INTERNATIONAL STANDARD

ISO 13399-1

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Cutting tool data representation and exchange —

Part 1: Overview, fundamental principles and general information model

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Représentation et échange des données relatives aux outils coupants —

Partie 1: Vue d'ensemble, principes fondamentaux et modèle général d'informations

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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 13399-1 was prepared by Technical Committee ISO/TC 29, *Small tools*.

ISO 13399 consists of the following parts, under the general title *Cutting tool data representation and exchange*:

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— *Part 1: Overview, fundamental principles and general information model*

— *Part 2: Reference dictionary for the cutting items* [Technical Specification]

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— *Part 100: Definitions, principles and methods for reference dictionaries* [Technical Specification]

The following parts are under preparation:

— *Part 3: Reference dictionary for the tool items* [Technical Specification]

— *Part 4: Reference dictionary of terms for adaptive items* [Technical Specification]

— *Part 50: Reference dictionary for reference systems and common concepts* [Technical Specification]

— *Part 60: Reference dictionary for connection systems* [Technical Specification]

Assembly items is to form the subject of a future Part 5.

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Introduction

ISO 13399 provides the means to achieve an electronic representation of cutting tool data by providing the information structure needed to describe various data about cutting tools and cutting tool assemblies. It is intended to facilitate the use, manipulation and exchange of cutting tool data within and between manufacturing, distribution, and usage.

A cutting tool with defined cutting edges is used on a machine tool to remove workpiece material through a shearing action at the cutting edge(s) of the tool. Cutting tool data are characteristics of the cutting tool and its use that must be known and evaluated in order to make manufacturing decisions and to perform manufacturing operations.

ISO 13399 includes the data representation of everything between the workpiece and the machine tool. Information about inserts, solid tools (e.g. solid drill and solid endmill), assembled tools (e.g. boring bars, indexable drills and indexable milling cutters), adaptors (e.g. milling arbor and chucks), components (e.g. shims, screws and clamps) or any combination of the above can be exchanged.

The cutting tool data described include, but are not limited to, geometrical and dimensional data, identification and designation data, miscellaneous and spare part data, cutting material data, and component connectivity.

The use of the tool information model established by ISO 13399 will provide increased productivity for the user in the same way as do the tools. The effective management of tool information will improve the management of the tools themselves. Use of the tool information model will enable the identification of the “right” tool in every operation — from tool purchase, through planning, set-up in machine-tools, maintenance and reuse of the tools — with short lead times and with high reliability and product quality. Tool users will benefit from improved support from the tool vendors who will be able to provide a standard information product to accompany the tool products. Computer interfaces for information exchange will be more efficient.

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The representation of product data is defined by ISO 10303, which specifies the computer-interpretable representation of product information and the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving (ISO 10303-1).

This part of ISO 13399 uses the following resources according to ISO 10303:

a) the EXPRESS language defined in ISO 10303-11;

b) the file format for data exchange defined in ISO 10303-21 and ISO 10303-28;

c) the integrated resources given in parts ISO 10303-40 to ISO 10303-56.

ISO 13399 is intended for use by manufacturers, tool vendors or producers, and developers of manufacturing software, among others. It provides a common structure for exchanging data about cutting tools (see Figure 1), and is intended to allow or improve several capabilities, including

— provision of a common set of definitions for use in describing cutting tools and cutting tool assemblies,

— the integration and sharing of cutting tool and assembly data between software applications,

— direct import of vendor cutting tool data into customer databases or applications, and

— a reduction in the level of effort required for manufacturers to maintain accurate and current cutting tool information from multiple sources and for multiple applications.

