# TECHNICAL SPECIFICATION

# ISO/TS 13399-2

# 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

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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).

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For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 29, *Small tools*.

This third edition cancels and replaces the second edition (ISO/TS 13399-2:2014), which has been technically revised.

The main change is as follows:

— update of the classes and properties in line with the modifications in the cutting tool dictionary.

A list of all parts in the ISO 13399 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

# Introduction

This document defines the terms, properties, and definitions for 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 this document is to provide a reference dictionary to support the use of the general information model defined in ISO 13399-1.

A cutting tool with defined cutting edges is used on 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 the ISO 13399 series 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 end mill), 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 the ISO 13399 series. The principles of the ISO 13399 series are given in Annex A; and possible assemblies of the components of a cutting tool are illustrated in Figure A.1.

The objective of the ISO 13399 series 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 facilitates the processing and exchange of cutting tool data within and between different software systems and computer platforms and supports the application of this 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 used for these representations are those developed by ISO/TC 184/SC 4 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 describes 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 is expected to 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.

An engineering information model is therefore a specification for data that establishes the meaning of that 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, 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.

This document uses the following International Standards developed by ISO/TC 184/SC 4:

— the EXPRESS language defined in ISO 10303-11 for defining the information model in ISO 13399-1;

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

— the data dictionary defined in the ISO 13584 series.

Each class, property, or domain of values of this application domain constitutes an entry of the reference dictionary defined in this document. 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/TC 184/SC 4 and IEC SC 3D, and in its extensions defined in ISO 13584-24 and ISO 13584-25.

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331dd544fefd/iso-ts-13399-2-2021

# Cutting tool data representation and exchange —

## Part 2:
## Reference dictionary for the cutting items

## 1 Scope

This document specifies a reference dictionary for cutting items, together with their descriptive properties and domains of values.

This document specifies a reference dictionary containing:

— 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;

— definitions and identifications of domains of values for describing the above-mentioned data element types.

The following are within the scope of this document:

— 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 in this document can be exchanged.

NOTE 1    The implementation method by which the standard data defined in this document can be exchanged is specified in ISO 10303-21.

The following are outside the scope of this document:

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

— implementation methods other than the one defined in this document by which the standard data can 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, ISO/TS 13399-4, and ISO/TS 13399-5, respectively.

## 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/TS 13399-100, *Cutting tool data representation and exchange — Part 100: Definitions, principles and methods for reference dictionaries*

## 3   Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1**
**applicable property**
*property* (3.17) that is defined for some family of items and that applies to any member of this family

[SOURCE: ISO 13584-24:2003, 3.3, modified — "family of parts" has been replaced by "family of items"; "shall apply" has been replaced by "applies"; "any part" has been replaced by "any member"; the EXAMPLE has been removed.]

**3.2**
**basic semantic unit**
*entity* (3.10) that provides an absolute and universally unique identification of a certain object of the application domain that is represented as a *dictionary* (3.9) element

[SOURCE: ISO 13584-42:2010, 3.4, modified — The 3 EXAMPLEs and note 1 to entry have been removed.]

**3.3**
**chip**
material removed from a *workpiece* (3.21) by a cutting process

**3.4**
**cutting tool**
device or assembly of items for removing material from a *workpiece* (3.21) through a shearing action at the defined cutting edge or edges of the device

Note 1 to entry: A cutting tool can be the assembly of one or more adaptive items, a tool item, and several cutting items on a tool item. See Figure A.1.

[SOURCE: ISO 13399-1:2006, 3.1]

**3.5**
**data**
representation of *information* (3.13) in a formal manner suitable for communication, interpretation, or processing by human beings or computers

[SOURCE: ISO 10303-1:2021, 3.1.29]

**3.6**
**data element type**
unit of *data* (3.5) for which the identification, description, and value representation have been specified

[SOURCE: ISO 13584-42:2010, 3.13, modified — Note 1 to entry has been removed.]

