PD ISO/TS 13399-5:2014

BSI Standards Publication

Cutting tool data representation and exchange

Part 5: Reference dictionary for assembly items

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National foreword

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TECHNICAL SPECIFICATION

ISO/TS 13399-5

Second edition
2014-02-15

Cutting tool data representation and exchange —

Part 5: Reference dictionary for assembly items

Représentation et échange des données relatives aux outils coupants —

Partie 5: Dictionnaire de référence de termes pour les éléments d'assemblage

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 29, *Small tools*.

This second edition cancels and replaces the first edition (ISO/TS 13399-5:2007), which has been technically revised.

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

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

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

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

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

— *Part 5: Reference dictionary for accessory and auxiliary items* [Technical Specification]

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

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

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

— *Part 150: Usage guidelines* [Technical Specification]

— *Part 301: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of thread-cutting taps, thread-forming taps and thread-cutting dies* [Technical Specification]

— *Part 302: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of solid drills and countersinking tools* [Technical Specification]

The following parts are under preparation:

— *Part 51: Designation system for customer solution cutting tools*

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— *Part 80: Concept for the design of 3D models based on properties according to ISO 13399: Overview and principles* [Technical Specification]

— *Part 201: Concept for the design of 3D models based on properties according to ISO/TS 13399-2: Modelling of regular inserts* [Technical Specification]

— *Part 202: Concept for the design of 3D models based on properties according to ISO/TS 13399-2: Modelling of irregular inserts* [Technical Specification]

— *Part 203: Concept for the design of 3D models based on properties according to ISO/TS 13399-2: Modelling of exchangeable inserts for drilling* [Technical Specification]

— *Part 204: Concept for the design of 3D models based on properties according to ISO/TS 13399-2: Modelling of inserts for reaming* [Technical Specification]

— *Part 303: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of end mills with non-indexable cutting edges* [Technical Specification]

— *Part 304: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of milling cutters with arbor hole and non-indexable cutting edges* [Technical Specification]

— *Part 307: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of end mills for indexable inserts* [Technical Specification]

— *Part 308: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of milling cutter with arbor hole for indexable inserts* [Technical Specification]

— *Part 309: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Tool holders for indexable inserts* [Technical Specification]

— *Part 311: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of solid reamers* [Technical Specification]

— *Part 312: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of reamers for indexable inserts* [Technical Specification]

— *Part 401: Concept for the design of 3D models based on properties according to ISO/TS 13399-4: Modelling of converting, extending and reducing adaptive items* [Technical Specification]

— *Part 405: Concept for the design of 3D models based on properties according to ISO/TS 13399-4: Modelling of collets* [Technical Specification]

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Introduction

This part of ISO 13399 defines the terms, properties, and definitions for items that are used to create an assembly of a cutting tool with defined cutting edges. The purpose of this part of ISO 13399 is to provide a reference dictionary to support the use of the general information model 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 ISO 13399 (all parts) 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 ISO 13399 (all parts). Possible assemblies of the components of a cutting tool are illustrated in Figure 1.

The objective of ISO 13399 (all parts) is to provide the means to represent the information that describes cutting tools in a computer-sensible form that is independent from any 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 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 standardised information models and reference dictionaries.

An information model is a formal specification of types, ideas, facts, and processes which together describe a portion of interests 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 part of ISO 13399 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.

The ISO 13399 series is intended for use by, among others, tool producers and vendors, manufacturers, and developers of manufacturing software. ISO 13399 provides a common structure for exchanging data about cutting tools with defined cutting edges. ISO 13399 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 for the manufacturing cycle and between different software applications,

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— the direct import of data from cutting tool suppliers into a customer's database, and

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

Different companies use different business models that 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 in ISO 13399.

ISO 13399 defines only the information that could be communicated, but does not specify what information shall be communicated.

