TECHNICAL SPECIFICATION

ISO/TS 13399-308

First edition
2016-02-01

Cutting tool data representation and exchange —

Part 308: Creation and exchange of 3D models — Milling cutters with arbor hole for indexable inserts

Représentation et échange des données relatives aux outils coupants —

Partie 308: Création et échange des modèles 3D — Fraises à métaux à trou de fixation et à plaquettes amovibles

Reference number
ISO/TS 13399-308:2016(E)

Contents

Page

Foreword .... **v**

Introduction .... **vii**

1 Scope **1**

2 Normative references **1**

3 Starting elements, coordinate systems, planes **2**
- 3.1 General 2
- 3.2 Reference system 2
- 3.3 Coordinate system at the cutting part 3
- 3.4 Planes 3
- 3.5 Design of the pocket seat and cutting reference point (CRP) of the insert 4
- 3.6 Adjustment coordinate system on workpiece side 7
  - 3.6.1 General 7
  - 3.6.2 Designation of the coordinate system workpiece side 8

4 Design of the model **9**
- 4.1 General 9
- 4.2 Necessary parameters for the connection interface feature 10
- 4.3 Necessary properties for inserts 10
  - 4.3.1 General 10
  - 4.3.2 Properties for equilateral, equiangular and equilateral, nonequiangular inserts 10
  - 4.3.3 Properties for nonequilateral, equiangular and nonequilateral, nonequiangular inserts 11
  - 4.3.4 Design of the pocket seat feature 12

5 Face milling cutter **12**
- 5.1 General 12
- 5.2 Necessary properties 13
- 5.3 Basic geometry 13
- 5.4 Determination of the position of the mounting coordinate system of insert 14
- 5.5 Chip flute and pocket seat 15
- 5.6 Face milling cutter, assembly 16

6 Shoulder milling cutter **17**
- 6.1 General 17
- 6.2 Necessary properties 17
- 6.3 Basic geometry 17
- 6.4 Determination of the position of the mounting coordinate system of insert 17
- 6.5 Chip flute and pocket seat 18
- 6.6 Shoulder milling cutter, assembly 18

7 Plain milling cutter **19**
- 7.1 General 19
- 7.2 Necessary properties 19
- 7.3 Basic geometry 20
- 7.4 Determination of the position of the mounting coordinate system of insert 20
- 7.5 Chip flute and pocket seat 21
- 7.6 Plain milling cutter, assembly 23

8 Shell milling cutter **23**
- 8.1 General 23
- 8.2 Necessary properties 24
- 8.3 Basic geometry 24
- 8.4 Determination of the position of the mounting coordinate system of insert 25
- 8.5 Chip flute and pocket seat 25
- 8.6 Shell milling cutter, assembly 25

9 Full-side-slot milling cutter **25**

9.1 General 25
9.2 Necessary properties 26
9.3 Basic geometry 26
9.4 Determination of the position of the mounting coordinate system of insert 27
9.5 Chip flute and pocket seat 28
9.6 Assembly of a full-side slot milling cutter 30

10 Half-side slot milling cutter 31
10.1 General 31
10.2 Necessary properties 31
10.3 Basic geometry 31
10.4 Determination of the position of the mounting coordinate system of insert 31
10.5 Chip flute and pocket seat 32
10.6 Half-side slot milling cutter, assembly 32

11 Full-side profile slot milling cutter 33
11.1 General 33
11.2 Necessary properties 33
11.3 Basic geometry 34
11.4 Determination of the position of the mounting coordinate system of insert 34
11.5 Chip flute and pocket seat 34
11.6 Full-side profile slot milling cutter, assembly 34

12 Full-side angular slot milling cutter 35
12.1 General 35
12.2 Necessary properties 35
12.3 Basic geometry 36
12.4 Determination of the position of the mounting coordinate system of insert 36
12.5 Chip flute and pocket seat 36
12.6 Full-side angular slot milling cutter, assembly 36

13 Saw blade/slitting cutter 36
13.1 General 36
13.2 Necessary properties 37
13.3 Basic geometry 37
13.4 Determination of the position of the mounting coordinate system of insert 38
13.5 Chip flute and pocket seat 40
13.6 Saw blade/slitting cutter, assembly 41

14 Design of details 42
14.1 Basics for modelling 42
14.2 Fixing threads for inserts 42
14.3 Contact surfaces/drive keys — Orientation 42
14.4 Chamfers, roundings, others 42

15 Attributes of surfaces — Visualization of the model features 42

16 Structure of the design elements (tree of model) 42

17 Data exchange model 43

Annex A (informative) **Information about nominal dimensions 45**

Bibliography 46

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).

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 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]

— *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]

Introduction

This part of ISO/TS 13399 defines the concept, the terms and the definitions on how to design simplified 3D models of milling cutters with arbors hole for indexable inserts 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/TS 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 the ISO/TS 13399 series. 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 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 308:
Creation and exchange of 3D models — Milling cutters with arbor hole for indexable inserts

1 Scope

This part of ISO/TS 13399 specifies a concept for the design of tool items, limited to any kind of milling cutters with arbor hole for indexable inserts, 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 milling cutters with arbor hole for indexable inserts, 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 milling cutters with arbor hole for indexable inserts.

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 other tool items not being described in the scope of this part of ISO/TS 13399;

— concept of 3D models for adaptive items;

— 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 11529, *Milling cutters — Designation — Shank-type and bore-type milling cutters of solid or tipped design or with indexable cutting edges*

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

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

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 part of ISO/TS 13399, 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.

3.2 Reference system

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 "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).

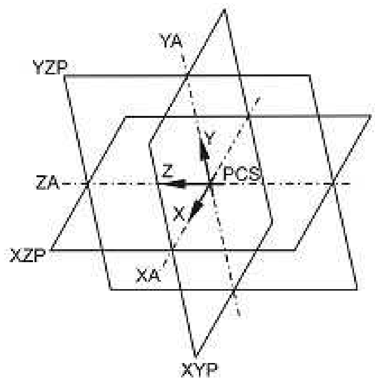


Figure 1 — Reference system

For virtually mounting of drilling and countersinking tools onto an adaptive item an additional reference system shall be defined. This reference system is called "mounting coordinate system" (MCS). It shall be located at the starting point of the protruding length of a tool item. The orientation is shown in Figure 2.

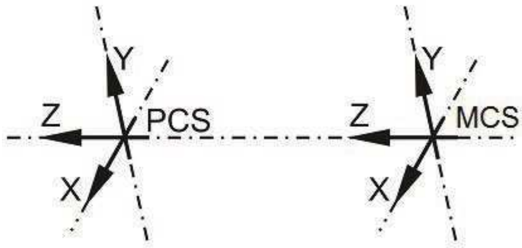


Figure 2 — Example of the orientation of “PCS” and “MCS” reference system

3.3 Coordinate system at the cutting part

The coordinate system at the cutting part, named “coordinate system in process” (CIP), with a defined distance to the PCS shall be oriented as follows (see Figure 3):

— the origin is on a plane that is parallel to the xy-plane 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.

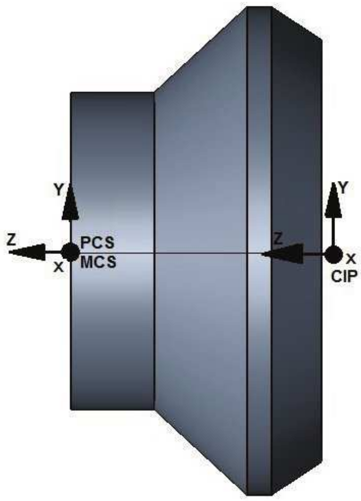


Figure 3 — Orientation of CIP

If the 3D modelling software gives the possibility to include interfaces for components to, for example, mount a front cutting disk onto a complete cutting tool, it shall be advised to use the coordinate system “CIP”.

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”.

3.4 Planes

The modelling shall take place based on planes according to Figure 4, which shall be used as reference, if applicable. Therefore, it is assured to be able to vary the model or to suppress single features of independent design features 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 in 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 drilling and countersinking tools for indexable inserts, the general planes shall be determined as follows (see Figure 4):

— “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 “CIP” and “TEP”;

— “CDP”: “cutting depth plane” for the cutting depth maximum (CDX); based on “CIP”;

— “LCCBP”: “counterbore depth connection bore plane” plane for the depth of the counterbore of the connection bore; based on “CIP”;

— “HEP”: “head end plane” is coplanar with the xy-plane of the “CIP”.

Other planes, if necessary, shall be defined in the appropriate clauses.

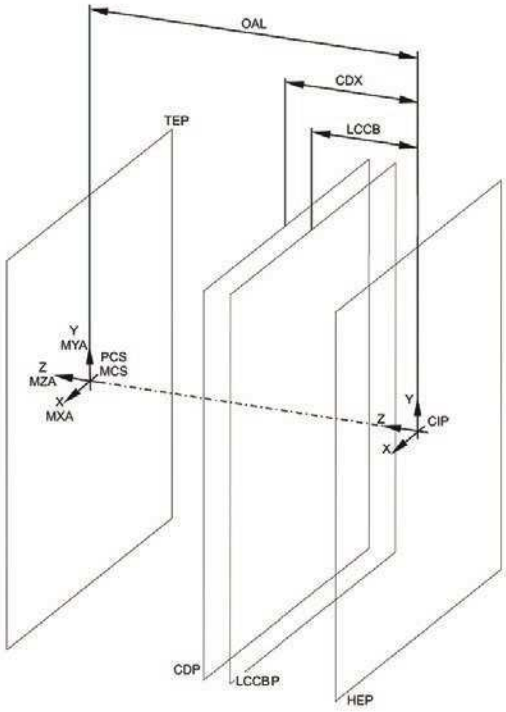


Figure 4 — Planes for design

3.5 Design of the pocket seat and cutting reference point (CRP) of the insert

If regular inserts have a specific design and are not interchangeable between vendors, the location of the MCS shall be left at the manufacturer’s discretion, either on the top face or on the bottom face. The orientation of the axis shall conform to this part of ISO/TS 13399.

The final position of the pocket seat shall be designed by means of designing an insert. This feature shall be used for subtraction from the tool body. To give the possibility to use inserts with different corner radii, only that corner defining the functional dimensions shall carry the corner radius; the remaining corners shall be designed without a corner radius.

The size of the corner radius shall meet the determination of a master radius. Table 1 shows the size of the corner radii dependent from the inscribed circle.

Table 1 — Dependency of inscribed circle and corner radius

Dimensions in millimetres

Inscribed circle	Corner radius
3,970	0,4
4,760	0,4
5,560	0,4
6,350	0.4
9,525	0,8
12,700	0,8
15,875	1,2
19,050	1,2
22,250	2,4
25,400	2,4
31,750	2,4

NOTE At rectangular (style L) and parallelogram-shaped (styles A, B, K) inserts, the longer side that is equal to the inscribed circle determines the size of the corner radius.

MCS-coordinate system of the insert (MCS_INSERT) and the PCS-coordinate system of the insert (PCS_INSERT) are oriented differently to the primary coordinate system of the tool (PCS_TOOL). The orientation is shown in Figure 5.

The neutral position of an insert shall be determined as follows:

— the origin of the MCS_INSERT positioned onto the centre of the inscribed circle; at rectangular and parallelogram-shaped inserts the point of origin is determined through the intersection of the two diagonal lines;

— the x-axis of MCS_INSERT parallel to the x-axis of PCS_INSERT;

— the y-axis of MCS_INSERT parallel to the y-axis of PCS_INSERT;

— the z-axis of MCS_INSERT parallel to the z-axis of PCS_INSERT;

— the x-axis of PCS_INSERT collinear to the x-axis of PCS_TOOL;

— the y-axis of PCS_INSERT collinear to the z-axis of PCS_TOOL;

— the z-axis of PCS_INSERT collinear to the y-axis of PCS_TOOL.

