TECHNICAL SPECIFICATION

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Cutting tool data representation and exchange —

Part 305: Creation and exchange of 3D models — Modular tooling systems with adjustable cartridges for boring

Représentation et échange des données relatives aux outils coupants —

Partie 305: Création et échange des modèles 3D — Systèmes d'outils modulables avec cartouches réglables pour alésage

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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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

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

Introduction

This document defines the concept, the terms and the definitions of how to design simplified 3D models of modular tooling systems with adjustable cartridges for boring 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 13399 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 this document. The increasing demand providing the end user with 3D models for the purposes defined above is the basis for the development of the ISO 13399 series.

The objective of 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 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.

Cutting tool data representation and exchange —

Part 305:
Creation and exchange of 3D models — Modular tooling systems with adjustable cartridges for boring

1 Scope

This document specifies a concept for the design of tool items, for all kinds of modular tooling systems with adjustable cartridges for boring, together with the usage of the related properties and domains of values.

This document specifies a common way of designing simplified models that contain the following:

— definitions and identifications of the design features of modular tooling systems with adjustable cartridges for boring, 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 modular tooling systems with adjustable cartridges for boring.

The following are outside the scope of this document:

a) applications where these standard data may be stored or referenced;

b) concept of 3D models for cutting tools;

c) concept of 3D models for cutting items;

d) concept of 3D models for other tool items not being described in the scope of this document;

e) concept of 3D models for adaptive items;

f) concept of 3D models for assembly items and auxiliary items.

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

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

ISO/TS 13399-201, *Cutting tool data representation and exchange — Part 201: Creation and exchange of 3D models — Regular inserts*

ISO/TS 13399-202, *Cutting tool data representation and exchange — Part 202: Creation and exchange of 3D models — Irregular inserts*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Starting elements, coordinate systems, planes

4.1 General

The modelling of the 3D models shall be done by means of nominal dimensions. Some examples of nominal dimensions are given in Annex A.

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 1 Some of the definitions have been taken from ISO/TS 13399-50.

NOTE 2 ISO 10303-242 (STEP 3D) allow to write sub-assemblies as separate STEP 3D files.

4.2 Reference system

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

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

— **three 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);

— **three orthogonal axis**: axes built as intersections of the three orthogonal plane lines respectively, named “X-axis” (XA), “Y-axis” (YA) and “Z-axis” (ZA).