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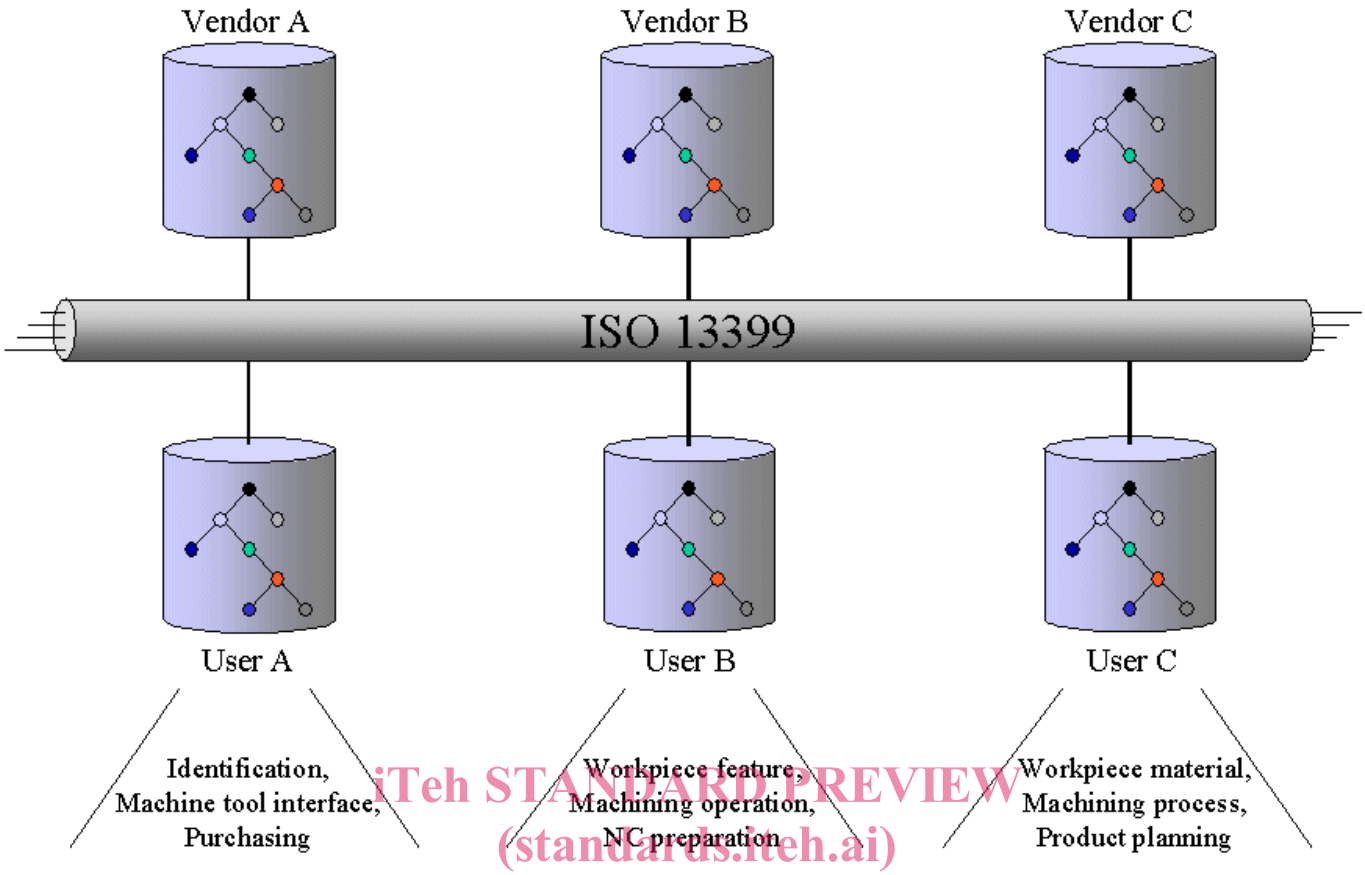

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Figure 1 — Role of ISO 13399 in communication of cutting tool data and potential user viewpoints

While the use of ISO 13399 can facilitate the creation of an electronic catalogue, it does not set forth the rules or procedures for creating electronic catalogues. These are defined in ISO 13584.

The responsibility for providing different viewpoints lies outside the scope of ISO 13399. Viewpoints might be the material to be cut, the shape to be produced, the application for which the tool will be used or any other valid viewpoint.

NOTE Use of the modelled information for different purposes can be regarded as different viewpoints of the information. Although ISO 13399 does not provide the viewpoints, the information may be viewed from several alternative viewpoints (see Figure 1).

Different companies use different business models to determine their need for the communication of information about their products. For example, one cutting tool manufacturer could regrind its customers' tools while another could allow its customers to do the regrinding and provide the information to enable them to do so. Therefore, the two cutting tool manufacturers could have a different set of cutting tool properties to communicate using the information model and dictionaries provided by ISO 13399.

ISO 13399 defines only that information which could be communicated; it not specify what information must be communicated.

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Cutting tool data representation and exchange —

Part 1: Overview, fundamental principles and general information model

1 Scope

This part of ISO 13399 covers the main categories of cutting tool data and the relationships between them. It provides a general information model of data representation and information exchange for these categories, as well as an overview of the principles of product data exchange used in ISO 13399 as a whole, a description of the other parts of ISO 13399 and a method for transferring cutting tool data.

The following is not covered by this part of ISO 13399:

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— general data transfer and representations other than cutting tool data;

— data describing rules, guidelines and expert knowledge used to design and manufacture machined parts and cutting tools;

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— data describing why a particular design or manufacturing decision was made.

