TECHNICAL SPECIFICATION

ISO/TS 13399-305

First edition
2017-01

Cutting tool data representation and exchange —

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

Représentation et échange des données relatives aux outils coupants —

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

Reference number
ISO/TS 13399-305:2017(E)

Contents

Page

Foreword .... **vi**

Introduction .... **vii**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **2**

4 Starting elements, coordinate systems, planes **2**
4.1 General 2
4.2 Reference system 2
4.3 Mounting coordinate system 3
4.4 Coordinate system at the cutting part 4
4.5 Planes 5
4.6 Adjustment coordinate system on workpiece side 6
4.6.1 General 6
4.6.2 Designation of the coordinate system workpiece side 7
4.6.3 Arrangement of coordinate system workpiece side 8
4.7 Design of the pocket seat and cutting reference point (CRP) of the insert 9

5 Design of the model **13**
5.1 General 13
5.2 Necessary parameters for the connection interface feature 13
5.3 Necessary properties for insert and pocket seat 14
5.3.1 General 14
5.3.2 Properties for equilateral, equiangular and equilateral, non-equiangular inserts 14
5.3.3 Properties for non-equilateral, equiangular and non-equilateral, non-equiangular inserts 15
5.3.4 Properties for round inserts 15
5.3.5 Design of the pocket seat feature 16

6 Basic shapes for extension bridges, adjustment and assembly parts **16**
6.1 Monoblock extension bridges with adaptor 16
6.1.1 General 16
6.1.2 Necessary properties 16
6.1.3 Basic geometry 17
6.2 Bridge tool adapter 19
6.2.1 General 19
6.2.2 Necessary properties 19
6.2.3 Basic geometry 19
6.3 Bridge tool 20
6.3.1 General 20
6.3.2 Necessary properties 21
6.3.3 Basic geometry 21
6.4 Slide for adjustable units 22
6.4.1 General 22
6.4.2 Necessary properties 22
6.4.3 Basic geometry of slides for adjustable units 22
6.5 Slide element 23
6.5.1 General 23
6.5.2 Necessary properties 24
6.5.3 Basic geometry of slide elements 24
6.6 Balance weight 25
6.6.1 General 25
6.6.2 Necessary properties 26
6.6.3 Basic geometry of balance weights 26

7 Basic shapes for cartridges and insert holders 27
7.1 Adjustable unit 27
7.1.1 General 27
7.1.2 Necessary properties 28
7.1.3 Basic geometry of adjustable units 28
7.2 Boring head for adjustable units 29
7.2.1 General 29
7.2.2 Necessary properties 30
7.2.3 Basic geometry of boring heads for adjustable units 30

8 Basic shapes of rotating boring systems 31
8.1 General 31
8.2 Assembled single-point bridge tool 31
8.2.1 General 31
8.2.2 Necessary properties 32
8.2.3 Assembled model of single-point bridge tool 33
8.3 Assembled single-point bridge tool for reverse internal operations 35
8.3.1 General 35
8.3.2 Necessary properties 36
8.3.3 Assembled model of single-point bridge tool for reverse operations 36
8.4 Assembled multi-point bridge tool 37
8.4.1 General 37
8.4.2 Necessary properties 38
8.4.3 Assembled model of multi-point bridge tool 39
8.5 Assembled single-point bridge tool for external operations 40
8.5.1 General 40
8.5.2 Necessary properties 40
8.5.3 Assembled model of single-point bridge tool for external operations 41
8.6 Assembled multi-point bridge tool for external operations 42
8.6.1 General 42
8.6.2 Necessary properties 43
8.6.3 Assembled model of a multi-point bridge tool for external operations 43
8.7 Single-point bridge tool for axial grooving 44
8.7.1 General 44
8.7.2 Necessary properties 45
8.7.3 Assembled model of single-point bridge tool for axial grooving 46
8.8 Assembled multi-point bridge tool for axial grooving 47
8.8.1 General 47
8.8.2 Necessary properties 47
8.8.3 Assembled model of multi-point bridge tool for axial grooving 47
8.9 Boring head 48
8.9.1 General 48
8.9.2 Necessary properties 49
8.9.3 Assembled model of boring head 49
8.10 Fine boring head with boring bar 50
8.10.1 General 50
8.10.2 Necessary properties 50
8.10.3 Assembled model of fine boring head with boring bar 51
8.11 Boring head with adjustable unit 52
8.11.1 General 52
8.11.2 Necessary properties 52
8.11.3 Assembled model of boring head with adjustable unit 53

9 Design of details 54
9.1 Basis for modelling 54
9.2 Fixing threads for inserts 54
9.3 Contact/clamping surfaces — Orientation 54
9.4 Chamfers and roundings 54

10 Attributes of surfaces — Visualization of model features 55

11 Data exchange model 55
Annex A (informative) **Information about nominal dimensions** 67
Annex B (informative) **STP structure** 68
Bibliography 73

Foreword

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

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

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

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

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

Introduction

This document defines the concept, the terms and the definitions of how to design simplified 3D models of modular tooling systems with adjustable cartridges for boring that can be used for NC-programming, simulation of the manufacturing processes and the determination of collision within machining processes. It is not intended to standardize the design of the cutting tool itself.

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

The objective of ISO 13399 series is to provide the means to represent the information that describes cutting tools in a computer sensible form that is independent from any particular computer system. The representation will facilitate the processing and exchange of cutting tool data within and between different software systems and computer platforms and support the application of this data in manufacturing planning, cutting operations and the supply of tools. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and for archiving. The methods that are used for these representations are those developed by ISO/TC 184/SC 4 for the representation of product data by using standardized information models and reference dictionaries.

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

Cutting tool data representation and exchange —

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

1 Scope

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

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

— definitions and identifications of the design features of modular tooling systems with adjustable cartridges for boring, with an association to the used properties;

— definitions and identifications of the internal structure of the 3D model that represents the features and the properties of modular tooling systems with adjustable cartridges for boring.

The following are outside the scope of this document:

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

b) concept of 3D models for cutting tools;

c) concept of 3D models for cutting items;

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

e) concept of 3D models for adaptive items;

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Starting elements, coordinate systems, planes

4.1 General

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

WARNING — There is no guarantee that the 3D model, created according to the methods described in this document, is a true representation of the physical tool supplied by the tool manufacturer. If the models are used for simulation purposes, e.g. CAM simulation, it shall be taken into consideration that the real product dimensions can differ from those nominal dimensions.

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

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

4.2 Reference system

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

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

— **three orthogonal planes**: planes in the coordinate system that contain the axis of the system, named “XY-plane” (XYP), “XZ-plane” (XZP) and “YZ-plane” (YZP);

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

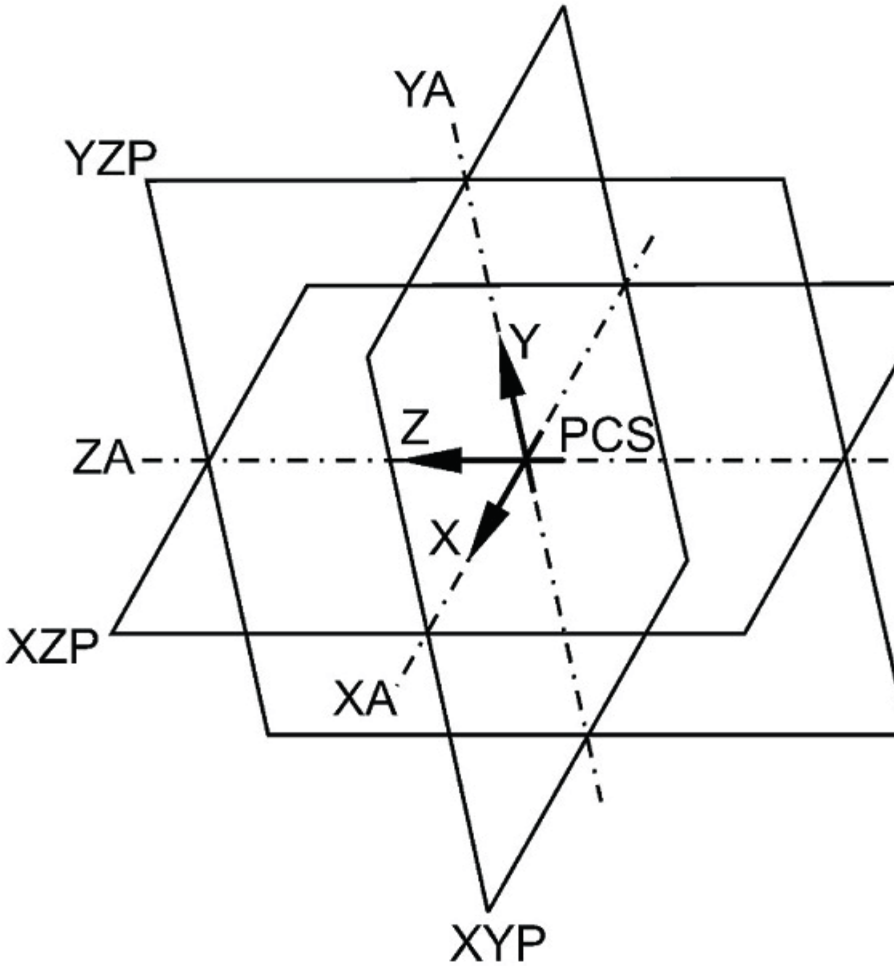


Figure 1 — Primary coordinate system

4.3 Mounting coordinate system

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

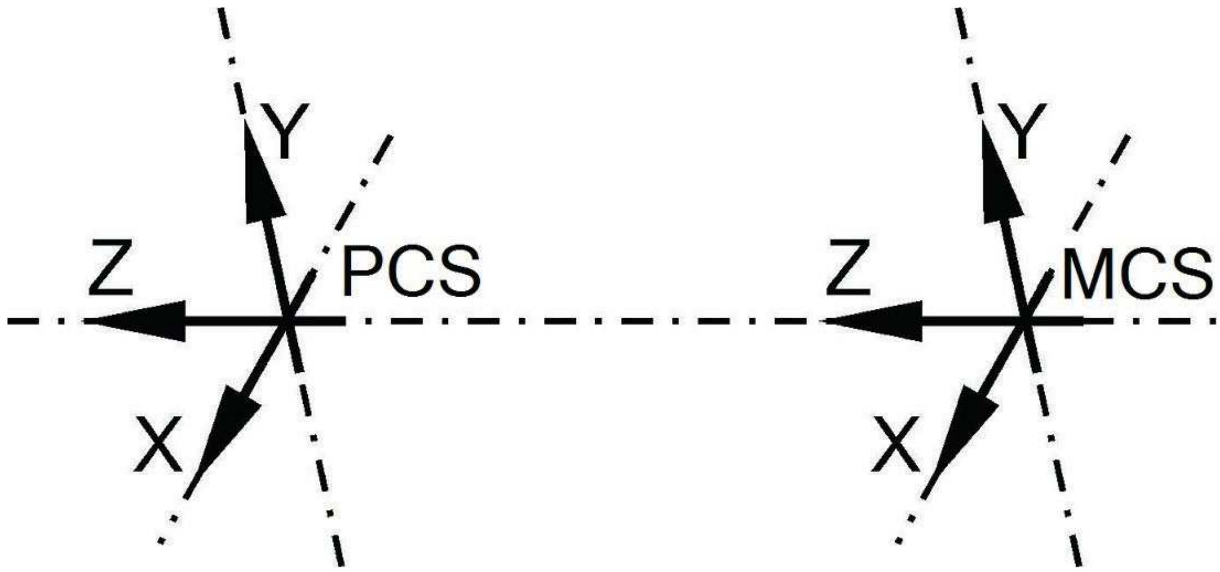


Figure 2 — Orientation of MCS

4.4 Coordinate system at the cutting part

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

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

— Z-axis of CIP points to the PCS;

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

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

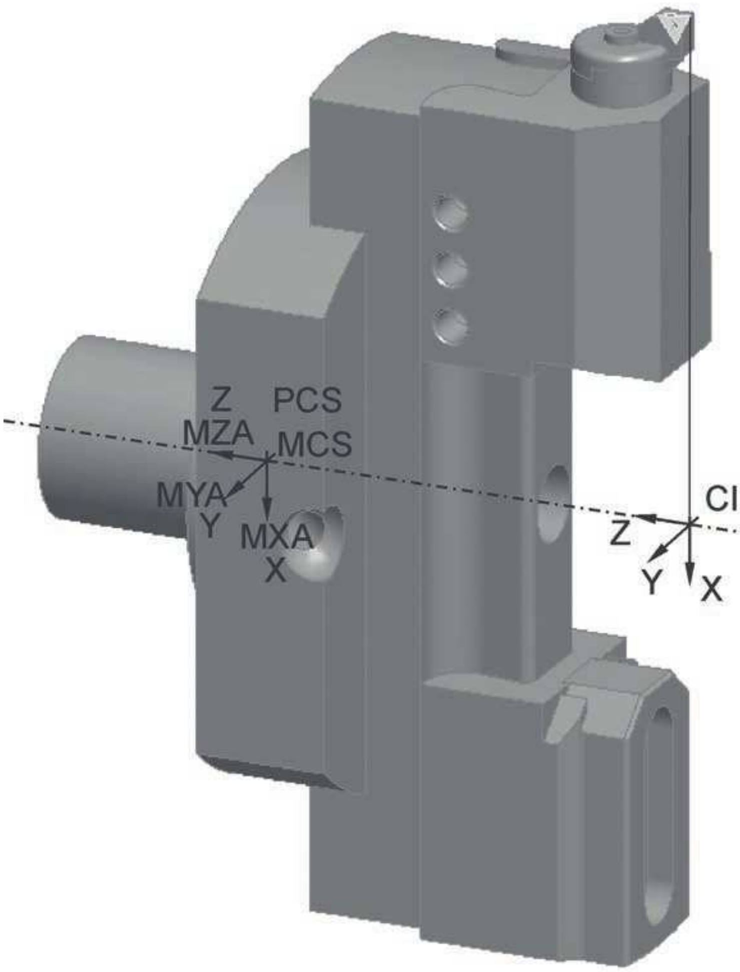


Figure 3 — Orientation of CIP

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

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

4.5 Planes

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

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

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

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

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

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

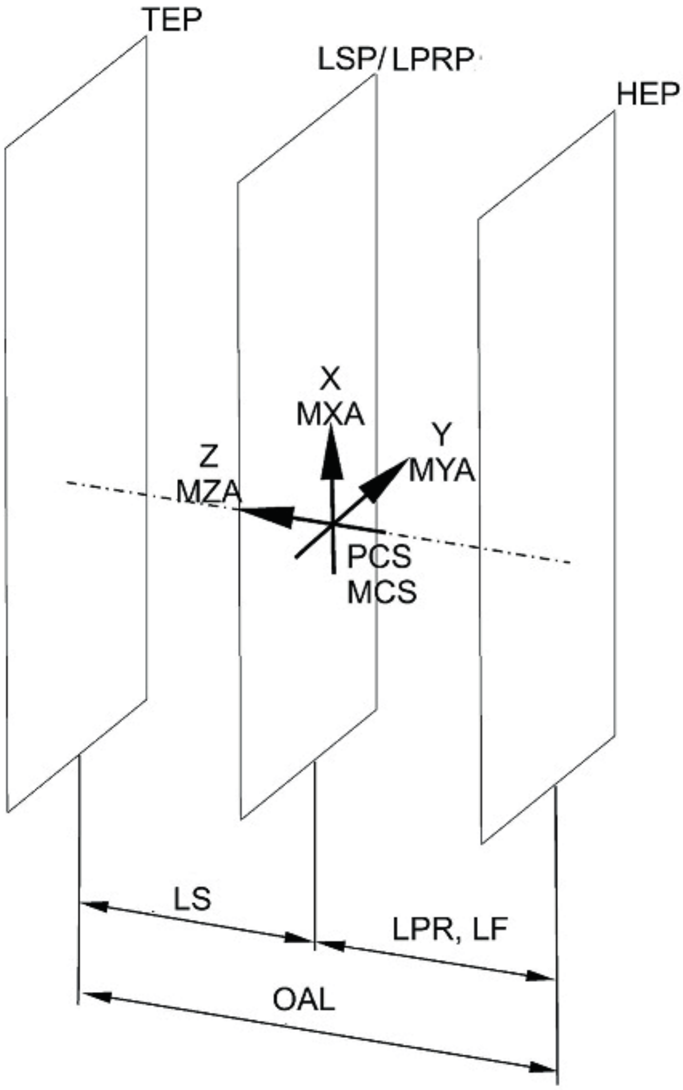


Figure 4 — Planes for design

4.6 Adjustment coordinate system on workpiece side

4.6.1 General

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

4.6.2 Designation of the coordinate system workpiece side

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

Case 2 One coordinate system at workpiece side on different levels shall be designated as "CSWx", e.g. "CSW1", "CSW2". The numbering shall start at the workpiece side and end at the machine side in the direction of the positive Z-axis.

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

Case 4 Multiple coordinate systems at one level, one angle and different diameters shall be designated as described in case 3. The counting shall start at the smallest diameter.

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

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

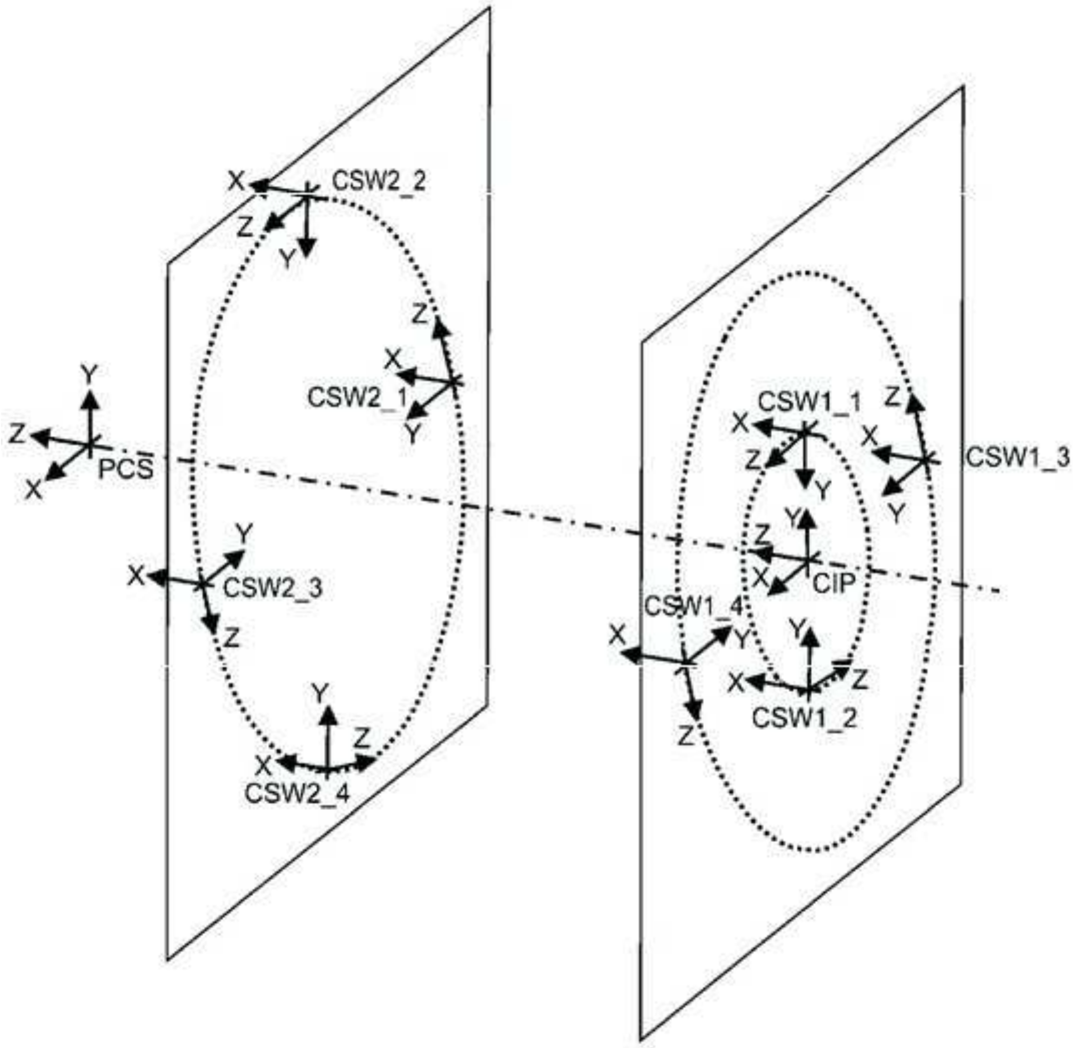


Figure 5 — Example of adjustment coordinate system on workpiece side

4.6.3 Arrangement of coordinate system workpiece side

The CSWx_y can be arranged in relation to the PCS by means of using the six degrees of freedom.

a) Rotation about:

1) the X-axis by the angle rho ("RHO");

2) the Y-axis by the angle kappa ("KAP");

3) the Z-axis by the angle phi ("PHI").

b) Distance from the PCS origin perpendicular to:

1) XYW-plane by XYWD;

2) XZW-plane by XZWD;

3) YZW-plane by YZWD.

The orientation and location of CSW are shown in Figure 6.

