INTERNATIONAL STANDARD

ISO 16792

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Technical product documentation — Digital product definition data practices

Documentation technique de produits — Données de définition d'un produit

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16792 was prepared by Technical Committee ISO/TC 10, *Technical product documentation*.

Introduction

Every effort was made during the preparation of this International Standard — adapted from ASME Y14.41:2003 — to apply existing requirements developed for two-dimensional (2-D) presentation equally to the output from three-dimensional (3-D) models. Where new Geometrical Product Specification (GPS) rules have proved essential, these have been drafted with a view to their being equally applicable to both 2-D and 3-D. Therefore, in order to maintain the integrity of a single system, these new rules are being incorporated in the relevant existing ISO standards for cross-reference. Application examples have been included where, due to the specific requirements of 3-D modelling, additional guidance was deemed beneficial.

It is recognised that there is a need to support drawings in conjunction with 3-D models now and for the foreseeable future. This need has been addressed in this International Standard through the definition of the two methods for documenting digital models and specification of requirements to ensure that the information in a data set is consistent between the model and the drawing.

The figures in this International Standard are intended only as illustrations to aid the user in understanding the practices elaborated in the text. In some cases, figures show a level of detail as needed for emphasis; in others, they are only complete enough to illustrate a concept or facet thereof. The absence of figures has no bearing on the applicability of the specified requirement or practice.

In order to comply with the requirements of this International Standard, actual data sets will need to meet the content requirements set forth in its text.

Most figures are illustrations of models in a 3-D environment. Figures illustrating drawings in digital format include a border.

Text in uppercase letters used in the figures are intended to appear in digital product definition data, or data sets; while that in lowercase letters is for information only and is not intended to appear in data sets.

Technical product documentation — Digital product definition data practices

1 Scope

This International Standard specifies requirements for the preparation, revision and presentation of digital product definition data, hereafter referred to as data sets. It supports two methods of application: model-only, and model and drawing in digital format. Its structure presents requirements common to both methods followed by clauses providing for any essential, differing requirements for each method. Additionally, its use in conjunction with computer aided design (CAD) systems could assist in the progression towards improved modelling and annotation practices for CAD and engineering disciplines, as well as serving as a guideline for IT engineers.

The aspects specified in this International Standard refer mainly, but not exclusively, to requirements that differ or are additional to those provided in existing, related standards. Where no such requirements are identified, it is safe to assume that the appropriate existing ISO standards are instead applicable.

2 Normative references

The following referenced documents are indispensable for the application 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 31-0:1992, *Quantities and units — Part 0: General principles*

ISO 128 (all parts), *Technical drawings — General principles of presentation*

ISO 129-1:2004, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

ISO 286 (all parts), *ISO system of limits and fits*

ISO 406, *Technical drawings — Tolerancing of linear and angular dimensions*

ISO 1101:2004, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 2692, *Technical drawings — Geometrical tolerancing — Maximum material principle*

ISO 2768-1:1989, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 3098-0:1997, *Technical product documentation — Lettering — Part 0: General requirements*

ISO 3098-5:1997, *Technical product documentation — Lettering — Part 5: CAD lettering of the Latin alphabet, numerals and marks*

ISO 5456 (all parts), *Technical drawings — Projection methods*

ISO 5457:1999, *Technical product documentation — Sizes and layout of drawing sheets*

ISO 5458, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Positional tolerancing*

ISO 5459:1981, *Technical drawings — Geometrical tolerancing — Datums and datum-systems for geometrical tolerances*

ISO 7083, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*

ISO 7200:2004, *Technical product documentation — Data fields in title blocks and document headers*

ISO 8015:1985, *Technical drawings — Fundamental tolerancing principles*

ISO 11442:2006, *Technical product documentation — Document management*

ISO 12944 (all parts), *Paints and varnishes — Corrosion protection of steel structures by protective paint systems*

ISO 14660-1:1999, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

ISO 16016:2000, *Technical product documentation — Protection notices for restricting the use of documents and products*

ISO 82045-2:2004, *Document management — Part 2: Metadata elements and information reference model*

3 Terms and definitions

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

3.1
annotation
dimension(s), tolerance(s), note(s), text or symbol(s) visible without any manual or external manipulation

3.2
annotation plane
conceptual plane containing annotation

NOTE 1 It is desirable that annotation planes intersect or be coincident with a model feature.

NOTE 2 The plane is “conceptual” because it is not physically shown as geometry on the model but is provided to replace the drawing media.

