TECHNICAL SPECIFICATION

ISO/TS 13399-304

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Cutting tool data representation and exchange —

Part 304:
Creation and exchange of 3D models — Solid milling cutters with arbor hole

Représentation et échange des données relatives aux outils coupants —

Partie 304: Création et échange de modèles 3D — Fraises monobloc à trou central

Reference number
ISO/TS 13399-304:2016(E)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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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 arbor hole and non-indexable cutting edges that can be used for NC-programming, simulation of the manufacturing processes and the determination of collision within machining processes. It is not intended to standardize the design of the cutting tool itself.

A cutting tool is used in a machine to remove material from a workpiece by a shearing action at the cutting edges of the tool. Cutting tool data that can be described by ISO/TS 13399 (all parts) include, but are not limited to, everything between the workpiece and the machine tool. Information about inserts, solid tools, assembled tools, adaptors, components and their relationships can be represented by ISO/TS 13399 (all parts). The increasing demand providing the end user with 3D models for the purposes defined above is the basis for the development of this series of International Standards.

The objective of ISO/TS 13399 (all parts) is to provide the means to represent the information that describes cutting tools in a computer-sensible form that is independent from any particular computer system. The representation will facilitate the processing and exchange of cutting tool data within and between different software systems and computer platforms and support the application of this data in manufacturing planning, cutting operations and the supply of tools. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and for archiving. The methods 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 304:
Creation and exchange of 3D models — Solid milling cutters with arbor hole

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 and non-indexable cutting edges, 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 and non-indexable cutting edges, 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 and non-indexable cutting edges.

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

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

ISO/TS 13399-60, *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*

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 dimension can differ from those nominal dimensions.

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

3.2 Reference system

The reference system (see Figure 1) consists of the following standard elements:

— standard coordinate system

right-handed rectangular Cartesian system in three-dimensional space called “primary coordinate system” (PCS);

— 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 planes lines respectively, named “x-axis” (XA), “y-axis” (YA) and “z-axis” (ZA).

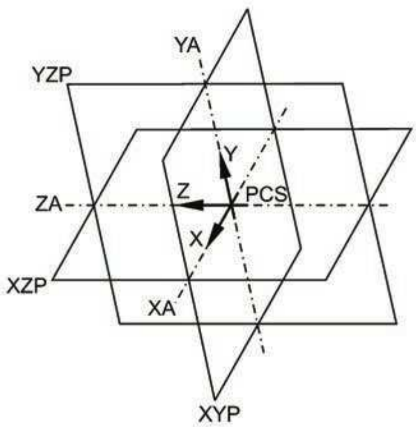


Figure 1 — Reference system

For virtually mounting of milling cutters onto an adaptive item, an additional reference system shall be defined. This reference system is called “mounting coordinate system” (MCS). It is located at the starting point of the protruding length of a tool item. The orientation is shown in Figure 2.

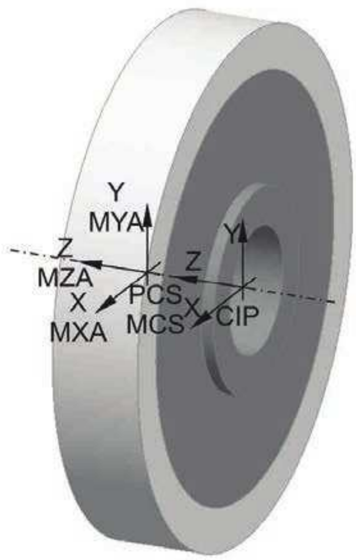


Figure 2 — Orientation of “PCS” and “MCS” reference system (example)

3.3 Coordinate system at the cutting part

The coordinate system at the cutting part 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:

— 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.

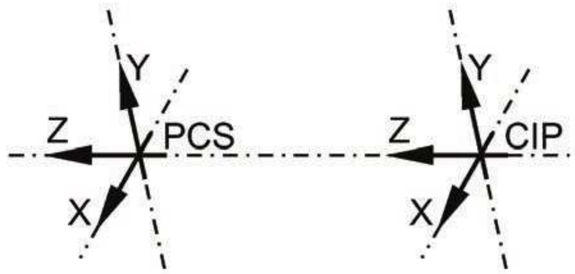


Figure 3 — Orientation of CIP

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

If necessary, another designation can 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 ensured 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 by using the plane concept, even if they contact each other with the same size, e.g. chip flute, shank and etc.

For the 3D visualization of milling cutter with arbor hole and non-indexable cutting edges, the planes shall be determined by the following and shown in Figure 4:

— “CWP” plane for the cutting width (CW), based on “CIP”; the distance of CWP to CIP shall be taken from the property “CW” or “CWN” if the cutting width is adjustable;

— “HEP” (head end plane) plane for the overall length (OAL), based on “PCS”;

— “LCCBP” plane for the counter bore depth of a connection bore (LCCB), based on “CIP”;

— “LCCP” plane for the distance of the cutting corner (distance cutting corner) of a profiled milling cutter, based on “CIP”;

— “TEP” (tool end plane) plane that is the base of any other planes, located at origin of PCS.

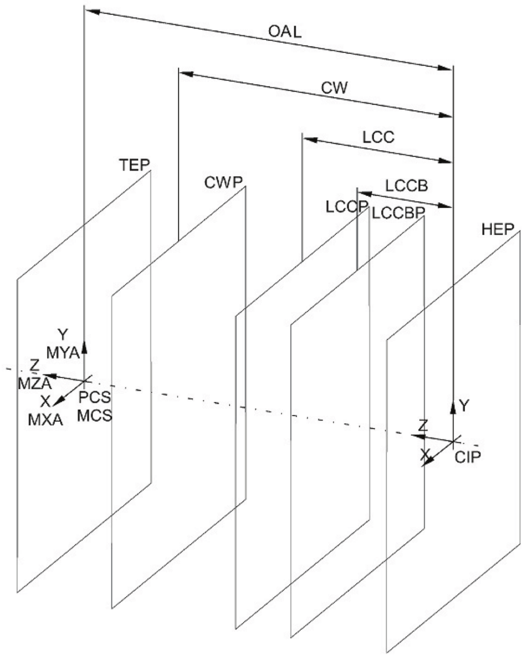


Figure 4 — Planes for design

3.5 Cutting reference point (CRP)

For the design, the cutting reference point shall be defined. The point is defined as the theoretical cutting edge in the XZ plane of the “PCS”. Therefore, it is always referenced to the cutting diameter as shown in Figure 5.