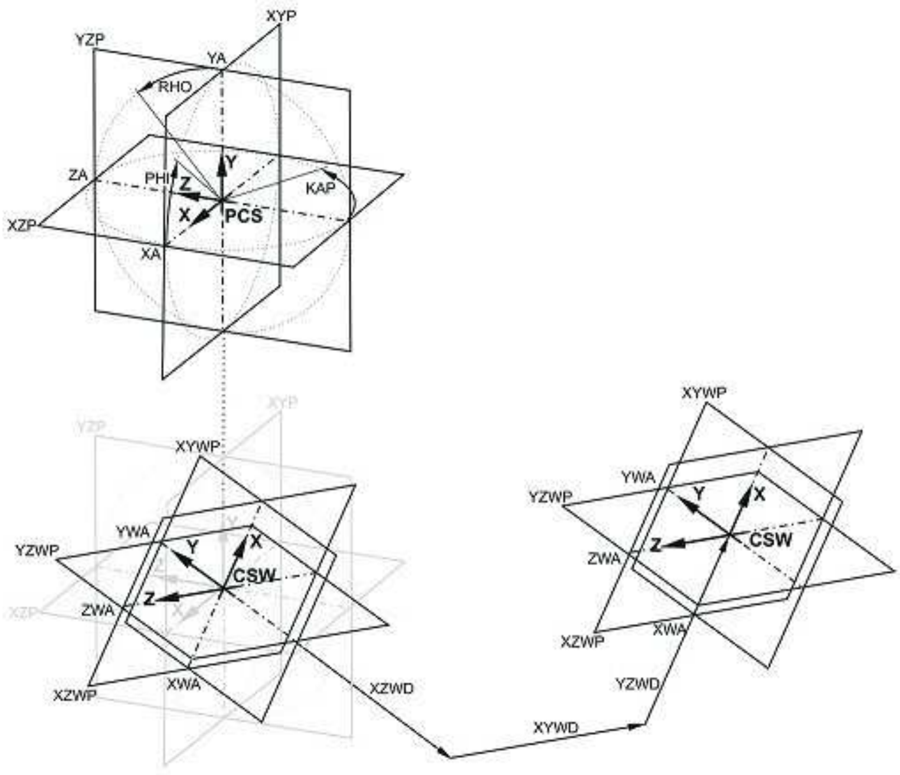


Figure 6 — Orientation of coordinate system at workpiece side

Figure 7 shows an example of the location of the different coordinate systems.

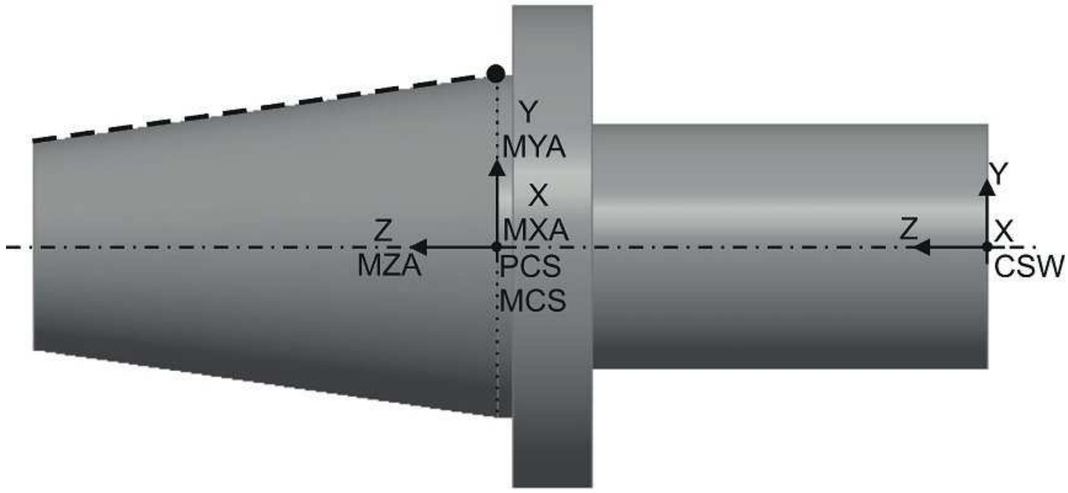


Figure 7 — Example of the position of PCS, MCS and CSW

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

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

MCS-coordinate system of the insert (MCS_INSERT) and the PCS-coordinate system of the insert (PCS_INSERT) are oriented differently to the primary coordinate system of the tool (PCS_TOOL). The orientation is shown in Figure 8.

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

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

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

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

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

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

— the Y-axis of PCS_INSERT collinear to the Z-axis of PCS_TOOL;

— the Z-axis of PCS_INSERT collinear to the Y-axis of PCS_TOOL.

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

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

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

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

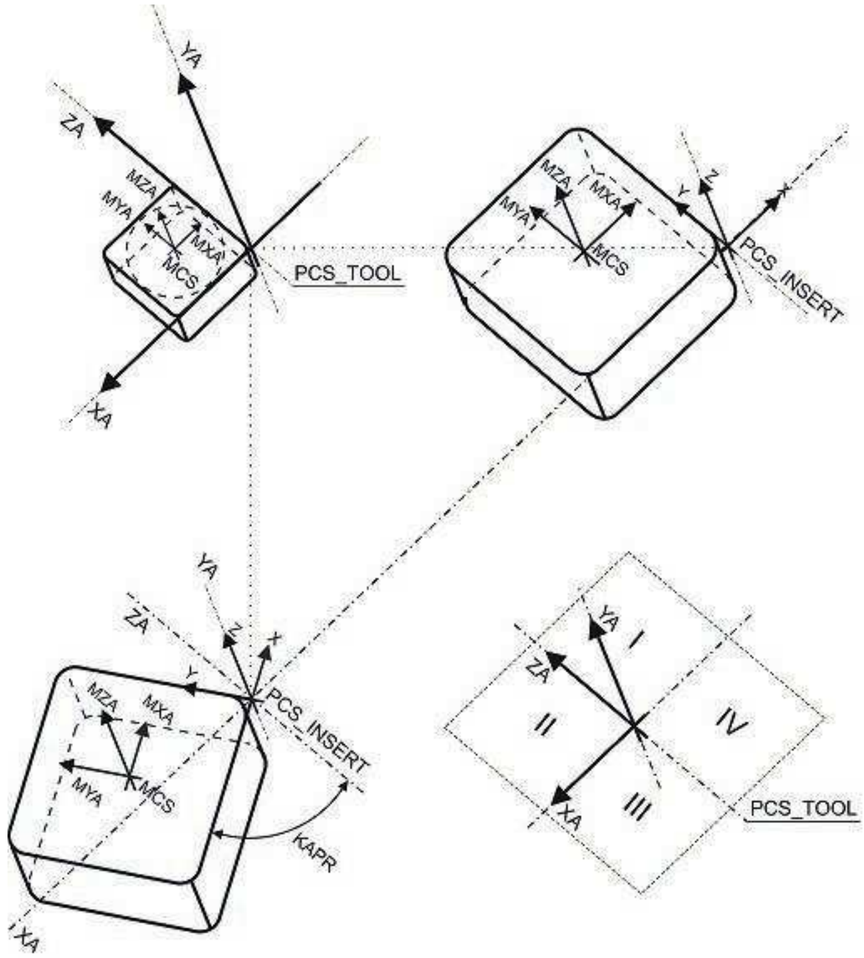


Figure 8 — Orientation of PCS_INSERT, MCS_INSERT and PCS_TOOL on end cutting edge angle

b) The cutting reference point "CRP" is the point where the functional dimensions are based. The definition of the CRP is given in ISO/TS 13399-50. The coordinate system of CRP (CS_CRP) shall be defined as follows:

— the X-axis of CS_CRP collinear to the X-axis of PCS_INSERT;

— the Y-axis of CS_CRP parallel to the Y-axis of PCS_INSERT;

— the Z-axis of CS_CRP parallel to the Z-axis of PCS_INSERT.

c) If the tool is defined with an orthogonal rake angle and an inclination angle that are unequal to 0° as shown in Figure 9, the insert shall be rotated about its CRP.

— To define the orthogonal rake angle (GAMO) on the tool, the pocket seat shall be rotated about the X-axis of C_CRP. If GAMO is smaller than 0° (zero degree), the rotation shall be done in mathematic positive direction. If GAMO is greater than 0° (zero degree), the rotation shall be done in mathematic negative direction.

— To define the inclination angle (LAMS) on the tool, the pocket seat shall be rotated about the Y-axis of C_CRP. If LAMS is smaller than 0° (zero degree), the rotation shall be done in mathematic positive direction. If LAMS is greater than 0° (zero degree), the rotation shall be done in mathematic negative direction.

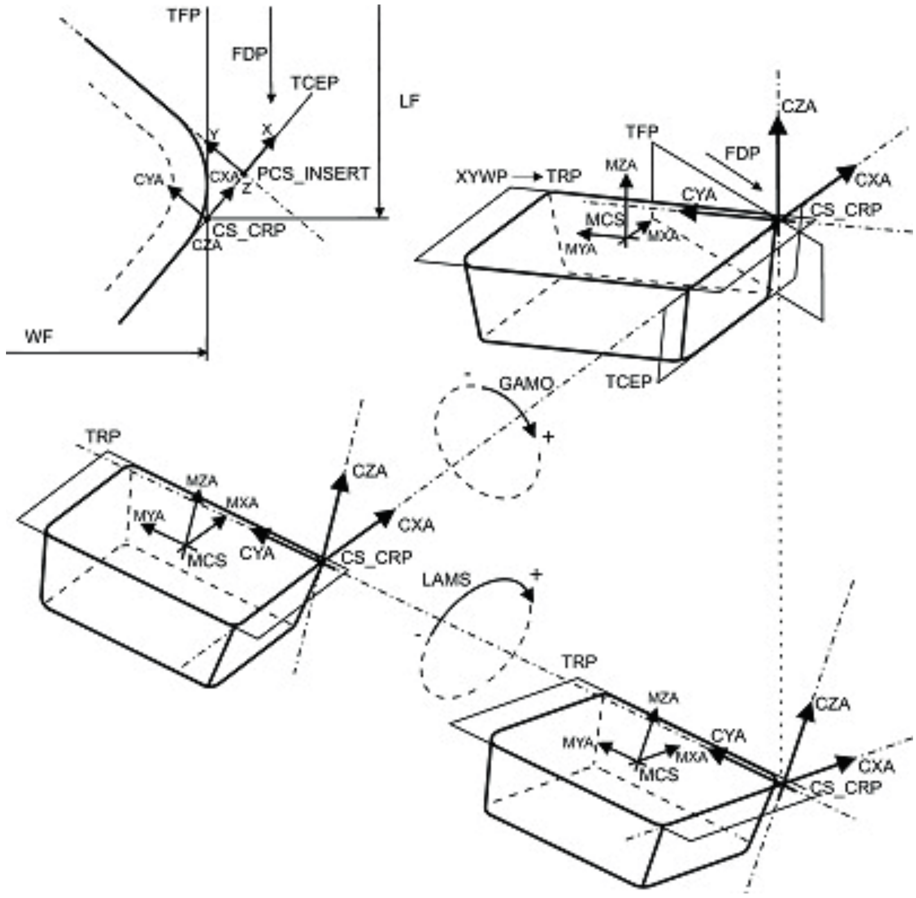


Figure 9 — Orthogonal angle and inclination angle on insert

d) Design with side cutting edge angle on a right-handed tool.

— Only those inserts located in the first quadrant of the primary coordinate system of the insert, also called "right-handed" or "neutral" inserts, shall be used.

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

— The cutting reference point "CRP" shall be the point where the functional dimensions are based.

— Definition of the coordinate system of CRP (see above).

— Orientation of GAMO and LAMS (see Figure 10).

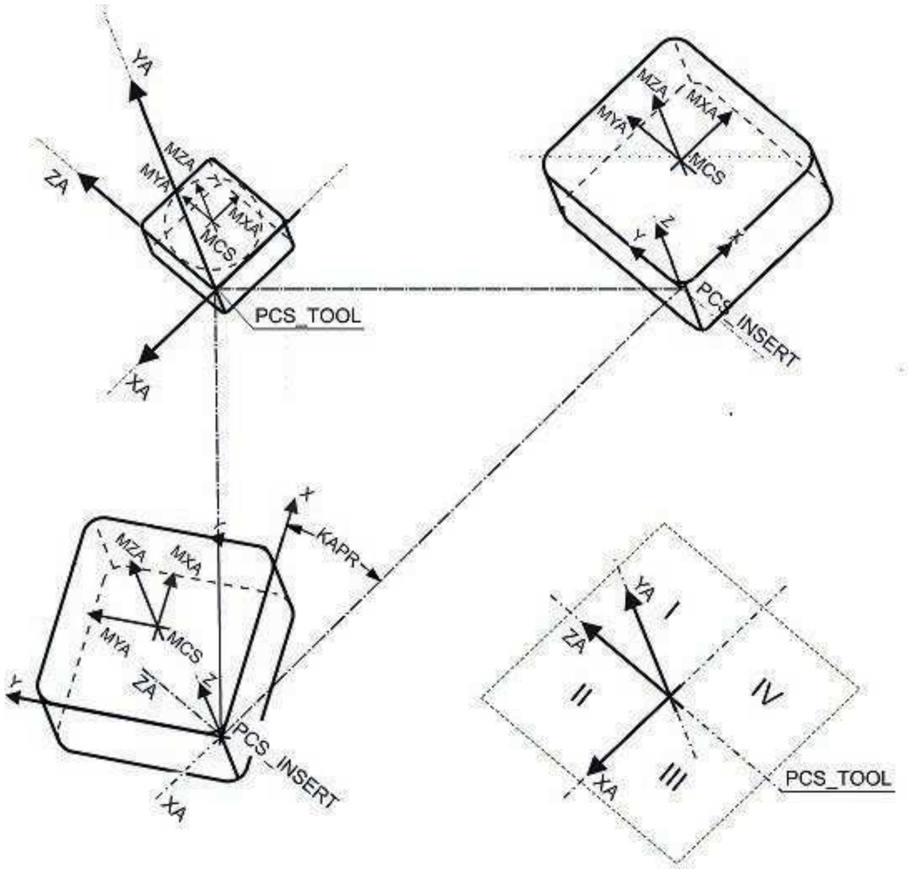


Figure 10 — Orientation of PCS_INSERT, MCS_INSERT and PCS_TOOL on side cutting edge angle

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

— The X-axis of MCS_INSERT is collinear to the X-axis of CSWx_y.

— The Y-axis of MCS_INSERT is collinear to the Y-axis of CSWx_y.

— The Z-axis of MCS_INSERT is collinear to the Z-axis of CSWx_y.

Figure 11 illustrates an example of mounting insert on pocket seat.

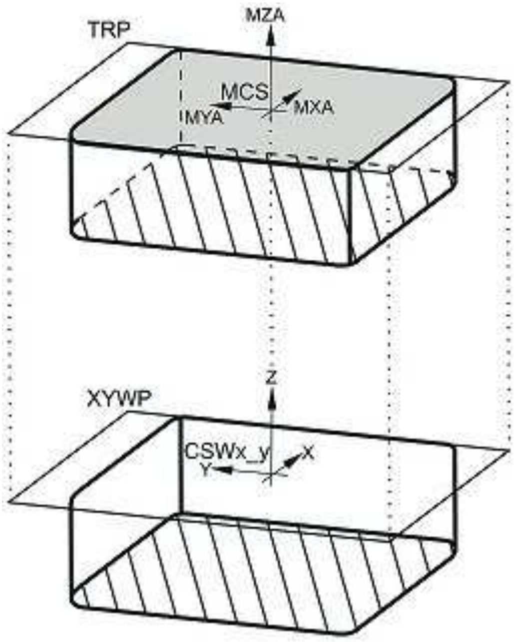


Figure 11 — Mounting of insert on pocket seat

5 Design of the model

5.1 General

The sketches and features of the crude model may not contain details like slots, chamfers, rounding and grooves. Those features shall be designed as separate design elements after the crude geometry and shall be grouped as detail geometry. Based on the non-cutting features (group "NOCUT"), the cutting features shall be loaded as assembly parts (group "CUT") into the basic model.

Inserts shall be incorporated into the assembly as independent components. The reference to the adjustment coordinate systems shall be used for the mounting.

The examples of the basic shapes of adaptive items of the modular systems shall be designed with cylindrical shank and positioned on to the PCS.

All examples shall be designed with 0° orthogonal rake angle and 0° inclination angle.

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

The specific model structure of the different shapes and components of modular tooling systems with adjustable cartridges for boring shall be described in the next clauses of this document.

5.2 Necessary parameters for the connection interface feature

Information about the connection interface code shall be filed as properties within the model and 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
CCWS	Connection code workpiece side	ISO/TS 13399-3 and ISO/TS 13399-4	71D102AE8A5A9
CCTWS	Connection code type workpiece side	ISO/TS 13399-60 short name of subtype of connection_interface_feature	feature_class
CCFWS	Connection code form workpiece side	ISO/TS 13399-60 number of the variant of the subtype of connection_interface_feature	feature_class
CZCWS	Connection size code workpiece side	connection size code (dependent of side)	71FC193318002

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

5.3 Necessary properties for insert and pocket seat

5.3.1 General

Necessary properties for the design of the pocket seat features shall be taken in accordance with the defined properties for cutting items (see ISO/TS 13399-2). To be able to differentiate between tool-item and cutting-item properties, a postfix shall be added to the preferred symbols of the cutting-item properties. The postfix shall have the same code and sequence as the different coordinate axis systems on workpiece side that are defined in 4.6.

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

Equilateral and equiangular inserts are as follows:

— H: hexagonal insert;

— O: octogonal insert;

— P: pentagonal insert;

— S: square insert;

— T: triangular insert.

Equilateral and non-equiangular inserts are as follows:

a) C, D, E, M, V: rhombic insert;

b) W: trigon insert.

Table 2 lists the properties needed for equilateral, equiangular and equilateral non-equiangular seats.

Table 2 — Properties for modelling equilateral, equiangular and equilateral, non-equiangular 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] To be calculated. It is dependent on IC and EPSR.

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

Inserts are designated as follows:

— non-equilateral and equiangular inserts designated as: L — rectangular insert;

— non-equilateral and non-equiangular inserts designated as: A, B, K — parallelogram-shaped insert.

Table 3 lists the properties needed for non-equilateral, equiangular and non-equilateral non-equiangular seats.

Table 3 — 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] To be calculated. It is dependent on INSL and EPSR.

5.3.4 Properties for round inserts

Round inserts are designated as: R — round insert.

Table 4 lists the properties needed for round seats.

Table 4 — Properties for modelling round pocket seats

Preferred name	Preferred symbol
Clearance angle major	AN
Inscribed circle diameter	IC
Insert thickness	S

5.3.5 Design of the pocket seat feature

The design shall be done according to ISO/TS 13399-201 for regular inserts or according to ISO/TS 13399-202 for irregular inserts, but without any corner configuration on the opposite side where the functional dimensions are based.

6 Basic shapes for extension bridges, adjustment and assembly parts

6.1 Monoblock extension bridges with adaptor

6.1.1 General

Figure 12 shows the properties used for identification and classification of monoblock extension bridges with adaptor. The example shows a bridge with cylindrical shank.

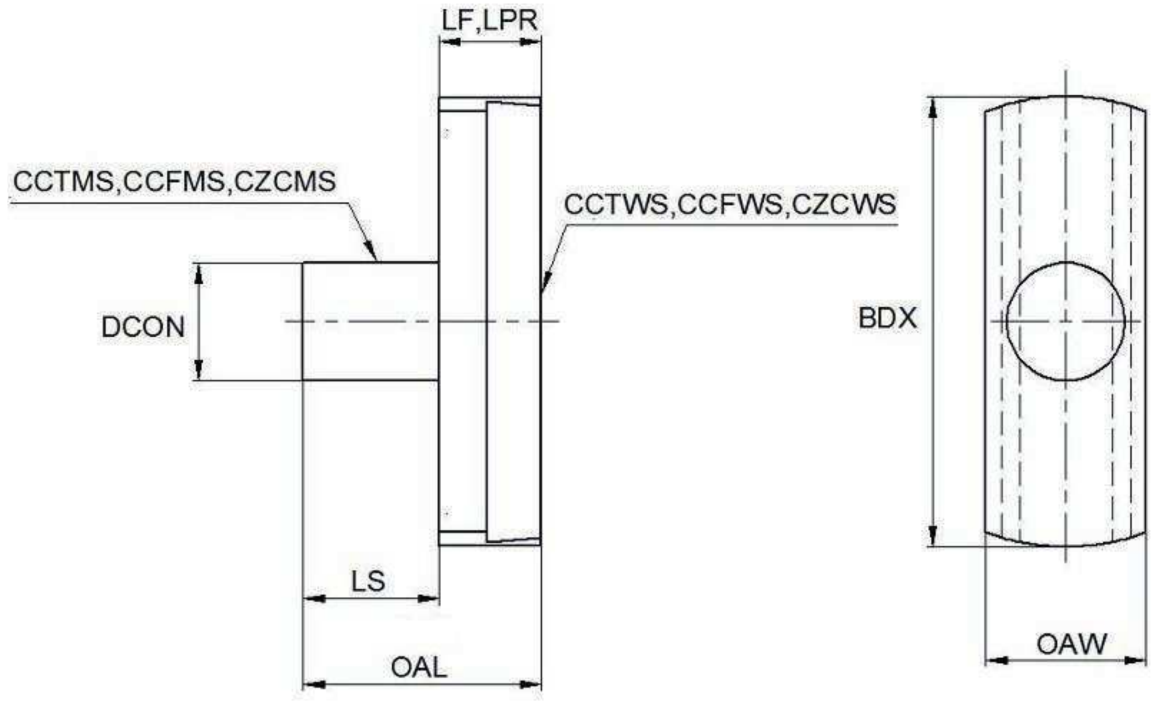


Figure 12 — Determination of properties for monoblock extension bridges with adaptor

6.1.2 Necessary properties

A bloc is as follows.

Table 5 lists the properties needed for a monoblock extension bridge with adaptor.