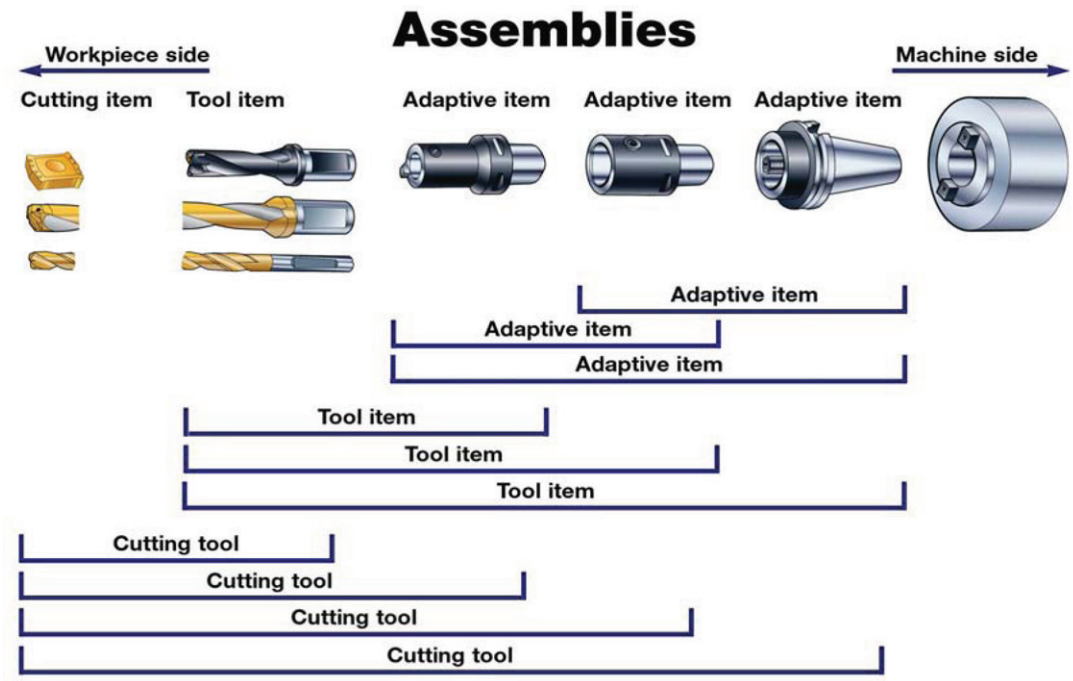

Figure 1 — Possible assemblies of the components of a cutting tool

Since the content of those dictionaries evolves according to industrial innovations and constant improvement of technology in cutting tools, a Maintenance Agency has been established for the purposes of

— correcting errors in the entries of existing classes and properties,

— adding new properties to existing classes,

— adding new classes and their properties,

— managing the status of those properties and classes, and

— migrating the dictionary to subsequent editions of ISO 13399 (all parts).

The secretariat of this Maintenance Agency has been assigned to:

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The website of the Maintenance Agency is available at: http://www.unm.fr/main/core.php?pag_id=135

The reference dictionaries are available in the form of EXPRESS files on the website of the Maintenance Agency. These files are considered complementary to this part of ISO 13399; they can be freely downloaded and used for cutting tool data representation and exchange.

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Cutting tool data representation and exchange —

Part 5: Reference dictionary for assembly items

1 Scope

This part of ISO 13399 specifies a reference dictionary for items used to assemble cutting tools, together with their descriptive properties and domains of values.

This part of ISO 13399 specifies a reference dictionary containing:

— definitions and identifications of the classes of assembly items, with an associated classification scheme;

— definitions and identifications of the data element types that represents the properties of assembly items;

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

Each class, property, or domain of values of this application domain constitutes an entry of the reference dictionary defined in this part of ISO 13399. 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.

The following are within the scope of this part of ISO 13399:

— standard data that represent the various classes of assembly items for cutting tools;

— standard data that represent the various properties of assembly items for cutting tools;

— standard data that represent domains of values used for properties of assembly items for cutting tools;

— one implementation method by which the standard data defined in this part of ISO 13399 can be exchanged.

