TECHNICAL SPECIFICATION

ISO/TS 13399-309

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Cutting tool data representation and exchange —

Part 309: Creation and exchange of 3D models — Tool holders for indexable inserts

Représentation et échange des données relatives aux outils coupants —

Partie 309: Création et échange de modèles 3D — Porte outil à plaquette amovible

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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For an explanation 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 tool holders for indexable inserts that can be used for NC-programming, simulation of the manufacturing processes and the determination of collision within these processes. It is not intended to standardize the design of the cutting tool itself.

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

The objective of this International Standard is to provide the means to represent the information that describes cutting tools in a computer sensible form that is independent from any particular computer system. The representation will facilitate the processing and exchange of cutting tool data within and between different software systems and computer platforms and support the application of this data in manufacturing planning, cutting operations and the supply of tools. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and for archiving. The methods that are used for these representations are those developed by ISO/TC 184/SC 4 for the representation of product data by using standardized information models and reference dictionaries.

Definitions and identifications of dictionary entries are defined by means of standard data that consist of instances of the EXPRESS entity data types defined in the common dictionary schema, resulting from a joint effort between ISO/TC 184/SC 4 and IEC/TC 3/SC 3D and in its extensions defined in ISO 13584-24 and ISO 13584-25.

Cutting tool data representation and exchange —

Part 309: Creation and exchange of 3D models — Tool holders for indexable inserts

1 Scope

This part of ISO/TS 13399 specifies a concept for the design of turning tools 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 designing simplified models that contain the following:

— definitions and identifications of the design features of turning tools for indexable inserts, with an association to the descriptive properties and dimensions;

— definition and identification of the 3D model internal structure that represents the features and the properties of turning tools 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 5608, *Turning and copying tool holders and cartridges for indexable inserts — Designation*

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

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

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

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

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

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

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

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

3.2 Reference system (PCS — primary coordinate system)

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

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

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

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

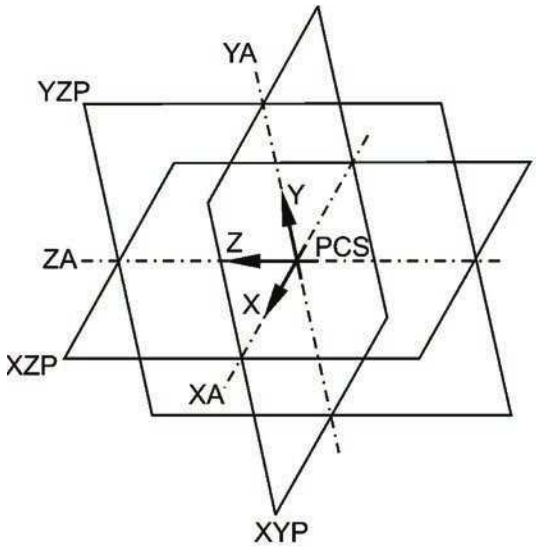


Figure 1 — Primary coordinate system

3.3 Tool item position

The definition of the tool position in 3.3.1 and 3.3.2 applies to right-handed tools. Left hand tools are as defined for right hand items but mirrored through the yz-plane.

3.3.1 Prismatic tool position

A prismatic tool position identifies the location on the coordinate reference system of a turning tool with planar sides and a rectangular cross section, as shown in Figure 2, where

— the base of the tool item shall be coplanar with the xz-plane,

— the normal for the base of the item shall be in the Y direction,

— the rear backing surface shall be coplanar with the yz-plane,

— the normal for the rear backing surface shall be in the X direction,

— the end of the item shall be coplanar with the xy-plane,

— the normal for the end of the item shall be in the Z direction,

— the rake face of the primary cutting item shall be completely visible in the X-Z quadrant, and

— for cartridges, the top of the axial adjustment screw shall be coincident with xy-plane.

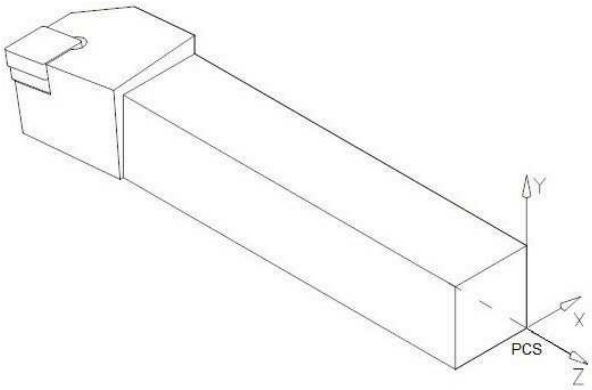


Figure 2 — Prismatic tool position

3.3.2 Round tool position

A round tool position identifies the location on the coordinate reference system of a turning tool with non-planar sided cross section, as shown in Figures 3 and 4, where

— the axis of the tool item shall be collinear with the z-axis,

— the vector of the shank that points in the Z direction shall also point towards the workpiece side,

— the drive slots or clamping flats, if present, shall be parallel with the xz-plane,

— the contact surface of the coupling, the gauge plane or the end of the cylindrical shank shall be coplanar with the xy-plane,

— the rake face of the primary cutting item shall be visible in the X-Z quadrant, and

— if a bore is present, the vector of the bore of the item that points in the Z direction shall also point towards the workpiece side.

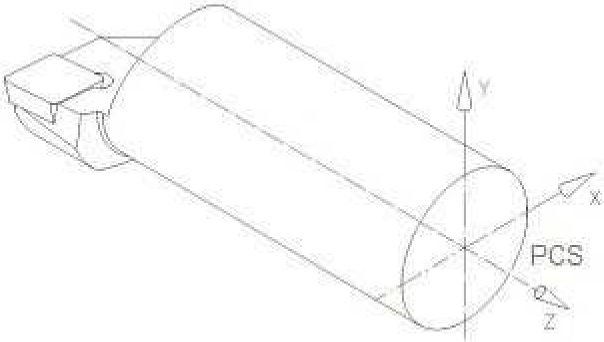


Figure 3 — Round tool position — Cylindrical shank

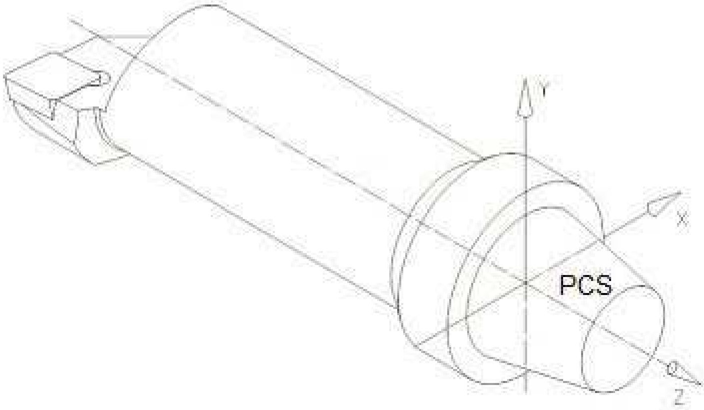


Figure 4 — Round tool position — Gauge plane or planar contact surface

3.4 Planes

The modelling shall be based on planes according to Figures 5 and 6, which shall be used as reference, if applicable. Therefore, it is assured that the model can be varied to suppress single features of independent design features by means of changing the value of one or more parameters. Furthermore, the identification of the different features shall be simplified in using the plane concept, even if they contact each other with the same size, e.g. chip flute, shank.

For the 3D visualization of turning tools for indexable inserts the general planes shall be determined as follows:

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

— “HEP” head end plane: plane for most front point of the tool; based on either LPR for tools with gauge line or contact surface or OAL for tools without gauge plane or contact surface;

— “HFP” functional height plane: plane for the functional height (HF); based on XZ plane of PCS;

— “LSCP” clamping length plane: plane for the clamping length (LSC); based on XY plane of PCS;

— “LFP” functional length plane: plane for the functional length (LF); based on XY plane of PCS;

— “LHP” head length plane: plane for the head length (LH); based on “HEP”;

— “TCEP tool cutting edge plane: plane perpendicular to the XY plane of a master insert through its major cutting edge;

— "TEP" tool end plane: the 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 HEP and TEP;

— "TFP" tool feed plane: plane perpendicular to the XZ plane that is parallel to the primary feed direction of the tool and that is tangential to the cutting corner of the master insert;

— "TRP" tool rake plane: plane that contains the cutting edges of a master insert;

— "TSP" theoretical sharp point: the intersection in the tool rake plane of the two planes that are perpendicular to the XY plane of the master insert through the major and minor cutting edges of the master insert;

— "WFP" plane for the functional width (WF); based on YZ plane of PCS.

3.5 Cutting reference point (CRP)

The cutting reference point is the theoretical point of the cutting tool from which the major functional dimensions are taken.

For the calculation of this point, the following cases apply.

— Case 1: For a tool cutting edge angle less than or equal to 90°, the point is the intersection of **TCEP**, **TFP** and **TRP** (see Figures 5 and 6).

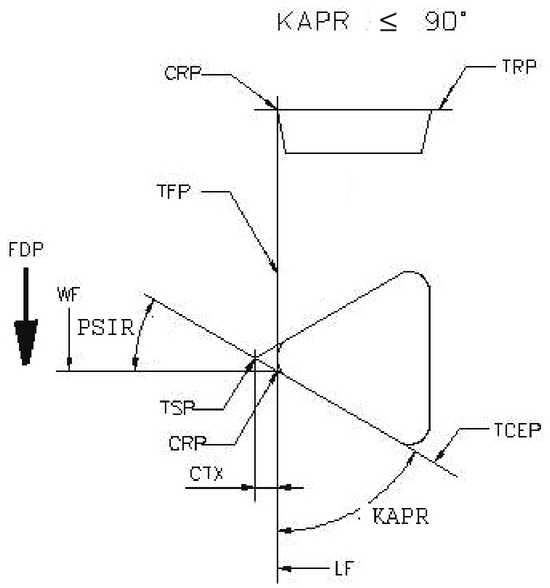


Figure 5 — Feed direction perpendicular to tool axis — KAPR ≤ 90°

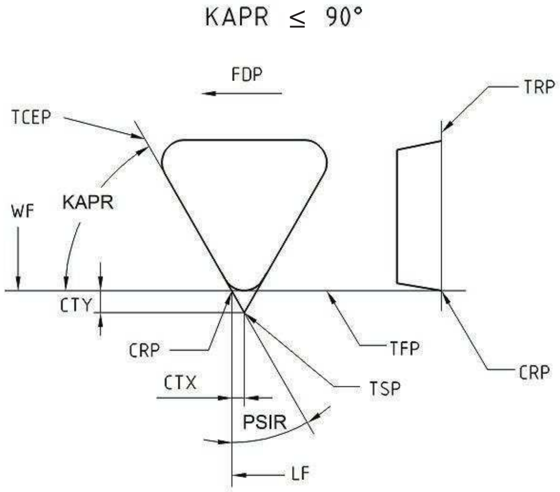


Figure 6 — Feed direction parallel to tool axis — KAPR ≤ 90°

— Case 2: For a tool cutting edge angle greater than 90°, the point is the intersection of three planes: **TFP**, a plane which both **perpendicular to the TFP** and tangential to the cutting corner, as well as the **TRP** (see Figures 7 and 8).

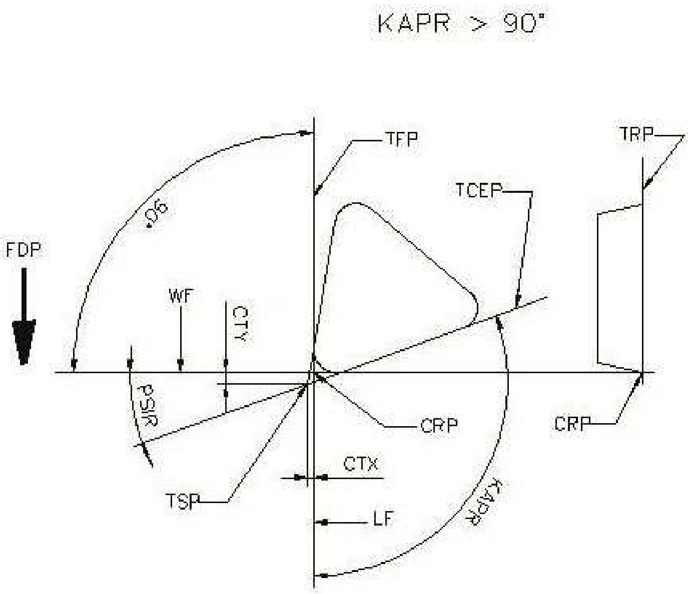


Figure 7 — Feed direction perpendicular to tool axis — KAPR > 90°

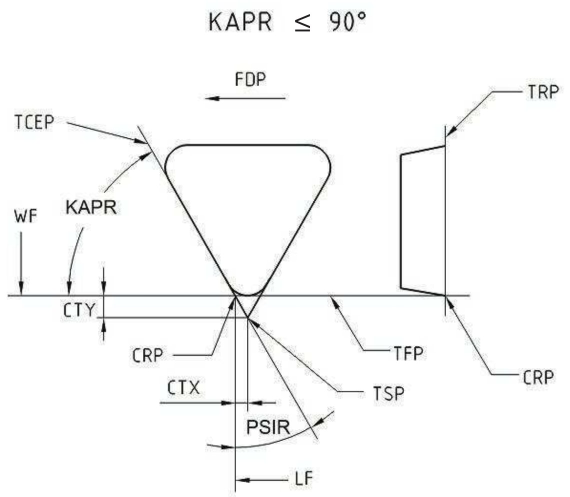


Figure 8 — Feed direction parallel to tool axis — KAPR > 90°

— Case 3: For ISO tool styles D and V (ISO 5610 series) with only axial rake, the point is the intersection of three planes: a plane **perpendicular to TFP** and tangential to the cutting corner (tangential point), a plane **parallel to TFP** through the tangential point, and **TRP** (see Figure 9).

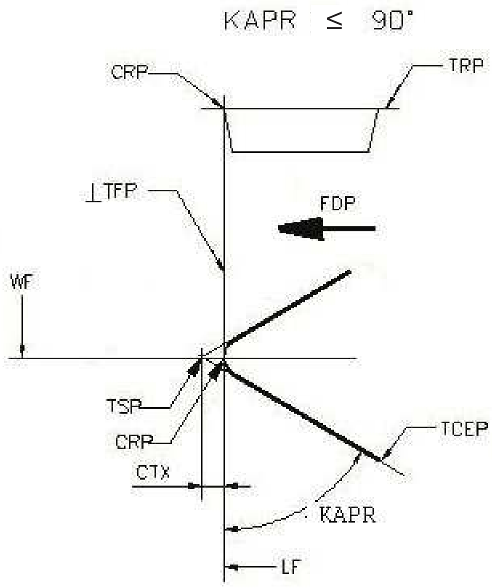


Figure 9 — CRP for neutral tools with only axial rake angle

— Case 4a: For round inserts with one feed direction parallel to the tool axis, primarily used for turning tools, the point is the intersection of three planes: a plane **perpendicular to TFP** and tangential to the cutting edge (tangential point), a plane **parallel to TFP** through the tangential point, and the **TRP** (see Figure 10).