Table 5 — Properties for the modelling of a monoblock extension bridge with adaptor

Preferred name	Preferred symbol
Body diameter maximum	BDX
Connection diameter	DCON
Functional length	LF
Protruding length	LPR
Shank length	LS
Overall length	OAL
Overall width	OAW

6.1.3 Basic geometry

The basic of that part is a rotational design feature which contains all elements between the plane "TEP" and the plane "HEP" to the part.

The sketch (outline contour) includes all the real measure elements of Table 5 and shall be designed on the XZ plane of the "PCS". The rotational axis is the standard Z-axis.

The design of the sketch shall be done 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 "HEP" according to Figure 13. If the CAD software does not support the use of datum planes, the sketch shall be fully dimensioned. Otherwise, the distances shall be in conjunction with the defined datum planes.

— The dimensioning shall be done with the appropriate properties listed in Table 1.

— The sketch shall be revolved about the Z-axis by 360°.

— The examples show the dovetail connection designed as an extruded solid feature, which is based on the YZ-plane, extruded in direction of X-axis and then subtracted from the basic body.

Adjustment coordinate systems at workpiece side (CSWx_y) shall be done as follows.

a) For the assembly of the components on the workpiece side, the adjustment coordinate systems CSWx_y shall be used.

b) The example shows the maximum and minimum positions of the CSW. In between these two extremes, the components shall have any possible location. To address the location of the CSWs, two temporary dimensions that define the extreme dimensions from the centre line of the extension bridge based on the maximum and minimum cutting diameter are determined.

Figure 13 shows the monoblock extension bridges with adaptor and Figure 14 shows the determination of the temporary properties for the design of the dovetail connection.

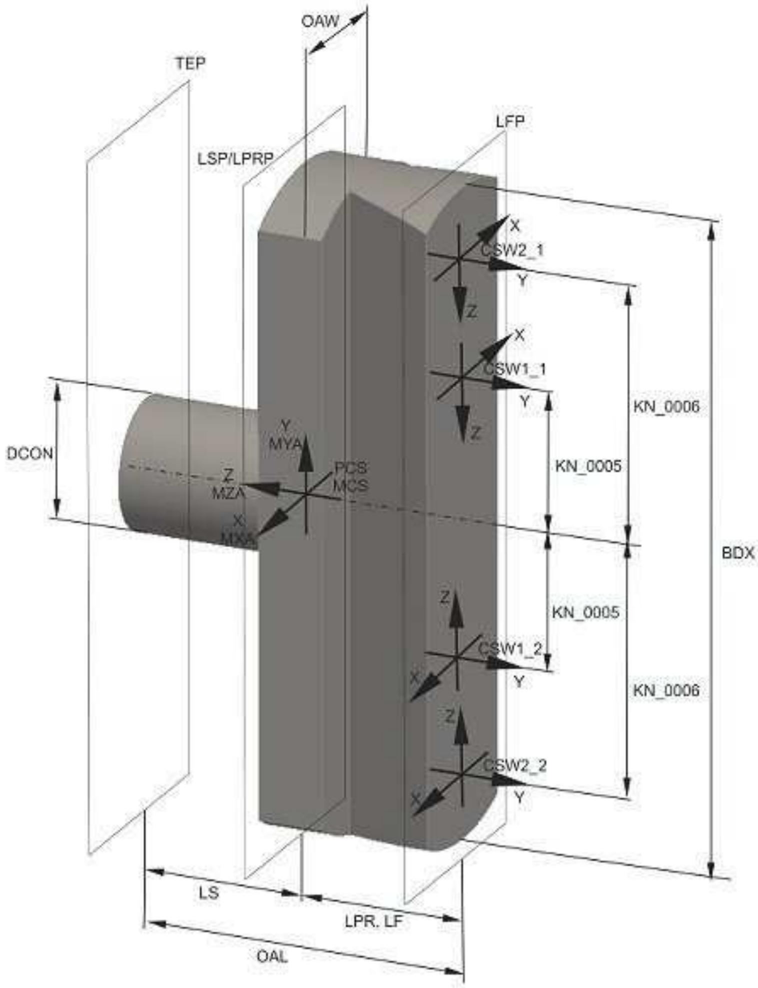


Figure 13 — 3D model of a monoblock extension bridge with adaptor

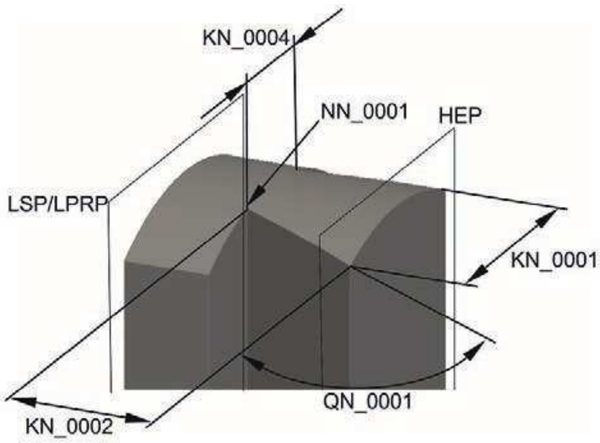


Figure 14 — Determination of properties for the design of the dovetail connection

6.2 Bridge tool adapter

6.2.1 General

Figure 15 shows the properties used for identification and classification of bridge tool adaptors. The example shows a bridge tool adaptor with cylindrical shank.

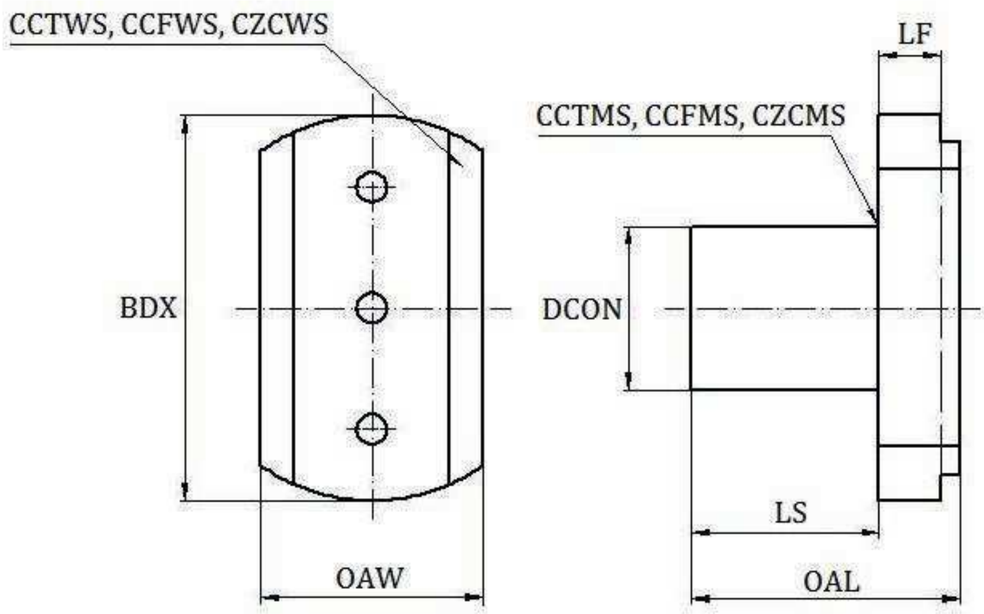


Figure 15 — Determination of properties for bridge tool adaptors

6.2.2 Necessary properties

See Table 5 for necessary properties.

6.2.3 Basic geometry

The structure of the model is described in 6.1.3 and is in accordance with Figure 16.

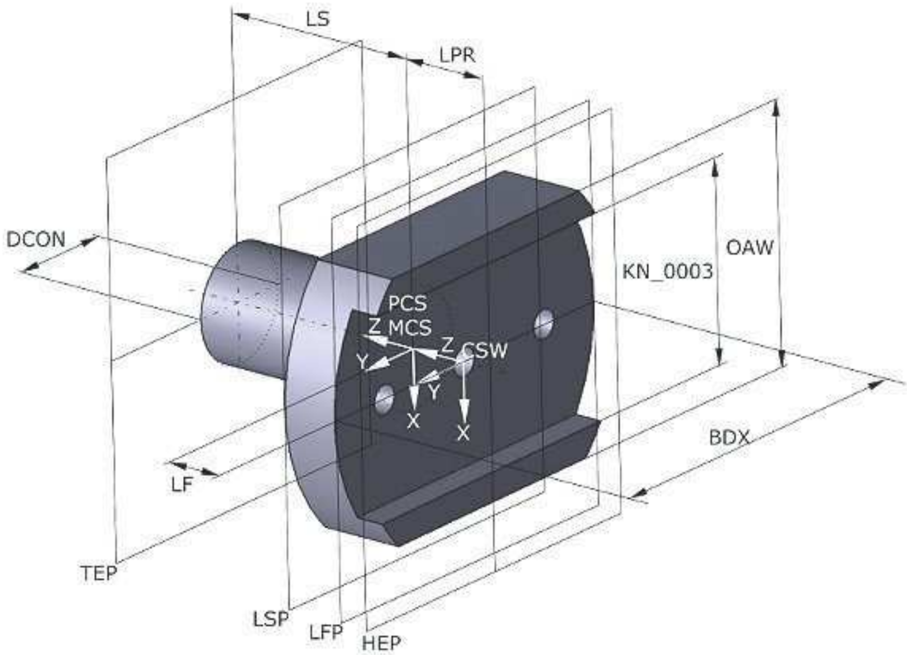


Figure 16 — 3D model of a bridge tool adaptor

6.3 Bridge tool

6.3.1 General

Figure 17 shows the properties used for identification and classification of bridge tool. The example shows a bridge tool adaptor with dovetail connection.

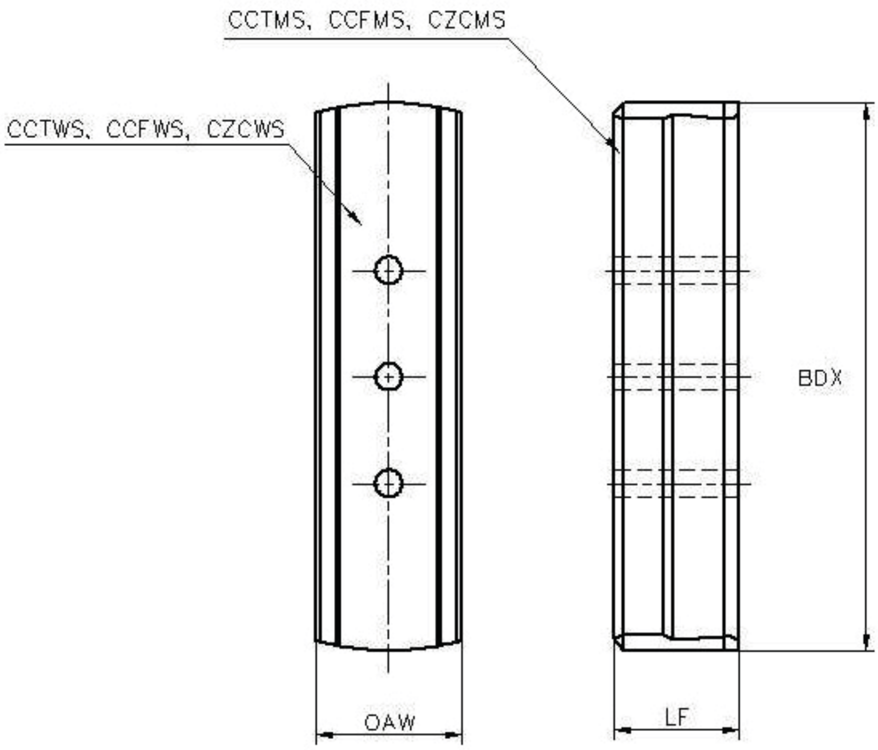


Figure 17 — Determination of properties for a bridge tool

6.3.2 Necessary properties

Table 6 lists the properties needed for a bridge tool.

Table 6 — Properties for the modelling of a bridge tool

Preferred name	Preferred symbol
Body diameter maximum	BDX
Functional length	LF
Protruding length	LPR
Overall width	OAW

In the case of bridge tools, the protruding length is equal the functional length.

6.3.3 Basic geometry

The structure of the model is described in 6.1.3 and in accordance with Figure 18.

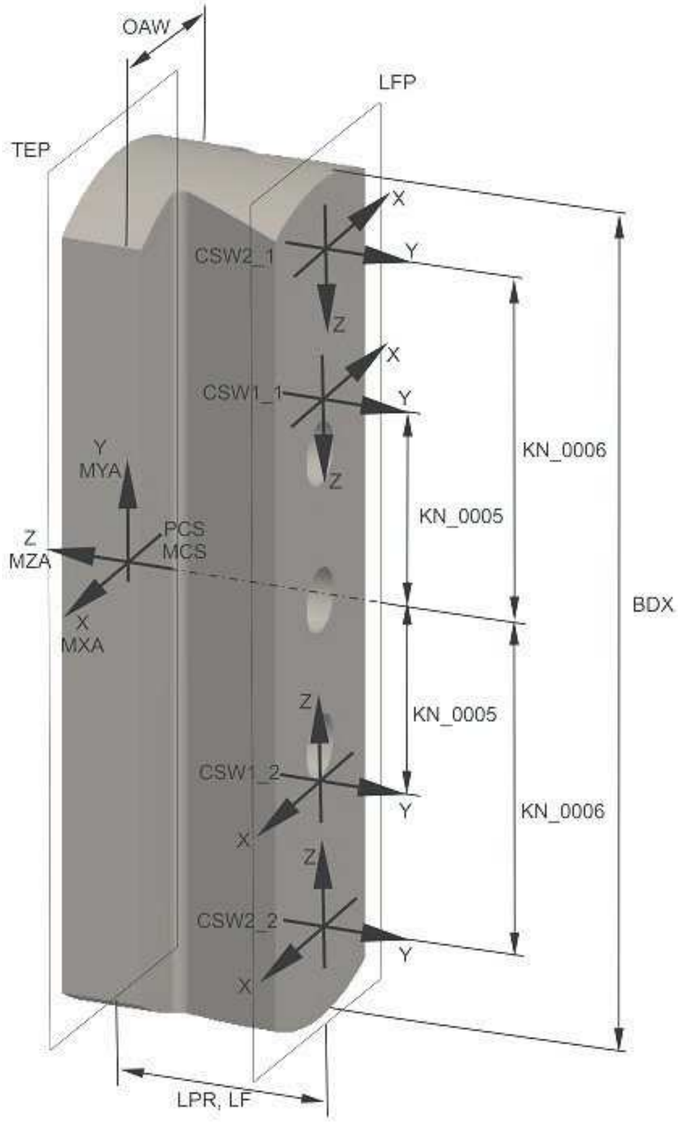


Figure 18 — 3D model of a bridge tool

For the determination of properties for the design of the dovetail connection, see Figure 14.

6.4 Slide for adjustable units

6.4.1 General

Figure 19 shows the properties used for identification and classification of slides for adjustable units. The example shows a slide with dovetail connection.

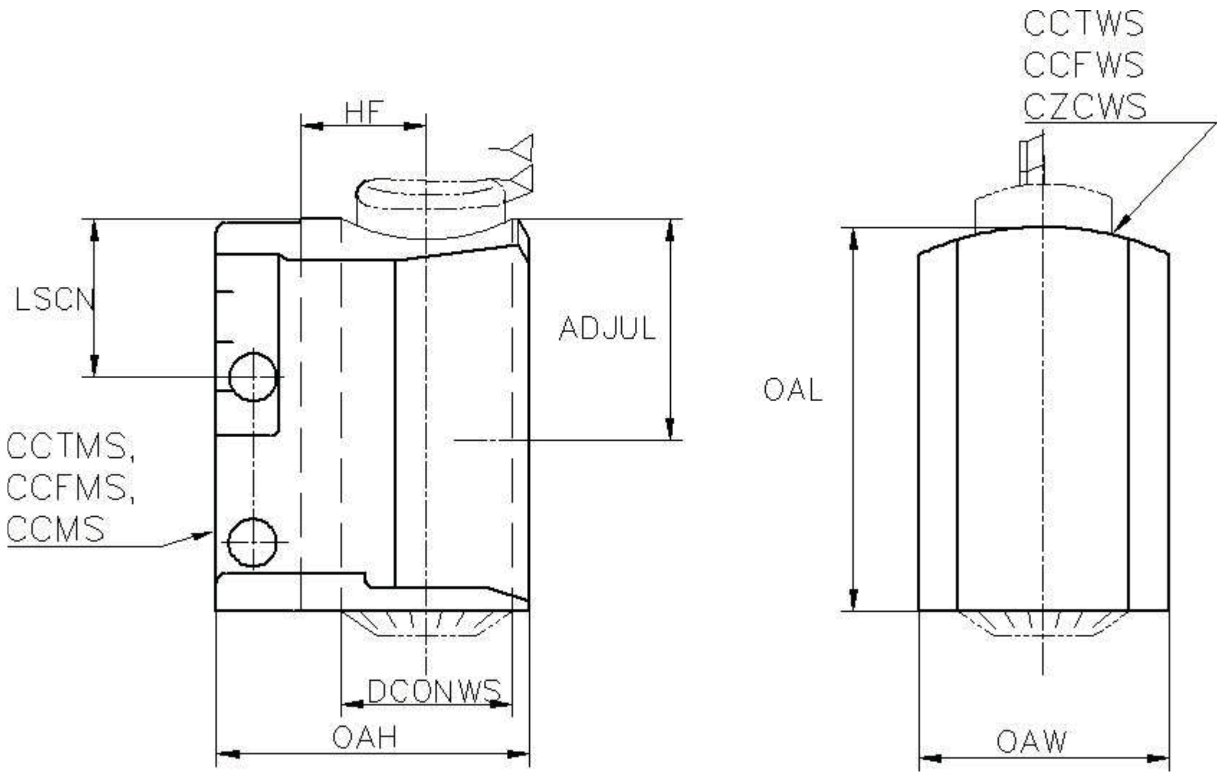


Figure 19 — Determination of properties for the slide for adjustable units

6.4.2 Necessary properties

Table 7 lists the properties needed for a slide for an adjustable unit.

Table 7 — Properties for modelling of a slide for adjustable units

Preferred name	Preferred symbol
Adjustable unit assembly length	ADJUL
Connection diameter workpiece side	DCONWS
Functional height	HF
Clamping length	LSCN
Overall height	OAH
Overall length	OAL
Overall width	OAW

6.4.3 Basic geometry of slides for adjustable units

The basis of that part is an extruded design feature which contains all elements between the plane "TEP" and the plane HEP.

The sketch includes all the real measure elements defined in Table 7 and shall be designed on the XY plane of the PCS. The extrusion shall be done parallel to the negative Z-axis.

The design of the sketch shall be as follows.

— The sketch shall be determined as a cross section.

— The sketch shall be constrained to the coordinate system “PCS” and to the planes “TEP” and “HEP” according to Figure 20. If the CAD software does not support the use of datum planes, the sketch shall be fully dimensioned. Otherwise, the distances shall be in conjunction with the defined datum planes.

— The dimensioning shall be done with the appropriate properties listed in Table 7.

— The sketch shall be extruded along the negative Z-axis.

— The examples shows the dovetail connection designed as an extruded solid feature, based on the YZ-plane, extruded in direction of X-axis and then subtracted from the basic body.

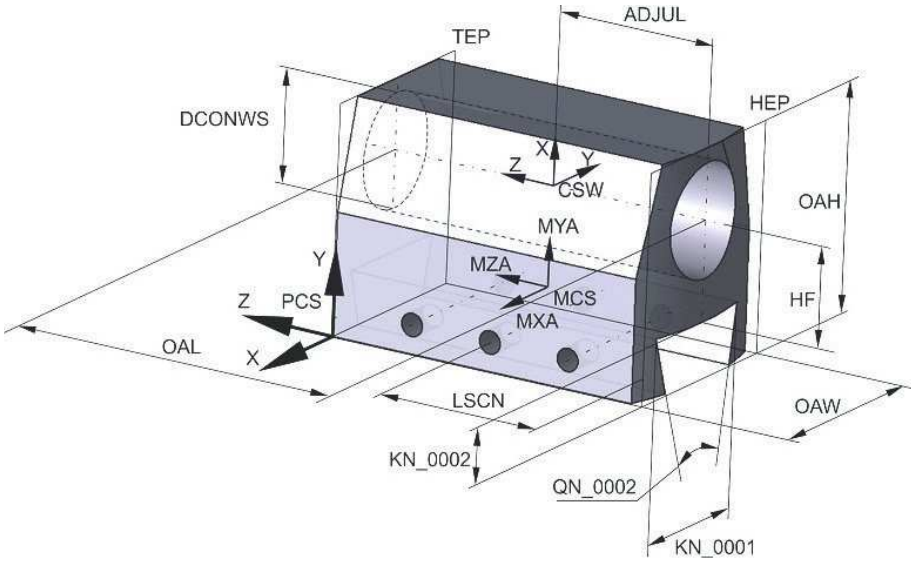


Figure 20 — 3D model of slide for adjustable unit

The slide for adjustable units shall be used for external machining operations as well. In this case, the mounting coordinate system shall be turned by 180° about its Z-axis.

6.5 Slide element

6.5.1 General

Figure 21 shows the properties used for identification and classification of slides for adjustable units. The example shows a slide with dovetail connection.