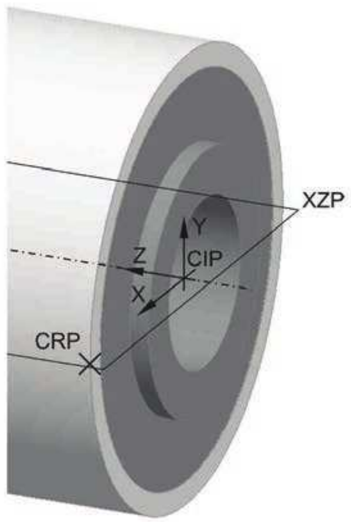


Figure 5 — Position of the cutting reference point “CRP”

4 Design of the model

The sketches and contours of the crude geometry do not contain any details, such as grooves, chamfers, rounding. These details shall be designed as separate design features after the design of the crude geometry and, therefore, they are named precision geometry.

The order of the structure of the model shall be kept by means of the state of the technology of the CAD systems. It shall be waived on references between the design components of the cutting and non-cutting part.

Milling cutters with arbor hole and non-indexable cutting edges shall be built as rotational symmetric design elements based on properties in accordance with ISO/TS 13399-3:

— geometry of the non-cutting part, including the connection interface, if applicable;

— geometry of the cutting part;

— cutting part line, which is a cross section of the surface of the cutting part along the centre line.

NOTE 1 These both geometrical parts are coloured as described in Clause 18.

NOTE 2 The total amount of design elements is focused on the depth of modelling and the complexity of the cutting tool.

Within the following clauses, the specified structure of the model of the defined basic shapes of milling cutters with arbor hole and non-indexable cutting edges are described.

4.1 Necessary properties 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 1.

Table 1 — 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 above and other relevant properties shall be incorporated into the model as parameters or shall be taken as a separate file.

5 Plain milling cutter

5.1 General

Figure 6 shows the properties used for identification and classification of plain milling cutters.

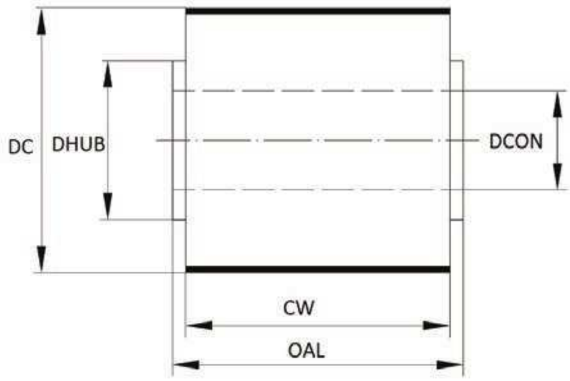


Figure 6 — Plain milling cutter: Determination of properties

5.2 Necessary properties

Table 2 shows the properties needed for the modelling of a plain milling cutter.

Table 2 — Properties for the modelling of a plain milling cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Counterbore depth connection bore	LCCB
Overall length	OAL

5.3 Geometry of the non-cutting part inclusive of the connection

To avoid any collision between the cutting tool and the workpiece during simulation processes, it is absolutely necessary to design the non-cutting part smaller than the cutting part. If the necessary properties cannot be provided for the modelling, it shall be sufficient to design the non-cutting part by means of using the given dimensions describing the basic part and covering the cutting part of the basic part with a separate surface describing the cutting part.

The connection feature shall be integrated into the non-cutting part.

Two different main types of a connection bore are available.

— Type 1 shall be a simple cylindrical hole (see Figures 7 and 8).

— Type 2 shall be a cylindrical hole also, but with a countersunk for either a cutter retaining screw or a socket head cap screw (see Figures 9 and 10).

On type 2, the depth of the countersunk shall be handled with the plane “LCCBP”.

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

The design of the sketch is as follows.

— 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 according to Figures 7 and 8 or Figures 9 and 10. If the CAD software does not support the use of datum planes, the sketch shall be fully dimensioned otherwise the distances are 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°.

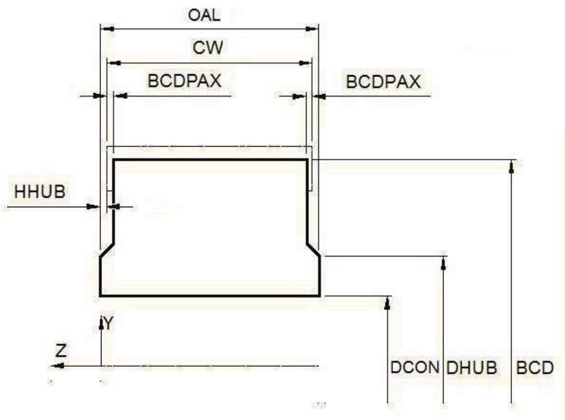


Figure 7 — Connection type 1 — Through bore — Sketch

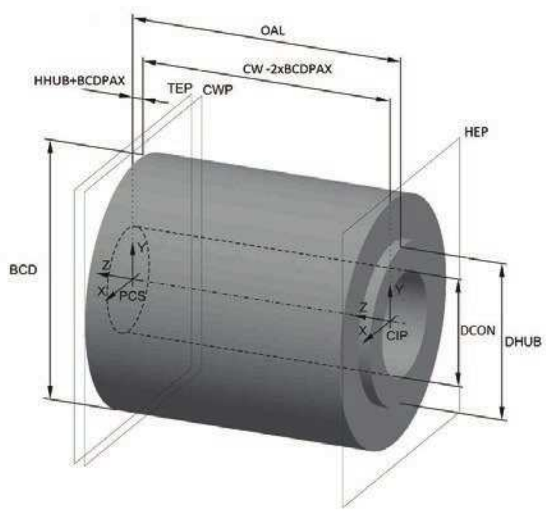


Figure 8 — Connection type 1 — Through bore — Revolved body

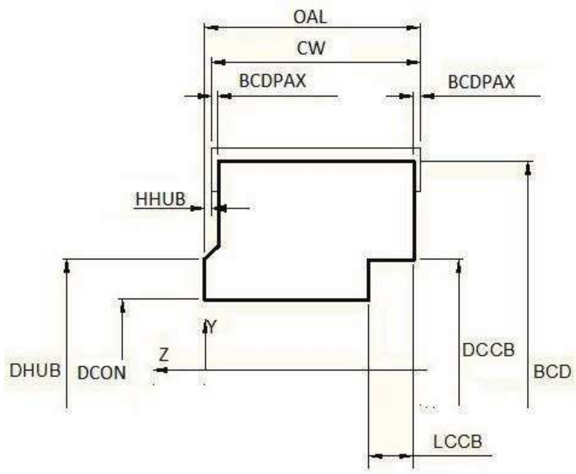


Figure 9 — Connection type 2 — Bore with countersunk — Sketch

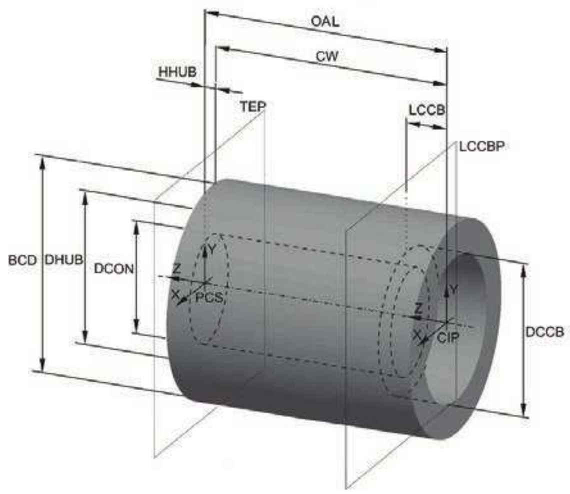


Figure 10 — Connection type 2 — Bore with countersunk — Revolved body

5.4 Geometry of the cutting part

The geometry of the cutting part shall be designed as a separate surface as described in 5.3.