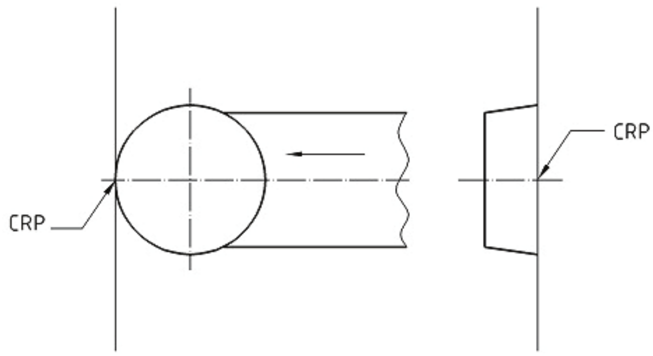


Figure 10 — CRP for round insert — TFP parallel to tool axis

— Case 4b: For round inserts with two feed directions, one parallel to the tool axis and one perpendicular to the tool axis with two **CRP's**, each point is the intersection of three planes: a plane perpendicular to its feed direction and tangential to the cutting edge (tangential point), a plane parallel to the feed direction through the tangential point, and the **TRP** (see Figure 11).

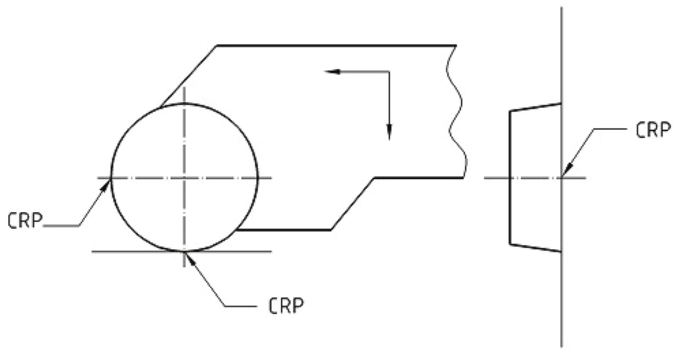


Figure 11 — Round insert with two CRPs

3.6 Design of the pocket seat

The final position of the pocket seat shall be determined by means of choosing an insert design. 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 functional dimensions depend on a defined reference insert with a defined 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 as given in the ISO 5610 series.

Table 1 — Dependency of inscribed circle and corner radius

Dimensions in millimetre

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

Table 1 *(continued)*

Inscribed circle	Corner radius
15,875	1,2
19,050	1,2
22,250	2,4
25,400	2,4
31,750	2,4

NOTE On rectangular (style L) and parallelogram-shaped (styles A, B, K) inserts, the value of the longer side is used as the reference inscribed circle value of Table 1 which determines the size of the corner radius.

MCS-coordinate system of the insert (MCS_INSERT) and the PCS-coordinate system of the insert (PCS_INSRT) are oriented differently to the primary coordinate system of the tool (PCS_TOOL). The orientation is shown in Figure 12.

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

— the origin of the MCS_INSERT for insets with inscribed circle is positioned at the centre of the inscribed circle;

— the origin of the MCS_INSERT for rectangular or parallelogram-shaped inserts the point of origin is determined through the intersection of the two diagonal lines between the theoretical sharp corners;

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

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

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

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

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

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

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

a) A tool design with end cutting edge angle on a right handed tool:

   1) 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.

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

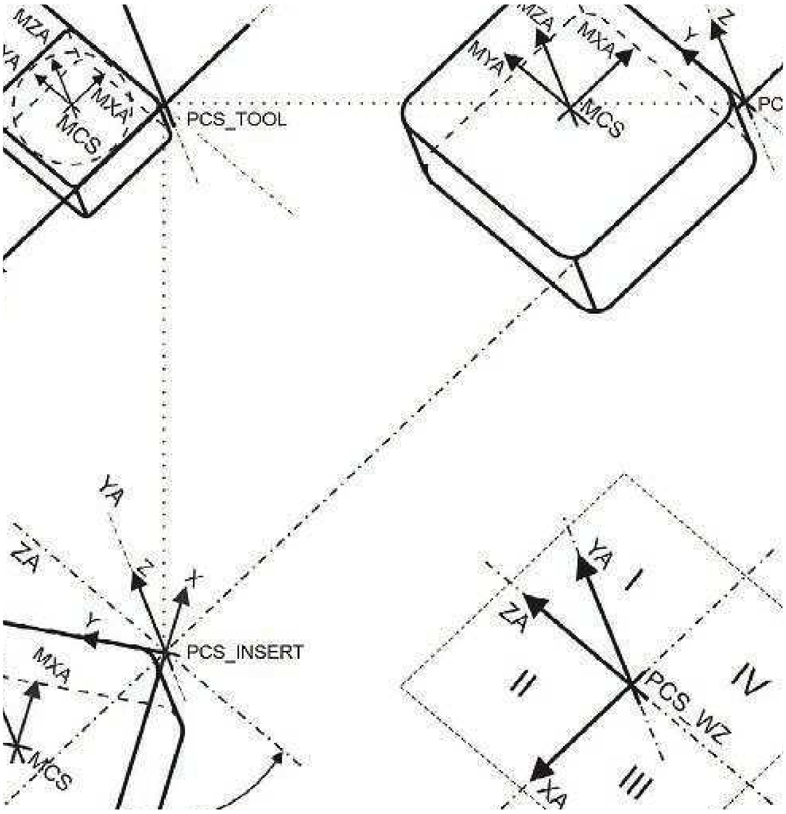


Figure 12 — Orientation of PCS_INSERT, MCS_INSERT and PCS_TOOL

3) The cutting reference point "CRP" is the point where the functional dimensions HF, LF and WF are based.

4) The coordinate system of CRP (CS_CRP) is defined as follows.

   i) The x-axis of CS_CRP is collinear to the x-axis of PCS_INSERT.

   ii) The y-axis of CS_CRP is parallel to the y-axis of PCS_INSERT.

   iii) The z-axis of CS_CRP is parallel to the z-axis of PCS_INSERT.

5) If the tool is defined by an orthogonal rake angle and an inclination angle, if either or both are not equal to 0 degree, the insert shall be rotated about its CRP. See Figure 13.

   i) To define the orthogonal rake angle (GAMO) on the tool, the pocket seat has to be rotated about the x-axis of C_CRP; if GAMO is smaller than 0° (zero degree), the rotation has to be done in the mathematical positive direction; if GAMO is greater than 0° (zero degree) the rotation has to be done in the mathematical negative direction.

   ii) To define the inclination angle (LAMS) on the tool, the pocket seat has to be rotated about the y-axis of C_CRP; if LAMS is smaller than 0° (zero degree), the rotation has to be done in the mathematical positive direction; if LAMS is greater than 0° (zero degree) the rotation has to be done in the mathematical negative direction.

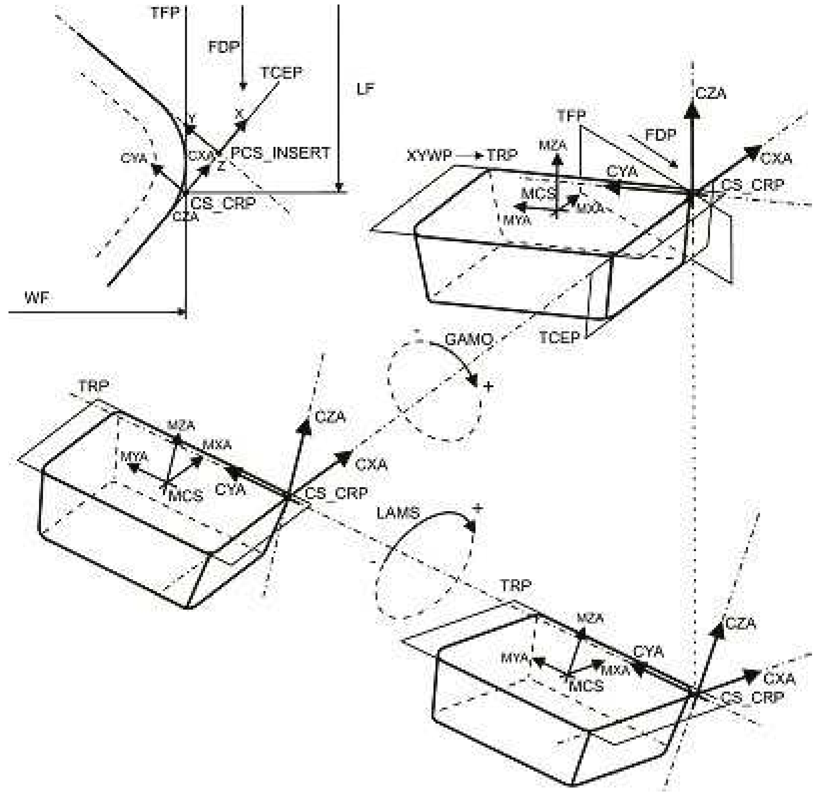


Figure 13 — Orthogonal angle and inclination angle on insert

b) A tool design with side cutting edge angle on a right handed tool:

1) only those inserts that are located in the first quadrant of the primary coordinate system of the insert shall be used – also called “right handed” or “neutral” inserts;

2) the insert shall be rotated by KAPR degrees in the mathematical positive direction (counter-clockwise) about the y-axis of PCS_TOOL;

3) the cutting reference point “CRP” is the point on which the functional dimensions are based;

4) for the definition of the coordinate system of CRP [see list item 4) of a)];

5) for theorientation of GAMO and LAMS [see list item 5) of a)].

c) A tool design with triangle lay-down threading insert.

On threading inserts, the functional dimensions HF, LF and WF are based on the theoretical sharp corner of the two sides of the triangle shape, as shown in Figure 14. This point shall be named as CRP_NC (cutting reference point for NC-programming). The origin of the CRP is located at the cutting profile in relation to the CRP_NC with its distances PDX and PDY.

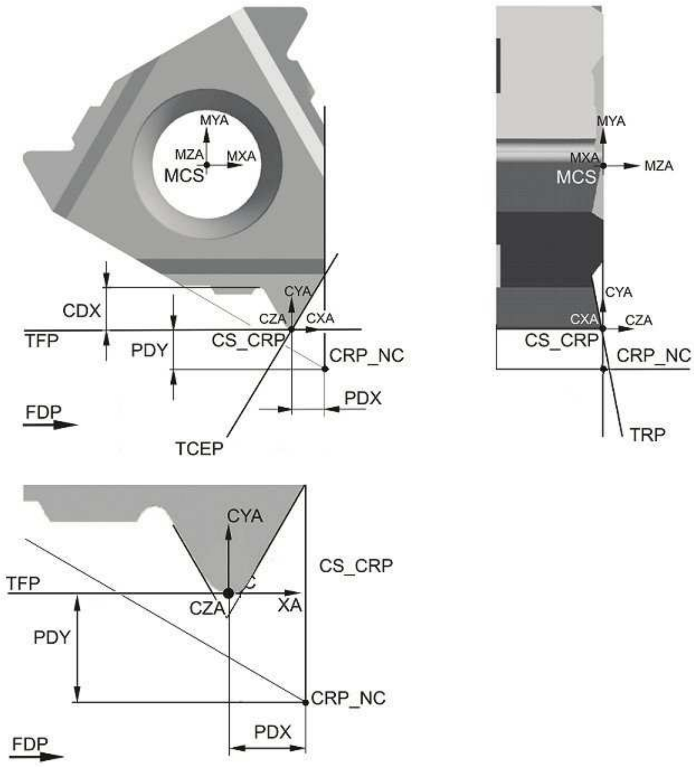


Figure 14 — Coordinatesystem CRP; cutting reference point NC

3.7 Adjustment coordinate system on workpiece side

3.7.1 General

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

3.7.2 Designation of the coordinate system workpiece side

For the designation of the coordinate system workpiece side, the following cases apply.

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

— Case 2: Coordinate systems at workpiece side on different levels shall be designated as “CSWx”, e.g. “CSW1”, “CSW2”. The numbering shall start at the workpiece side and ends at the machine side in the direction of the positive z-axis.

— Case 3: Multiple coordinate systems at one level, with different angles and not at the centre of the tool axis, shall be designated with “CSWx_y”, where the “x” defines the level and the “y” defines the number of the coordinate system itself. The counting shall start at the three o’clock position counting in counter-clockwise direction while looking towards the machine spindle (positive Z-Axis).

— Case 4: Multiple coordinate systems at one level, with 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, with different angles and different diameters shall be designated as described in case 3. The counting shall start at the workpiece side, at the smallest diameter and at the three o’clock position. The counting shall start in counter-clockwise direction while looking towards the machine spindle (positive Z-Axis) (see Figure 15).

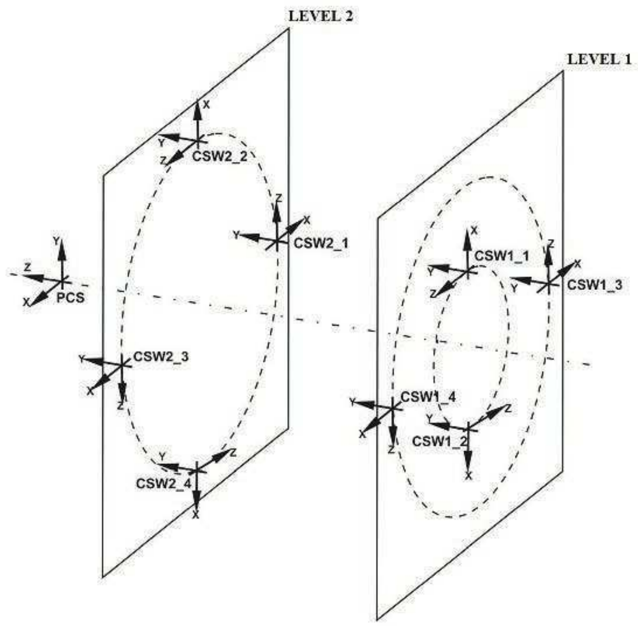


Figure 15 — Example of adjustment coordinate system on workpiece side

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

— The x-axis of MCS_INSERT is colinear to the x-axis of CSWx_y.

— The y-axis of MCS_INSERT is colinear to the y-axis of CSWx_y.

— The z-axis of MCS_INSERT is colinear to the z-axis of CSWx_y.