Positioning of the insert into the functional location shall be done as follows:

a) Design with end cutting edge angle on a right handed tool

NOTE This design is commonly used on the face of the end mill, typically for spot facing cutters.

— Only those inserts shall be used that are located in the second quadrant of the primary coordinate system of the insert, also called “left handed” inserts.

— The insert shall be rotated by 90-KAPR degrees in mathematic positive direction (counterclockwise) about the y-axis of PCS_TOOL.

— The cutting reference point “CRP” is the point where the functional dimensions are based. The definition of the CRP is given in ISO/TS 13399-50.

— The coordinate system of CRP (CS_CRP) shall be defined as follows:

— The x-axis of CS_CRP collinear to the x-axis of PCS_INSERT;

 - The y-axis of CS_CRP parallel to the y-axis of PCS_INSERT;
 - The z-axis of CS_CRP parallel to the z-axis of PCS_INSERT.
- If the tool is defined with an axial rake and a radial rake angle that are unequal 0 degree, the insert shall be rotated about its CRP as illustrated in Figure 6. Therefore, two axis shall be added.
 - GAMP-axis positioned on CRP with its vector that is parallel to x-axis of PCS_TOOL: defines the rotation of axial rake angle.
 - GAMF-axis positioned on CRP with its vector that is parallel to z-axis of PCS_TOOL: defines the rotation of radial rake angle.

b) Design with side cutting edge angle on a right handed tool as shown in Figure 7, commonly used on the periphery of the end mill, typically for all kind of side cutting end mills.

- The inserts that are located in the first quadrant of the primary coordinate system of the insert, also called “right handed” or “neutral” inserts, shall only be used.
- The insert shall be rotated by KAPR degrees in mathematic positive direction (counterclockwise) about the y-axis of PCS_TOOL.
- The cutting reference point “CRP” is the point where the functional dimensions are based. The definition of the CRP is given in ISO/TS 13399-50.

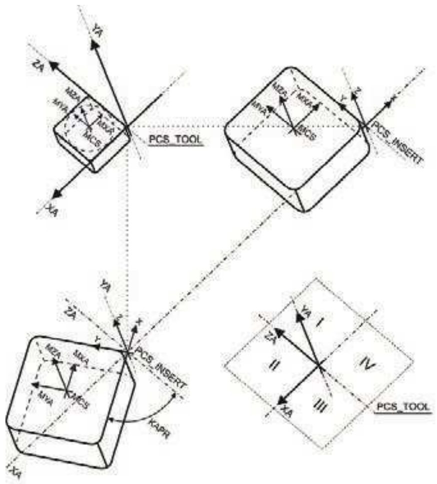


Figure 5 — Orientation of PCS_INSERT, MCS_INSERT and PCS_TOOL on end cutting edge angle

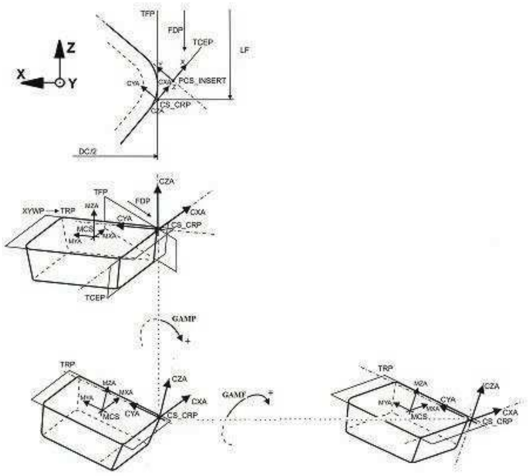


Figure 6 — Axial and radial rake angle on insert

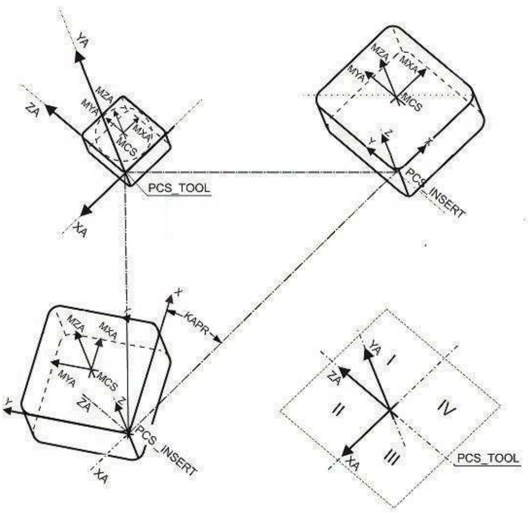


Figure 7 — Orientation of PCS_INSERT, MCS_INSERT and PCS_TOOL on side cutting edge angle

3.6 Adjustment coordinate system on workpiece side

3.6.1 General

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

3.6.2 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 counterclockwise 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 counterclockwise direction while looking towards the machine spindle (positive z-axis).

Figure 8 illustrates an example of the arrangement of the CSWs.

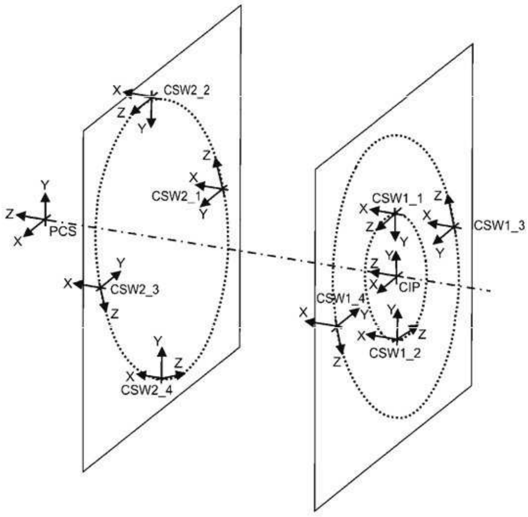


Figure 8 — Example of adjustment coordinate system on workpiece side

The MCS_INSERT shall be placed onto the CSWx_y of the tool with determinations as follows:

— the x-axis of CSWx_y parallel to the x-axis of CRP;

— the y-axis of CSWx_y parallel to the y-axis of CRP;

— the z-axis of CSWx_y parallel to the z-axis of CRP.

Figure 9 illustrates an example of mounting insert onto pocket seat.

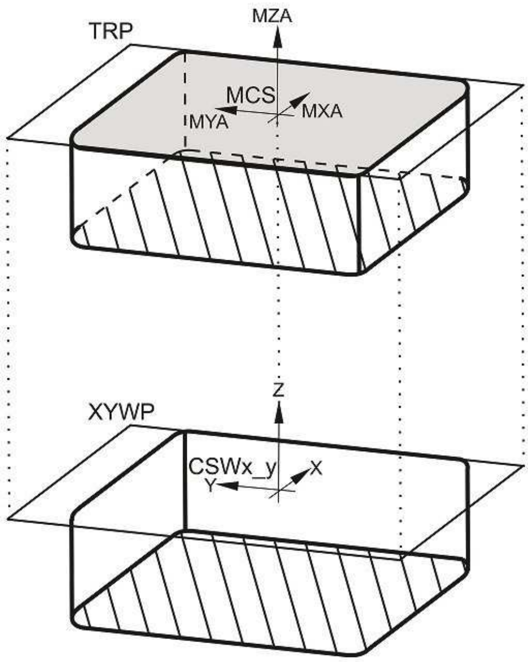


Figure 9 — Mounting of insert onto pocket seat

4 Design of the model

4.1 General

The sketches and features of the crude model may not contain details like slots, chamfers, roundings and grooves. Those features shall be designed as separate design elements after the crude geometry and be grouped as detail geometry. Based on the non-cutting features (group "NOCUT"), the cutting features shall be loaded as assembly parts (group "CUT") into the basic model; for the group "DETAILS", see Clause 14. The sequence of the model structure shall be kept as described. No references between the connection and the basic body shall be given. Only the group "DETAILS" may contain references to other design features.

End mills for indexable inserts shall be designed as rotational features:

— basic geometry containing connection and tool body designed as rotating body;

— geometry of the tool body (chip flute, pocket seat, etc.);

— geometry of the connection;

— details (chamfers, roundings, slots, etc.).

The examples of the basic shapes of end mills shall be designed with cylindrical shank and positioned onto the PCS.

All examples shall be designed with 0° axial and radial rake angle.

The total amount of design elements shall be dependent on the level of detail and on the complexity of the cutting tool.

The specific model structure of the different shapes of end mills for indexable inserts shall be described in the next clauses.

4.2 Necessary parameters for the connection interface feature

Information about the connection interface code shall be filed as properties within the model and being named as parameters as listed in Table 2.

Table 2 — Parameter list for connection interface feature

Preferred symbol	Description	Source of symbol	ISO-ID number
CCMS	connection code machine side	ISO/TS 13399-3 and ISO/TS 13399-4	71D102AE3B252
CCTMS	connection code type machine side	ISO/TS 13399-60 short name of subtype of connection_interface_feature	feature_class
CCFMS	connection code form machine side	ISO/TS 13399-60 number of the variant of the subtype of connection_interface_feature	feature_class
CZCMS	connection size code machine side	connection size code (dependent of side)	71FC193318002

The information of Table 2 and other relevant properties shall be incorporated into the model as parameters or shall be taken as a separate file.

4.3 Necessary properties for inserts

4.3.1 General

Necessary properties for the design of the pocket seat features shall be taken in accordance with the defined properties for cutting items (see ISO/TS 13399-2). To be able to differentiate between tool-item and cutting-item properties, a postfix shall be added to the preferred symbols of the cutting-item properties. The postfix shall have the same code and sequence as the different coordinate systems on workpiece side that are defined in 3.6.

4.3.2 Properties for equilateral, equiangular and equilateral, nonequiangular inserts

Equilateral and equiangular inserts are as follows:

— H – hexagonal insert;

— O – octagonal insert;

— P – pentagonal insert;

— S – square insert;

— T – triangular insert.

Equilateral and nonequiangular inserts are as follows:

— C, D, E, M, V – rhombic insert;

— W – trigon insert.

Table 3 lists the properties for regular inserts with inscribed circle.

Table 3 — Properties for modelling equilateral, equiangular and equilateral, nonequiangular pocket seats

Preferred name	Preferred symbol
Clearance angle major	AN
Clearance angle wiper edge	AS
Corner chamfer length	BCH[b]
Corner chamfer length minor	BCHN[b]
Wiper edge length	BS[c]
Insert included angle	EPSR
Insert included angle minor	EPSRN
Inscribed circle diameter	IC
Corner chamfer angle	KCH[b]
Corner chamfer angle minor	KCHN[b]
Cutting edge angle major	KRINS[c]
Cutting edge length[a]	L[a]
Corner radius	RE[b]
Corner radius minor	REN[b]
Insert thickness	S

a Shall be calculated; is dependent on IC and EPSR.

b Dependent on the corner configuration, either rounded or chamfered corner.

c Shall be used if a wiper edge is on the insert.

For the "trigon" insert, an additional property (EPSRN) shall be necessary in order to design a 3D model; for the rhombic (nonequiangular, equilateral) insert, properties describing the corner radius at the minor corner radius (REN), the minor corner chamfer length (BCHN) and the minor corner chamfer angle (KCHN) shall be added.

4.3.3 Properties for nonequilateral, equiangular and nonequilateral, nonequiangular inserts

Nonequilateral and equiangular inserts are as follows:

— L – rectangular insert.

Nonequilateral and nonequiangular inserts are as follows:

— A, B, K – parallelogram-shaped insert.