3.3
assembly model
model in which the product described is an assembly of two or more items

3.4
associated entities
portion of a product definition to which annotation pertains

3.5
associated group
user-defined set of related digital elements

3.6
associativity
established relationship between digital elements

3.7
attribute
dimension, tolerance, note, text or symbol required to complete the product definition or model feature of the product that is not visible but available upon querying the model

3.8
data
information represented in a formal manner suitable for communication, interpretation or processing by human beings or computers

3.9
datum system
ordered list of two or three datums, which can be single or common

NOTE 1 See ISO 5459:1981.

NOTE 2 This can be considered as a partial or complete datum system.

3.10
design model
portion of the data set that contains model and supplemental geometry

3.11
digital element
geometric element, model feature, group of model features, annotation, associated group or attribute that exists in a data set

3.12
digital element identifier
label or name used to specify a unique digital element

3.13
direction dependent tolerance
tolerance that invokes a zone of parallel lines or curves

3.14
flagnote
note that is located with the general notes but applies only at specific areas or points on the model or drawing

3.15
geometric element
graphic entity used in a data set

EXAMPLE Representation of geometric feature as defined in ISO 14660-1, representation of models coordinate system, or representation of crosshatching.

3.16
hard copy
printed or plotted copy of all or part of a data set

3.17
installation model
model in which the product described is an installation, showing parts or assemblies and a partial or complete representation of the installation site

3.18
management data
data required for the release, control and storage of product definition data as well as other relevant engineering data

3.19
model
combination of design model, annotation and attributes that describes a product

3.20
model coordinate system
representation of a Cartesian coordinate system in a product definition data set

3.21
model geometry
geometric elements in product definition data which represent designed product

3.22
model feature
model geometry that represents a physical portion of a part

3.23
model value
numerical value derived by querying the model that quantifies the form and spatial relationships of the geometry composing a design model or assembly of models to the precision (number of decimal places) of the computer system

3.24
product definition data
data elements required to completely define a product

3.25
product definition data set
collection of one or more computer file(s) that discloses (directly or by reference), by means of graphic or textual presentations, or combinations of both, the physical and functional requirements of a product

3.26
screen dump
hard copy of a displayed image

3.27
query
means of interrogating a digital element or the relationship between digital elements

3.28
represented line element
supplemental geometry line or curve segment indicating the orientation of a direction-dependent tolerance

3.29
resolved dimension
model value that is rounded off to the number of decimal places required for the design

3.30
saved view
stored and retrievable specific orientation and a magnification factor of a model

3.31
special character
character not included in the set of letters A–Z, a–z, numerals and punctuation symbols

3.32
supplemental geometry
geometric elements included in product definition data to communicate design requirements but not intended to represent a portion of the manufactured product

4 Data set identification and control

4.1 General

Data sets for which compliance with this International Standard is claimed shall include a reference to this International Standard, ISO 16792, either in the data set itself or in a document referenced by the data set.

The current revision of the data and the computer application(s) and version(s) used to develop the data set shall be specified with other management data, see 5.4.

The data set identifier shall be unique and shall consist of numeric, alphabetic or special characters in any combination. Spaces are not permitted between any of the characters of the data set identifier.

The length of the data set identifier may be a direct function of the computer system and the operating system. When the part or identifying number is used as the data set identifier, the length shall be compatible with recognised limitations on number length in accordance with ISO 7200 and ISO 82045-2.

Special characters, such as hyphen (-), slash (/), or asterisk (*), shall be selected in a manner that does not hinder data set identification or have an adverse affect on the computer system operation.

A recognisable prefix or suffix may be included as part of the identifier to associate files and sets of related data.

See ISO 7200 and ISO 82045-2 for the description and use of drawings, drawing numbers, and identifying numbers.