Cutting tool data and exchange for specific items (cutting, tool, adaptive and assembly items) and the classification and definition of terms used in the description of cutting tools are defined in the other parts of ISO 13399, respectively, and referenced by them.

ISO 13399 establishes a means of communicating industrial data between different computer systems that is independent of any proprietary system.

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 639-2, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ISO 3002-1, *Basic quantities in cutting and grinding — Part 1: Geometry of the active part of cutting tools — General terms, reference systems, tool and working angles, chip breakers*

ISO 3002-3, *Basic quantities in cutting and grinding — Part 3: Geometric and kinematic quantities in cutting*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

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ISO 10303-41, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support*

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

ISO 10303-43, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures*

ISO 10303-44, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resource: Product structure configuration*

ISO 10303-45, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resource: Materials*

ISO 10303-46, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation*

ISO 10303-47, *Industrial automation systems and integration — Product data representation and exchange — Part 47: Integrated generic resource: Shape variation tolerances*

ISO/DIS 10303-56, *Industrial automation systems and integration — Product data representation and exchange — Part 56: Integrated generic resource: State*

ISO 10303-214, *Industrial automation systems and integration — Product data representation and exchange — Part 214: Application protocol: Core data for automotive mechanical design processes*

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ISO 13584-26, *Industrial automation systems and integration — Parts library — Part 26: Logical resource: Information supplier identification*

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ISO 13584-42, *Industrial automation systems and integration — Parts library — Part 42: Description methodology: Methodology for structuring part families*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13399-100 and the following apply.

3.1
cutting tool
device or assembly of items for removing material from a workpiece through a shearing action at the defined cutting edge or edges of the device

NOTE A cutting tool could be the assembly of one or more adaptive items, a tool item and several cutting items on a tool item. See Figure 3.

3.2
information model
formal model of a bounded set of facts, concepts, or instructions to meet a specified requirement

NOTE See Reference [3].

NOTE "An information model is a formal description of types of ideas, facts and processes which together form a model of a portion of interest of the real world and which provides an *explicit set of interpretation rules*. (If an information model is written in EXPRESS or any other computer-sensible representation, it has the additional quality of being computer processible.)"[9].

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4 Fundamental concepts and assumptions

ISO 13399 does not standardize cutting tools but the representation of information about cutting tools. Any standard dealing with information representation must be designed with the intent to standardize the *description* of the items that the standard deals with and not to standardize the items themselves. This method is also a step towards having standards that are not made obsolete by developments within the area where the standard applies [10].

The intent of ISO 13399 is achieved by means of a computer-processable information model that defines the framework within which data values can be placed. The benefits of such an information model are that it can be interpreted by different computer applications and be generic enough to describe many different kinds of tools. The aim of ISO 13399 is to allow for the different tools and machining operations that can be expected in the future, while meeting the needs of current types of tool and their uses. It should also be possible to describe a tool independently of its use, since the combination of modern tools and machines may allow a tool to be used for many different kinds of cutting operation.

ISO 13399 specifies the representation of information on

— cutting tools,

— cutting items,

— tool items,

— adaptive items, and

— assembly items.

See Figure 2.

