TECHNICAL SPECIFICATION

ISO/TS 13399-2

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Cutting tool data representation and exchange —

Part 2:
Reference dictionary for the cutting items

Représentation et échange des données relatives aux outils coupants —

Partie 2: Dictionnaire de référence pour les éléments coupants

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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.

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 document:

— 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 casting 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 after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

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

— *Part 2: Reference dictionary for the cutting items*

— *Part 3: Reference dictionary of terms for tools*

— *Part 4: Reference dictionary of terms for attachments*

— *Part 5: Reference dictionary of terms for accessories*

— *Part 100: Definitions, principles and methods for reference dictionaries*

Introduction

This Technical Specification defines the terms, properties and definitions for those portions of a cutting tool that remove material from a workpiece. Cutting items include: replaceable inserts, brazed tips and the cutting portions of solid cutting tools. The purpose of ISO/TS 13399-2 is to provide a reference dictionary to support the use of the general information model defined in ISO 13399-1.

A cutting tool is used in a machine to remove material from a workpiece by a shearing action at the cutting edges of the tool. Cutting tool data that can be described by ISO 13399 include, but are not limited to, everything between the workpiece and the machine tool. Information about inserts (e.g. regular and irregular shaped replaceable cutting items), 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 drilling chuck), components (e.g. shims, screws and clamps) and their relationships can be represented by this standard. Possible assemblies of the components of a cutting tool are illustrated in Figure 1.

The objective of ISO 13399 is to provide the means to represent the information that describes cutting tools in a computer-sensible form that is independent from any particular computer system. The representation will facilitate the processing and exchange of cutting tool data within and between different software systems and computer platforms and support the application of these data in manufacturing planning, cutting operations and the supply of tools. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and for archiving. The methods that are used for these representations are those developed by ISO TC184/SC4 for the representation of product data by using standardized information models and reference dictionaries.

An information model is a formal specification of types of ideas, facts and processes which together describe a portion of interest of the real world and which provides an explicit set of interpretation rules. Information is knowledge of ideas, facts and/or processes. Data are symbols or functions that represent information for processing purposes. Data are interpreted to extract information by using rules for how that should be done and a dictionary to define the terms that identify the data. Everyone in a communication process must use the same information model, the same set of explicit rules and the same dictionary in order to avoid misunderstanding. If an information model and its dictionary are written in a computer-sensible language then there is the additional benefit that they can be computer-processable [1].

An engineering information model is therefore a specification for data that establishes the meaning of those data in a particular engineering context. A model has to be developed by formal methods to ensure that it meets the needs of the situation that it represents. An engineering information model defines the information objects that represent the concepts in an engineering application, the attributes of the objects and their relationships and the constraints that add further meaning. An information model is an abstract concept that can be used repeatedly for any example of the real-world situation that it represents. An instance of the model is produced when it is populated with the data items and their values that are applicable to a particular example of that situation.

ISO 13399 uses the following standards developed by ISO TC184/SC4:

— the EXPRESS language defined in ISO 10303-11 for defining the information model;

— the file format for data exchange derived from the model and defined in ISO 10303-21;

— the data dictionary defined in ISO 13584.

ISO 13399 is intended for use by, among others, tool producers and vendors, and manufacturers and developers of manufacturing software. ISO 13399 provides a common structure for exchanging data about cutting tools. The standard is intended to provide for, or improve, several manufacturing activities, including:

— the integration and sharing of data for cutting tools and assemblies between different stages of the manufacturing cycle and between different software applications;

— the direct import of data from cutting tool suppliers into customer's databases;