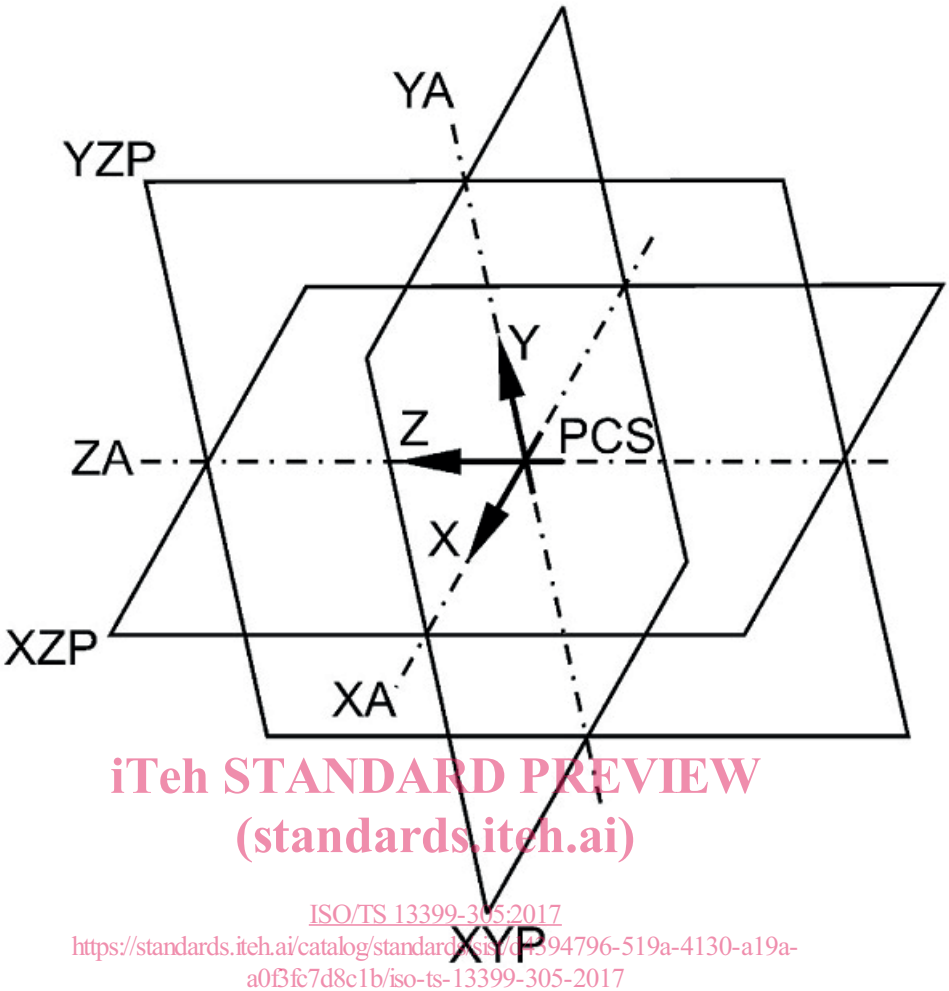

Figure 1 — Primary coordinate system

4.3 Mounting coordinate system

For the virtual mounting of components of modular systems either on an adaptive item or on another component, an additional reference system shall be defined. This reference system shall be called "mounting coordinate system" (MCS). It is located at the starting point of the protruding length of a tool item. The orientation is shown in Figure 2.

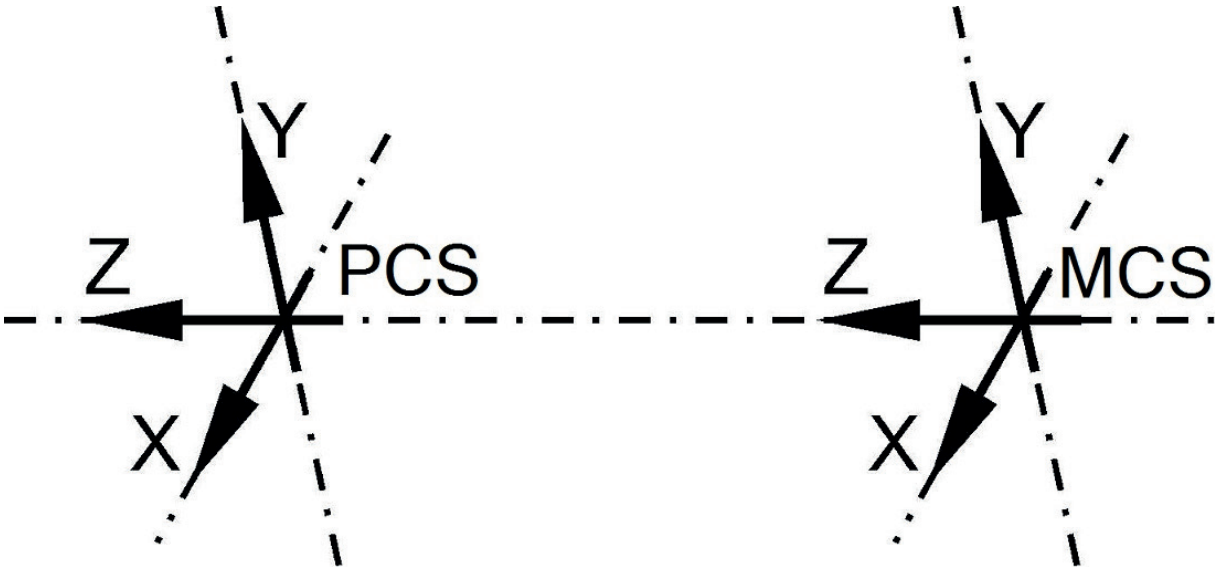

Figure 2 — Orientation of MCS

4.4 Coordinate system at the cutting part

The coordinate system at the cutting part is shown in Figure 3, e.g. the front face, named "coordinate system in process" (CIP), with a defined distance to the PCS shall be oriented as follows:

— the origin is on a plane that is parallel to the XY-pane of PCS and is located on the most front-cutting point;

— Z-axis of CIP points to the PCS;

— Z-axis of CIP is collinear to the Z-axis of PCS;

— Y-axis of CIP is parallel to the Y-axis of PCS.

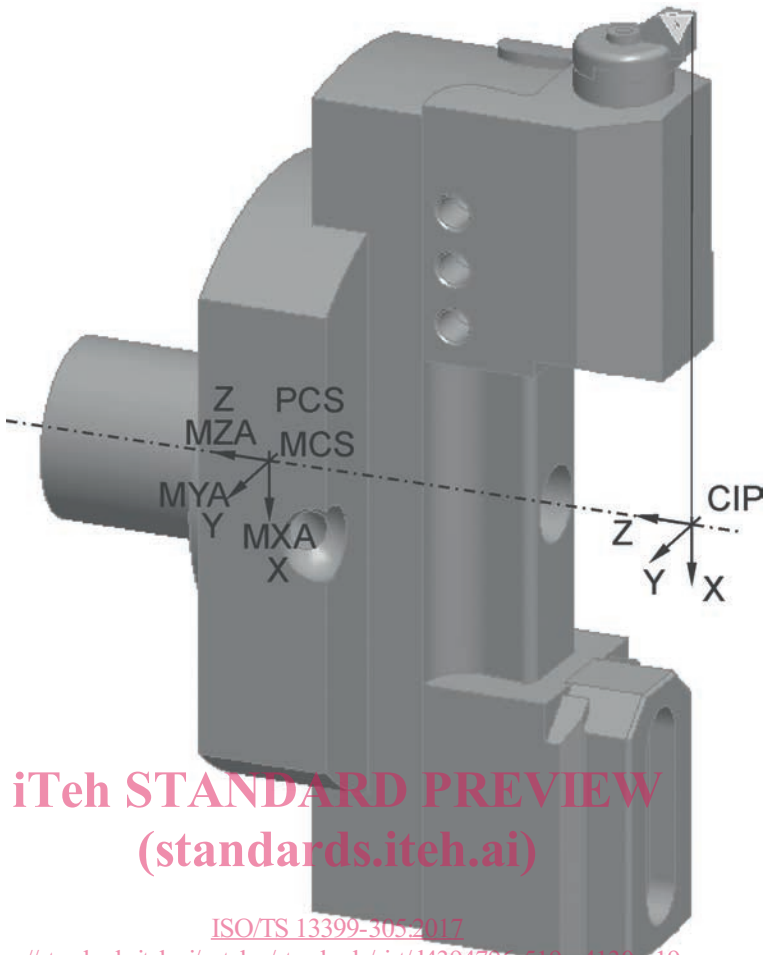

Figure 3 — Orientation of CIP

If the 3D modelling software gives the possibility to include interfaces for components, e.g. mount a face cutting part onto a complete cutting tool, the coordinate system "CIP" should be used.

If necessary, another designation shall be given to the interface of the component (dependent on the software). The name is "CSIF" (for "coordinate system interface") and includes the coordinate system "CIP".

4.5 Planes

The modelling shall take place based on planes according to Figure 4, used as reference if applicable. Therefore, the model shall be able to vary or single features of independent design features shall be deleted by means of changing the value of one or more parameter of the model design. Furthermore, the identification of the different areas shall be simplified by using the plane concept, even if they contact each other with the same size, e.g. chip flute, shank, etc.