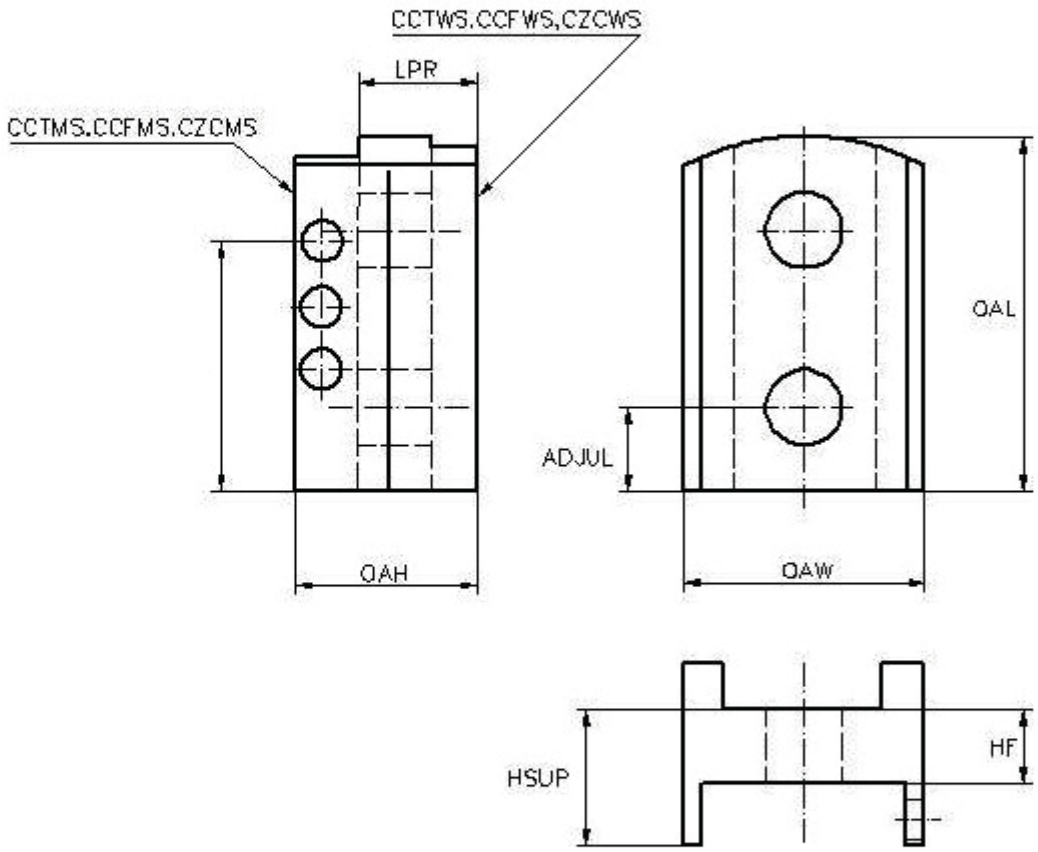


Figure 21 — Determination of properties for the slide element

6.5.2 Necessary properties

Table 8 lists the properties needed for a slide element.

Table 8 — Properties for the modelling of a slide element

Preferred name	Preferred symbol
Adjustable unit assembly length	ADJUL
Support height	HSUP
Functional height	HF
Protruding length	LPR
Overall height	OAH
Overall length	OAL
Overall width	OAW

6.5.3 Basic geometry of slide elements

The structure of the model is described in 6.4.3 and is in accordance with Figure 22.

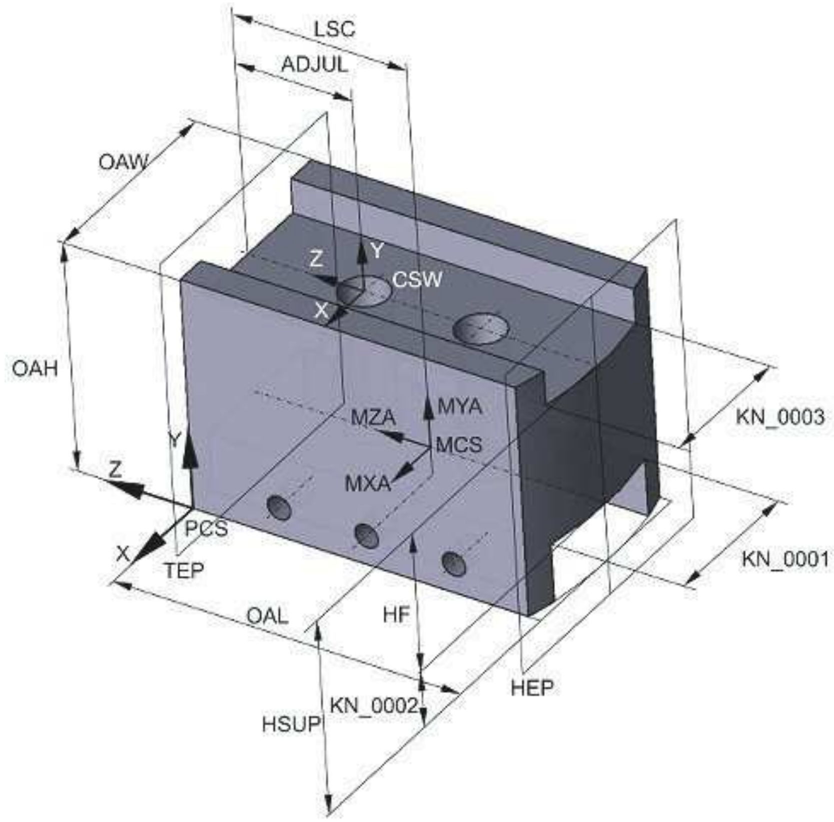


Figure 22 — 3D model of a slide element

6.6 Balance weight

6.6.1 General

Figure 23 shows the properties used for identification and classification of balance weight with rectangular connection.

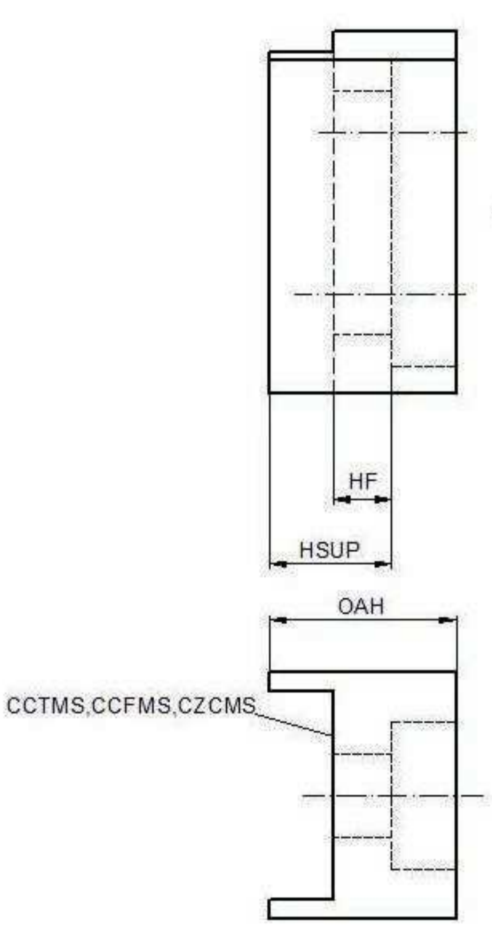


Figure 23 — Determination of properties for balance weight

6.6.2 Necessary properties

See Table 8 for necessary properties.

6.6.3 Basic geometry of balance weights

The structure of the model is described in 6.4.3 and is in accordance with Figure 24. The balance weight shall not have any coordinate system workpiece side.

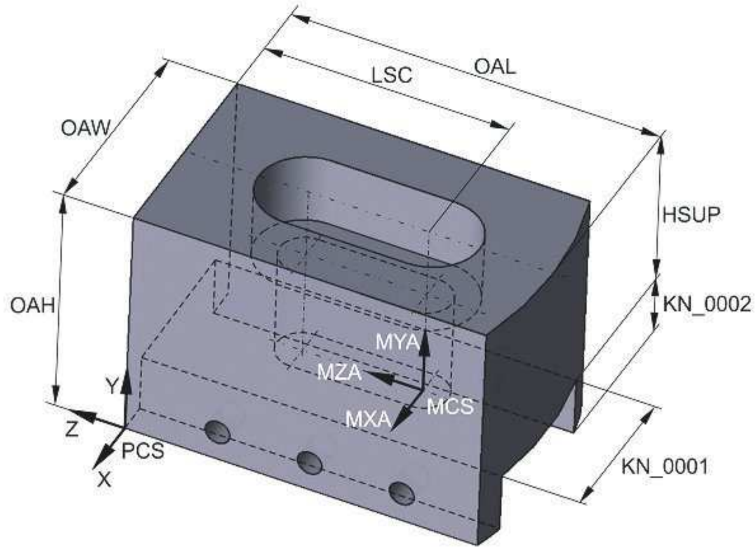


Figure 24 — 3D model of a balance weight

7 Basic shapes for cartridges and insert holders

7.1 Adjustable unit

7.1.1 General

Figure 25 shows the properties used for identification and classification of adjustable units. The example shows an adjustable unit without any mounted components because of the universal application of these adjustable units.

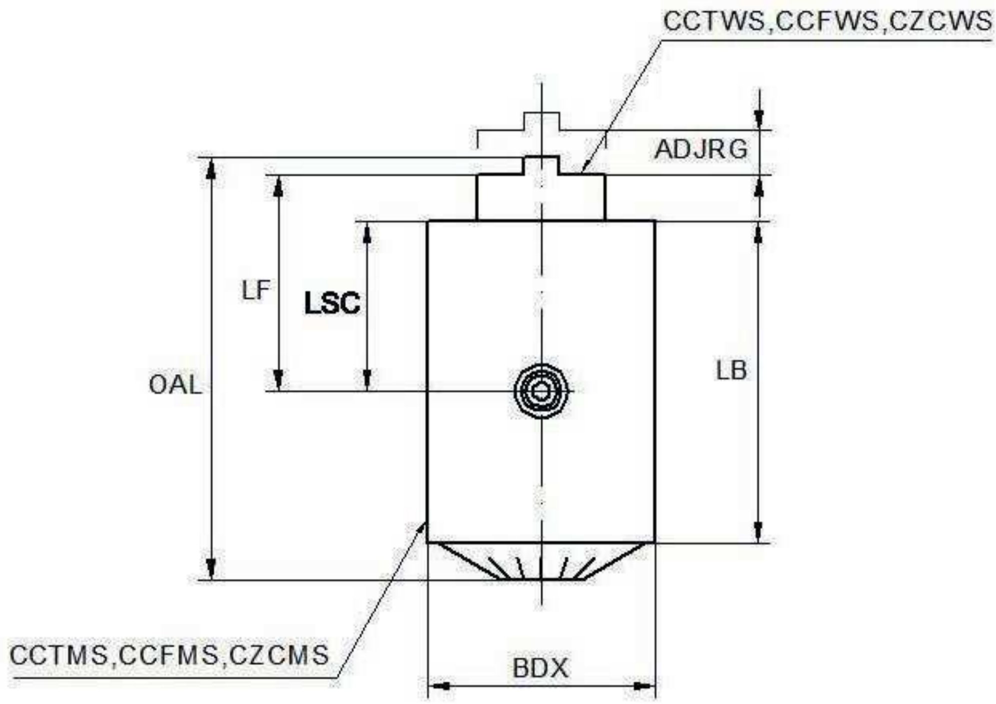


Figure 25 — Determination of properties for adjustable units

7.1.2 Necessary properties

Table 9 lists the properties needed for an adjustable unit.

Table 9 — Properties for the modelling of an adjustable unit

Preferred name	Preferred symbol
Adjustment range	ADJRG
Body diameter, maximum	BDX
Body length	LB
Functional length	LF
Clamping length	LSC
Overall length	OAL

7.1.3 Basic geometry of adjustable units

The basic of that part shall be a rotational design feature which contains all elements between the plane “TEP” and the plane “HEP” to the part.

The sketch (outline contour) shall include all the real measure elements defined in Table 10 and shall be designed on the XZ plane of the “PCS”. The rotational axis is the standard Z-axis.

The design of the sketch shall be 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 “HEP” according to Figure 26. If the CAD software does not support the use of datum planes, the sketch shall be fully dimensioned. Otherwise, the distances shall be in conjunction with the defined datum planes.

— The dimensioning shall be done with the appropriate properties listed in Table 1. Missing dimension shall be named as defined in ISO/TS 13399-80.

— The sketch shall be revolved about the Z-axis by 360°.

— The example shows the rectangular key connection designed as an extruded solid feature, based on the YZ-plane, extruded in direction of X-axis and then subtracted from the basic body.

The adjustment coordinate systems at workpiece side (CSWx_y) shall be as follows:

— for the assembly of the components on the workpiece side, the adjustment coordinate system CSW shall be used.

Figure 26 shows a possible design of a cutting component mounted on the adjustable unit.

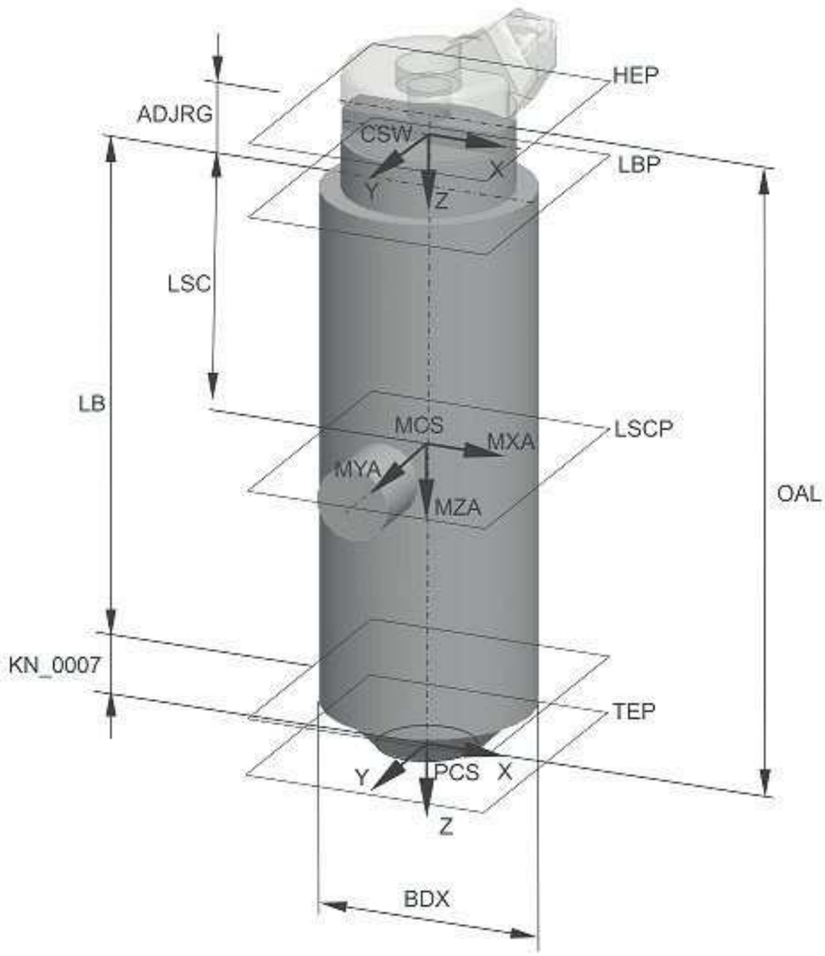


Figure 26 — 3D model of an adjustable unit

7.2 Boring head for adjustable units

7.2.1 General

Figure 27 shows the properties used for identification and classification of adjustable units. The example shows an adjustable unit without any mounted components because of the universe application of these adjustable units.

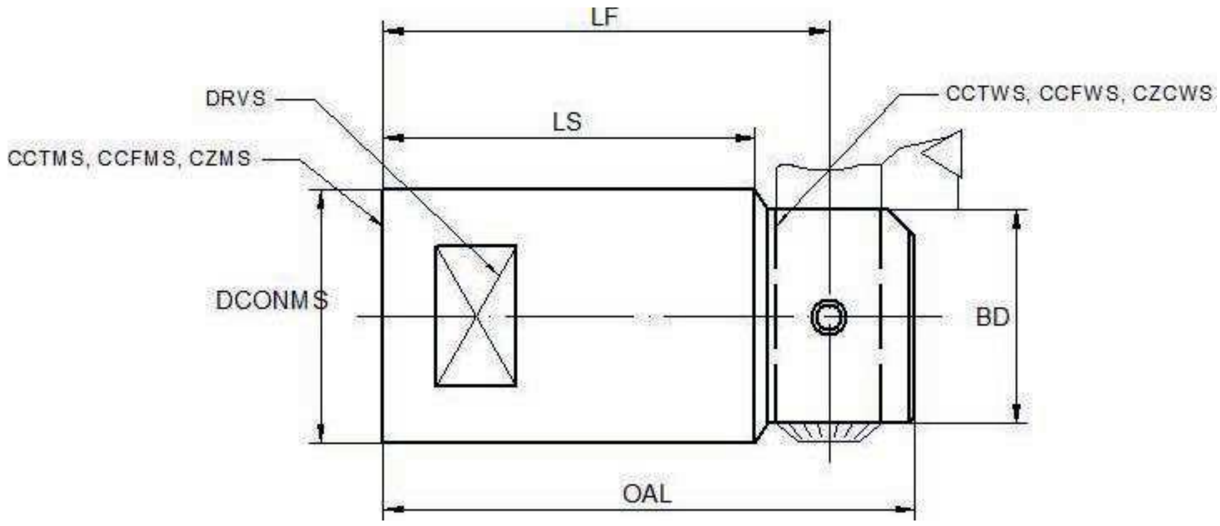


Figure 27 — Determination of properties for a boring head for adjustable units

7.2.2 Necessary properties

Table 10 lists the properties needed for a boring head for adjustable units.

Table 10 — Properties for the modelling of a boring head for adjustable units

Preferred name	Preferred symbol
Body diameter	BD
Body diameter, maximum	BDX
Drive size	DRVS
Functional length	LF
Shank length	LS
Overall length	OAL

7.2.3 Basic geometry of boring heads for adjustable units

The structure of the model is described in 7.1.3 and is in accordance with Figure 28.

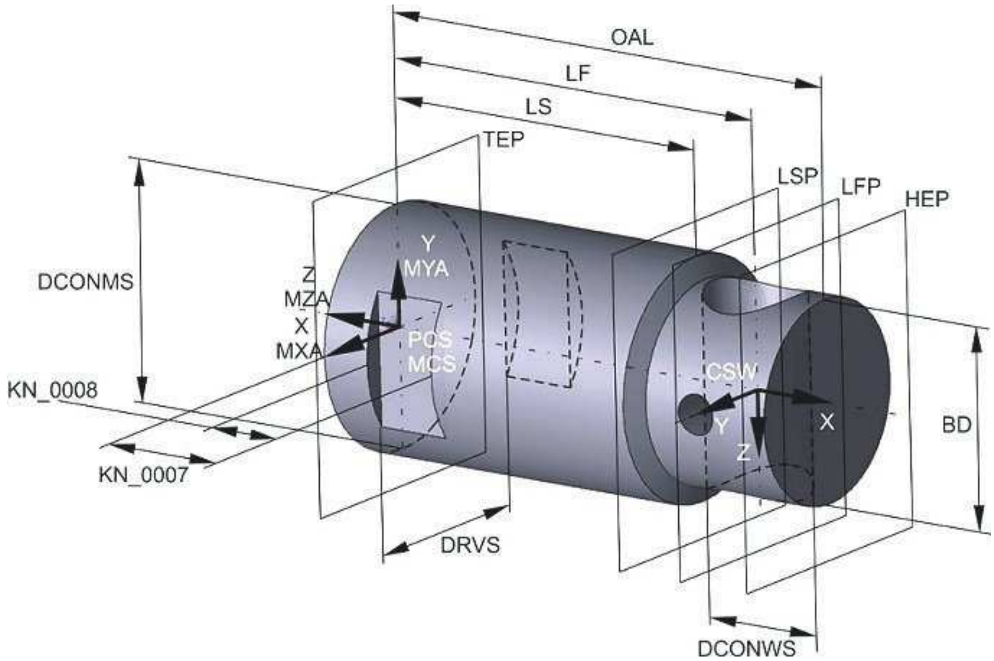


Figure 28 — 3D models of a boring head for adjustable units

8 Basic shapes of rotating boring systems

8.1 General

The following subclauses describe the structure of assembled rotating boring systems that contain one or more of the components being described in the clauses before. Basis for the assembly shall be an "MCS/CSW" coordinate system to which the components shall be mated.

For the assembly along with the coordinate systems MCS and CSW, the planes defined in 4.5 shall be used.

8.2 Assembled single-point bridge tool

8.2.1 General

Figure 29 shows the properties used for identification and classification of a single-point bridge tool. The example shows a bridge tool with cylindrical shank.