— the management of cutting tool information from multiple sources and for multiple applications.
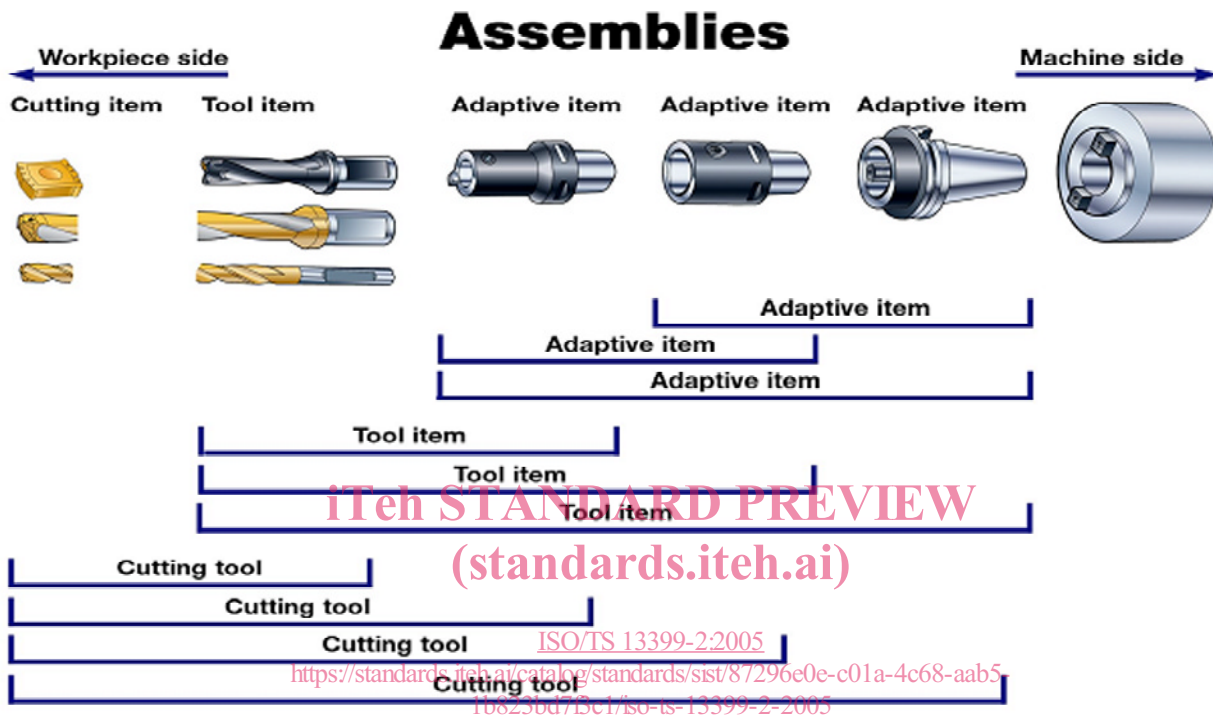

Figure 1 — Possible assemblies of components of a cutting tool

Cutting tool data representation and exchange —

Part 2:
Reference dictionary for the cutting items

1 Scope

This Technical Specification specifies a reference dictionary for cutting items, together with their descriptive properties and domains of values, for use in cutting tool data representation. The reference dictionary contains

— definitions and identifications of the classes of cutting items and their features, with an associated classification scheme,

— definitions and identifications of the data element types that represent the properties of cutting items and their features, and

— definitions and identifications of domains of values for describing those data element types.

Each class, property or domain of values of this application domain constitutes an entry of the reference dictionary defined in this Technical Specification. It is associated with a computer-sensible and human-readable definition, and with a computer-sensible identification. Identification of a dictionary entry allows unambiguous reference to it from any application that implements the information model defined in ISO 13399-1.

Definitions and identifications of dictionary entries are defined by means of standard data that consist of instances of the EXPRESS entity data types defined in the common dictionary schema, resulting from a joint effort between ISO TC184/SC4/WG2 and IEC SC3D, and in its extensions defined in ISO 13584-24 and ISO 13584-25.

The following are within the scope of this Technical Specification:

— standard data that represent the various classes of cutting items and cutting item features;

— standard data that represent the various properties of cutting items and cutting item features;

— standard data that represent domains of values used for properties of cutting items and cutting item features;

— definitions of reference systems for cutting items and their properties;

— one implementation method by which the standard data defined may be exchanged.

NOTE 1   The implementation method by which the standard data defined in this Technical Specification may be exchanged is given in ISO 10303-21.

The following are outside its scope:

— applications where these standard data may be stored or referenced;

— implementation methods other than the one defined by which the standard data may be exchanged and referenced;

— information model for cutting tools;

— definitions of classes and properties for tool items;

— definitions of classes and properties for adaptive items;

— definitions of classes and properties for assembly items and auxiliary items.

NOTE 2   The information model for cutting tools is defined in ISO 13399-1.

NOTE 3   The definitions of classes and properties for tool items, adaptive items, assembly items and auxiliary items are provided in ISO/TS 13399-3, 4 and 5 respectively.

NOTE 4   Terms and definitions used in the compilation of this reference dictionary are provided in Clause 3. The main collection of the terms and their definitions in the reference dictionary is provided in Annexes B to D. Terms used to define the structure and contents of the dictionary are specified in ISO/TS 13399-100.