**3.7**
**data exchange**
storing, accessing, transferring, and archiving of *data* (3.5)

[SOURCE: ISO 10303-1:2021, 3.1.31]

**3.8**
**data type**
domain of values

[SOURCE: ISO 10303-11:2004, 3.3.5]

**3.9**
**dictionary**
table consisting of a series of entries with one meaning corresponding to each entry in the dictionary and one dictionary entry identifying a single meaning

Note 1 to entry: In the ISO 13399 series, a dictionary is a formal and computer-sensible representation of an *ontology* (3.16).

[SOURCE: ISO 13584-511:2006, 3.1.9, modified — The original notes 1 to 3 to entry have been replaced by a new note 1 to entry.]

**3.10**
**entity**
class of *information* (3.13) defined by its attributes which establishes a domain of values defined by common attributes and constraints

**3.11**
**entity data type**
representation of an *entity* (3.10)

**3.12**
**implementation method**
means for computers to exchange *data* (3.5)

**3.13**
**information**
facts, concepts, or instructions

[SOURCE: ISO 10303-1:2021, 3.1.41]

**3.14**
**information model**
formal model of a bounded set of facts, concepts, or instructions to meet a specific requirement

**3.15**
**irregular insert**
replaceable cutting item that cannot be described by a regular geometric shape

**3.16**
**ontology**
explicit and consensual specification of concepts of an application domain independent of any use of these concepts

Note 1 to entry: In the ISO 13399 series, a *dictionary* (3.9) is the formal and computer-sensible representation of ontology.

[SOURCE: ISO 13584-511:2006, 3.1.20, modified — In note 1 to entry, the reference to "ISO 13584" has been replaced by "the ISO 13399 series".]

**3.17**
**property**
defined parameter suitable for the description and differentiation of products

[SOURCE: ISO 13584-42:2010, 3.37, modified — Notes 1 to 5 to entry have been removed.]

**3.18**
**regular insert**
replaceable cutting item that can be described by a regular geometric shape

**3.19**
**transient surface**
part of the surface which is formed on the *workpiece* (3.21) by the cutting edge and removed during the following cutting stroke, during the following revolution of the tool or workpiece, or by the following cutting edge

[SOURCE: ISO 3002-1:1982, 3.1.3]

**3.20**
**visible property**
*property* (3.17) that has a definition meaningful in the scope of a given characterization class, but that does not necessarily apply to the various products belonging to this class

[SOURCE: ISO 13584-42:2010, 3.46]

**3.21**
**workpiece**
object on which a cutting action is performed

**3.22**
**work surface**
surface on the *workpiece* (3.21) to be removed by machining

[SOURCE: ISO 3002-1:1982, 3.1.1]

# 4   Abbreviated terms

BSU        basic semantic unit

DET        data element type

# 5   Representation of the ontological concepts as dictionary entries

## 5.1   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 lower-case letters with multiple words joined by an underscore character.

EXAMPLE        "cutting item type" is the name of a concept in the ontology. "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 and cutting_item_type.

The ISO 13399 series shall follow the principles in Annex A. The structure of the classification is provided in Annex B. The definitions of the cutting item classes are provided in Annex C.

## 5.2 cutting_item_feature

### 5.2.1 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;

— regrinding;

— top_face.

### 5.2.2 chip_breaker

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

NOTE    A chip breaker is either an integral groove or an obstruction attached to the face.

### 5.2.3 cutting_corner

Transition between two cutting edges.

cutting_corner has the following subclasses:

— chamfered_corner;

— rounded_corner.

### 5.2.4 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.

### 5.2.5 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.

### 5.2.6 cutting_item_material

Substance from which a cutting item is made.

### 5.2.7 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.

### 5.2.8 fixing_hole

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

### 5.2.9 flank

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

flank has the following subclasses:

— flank_major;

— flank_minor;

— flank_wiper_edge.

### 5.2.10 gauge_circle

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

### 5.2.11 inscribed_circle

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

## 5.3 cutting_item_type

### 5.3.1 General

Family of items that can be held by a tool item or be part of a solid tool.

NOTE 1        The cutting item is the part of the cutting tool that is in contact with the workpiece during the cutting operation.