Table 4 lists the properties for rectangular inserts and parallelogram-shaped inserts.

Table 4 — Properties for modelling nonequilateral, equiangular and nonequilateral, nonequiangular pocket seats

Preferred name	Preferred symbol
Clearance angle major	AN
Clearance angle minor	ANN
Clearance angle wiper edge	AS
Corner chamfer length	BCH[b]
Corner chamfer length minor	BCHN[b]
Wiper edge length	BS[c]
Insert included angle	EPSR
Insert length	INSL
Corner chamfer angle	KCH[b]
Corner chamfer angle minor	KCHN[b]
Cutting edge angle major	KRINS[c]
Cutting edge length[a]	L[a]
Corner radius	RE[b]
Corner radius minor	REN[b]
Insert thickness	S
Insert width	W1

[a] Will be calculated; is dependent on INSL and EPSR.

[b] Dependent on the corner configuration, either rounded or chamfered corner.

[c] Will be used if a wiper edge is on the insert.

4.3.4 Design of the pocket seat feature

The design shall be done in conjunction with ISO/TS 13399-201, but without any corner configuration on the opposite side where the functional dimensions are based.

5 Face milling cutter

5.1 General

Figure 10 shows the properties to be used for the design of face milling cutters.

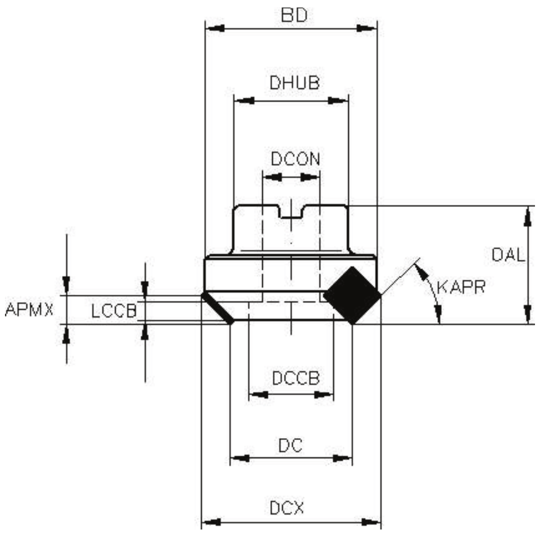


Figure 10 — Determination of properties of face milling cutters

5.2 Necessary properties

The properties listed in Table 5 shall be used for the modelling of a face milling cutter.

Table 5 — Properties for the modelling of a face milling cutter

Preferred name	Preferred symbol
Depth of cut maximum	APMX
Body diameter	BD
Cutting diameter	DC
Counterbore diameter connection bore	DCCB
Connection diameter	DCON
Cutting diameter max	DCX
Hub diameter	DHUB
Rake angle axial	GAMF
Rake angle radial	GAMP
Tool cutting edge angle	KAPR
Counterbore depth connection bore	LCCB
Overall length	OAL
Face effective cutting edge count	ZEFF
Face mounted insert count	ZNF

5.3 Basic geometry

The basic of that part is a rotational design feature, which contains all elements between the plane “TEP” und the separation plane “CIP” to the cutting part.

The sketch includes all the real measure elements above and has to be design on the xz plane of the “PCS”. The rotational axis is the standard z-axis.

The following are the design of the sketch.

— The sketch shall be determined as a half section.

— The sketch shall be constrained to the coordinate system “PCS” and to the planes “TEP” and “CIP” according to Figure 8. If the CAD software does not support the use of datum planes, the sketch shall be fully dimensioned; otherwise, the distances shall be in conjunction with the defined datum planes.

— The dimensioning shall be done with the appropriate properties listed in Table 2.

The sketch shall be revolved about the z-axis by 360 (see Figure 11).

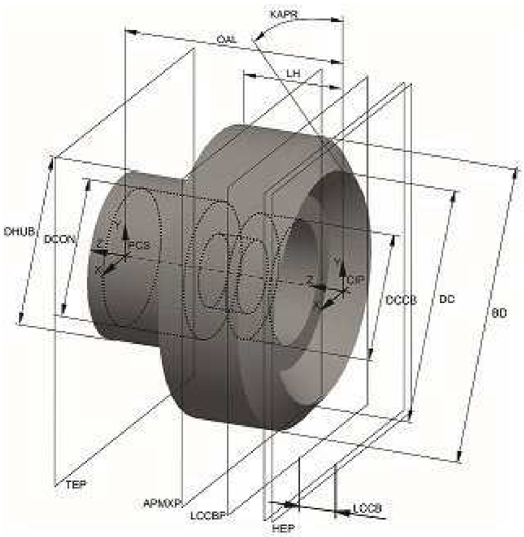


Figure 11 — Basic geometry of face milling cutter

5.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes shall be determined for each insert in accordance with their definitions given in ISO/TS 13399-50 and as shown in Figure 12.

The coordinate systems “CSWx_y” shall be referenced to “PCS”. The position is determined through the following:

— the dimensions DC, LF;

— the geometry of the insert;

— the cutting reference point.

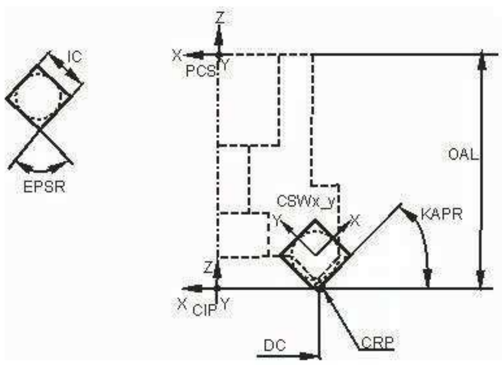


Figure 12 — Determination of CSWx_y for face milling cutters

For the determination of the CSWs, Figure 13 illustrates the location of the CSWs in relation to PCS.

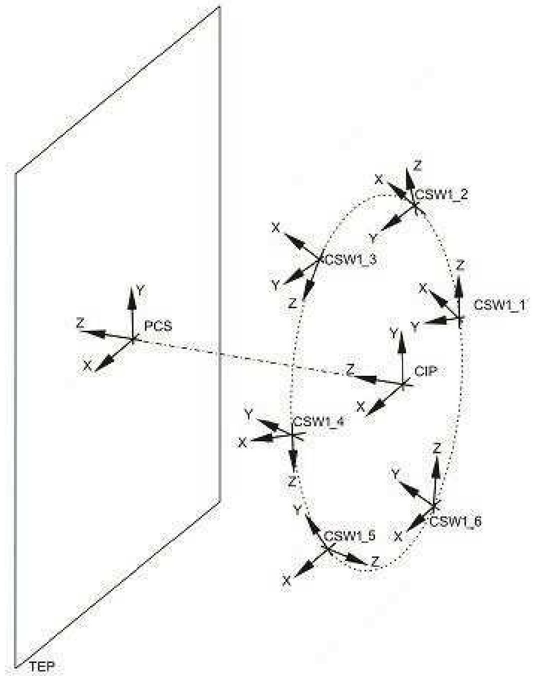


Figure 13 — Location of CSWs of face milling cutters

5.5 Chip flute and pocket seat

The chip flute shall be designed as solid body for subtraction from the tool body. The sketch of the chip flute shall be referenced to the xz-plane of PCS and to CIP. The chip flute body shall be positioned to its final position in using the properties “GAMF”, “GAMP”, “KAPR” and the point “CRP” and the property “OFFCFEX”.

The number and location of the chip flutes shall be ordered by means of using the CAD-arrangement function (see Figure 14).

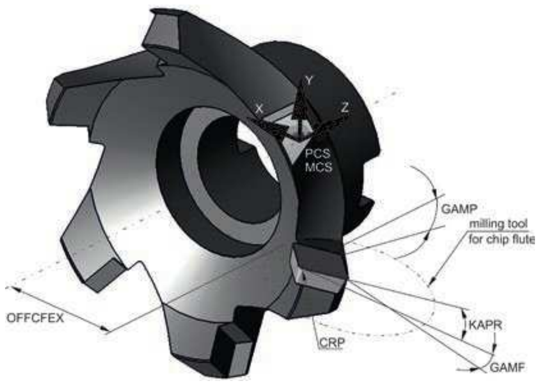


Figure 14 — Chip flute and pocket seat

To position the pocket seat onto the body, the corresponding CSWx_y shall be selected (see Figure 15). The pocket seat shall be designed with reference to the xy-plane of the PCS_INSERT and transformed to the corresponding CSW (see Figure 16).

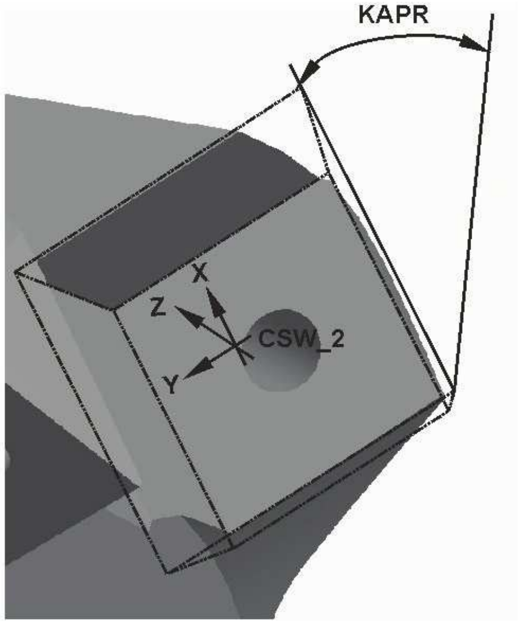


Figure 15 — Position of CSWs

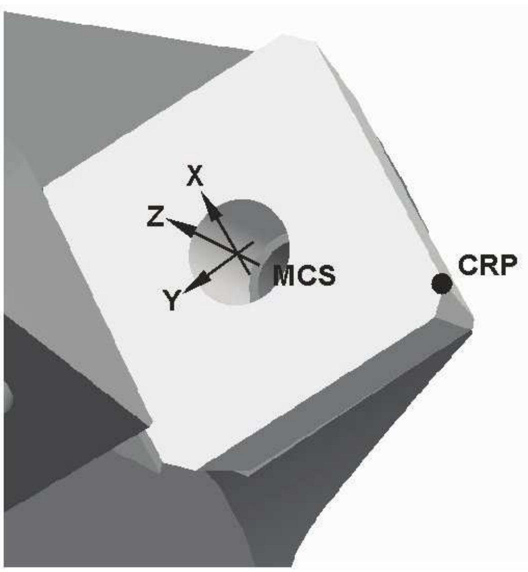


Figure 16 — Position of MCS and CRP

5.6 Face milling cutter, assembly

The assembly of the face milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y (see Figure 17).

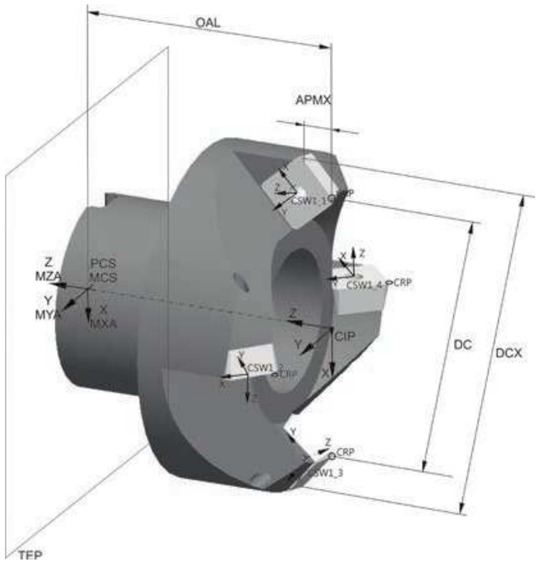


Figure 17 — Assembled face milling cutter

6 Shoulder milling cutter

6.1 General

Figure 18 shows the properties to be used for the design of shoulder milling cutters.