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 1832, *Indexable inserts for cutting tools — Designation*

ISO 3002-1:1982, *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 3002-3:1984, *Basic quantities in cutting and grinding — Part 3: Geometric and kinematic quantities in cutting*

ISO 3365:1985, *Indexable hardmetal (carbide) inserts with wiper edges, without fixing hole — Dimensions*

ISO 5608:1995, *Turning and copying tool holders and cartridges for indexable inserts — Designation*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*

ISO 13399-1[1]), *Cutting tool data representation and exchange — Part 1: Overview, fundamental principles and general information model*

ISO/TS 13399-100[1]), *Cutting tool data representation and exchange — Part 100: Definitions, principles and methods for reference dictionaries*

ISO 13584-1:2000, *Industrial automation systems and integration — Parts library — Part 1: Overview and fundamental principles*

ISO 13584-24:2003, *Industrial automation systems and integration — Parts library — Part 24: Logical resource: Logical model of a supplier library*

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1) To be published.

ISO 13584-25:2004, *Industrial automation systems and integration — Parts library — Part 25: Logical resource: Logical model of supplier library with aggregate values and explicit content*

ISO 13584-42:1998, *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 10303-1, ISO 10303-11, ISO 13584-1, ISO 13584-42, ISO 13584-24 and the following apply.

3.1
applicable property
property that is defined for some family of items and that shall apply to any member of this family

[ISO 13584-24:2002]

3.2
basic semantic unit
BSU
entity that provides an absolute and universal identification of classes and data element types in an application domain

[ISO 13584-42:1998]

3.3
chip
material removed from a workpiece by a cutting process

3.4
cutting tool
assembly of items able to perform a cutting operation

See Figure 1.

NOTE   A cutting tool could be the assembly of several cutting items on a tool item.

3.5
data
representation of facts, concepts or instructions in a formal manner suitable for communication, interpretation or processing by human beings or computers

[ISO 10303-1:1994]

3.6
data element type
DET
unit of data for which the identification, description and value representation have been specified

[ISO 13584-42:1998]

3.7
data exchange
storing, accessing, transferring and archiving of data

[ISO 10303-1:1994]

3.8
data type
domain of values

[ISO 10303-11:1994]

3.9
dictionary
structured set of entries with one and only one meaning corresponding to each entry and one and only one entry identifying a single meaning

NOTE   In ISO 13399, a dictionary is a formal and computer-sensible representation of an ontology.

3.10
entity
class of information defined by its attributes that establishes a domain of values defined by common attributes and constraints

3.11
entity data type
representation of an entity

3.12
entity instance
named unit of data that represents a unit of information within the class defined by an entity and it is a member of the domain established by an entity data type

3.13
family of items
simple or generic family of items

[ISO 13584-42:1998]

3.14
generic family of items
grouping of simple or generic families of items for the purpose of classification or for associating common information

[ISO 13584-42:1998]

3.15
implementation method
means for computers to exchange data

3.16
information
facts, concepts or instructions

[ISO 10303-1:1994]

3.17
information model
formal description of a bounded set of information to meet a specific requirement

[ISO 10303-1:1994]

3.18
irregular insert
replaceable cutting item that cannot be described by a regular geometric shape

3.19
machined surface
surface produced by the action of a cutting tool

[ISO 3002-1:1982]

3.20
ontology
explicit and consensual specification of concepts of an application domain independent of any use of these concepts

NOTE   In ISO 13399 a dictionary is the formal and computer-sensible representation of an ontology.

3.21
property
information that may be represented by a data element type

[ISO 13584-42:1998]

3.22
regular insert
replaceable cutting item that can be described by a regular geometric shape

3.23
simple family of items
set of items in which each item may be described by the same group of properties

[ISO 13584-42:1998]

3.24
transient surface
part of the surface which is formed on the workpiece by the cutting operation and is removed during the following cutting action either during the following revolution of the tool or the workpiece or by the following cutting edge

[ISO 3002-1:1982]

3.25
visible property
property that is defined for some family of items that may or may not be applicable to the different members of the family

[ISO 13584-42:1998]

3.26
workpiece
object on which a cutting action is performed

3.27
work surface
surface that is to be removed on the workpiece

[ISO 3002-1:1982]

4 Representation of the ontological concepts as dictionary entries

4.1 General

A concept in the ontology is identified by a name in lower-case characters. The name of a class that represents the concept in the dictionary is identified by bold, lower-case letters with multiple words joined by an underscore character.

For example, "cutting item type" is the name of a concept in the ontology, while **cutting_item_type** is the identifier of the class in the dictionary that represents the concept.

Cutting items are represented by two main classes: **cutting_item_feature**, **cutting_item_type**. The structure of the classification is provided in Annex B. The definitions of the cutting item classes are provided in Annex C.