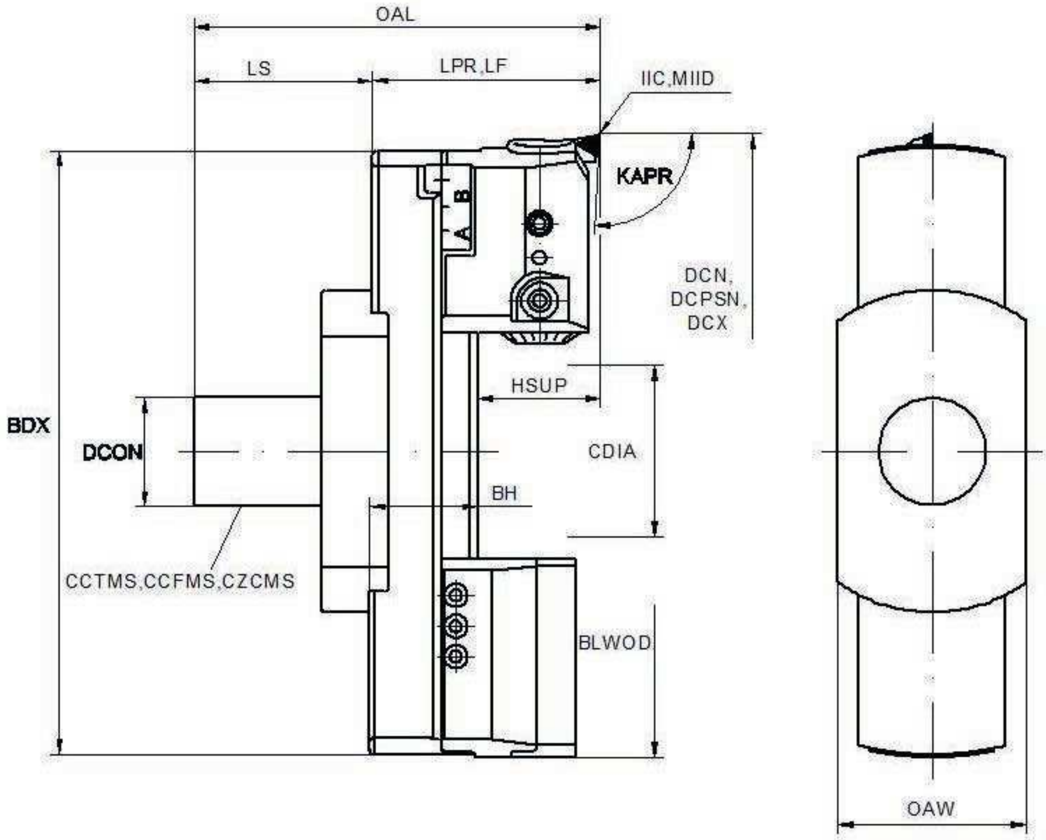


Figure 29 — Determination of properties for assembled single-point bridge tool

8.2.2 Necessary properties

Table 11 lists the properties needed for the assembly of a bridge tool. For the position of the cutting edge, the property “cutting diameter, maximum” shall be used. The properties describing the other values of the cutting diameter shall be listed for information only.

Table 11 — Properties for the assembly of single-point bridge tools

Preferred name	Preferred symbol
Body diameter, maximum	BDX
Bridge height	BH
Balance weight outside diameter	BLWOD
Collision diameter	CDIA
Tool cutting edge angle type code	CEATC
Cutting diameter, minimum	DCN
Connection diameter	DCON
Cutting diameter, maximum	DCX
Pre-setting cutting diameter, smaller	DCPSN
Support height	HSUP
Insert interface code	IIC
Tool cutting edge angle	KAPR
Functional length	LF
Protruding length	LPR
Shank length	LS
Master insert identification	MIID
Overall length	OAL
Overall width	OAW

8.2.3 Assembled model of single-point bridge tool

The assembly shall take place by means of using the coordinate systems. These are part of the individual models. To assemble the components together, the corresponding mating conditions shall be used to mate the MCS of the component located towards the workpiece to the appropriate CSW of the component located on the machine side.

Figure 30 shows the different coordinate systems of the individual components for the assembly.

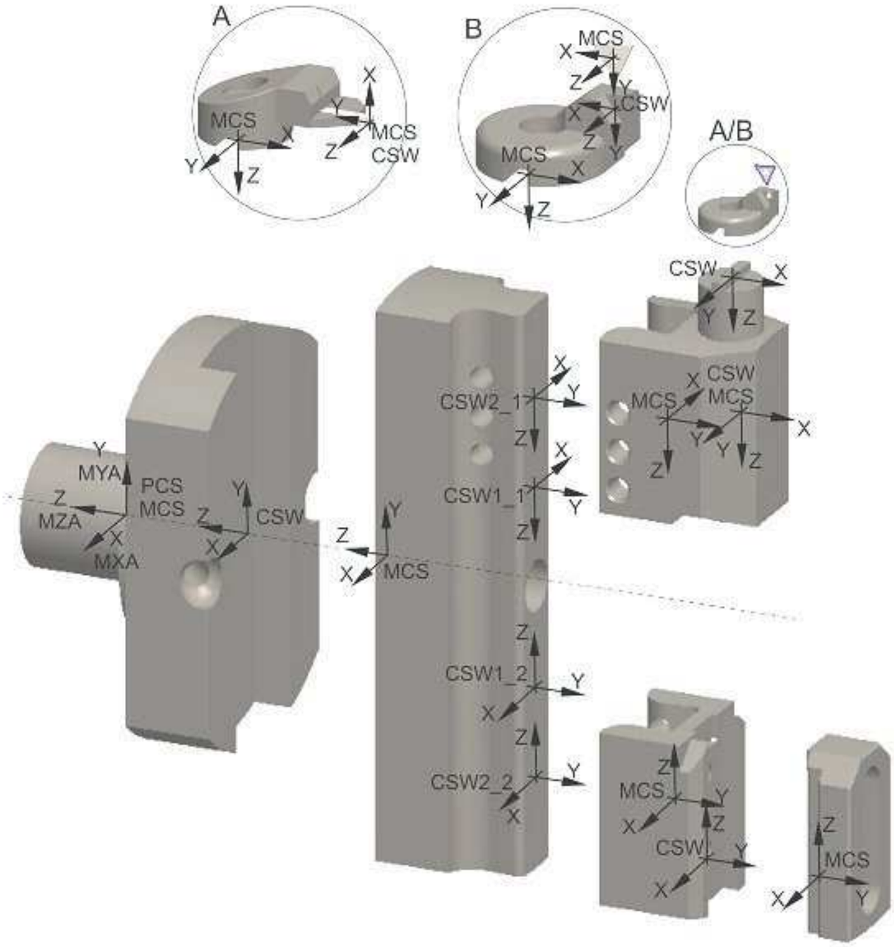


Figure 30 — Coordinate systems for assembly

For the determination of the functional length and the usage of the model for the NC-programming, an additional coordinates system called “CIP” (coordinate system in process) shall be placed at the axis of the bridge tool with the distance of the functional length “LF”.

Figure 31 shows the assembled bridge tool with its main dimensions and coordinate systems.

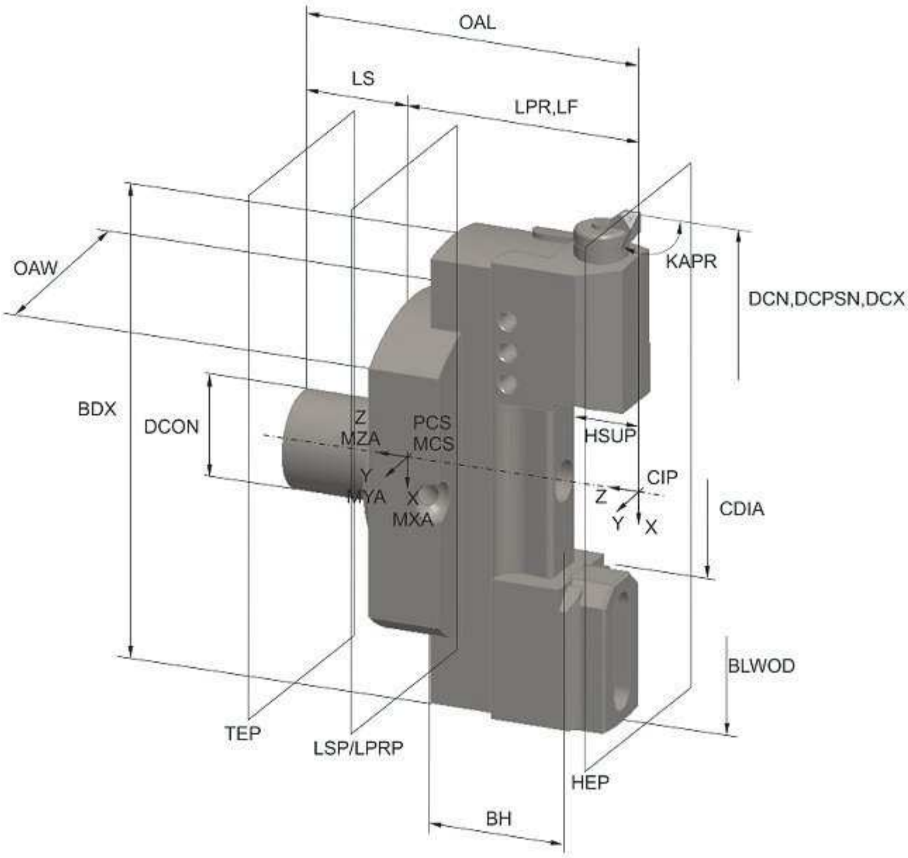


Figure 31 — Assembled single-point bridge tool

8.3 Assembled single-point bridge tool for reverse internal operations

8.3.1 General

Figure 32 shows the properties used for identification and classification of a single-point bridge tool for reverse internal operations. The example shows a bridge tool with cylindrical shank.

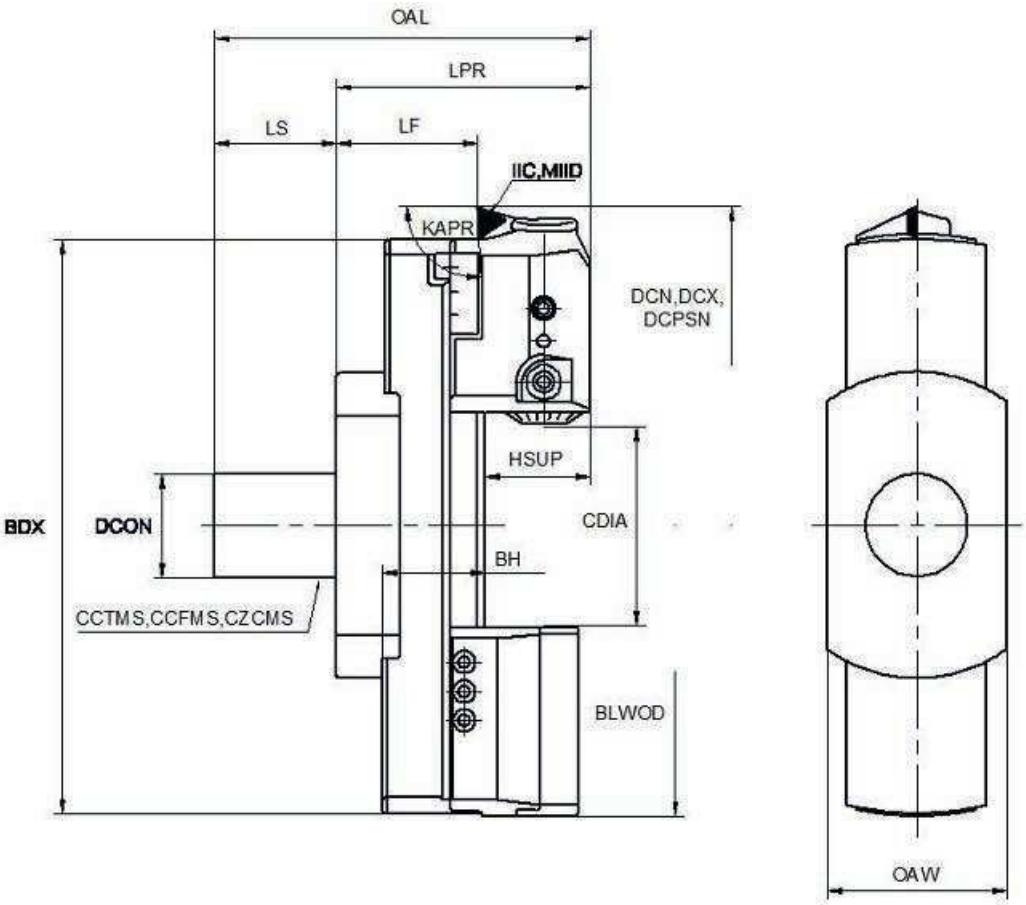


Figure 32 — Determination of properties for assembled single-point bridge tool for reverse internal operations

8.3.2 Necessary properties

See Table 11 for necessary properties.

8.3.3 Assembled model of single-point bridge tool for reverse operations

The structure of the model is described in 8.2.3 and is in accordance with Figure 33.

Figure 33 shows the assembled bridge tool for reverse operations with its main dimensions and coordinate systems.

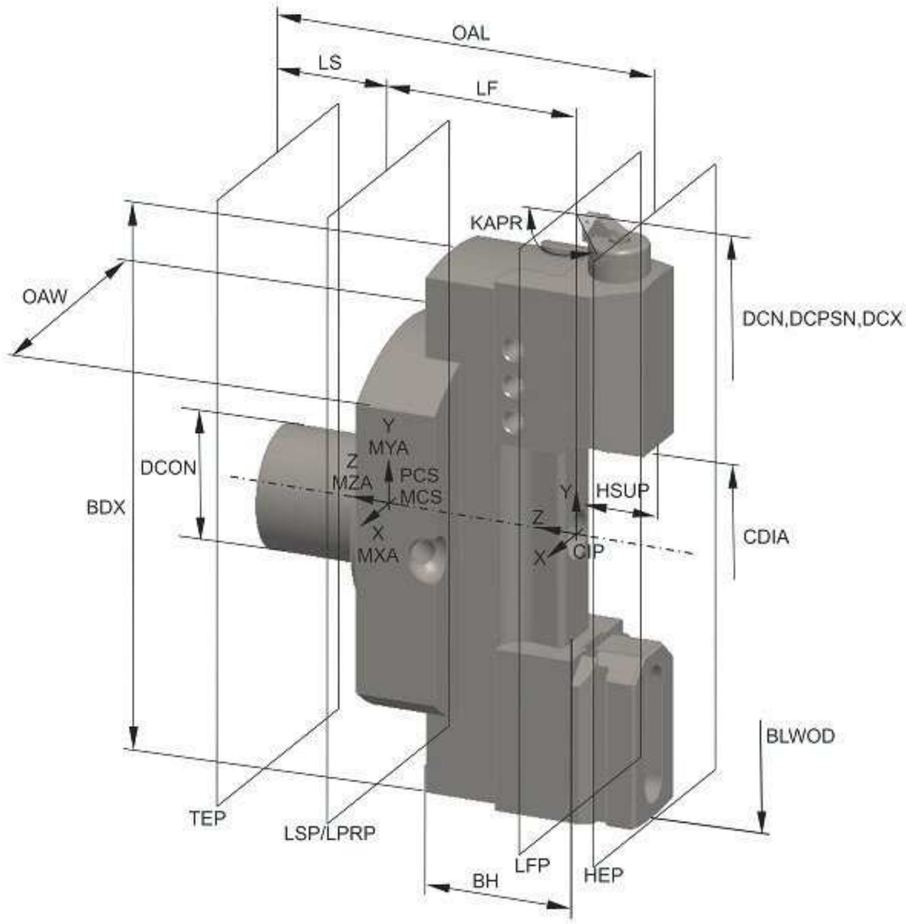


Figure 33 — Assembled single-point bridge tool for reverse operations

8.4 Assembled multi-point bridge tool

8.4.1 General

Figure 34 shows the properties used for identification and classification of a multi-point bridge tool. The tool enables to adjust different cutting diameters and functional length, for example, for roughing and finishing. The example shows a bridge tool with cylindrical shank.

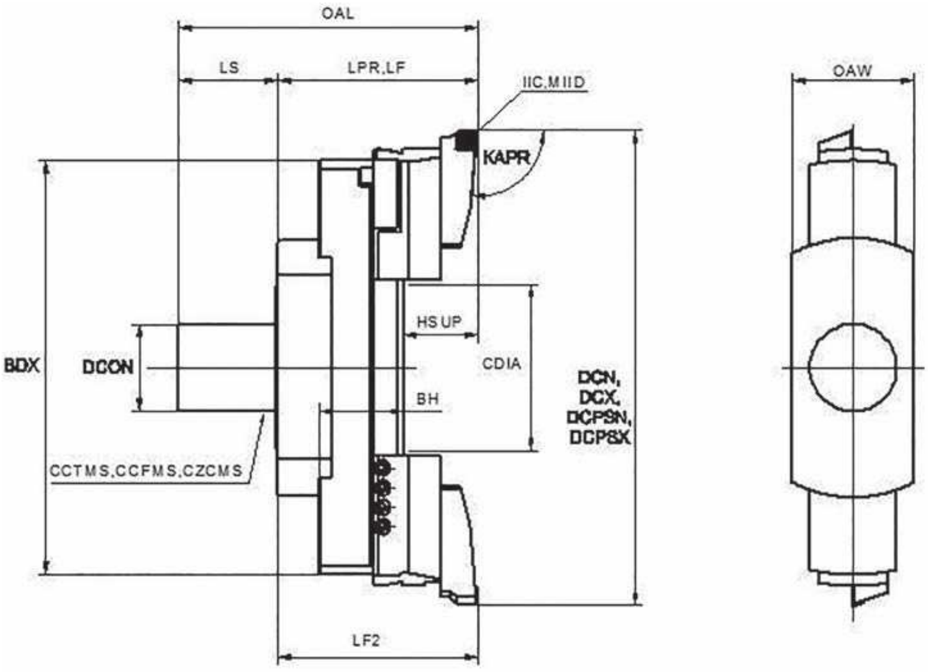


Figure 34 — Determination of properties for multi-point assembled bridge tool

8.4.2 Necessary properties

Table 12 lists the properties needed for the assembly of a bridge tool. For the position of the cutting edges, the property “cutting diameter, maximum” shall be used. The properties describing the other values of the cutting diameter shall be listed for information only.

Table 12 — Properties for the assembly of multi-point bridge tools

Preferred name	Preferred symbol
Body diameter, maximum	BDX
Bridge height	BH
Balance weight outside diameter	BLWOD
Collision diameter	CDIA
Tool cutting edge angle type code	CEATC
Cutting diameter, minimum	DCN
Connection diameter	DCON
Cutting diameter, maximum	DCX
Pre-setting cutting diameter, smaller	DCPSN
Pre-setting cutting diameter, greater	DCPSX
Support height	HSUP
Insert interface code[a]	IIC
Tool cutting edge angle	KAPR
Functional length[a]	LF
Protruding length	LPR
Shank length	LS

[a] Properties are indexed for the determination of the second cutting edge on the bridge tool.

Table 12 *(continued)*

Preferred name	Preferred symbol
Master insert identification[a]	MIID
Overall length	OAL
overall width	OAW
[a] Properties are indexed for the determination of the second cutting edge on the bridge tool.	

8.4.3 Assembled model of multi-point bridge tool

The structure of the model is described in 8.2.3 and is in accordance with Figure 35.

Figure 35 shows the assembled multi-point bridge tool with its main dimensions and coordinate systems.

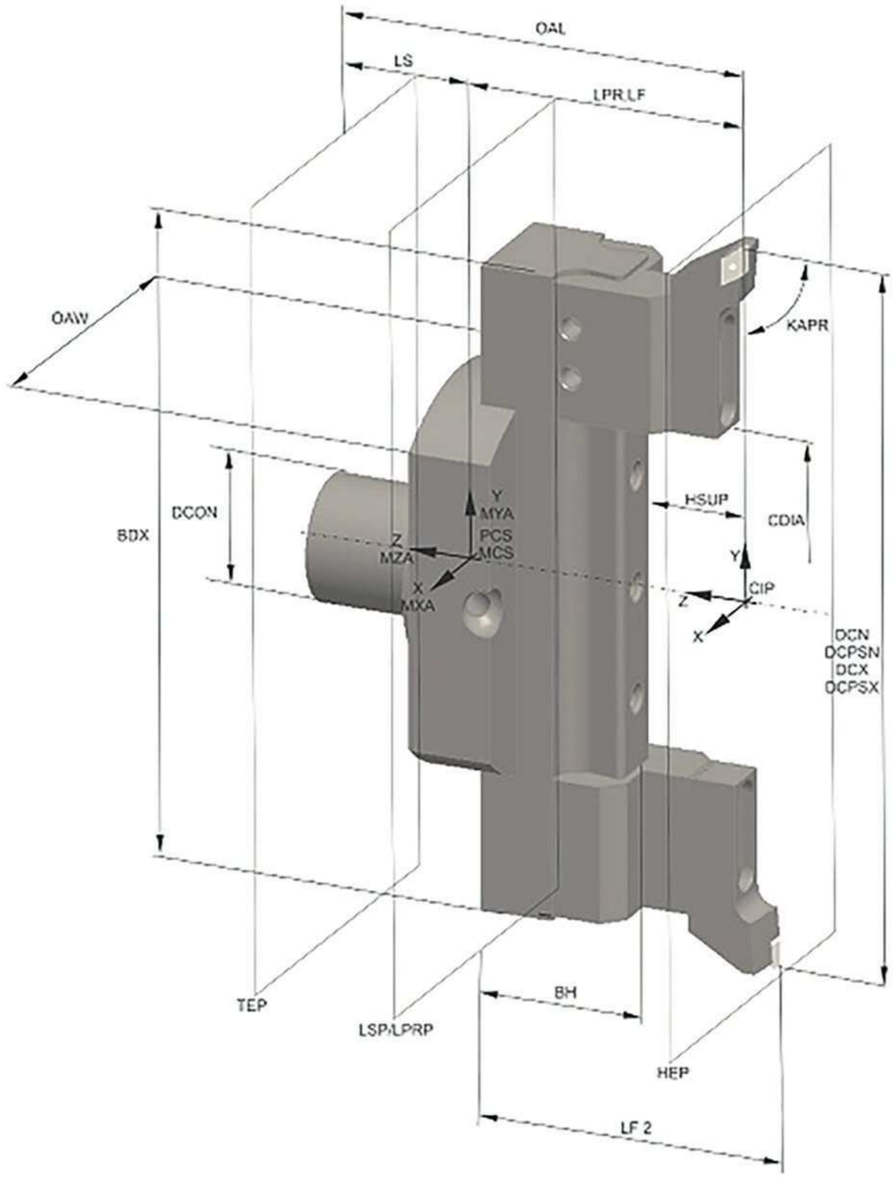


Figure 35 — Assembled multi-point bridge tool

8.5 Assembled single-point bridge tool for external operations

8.5.1 General

Figure 36 shows the properties used for identification and classification of an assembled single-point bridge tool for external operations. The example shows a bridge tool with cylindrical shank.