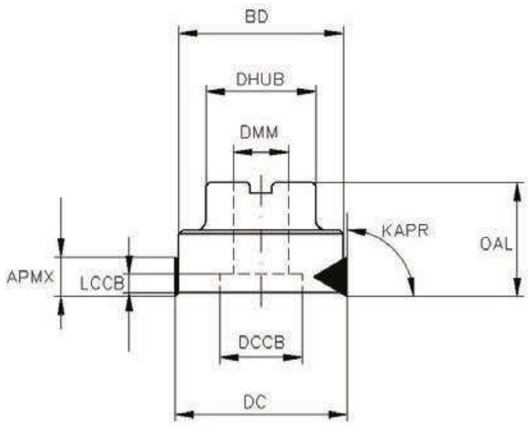


Figure 18 — Determination of properties of shoulder milling cutters

6.2 Necessary properties

The properties listed in Table 5 shall be used (see 5.2).

6.3 Basic geometry

The structure of the model is described in 5.3 and in accordance with Figure 11.

6.4 Determination of the position of the mounting coordinate system of insert

See 5.4, Figures 12 and 13 for the determination of CSWs and the locations in reference to the PCS; use KAPR = 90°.

6.5 Chip flute and pocket seat

See 5.5 for the structure of the chip flutes and the pocket seat.

To position the pocket seat onto the body, the corresponding CSWx_y shall be selected. The pocket seat shall be designed with reference to the xy-plane of the PCS_INSERT and transformed to the corresponding CSW. Figures 19 and 20 illustrate the related properties of an insert without inscribed circle.

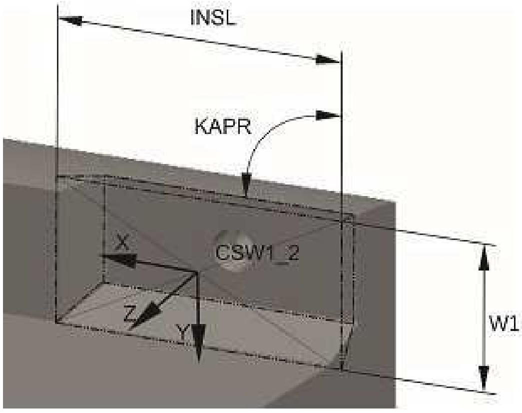


Figure 19 — Position of CSWs

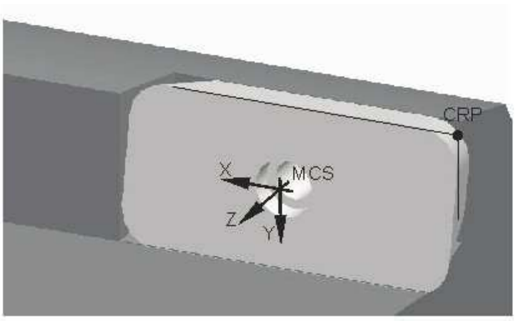


Figure 20 — Position of MCS and CRP

6.6 Shoulder milling cutter, assembly

The assembly of the shoulder milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y.

Figure 21 illustrates the related properties of the assembly of the shoulder milling cutter.

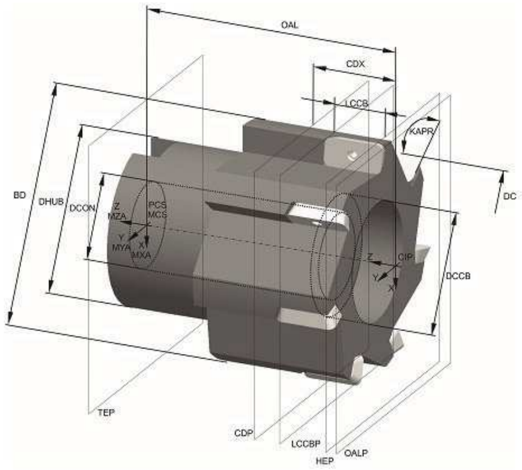


Figure 21 — Shoulder milling cutter, assembly

7 Plain milling cutter

7.1 General

Figure 22 shows the properties to be used for the design of shoulder milling cutters.

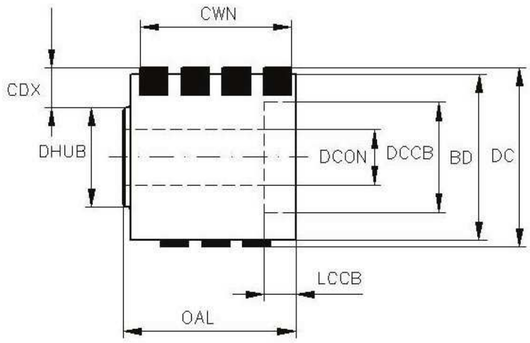


Figure 22 — Determination of properties of plain milling cutters

7.2 Necessary properties

The properties listed in Table 6 shall be used for the modelling face milling cutter.

Table 6 — Properties for the modelling of a plain milling cutter

Preferred name	Preferred symbol
Body diameter	BD
Body length	LB
Cutting depth maximum	CDX
Cutting width	CW
Cutting diameter	DC
Counterbore diameter connection bore	DCCB
Connection diameter	DCON
Hub diameter	DHUB

Table 6 *(continued)*

Preferred name	Preferred symbol
Rake angle axial	GAMF
Rake angle radial	GAMP
Hub height	HHUB
Length cutting corner distance	LCC
Counterbore depth connection bore	LCCB
Row count	NOR
Overall length	OAL
Peripheral effective cutting edge count	ZEFP
Peripheral mounted insert count	ZNP

7.3 Basic geometry

The structure of the model is described in 5.3.

Figure 23 illustrates the additional needed properties “body length - LB” and “hub height - HHUB”.

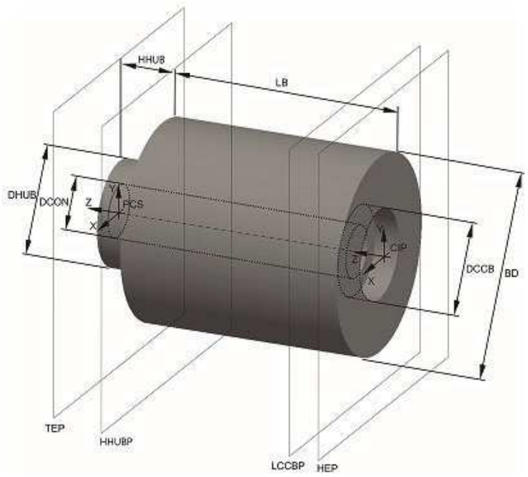


Figure 23 — Basic geometry of a plane cutter

7.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes shall be determined for each insert and each row in accordance with their definitions given in ISO/TS 13399-50.

The coordinate systems “CSWx_y” shall be referenced to “PCS” (see Figure 24). The position is determined through the following:

— the dimensions DC, LF;

— the geometry of the insert;

— the number of rows;

— the cutting reference point.

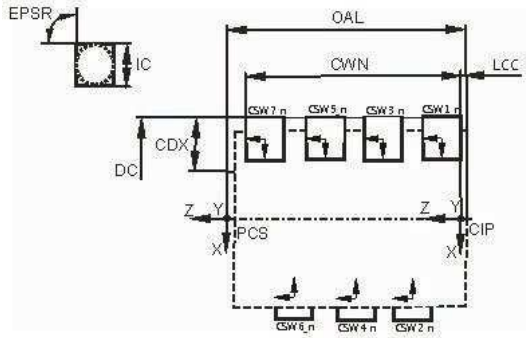


Figure 24 — Determination of CSWx_y on a plain milling cutter

For the position of the CSWs (see Figure 25), it is important to use only that part of the cutting edge without any corner configuration, e.g. the straight portion of the cutting edge without the corner radius. To avoid any gap between the different rows, it is recommended to calculate with 75 percent of the usable cutting edge length to get a correct arrangement of the cutting edges along the maximum cutting depth.

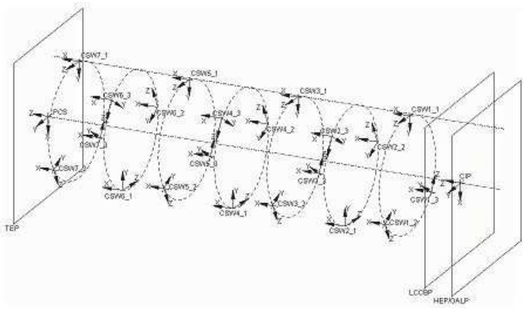


Figure 25 — Position of CSWs

7.5 Chip flute and pocket seat

See 5.5 and Figure 26 for modelling of the chip flute and position on to the basic body.

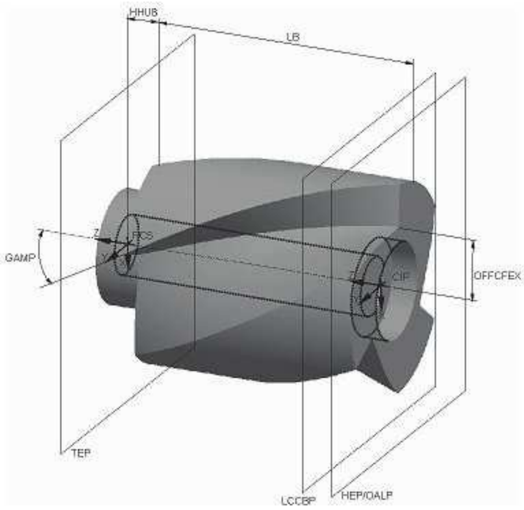


Figure 26 — Design of chip flutes on a plain milling cutter

Along the chip flute, the individual rows of inserts shall be placed with their values of GAMF and GAMP, if the axial rake angle is not 0 (zero) degrees, the tool cutting edge angle KAPR has to be corrected accordingly. Figure 27 shows the arrangement of the pocket seats without axial rake angle (GAMF) and radial rake angle (GAMO).

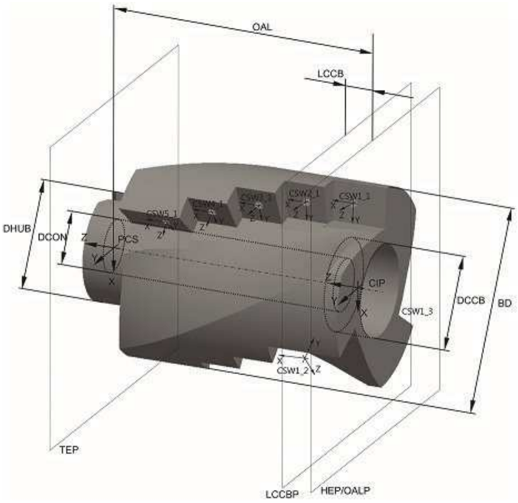


Figure 27 — Arrangement of the pocket seats along the chip flutes

The location of the CSWs of the pocket seats and the location of the corresponding MCS'S of the inserts are shown in Figures 28 and 29.