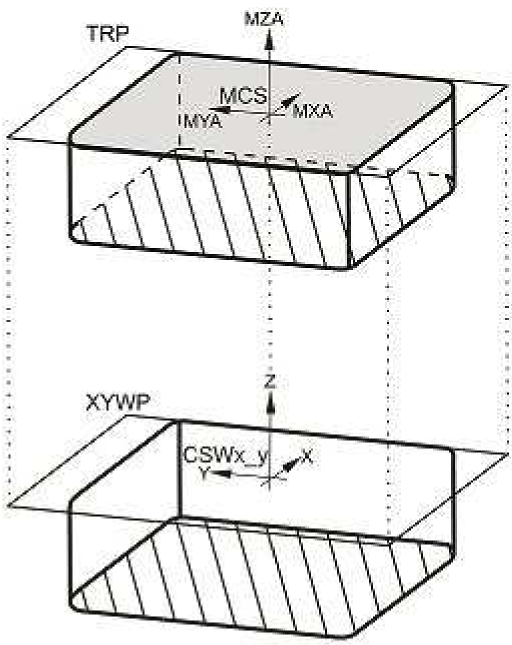


Figure 16 — Mounting of insert onto pocket seat

NOTE If regular inserts have a specific design and are not interchangeable between vendors, the location of the MCS is upon the manufacturer's discretion—either on the top face or on the bottom face. The orientation of the axis follows the definitions in this part of ISO/TS 13399.

4 Design of the model

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 shall be grouped as a detailed 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. There shall be no reference between the connection and the basic body. Only the group "DETAILS" may contain references to other design features.

Turning tools for indexable inserts, differentiated as tool holders, boring bars and system tools, shall be designed as follows:

a) basic geometry containing tool head and shank:

— as "extrusion" sketch for tools with rectangular shank;

— as "rotational" sketch for boring bars and system tools;

b) chip space and pocket seat;

c) details (chamfers, roundings, slots, etc.);

d) assembly (mating of spare parts):

— inserts shall be assembled as individual parts with its reference of MCS/CSW;

— spare parts which can collide with the workpiece – shims, coolant supply parts, insert screws, etc. shall not be part of the simplified model.

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

The specific model structure of the different shapes of tool holders for indexable inserts shall be described in the next clauses of this part of ISO/TS 13399.

4.1 Necessary parameters for the connection interface feature

Information about the connection interface code has to be filed as properties within the model and being named as parameters, as indicated 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 on 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.

4.2 Necessary properties for insert and pocket seat

4.2.1 General

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

4.2.2 Properties for equilateral, equiangular and equilateral, non-equiangular inserts

Equilateral and equiangular inserts are the following:

— H – hexagonal insert;

— O – octogonal insert;

— P – pentagonal insert;

— S – square insert;

— T – triangular insert.

Equilateral and non-equiangular inserts are the following:

— C, D, E, M, V – rhombic insert;

— W – trigon insert.

The preferred names and symbol of the properties for equilateral, equiangular and equilateral, non-equiangular pocket seats shall be as given in Table 3.

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

Preferred name	Preferred symbol
clearance angle major	AN
insert included angle	EPSR
insert included angle minor	EPSRN
inscribed circle diameter	IC
cutting edge length[a]	L[a]
corner radius	RE
corner radius minor	REN
insert thickness	S

[a] Calculated and dependent on IC and EPSR.

4.2.3 Properties for non-equilateral, equiangular and non-equilateral, non-equiangular inserts

Nonequilateral and equiangular inserts are L – rectangular insert.

Nonequilateral and nonequiangular inserts are A, B, K – parallelogram-shaped insert.

The preferred names and symbol of the properties for non-equilateral, equiangular and non-equilateral, non-equiangular inserts shall be as given in Table 4.

Table 4 — Properties for modelling non-equilateral, equiangular and non-equilateral, non-equiangular pocket seats

Preferred name	Preferred symbol
clearance angle major	AN
clearance angle minor	ANN
insert included angle	EPSR
insert length	INSL
corner radius	RE
corner radius minor	REN
insert thickness	S
insert width	W1
cutting edge length[a]	L[a]
[a] Calculated and dependent on INSL and EPSR.	

4.2.4 Properties for round inserts

The preferred names and symbol of the properties for round inserts shall be as given in Table 5.

Round inserts are designated as R – round insert.

Table 5 — Properties for modelling round pocket seats

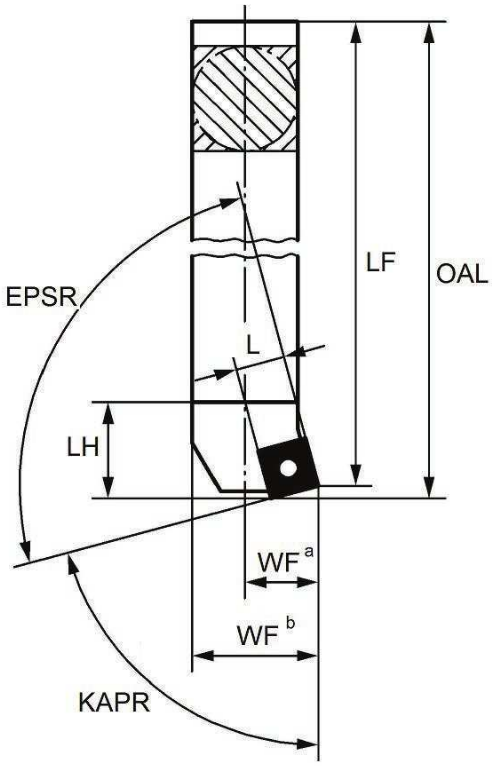
Preferred name	Preferred symbol
clearance angle major	AN
inscribed circle diameter	IC
insert thickness	S

4.2.5 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 Tool holder for longitudinal and transversal turning

5.1 General



Key

a functional length at boring bars

b functional length at prismatic tool holders

Figure 17 — Determination of properties for external and internal turning tool

The properties shown in Figure 17 are listed in Table 6.

5.2 Necessary properties

Table 6 shows the properties needed for the example of modelling of a converter as described in 5.1.

Table 6 — Properties for the modelling of an external or internal turning tool

Preferred name	Preferred symbol
shank width	B
reduced body diameter	BDRED
cutting edge angle type code	CEATC
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H

Table 6 *(continued)*

Preferred name	Preferred symbol
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
cutting edge length	L
inclination angle	LAMS
reduced body diameter length	LDRED
functional length	LF
head length	LH
overall height	OAH
overall length	OAL
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF

5.3 Basic geometry

The basic design of the model is a sketch to be used either for the “extrusion” function for models with rectangular shank or for the “revolved” function for models with cylindrical shank. This basic design contains all elements between the plane “TEP” and the plane “HEP”.

In order to cover all the different designs specified in ISO 5608, it is recommended to name the sketches as listed in Table 7.

Table 7 — Determination of turning tool type and tool holder shape code

Recommended sketch designation	Turning tool type	Tool holder shape code	Cutting edge angle type code	Insert style	Hand of tool
BB_offset_end_rhombic	boring bar	offset	end cutting edge angle	rhombic	right or left
BB_offset_end_triangle	boring bar	offset	end cutting edge angle	triangle	right or left
BB_offset_end_round	boring bar	offset	end cutting edge angle	round	right or left
TT_offset_end_rhombic	turning tool	offset	end cutting edge angle	rhombic	right or left
TT_offset_end_triangle	turning tool	offset	end cutting edge angle	triangle	right or left
TT_offset_end_round	turning tool	offset	end cutting edge angle	round	right or left
TT_neutral_square	turning tool	straight	side cutting edge angle	square	neutral
TT_neutral_round	turning tool	straight	side cutting edge angle	round	neutral
TT_neutral_rhombic	turning tool	straight	side cutting edge angle	rhombic	neutral
TT_neutral_triangle	turning tool	straight	end cutting edge angle	triangle	neutral
TT_offset_side_rhombic	turning tool	offset	side cutting edge angle	rhombic	right or left
TT_offset_side_triangle	turning tool	offset	side cutting edge angle	triangle	right or left
TT_straight_side_rhombic	turning tool	offset	side cutting edge angle	rhombic	right or left
TT_straight_side_triangle	turning tool	offset	side cutting edge angle	triangle	right or left

The rombic insert style shall also include the parallelogram style of inserts (ISO code A, B, K). The triangle insert style shall also include the trigon style of insert.

The sketch includes all the real measure elements listed in Table 6 and shall be designed on the XZ plane of the PCS. The tool axis shall be the standard z-axis.

The design of the sketch shall be as follows:

— the sketch shall be determined as a half section, if it is a boring bar; otherwise it shall be determined as full section from top view (parallel to y-axis of PCS);

— the sketch shall be constrained to the coordinate system “PCS” and to the planes “TEP” and “HEP”. 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 planes;

— the dimensioning shall be done with the appropriate properties listed in Table 6;

— the sketch shall be revolved about the z-axis by 360°, if it is a boring bar; otherwise it shall be extruded along the y-axis.

Figures 18 and 19 represent a turning tool with side cutting edge angle.

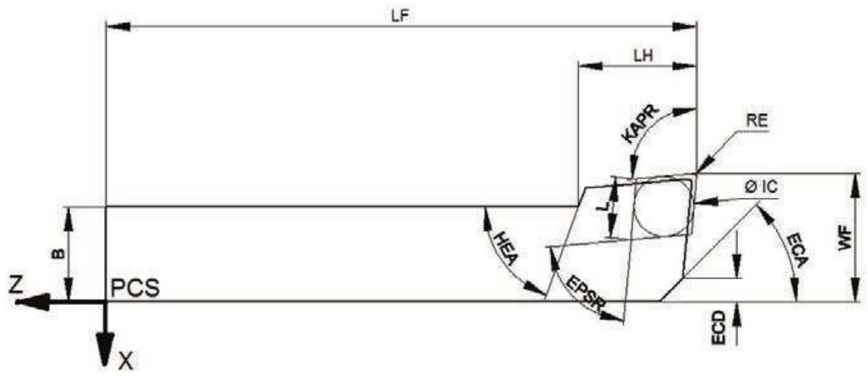


Figure 18 — Sketch of turning tool, offset, side, rhombic

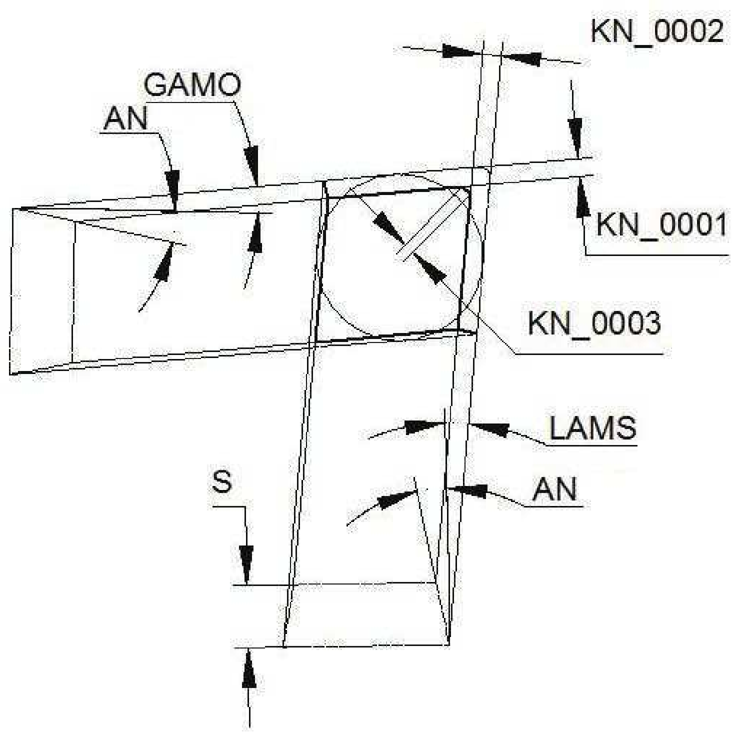


Figure 19 — Turning tool detail of pocket seat offset surfaces

Figures 20 and 21 represent a boring bar with end cutting edge angle. If the property BDRED is not given as a dimension, it shall be calculated as BDRED = DCON-1 mm. If LDRED is not given, it shall be calculated as LDRED = 2xLH

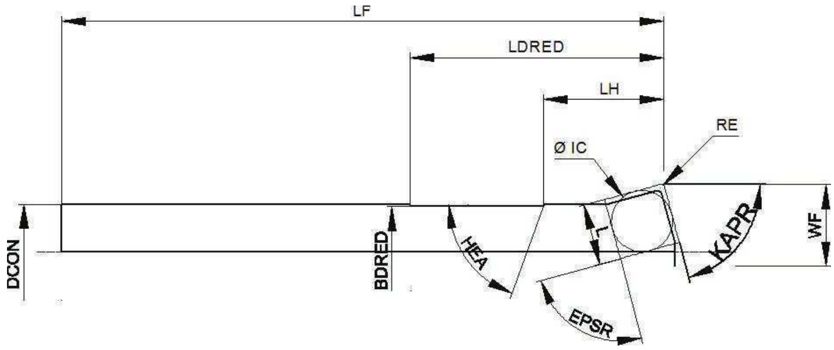


Figure 20 — Sketch of boring bar, offset, end, rhombic

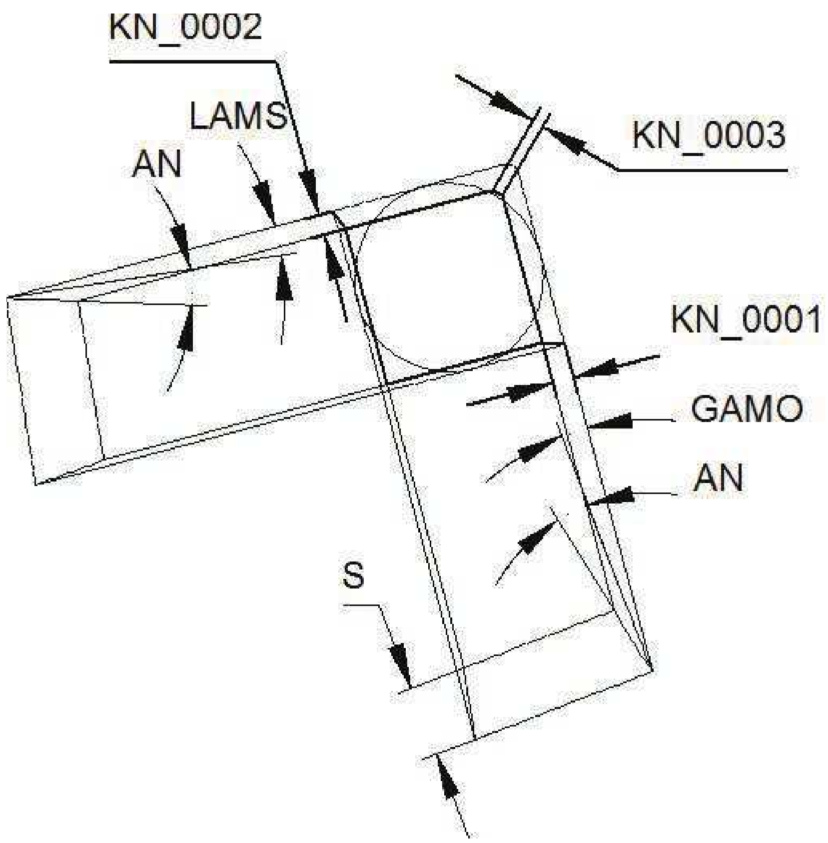


Figure 21 — Boring bar detail of pocket seat offset surfaces

The temporary dimensions KN_0001 and KN_0002 are functions of cutting edge height, normal clearance angle major cutting edge, orthogonal rake angle, normal clearance angle minor cutting edge and inclination angle; the formulae are as follows:

$$KN\_0001 = abs(S \cdot \tan(AN))+abs(S \cdot \sin(GAMO)) \quad (1)$$

$$KN\_0002 = abs(S \cdot tan(AN)) + abs(S \cdot sin(LAMS)) \quad (2)$$

The dimension KN_0003 shall be approximately the size of the corner radius of the master insert to ensure that no collision with the workpiece occurs. It shall also be allowed to round the corner instead of chamfering as shown in Figure 21.