5.5 Plain milling cutter, complete

Figure 11 shows the complete plain milling cutter with cutting and non-cutting part.

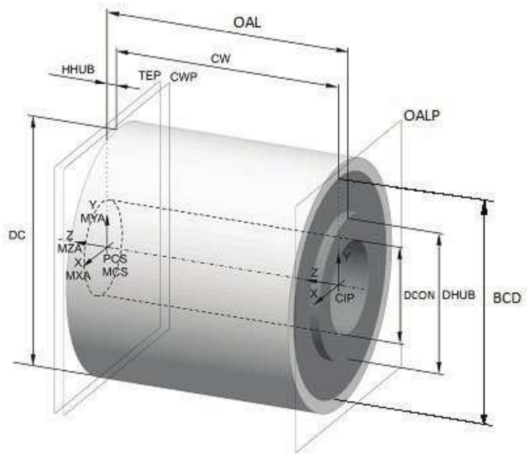


Figure 11 — Plain milling cutter, complete

6 Shell mill

6.1 General

Figure 12 shows the properties used for identification and classification of shell mills.

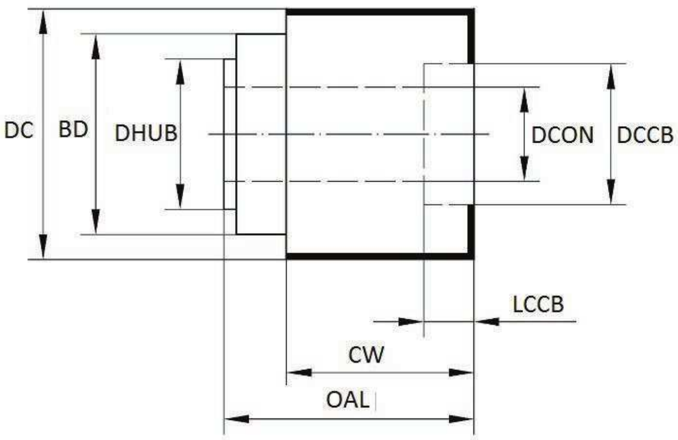


Figure 12 — Shell mill: Determination of properties

6.2 Necessary properties

Table 3 shows the properties needed for the modelling of a shell mill.

Table 3 — Properties for the modelling of a shell mill

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Body diameter	BD
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Counterbore depth connection bore	LCCB
Overall height	OAH

6.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

6.4 Geometry of the cutting part

The structure of the model is described in 5.4

6.5 Shell mill, complete

Figure 13 shows the complete shell mill with cutting and non-cutting part.

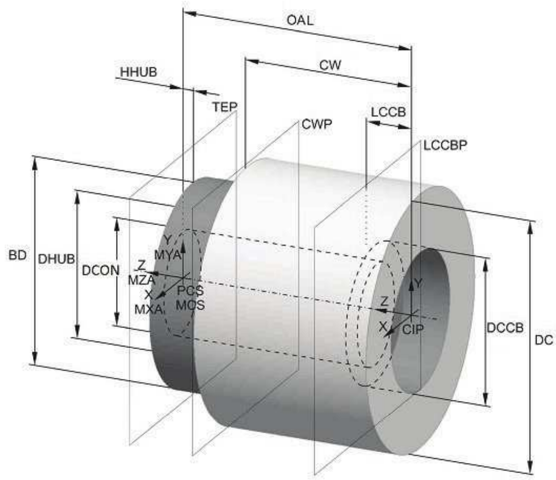


Figure 13 — Shell mill, complete

7 Thread milling cutter

7.1 General

Figure 14 shows the properties used for identification and classification of thread milling cutters.

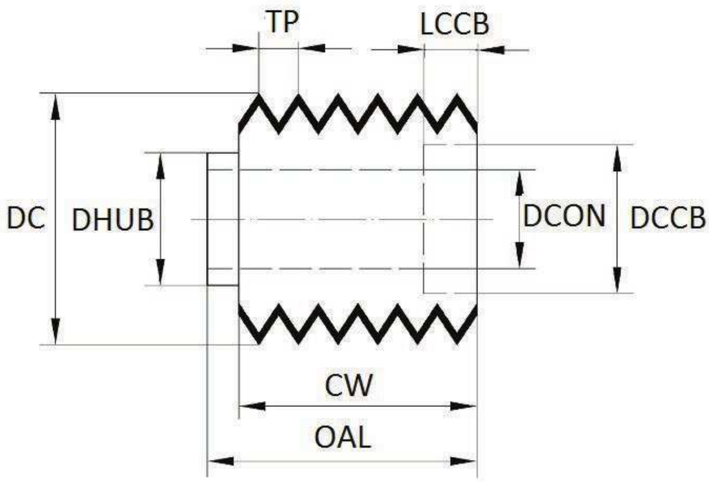


Figure 14 — Thread milling cutter: Determination of properties

7.2 Necessary properties

See 5.2 and Table 2 for necessary properties.

Table 4 lists additional properties for the identification of the thread.

Table 4 — Additional properties to classify a thread milling cutter

Preferred name	Preferred symbol
Thread form type	THFT
Thread pitch	TP
Threads per inch	TPI

The properties listed in Table 4 shall be incorporated into Table 1.

7.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

7.4 Geometry of the cutting part

The structure of the model is described in 5.4

See 7.5 and Figure 15 for the dimensions for the sketch.

7.5 Thread milling cutter, complete

Figure 15 shows the complete thread milling cutter with cutting and non-cutting part.

