PD ISO/TS 13399-4:2014

BSI Standards Publication

Cutting tool data representation and exchange

Part 4: Reference dictionary for adaptive items

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National foreword

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TECHNICAL SPECIFICATION

ISO/TS 13399-4

Second edition
2014-02-15

Cutting tool data representation and exchange —

Part 4: Reference dictionary for adaptive items

Représentation et échange des données relatives aux outils coupants —

Partie 4: Dictionnaire de référence pour les éléments relatifs aux attachements

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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 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 13399-4:2007), 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 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 this part of ISO 13399 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 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. 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 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 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 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 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.

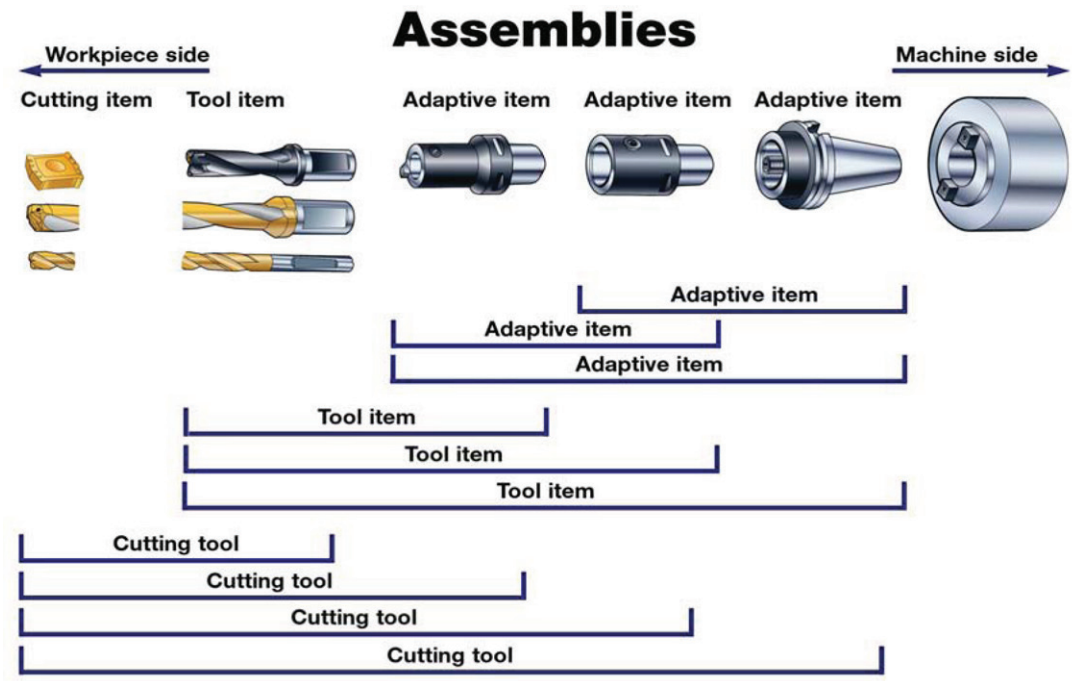

Figure 1 — Possible assemblies of the components of a cutting tool

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 4: Reference dictionary for adaptive items

1 Scope

This part of ISO 13399 specifies a reference dictionary for adaptive items, 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 adaptive items, with an associated classification scheme;

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

— standard data that represent the various properties of adaptive items;

— standard data that represent domains of values used for properties of adaptive items;

— 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 in the design and use of cutting tools;

— rules to determine what information should 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 assembly items;

— definitions of classes and properties for connection systems;

— definitions of classes and properties for reference systems.

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, and assembly items are provided in ISO 13399-2, ISO 13399-3, and ISO 13399-5.

NOTE 4 The definitions of classes and properties for connection systems and reference systems are provided in ISO 13399-50.

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/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 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 13339-1:2006, 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 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]

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

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

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

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
mirror plane
xz plane in the coordinate axis system

[SOURCE: ISO/TS 13399-50:2013, 5.3.7]

3.20
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.