5.4 Turning tool with pocket seat and top surface offset

For the extrusion the value of overall height shall be taken, which can also be calculated by means of GAMO, HF, LAMS and L.

Figure 22 shows the design of the basic tool body with the pocket seat.

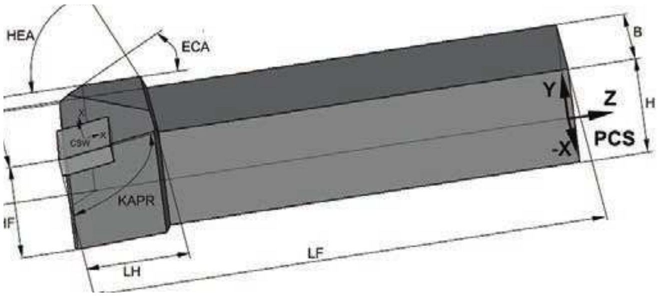


Figure 22 — Turning tool basic geometry with pocket seat model

For the determination of the offset between the cutting edge and the top face, the temporary property KN_0004 shall be used. See Figure 23.

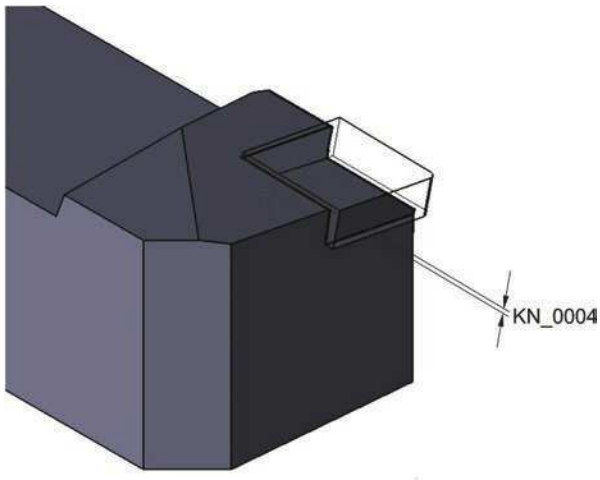


Figure 23 — Top face distance to cutting edge

5.5 Turning tool assembly

Figure 24 shows the assembled turning tool. The insert is placed with its MCS on to the appropriate CSW of the tool body. To be able to exchange a right-handed tool with a left-handed tool on the adaptive item, the MCS of the turning tool shall be placed in the middle of the shank width and approximately at 3/4 of the shank length as shown in Figure 24.

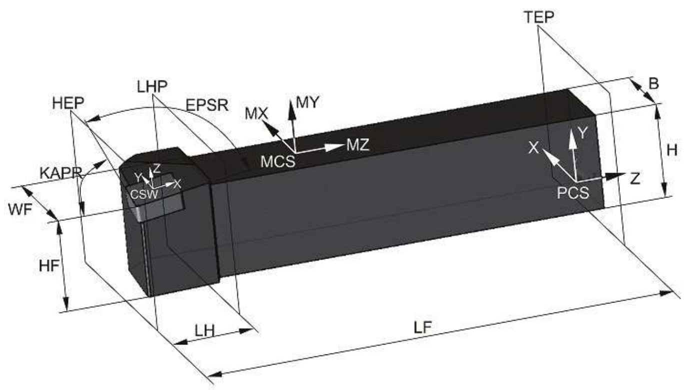


Figure 24 — Turning tool assembly with insert

5.6 Boring bar body

After revolving the boring bar sketch about the z-axis by 360°, the basic body shall be created as shown in Figure 25.

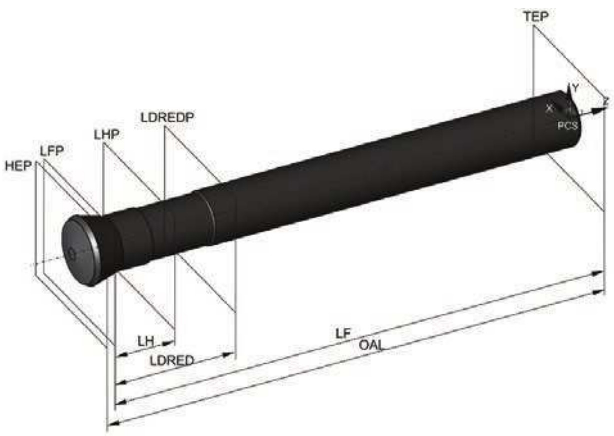


Figure 25 — Boring bar body

In regards of the minimum bore diameter, DMIN, the shape of the head shall be trimmed accordingly as shown in Figure 26. Hereby, a body shall be designed, where the clearance diameter is a hole to subtract material from the boring bar head. The clearance diameter can be calculated as follows:

$$KN\_0005 = (WF - S \cdot \tan(AN) - abs(Sxsin(LAMS) + BDRED/2) \quad (3)$$

The centre of the clearance diameter is (KN_0005-BDRED)/2 on the x-axis in the direction of WF.

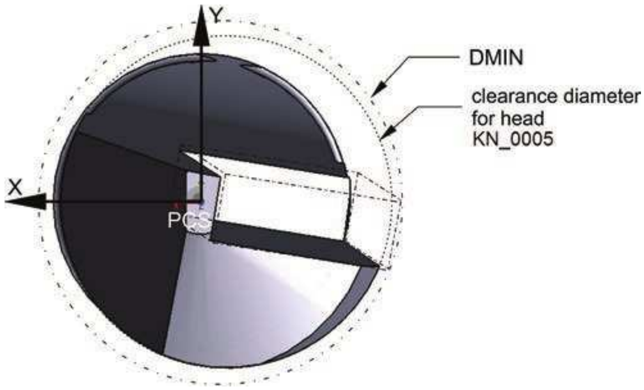


Figure 26 — Trimmed boring bar head for DMIN

Figure 27 shows the assembled boring bar with insert. To be able to exchange a right-handed tool with a left-handed tool on the adaptor, the MCS of the boring bar shall be placed on the centre line and approximately at 3/4 of the shank length as shown as “clamping length - LSC” in Figure 27.

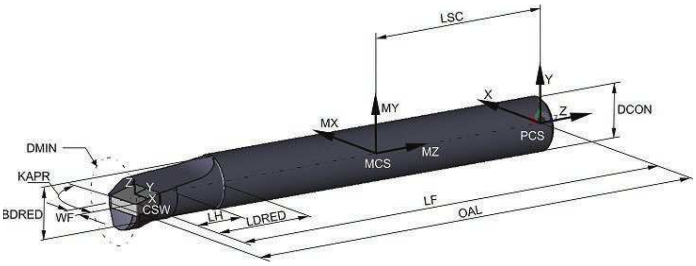


Figure 27 — Assembled boring bar

6 Turning tool for external threading

6.1 General

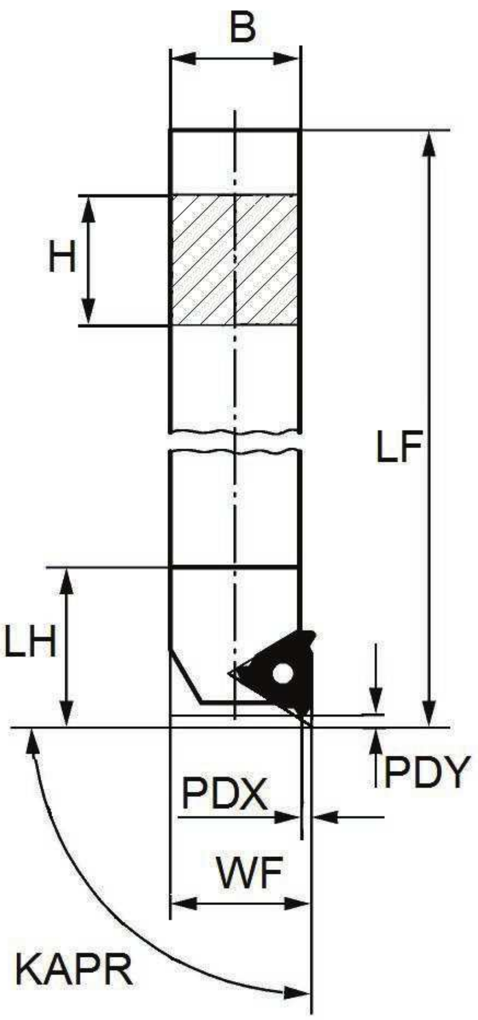


Figure 28 — Determination of properties of a turning tool for external threading

6.2 Necessary properties

The properties shown in Figure 28 are listed in Table 8.

Table 8 — Properties for the modelling of an external turning tool for threading

Preferred name	Preferred symbol
shank width	B
cutting edge angle type code	CEATC
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
[a] Value taken from the basic shape of the insert.	

Table 8 *(continued)*

Preferred name	Preferred symbol
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
cutting edge length	L[a]
inclination angle	LAMS
functional length	LF
head length	LH
overall height	OAH
overall length	OAL
profile distance ex	PDX
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF
[a] Value taken from the basic shape of the insert.	

6.3 Basic geometry

The basic design of the model is a sketch for the "extrusion" function for models with a rectangular shank. The basic design contains all elements between the plane "TEP" and the plane "HEP". See Figure 29 for the details of dimensioning.

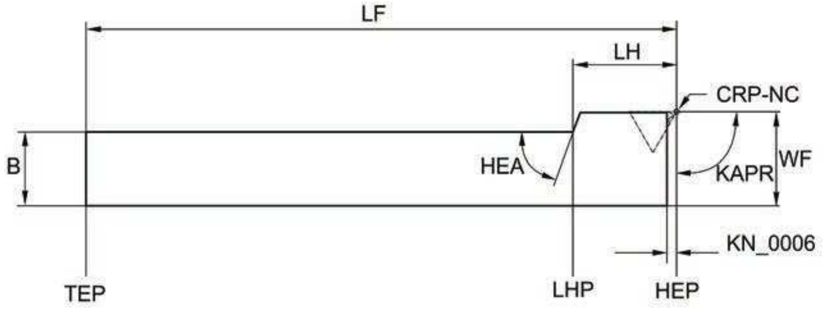


Figure 29 — Sketch of turning tool for OD threading

The temporary property KN_0006 shall be calculated with the properties PDY + CDX. The formula is as follows.

$$KN\_0006 = PDY + CDX + abs(S \cdot \sin(GAMO)) \quad (4)$$

6.4 Turning tool with pocket seat and top surface offset

For the extrusion, the value of overall height shall be taken. It can also be calculated by means of GAMO, HF, LAMS and L.

Figures 30 and 31 show the design of the basic tool body with the pocket seat.

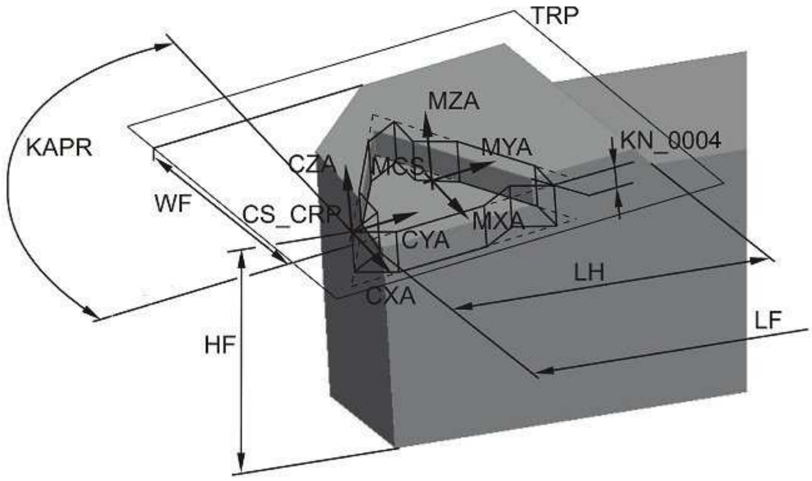


Figure 30 — Turning tool basic geometry with pocket seat model

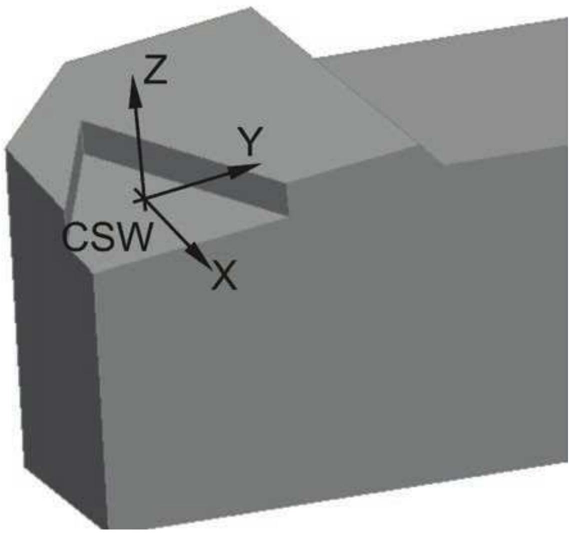


Figure 31 — Turning tool with CSW

6.5 Turning tool assembly

Figure 32 shows the assembled turning tool. The insert is placed with its MCS on to the appropriate CSW of the tool body. In order to exchange a right-handed tool with a left-handed tool on the adaptive item, the MCS of the turning tool shall be placed in the middle of the shank width and approximately at 3/4 of the shank length as shown in Figure 32.