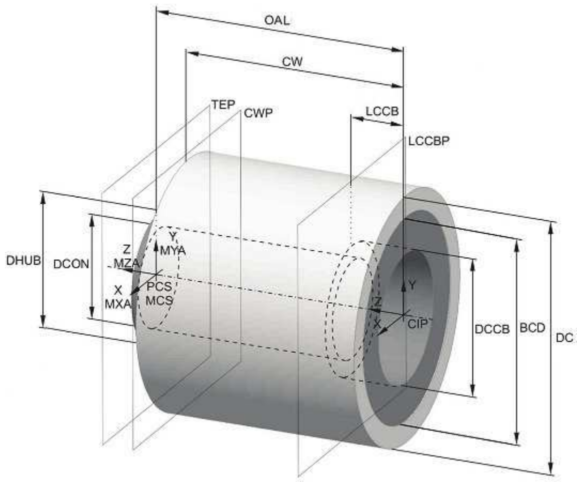


Figure 15 — Thread milling cutter, complete

8 Slotting cutter

8.1 General

Figure 16 shows the properties used for identification and classification of slotting cutters.

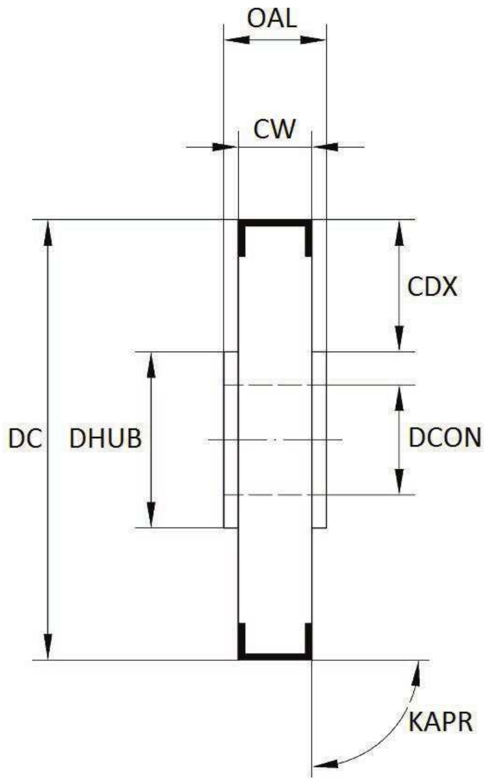


Figure 16 — Slotting cutter, full side and face: Determination of properties

8.2 Necessary properties

Table 5 shows the properties needed for the modelling of a slotting cutter.

Table 5 — Properties for the modelling of a slotting cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Counterbore depth connection bore	LCCB
Overall length	OAL

8.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

8.4 Geometry of the cutting part

The structure of the model is described in 5.4

8.5 Slotting cutter, complete

Figure 17 shows the complete slotting cutter with cutting and non-cutting part.

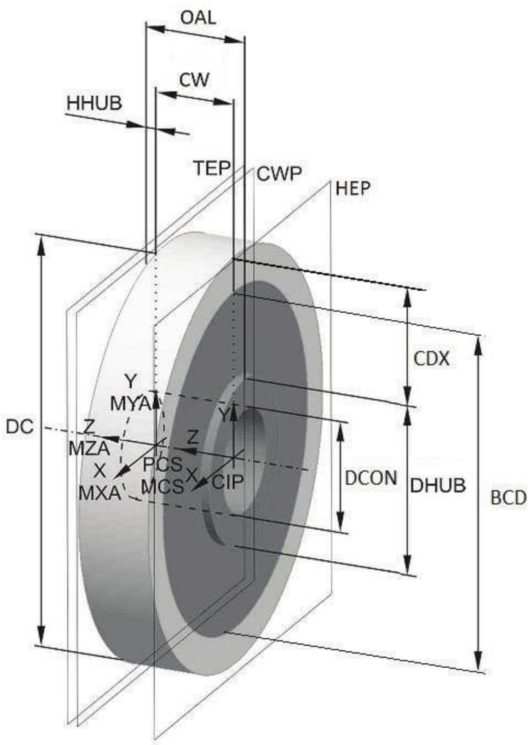


Figure 17 — Slotting cutter, complete

9 Pointed profile slotting cutter

9.1 General

Figure 18 shows the properties used for identification and classification of pointed profile slotting cutters.

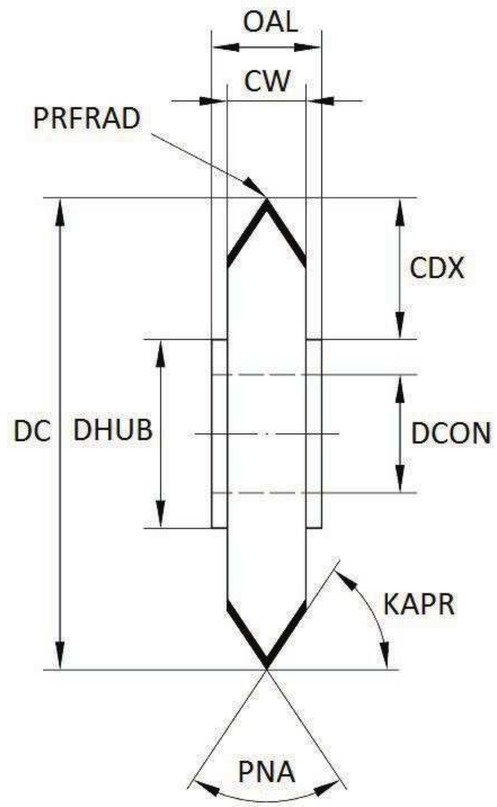


Figure 18 — Pointed profile slotting cutter: Determination of properties

9.2 Necessary properties

Table 6 shows the properties needed for the modelling of a pointed profile slotting cutter.

Table 6 — Properties for the modelling of a pointed profile slotting cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Tool cutting edge angle	KAPR
Counterbore depth connection bore	LCCB
Overall length	OAL
Profile included angle	PNA
Profile radius	PRFRAD

9.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

9.4 Geometry of the cutting part

The structure of the model is described in 5.4

9.5 Pointed profile slotting cutter

Figure 19 shows the complete pointed profile slotting cutter with cutting and non-cutting part.

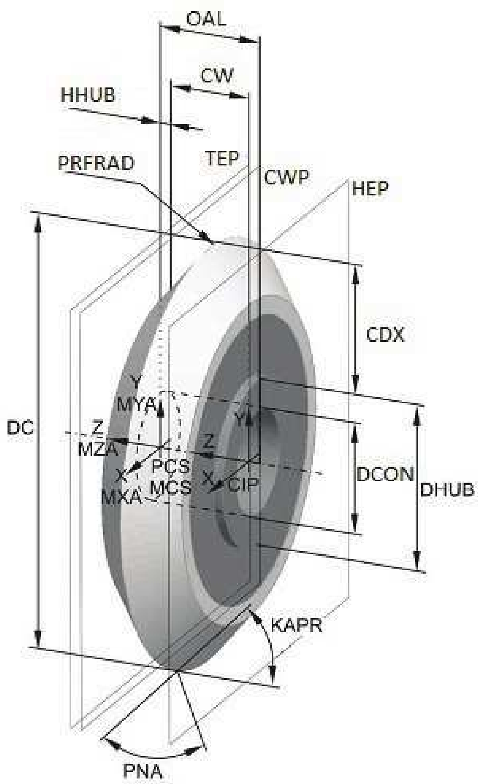


Figure 19 — Pointed profile slotting cutter, complete

10 Flatted profile slotting cutter

10.1 General

Figure 20 shows the properties used for identification and classification of flatted profile slotting cutters.