NOTE 1 The implementation method by which the standard data defined in this part of ISO 13399 can be exchanged is specified in ISO 10303-21.

The following are outside the scope of this part of ISO 13399:

— specialized or expert knowledge on the design and use of cutting tools;

— rules to determine what information could be communicated;

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

— implementation methods other than the one defined in this part of ISO 13399 by which the standard data can be exchanged and referenced;

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— information model for cutting tools;

— definitions of classes and properties for cutting items;

— definitions of classes and properties for tool items;

— definitions of classes and properties for adaptive items;

— definitions of classes and properties for reference systems and common features;

— definitions of classes and properties for connection interface features.

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

NOTE 3 The definitions of classes and properties for cutting items, tool items, adaptive items, reference systems and common features, and connection interface features are provided in ISO/TS 13399-2, ISO/TS 13399-3, ISO/TS 13399-4, ISO/TS 13399-50, and ISO/TS 13399-60, respectively.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1832:2012, *Indexable inserts for cutting tools — Designation*

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/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 (structure and contents of the dictionary) and the following apply.

NOTE The main collection of the terms and their definitions in the reference dictionary is provided in Annexes B to D.

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

[SOURCE: ISO 13584-24:2003]

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

[SOURCE: ISO 13584-42:2010, 3.4]

3.3
chip
material removed from a workpiece by a cutting process

[SOURCE: ISO/TS 13399-2:2014, 3.3]

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3.4
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

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

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

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

[SOURCE: ISO 10303-1:1994, 3.2.14]

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

[SOURCE: ISO 13584-42:2010, 3.13]

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

[SOURCE: ISO 10303-1:1994, 3.2.15]

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

[SOURCE: ISO 13584-511:2006, 3.1.9]

Note 1 to entry: In the ISO 13399 series, 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

[SOURCE: ISO/TS 13399-2:2014, 3.10]

3.11
entity data type
representation of an entity

[SOURCE: ISO/TS 13399-2:2014, 3.11]

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3.12
entity instance
named unit of data that represents a unit of information within the class defined by an entity.

[SOURCE: ISO/TS 13399-2:2014, 3.12]

Note 1 to entry: An entity instance is a member of the domain established by an entity data type.

3.13
family of products
set of products represented by the same characterization class

[SOURCE: ISO 13584-42:2010, 3.16]

3.14
implementation method
means for computers to exchange data

[SOURCE: ISO/TS 13399-2:2014, 3.14]

3.15
information
facts, concepts, or instructions

[SOURCE: ISO 10303-1:1994, 3.2.20]

3.16
information model
formal model of a bounded set of facts, concepts, or instructions to meet a specific requirement

[SOURCE: ISO 10303-1:1994, 3.2.21]

3.17
machine side
identification of a direction pointing towards the machine

3.18
machined surface
desired surface produced by the action of the cutting tool

[SOURCE: ISO 3002-1:1982, 3.1.2]

3.19
ontology
explicit and consensual specification of concepts of an application domain independent of any use of these concepts

[SOURCE: ISO 13584-511:2006, 3.1.20]

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

3.20
property
defined parameter suitable for the description and differentiation of products

[SOURCE: ISO 13584-42:2010, 3.37]

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3.21
visible property
property 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]

3.22
workpiece
object on which a cutting action is performed

[SOURCE: ISO/TS 13399-2:2014, 3.24]

3.23
workpiece side
identification of a direction pointing towards the workpiece

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

BSU basic semantic unit

DET data element type

5 Representation of the ontology concepts as dictionary entries

5.1 General

In the following subclauses, 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 characters with multiple words linked by an underscore character.

EXAMPLE insert clamp is the name of a concept in the ontology. **insert_clamp** is the identifier of the class in the dictionary that represents the concept.

Each classified item in the following subclauses is associated with its definition from the dictionary.