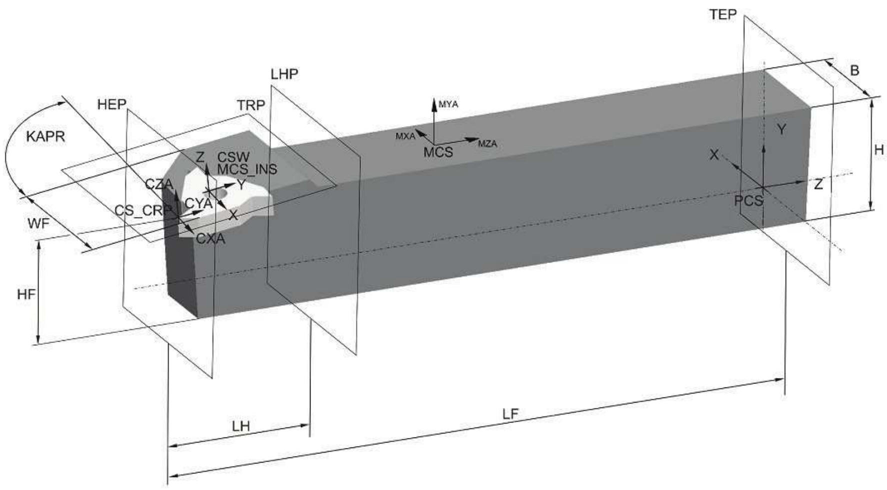


Figure 32 — Turning tool assembly

7 Boring bar for internal threading

7.1 General

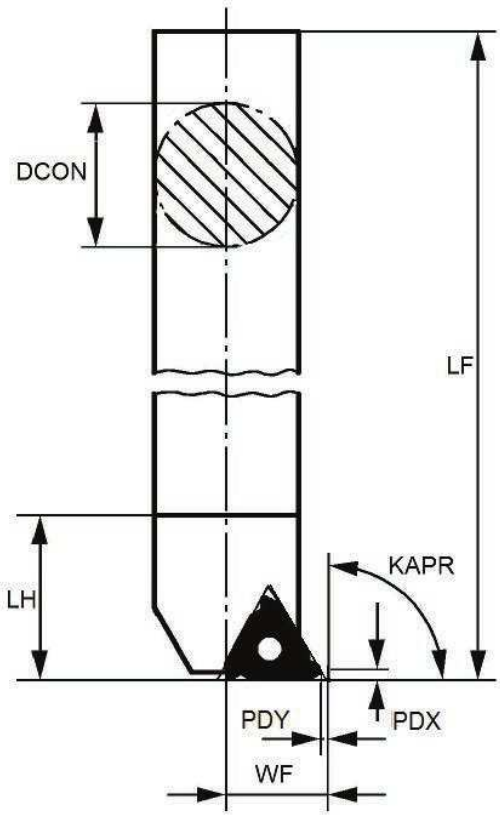


Figure 33 — Determination of properties of a boring bar for internal threading

7.2 Necessary properties

The properties shown in Figure 33 are listed in Table 9.

Table 9 — Properties for the modelling of a boring bar for internal threading

Preferred name	Preferred symbol
shank width	B
cutting edge angle type code	CEATC
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
cutting edge length	L[a]
inclination angle	LAMS
functional length	LF
head length	LH
overall height	OAH
overall length	OAL
profile distance ex	PDX
profile distance ey	PDY
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF

[a] Value taken from the basic shape of the insert.

7.3 Basic geometry

The basic design of the model is a sketch for the “revolve” function for models with cylindrical shank, which contains all elements between the plane “TEP” and the plane “HEP”. See Figure 34 for the details of dimensioning.

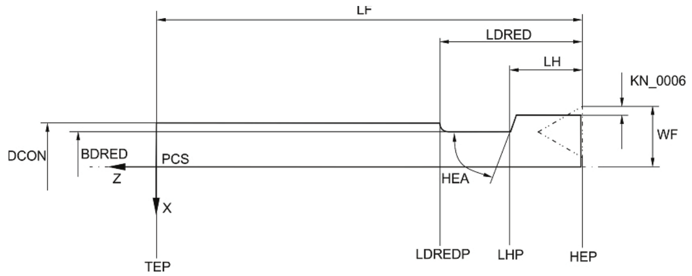


Figure 34 — Sketch of a turning tool for ID threading

For KN_0006, see Formula (4).

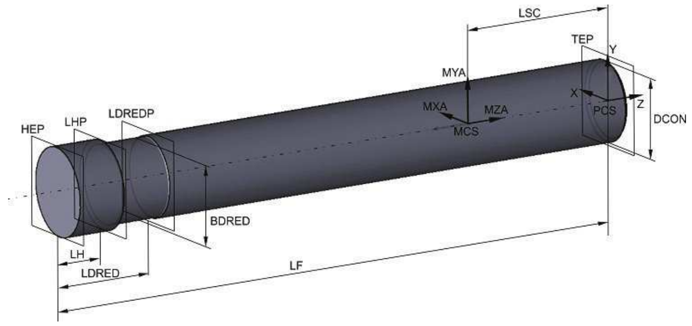


Figure 35 — Boring bar body for internal threading

Regarding the minimum bore diameter DMIN, the shape of the head shall be trimmed accordingly as shown in Figure 26. Hereby a body shall be designed, where the clearance diameter is a hole to subtract material from the boring bar head. The clearance diameter can be calculated as follows.

KN_0005 = (WF - KN_0006 + BDRED/2) (5)

The centre of the clearance diameter is (KN_0005-BDRED)/2 on the x-axis in the direction of WF. See Figure 26.

7.4 Boring bar with pocket seat and top surface offset

Before placing the pocket seat to the appropriate position the chip flute shall be designed using the values of the properties BDRED, GAMO, HF, LAMS, LDRED and LH.

Figures 36 and 37 show the design of the basic tool body with the pocket seat and the corresponding coordinate systems CSW and MCS.

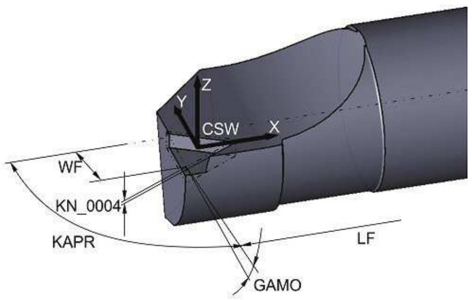


Figure 36 — Boring bar basic geometry with pocket seat model

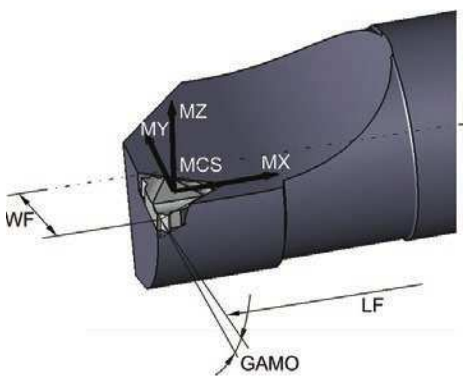


Figure 37 — Boring bar with MCS of insert

7.5 Boring bar assembly

Figure 38 shows the assembled boring bar. The insert is placed with its MCS on to the appropriate CSW of the tool body. In order to exchange a right handed tool with a left handed tool on the adaptive item, the MCS of the boring bar shall be placed on the centre line and approximately at 3/4 of the shank length as shown as “clamping length - LSC” in Figure 38.

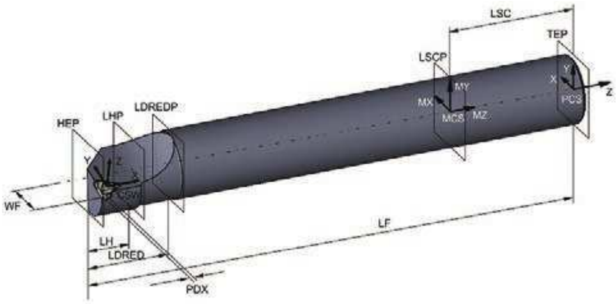


Figure 38 — Boring bar assembly

8 Turning tool for OD grooving and parting

8.1 General

The determination of properties of a turning tool for external grooving and/or cut-off shall be done according to Figure 39.

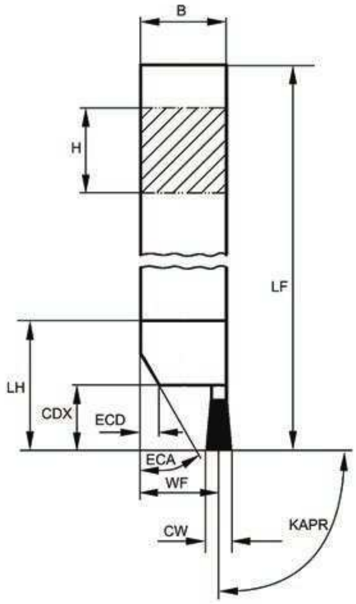


Figure 39 — Determination of properties of a turning tool for external grooving and/or cut-off

8.2 Necessary properties

The properties shown in Figure 39 are listed in Table 10.

Table 10 — Properties for the modelling of a turning tool for external grooving and/or cut-off

Preferred name	Preferred symbol
shank width	B
blade reinforcement radius	BLRAD
cutting depth maximum	CDX
cutting edge angle type code	CEATC
cutting width	CW
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
inclination angle	LAMS
functional length	LF
head length	LH
overall height	OAH
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF

For the design of an axial grooving tool, the following properties shall be required in addition to the properties listed in Table 11.

Table 11 — Properties for the modelling of turning tools for axial grooves

Preferred name	Preferred symbol
axial groove support direction	AXGSUP
axial groove outside diameter minimum	DAXN
axial groove outside diameter maximum	DAXX

The property “axial groove support direction” is also called “sweep”. For the illustration of how the properties for axial grooving shall be used, see Table 12 and Figure 40.

Table 12 — Determination of axial groove support direction

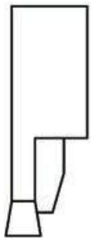
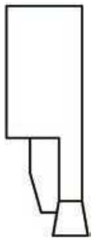
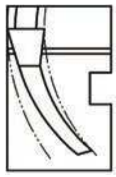
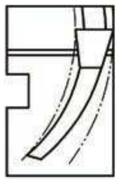
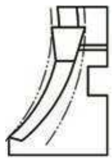
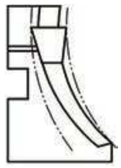
Valid value	Direction	Left-hand tool holder	Right-hand tool holder
			
1	inside direction (sweep)		
2	outside sweep (sweep)		

Figure 40 shows the definition of the axial groove diameters DAXN and DAXX.

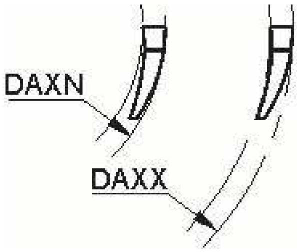


Figure 40 — Axial groove diameter min and max

8.3 Basic geometry

The basic design of the model is a sketch for the “extrusion” function for models with rectangular shanks, which contains all elements between the plane “TEP” and the plane “HEP”. See Figure 41 for details of dimensioning.

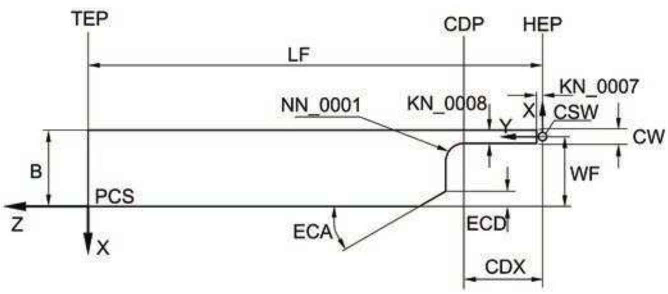


Figure 41 — Sketch of grooving and parting turning tool

The extrusion requires the dimension of the overall height to be determined.

After the extrusion, the pocket seat and the main design shall be included by means of using the trim and subtract functions of the CAD software.

Figure 42 shows the basic model.

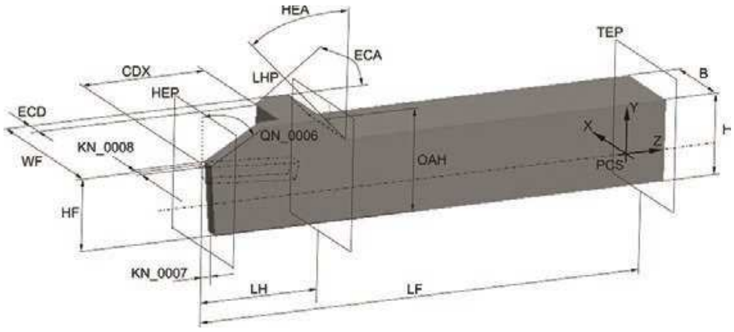


Figure 42 — Basic model of grooving tool holder

8.4 Grooving tool with pocket seat and top surface offset

To subtract the pocket seat from the basic body, an appropriate insert shall be taken that represents the basic shape. The MCS of the pocket seat shall be placed on to the CSW of the grooving tool. Figures 43 and 44 show the basic model and the location of CSW and MCS.

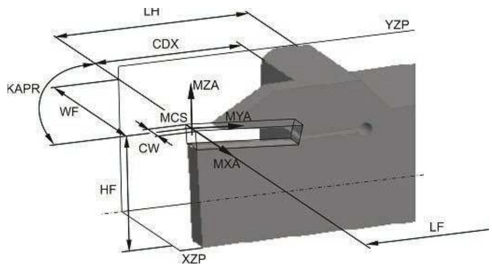


Figure 43 — Position of pocket seat model and its MCS on the basic model

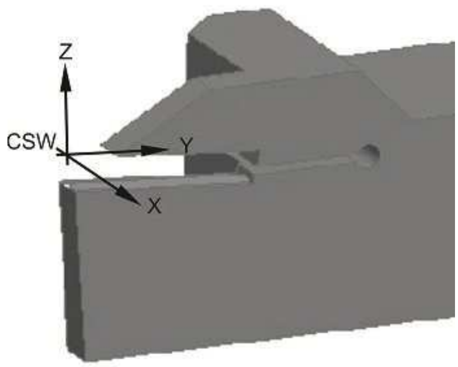


Figure 44 — Position of CSW on the basic model

8.5 Grooving and cut-off tool assembly

Figure 45 shows the assembled grooving tool. The insert is placed with its MCS on to the appropriate CSW of the tool body. In order to exchange a right handed tool with a left handed tool on the adaptive item, the MCS of the grooving tool shall be placed in the middle of the shank width and approximately at 3/4 of the shank length as shown in Figure 45.

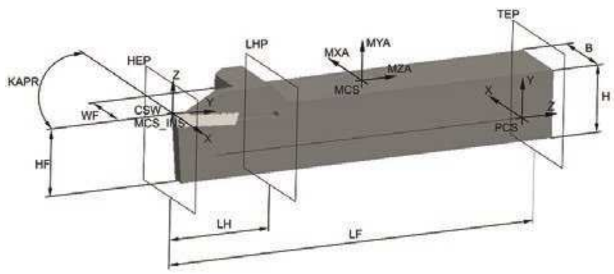


Figure 45 — Grooving and parting tool holder assembly

9 Boring bar for ID grooving

9.1 General

The determination of properties of a boring bar for internal grooving shall be done according to Figure 46.

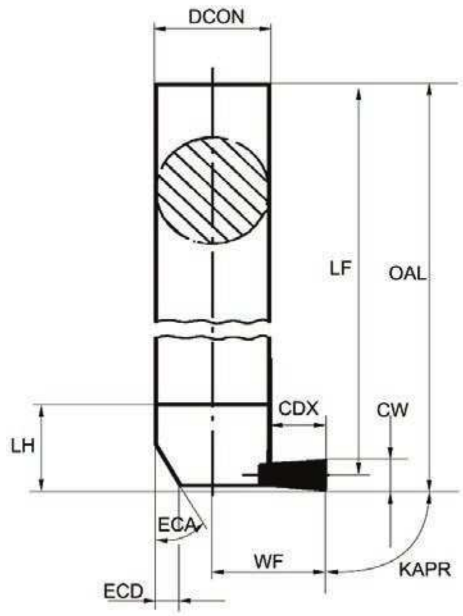


Figure 46 — Determination of properties of a boring bar for internal grooving

9.2 Necessary properties

The properties shown in Figure 46 are listed in Table 13.