4.2 Related data

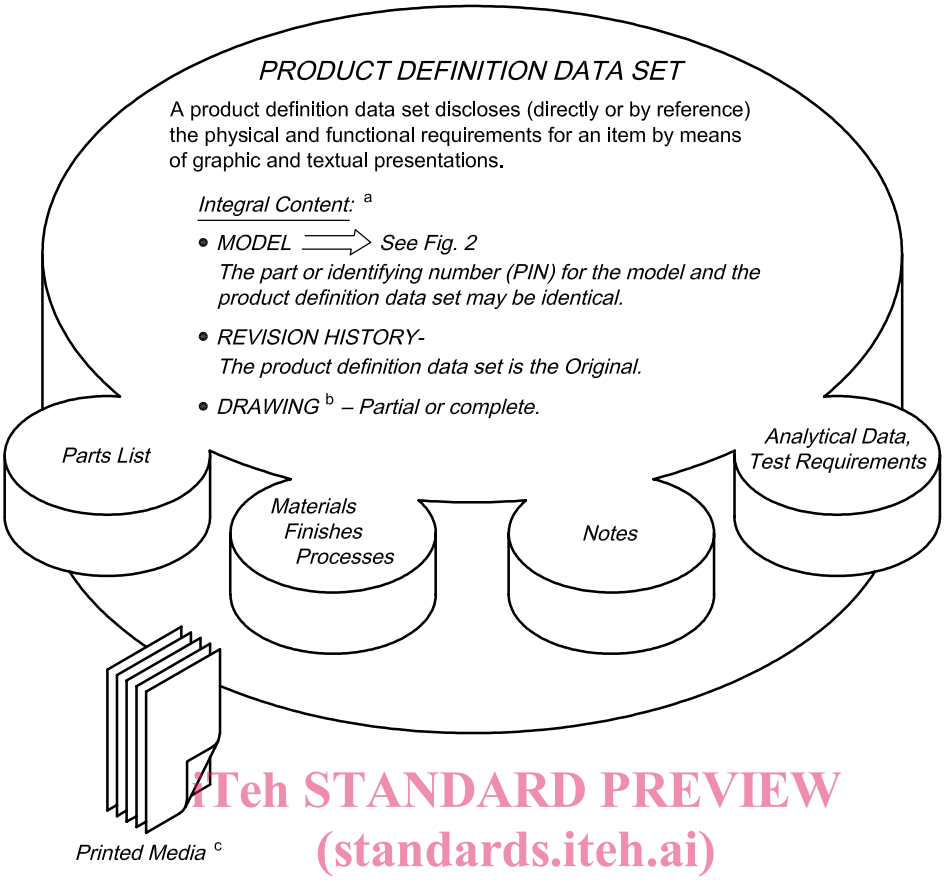
Related data shall be integral to, or referenced in, the data set. Related data consists of, but is not limited to, analytical data, parts lists, test requirements, material specifications, process and finish requirements in accordance with Figure 1.

4.3 Data management

The following specifies the structure and control requirements for data management:

a) The data management system shall meet the requirements of ISO 11442, providing information to enable the control and tracking of data sets, throughout the life cycle of the product to which each relates. The system may include work in process, data review status, model checked status, release status, design tool and version, libraries, etc.

b) Revision history information per ISO 11442 shall be contained in the data set.



Key

a Related data (as applicable) required for complete definition may be integral to or referenced in the product definition data set. Data not integral to the product definition data set may be revised independently.

b A drawing is not required for Model Only data sets.

c Related data may be manually or computer generated.

Figure 1 — Content of a product definition data set

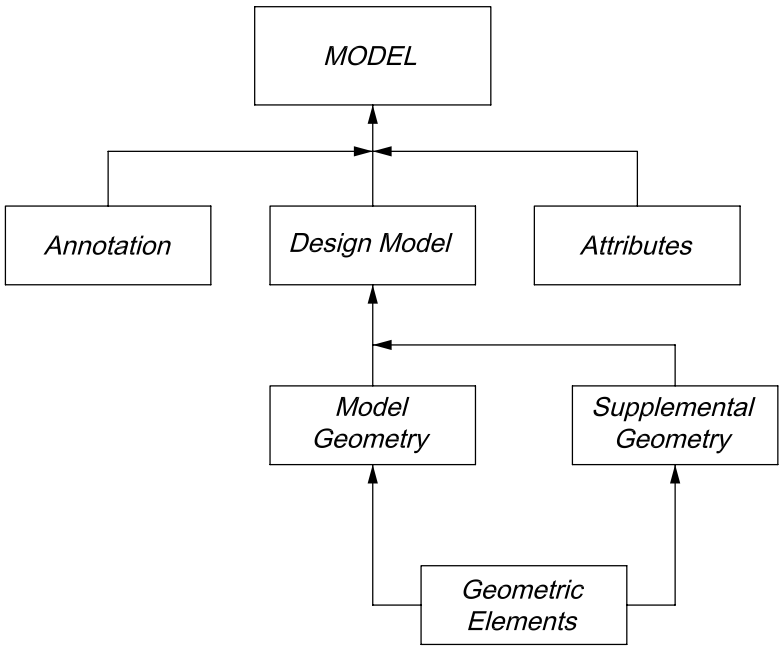


Figure 2 — Content of a model

5 Data set requirements

5.1 General

The data set shall provide complete product definition. For example, a design model, its annotation, and related documentation.