For the 3D visualization of modular tooling systems, the planes shall be determined as follows.

— “TEP” “tool end plane” is located at that end of the connection that points away from the workpiece, if the tool does not have a contact surface and/or a gauge line the TEP is coplanar with the XY-plane of the PCS. The overall length (OAL) is the distance between the extremes of the object and starts at the “TEP”.

— “HEP” “head end plane” is either coplanar with the XY plane of the “CIP”, if CIP does exist, or is located at the distance of “overall length”.

— “LSP” “shank length plane” is located at the end of the dimension “shank length”, if the connection is cylindrical. If “shank length” does not exist, the plane shall be named as “protruding length plane, LPRP”.

Figure 4 shows an example of the order and location of defined planes for design.

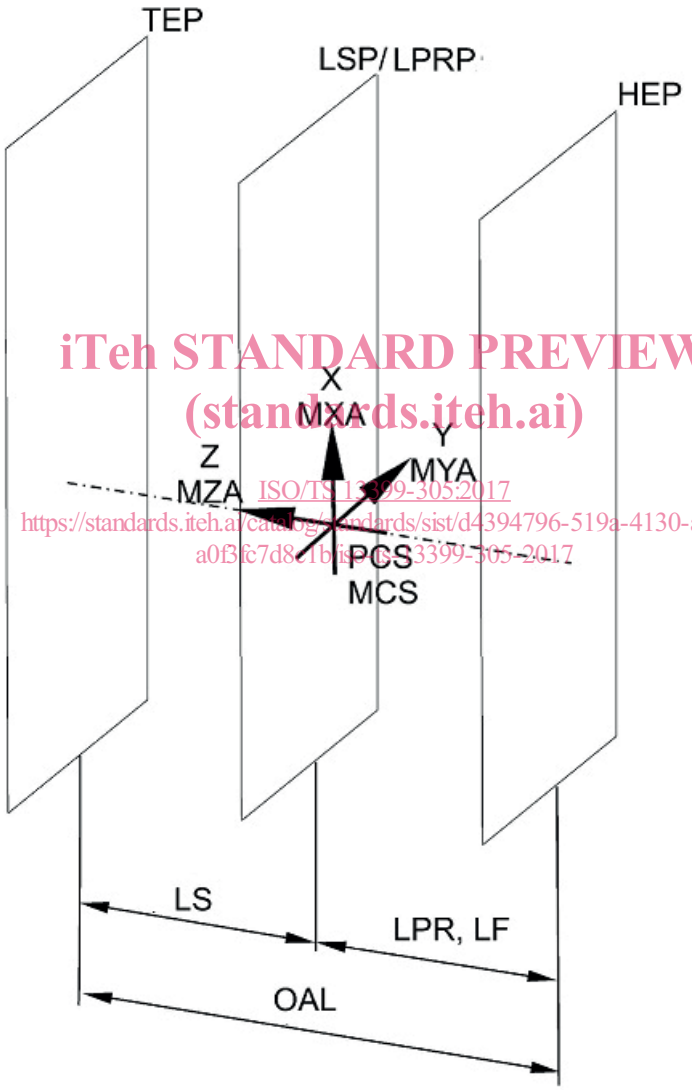

Figure 4 — Planes for design

4.6 Adjustment coordinate system on workpiece side

4.6.1 General

Additional coordinate systems for mounting components “CSWx_y” (coordinate system workpiece side) shall be defined according to ISO/TS 13399-50.

4.6.2 Designation of the coordinate system workpiece side

Case 1 One coordinate system at the workpiece side shall be designated as “CSW”.

Case 2 One coordinate system at workpiece side 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 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 at one level, one angle and different diameters shall be designated as described in case 3. The counting shall start at the smallest diameter.

Case 5 Multiple coordinate systems at one level, different angles and different diameters shall be designated as described in case 3. The counting shall start at the smallest diameter and at the three o’clock position counting in counter-clockwise direction while looking towards the machine spindle (positive Z-axis).