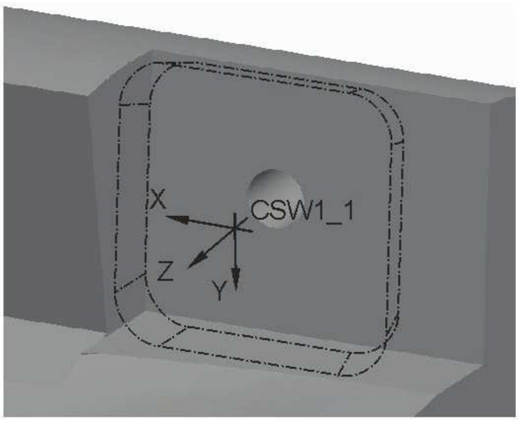


Figure 28 — Location of CSWs

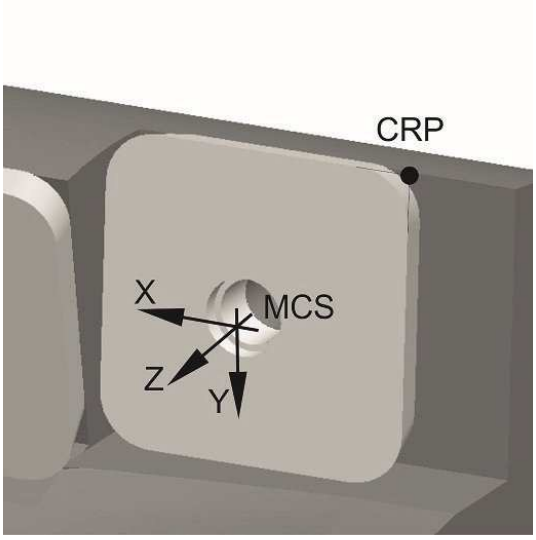


Figure 29 — Location of MCS and CRP

7.6 Plain milling cutter, assembly

The assembly of the plain milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y. Figure 30 shows the complete assembled plain milling cutter.

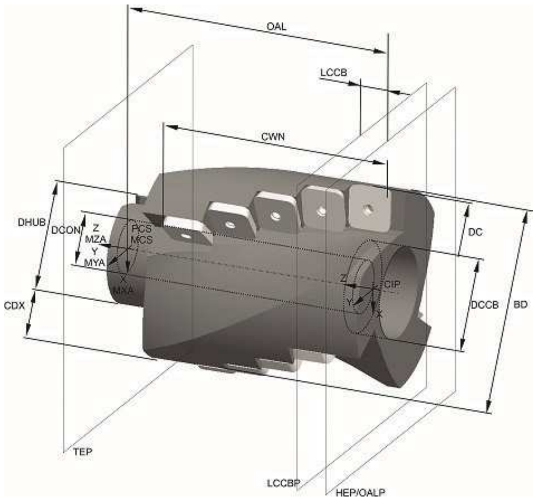


Figure 30 — Assembly of a plain milling cutter

8 Shell milling cutter

8.1 General

Figure 31 shows the properties to be used for the design of shell milling cutters.

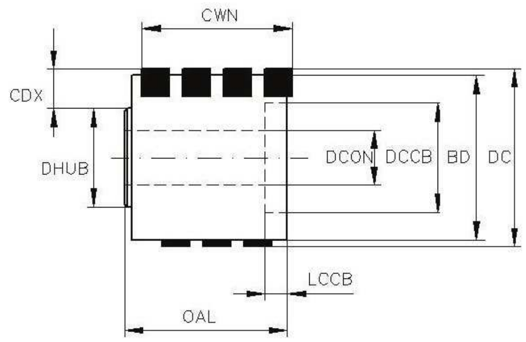


Figure 31 — Determination of properties of shell milling cutters

8.2 Necessary properties

Table 7 lists the properties that are needed for the modelling of a shell milling cutter.

Table 7 — Properties for the modelling of a shell milling cutter

Preferred name	Preferred symbol
Body diameter	BD
Body length	LB
Cutting depth maximum	CDX
Cutting width	CW
Cutting diameter	DC
Counterbore diameter connection bore	DCCB
Connection diameter	DCON
Hub diameter	DHUB
Rake angle axial	GAMF
Rake angle radial	GAMP
Hub height	HHUB
Length cutting corner distance	LCC
Counterbore depth connection bore	LCCB
Row count	NOR
Overall length	OAL
Face effective cutting edge count	ZEFF
Peripheral effective cutting edge count	ZEFP
Face mounted insert count	ZNF
Peripheral mounted insert count	ZNP

8.3 Basic geometry

The structure of the model is described in 5.3.

See Figure 23 for the similar 3D model of a shell milling cutter. The only difference between the models described in Clauses 7 and 8 are the face cutting inserts of a shell milling cutter.

8.4 Determination of the position of the mounting coordinate system of insert

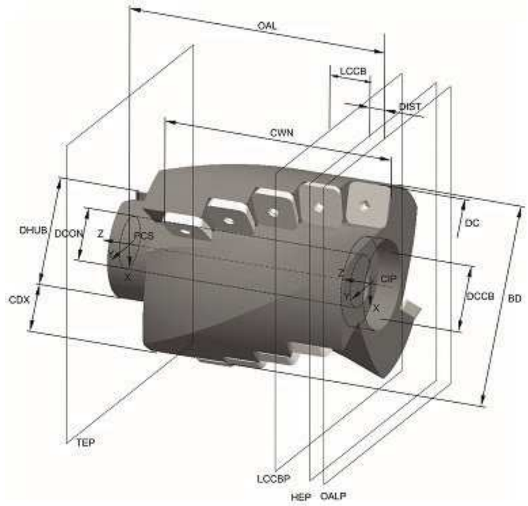
See 7.4 for the determination of the CSWs and their location within the model.

8.5 Chip flute and pocket seat

See 7.5 for the modelling of the chip flutes and the pocket seats, with the exception of the pocket seat placed on the face of the tool body.

8.6 Shell milling cutter, assembly

The assembly of the shell milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y. Figure 32 shows the complete assembled plain milling cutter.



NOTE The property "DIST" will be calculated with the formula "DIST = S x tan(AN)" (see 4.3 for "AN" and "S").

Figure 32 — Assembly of a shell milling cutter

9 Full-side-slot milling cutter

9.1 General

Figure 33 shows the properties to be used for the design of full-side slot milling cutters.

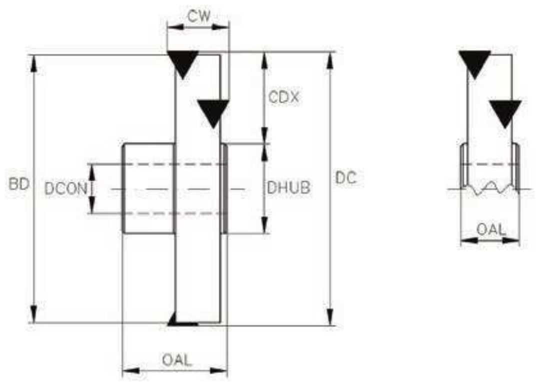


Figure 33 — Determination of properties of full-side slot milling cutters

9.2 Necessary properties

Table 8 lists the properties that are needed for the modelling of a full-side slot milling cutter.

Table 8 — Properties for the modelling of a full-side slot milling cutter

Preferred name	Preferred symbol
Body diameter	BD
Cutting depth maximum	CDX
Cutting width	CW
Cutting diameter	DC
Hub diameter	DHUB
Connection diameter	DCON
Rake angle axial	GAMP
Rake angle radial	GAMF
Hub height	HHUB
Overall length	OAL
Face effective cutting edge count	ZEFF
Peripheral effective cutting edge count	ZEFP
Face mounted insert count	ZNF
Peripheral mounted insert count	ZNP

9.3 Basic geometry

The structure of the model is described in 5.3.

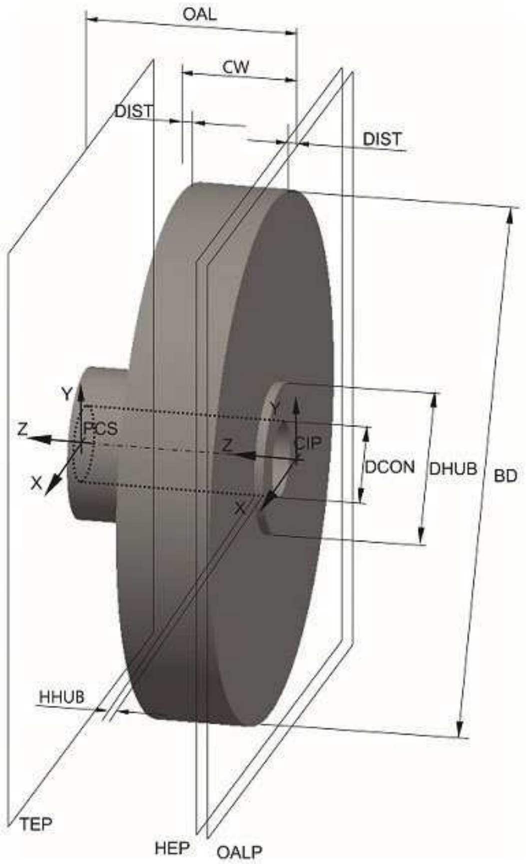


Figure 34 — Basic geometry of a full-side slotting cutter

NOTE The property “DIST” will be calculated with the formula: “DIST = (S x tan(AN)-S x sin(GAMF))/ tan(EPSR/2)” (see 4.3 for “AN”, “EPSR” and “S”).

9.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes have to be determined for each insert and each row in accordance to their definitions in ISO/TS 13399-50.

The coordinate systems “CSWx_y” shall be referenced to “PCS” (see Figures 35 and 36). The position is determined through the following:

— the dimensions DC, OAL, CW;

— the geometry of the insert;

— the number of rows;

— the cutting reference point CRP.

The example of the design shows two rows of cutting items, if the cutting width is larger than twice the cutting edge length of the insert, a third, fourth cutting row shall be defined. In accordance with ISO 11529, the slotting cutter is defined as a “full-side and face mill”, where CW < DC.

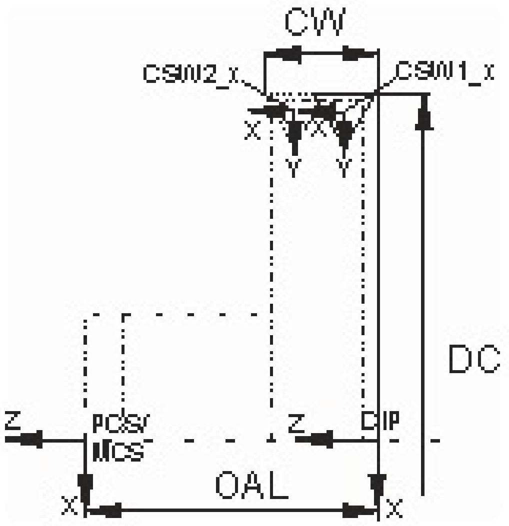


Figure 35 — Determination of CSWx_y on full-side slot milling cutters

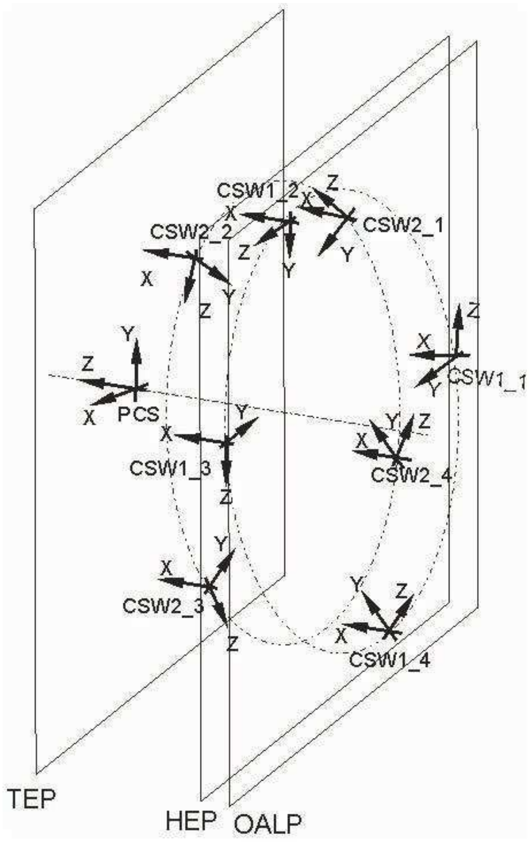


Figure 36 — Position of CSWs

9.5 Chip flute and pocket seat

Dependent on the method how the inserts are mounted on to the cutter body, the chip flute shall be designed. It shall be differentiated between a radial and a tangential mounting method. Radial mounted cutting items are shown in this part of ISO/TS 13399. Figure 37 illustrates the arrangement of the cutting items and the width of the chip flute. Figure 38 shows the positions of the CSWs.