5.1.1 Fundamental requirements

The following are the fundamental requirements and other provisions applicable to both annotated models and drawings, specific to annotated models and specific to drawings.

a) Common to annotated models and drawings

- All model values and resolved dimensions shall be obtained from the model.
- Rounding requirements for resolved dimensions shall comply with 9.2.2.
- The ability to query the model shall be available, see 7.3.8.
- All angular values shall be queried from the model, see 9.3. Exceptions to this are model coordinate system(s), planes and axes in a datum system, and orthographic views.
- When query is required, a notation stating the requirement for query of the model or associated data shall be added to the drawing or in the general notes.
- When applying tolerances to features, alignment of the annotation plane to the nominal or theoretically exact profile is not required.
- Values obtained from the model for any feature(s) without any tolerance or datum target specifications assigned shall be auxiliary dimensions.
- Legibility requirements of ISO 3098-0 and ISO 3098-5 shall apply when the annotation is viewed perpendicular to the annotation plane.
- Annotation in any given annotation plane shall not overlap other annotation in the same annotation plane when the model is viewed perpendicular to the annotation plane.
- Annotation text within any given annotation plane shall not be placed over the design model when the model is viewed perpendicular to the annotation plane.

b) Applicable only to models

- All annotation shall be specified in one or more annotation planes. When CAD software does not support maintenance of annotation plane orientation relative to the model, the model-only method shall not be used, see 7.3.4.
- The associated entities, annotation, and attributes shall be in agreement, see 7.3.2.
- Resolved dimensions created from queried model values are considered the same as dimensions displayed on a model, see 9.2.1.
- Display of centrelines or centre planes for features of size is optional.
- To ensure that the annotation is readable — the text, for example, could be upside down or backwards following rotation of the model — one of the following techniques shall be used:

  i) ensuring that the reading direction is updated after rotation of a model;

ii) inclusion of means of determining the correct reading direction in each annotation plane applied to a model;

iii) when using saved views, ensuring that the model is orientated in the intended view direction — for example, by including a means of determining the correct reading direction in the view.

— Dimensions and tolerances to internal features may be shown without the use of a section, see Figure 25 c).

c) Applicable only to drawings

— Annotation may be applied to orthographic or axonometric views.

— For axonometric views, the orientation of the annotation shall be parallel to, normal to or coincident with the surface to which it applies. An annotation shall not overlap another or the geometrical representation of the part.

5.1.2 Design model requirement

A design model is required and shall be in accordance with 5.2 and Clause 6.

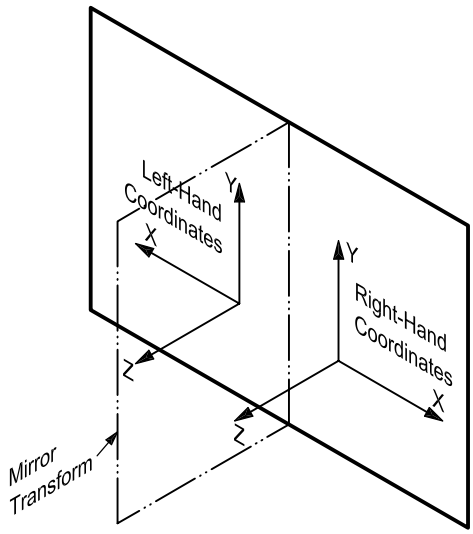
5.2 General model requirements

5.2.1 Associativity

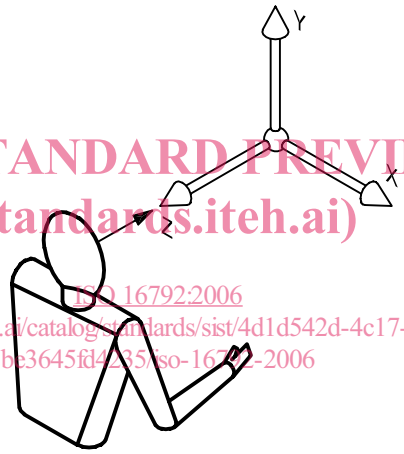
The ability to associate digital elements shall be available and maintained. Associativity information shall be electronically accessible.

5.2.2 Model coordinate systems

A design model shall contain one or more model coordinate systems. A model coordinate system shall be depicted by three mutually perpendicular line segments with its origin located at the intersection of the three axes. Each axis shall be labelled and the positive direction shown. Model coordinate systems shall be right-handed unless otherwise specified, see Figure 3 b).



a) Mirror-image relationship



NOTE When observed in the Z direction, with positive Y ascending, positive X is directed to the right-hand side of the observer.

b) Recognising the right-hand coordinate system

Figure 3 — Left- and right-hand model coordinate systems

5.2.3 Applications of supplemental geometry

When supplemental geometry is used, there shall be a clear distinction between the supplemental geometry and the design model geometry.

a) Represented line element

When a represented line element is used to indicate the direction of a geometric tolerance application, the leader line from the tolerance indicator shall terminate on the represented line element in an arrowhead, see Figure 41. The following geometric tolerances may use a represented line element to clarify the directionality of a two-dimensional tolerance zone of parallel lines:

— straightness applied to the line elements of a planar surface, see 11.3.2 and Figure 41;