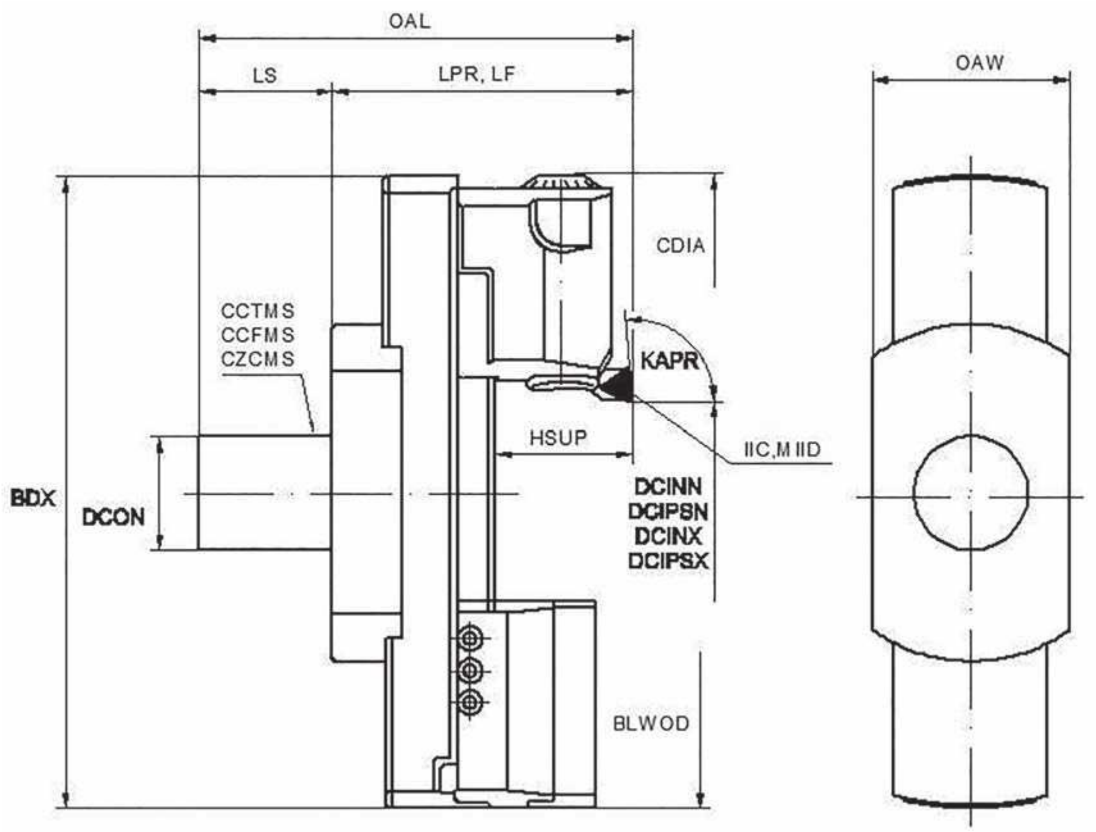


Figure 36 — Determination of properties for assembled single-point bridge tool for external operations

8.5.2 Necessary properties

Table 13 lists the properties needed for the assembly of a bridge tool. For the position of the cutting edge, the property "cutting diameter internal, maximum" shall be used. The properties describing the other values of the internal cutting diameter shall be listed for information only.

Table 13 — Properties for the assembly of single-point bridge tools for external operations

Preferred name	Preferred symbol
Body diameter, maximum	BDX
Bridge height	BH
Balance weight outside diameter	BLWOD
Collision diameter	CDIA
Tool cutting edge angle type code	CEATC
Cutting diameter, inner, minimum	DCINN
Cutting diameter, inner, maximum	DCINX
Pre-setting cutting diameter, inner, smaller	DCIPSN
Pre-setting cutting diameter, inner, greater	DCIPSX
Connection diameter	DCON
Support height	HSUP
Insert interface code	IIC
Tool cutting edge angle	KAPR
Functional length	LF
Protruding length	LPR
Shank length	LS
Master insert identification	MIID
Overall length	OAL
Overall width	OAW

8.5.3 Assembled model of single-point bridge tool for external operations

The structure of the model is described in 8.2.3 and is in accordance with Figure 37.

Figure 37 shows a left-handed assembled single-point bridge tool for external operations with its main dimensions and coordinate systems.

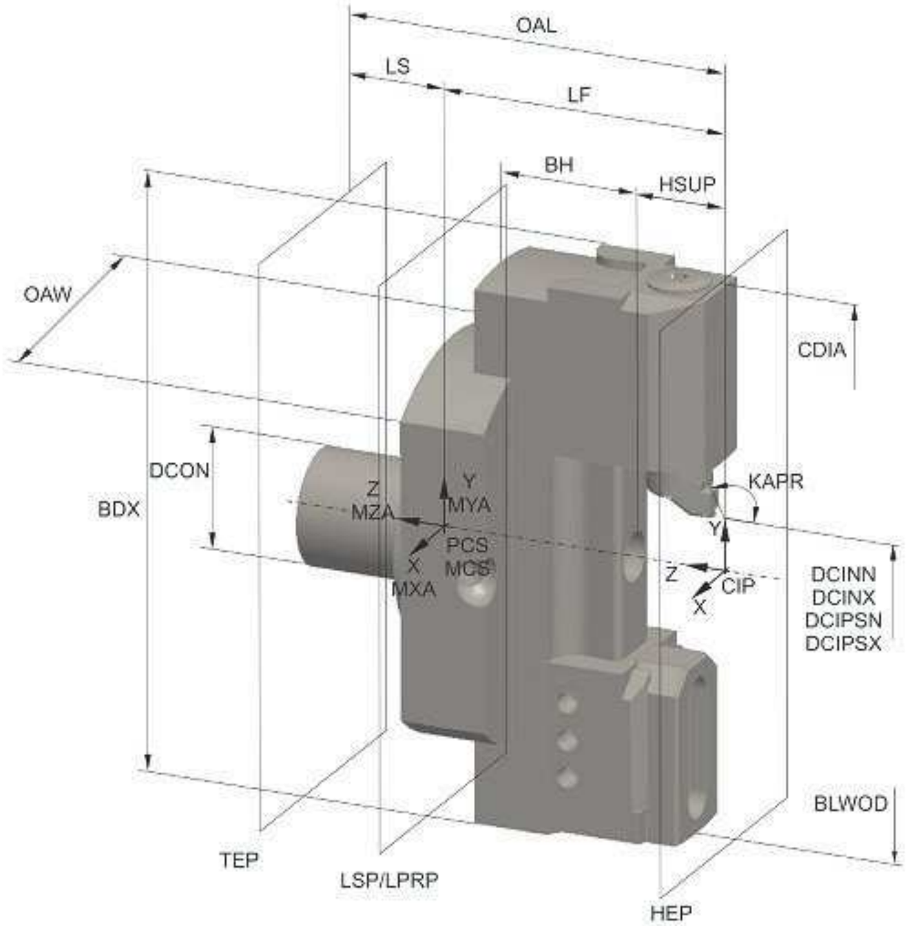


Figure 37 — Assembled single-point bridge tool for external operations

8.6 Assembled multi-point bridge tool for external operations

8.6.1 General

Figure 38 shows the properties used for identification and classification of an assembled multi-point bridge tool for external operations. The example shows a bridge tool with cylindrical shank.

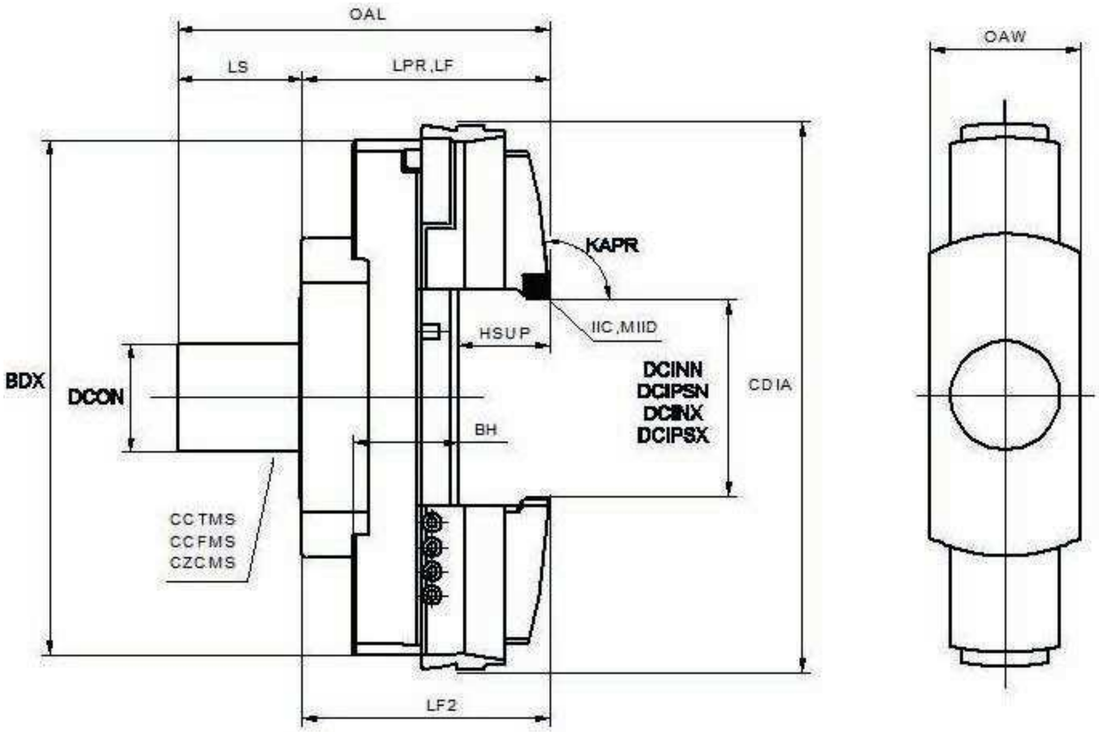


Figure 38 — Determination of properties for assembled multi-point bridge tool for external operations

8.6.2 Necessary properties

See Table 13 for necessary properties.

8.6.3 Assembled model of a multi-point bridge tool for external operations

The structure of the model is described in 8.2.3 and is in accordance with Figure 39.

Figure 39 shows a left-handed assembled multi-point bridge tool for external operations with its main dimensions and coordinate systems.

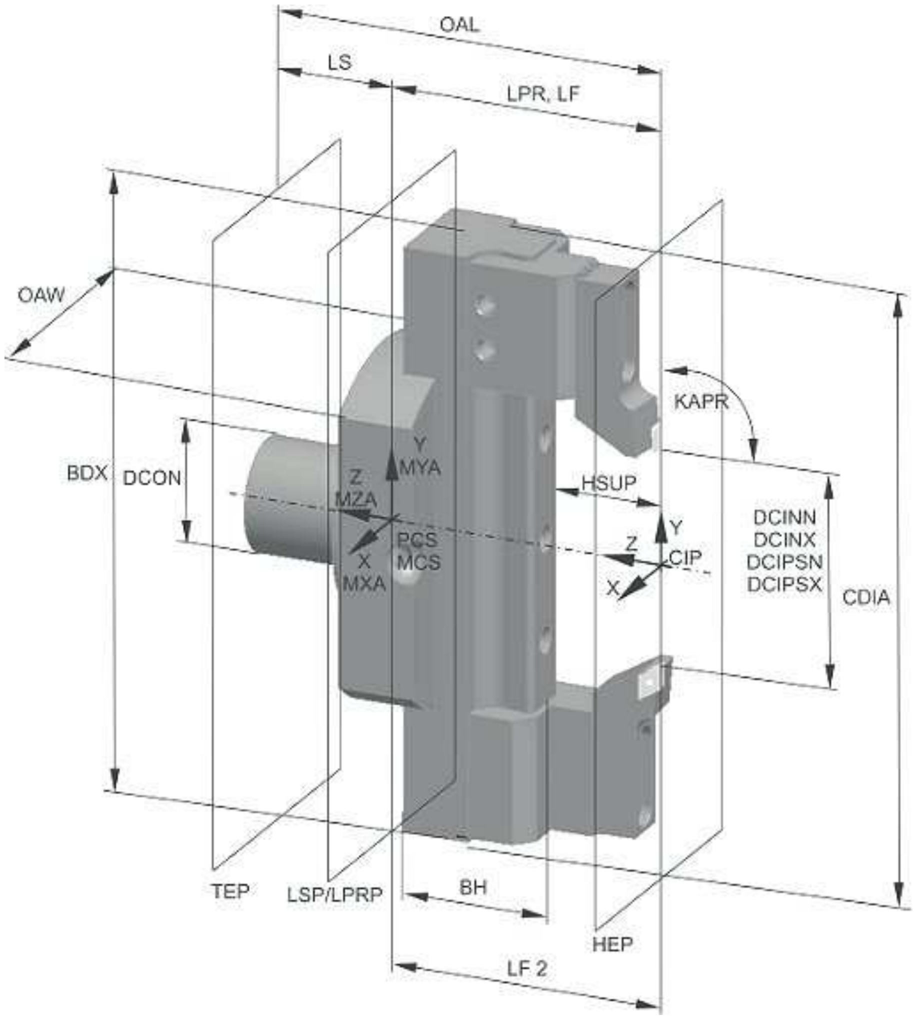


Figure 39 — Assembled multi-point bridge tool for external operations

8.7 Single-point bridge tool for axial grooving

8.7.1 General

Figure 40 shows the properties used for identification and classification of an assembled single-point bridge tool for axial grooving. The example shows a bridge tool with cylindrical shank.

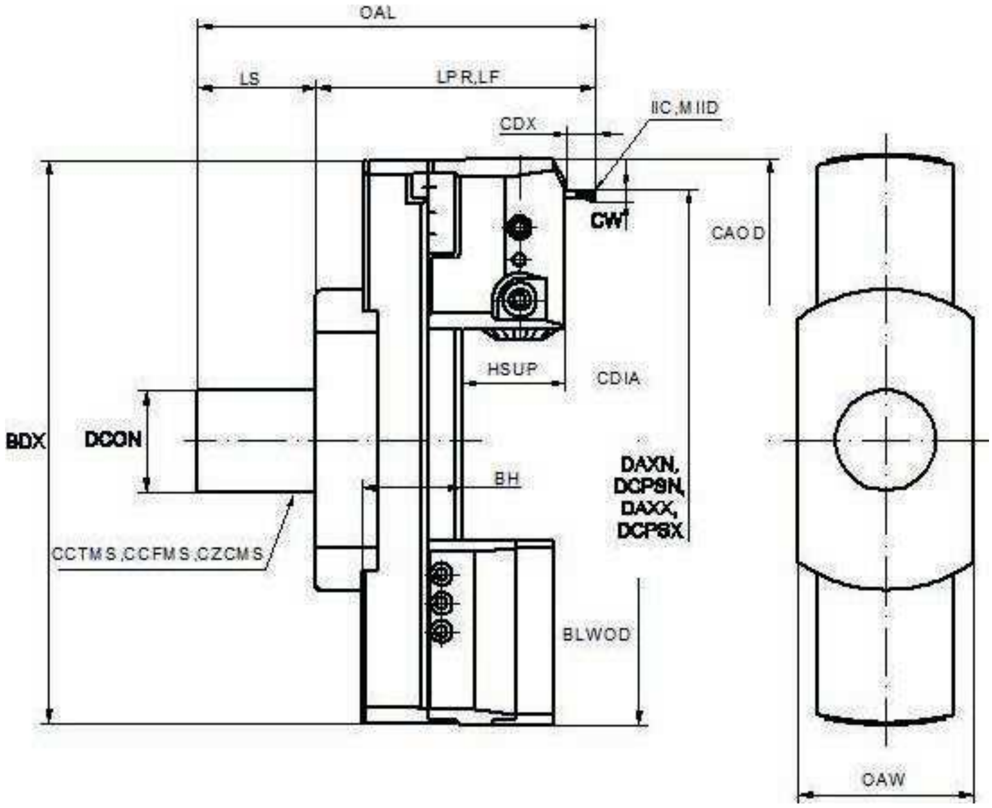


Figure 40 — Determination of properties for assembled single-point bridge tool for axial grooving

8.7.2 Necessary properties

Table 14 lists the properties needed for the assembly of a bridge tool. For the position of the cutting edge, the property “cutting diameter, maximum” shall be used. The properties describing the other values of the cutting diameter shall be listed for information only.

Table 14 — Properties for assembly of single-point bridge tools for axial grooving

Preferred name	Preferred symbol
Body diameter, maximum	BDX
Bridge height	BH
Balance weight outside diameter	BLWOD
Cartridge outside diameter	CAOD
Collision diameter	CDIA
Cutting depth maximum	CDX
Tool cutting edge angle type code	CEATC
Cutting width	CW
Axial groove outside diameter minimum	DAXN
Axial groove outside diameter maximum	DAXX
Pre-setting cutting diameter, inner, smaller	DCPSN
Pre-setting cutting diameter, smaller	DCPSN
Pre-setting cutting diameter, greater	DCPSX
Connection diameter	DCON
Support height	HSUP

Table 14 *(continued)*

Preferred name	Preferred symbol
Insert interface code	IIC
Tool cutting edge angle	KAPR
Functional length	LF
Protruding length	LPR
Shank length	LS
Master insert identification	MIID
overall length	OAL
Overall width	OAW

8.7.3 Assembled model of single-point bridge tool for axial grooving

The structure of the model is described in 8.2.3 and is in accordance with Figure 41.

Figure 41 shows an assembled single-point bridge tool for axial grooving with its main dimensions and coordinate systems.

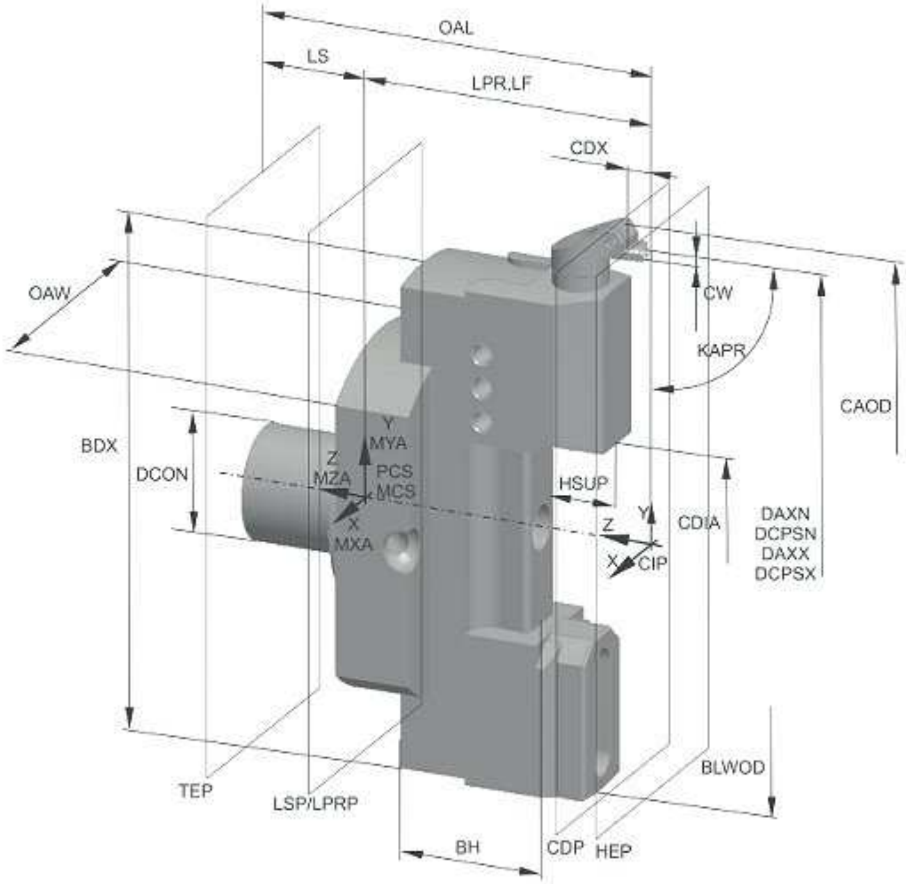


Figure 41 — Assembled single-point bridge tool for axial grooving

8.8 Assembled multi-point bridge tool for axial grooving

8.8.1 General

Figure 42 shows the properties used for identification and classification of an assembled multi-point bridge tool for axial grooving. The example shows a bridge tool with cylindrical shank.