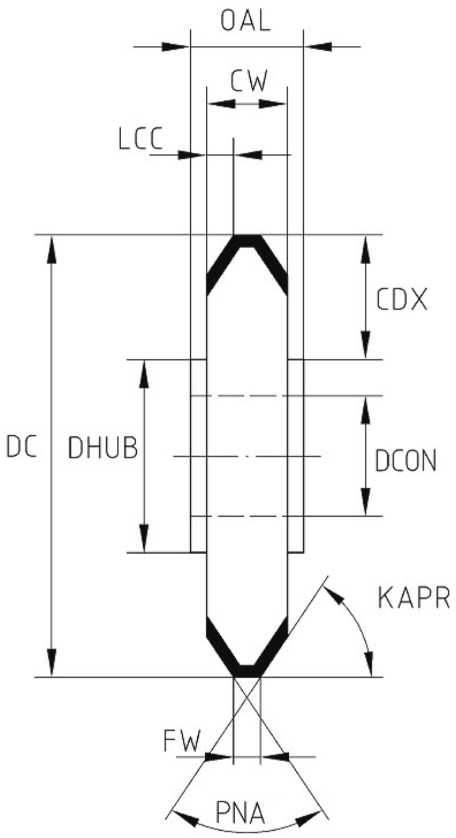


Figure 20 — Flatted profile slotting cutter: Determination of properties

10.2 Necessary properties

Table 7 shows the properties needed for the modelling of a flatted profile slotting cutter.

Table 7 — Properties for the modelling of a flatted profile slotting cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Flat width	FW
Tool cutting edge angle	KAPR
Cutting corner distance	LCC
Counterbore depth connection bore	LCCB
Overall length	OAL
Profile included angle	PNA
Profile radius	PRFRAD

10.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

10.4 Geometry of the cutting part

The structure of the model is described in 5.4

10.5 Flatted profile slotting cutter, complete

Figure 21 shows the complete flatted profile slotting cutter with cutting and non-cutting part.

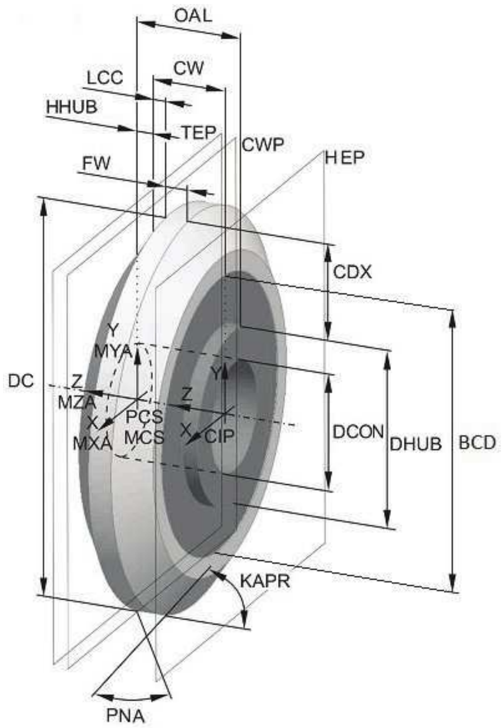


Figure 21 — Flatted profile slotting cutter, complete

11 Concave profile cutter

11.1 General

Figure 22 shows the properties used for identification and classification of concave profile cutters.

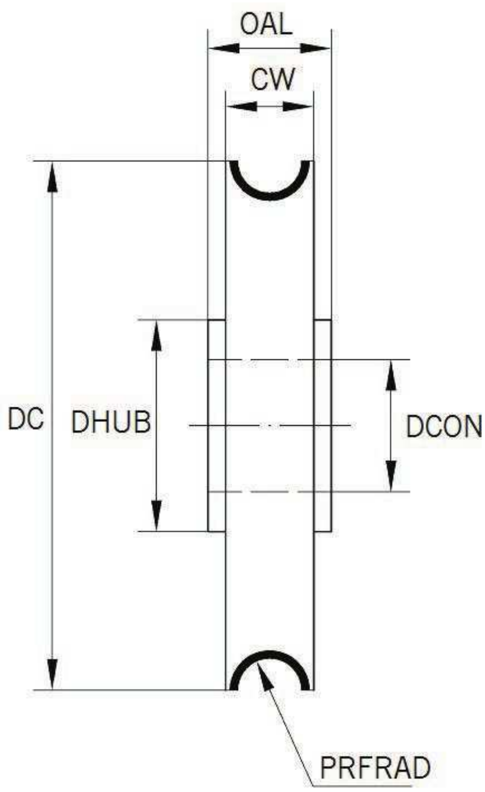


Figure 22 — Concave profile cutter: Determination of properties

11.2 Necessary properties

Table 8 shows the properties needed for the modelling of a concave profile cutter.

Table 8 — Properties for the modelling of a concave profile cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Cutting diameter	DC
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Counterbore depth connection bore	LCCB
Overall length	OAL
Profile radius	PRFRAD

11.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

11.4 Geometry of the cutting part

The structure of the model is described in 5.4

11.5 Concave profile cutter, complete

Figure 23 shows the complete concave profile cutter with cutting and non-cutting part.

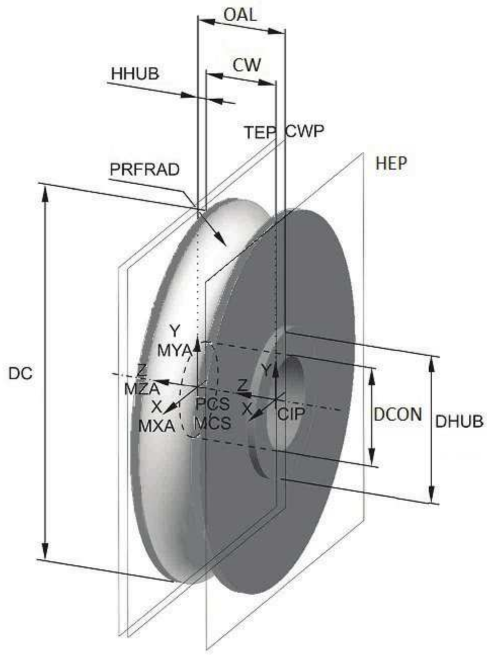


Figure 23 — Concave profile cutter, complete

12 Convex profile cutter

12.1 General

Figure 24 shows the properties used for identification and classification of convex profile cutters.

