1) for connecting the product with other ports to transfer media or (2) to fasten the product to other products, accessories, walls, ceilings, floors, etc. or (3) for executing control

3.4

solid model

complete representation of the nominal shape of a product such that all points in the interior are connected and that any point can be classified as being inside, outside or on the boundary of a solid.

[SOURCE: ISO 10303-42:2014, 6.4.1]

3.5

parametrizable primitive solid

model of a defined primitive solid, e.g. a block, cylinder, sphere or cone whose dimensions are represented by parameters to generate variants

3.6

constructive solid geometry CSG

type of geometric modelling in which a solid is defined as the result of a sequence of regularised Boolean operations operating on solid models

[SOURCE: ISO 10303-42]

3.7

clipping

operation applied to a geometric model to remove parts of the model beyond a defined boundary

4 Catalogue structure and catalogue information

All kinds of product data in the scope of ISO 16757 can be transmitted in a product catalogue data file.

The catalogue structure which is explained in more depth in ISO 16757-1 is depicted in Figure 1.





5 Geometry

Geometry objects are representation objects in a catalogue. They can represent a product, an accessory or a part of one of them (see Figure 2).



Figure 2 — Overview of the geometric elements of a catalogue and the kind of data objects

Geometry contains different kinds of geometric data:

- shapes;
- symbolic shapes;
- spaces;
- surfaces;
- ports.

The shapes, symbolic shapes and spaces are built by CSG trees. The leaves are geometric primitives (see <u>Clause 7</u>). For each primitive, a number of attributes have been defined which have to be supplied with concrete values to build the respective shapes. The inner nodes are CSG operators which also may have attributes that need to be fed by values. In the same way, attributes are specified for ports, and by filling in specific values for the attributes, specific ports are described.

To support the representation of a number of variants, each geometric representation is abstract, i.e. the attributes are not filled by fixed values for each product. Rather, the attribute values are described by formulas which use geometric properties as their parameters. These geometric properties are defined by the manufacturer, i.e. they are specific for the catalogue and may be different from catalogue to catalogue.

The geometric properties provide specific values for each product. They have to be computed for each product on the basis of the technical property values of that specific product variant. Thus, they are derived properties, and they are provided with a function which computes the actual value of the property for a given product variant (see ISO 16757-1). Some geometric properties may also be dynamic, i.e. they depend not only on the product properties, but also on conditions in the environment of the installed product.

A single product can consist of one or more components (see <u>Figure 3</u>). Each component of such a product shall be described as a separate geometric entity.



Figure 3 — Single product (heater with heat exchanger and water storage) as an assembly of components

5.1 Shapes

Shapes support the visualization of the product as a 3D geometry model (see Figure 4). In addition, they are required for interference checking with other shapes and spaces in the building model or the building services system model surrounding the building services product.



Figure 4 — Shape of a valve

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5.2 Symbolic shapes

In addition to shapes, symbolic shapes are useful for the understanding of the model in visualizations and drawings. To illustrate, a 3D representation of a valve's shape cannot give information provided by 57-2-2019 a symbolic shape, e.g. a valve symbol will give additional information about the type of the valve, its function and form of activation.

The symbolic shape object also contains information about whether it is 2D or 3D.

The method for describing symbolic shapes is the same as that for shape data.

5.3 Space data

The description of the product's shape alone is not sufficient to check whether a product is correctly installed into the building services system. Many pieces of equipment need an operation space in front of their control or display panel, and additional space for installation and/or assembly (see Figure 5).

Spaces are categorized as follows.

5.3.1 Overall space

The space required for preliminary automatic interference checks by CAD systems, including all other spaces: the minimum operation space, the access space, the placement and transportation space and the installation space of the product.