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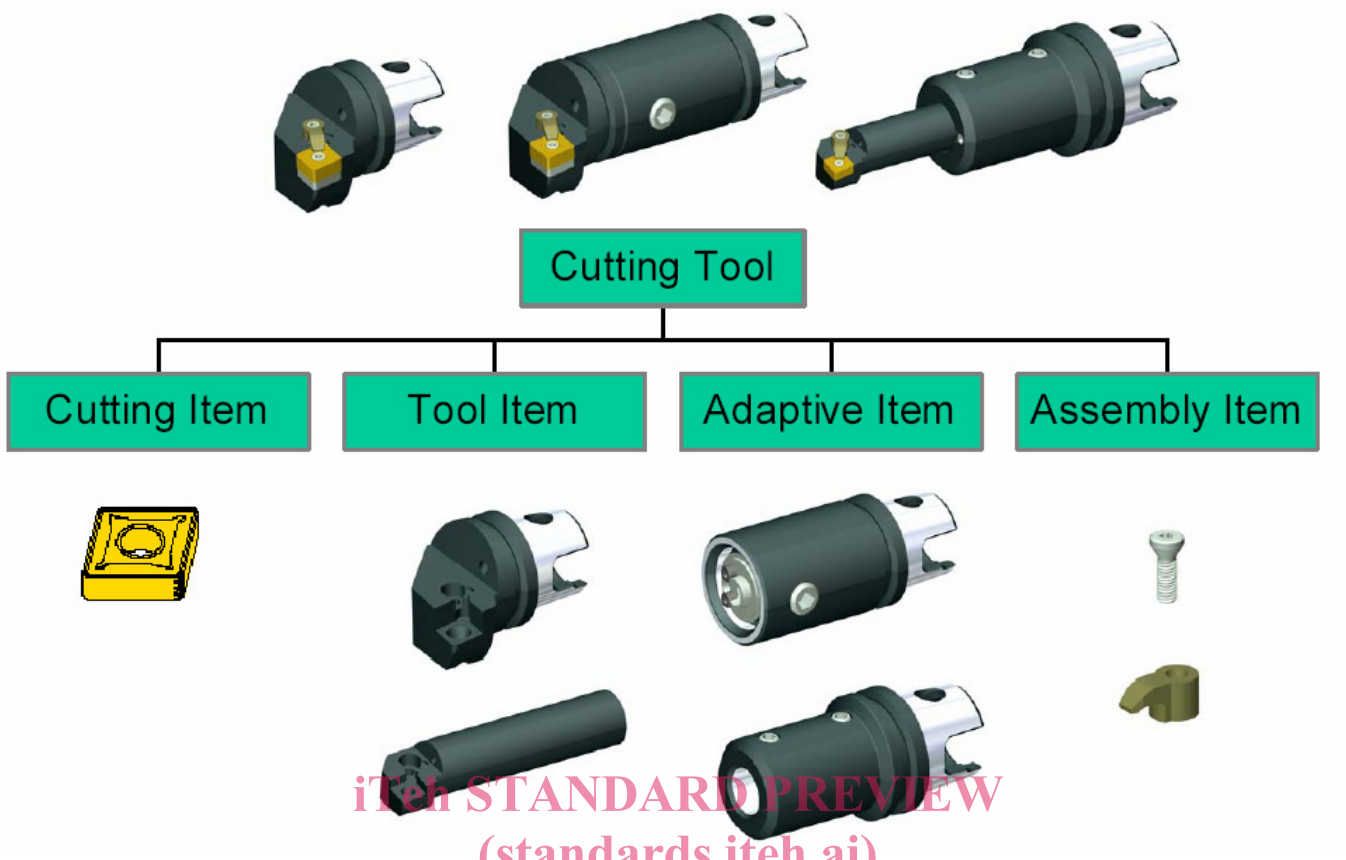

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Figure 2 — Examples of the main groups

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The definitions of these groups are given in their respective parts of ISO 13399. Different combinations of these groups are shown in Figure 3.

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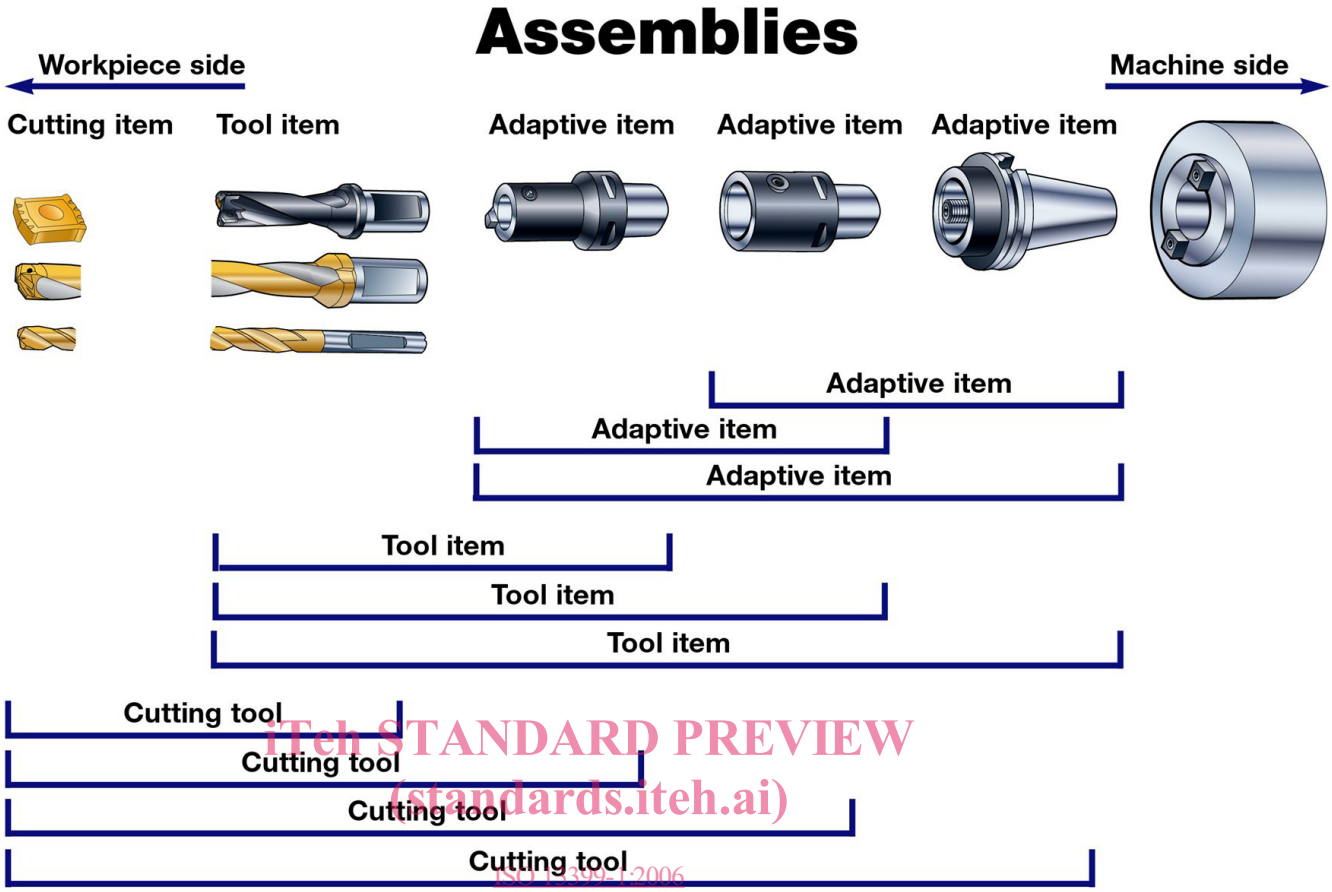

