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Cutting tool data representation and exchange —

Part 403: Creation and exchange of 3D models — Modelling of driven tool units

Représentation et échange des données relatives aux outils coupants —

Partie 403: Création et échanges de modèles 3D — Conception d'outils à entrainement

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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

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

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

Introduction

This document defines the concept, terms and definitions of how to design simplified 3D models of driven tool units for the design of cutting tools, 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 the ISO 13399 series 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 for 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 the ISO 13399 series is to provide the means to represent the information that describes cutting tools in a computer sensible form that is independent from any particular computer system. The representation 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, *Automation systems and integration*, SC 4 *Industrial data,* 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, *Product properties and classes and their identification*, and in its extensions defined in ISO 13584-24 and ISO 13584-25.

Cutting tool data representation and exchange —

Part 403:
Creation and exchange of 3D models — Modelling of driven tool units

1 Scope

This document defines the concept of how to design adaptive items, limited to any kind of driven tool units, together with the usage of the related properties and domains of values.

This document specifies the requirements of simplified 3D models for data exchange of driven tool units.

The following are outside the scope of this document:

— applications where these standard data can 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 document;

— 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 13399-4, *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 13399-80, *Cutting tool data representation and exchange — Part 80: Creation and exchange of 3D models — Overview and principles*

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:

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

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

4 Abbreviated terms

BD	body diameter
BDX	body diameter maximum
BD1	body diameter 1
BD2	body diameter 2
CCFMS	connection code form machine side
CCFWS	connection code form workpiece side (referred to as CCFOP in this document)
CCTMS	connection code type machine side
CCTWS	connection code type workpiece side (referred to as CCTOP in this document)
CSWx_y	coordinate system workpiece side
CZCMS	connection size code machine side
CZCWS	connection size code workpiece side (referred to as CZCOP in this document)
DCCTX	cutting diameter cutting tool maximum
DCONMS	connection diameter
DCONWS	connection diameter workpiece side
DF	flange diameter
DIX	tool changer interference diameter maximum
DRVDIA	drive diameter
DRVL	drive length
DRVLP	plane for the drive length
DRVSC	drive size code
DRVTY	drive type
HEP	plane located at the front of the tool and is coplanar with the XY-plane of CIP
HF	functional height
HF1	functional height 1
HF2	functional height 2
HF3	functional height 3
HTB	body height
KAP	the angle κ
KN_0001, KN_0002, MN_0001, NN_0001, QN_0001	temporary properties used as functions of cutting edge height, normal clearance angle major cutting edge, orthogonal rake angle, normal clearance angle minor cutting edge and inclination angle

KWW	keyway width
LB	body length
LBP	plane for the body length
LB1	body length 1
LB2	body length 2
LDG	gauge diameter distance
LF	functional length
LFSF	distance to face
LF1	functional length 1
LF2	functional length 2
LF3	functional length 3
LIN	tool changer interference length minimum
LPCON	connection protruding length
LPR	protruding length
LPRCP	protruding length of the coolant pipe
LPRP	plane for the protruding length
LS	shank length
LSP	plane for the shank length
MCS	mounting coordinate system
MXA	x-axis of MCS
MYA	y-axis of MCS
MZA	z-axis of MCS
OAH	overall height
OAL	overall length
OALP	plane for overall length
OAW	overall width
PCS	primary coordinate system
PHI	the angle ϕ
RADH	radial height
RADW	radial width
RHO	the angle ρ

SWAH	swing arm height
SWAL	swing arm length
SWANGX	swing angle maximum
SWANGXP	plane for swing angle maximum
SWANG2X	swing angle 2 maximum
SWANG2XP	plane for swing angle 2 maximum
SWANG3X	swing angle 3 maximum
SWANG4X	swing angle 4 maximum
SWAW	swing arm width
SWRAD	swing radius
TEP	plane located at the end of the interface on the machine side with reference to CIP
TQBRRD	torque bracing radial distance
TQBRANG	torque bracing angle
TQBRDIA	torque bracing diameter
TQBRL	torque bracing length
WB	body width
WB1	body width 1
WB2	body width 2
WF	functional width
WF1	functional width 1
WF2	functional width 2
WF3	functional width 3
XA	x-axis
YA	y-axis
ZA	z-axis
XYP	xy-plane
XYWP	xyw-plane
XZP	xz-plane
XZWP	xzw-plane
YZP	yz-plane
YZWP	yzw-plane

5 Starting elements, coordinate systems, planes

5.1 General

The modelling of the 3D models shall be done by means of nominal dimensions. Deviations within the tolerances are allowed.

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 have been taken from ISO/TS 13399-50.

5.2 Reference system (PCS)

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

— **standard coordinate system**: right-handed rectangular Cartesian system in three dimensional space, called PCS;

— **3 orthogonal planes**: planes in the coordinate system that contain the axis of the system, named XYP, XZP and YZP;

— **3 orthogonal axes**: axes built as intersections of the three orthogonal planes lines respectively, named XA, YA and ZA.

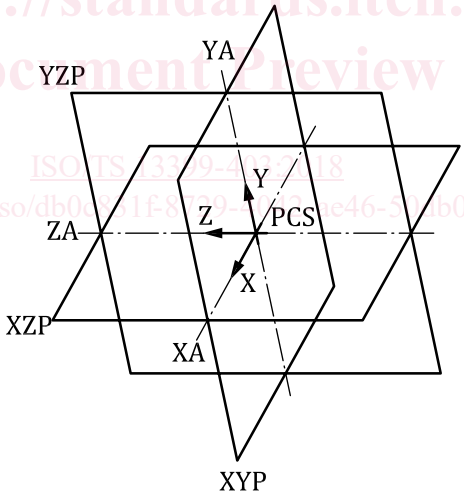

Figure 1 — Primary coordinate system

5.3 Adjustment coordinate system at workpiece side

5.3.1 General

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

5.3.2 Designation of coordinate systems at workpiece side

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

a) Case 1: one coordinate system at workpiece side

A single coordinate system at the workpiece side shall be designated as CSW.

b) 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 ends at the machine side in the direction of the positive Z-axis.

c) Case 3: multiple coordinate systems on one level and at different angles or different positions at workpiece side

Multiple coordinate systems on one level, but at different angles and not at the centre of the tool axis, shall be designated with CSWx_y, where x defines the level and y defines the number of the coordinate system itself.

The counting shall start at the three o'clock position counting in counterclockwise direction while looking towards the machine spindle (positive z-Axis). If the positions of the coordinate systems are not defined by means of different angles, the counting of the different coordinate systems shall start at that CSW with firstly the least absolute number on the x-axis and secondly the least absolute number on the y-axis of the PCS.

d) Case 4: multiple coordinate systems on one level, at one angle and with different diameters at workpiece side

The designation shall be the same as defined in case 3. The counting shall start at the smallest diameter.

e) Case 5: multiple coordinate systems on different levels, at different angles and with 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.

Figures 2 and 3 show examples of the arrangement of coordinate systems on workpiece side.