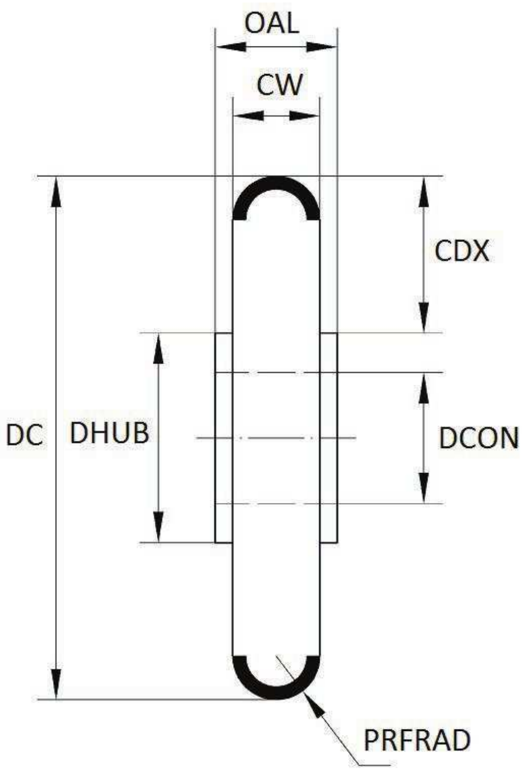


Figure 24 — Convex profile cutter: Determination of properties

12.2 Necessary properties

See Table 8.

12.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

12.4 Geometry of the cutting part

The structure of the model is described in 5.4.

12.5 Convex profile cutter, complete

Figure 25 shows the complete convex profile cutter with cutting and non-cutting part.

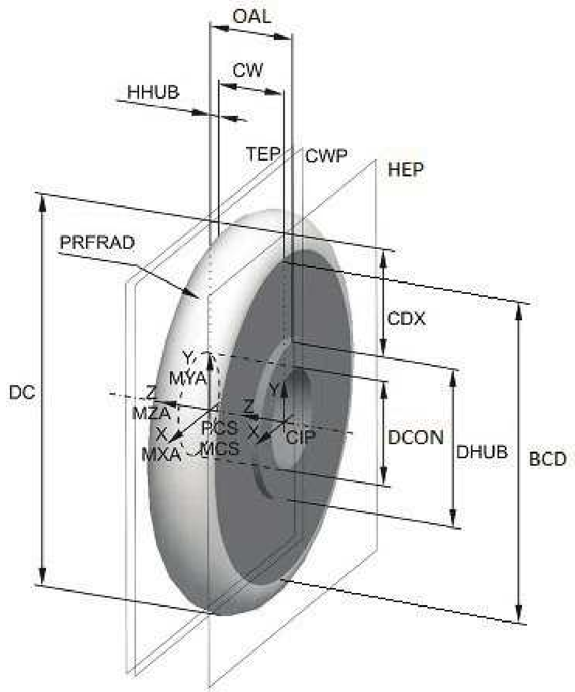


Figure 25 — Convex profile cutter, complete

13 Corner-rounding cutter

13.1 General

Figure 26 shows the properties used for identification and classification of convex corner-rounding cutters.

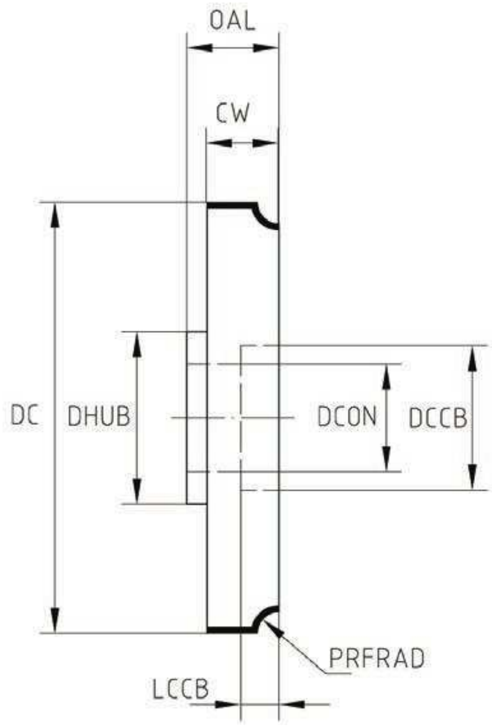


Figure 26 — Corner-rounding cutter: Determination of properties

13.2 Necessary properties

See Table 8.

13.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

13.4 Geometry of the cutting part

The structure of the model is described in 5.4

13.5 Corner-rounding cutter, complete

Figure 27 shows the complete corner-rounding cutter with cutting and non-cutting part.

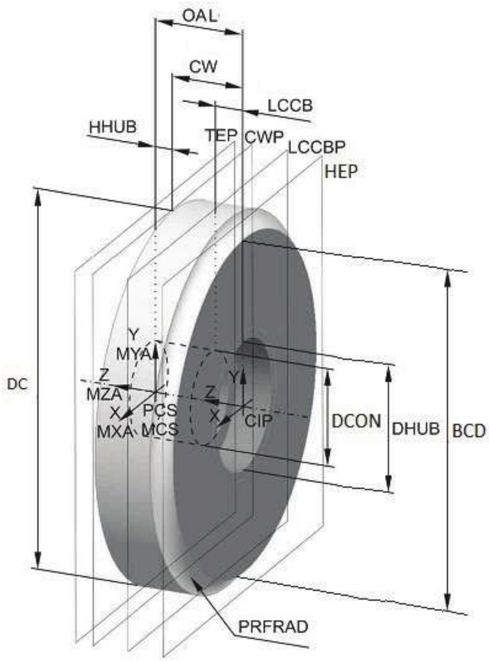


Figure 27 — Corner-rounding cutter, complete

14 Angular milling cutter

14.1 General

Figure 28 shows the properties used for identification and classification of angular milling cutters.

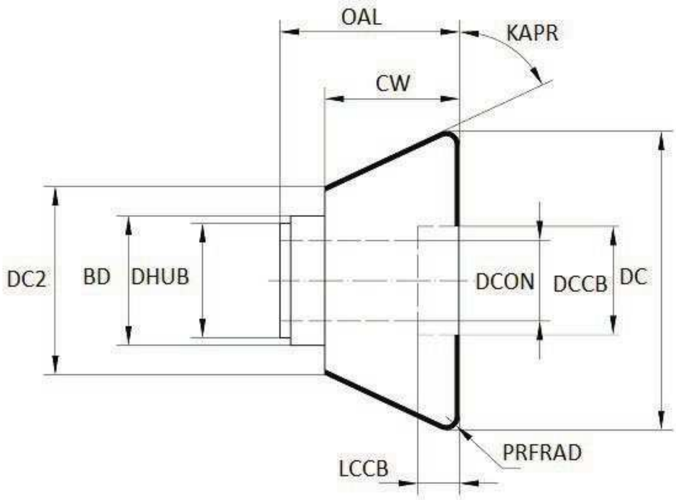


Figure 28 — Angular milling cutter: Determination of properties

14.2 Necessary properties

Table 9 shows the properties needed for the modelling of an angular milling cutter.