Figure 5 illustrates an example of the arrangement of the CSWs.

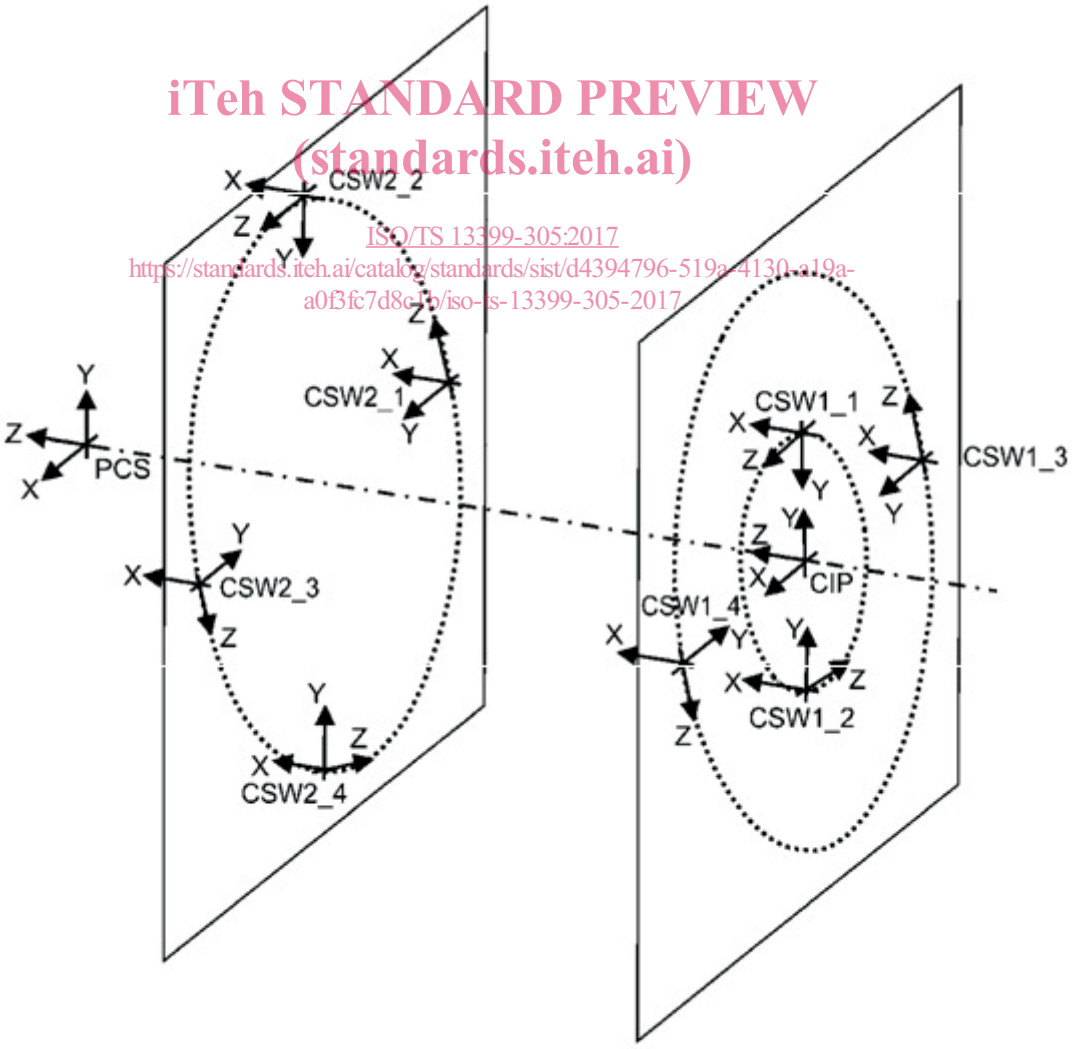

Figure 5 — Example of adjustment coordinate system on workpiece side