PD ISO/TS 13399-405:2016

BSI Standards Publication

# Cutting tool data representation and exchange

## Part 405: Creation and exchange of 3D models — Collets

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## National foreword

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The UK participation in its preparation was entrusted to Technical Committee MTE/18, Tools tips and inserts for cutting applications.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 84148 4

ICS 25.100.01; 35.240.50

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 March 2016.

**Amendments issued since publication**

| Date | Text affected |
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TECHNICAL SPECIFICATION

# ISO/TS 13399-405

First edition
2016-03-01

# Cutting tool data representation and exchange —

## Part 405: Creation and exchange of 3D models — Collets

*Représentation et échange des données relatives aux outils coupants —*

*Partie 405: Création et échange de modèles 3D — Pinces de serrage*

Reference number
ISO/TS 13399-405:2016(E)

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
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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.

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*.

ISO/TS 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 the 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 assembly 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 80: Creation and exchange of 3D models — Overview and principles* [Technical Specification]

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

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

— *Part 201: Creation and exchange of 3D models — Regular inserts* [Technical Specification]

— *Part 202: Creation and exchange of 3D models — Irregular inserts* [Technical Specification]

— *Part 203: Creation and exchange of 3D models — Replaceable inserts for drilling* [Technical Specification]

— *Part 204: Creation and exchange of 3D models — Inserts for reaming* [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]

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— *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]

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

— *Part 307: Creation and exchange of 3D models — End mills for indexable inserts* [Technical Specification]

— *Part 308: Creation and exchange of 3D models — Milling cutters with arbor hole for indexable inserts* [Technical Specification]

— *Part 309: Creation and exchange of 3D models — Tool holders for indexable inserts* [Technical Specification]

— *Part 311: Creation and exchange of 3D models — Solid reamers* [Technical Specification]

— *Part 312: Creation and exchange of 3D models — Reamers for indexable inserts* [Technical Specification]

— *Part 401: Creation and exchange of 3D models — Converting, extending and reducing adaptive items* [Technical Specification]

— *Part 405: Creation and exchange of 3D models — Collets* [Technical Specification]

The following parts are under preparation:

— *Part 70: Graphical data layout — Layer settings for tool designs* [Technical Specification]

— *Part 71: Graphical data layout — Creation of documents for the standardized data exchange — Graphical product information* [Technical Specification]

— *Part 72: Creation of documents for the standardized data exchange — Definition of properties for drawing header and their XML-data exchange* [Technical Specification]

— *Part 305: Creation and exchange of 3D models — Modular tooling systems with adjustable cartridges for boring* [Technical Specification]

— *Part 310: Creation and exchange of 3D models — Turning tools with carbide tips* [Technical Specification]


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# Introduction

This part of ISO/TS 13399 defines the concept, the terms and the definitions on how to design simplified 3D models of collets, clamping sleeves, ferrules and expanding sleeves that can be used for NC-programming, simulation of the manufacturing processes and the determination of collision within machining processes. It is not intended to standardize the design of the cutting tool itself.

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/TS 13399 (all parts) include, but are not limited to, everything between the workpiece and the machine tool. Information about inserts, solid tools, assembled tools, adaptors, components and their relationships can be represented by ISO/TS 13399 (all parts). The increasing demand providing the end user with 3D models for the purposes defined above is the basis for the development of this series of International Standards.

The objective of this International Standard 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 that are 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.

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/TC 3/SC 3D and in its extensions defined in ISO 13584-24 and ISO 13584-25.

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# Cutting tool data representation and exchange —

# Part 405: Creation and exchange of 3D models — Collets

## 1 Scope

This part of ISO/TS 13399 specifies a concept for the design of adaptive items, limited to any kind of collets, clamping sleeves and ferrules, together with the usage of the related properties and domains of values.

This part of ISO/TS 13399 specifies a common way of design simplified models that contain the following:

— definitions and identifications of the design features of collets, clamping sleeves, and ferrules, with an association to the used properties;

— definitions and identifications of the internal structure of the 3D model that represents the features and the properties of collets, clamping sleeves, and ferrules.

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

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

— concept of 3D models for cutting tools;

— concept of 3D models for cutting items;

— concept of 3D models for tool items;

— concept of 3D models for other adaptive items not being described in the scope of this part of ISO 13399;

— concept of 3D models for assembly items and auxiliary items.

## 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 296, *Machine tools — Self-holding tapers for tool shanks*

ISO/TS 13399-3, *Cutting tool data representation and exchange — Part 3: Reference dictionary for tool items*

ISO/TS 13399-4, *Cutting tool data representation and exchange — Part 4: Reference dictionary for adaptive items*

ISO/TS 13399-50, *Cutting tool data representation and exchange — Part 50: Reference dictionary for reference systems and common concepts*

ISO/TS 13399-60, *Cutting tool data representation and exchange — Part 60: Reference dictionary for connection systems*

ISO/TS 13399-80, *Cutting tool data representation and exchange — Part 80: Creation and exchange of 3D models — Overview and principles*

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# 3 Starting elements, coordinate systems, planes

## 3.1 General

The modelling of the 3D models shall be done by means of nominal dimensions.

**WARNING — There is no guarantee that the 3D model, created according to the methods described in this document, is a true representation of the physical tool supplied by the tool manufacturer. If the models are used for simulation purposes, e.g. CAM simulation, it shall be taken into consideration that the real product dimensions can differ from those nominal dimensions.**

NOTE Some of the definitions are taken from ISO/TS 13399-50.