Each entry in the dictionary, either a class or a property, is identified with a numerical code (BSU) that is generated at random when the dictionary is compiled. A BSU can be made unique by the addition of a code that is a reference to the supplier of the dictionary.

The structure of the classification is summarized in Annex B. The complete definitions of the classes in this part of ISO 13399 are provided in Annex C. The properties applicable to these classes are defined in Annex D.

5.2 assembly_item_type

An **assembly_item_type** is a family of objects that enable the combination of items to form a cutting tool.

assembly item type has the following subclasses:

— **bearing**;

— **bush**;

— **centre_pin**;

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— **coolant_deflector**;

— **driving_key**;

— **driving_ring**;

— **externally_threaded_fastener_component**;

— **insert_clamp**;

— **insert_clamping_system**;

— **insert_lever**;

— **insert_shim**;

— **insert_wedge**;

— **nest**;

— **nozzle**;

— **pin**;

— **retaining_ring**;

— **screw_thread_lining**;

— **sealing_ring**;

— **sleeve**;

— **spacer**;

— **spring**.

5.2.1 bearing

A **bearing** is an object to support a load and reduce the friction between two surfaces.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.2 bush

A **bush** is a hollow cylindrical object that fits in a hole.

NOTE 1 A **bush** can act as a **bearing**.

NOTE 2 This class is for general engineering use and is not specific to cutting tools.

NOTE 3 This class can become an item class case of an entry in another dictionary conforming to ISO 13584.

5.2.3 centre_pin

A **centre_pin** is an elongated rigid object secured to the tool item that locates and holds an insert and or a shim by its central hole.

5.2.4 coolant_deflector

A **coolant_deflector** is a device to change the direction of flow of a coolant supply.

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5.2.5 driving_key

A **driving_key** is an object that fits in slots in components of an assembly to transmit torque from one component to the other and/or to locate the two components.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.6 driving_ring

A **driving_ring** is an annular-shaped object with integral keys or keyways that transmits torque from one component of an assembly to another.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.7 externally_threaded_fastener_component

An **externally_threaded_fastener_component** is a component class representing an externally threaded fastener.

NOTE **externally_threaded_fastener_component** is defined in ISO 13584-511.

externally_threaded_fastener_component has the following subclasses:

— **deflection_screw**;

— **differential_screw**;

— **eccentric_screw**;

— **insert_screw**;

— **lever_screw**;

— **shim_screw**.

5.2.7.1 deflection_screw

A **deflection_screw** is a screw with a conical portion of the shaft that can deflect to bear on the insert to hold it in place.

5.2.7.2 differential_screw

A **differential_screw** is an externally threaded fastener without a head with double-threaded shank with right-hand and left-hand threaded portions mainly used for fastening insert wedges.

5.2.7.3 eccentric_screw

An **eccentric_screw** is an externally threaded fastener with a round head that is not concentric with the shank.

5.2.7.4 insert_screw

An **insert_screw** is a screw with countersunk bearing surface used mainly for holding a cutting item on a tool item.

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5.2.7.5 lever_screw

A **lever_screw** is an externally threaded fastener without a head and with a waist used for holding an insert lever in contact with the insert.

5.2.7.6 shim_screw

A **shim_screw** is an externally threaded fastener for holding a shim in a pocket with a central-threaded-through hole into which an insert screw can go to hold the insert.

5.2.8 insert_clamp

An **insert_clamp** is an object to apply a clamping force to an insert.

insert_clamp has the following subclasses:

— **cantilever_clamp**

— **floating_wedge_clamp**;

— **lever_top_clamp**;

— **wedge_clamp**.

5.2.8.1 cantilever_clamp

A **cantilever_clamp** is a rigid object with an extended arm to apply a downward force to an insert.

5.2.8.2 floating_wedge_clamp

A **floating_wedge_clamp** is an object to apply a downward force on an insert by movement of part of the object along the surface of a wedge.

5.2.8.3 lever_top_clamp

A **lever_top_clamp** is an object to apply a downward force on an insert by the action of a lever.