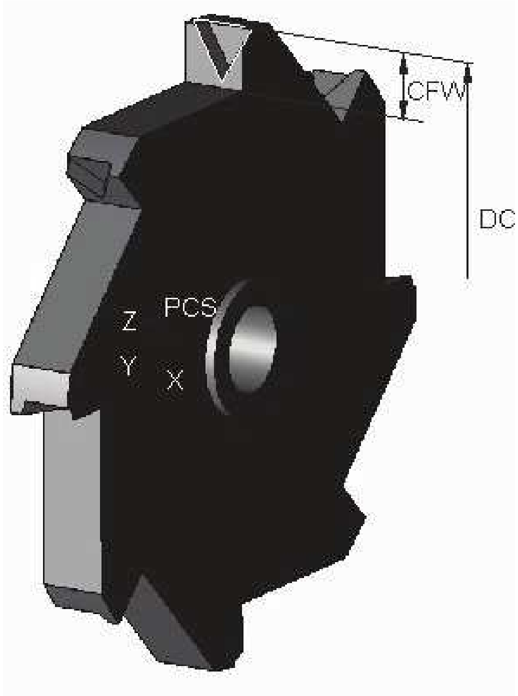


Figure 37 — Chip flute and pocket seats

NOTE The dimension CFW can be calculated from the dimensions of the used insert. Based on the inscribed circle CFW = fx{ IC; offset}, if insert shape code "SC" equals "T", CFW = 1,5·IC+offset; if SC equals "S" or "C", CFW = IC+offset; the offset is set with a value of 1 mm in the shown examples.

For the design of the pocket seats, it is important to know that on a three side slotting cutter, the pocket seats on CSW1_x (position A) shall be right handed and the pocket seats on CSW2_x (position B) shall be left handed.

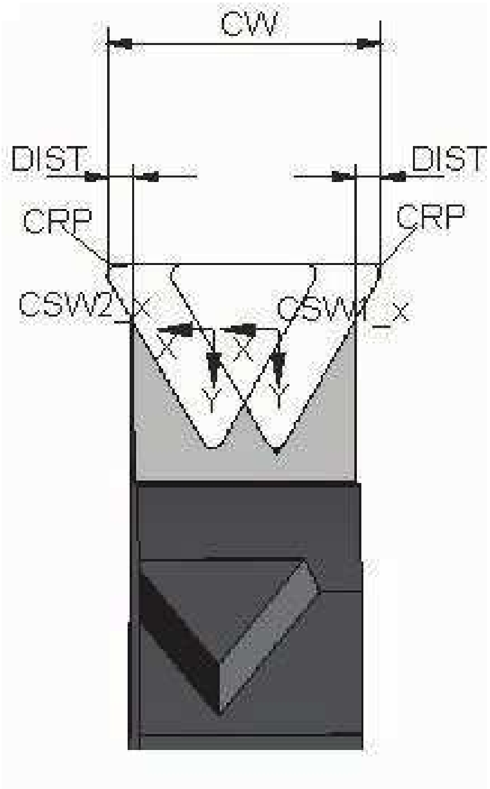


Figure 38 — Determination of CSWs and their positions

NOTE The pocket seat for CSW2_x is shown in the same plane only for visualizing (see Figure 37 for the real position).

9.6 Assembly of a full-side slot milling cutter

The assembly of the slot milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y.

Figure 39 illustrates the related properties of the assembly of a full-side slot milling cutter.

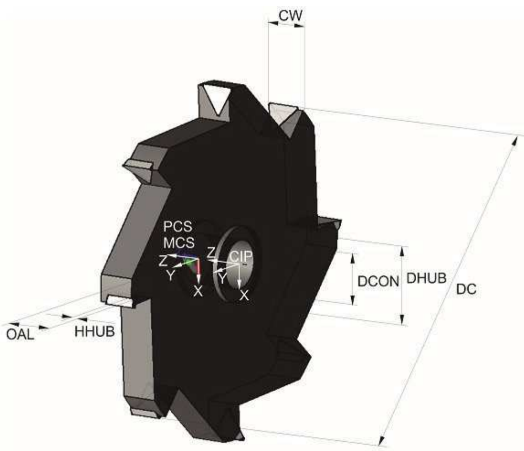


Figure 39 — Assembly of a full-side slot milling cutter

10 Half-side slot milling cutter

10.1 General

Figure 40 shows the properties to be used for the design of half-side slot milling cutters.

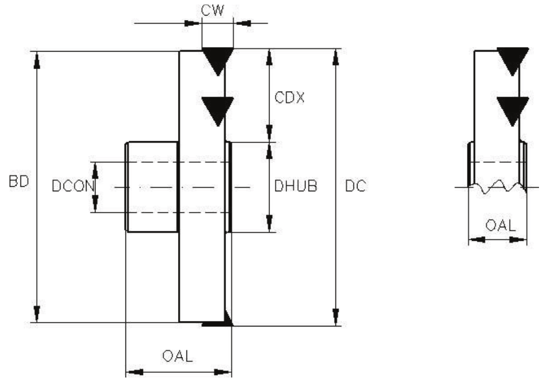


Figure 40 — Determination of properties of half-side slot milling cutters

10.2 Necessary properties

Table 9 lists the properties that are needed for the modelling of a half-side slot milling cutter.

Table 9 — Properties for the modelling of a half-side slot milling cutter

Preferred name	Preferred symbol
Body diameter	BD
Cutting depth maximum	CDX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Hub diameter	DHUB
Rake angle axial	GAMP
Rake angle radial	GAMF
Hub height	HHUB
Overall length	OAL
Face effective cutting edge count	ZEFF
Face mounted insert count	ZNF

10.3 Basic geometry

See 9.3 and Figure 34 for the basic geometry of a half-side slot milling cutter.

10.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes have to be determined for each insert and each row in accordance to their definitions in ISO/TS 13399-50.

The coordinate systems "CSWx_y" shall be referenced to "PCS". The position is determined through the following:

— the dimensions DC, OAL;

— the geometry of the insert;

— the number of rows;

— the cutting reference point CRP.

The example of the design shows one row of cutting items, if the cutting width is larger than the cutting edge length of the insert, a second, third, fourth cutting row shall be defined. In accordance with ISO 11529, the slotting cutter is defined as a "half-side and face mill", where CW < DC.

10.5 Chip flute and pocket seat

See 9.5 for the determination of the chip flutes and the pocket seats, but only position A shall be used for the location of the pocket seats and inserts (see Figure 41).

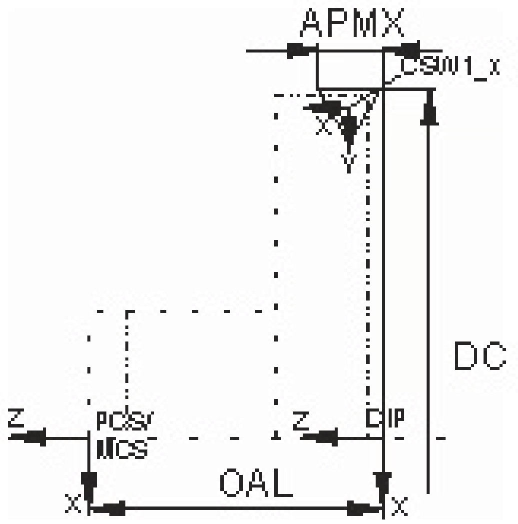


Figure 41 — Determination of the CSWs and their positions

10.6 Half-side slot milling cutter, assembly

The assembly of the slot milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y (see Figure 42).

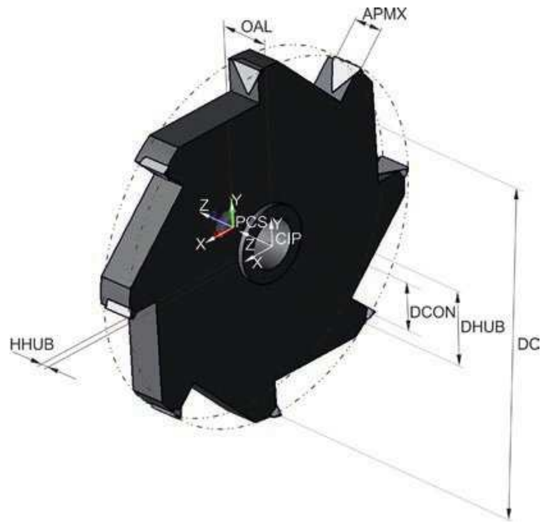


Figure 42 — Assembly of a half-side slot milling cutter

11 Full-side profile slot milling cutter

11.1 General

Figure 43 illustrates the properties to be used for the design of full-side profile slot milling cutters.

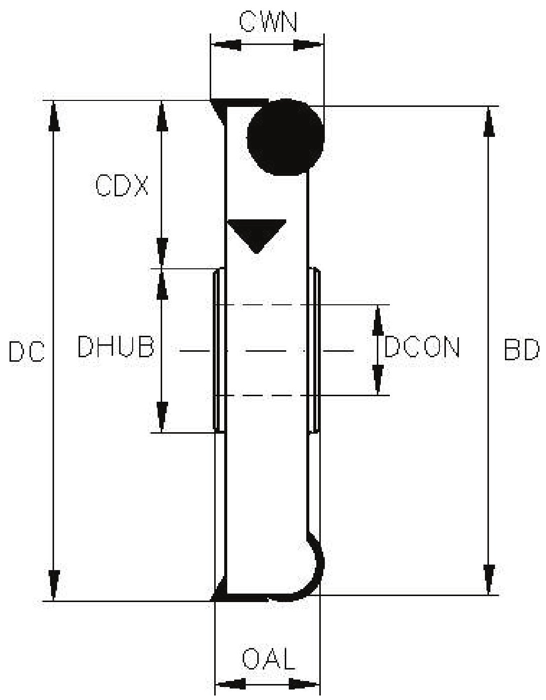


Figure 43 — Determination of properties of full-side profile slot milling cutters

11.2 Necessary properties

See 9.2 and Table 8.

11.3 Basic geometry

The structure of the model is described in 5.3. The design of the basic geometry shall be in accordance with 9.3.

11.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes shall be determined for each insert and each row in accordance with their definitions given in ISO/TS 13399-50.

The coordinate systems “CSWx_y” shall be referenced to “PCS”. The position is determined through the following:

— the dimensions DC, OAL, CW;

— the geometry of the insert;

— the number of rows;

— the cutting reference point CRP.

The example of the design shows two rows of cutting items, if the cutting width is larger than twice the cutting edge length of the insert, a third, fourth cutting row shall be defined. In accordance with ISO 11529, the slotting cutter is defined as a “full-side and face mill”, where CW < DC.

See also Figures 35 and 36 for the determination and location of the CSWs.

11.5 Chip flute and pocket seat

See 9.5 for the determination of the chip flutes and the pocket seats, but different insert shapes shall be used on position A and position B.

11.6 Full-side profile slot milling cutter, assembly

The assembly of the slot milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y (see Figure 44).