Table 9 — Properties for the modelling of an angular milling cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Body diameter	BD
Cutting width	CW
Cutting diameter	DC
Cutting diameter 2	DC2
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Tool cutting edge angle	KAPR
Counterbore depth connection bore	LCCB
Overall length	OAL
Profile radius	PRFRAD

14.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

14.4 Geometry of the cutting part

The structure of the model is described in 5.4.

14.5 Angular milling cutter, complete

Figure 29 shows the complete angular milling cutter with cutting and non-cutting part.

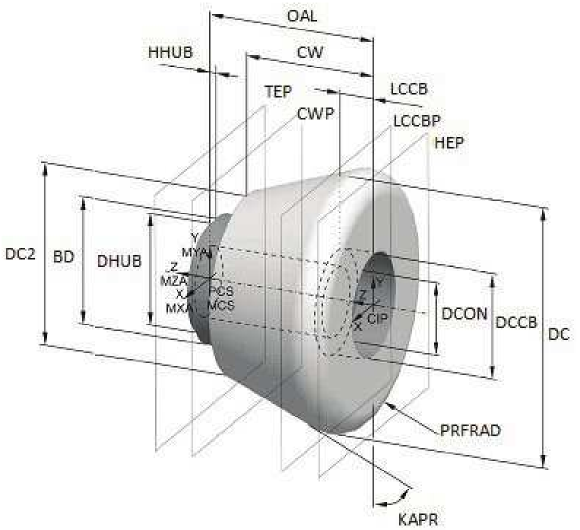


Figure 29 — Angular milling cutter, complete

15 Angular profile milling cutter

15.1 General

Figure 30 shows the properties used for identification and classification of angular profile milling cutters.

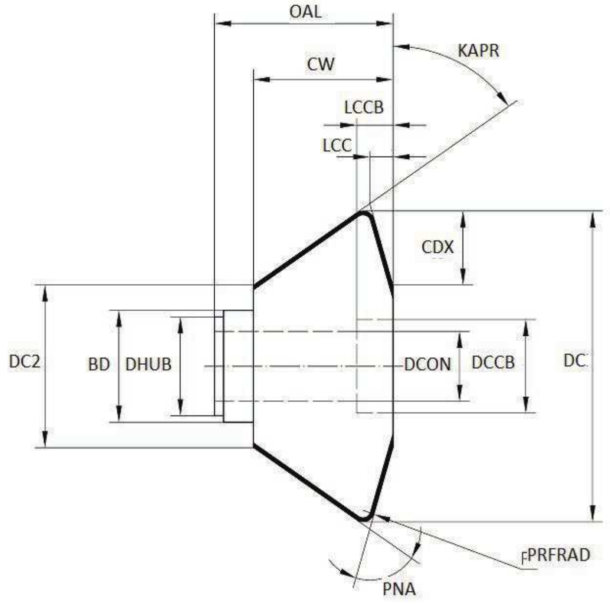


Figure 30 — Angular profile milling cutter: Determination of properties

15.2 Necessary properties

Table 10 shows the properties needed for the modelling of an angular profile milling cutter.

Table 10 — Properties for the modelling of an angular profile milling cutter

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Body diameter	BD
Cutting width	CW
Cutting diameter	DC
Cutting diameter 2	DC2
Connection diameter	DCON
Counterbore diameter connection bore	DCCB
Hub diameter	DHUB
Tool cutting edge angle	KAPR
Length cutting corner distance	LCC
Counterbore depth connection bore	LCCB
Overall length	OAL
Profile included angle	PNA
Profile radius	PRFRAD

15.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

15.4 Geometry of the cutting part

The structure of the model is described in 5.4

15.5 Angular profile milling cutter, complete

Figure 31 shows the complete angular profile milling cutter with cutting and non-cutting part.

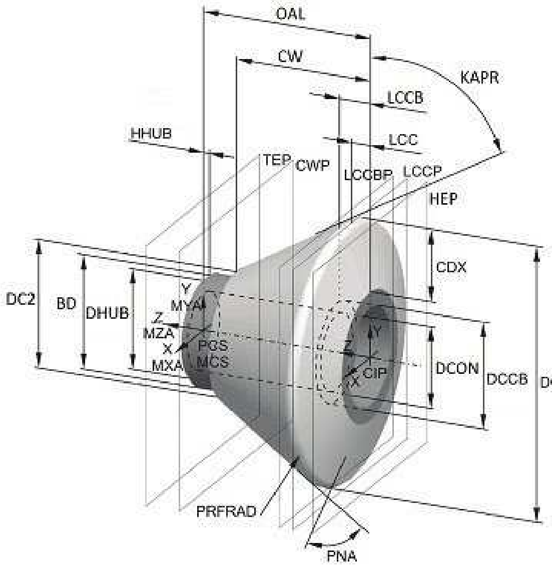


Figure 31 — Angular profile milling cutter, complete

16 Sawing blade

16.1 General

Figure 32 shows the properties used for identification and classification of sawing blades.

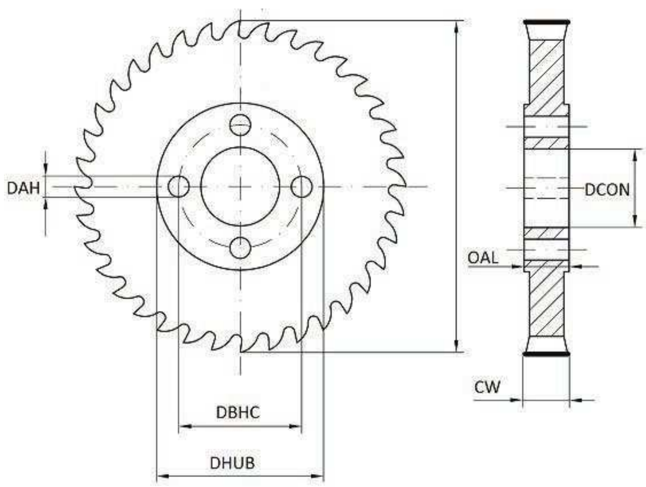


Figure 32 — Sawing blade: Determination of properties

16.2 Necessary properties

Table 11 shows the properties needed for the modelling of a sawing blade.