Table 13 — Properties for the modelling of a boring bar for internal grooving

Preferred name	Preferred symbol
shank width	B
blade reinforcement radius	BDRED
cutting depth maximum	CDX
cutting edge angle type code	CEATC
cutting width	CW

Table 13 *(continued)*

Preferred name	Preferred symbol
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
inclination angle	LAMS
functional length	LF
head length	LH
overall height	OAH
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF

9.3 Basic geometry

The basic design of the model is a sketch for the “revolve” function for models with cylindrical shanks, which contain all elements between the plane “TEP” and the plane “HEP”. See Figure 47 for the details of dimensioning.

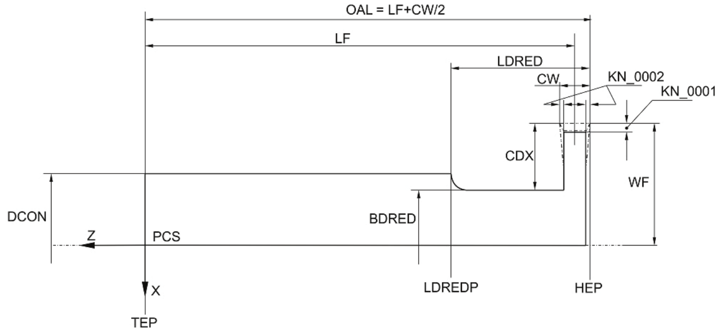


Figure 47 — Sketch of a boring bar for grooving

The temporary properties KN_0001 and KN_0002 are dependent on the properties of the irregular master insert, which are AN, S and BW, where KN_0002 is (CW-BW)/2.

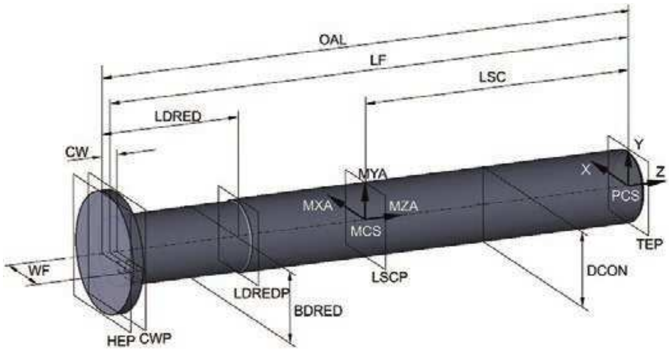


Figure 48 — Basic model of boring bar for grooving

Regarding the minimum bore diameter DMIN, the shape of the head shall be trimmed accordingly as shown in Figure 26. Hereby, a body shall be designed, where the clearance diameter is a hole to subtract material from the boring bar head. The clearance diameter can be calculated as follows:

KN_0005 = (WF - KN_0001 + BDRED/2) (6)

The centre of the clearance diameter is (KN_0005-BDRED)/2 on the x-axis in the direction of WF. See Figure 26.

9.4 Boring bar with pocket seat and top surfaces

See 8.4 and Figures 49 and 50 for the design of grooving boring bars.

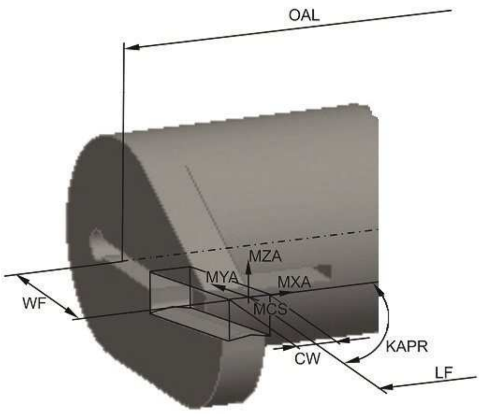


Figure 49 — Position of the pocket seat model and its MCS on the basic model

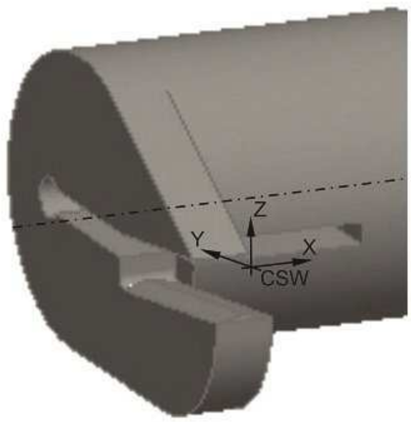


Figure 50 — Position of the CSW on the basic model

9.5 Grooving boring bar assembly

Figure 51 shows the assembled boring bar. The insert is placed with its MCS on to the appropriate CSW of the tool body. In order to exchange a right-handed tool with a left-handed tool on the adaptive item, the MCS of the boring bar shall be placed on the centre line and approximately at 3/4 of the shank length as shown as “clamping length - LSC” in Figure 51.

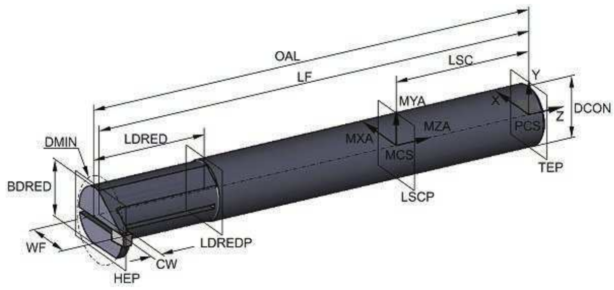


Figure 51 — Boring bar for grooving assembly

10 Pull back boring bar

10.1 General

The determination of properties of a pull back boring bar shall be done according to Figure 52.

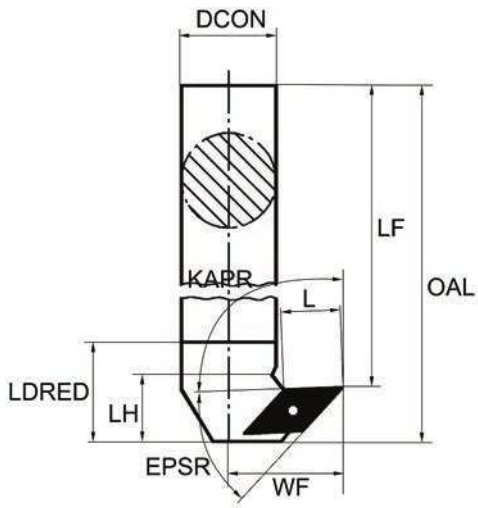


Figure 52 — Determination of properties of a pull back boring bar

10.2 Necessary properties

The properties shown in Figure 52 are listed in Table 6.

See 5.2 for the necessary properties.

10.3 Basic geometry

The basic design of the model is a sketch for the "revolve" function for models with cylindrical shanks, which contain all elements between the plane "TEP" and the plane "HEP". See Figure 53 for details of dimensioning.

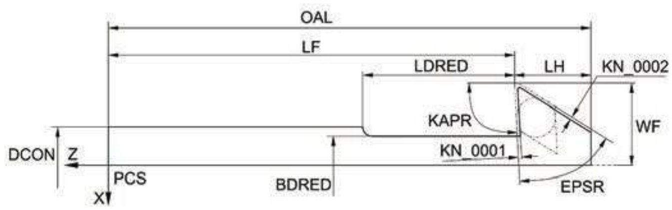


Figure 53 — Sketch of boring bar, pull back

See 5.3 for the temporary dimensions KN_0001 and KN_0002.

After revolving the boring bar sketch about the z-axis by 360°, the basic body shall be created as shown in Figure 54. For the design of the minimum bore diameter, see 5.6.

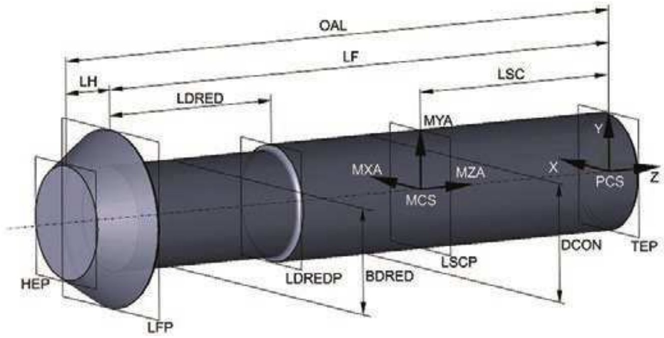


Figure 54 — Pull back boring bar, basic body

10.4 Boring bar with pocket seat and top surfaces

Before placing the pocket seat to the appropriate position, the chip flute shall be designed. The chip flute shall be designed using the values of the properties BDRED, GAMO, HF, LAMS, LDRED and LH.

Figures 55 and 56 show the design of the basic tool body with the pocket seat and the corresponding coordinate systems CSW and MCS.

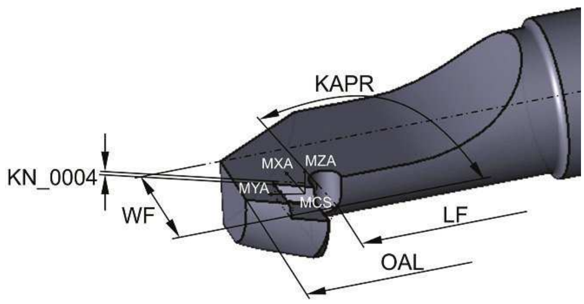


Figure 55 — Boring bar basic geometry with pocket seat model and MCS

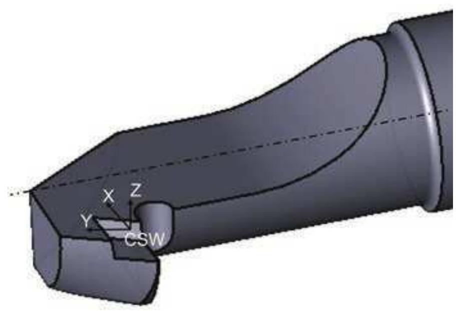


Figure 56 — Boring bar with CSW

10.5 Pull back boring bar assembly

Figure 57 shows the assembled boring bar. The insert is placed with its MCS on to the appropriate CSW of the tool body. In order to exchange a right-handed tool with a left-handed tool on the adaptive item, the MCS of the boring bar shall be placed on the centre line and approximately at 3/4 of the shank length as shown as “clamping length - LSC” in Figure 57.

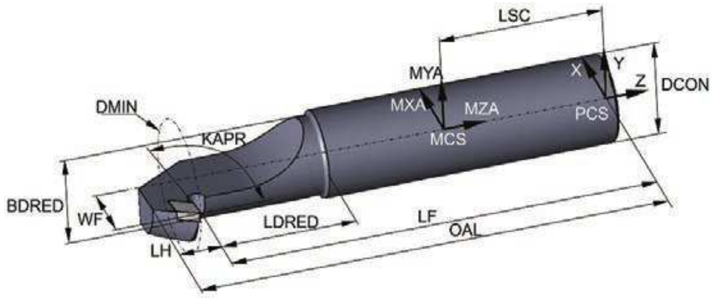


Figure 57 — Pull back boring bar assembly

11 System tool for external turning

11.1 General

The determination of properties of a system tool for external turning shall be done according to Figure 58.

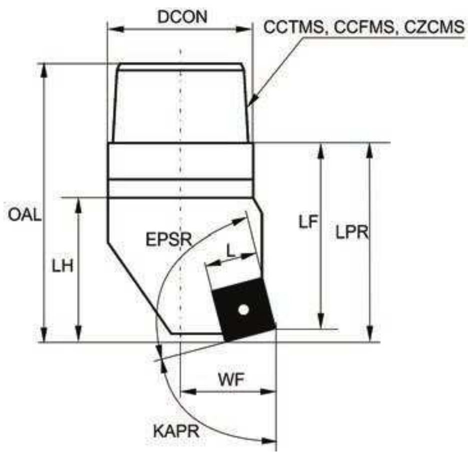


Figure 58 — Determination of properties of a system tool for external turning

11.2 Necessary properties

The properties shown in Figure 58 are listed in Table 14.

Table 14 — Properties for the modelling of system tools for external turning

Preferred name	Preferred symbol
reduced body diameter	BDRED
cutting edge angle type code	CEATC
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
hand	HAND

Table 14 *(continued)*

Preferred name	Preferred symbol
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
cutting edge length	L
inclination angle	LAMS
reduced body diameter length	LDRED
functional length	LF
head length	LH
overall length	OAL
tool holder shape code	THSC
functional width	WF

11.3 Basic geometry

The basic design of the model is a sketch for the "revolve" function for models with rotational symmetric connection, which contain all elements between the plane "TEP" and the plane "HEP". See Figure 59 for details of dimensioning.

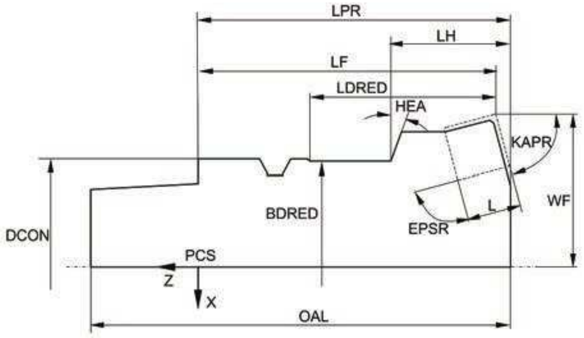


Figure 59 — Sketch of a system tool for external turning

For the determination of the contour beyond the insert, see 5.3 and Figure 21.

After revolving the tool sketch about the z-axis by 360°, the basic body shall be created as a solid body similar to a boring bar as shown in Figure 35. For the design of the minimum bore diameter, see 5.6

11.4 System tool with pocket seat and top surfaces

Before placing the pocket seat to the appropriate position the chip flute shall be designed. The chip flute shall be designed using the values of the properties BDRED, GAMO, HF, LAMS, LDRED and LH.

Figures 60 and 61 show the design of the basic tool body with the pocket seat and the corresponding coordinate systems CSW and MCS.