## 3.2 Reference system (PCS — primary coordinate system)

The reference system as shown in Figure 1 consists of the following standard elements:

— **standard coordinate system:** right-handed rectangular Cartesian system in three dimensional space, called “primary coordinate system” (PCS);

— **3 orthogonal planes:** planes in the coordinate system that contain the axis of the system, named “xy-plane” (XYP), “xz-plane” (XZP), and “yz-plane” (YZP);

— **3 orthogonal axis:** axes built as intersections of the 3 orthogonal planes lines respectively, named “x-axis” (XA), “y-axis” (YA), and “z-axis” (ZA).

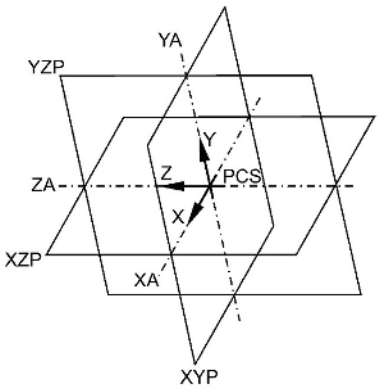


**Figure 1 — Primary coordinate system**

## 3.3 Mounting coordinate system

For virtually mounting of collets, clamping sleeves and ferrules onto an adaptive item to create a complete cutting tool, an additional reference system shall be defined. This reference system is called “mounting coordinate system” (MCS). It is located at the starting point of the protruding length of the collet or the other named items. At collets, the MCS is located at that point, where the nominal diameter is referenced.

Figure 2 shows an example of the location of the MCS in relation to the PCS.


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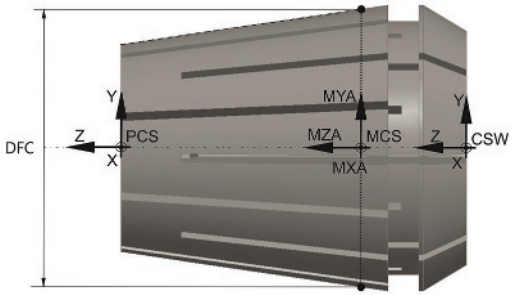


**Figure 2 — Example of orientation and location of PCS, MCS, and CSW**

## 3.4 Adjustment coordinate system at workpiece side

### 3.4.1 General

Additional coordinate systems named "CSWx_y" (coordinate system workpiece side) for mounting other adaptive items or tool items shall be defined according to ISO/TS 13399-50.

### 3.4.2 Designation of coordinate systems at workpiece side

The designation of the coordinate system workpiece side shall be done as follows.

| | |
|---|---|
| Case 1 | One coordinate system at workpiece side |
| | A single coordinate system at the workpiece side shall be designated as "CSW". |
| Case 2 | One coordinate system on different levels at workpiece side |
| | A single coordinate system on different levels shall be designated as "CSWx", e.g. "CSW1", "CSW2". The numbering shall start at the workpiece side and end at the machine side in the direction of the positive z-axis. |
| Case 3 | Multiple coordinate systems on one level and different angles at workpiece side |
| | Multiple coordinate systems at one level, but different angles and not at the centre of the tool axis shall be designated with "CSWx_y", where the "x" defines the level and the "y" defines the number of the coordinate system itself. The counting shall start at the three o'clock position counting in counter-clockwise direction while looking towards the machine spindle (positive z-axis). |
| Case 4 | Multiple coordinate systems on one level, one angle and different diameters at workpiece side |
| | The designation shall be the same as defined in Case 3. The counting shall start at the smallest diameter. |
| Case 5 | Multiple coordinate systems on different levels, different angles, and different diameters at workpiece side |
| | The designation shall be the same as defined in Case 3. The counting shall start at the smallest diameter and at the three o'clock position. |

Figure 3 shows an example of the arrangement of coordinate systems on workpiece side.

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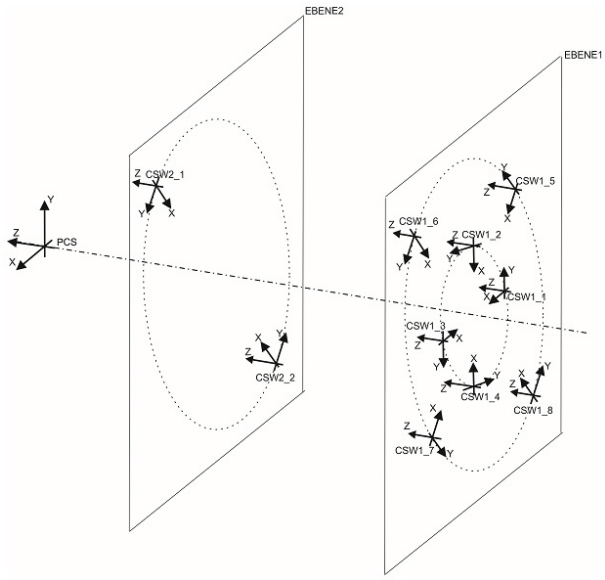


**Figure 3 — Adjustment of coordinate system at workpiece side**

### 3.4.3 Arrangement of coordinate system workpiece side

The CSWx_y can be arranged in relation to the PCS by means of using the six degrees of freedom as follows:

— rotation about

  — the x-axis by the angle rho (“RHO”);

  — the y-axis by the angle kappa (“KAP”);

  — the z-axis by the angle phi (“PHI”);

— distance from the PCS origin perpendicular

  — to XYW-plane by XYWD;

  — to XZW-plane by XZWD;

  — to YZW-plane by YZWD.

The orientation and location of CSW is shown in Figure 4.


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