5.2.8.4 wedge_clamp

A **wedge_clamp** is an object with the shape of a wedge that applies a downward force to an insert and presses the insert against the centre pin.

5.2.9 insert_clamping_system

An **insert_clamping_system** is a family of assemblies of objects for holding a cutting item on a tool item.

insert_clamping_system has the following subclasses:

— **cantilever_clamping**;

— **deflection_screw_clamping**;

— **eccentric_screw_clamping**;

— **floating_wedge_clamping**;

— **insert_screw_clamping**;

— **integrated_clamping**;

— **lever_insert_clamping**;

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— **lever_top_clamping**;

— **wedge_clamping**.

5.2.9.1 cantilever_clamping

A **cantilever_clamping** is an assembly for applying a holding force by a rigid cantilever arm.

5.2.9.2 deflection_screw_clamping

A **deflection_screw_clamping** is an assembly for applying a holding force by the bending of a symmetric screw caused by interference with the tool item.

5.2.9.3 eccentric_screw_clamping

An **eccentric_screw_clamping** is an assembly for applying a holding force by the eccentric rotation of a portion of a screw.

5.2.9.4 floating_wedge_clamping

A **floating_wedge_clamping** is an assembly for applying a holding force by the combined effect of a downward force and the lateral movement actuated by the surface of a wedge.

5.2.9.5 insert_screw_clamping

An **insert_screw_clamping** is an assembly for applying a holding force by the bearing surface of a symmetrical screw acting on the surface of a hole in the cutting item.

NOTE The axis of the threaded hole in the tool item is not coincident with the axis of the hole in the insert.

5.2.9.6 integrated_clamping

An **integrated_clamping** is an assembly for holding a cutting item in a tool item by the deflection of part of the tool item.

5.2.9.7 lever_insert_clamping

A **lever_insert_clamping** is an assembly for applying a holding force by the action of the end of a lever pressing on the inside of a hole in the cutting item.

5.2.9.8 lever_top_clamping

A **lever_top_clamping** is an assembly for applying a holding force on the top surface of a cutting item by the rotation of a lever about a pivot.

5.2.9.9 wedge_clamping

A **wedge_clamping** is an assembly for applying a holding force to an insert by the lateral movement of one or more wedge surfaces.

5.2.10 insert_lever

An **insert_lever** is an object that rotates about a pivot to apply a force to hold an insert onto a tool item.

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5.2.11 insert_shim

An **insert_shim** is an object placed between a cutting item and a tool item.

NOTE The use of the shim is to position the cutting item and to protect it from damage.

5.2.12 insert_wedge

An **insert_wedge** is an object with at least two surfaces inclined to each other used for holding an insert.

5.2.13 nest

A **nest** is an assembly item that contains a seat or pocket that cradles and positions a replaceable cutting item but does not lock the replaceable cutting item by itself.

5.2.14 nozzle

A **nozzle** is an object with an aperture to direct the flow of a liquid or a gas.

5.2.15 pin

A **pin** is a thin rod-shaped object with parallel or tapered form.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.16 retaining_ring

A **retaining_ring** is an annular-shaped object that fits into a groove to prevent the separation of two components.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.17 screw_thread_lining

A **screw_thread_lining** is an helical coil that modifies an existing internal thread.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.18 sealing_ring

A **sealing_ring** is an annular-shaped object that prevents the passage of a fluid or gas.

NOTE 1 This class is for general engineering use and is not specific to cutting tools.

NOTE 2 This class can become an **item_class_case_of** an entry in another dictionary conforming to ISO 13584.

5.2.19 sleeve

A **sleeve** is a cylindrical object with an inner surface that can be cylindrical or tapered or profiled that fits over a shaft.

NOTE 1 The length of the cylinder is greater than the wall thickness and the critical dimensions are on the diameters of the object.

NOTE 2 This class is for general engineering use and is not specific to cutting tools.

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