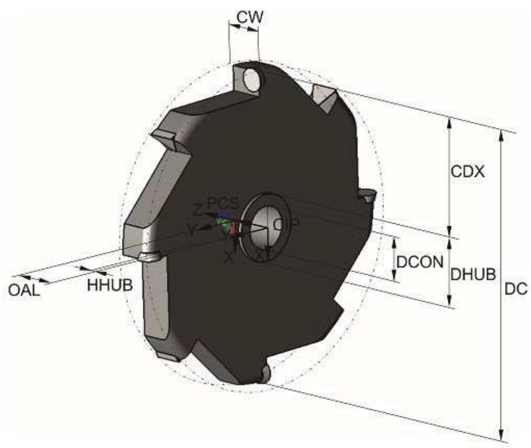


Figure 44 — Assembly of a full-side profile slot milling cutter

12 Full-side angular slot milling cutter

12.1 General

Figure 45 illustrates the properties to be used for the design of full-side angular slot milling cutters.

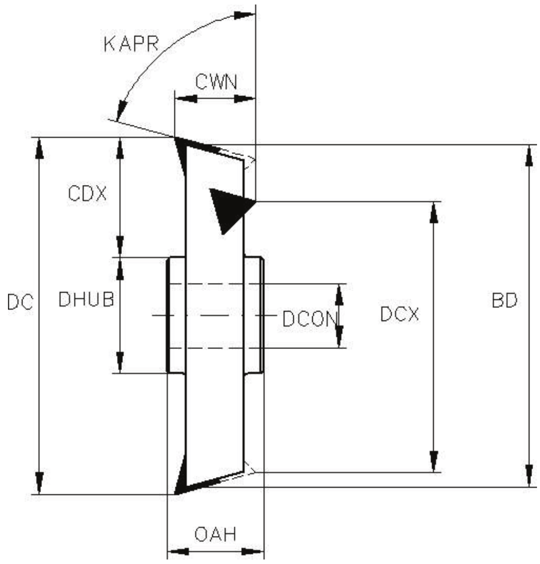


Figure 45 — Determination of properties of full-side angular slotting cutters

12.2 Necessary properties

Table 10 lists the properties that are needed for the modelling of a full-side angular slot milling cutter.

Table 10 — Properties for the modelling of a full-side angular slotting cutter

Preferred name	Preferred symbol
Body diameter	BD
Cutting depth maximum	CDX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Hub diameter	DHUB
Rake angle axial	GAMP
Rake angle radial	GAMF
Hub height	HHUB
Tool cutting edge angle	KAPR
Overall length	OAL
Face effective cutting edge count	ZEFF
Peripheral effective cutting edge count	ZEFP
Face mounted insert count	ZNF
Peripheral mounted insert count	ZNP

12.3 Basic geometry

The structure of the model is described in 5.3 and the design of the basic geometry in accordance with 9.3, but with respect using the property "tool cutting edge angle" KAPR.

12.4 Determination of the position of the mounting coordinate system of insert

See 9.4 for the determination of the position of the mounting coordinate system CSWx_y and MCS_INSERT.

12.5 Chip flute and pocket seat

See 9.5 for the design, orientation and location of the chip flutes and the pocket seats with respect of the use of KAPR.

12.6 Full-side angular slot milling cutter, assembly

The assembly of the slot milling cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y (see Figure 46).

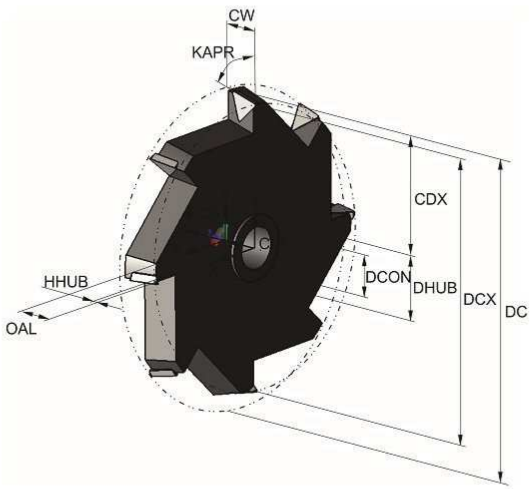


Figure 46 — Assembly of a full-side angular slotting cutter

13 Saw blade/slitting cutter

13.1 General

Figure 47 illustrates the properties to be used for the design of slitting cutters.

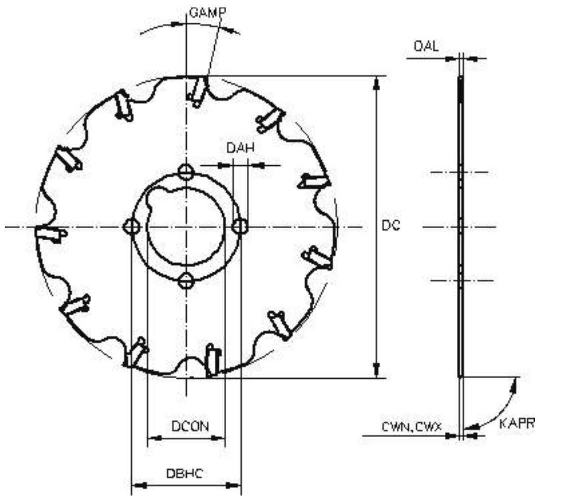


Figure 47 — Determination of properties of slitting cutter

13.2 Necessary properties

Table 11 lists the properties that are needed for the modelling of a slitting cutter.

Table 11 — Properties for the modelling of a slitting cutter

Preferred name	Preferred symbol
Body diameter	BD
Cutting width minimum	CWN
Cutting width maximum	CWX
Diameter access hole	DAH
Diameter bolt circle	DBC
Cutting diameter	DC
Connection diameter	DCON
Rake angle axial	GAMP
Rake angle radial	GAMF
Tool cutting edge angle	KAPR
Overall length	OAL
Peripheral effective cutting edge count	ZEFP
Peripheral mounted insert count	ZNP

13.3 Basic geometry

See 5.3 for the structure of the model. The design shall be made as a disc without any flange or hub, because of the removability of the hubs to support as much stiffness as possible. Therefore, the maximum cutting depth “CDX” shall not be given with the tool body, because it is dependent on the hub diameter.

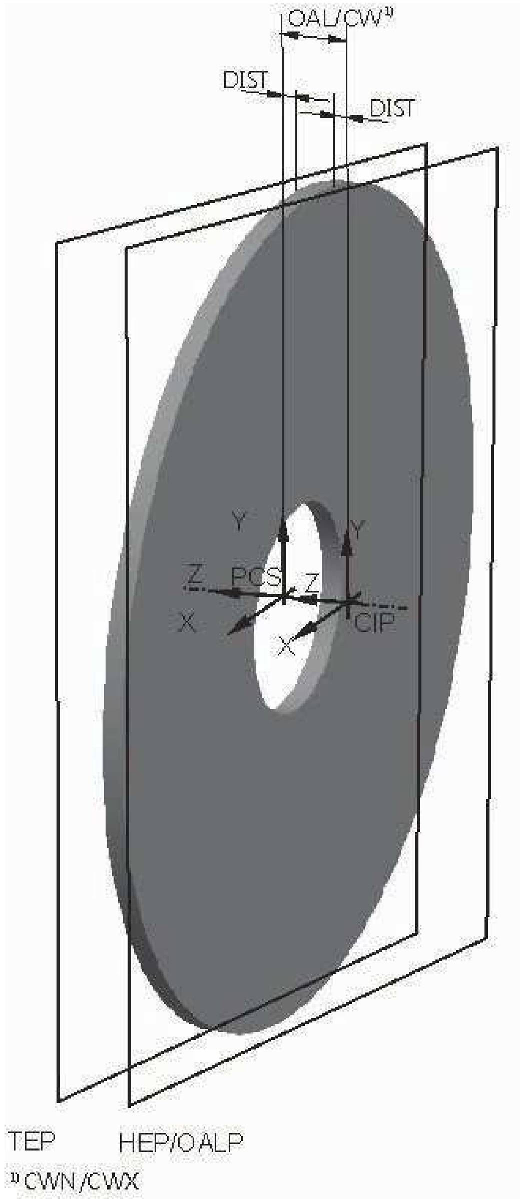


Figure 48 — Basic geometry of a slitting cutter

The property “DIST” shall be calculated with the following formula:

“DIST = (S x tan(AN)-S x sin(GAMF))/tan(EPSR/2)”

See 4.3 for “AN”, “EPSR” and “S”.

13.4 Determination of the position of the mounting coordinate system of insert

A coordinate system workpiece side and the corresponding planes shall be determined for each insert and each row in accordance with their definitions given in ISO/TS 13399-50.

The coordinate systems “CSWx_y” shall be referenced to “PCS”. The position is determined through the following:

— the dimensions DC, OAL, CW;

— the geometry of the insert;

— the cutting reference point CRP.

Dependent on the used insert, either regular inserts or irregular inserts, the location on CSWs changes. While the CSW on regular insert is located in the centre of the cutting edge plane, the CSW on irregular inserts is placed on the centre of the cutting edge, which is the middle of the cutting width of the cut-off insert, (see Figures 49 and 50).

See ISO/TS 13399-201 for the MCS of regular inserts or ISO/TS 13399-202 for the MCS of irregular cut-off inserts.

Slitting cutter with tangential mounted inserts shall also be possible. The examples shall be designed with irregular inserts and the according pocket seats.

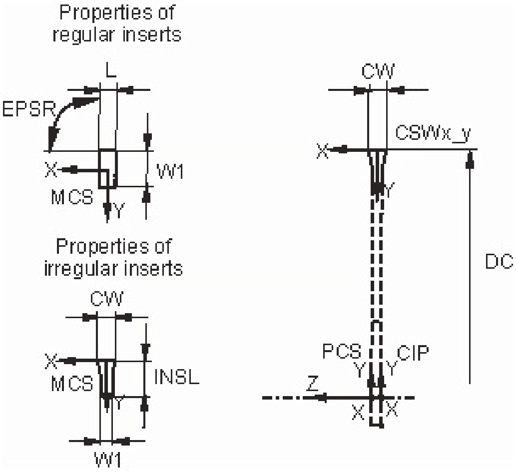


Figure 49 — Determination of CSWs

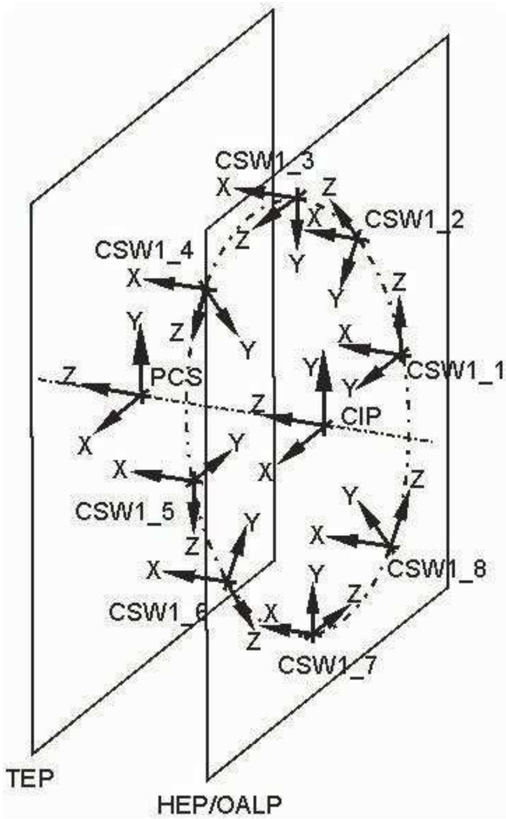


Figure 50 — Position of CSWs

13.5 Chip flute and pocket seat

The design of the chip flute shall independent from the used type of insert. If irregular inserts are used, the pocket seat shall be designed with a self-clamping mechanism. If regular inserts are used, they shall be mounted tangentially (see Figures 51 to 53).

