TECHNICAL SPECIFICATION

ISO/TS 8000-311

First edition
2012-04-15

Data quality —

Part 311: Guidance for the application of product data quality for shape (PDQ-S)

Qualité des données —

Partie 311: Directives pour l'application de la qualité des données de produit pour les formes (PDQ-S)

Reference number
ISO/TS 8000-311:2012(E)

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Published in Switzerland

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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 in 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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative documents:

— an ISO Publicly Available Specification(ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50% of the members of the parent committee casing a vote;

— an ISO Technical Specification(ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this part of ISO 8000 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 8000-311 was prepared by Technical Committee ISO/TC184, *Automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 8000 is organized as a series of parts, each published separately. The structure of ISO 8000 is described in ISO/TS 8000-1.

Each part of ISO 8000 is a member of one of the following series: general data quality, master data quality, transactional data quality and product data quality. This part of ISO 8000 is a member of the product data quality series.

A complete list of parts of ISO 8000 is available from the Internet:

`<http://www.tc184-sc4.org/titles/DATA QUALITY Titles.htm.>`

Introduction

The ability to create, collect, store, maintain, transfer, process and present data to support business processes in a timely and cost effective manner requires both an understanding of the characteristics of the data that determine its quality, and an ability to measure, manage and report on data quality.

ISO 8000 defines characteristics that can be tested by any organization in the data supply chain to objectively determine conformance of the data to ISO 8000.

ISO 8000 provides a framework for improving data quality that can be used independently or in conjunction with quality management systems.

ISO 8000 covers industrial data quality characteristics throughout the product life cycle from conception to disposal. ISO 8000 addresses specific kinds of data including, but not limited to, master data, transaction data, and product data.

Assets can be grouped into real and intellectual property. Information is intellectual property. Data is a prerequisite to information. Thus, the quality of data is a key determiner of an organization's ability to preserve and transfer intellectual property.

A characteristic of data is its portability from one system to another. Syntax and semantics encoding determine whether data is portable in a reliable way. ISO 8000 specifies requirements for the declaration of syntax and semantic encoding. This allows the user to determine the limitations of data portability. By requesting data that conforms to ISO 8000, the user is able to manage data portability and protect its intellectual property assets.

Data quality is the degree to which data meets user requirements. ISO 8000 contains specifications for the declaration of the conformance to stated data requirements. This allows the user to request data that meets its requirements and to determine if the data received meets its requirements.

This part of ISO 8000 is a member of the product data quality series and aims at facilitating effective use of product data quality for shape (PDQ-S), as described in ISO 10303-59.

Since the publication of ISO 10303-59, the worldwide automotive industry has made use of PDQ-S in ISO/PAS 26183, whilst the joint automotive and aerospace project, ISO 10303-242, will make use of the PDQ modules, which are a modular version of PDQ-S.

NOTE The first edition of ISO 10303-59, published in 2008, provides general specifications for the representation of quality criteria, quality measurement requirements, quality assessment specifications and quality inspection results for product data. These specifications are provided so that PDQ-S can be extended to deal with the quality of non-shape product data in the future. Extensions to externally conditioned data quality and geometric dimensioning and tolerance (GD&T) data quality, which are currently under development in the revision of ISO 10303-59, are examples of such extension. By focusing on three dimensional shape data, PDQ-S also provides detailed specifications for the representation of shape data quality criteria, together with associated measurement requirements, shape data quality assessment specifications and detailed results of shape data quality inspections.

PDQ-S is applicable to any International Standard dealing with product data. In order to further extend its usage, this part of ISO 8000 provides the necessary background knowledge to enable the effective use of PDQ-S in various circumstances.

Clause 4 provides a condensed description of PDQ-S.

Clause 5 facilitates the use of PDQ-S.

Clause 6 focuses on ensuring conformance with PDQ-S.

Data quality —
Part 311:
Guidance for the application of product data quality for shape (PDQ-S)

1. Scope

This part of ISO 8000 provides guidance for the application of product data quality for shape (PDQ-S), as described in ISO 10303-59.