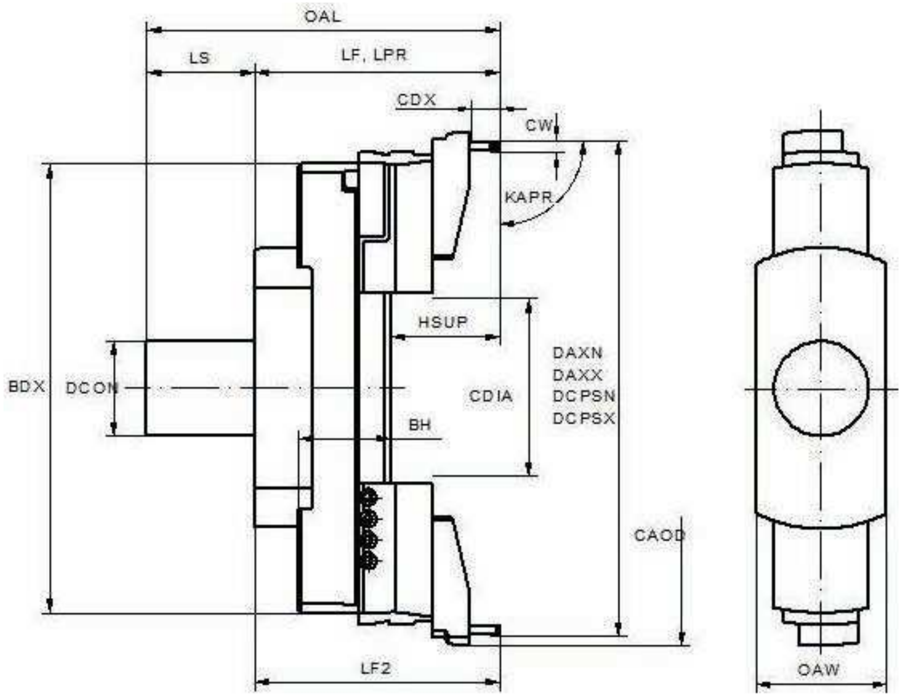


Figure 42 — Determination of properties for assembled multi-point bridge tool for axial grooving

8.8.2 Necessary properties

See Table 14 for necessary properties.

8.8.3 Assembled model of multi-point bridge tool for axial grooving

The structure of the model is described in 8.2.3 and is in accordance with Figure 43.

Figure 43 shows an assembled multi-point bridge tool for axial grooving with its main dimensions and coordinate systems.

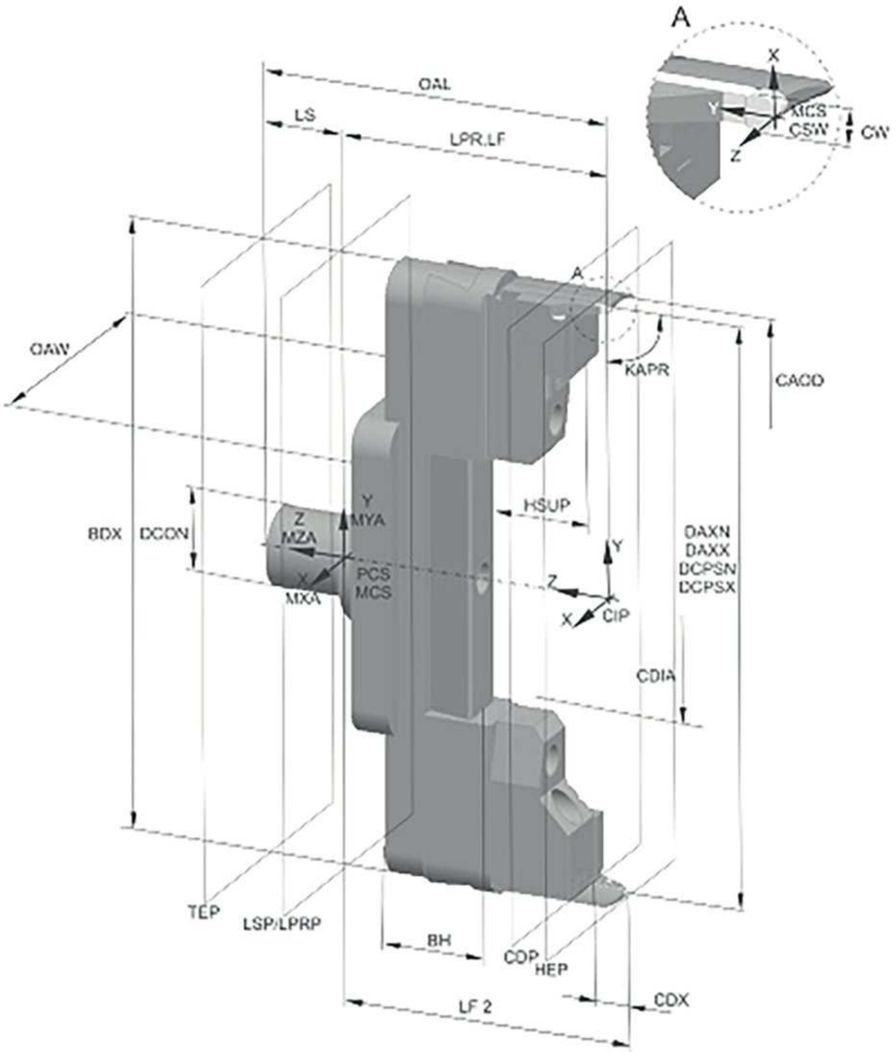


Figure 43 — Assembled multi-point bridge tool for axial grooving

8.9 Boring head

8.9.1 General

Figure 44 shows the properties used for identification and classification of an assembled boring head. The example shows a boring head with cylindrical shank.

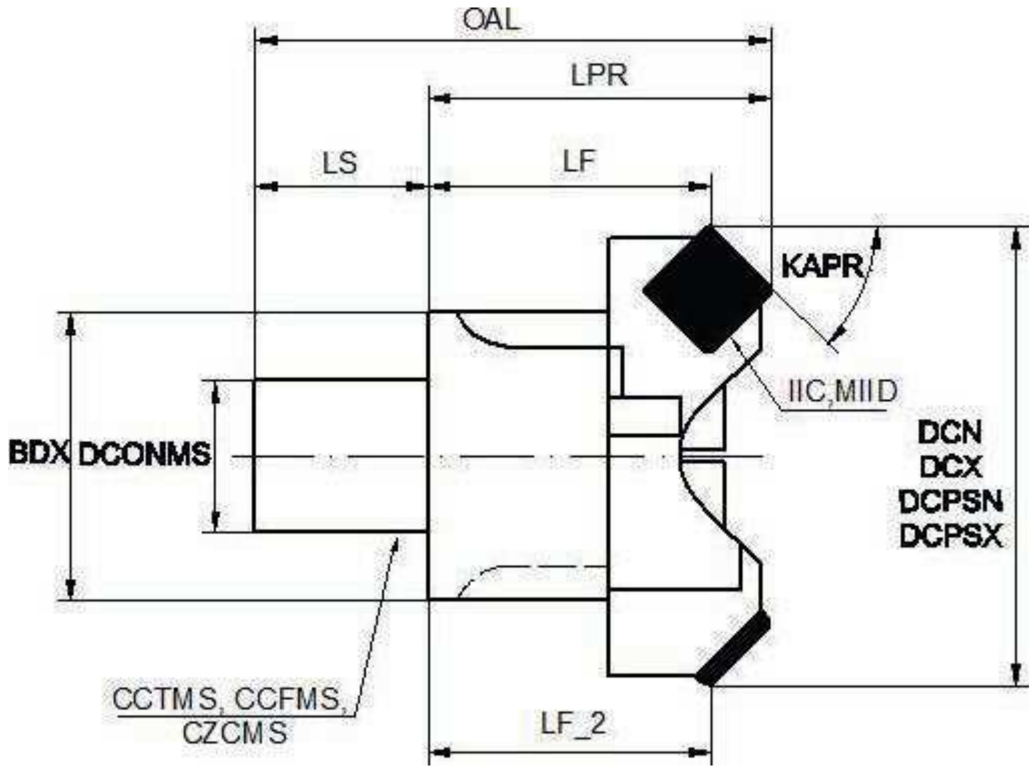


Figure 44 — Determination of properties for boring head

8.9.2 Necessary properties

Table 15 lists the properties needed for the assembly of a boring head. For the position of the cutting edge, the property "cutting diameter, maximum" shall be used. The properties describing the other values of the cutting diameter shall be listed for information only.

Table 15 — Properties for assembly of boring heads

Preferred name	Preferred symbol
Body diameter, maximum	BDX
Tool cutting edge angle type code	CEATC
Cutting diameter, minimum	DCN
Connection diameter	DCON
Cutting diameter, maximum	DCX
Pre-setting cutting diameter, smaller	DCPSN
Pre-setting cutting diameter, greater	DCPSX
Insert interface code	IIC
Tool cutting edge angle	KAPR
Functional length	LF
Protruding length	LPR
Shank length	LS
Master insert identification	MIID
Overall length	OAL

8.9.3 Assembled model of boring head

The structure of the model is described in 8.2.3 and is in accordance with Figure 45.

Figure 45 shows an assembled boring head with its main dimensions and coordinate systems.

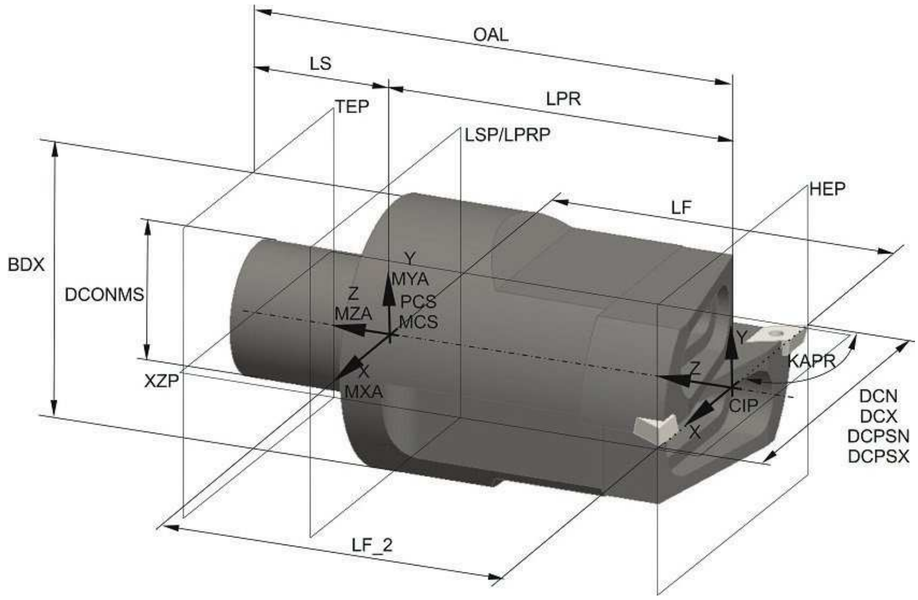


Figure 45 — Assembled boring head

8.10 Fine boring head with boring bar

8.10.1 General

Figure 46 shows the properties used for identification and classification of an assembled fine boring head with boring bar. The example shows a fine boring head with cylindrical shank.

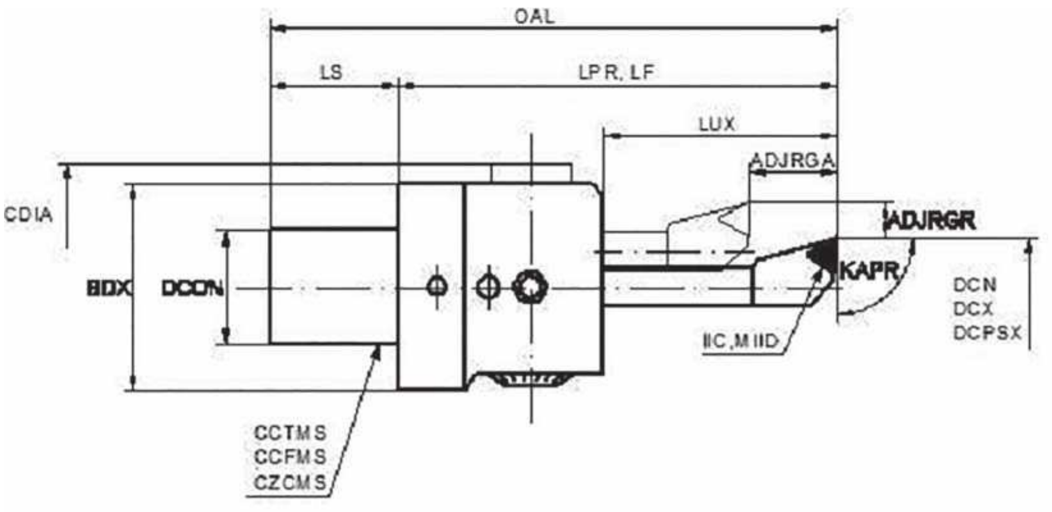


Figure 46 — Determination of properties for fine boring head with boring bar

8.10.2 Necessary properties

Table 16 lists the properties needed for the assembly of a fine boring head. For the position of the cutting edge, the property “cutting diameter, maximum” shall be used. The properties describing the other values of the cutting diameter shall be listed for information only.

Table 16 — Properties for the assembly of fine boring heads with boring bar

Preferred name	Preferred symbol
Adjustment range axial	ADJRGA
Adjustment range radial	ADJRGR
Body diameter, maximum	BDX
Collision diameter	CDIA
Tool cutting edge angle type code	CEATC
Cutting diameter, minimum	DCN
Connection diameter	DCON
Cutting diameter, maximum	DCX
Pre-setting cutting diameter, smaller	DCPSN
Insert interface code	IIC
Tool cutting edge angle	KAPR
Functional length	LF
Protruding length	LPR
Shank length	LS
Usable length maximum	LUX
Master insert identification	MIID
Overall length	OAL

8.10.3 Assembled model of fine boring head with boring bar

The structure of the model is described in 8.2.3 and is in accordance with Figure 47.

Figure 47 shows an assembled left-handed fine boring head with boring bar with its main dimensions and coordinate systems, where the cutting edge is shown with its maximum axial travel.

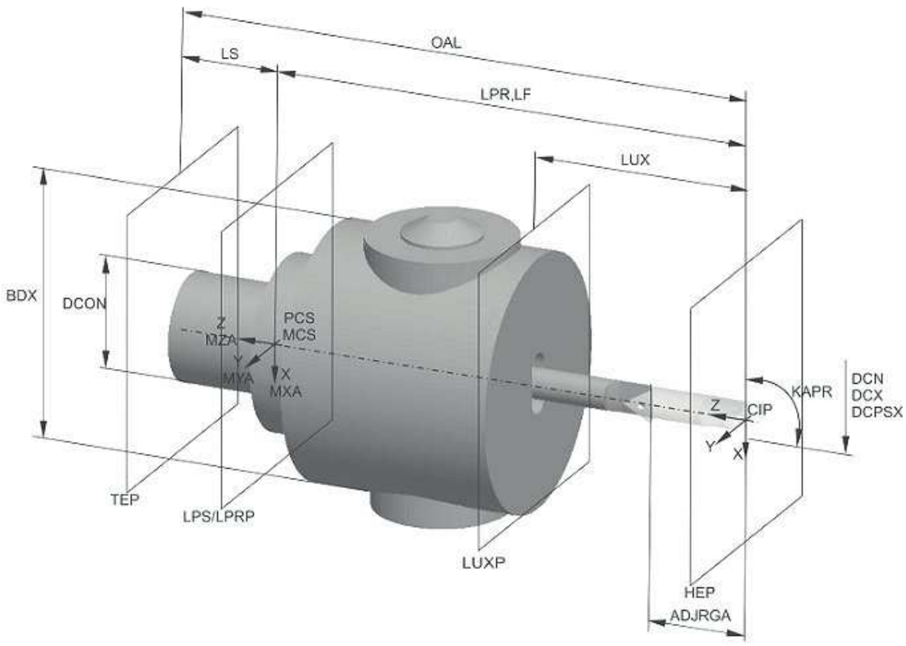


Figure 47 — Assembled fine boring head with boring bar

8.11 Boring head with adjustable unit

8.11.1 General

Figure 48 and Figure 49 show the properties used for identification and classification of an assembled boring head with adjustable unit. Figure 48 shows a boring head with cylindrical shank for boring operations. Figure 49 shows a boring head with cylindrical shank for reverse (pull back) operations.

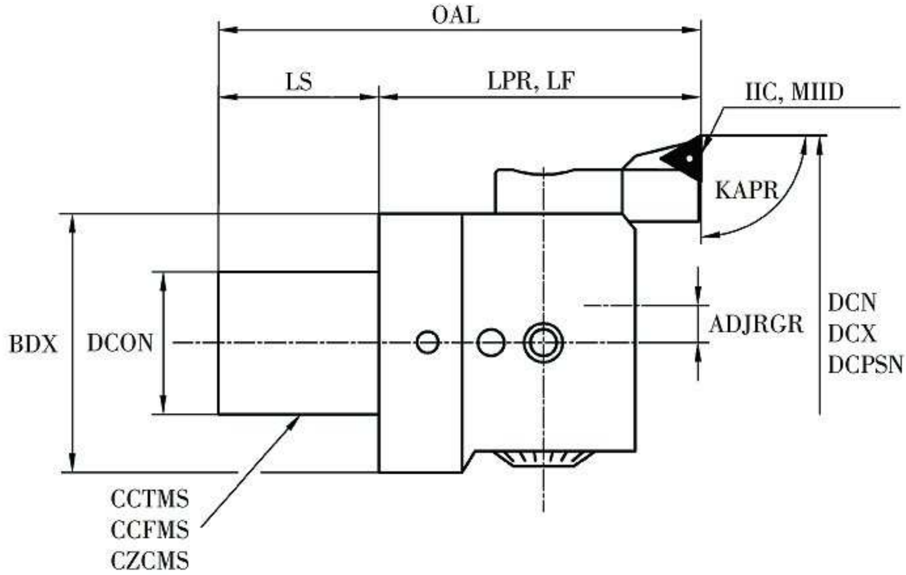


Figure 48 — Determination of properties for boring head with adjustable unit — Boring operation

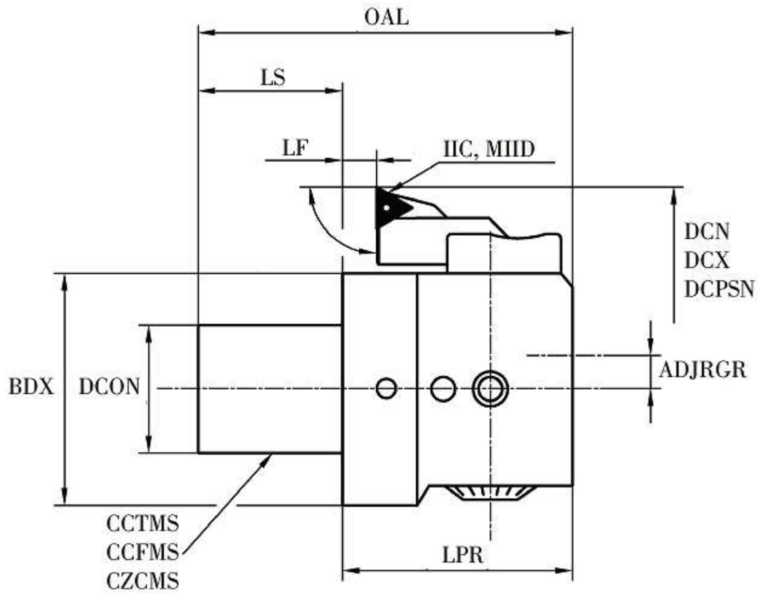


Figure 49 — Determination of properties for boring head with adjustable unit — Reverse operation

8.11.2 Necessary properties

See Table 15 for necessary properties.

8.11.3 Assembled model of boring head with adjustable unit

The structure of the model is described in 8.2.3 and is in accordance with Figure 50 and Figure 51.

Figure 50 shows an assembled boring head with adjustable unit with its main dimensions and coordinate systems for boring operations. Figure 51 shows an assembled boring head completed for reverse cutting operations.

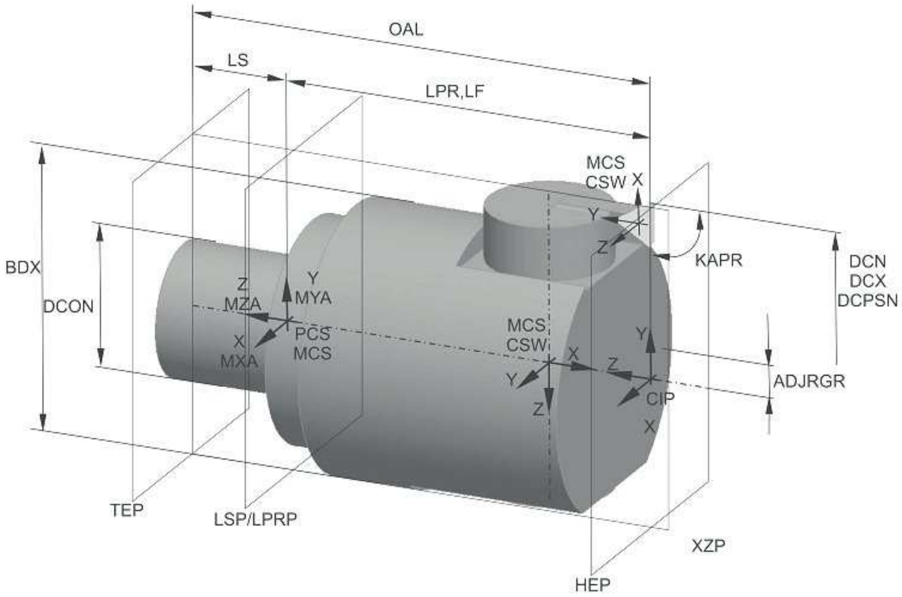


Figure 50 — Assembled boring head with adjustable unit for boring operations

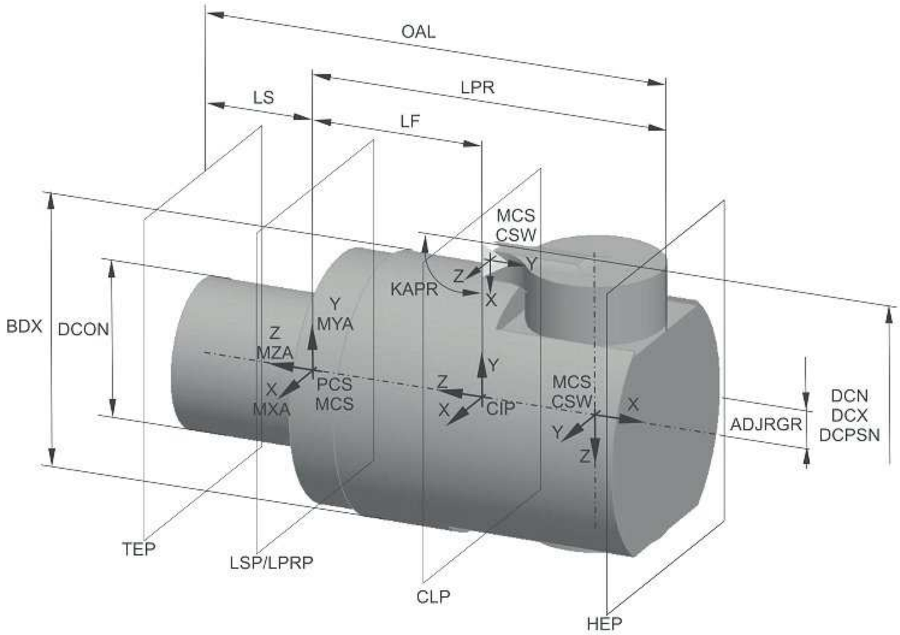


Figure 51 — Assembled boring head with adjustable unit for reverse operations

9 Design of details

9.1 Basis for modelling

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

9.2 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.