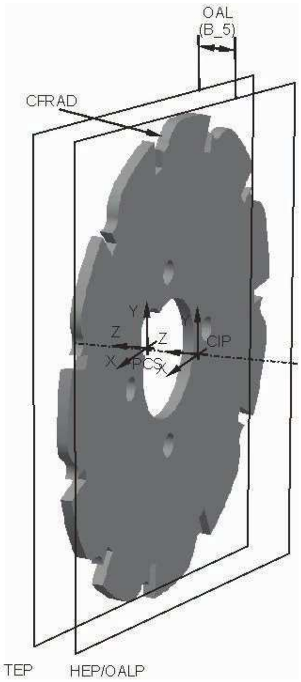


Figure 51 — Chip flute design

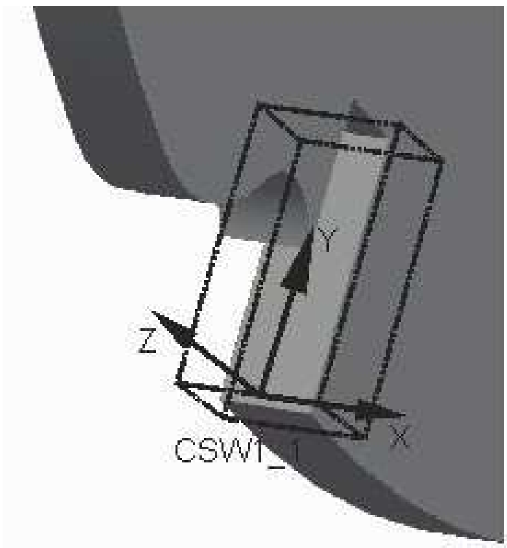


Figure 52 — Determination of CSWs

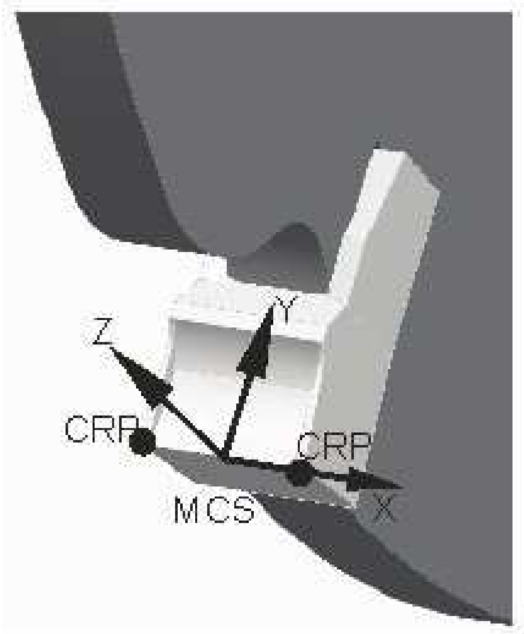


Figure 53 — Determination of MCS and CRP

13.6 Saw blade/slitting cutter, assembly

The assembly of the slitting cutter shall be done by means of using the CSWs. The mounting coordinate system of the inserts MCS_INSERT shall be mated directly onto the corresponding coordinate system workpiece side CSWx_y (see Figure 54).

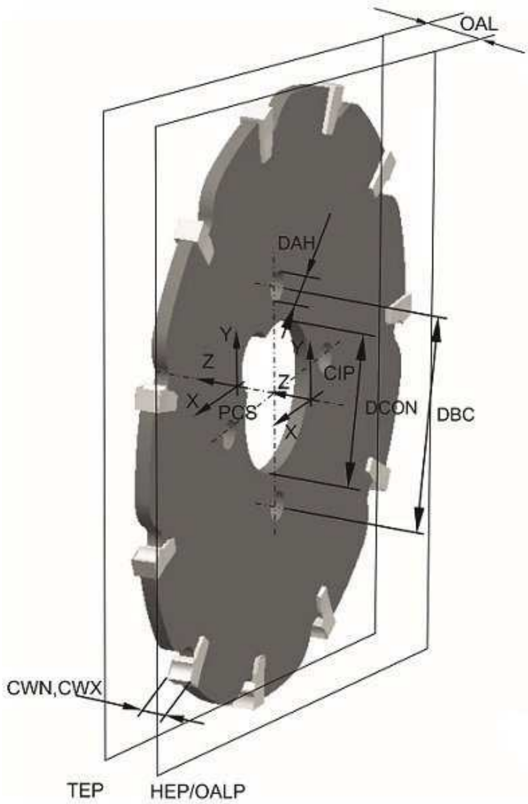


Figure 54 — Assembly of saw blade/slitting cutter

For the completeness of the slitting cutter, the drive and support rings shall be mounted on to the blade.

14 Design of details

14.1 Basics for modelling

All details shall be designed as separate design features and shall not be incorporated into the revolved body of the crude geometry.

14.2 Fixing threads for inserts

Internal threads for the fastening of the inserts shall not be designed as details because they are not relevant for collision.

14.3 Contact surfaces/drive keys — Orientation

Drive keys that are visualized within the model shall be oriented by means of a unique orientation. Transversal key ways shall be parallel to the x-axis of PCS; longitudinal key ways shall be parallel to the z-axis of PCS.

14.4 Chamfers, roundings, others

Necessary chamfers and roundings shall be created within the according function of the 3D CAD system.

15 Attributes of surfaces — Visualization of the model features

For a printed version of this part of ISO/TS 13399, the colour settings as part of the attributes of the surfaces shall be taken in accordance with ISO/TS 13399-80.

Some CAD systems identify only one surface of the same diameter even if these surfaces are mated by means of two solid design features. Therefore, to be able to address the surface attributes to each of these features, a revolved design feature is created over the cutting part feature. In the tree of elements and features, this element is called “CUTTING_SURFACE”. This design feature shall be created with the sketch elements of the cutting and non-cutting part and be placed at the end of the tree.

Some CAD systems give the possibility to use the available lines of the main sketches for the creation of the “CUTTING_SURFACE”. Hereby, the datum planes “LCFP” and other shall be used as references. With the suppression of the main design elements, all referenced design elements shall be supressed either.

16 Structure of the design elements (tree of model)

At milling cutters with arbor hole for indexable inserts, the inserts shall be defined as cutting features “CUT” only. The basic body of the cutting tool shall be defined as “NOCUT” design feature. The design features of the basic body shall be grouped within the group “BASIC”. Both groups can be suppressed or deactivated separately, without a mutually impact.

All the detailed design features shall be put together to a separate group named “DETAILS”. This group shall be the last element of the tree. It is dependent on the groups “CUT” and “NOCUT” and shall be suppressed either, if one of these two groups are suppressed (see Figure 55).

Such kind of grouping shall be built only, if the containing design features are arranged consecutively. Therefore, it shall be taken care for the correct sequence of the design features with notice to avoid reference.

The example of the structure of a full-side slotting cutter is shown in Figure 55. It will be similar in other CAD systems.

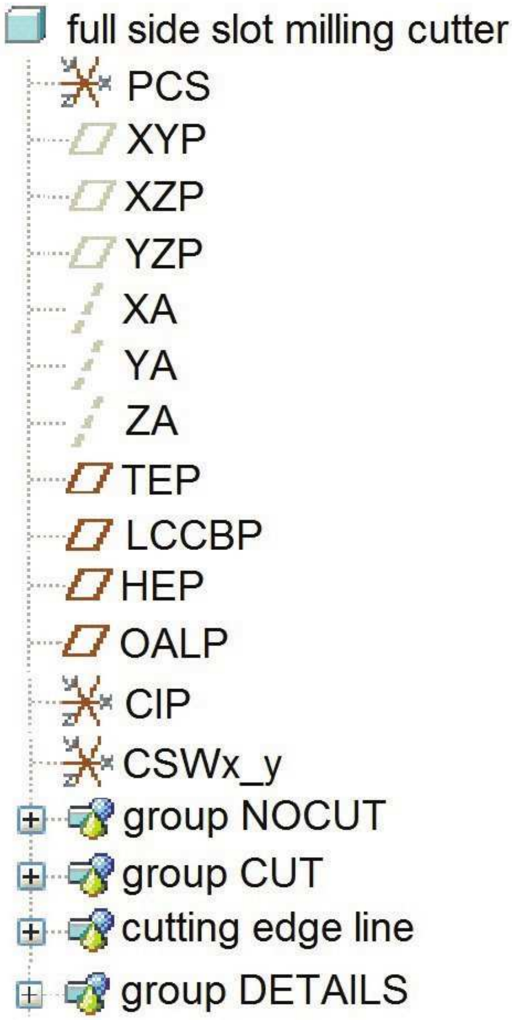


Figure 55 — Example of the structure of design features of a full-side slotting cutter

17 Data exchange model

Figure 56 illustrates an example of the data exchange model of a face milling cutter. All of those models shall contain the geometrical features (collision contour), primary coordinate system “PCS”, the mounting coordinate system “MCS”, the coordinate system in process “CIP” and the cutting line of the inserts that are relevant for the collision examination.

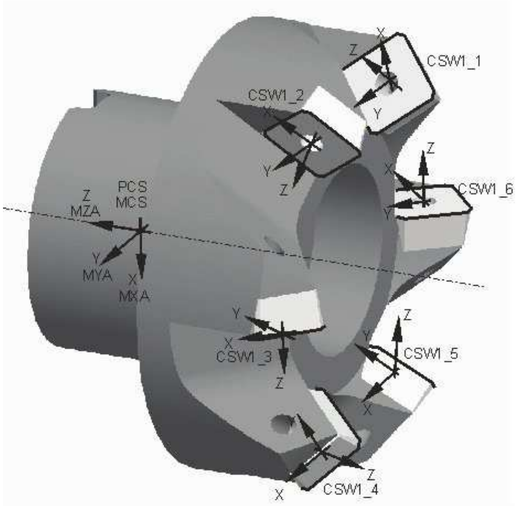


Figure 56 — Data exchange model of a face milling cutter

Annex A
(informative)

Information about nominal dimensions

A nominal dimension, nominal size or trade size is a size "in name only" used for identification. The nominal size my not match any dimension of the product, but within the domain of that product, the nominal size may correspond to a large number of highly standardized dimensions and tolerances. A nominal size may not even carry any unit of measure. In measurement, a nominal value is often a value existing in name only; it is assigned as a convenient designation rather than calculated by data analysis or following usual rounding methods. The use of nominal values can be based on de facto standards or some technical standards.

All real measurements have some variation depending on the accuracy and precision of the production method and the measurement uncertainty. The use of reported values often involves engineering tolerances. See Table A.1.

Table A.1 — Examples of nominal dimensions/sizes

Description	Value	Tolerance	Lower limit	Upper limit	Nominal dimension/size
Morse taper size 5	MT5	—	—	—	5
Internal diameter	⌀ 25	H6	25,000	25,013	25,000
External diameter	25	g7	24,972	24,993	25,000
Square shank size hxb	32 × 25	h13	31,61 × 24,67	32 × 25	32 × 25

Bibliography

[1] ISO 13584-24, *Industrial automation systems and integration — Parts library — Part 24: Logical resource: Logical model of supplier library*

[2] ISO 13584-25, *Industrial automation systems and integration — Parts library — Part 25: Logical resource: Logical model of supplier library with aggregate values and explicit content*

[3] ISO/TS 13399-2, *Cutting tool data representation and exchange — Part 2: Reference dictionary for the cutting items*

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

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

ICS 25.100.01; 35.240.50
Price based on 46 pages