The following are within the scope of this part of ISO 8000:

— purpose, approach and expected usage scenarios;

— the structure of PDQ-S;

— PDQ-S schema structure;

— target shape model;

— the relationship between ISO 10303-59 and other International Standards dealing with the nominal representation of product data;

— the major characteristics of PDQ-S;

— the relationship between product data quality problems and quality criteria in PDQ-S;

— some examples for selecting appropriate quality criteria;

— ensuring conformance with PDQ-S.

The following is outside the scope of this part of ISO 8000:

— guidance relating to the quality of product data other than shape data.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated reference, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10303-42, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resource: Geometric and topological representation*

ISO 10303-59, *Industrial automation systems and integration — Product data representation and exchange — Part 59: Integrated generic resource: Quality of product shape data*

ISO 8000-2, *Data quality — Part 2: Vocabulary*

3. Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8000-2 and the following apply.

3.1.1
application
group of one or more processes creating or using product data

[ISO 10303-1:1994, definition 3.2.2]

3.1.2
application protocol
AP
part of ISO 10303 that specifies an application interpreted model satisfying the scope and information requirements for a specific application

NOTE Adapted from ISO 10303-1:1994, definition 3.2.7

3.1.3
application reference model
ARM

information model that describes the information requirements and constraints of a specific application context

[ISO 10303-1: 1994, definition 3.2.8]

3.1.4
data exchange
storing, accessing, transferring and archiving of data

[ISO 10303-1:1994, definition 3.2.15]

3.1.5
product
thing or substance produced by a natural or artificial process

[ISO 10303-1:1994, definition 3.2.26]

3.1.6
product data
representation of information about a product in a formal manner suitable for communication, interpretation or processing by human beings or by computers

[ISO 10303-1:1994, definition 3.2.27]

3.1.7
accuracy
specification to control precision of approximate solution

NOTE The intended interpretation of the accuracy is that an approximate solution is acceptable if the difference between that approximate solution and any other approximate solution obtained by calculation with a finer distribution of sampling points is smaller than the given accuracy. There are two types of accuracy:
— general accuracy applied to all the measurement, and
— specific accuracy applied only to specified measurement.

3.1.8
inspection result
result of inspection which indicates whether, or not, the product shape data inspected contains quality defects

NOTE Such results can also include detailed information on what type of quality defects exist, and how serious the defect is, together with the shape element data where the problem is detected.

3.1.9
measurement requirement

textual description of how a criterion is measured, including any necessary additional attributes and rules to control the test and the element or elements to be tested, and which plays the role of an external specification for reliable measurement algorithm

NOTE It is important to take care that the measurement requirement does not provide an algorithm for the measurement process, since it is understood that algorithm development is a competitive arena for engineering system vendors and cannot be standardized by an International Standard.

3.1.10
product data quality
consistency, completeness, and suitability for its purpose of the product data

[ISO 10303-59:2008, definition 3.5.2]

3.1.11
product shape data
data representing product shape with geometric and topological information in accordance with ISO 10303-42

[ISO 10303-59:2008, definition 3.5.4]

3.1.12
quality criterion
criterion for evaluating product data quality

3.1.13
threshold
allowance used for the assessment of shape data quality by numerical test

NOTE An example of a typical threshold is distance threshold for evaluating the gap between a base surface and bounding curves for trimming the effective portion of the surface. That distance threshold implies that if the maximum distance between the surface and the curves is greater than or equal to the specified minimum value, then the gap is understood as a quality defect.

3.1.14
inspection
conformity evaluation by observation and judgement accompanied as appropriate by measurement, testing or gauging

[ISO 9000:2005, definition 3.8.2]

3.1.15
quality
degree to which a set of inherent characteristics fulfils requirements

NOTE 1 The term "quality" can be used with adjectives such as poor, good or excellent.

NOTE 2 "Inherent" as opposed to "assigned" means existing in something, especially as a permanent characteristic.

[ISO 9000:2005, definition 3.1.1]

3.1.16
quality requirement
need or expectation that is stated, generally implied or obligatory
NOTE Adapted from ISO 9000:2005, definition 3.1.2.