NOTE 2        The names of items in this class are not intended to refer to the use of the item in a particular cutting operation.

cutting_item_type has the following simple families of items as subclasses:

— drilling_insert;

— equilateral_equiangular;

— equilateral_nonequiangular;

— non_replaceable_cutting_item;

— nonequilateral_equiangular;

— nonequilateral_nonequiangular;

— reaming_insert;

— round_insert;

— specific_profile_insert.

### 5.3.2 equilateral_equiangular

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.

equilateral_equiangular has the following items as subclasses:

— hexagonal_insert;

— octagonal_insert;

— pentagonal_insert;

— square_insert;

— triangular_insert.

### 5.3.3 equilateral_nonequiangular

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.

equilateral_nonequiangular has the following items as subclasses:

— rhombic_insert;

— trigon_insert.

### 5.3.4 non_replaceable_cutting_item

Cutting item that is permanently fixed to, or part of, a tool item.

### 5.3.5 nonequilateral_equiangular

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.

nonequilateral_equiangular has the following item as a subclass: rectangular_insert.

### 5.3.6  nonequilateral_nonequiangular

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.

nonequilateral_nonequiangular has the following item as a subclass: parallelogram_insert.

### 5.3.7  round_insert

Type of cutting item with circular cutting edges.

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

### 5.3.8  specific_profile_insert

Type of cutting item that possesses a defined profile shape.

NOTE    A synonymous name is irregular_insert.

## 5.4  Reference systems for cutting items

### 5.4.1  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 (ISO 3002-1).

The classes of reference systems for cutting items are as follows:

— primary_coordinate_system;

— irregular_insert_position;

— mirror_plane;

— regular_insert_position;

— xy_plane;

— xz_plane;

— yz_plane.

### 5.4.2  primary_coordinate_system

The primary_coordinate_system is a right-handed, rectangular Cartesian system in three-dimensional space with three principal axes labelled X, Y, and Z.

### 5.4.3    irregular_insert_position

An irregular insert is located on the primary coordinate system in the XY quadrant with the cutting edges in the xy-plane, the cutting profile pointing in the negative Y direction, the forward extremity of the cutting profile on the positive x-axis, and the side extremity of the insert on the y-axis.

NOTE      The definition applies to right-hand inserts. The position of left-hand inserts is as mirrored through the yz-plane.

### 5.4.4    mirror_plane

The mirror_plane is the yz-plane in the primary coordinate system.

### 5.4.5    regular_insert_position

A regular insert is located on the primary coordinate system in the XY quadrant with the cutting edges on the xy-plane, the major cutting edge on the positive x-axis, and the theoretical sharp point of the insert on the y-axis.

NOTE 1      The definition applies to right-hand inserts. The position of left-hand inserts is as mirrored through the yz-plane.

NOTE 2      The positions of right-hand and left-hand regular inserts are illustrated in Figure G.12.

### 5.4.6    xy_plane

The xy_plane is the plane in the primary coordinate system that contains the X and Y axes with the normal of the plane in the positive Z direction.

### 5.4.7    xz_plane

The xz_plane is the plane in the primary coordinate system that contains the X and Z axes with the normal of the plane in the positive Y direction.

### 5.4.8    yz_plane

The yz_plane is the plane in the primary coordinate system that contains the Y and Z axes with the normal of the plane in the positive X direction.

## 6    Properties for cutting item features and cutting item types

The properties of cutting item types and cutting item features are defined in Annex D, where the association of a property with a class is specified. In the compilation of the dictionary, all properties are visible properties at the root class of the dictionary and are made applicable properties at the class level where they apply. The names of properties that can be applicable for cutting item features and cutting item types, with their identification codes (BSU), are shown in Table 1. The order of names in the table should be read in rows from left to right.

The ISYC pictures showing the properties for cutting item features and cutting item types are illustrated in Annex H.

NOTE      The BSU can be made unique by the addition of the supplier of the dictionary as a prefix to the identification code.

EXAMPLE      The unique BSU for chip_breaker_face_count would be: 0112/1///13399__2–71CE7A85CC4F9 for version two of the dictionary.