3.21
primary coordinate system
right-handed rectangular Cartesian coordinate system in three-dimensional space with three principal axes labelled X, Y, and Z

[SOURCE: ISO/TS 13399-50:2013, 5.3.1]

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3.22
property
defined parameter suitable for the description and differentiation of products

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

3.23
visible property
property that has a definition meaningful in the scope of a given characterization class but does not necessarily apply to the various products belonging to this class

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

3.24
workpiece
object on which a cutting action is performed

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

3.25
workpiece side
identification of a direction pointing towards the workpiece

3.26
xy plane
plane in the coordinate axis system that contains the X and Y axes with the normal of the plane in the positive Z direction

[SOURCE: ISO/TS 13399-50:2013, 5.3.18]

3.27
xyw plane
plane in the coordinate axis system related to the xy plane by the rotation angle PHI about the X axis in a anticlockwise (counter-clockwise) direction and by a distance located at a distance XYWD from the origin of the coordinate axis system

[SOURCE: ISO/TS 13399-50:2013, 5.3.19]

3.28
xz plane
plane in the coordinate axis system that contains the X and Z axes with the normal of the plane in the positive Y direction

[SOURCE: ISO/TS 13399-50:2013, 5.3.20]

3.29
xzw plane
plane in the coordinate system related to the xz plane by the rotation angle KAPPA about the Z axis in a counter clockwise direction and located at a distance XZWD from the origin of the primary coordinate system

[SOURCE: ISO/TS 13399-50:2013, 5.3.21]

3.30
yz plane
plane in the coordinate system that contains the Y and Z axes with the normal of the plane in the positive X direction

[SOURCE: ISO/TS 13399-50:2013, 5.3.22]

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3.31
yzw plane
plane in the coordinate system related to the yz plane by the rotation angle RHO about the Y axis in a counter-clockwise direction and located at a distance YZWD from the origin of the primary coordinate system

[SOURCE: ISO/TS 13399-50:2013, 5.3.23]

Note 1 to entry: The xzw plane, the xyw plane, and the yzw plane are mutually perpendicular.

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

The generic family of adaptive items is divided into several simple families and classes determined by their main function.

NOTE An adaptive item can have one or more than one function.

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 joined by an underscore character.

EXAMPLE round shape conversion is the name for a function of an adaptive item. **round_shape_conversion** is the identifier of the class in the dictionary that represents the concept.

Some of the definitions of properties that are applicable to adaptive items are defined in terms of a primary coordinate system. The coordinate system is the same for adaptive items, cutting items, and tool items and is defined in ISO/TS 13399-50. The applications of this system to adaptive items are described in this part of ISO 13399.

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

The structure of the classification is summarized in Annex B. The complete definitions of the adaptive item classes are provided in Annex C. The properties applicable to adaptive items are defined in Annex D.

5.2 adaptive_item_type

5.2.1 General

Family of objects for the assembly of a cutting tool classified by their main function.

NOTE An adaptive item can have one or more functions.

adaptive_item_type has the following subclasses:

— **collet**;

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— **converter**;

— **driver**;

— **extender**;

— **reducer**.

5.2.2 collet

A **collet** is a segmented band that can be expanded or contracted to grip a shaft.

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.

5.2.3 converter

A **converter** is an adaptive item with a different connection type, style, and size on the machine side from the workpiece side.

5.2.4 driver

A **driver** is an adaptive item with the capability to rotate a cutting tool for cutting operations not on the main machine spindle axis.

5.2.5 extender

An **extender** is an adaptive item that increases the length of an assembled cutting tool.

NOTE The adaptive item has the same connection type, style, and size on both the machine side and workpiece side.

5.2.6 reducer

A **reducer** is an adaptive item that diminishes the size of a connection in an assembled cutting tool.

NOTE 1 The adaptive item has the same connection type and style on the machine side and workpiece side.

NOTE 2 The connections on either side of an item must be different in gender, i.e. male and female.

5.3 Reference system for adaptive items

5.3.1 General

The primary coordinate system used for adaptive items in this part of ISO 13399 is defined in ISO/TS 13399-50. The additional reference entities relevant for adaptive items are:

— **prismatic_adaptive_item_position**;

— **round_adaptive_item_position**.

5.3.2 prismatic_adaptive_item_position

A **prismatic_adaptive_item_position** identifies the location of a prismatic adaptive item where:

— the base of the adaptive item shall be coplanar with the XZ-plane;

— the normal for the base of the item shall be in the –Y direction;

— the rear backing surface shall be coplanar with the YZ-plane;

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— the normal for the rear backing surface shall be in the –X direction;

— the end of the item shall be coplanar with the XY-plane;

— the normal for the end of the item shall be in the –Z direction;

— if with a bore, then the vector of the bore of the item that points in the Z direction shall also point towards the workpiece side.