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Figure 3 — Examples of different types of assemblies of items

The allowed relationships between these groups are shown in Table 1.

Table 1 — Matrix of Combinations

		Machine side		
		Tool item	Adaptive item	Assembly item
Workpiece side	Cutting item	X		X
	Tool item	X	X	X
	Adaptive item		X	X
	Assembly item	X	X	X

ISO 13399 does not deal with how to construct a cutting tool item, but provides an information representation for cutting tools. Tools may be classified according to any scheme, and viewed from many viewpoints.

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5 Information requirements

5.1 Units of Functionality

5.1.1 classification

This unit of functionality provides the capability to classify items into specific categories.

EXAMPLE Examples are the classification as raw materials, parts, or tools, or as safety or in-process items.

Additionally items may be classified by their attributes.

EXAMPLE Examples for categories of attribute based classification are screws, bolts, nuts, shafts, or brackets.

The following application objects are used by the classification UoF:

- classification_association
- classification_association_relationship
- classification_attribute
- classification_system
- din4000_reference
- external_library_reference
- general_classification
- general_classification_hierarchy
- plib_class_reference
- plib_property_reference
- specific_item_classification
- specific_item_classification_hierarchy

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5.1.2 dimension_tolerance

This unit of functionality specifies the representation of geometric dimensions and of tolerances limiting geometric dimensions. Tolerances for geometric dimensions are characterized by plus-minus-tolerances, limits and fits, dimension ranges, or dimension limits and describe the allowable deviation range.

The following application objects are used by the dimension_tolerance UoF:

- limits_and_fits
- plus_minus_bounds
- value_limitation

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5.1.3 effectivity

This unit of functionality provides the capability to represent information concerning the validity of data. Implicit propagation of data specifying validity is not available.

The validity of data can be expressed by effectivities that specify time ranges within which data may be used.

The following application objects are used by the effectivity UoF:

— duration

— effectivity

— effectivity_assignment

— effectivity_relationship

5.1.4 external_reference_mechanism

This unit of functionality provides a reference mechanism to specify external documents that are associated with objects defined in this part of ISO 13399. These documents may contain data that are not in scope of this part of ISO 13399. This includes conventional non-digital data and digital data in other computer interpretable formats.

EXAMPLE Technical drawings on paper, standards documents, or hand-written documents, are examples of non-digital data referenced by the external reference mechanism.

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EXAMPLE CAD data in a system's native format, text documents in SGML, or NC-data in ISO 6983 are examples of digital data referenced by the external reference mechanism.

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The following application objects are used by the external_reference_mechanism UoF:

— cartesian_coordinate_space

— cartesian_coordinate_space_2d

— cartesian_coordinate_space_3d

— digital_document

— digital_file

— document

— document_assignment

— document_content_property

— document_creation_property

— document_file

— document_format_property

— document_location_property

— document_representation

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