Table 11 — Properties for the modelling of a sawing blade

Preferred name	Preferred symbol
Body clearance diameter	BCD
Body clearance depth axial	BCDPAX
Cutting width	CW
Diameter access hole	DAH
Diameter bolt circle	DBC
Cutting diameter	DC
Connection diameter	DCON
Hub diameter	DHUB
Overall length	OAL

16.3 Geometry of the non-cutting part inclusive of the connection

The structure of the model shall be as described in 5.3 and in accordance with Figures 7 and 8 or Figures 9 and 10.

In addition to the design described in 5.3, one or two bolt hole circles with access holes shall be placed to the tool body. For this design feature, the two properties with its preferred symbols “DAH” and “DBC” shall be used.

16.4 Geometry of the cutting part

The structure of the model is described in 5.4

16.5 Sawing blade, complete

Figure 33 shows the complete sawing blade with cutting and non-cutting part.

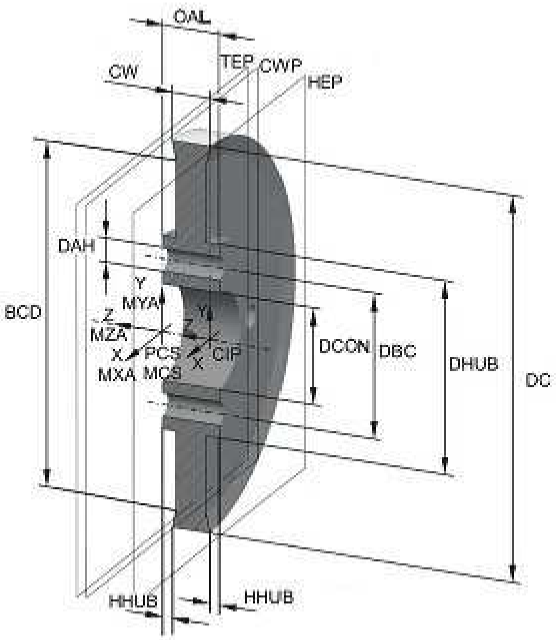


Figure 33 — Sawing blade, complete

17 Design of details

17.1 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.

17.2 Contact surfaces, driving features — Orientation

Transversal driving features shall be visualized within the tool model and shall be orientated by means of a unique orientation. The axis of the driving features shall be parallel with the “X-axis” of the primary coordinate axis system “PCS”.

18 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 to 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 shall be 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 shall 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 others shall be used as references. With the suppression of the main design elements, all referenced design elements shall be supressed either.

19 Structure of the design elements (tree of model)

At milling cutters with arbor hole and non-indexable cutting edges, it shall be distinguished between cutting “CUT” and non-cutting “NOCUT” design features. This shall take place by means of building groups. Hereby, it is necessary that both groups can be suppressed or deactivated separately, without mutual impact.

All the detailed design features shall be put together to a separate group named "DETAIL". 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 is suppressed (see Figure 34).

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

The structure shall be as shown in Figure 34 and shall be similar in other CAD systems:

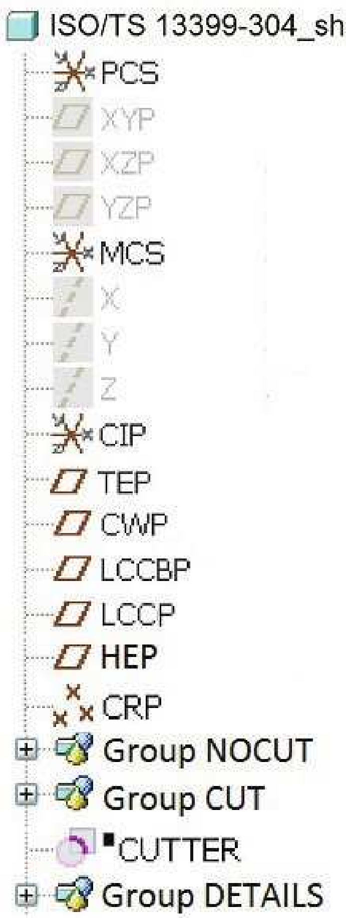
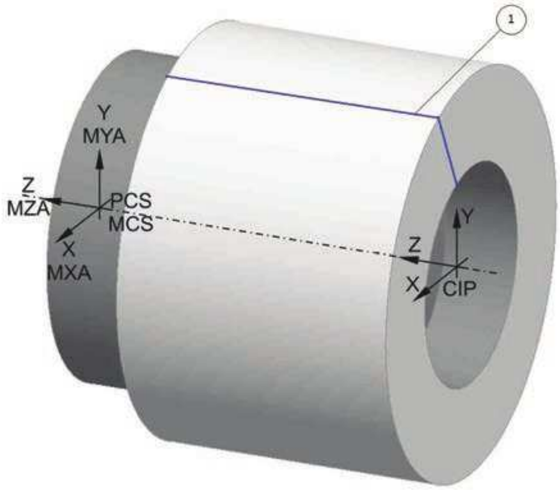


Figure 34 — Shell mill: Example of the structure of design features

20 Data exchange model

Exemplary on a shell mill and on an angular milling cutter, the models for the data exchange shall be illustrated. All of those models shall contain the geometrical features (collision contour), the primary coordinate system "PCS", the mounting coordinate system "MCS" and the coordinate system in process "CIP" that are relevant for the collision examination. Also, the cutting part line shall be transmitted.



Key

1 cutting part line

Figure 35 — Shell mill

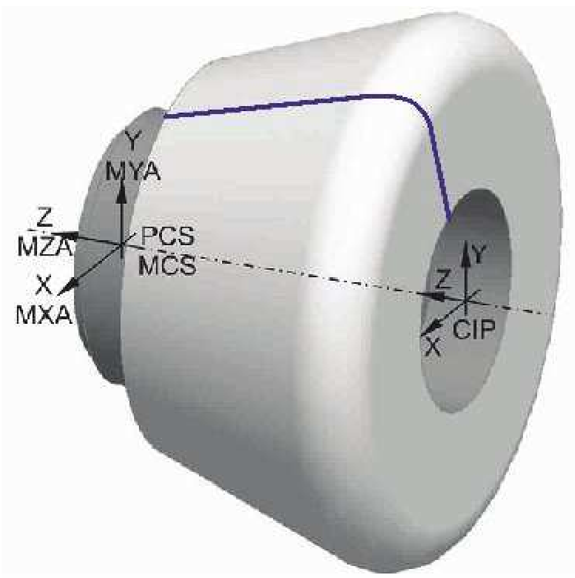


Figure 36 — Angular milling cutter

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 may 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.

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	Ø 25	H6	25,000	25,013	25,000
External diameter	Ø 25	g7	24,972	24,993	25,000
Square shank size h × b	32 × 25	h13	31,61 × 24,67	32 × 25	32 × 25

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[3] 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*

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[9] ISO/TS 13399-150, *Cutting tool data representation and exchange — Part 150: Usage guidelines*

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