NOTE Applicable to right-handed adaptive items. Left-hand items are defined as for right-hand items but mirrored through the YZ-plane.

5.3.3 round_adaptive_item_position

A **round_adaptive_item_position** identifies the location of a round adaptive item where:

— the axis of the adaptive item shall be colinear with the Z axis;

— the vector of the shank that points in the Z direction shall also point towards the workpiece side;

— the drive slots or clamping flats if present shall be parallel with the XZ-plane;

— the contact surface of the coupling, the gauge plane, or the end of the cylindrical shank shall be coplanar with the XY-plane;

— if with a bore, then the vector of the bore of the item that point in the Z direction shall also point towards the workpiece side.

NOTE The conditions listed above apply to right-handed adaptive items. Left-handed adaptive items are defined as for right-handed items but mirrored though the YZ-plane.

6 Properties for adaptive items

The properties of adaptive items 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 adaptive 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.

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 **adaptor clamp** would be: 0112/1///13399__2–71CED04F3300A for version two of the dictionary.

Table 1 — Names of properties for adaptive items

Property name	Identification code (BSU)
adaptor clamp	71CED04F3300A
adaptor tool clamp	71CED04F920EC
adjusting screw protrusion	71EAC0F0EFDB6
balance quality code	71DF151EA5CF1
balanced by design	71EAC0CAB861F
body diameter	71ED6A9AF7D1D
body diameter maximum	71D08462F8185
body half taper angle	71EAC472BD116
body height	71EBB332C60EB

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Table 1 *(continued)*

Property name	Identification code (BSU)
body length	71ED6AA478A3D
body length maximum	71DCD3B16750B
body material code	71DF1523224D8
body taper end length	71EADEA2BF8DF
body width	71EBB33230236
cartridge size code	71DF1523EE184
clamping force maximum	71CED05149532
clamping length	71EBAF896BE9A
clamping length maximum	71ED6E54B15C4
clamping length minimum	71EBB339ED2BD
clamping width	71EBAF85006BD
connection bore depth	71EAC48CAD407
connection bore diameter	71E01D92C41E8
connection bore diameter maximum	71EBDBF4D0F49
connection bore diameter minimum	71EBDBF49F96C
connection code machine side	71D102AE3B252
connection code workpiece side	71D102AE8A5A9
connection count workpiece side	71EDD2C17746F
connection diameter	71EBDBF5060E6
connection retention knob thread size	71CF298A76B66
connection size code	71FC193318002
connection unit basis	71ED6E16D5978
contact surface diameter machine side	71D087D97FCE3
contact surface diameter workpiece side	71EAC0DD5D650
coolant supply property	71EBB342CC751
damping property	71CED03D70452
data chip provision	71CF29869CA0F
driving key type	71EC5E1ECC776
functional height	71CF29994E737
functional length	71DCD39338974
functional length minimum	71EBC1EB8456A
functional width	71CF29984CDA7
kappa	71ED6E4A7EFBA
keyway property	71DF5C0761888
overall height	71D078EB73E87
overall length	71D078EB7C086
overall width	71CF299257986
phi	71ED6E4AE850B
protruding length	71DCD394BB20E
rho	71ED6E4B254E5
rotational speed maximum	71DF153A691F2

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Table 1 *(continued)*

Property name	Identification code (BSU)
shank diameter	71CF29862B277
shank height	71CF29883E014
shank length	71CF298870946
shank width	71CF298751FCF
side	71EBDBF130AE6
tool changer interference diameter maximum	71CF298A3A99A
tool changer interference length minimum	71CF2989AF0E0
tool style code	71D078FBF6C68
unit system	71EBBA9ED6C0A
usable length	71EBB33490FDA
usable length maximum	71CF2992BDBCC
weight of item	71CED03C97AAB

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Annex A
(normative)

Information object registration

A.1 Document identification

In order to provide for unambiguous identification of an information object in an open system, the object identifier:

{iso technical specification 13399 part (4) version (2)}

is assigned to this part of ISO 13399. The meaning of this value is defined in ISO/IEC 8824-1 and is described in ISO 13584-1.

A.2 Dictionary identification

The dictionary defined in this part of ISO 13399 is assigned the object identifier:

{iso standard 13399 part (4) version (2) object (2) adaptive items (2)}

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