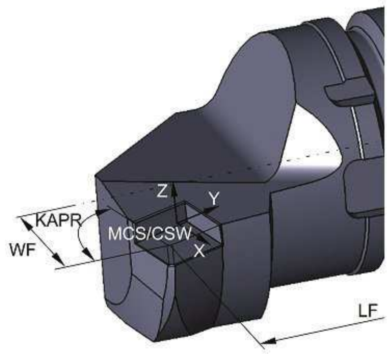


Figure 60 — System tool — Basic geometry with pocket seat model and MCS

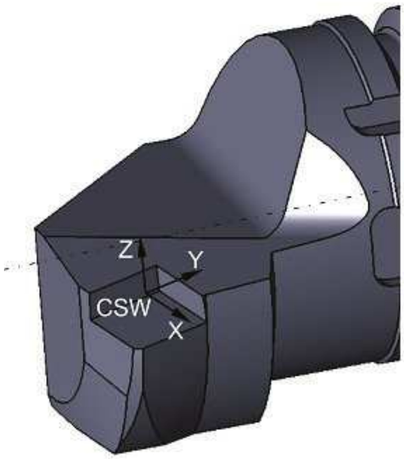


Figure 61 — System tool with CSW

11.5 Assembly of system tool for external turning

Figure 62 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

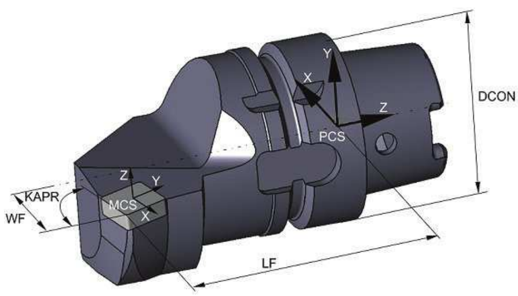


Figure 62 — Assembly system tool for external turning

12 System tool for external threading

12.1 General

The determination of properties of system tools for external threading shall be done according to Figure 63.

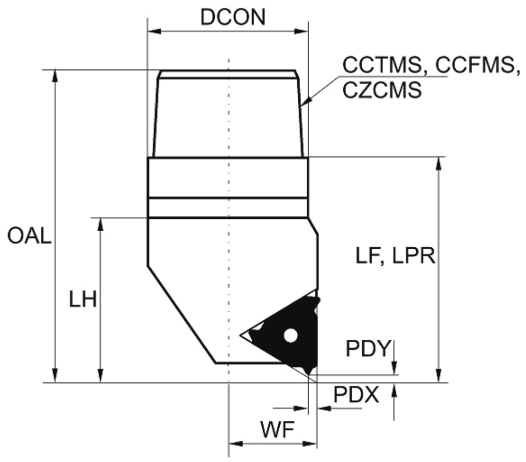


Figure 63 — Determination of properties of system tools for external threading

12.2 Necessary properties

The properties shown in Figure 63 are listed in Table 15.

Table 15 — Properties for the modelling of system tools for external threading

Preferred name	Preferred symbol
reduced body diameter	BDRED
cutting edge angle type code	CEATC
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
cutting edge length	L[a]
inclination angle	LAMS
reduced body diameter length	LDRED
functional length	LF
head length	LH
overall height	OAH
overall length	OAL
[a] Value taken from the basic shape of the insert.	

Table 15 *(continued)*

Preferred name	Preferred symbol
profile distance ex	PDX
profile distance ey	PDY
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF
[a] Value taken from the basic shape of the insert.	

12.3 Basic geometry

For the basic design, see 11.3. The dimensioning shall be done similarly as described in 6.3 for external threading.

12.4 System tool with pocket seat and top surfaces

See 11.4 for the position of the pocket seat and the top surfaces.

12.5 Assembly of a system tool for external threading

Figure 64 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

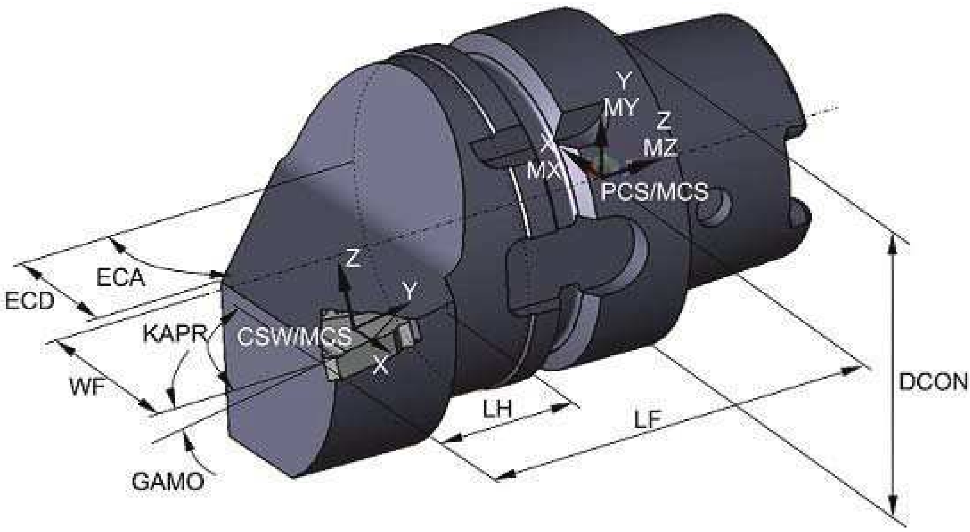


Figure 64 — Assembly of a system tool for external threading

13 System tool for internal turning

13.1 General

The determination of properties of system tools for internal turning shall be done according to Figure 65.

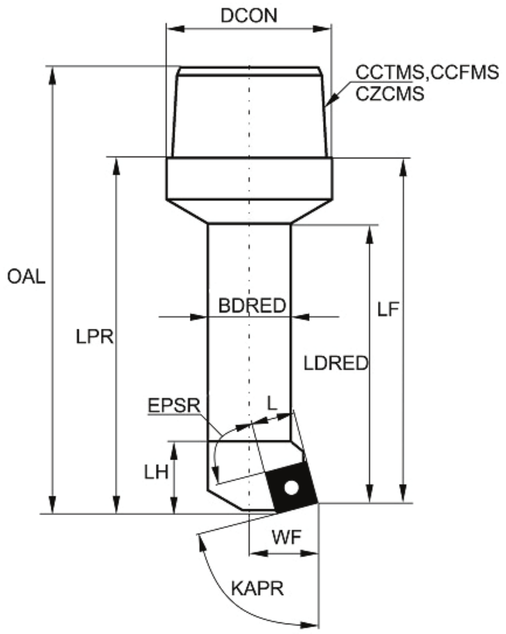


Figure 65 — Determination of properties of system tools for internal turning

13.2 Necessary properties

The properties shown in Figure 65 are listed in Table 15.

See 11.2 for the necessary properties.

13.3 Basic geometry

See 11.3 for the design of the sketch of the system tool for internal turning.

13.4 System tool with pocket seat and top surfaces

See 11.4 for the position of the pocket seat and the top surfaces.

13.5 System tool for internal turning assembly

Figure 66 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

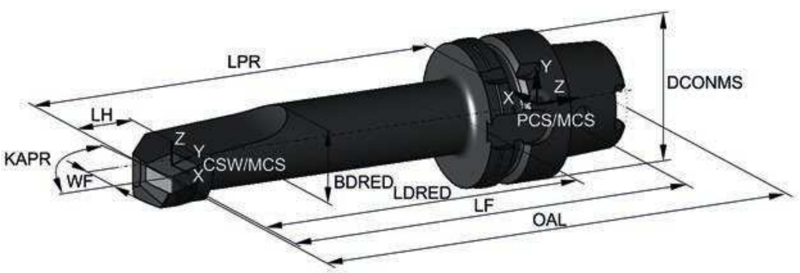


Figure 66 — System tool for internal turning assembly

14 System tool for internal threading

14.1 General

The determination of properties of system tools for internal threading shall be done according to Figure 67.

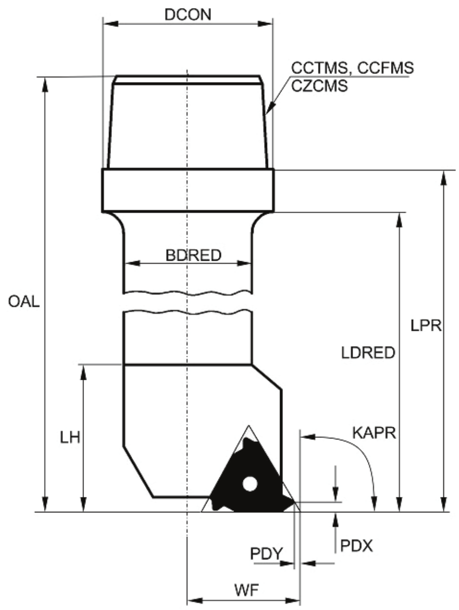


Figure 67 — Determination of properties of system tools for internal threading

14.2 Necessary properties

The properties shown in Figure 67 are listed in Table 15.

See 12.2 for the necessary properties.

14.3 Basic geometry

See 11.3 for the design of the sketch of the system tool for internal threading. The dimensioning shall be done similarly as described in 7.3 for internal threading.

14.4 System tool with pocket seat and top surfaces

See 11.4 for the position of the pocket seat and the top surfaces.

14.5 System tool for internal threading assembly

Figure 68 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

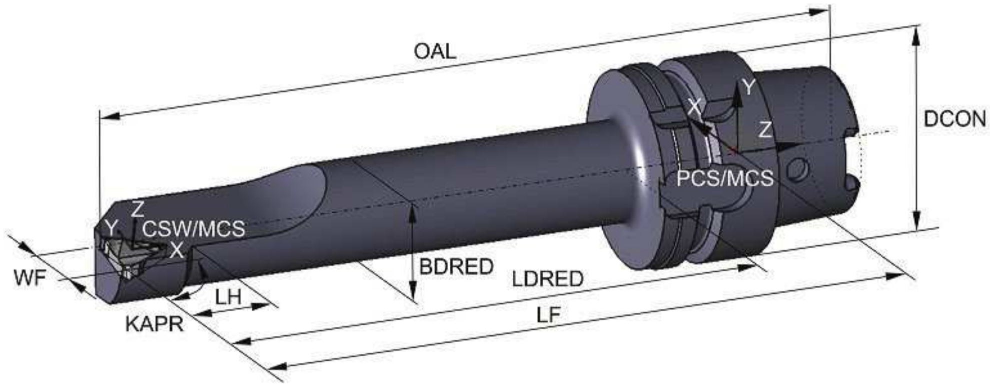


Figure 68 — System tool for internal threading assembly

15 System tool for OD grooving and/or cut-off

15.1 General

The determination of properties of system tools for OD grooving and/or cut-off shall be done according to Figure 69.

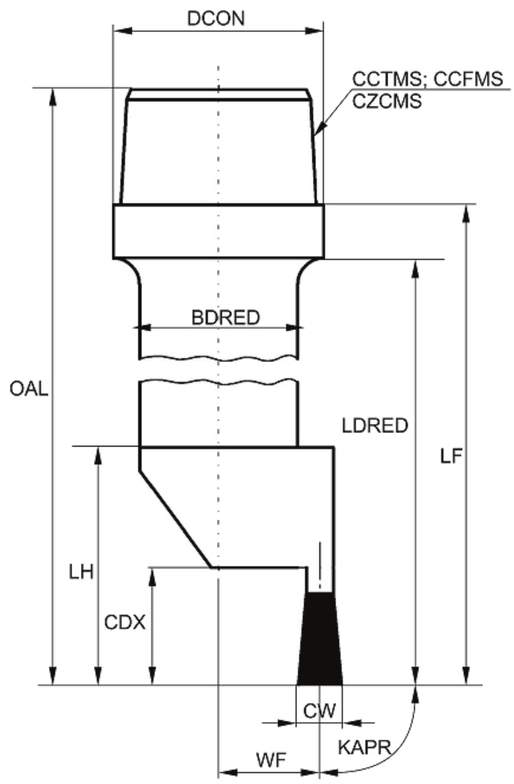


Figure 69 — Determination of properties of system tools for OD grooving and/or cut-off

15.2 Necessary properties

The properties shown in Figure 69 are listed in Table 16.

Table 16 — Properties for the modelling of system tools for OD-grooving and/or cut-off

Preferred name	Preferred symbol
blade reinforcement radius	BLRAD
cutting depth maximum	CDX
cutting edge angle type code	CEATC
cutting width	CW
connection diameter	DCON
end chamfer	EC
end chamfer angle	ECA
end chamfer distance	ECD
included angle	EPSR
orthogonal rake angle	GAMO
shank height	H
hand	HAND
head end angle	HEA
functional height	HF
tool cutting edge angle	KAPR
inclination angle	LAMS
functional length	LF
head length	LH
overall height	OAH
shank cross section shape code	SX
tool holder shape code	THSC
functional width	WF

For the design of an axial grooving tool the properties listed in 8.2, Tables 11 and 12 shall be required in addition to the properties listed in Table 16. See also Figure 40 for the direction of the sweep.

15.3 Basic geometry

The basic design of the model is a sketch for the "extrusion" function, which contains all elements between the "PCS" and the plane "HEP", but without the connection feature of the system tool. The extruded body shall be combined with the connection body. See Figure 41 for the details of dimensioning.

15.4 Grooving tool with pocket seat and top surface offset

See 8.4 for the details of design.

15.5 System tool for OD grooving and parting assembly

Figure 70 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

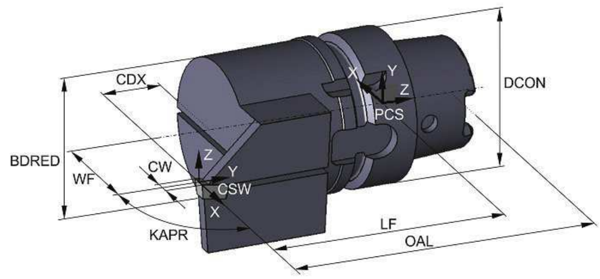


Figure 70 — System tool for OD grooving and/or cut-off assembly

16 System tool for ID grooving

16.1 General

The determination of properties of system tools for ID grooving shall be done according to Figure 71.

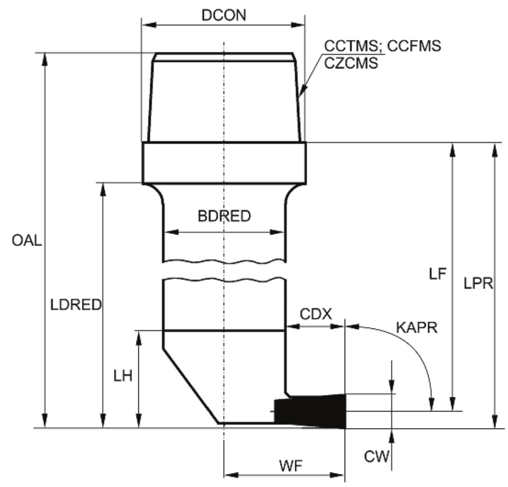


Figure 71 — Determination of properties of system tools for ID grooving

The properties shown in Figure 71 are listed in Table 16.

16.2 Necessary properties

See 15.2 for the necessary properties.

16.3 Basic geometry

See 9.3 for the design of the system tool for internal grooving.

16.4 Grooving tool with pocket seat and top surface offset

See 9.4 for the details of design.