3.2 Abbreviated terms

AP application protocol

ARM application reference model

AM application module

B-rep boundary representation

IR integrated resource (of ISO 10303)

PDQ-S product data quality for shape (as described in ISO 10303-59)

4. Overview of PDQ-S

4.1 Purpose, approach and expected usage scenarios

The purpose of PDQ-S, as described in ISO 10303-59, is to eliminate inadequate quality product data which is a major reason for rework and repair of data by the data receiver. The approach of PDQ-S is to enumerate concrete measures for eliminating inadequate quality product data.
Amongst the expected scenarios for the use of PDQ-S are as follows.

— **Requirement of quality:** The company placing an order requires the company receiving the order to create product data that satisfies prescribed quality requirements. Examples are exclusion of infinitesimal geometry smaller than the given tolerance and exclusion of redundant geometry not contributing to the representation of product shape. Very limited information, namely relevant criteria together with required thresholds from those provided in PDQ-S, is necessary in this scenario. The information is transferred together with the order.

— **Declaration of quality:** The creator of a product data uses quality information for explicitly declaring the quality level satisfied by the product model. Depending on the design method and the CAD system used, the quality of the product data can be unambiguously declared without any inspection. Selective criteria and thresholds for which the model is judged to be free from quality defects are required information in this scenario. The quality information is transferred together with the corresponding product model data.

— **Assurance of quality:** A quality assurance organization uses quality information for representing the results of quality inspection for a particular product model. This scenario will require inspected quality criteria together with thresholds used, measurement requirements deployed and inspection results obtained. The accuracies used can also be included. The information is transferred together with the corresponding product model data.

— **Quality information for use in quality improvement:** If a quality defect is detected by quality inspection, necessary actions for improving critical data will be required. For that purpose, information on the nature and severity of any quality defects is provided. Therefore, this scenario will require a detailed inspection result report at the level of geometric entity instances. The information is transferred together with the corresponding product model data.

— **Long-term archiving of product data:** It is desirable that a detailed record of product model data quality is archived with product data. The data requirement for this purpose is similar to that needed for assurance of quality.

4.2 Structure of ISO 10303-59

Terminology specific to ISO 10303-59:2008 is described in Clause 3. The main body of ISO 10303-59 contains the following schemas:

— Clause 4: Product data quality definition schema;
— Clause 5: Product data quality criteria schema;
— Clause 6: Product data quality inspection result schema;
— Clause 7: Shape data quality criteria schema;
— Clause 8: Shape data quality inspection result schema.

Appendices include EXPRESS-G diagrams, graphical notation of EXPRESS schemas to ease understanding of structure and relationships of entity data types, technical discussion that summarizes

basic understanding of standard developers on key technical issues, expected usage scenarios and some examples in entity instance level.

4.3 PDQ-S schema structure

PDQ-S consists of five mutually related schemas. Each schema is a collection concepts, functions and entities.

Product data quality definition schema defines high-level data elements for managing product data quality information.

Product data quality criteria schema provides general specifications for the representation of quality criteria, quality measurement requirements and quality assessment specifications for product data.

Product data quality inspection result schema provides general specifications for the representation of quality inspection results for a particular product data.

Shape data quality criteria schema provides representations of shape data quality criteria together with corresponding measurement requirements, thresholds for judging the existence or absence of quality defects and assessment specifications for product shape data.

Shape data quality inspection result schema provides representations of quality inspection results for a particular product shape data with regard to specified quality criteria. Detailed information on what type of quality defect is existing, and how serious the defect is, together with the shape element data where the problem is detected can also be represented.

These schemas are related as depicted in Figure 1 where the number in each block indicates the relevant clause number in ISO 10303-59:2008. The product data quality definition schema plays the role of a root node for a set of quality information. The shape data quality criteria schema is a specialization of the product data quality criteria schema to three dimensional shape data. In the same way, the shape data quality inspection result schema is a specialization of the product data quality inspection result schema to three dimensional shape data.