4.2 Cutting_item_feature

4.2.1 General

Characteristic of a cutting item that cannot exist independently of the cutting item.

cutting_item_feature has the following subclasses:

— **chip_breaker;**

— **cutting_corner;**

— **cutting_edge;**

— **cutting_item_coating;**

— **cutting_item_material;**

— **cutting_item_profile;**

— **fixing_hole;**

— **flank;**

— **gauge_circle;**

— **inscribed_circle.**

4.2.2 chip_breaker

Modification of the face of a cutting item to control or break the chip.

4.2.3 cutting_corner

Transition between two cutting edges.

cutting_corner has the following subclasses:

— **chamfered_corner;**

— **rounded_corner.**

4.2.4 cutting_edge

Junction between two surfaces that performs the cutting operation.

cutting_edge has the following subclasses:

— **cutting_edge_conditioned;**

— **cutting_edge_interrupted;**

— **cutting_edge_major;**

— **cutting_edge_minor;**

— **wiper_edge.**

4.2.5 cutting_item_coating

Additional material deposited on the surface of a cutting item.

NOTE   A cutting item coating can consist of layers of several materials.

4.2.6 cutting_item_material

Substance from which a cutting item is made.

4.2.7 cutting_item_profile

Shape traced out by the cutting edges of a cutting item.

cutting_item_profile has the following subclasses:

— **ball_nosed_profile;**

— **drilling_profile;**

— **grooving_parting_profile;**

— **threading_profile.**

4.2.8 fixing_hole

Hole through the body of a replaceable cutting item that is used for attaching the cutting item to a tool item.

4.2.9 flank

Surface or surfaces of a cutting item which pass over the transient surface on the workpiece.

flank has the following subclasses:

— **flank_major;**

— **flank_minor;**

— **flank_wiper_edge.**

4.2.10 gauge_circle

Circle established by a measurement device on a cutting item that does not have an inscribed circle (see 4.2.11).

4.2.11 inscribed_circle

Circle to which all edges of an equilateral and round regular insert are tangential.

4.3 Cutting_item_type

4.3.1 General

cutting_item_type is a generic class of cutting items describable by their geometrical characteristics.

cutting_item_type has the following simple families of items as subclasses:

— **equilat_equiang;**

— **equilat_nonequiang;**

— **nonequilat_equiang;**

— **nonequilat_nonequiang;**

— **round_insert;**

— **specific_profile_insert.**

4.3.2 equilat_equiang

Type of cutting item of regular geometric shape with sides of equal length and equal included angles.

NOTE   The class contains inserts with the ISO shape codes: H, O, P, S and T.

equilat_equiang has the following items as subclasses:

— **hexagonal_insert;**

— **octagonal insert;**

— **pentagonal_insert;**

— **square_insert;**

— **triangular_insert.**

4.3.3 equilat_nonequiang

Type of cutting item of regular geometric shape with sides of equal length and non-equal included angles.

NOTE   The class contains inserts with the ISO shape codes: C, D, E,M and V for rhombic inserts and W for trigon inserts.

equilat_nonequiang has the following items as subclasses:

— **rhombic_insert;**

— **trigon_insert.**

4.3.4 nonequilat_equiang

Type of cutting item of regular geometric shape with sides of non-equal length and equal included angles.

NOTE   The class contains inserts with the ISO shape code: L.

nonequilat_equiang has the following item as a subclass:

— **rectangular_insert.**

4.3.5 nonequilat_nonequiang

Type of cutting item of regular geometric shape with sides of non-equal length and non-equal included angles.

NOTE   The class contains inserts with the ISO shape codes: A, B and K.

nonequilat_nonequiang has the following items as subclasses:

— **parallelogram_insert.**

4.3.6 round_insert

Type of cutting item with circular cutting edges.

NOTE   This class contains inserts with the ISO shape code: R.

4.3.7 specific_profile_insert

Type of cutting item that possesses a defined profile shape.

NOTE   A synonymous name is **irregular_insert.**

4.4 Reference systems for cutting items

4.4.1 General

Reference systems are geometrical coordinate axes with planes and locations on these axes that allow the definition of properties of cutting items and other components of a cutting tool. Reference systems are illustrated in Annex G.

NOTE   The convention for all the reference systems is the tool-in-hand system (see ISO 3002-1:1982).

The classes of reference systems for cutting items are:

— **coordinate_axis_system;**

— **irregular_insert_position;**

— **mirror_plane;**

— **regular_insert_position;**

— **xy_plane;**

— **xz_plane;**

— **yz_plane.**