16.5 System tool for ID grooving assembly

Figure 72 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

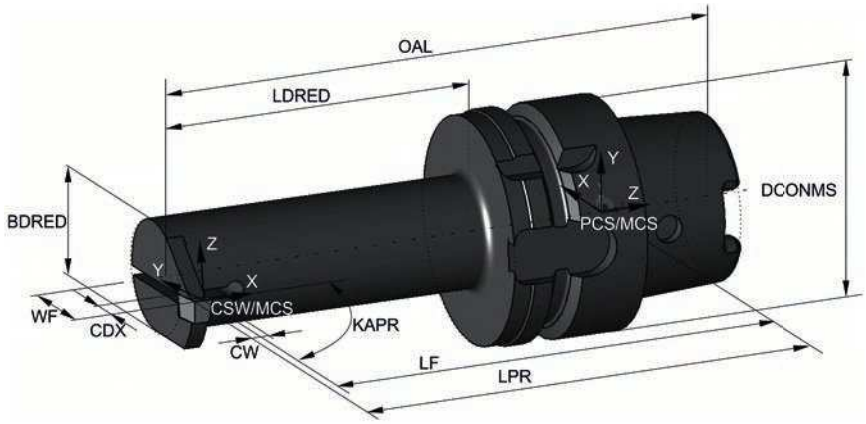


Figure 72 — System tool for ID grooving assembly

17 Pull back system tool

17.1 General

The determination of properties for pull back system tools shall be done according to Figure 73.

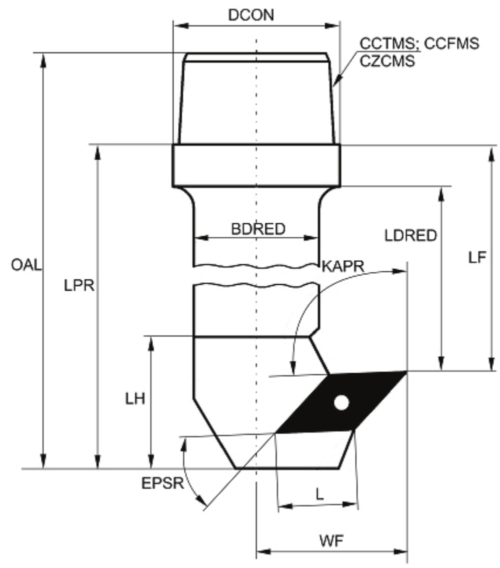


Figure 73 — Determination of properties for pull back system tools

17.2 Necessary properties

The properties shown in Figure 73 are listed in Table 14.

See 11.2 for the necessary properties.

17.3 Basic geometry

See 10.3 for the design of the pull back system tool.

17.4 System tool with pocket seat and top surfaces

See 10.4 for the details of design.

17.5 Pull back system tool assembly

Figure 74 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

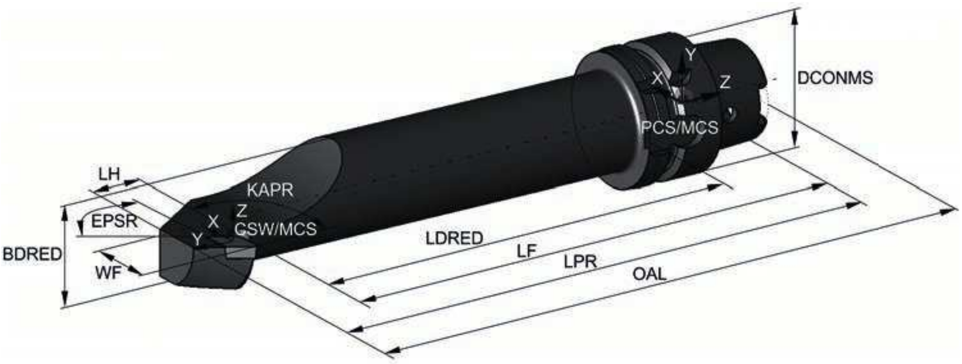


Figure 74 — System tool for pull back machining assembly

18 System tool, neutral design for OD turning

18.1 General

The determination of properties for system tools, neutral design shall be done according to Figure 75.

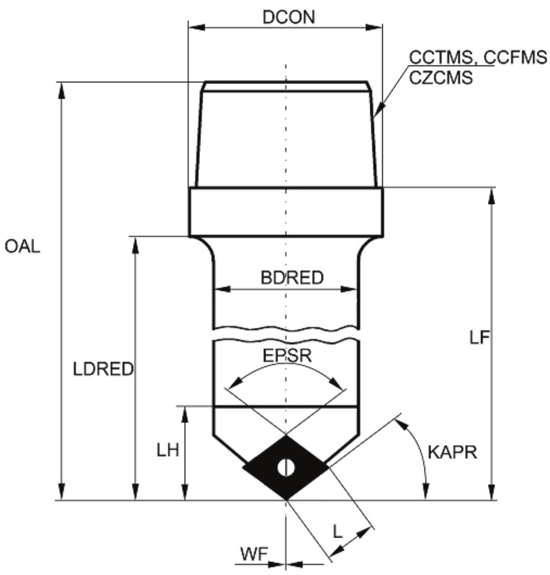


Figure 75 — Determination of properties for system tools, neutral design

18.2 Necessary properties

See 11.2 and Table 14 for the necessary properties.

18.3 Basic geometry

See 11.3 for the design of the system tool.

18.4 System tool with pocket seat and top surfaces

See 11.4 for the details of design.

18.5 System tool, neutral design for OD turning assembly

Figure 76 shows the assembled system tool. The insert is placed with its MCS on to the appropriate CSW of the tool body.

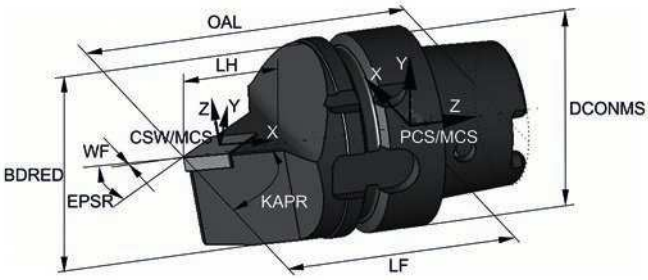


Figure 76 — System tool, neutral design for OD turning assembly

19 Design of details

19.1 Basics for modelling

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

19.2 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.

19.3 Contact surfaces/drive keys — Orientation

Drive keys that shall be 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.

19.4 Chamfers and roundings

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

20 Attributes of surfaces — Visualization of the model features

The colour settings as part of the attributes of the surfaces shall be taken in accordance with ISO/TS 13399-80.

NOTE 1 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, in order 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 is created with the sketch elements of the cutting and non-cutting part and is placed at the end of the tree.

NOTE 2 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 plane “LCFP” and other planes are used as references. With the suppression of the main design elements, all referenced design elements is also supressed.

21 Structure of the design elements (tree of model)

On turning tools, boring bar and system tools 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”. Hereby, it is necessary that both groups can be suppressed or deactivated separately, without a mutual impact.

All the detailed design features shall be put together in a separate group named “DETAILS”. This group shall be the last element of the tree. The group “DETAILS” is dependent on the groups “CUT” and “NOCUT” and shall be suppressed if either one of these two groups “CUT” or “NOCUT” shall be suppressed. See Figures 77 and 78.

This kind of grouping shall only be built 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 reference.

The structure of a basic body shall be as shown in Figures 77 and 78 and shall be similar in other CAD systems.

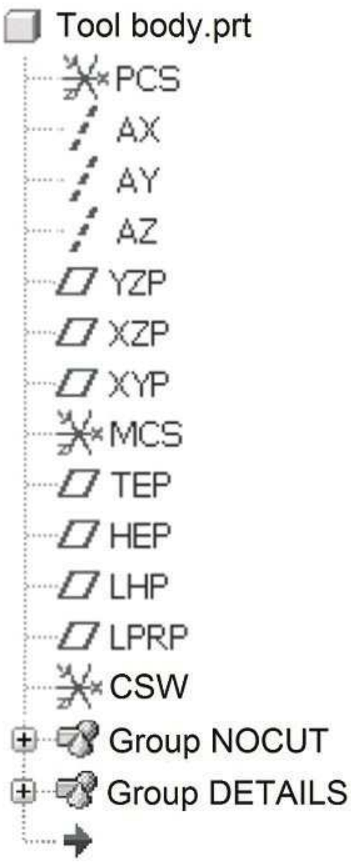


Figure 77 — Structure of a basic tool body

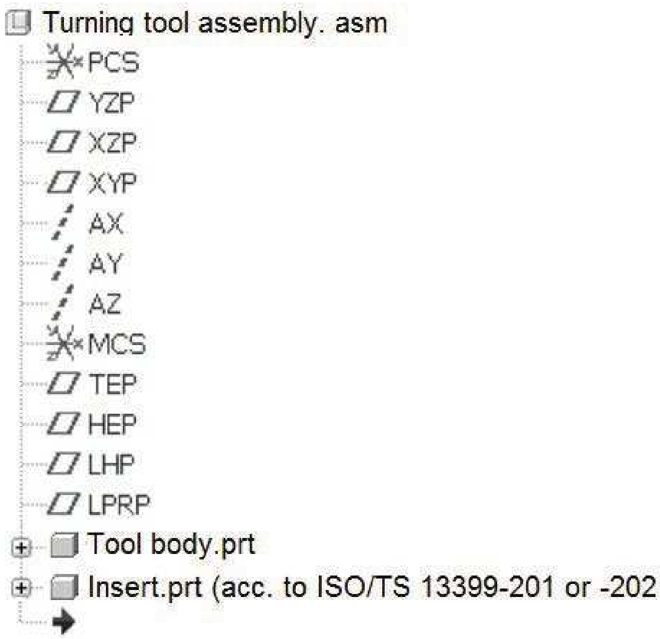
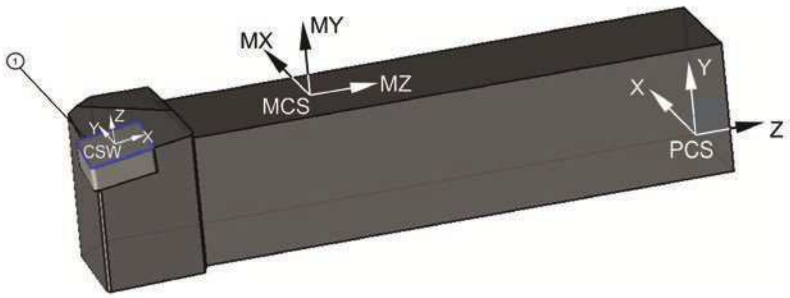


Figure 78 — Structure of an assembled turning tool

22 Data exchange model

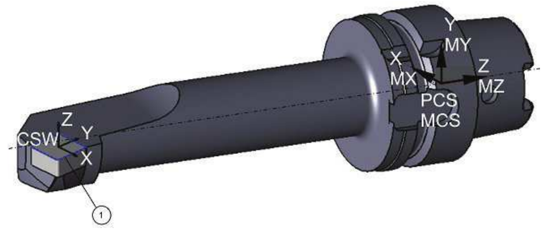
Example models for the data exchange of a turning tool holder and an internal system tool are illustrated in Figures 79 and 80. All these models shall contain the geometrical features (collision contour), primary coordinate system “PCS”, the mounting coordinate system “MCS”, the coordinate system workpiece side “CSW” and the cutting edge line of the inserts that are relevant for the collision examination.



Key

1 cutting edge line

Figure 79 — Example of a tool holder for OD turning



Key

1 cutting edge line

Figure 80 — Example of a system tool for internal turning

Annex A
(normative)

Mirror planes for left-handed tools

Figures A.1 and A.2 show the location of a right-handed and left-handed tool. The mirror plane is determined as the YZ plane of the primary coordinate system.

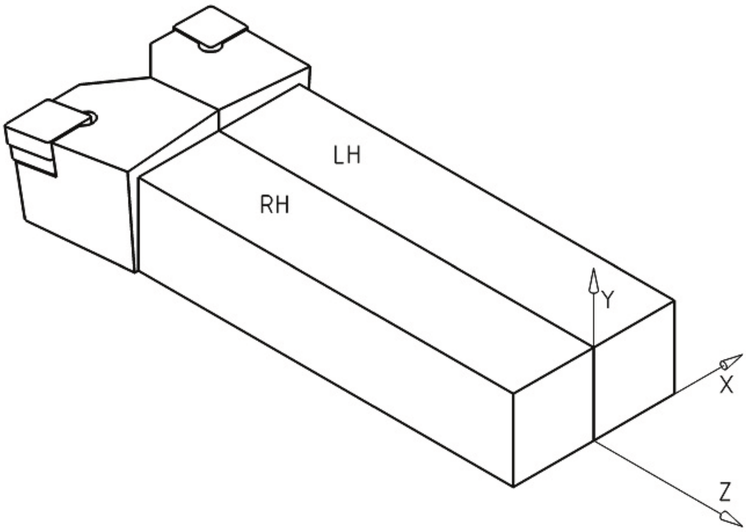


Figure A.1 — Orientation of the primary coordinate system PCS on square shank tool holders

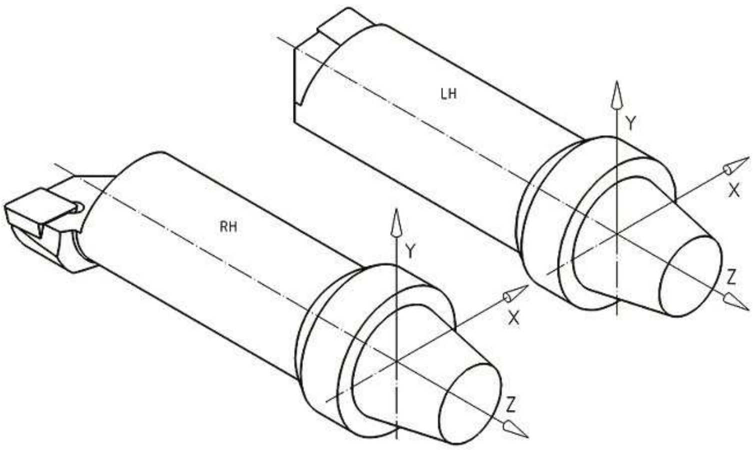


Figure A.2 — Orientation of the primary coordinate system PCS on round shank tool holders

Annex B
(informative)

Information about nominal dimensions

A nominal dimension, nominal size or trade size is a size "in name only" used for identification(see Table B.1) . 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 B.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	25	g7	24,972	24,993	25,000
Square shank size h×b	32×25	h13	31,61×24,67	32×25	32×25

Bibliography

[1] ISO 5610 (all parts), *Tool holders with rectangular shank for indexable inserts*

[2] ISO 12164-1, *Hollow taper interface with flange contact surface — Part 1: Shanks — Dimensions*

[3] ISO 13399-1, *Cutting tool data representation and exchange — Part 1: Overview, fundamental principles and general information model*

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

[5] 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*

[6] ISO 26622-1, *Modular taper interface with ball track system — Part 1: Dimensions and designation of shanks*

[7] ISO 26623-1, *Polygonal taper interface with flange contact surface — Part 1: Dimensions and designation of shanks*

[8] ISO/TS 13399-70, *Cutting tool data representation and exchange — Part 70: Graphical data layout — Layer settings for tool designs*

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