9.3 Contact/clamping surfaces — Orientation

Clamping surfaces to be visualized within the tool model shall be orientated by means of a unique orientation. The normal of the face shall be parallel with the “+Y”-axis of the primary coordinate system “PCS” as shown in Figure 52.

Figure 52 — Orientation of planar/clamping surfaces

9.4 Chamfers and roundings

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

10 Attributes of surfaces — Visualization of model features

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

NOTE 1 Some CAD systems identify only one surface of the same diameter even if this surface is mated by means of two solid design features. Therefore, to be able to address the surface attributes to each of these features, a revolved design feature is created over the cutting part feature. In the tree of elements and features, this element is called “CUTTING_SURFACE”. This design feature is created with the sketch elements of the cutting and non-cutting part and will be 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 planes “LCFP” and others are used as references. With the suppression of the main design elements, all referenced design elements are supressed either.

11 Data exchange model

The model for the data exchange is shown in an example of a boring head in Figure 53.

The modular tooling system with adjustable cartridges for boring is created as an assembly of components. All of these components shall contain the geometrical features (collision contour), primary coordinate system “PCS”, the mounting coordinate system “MCS”, the coordinate system in process “CIP”, CRP points and the cutting edge line that are relevant for components and for the collision examination.

For a basic model, the number of the CUT components is equal to the amount of insert position levels (see 4.6). For detail model, the number of the CUT components is the number of inserts in the tool.

If more than one insert exists in a single tool, each insert is defined as a “CUT” feature and it is named “CUT1”, “CUT2”, “CUT1_1”, “CUT1_2”.

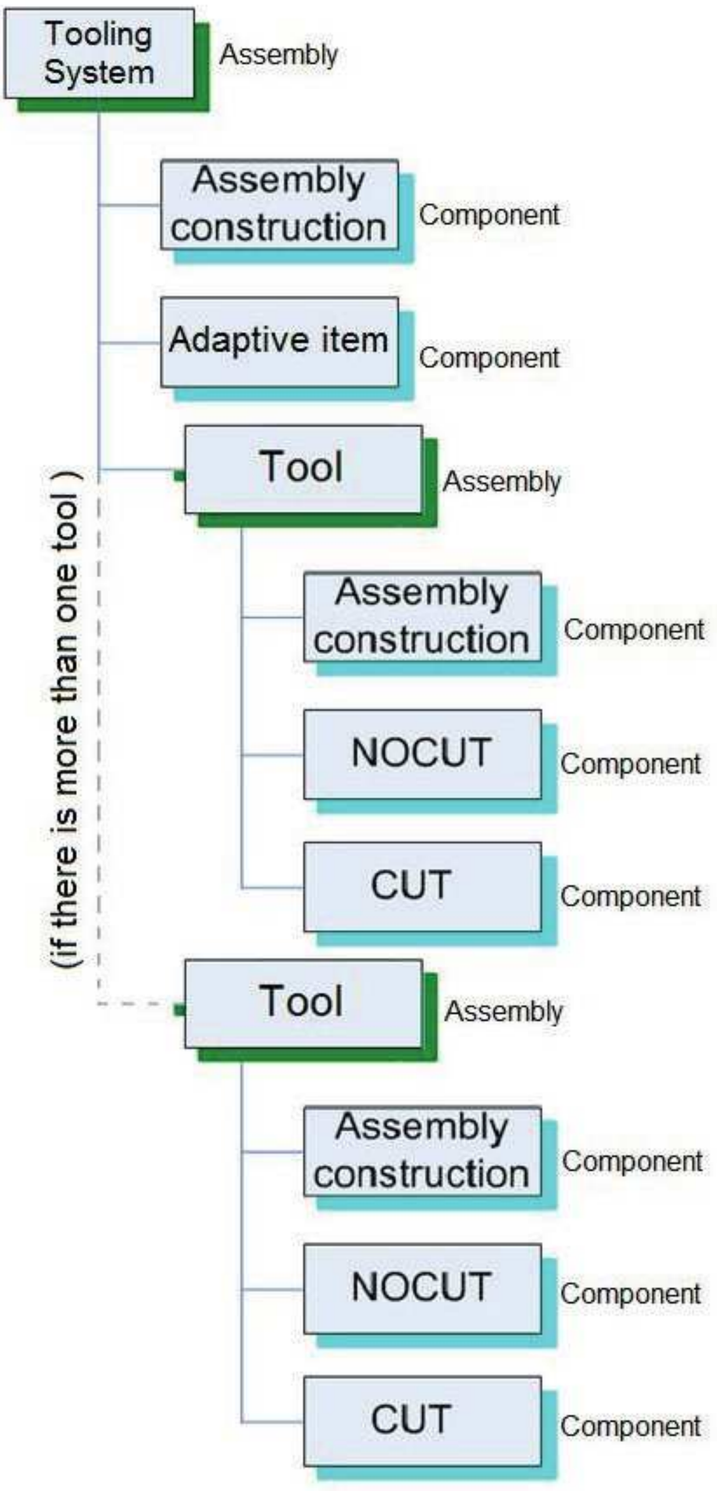


Figure 53 — Model for data exchange

The structure of the detailed and basic models should be as shown in Figure 54 and Figure 55. The example presents a modular tool system with one holder and two tools including one insert in each tool.

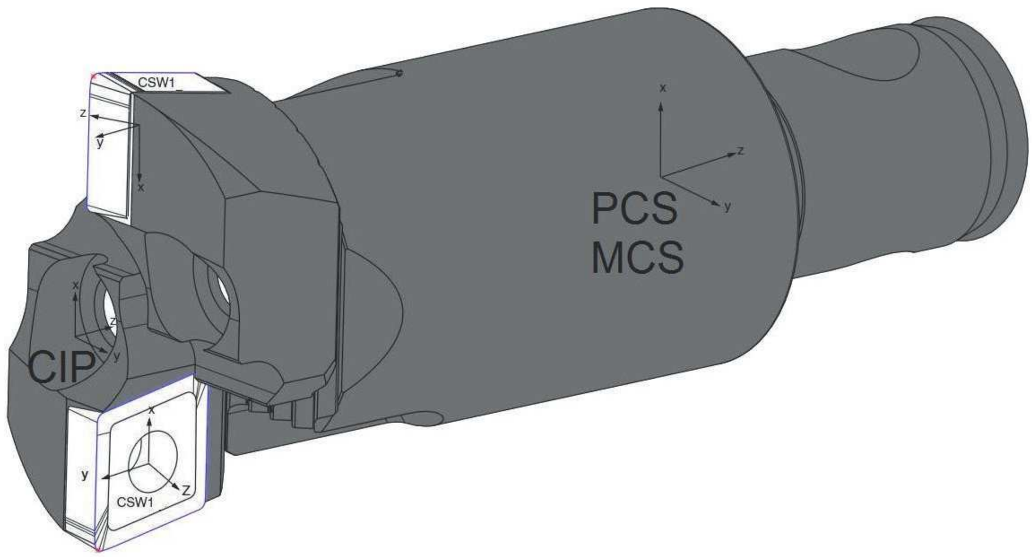


Figure 54 — Detailed model

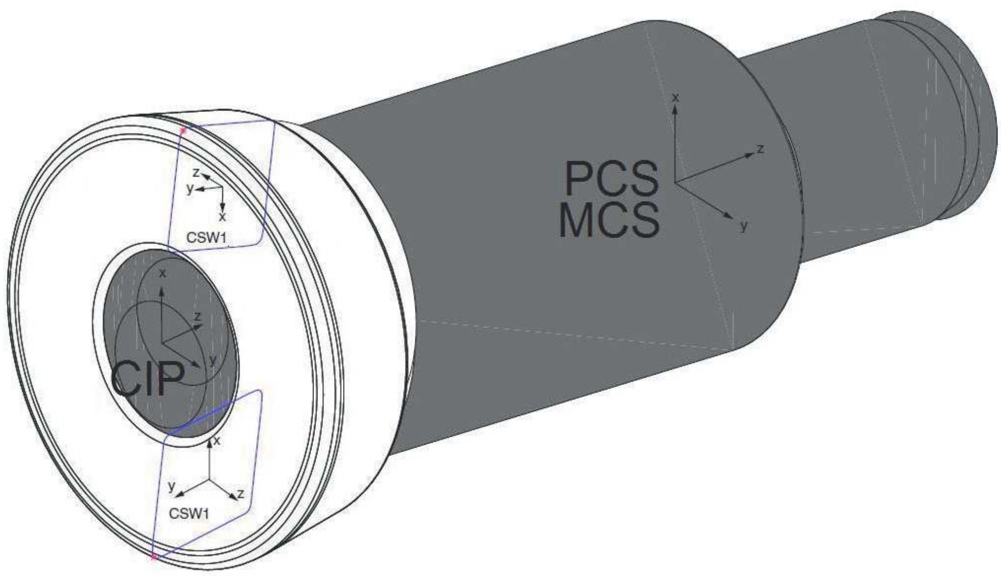
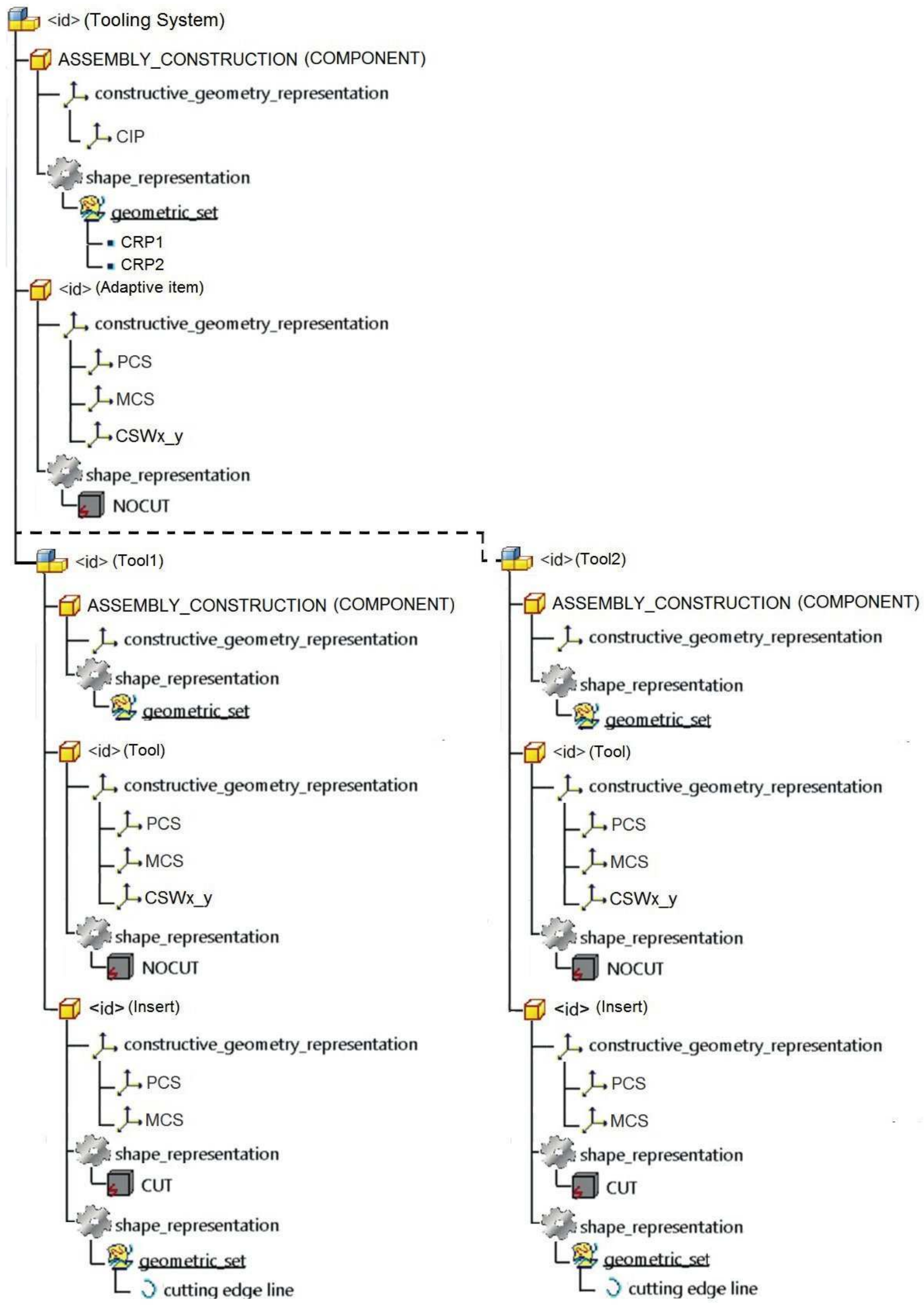


Figure 55 — Basic model

An example of modular tooling system with adjustable cartridge is shown in Figure 56.

For extended STP diagram structure, see Annex B.



Key

<id> product designation

NOTE Solid line means “required”. Dashed line means “if required”.

Figure 56 — Example of template of modular tooling system with adjustable cartridge in a system

The models for modular tooling system with adjustable cartridges shall contain the features given in Table 17.

Table 17 — Models for modular tooling system with adjustable cartridges for boring

Assembly/ component	Geometric elements	Basic STP	Detailed STP
Tooling system (assembly)	Solid body (manifold_solid_brep)	N/A	N/A
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	N/A	N/A
	Geometric_ set	N/A	N/A
Assembly construction (component)	Solid body (manifold_solid_brep)	N/A	N/A
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	CIP	CIP
	Geometric_ set	CRP1 CRP2	CRP1 CRP2
Adaptive item (component)	Solid body (manifold_solid_brep)	NOCUT	NOCUT
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	MCS PCS CSWx_y	MCS PCS CSWx_y
	Geometric_ set	N/A	N/A
Tool (assembly)	Solid body (manifold_solid_brep)	N/A	N/A
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	N/A	N/A
	Geometric_set	N/A	N/A
Assembly construction (Tool component)	Solid body (manifold_solid_brep)	N/A	N/A
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	N/A	N/A
	Geometric_ set	N/A	N/A
Tool (component) As many tools as exists.	Solid body (manifold_solid_brep)	NOCUT	NOCUT
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	MCS PCS CSWx_y	MCS PCS CSWx_y
	Geometric_ set	N/A	N/A
Insert (component)	Solid body (manifold_solid_brep)	CUT As many inserts as exists in one insert level	CUT As many inserts as exists in the tool
	Axis system (Axis2_placement_3d under constructive_ geometry_ representative)	MCS PCS	MCS PCS
	Geometric_ set	Cutting edge line	Cutting edge line

The basic STP model of a tooling system is built as one assembly object (see Figure 57 and Figure 58), containing the following:

a) assembly construction (component):

   1) axis systems:

      i) CIP;

   2) geometric set:

      i) CRP1;

    ii) CRP2;

b) adaptive item (component):

  1) solid body:

    i) NOCUT;

  2) axis systems:

    i) MCS;

    ii) PCS;

    iii) CSWx or CSWx_1;

c) tool(*n) (assembly):

  1) assembly construction (component);

  2) nocut (component):

    i) solid body:

      — NOCUT;

    ii) axis systems:

      — PCS;

      — MCS;

      — CSW CSWx or CSWx_1;

  3) cut (component):

    i) solid body:

      — CUT;

    ii) axis systems:

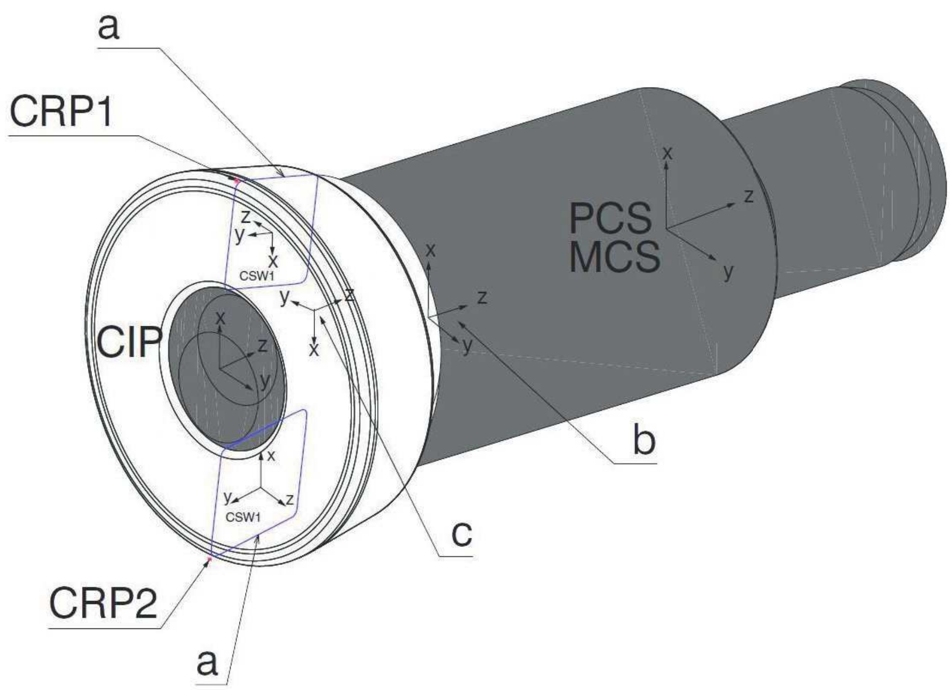
      — PCS;

      — MCS;

    iii) geometric set:

      — cutting edge line (composite curve).

NOTE 1 *n is the number of the tool.



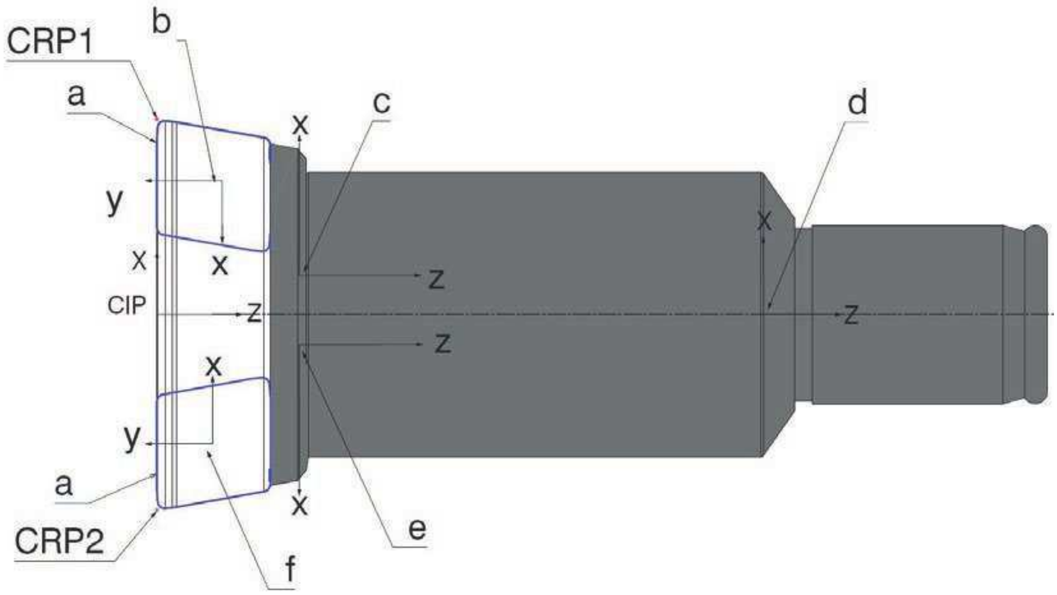
Key

a cutting edge line

b MCS (tool) ; CSW1_1 (adaptive item)

c MCS (tool) ; CSW1_2 (adaptive item)

Figure 57 — Basic STP model built as one assembly object



Key

a	cutting edge line	d	MCS (adaptive item) ; PCS (adaptive item)
b	MCS (insert) ; CSW1_1 (tool)	e	CSW1_2 (adaptive item) ; MCS (tool)
c	MCS (tool) ; CSW1_1 (adaptive item)	f	CSW1_1 (tool) ; MCS (insert)

Figure 58 — Basic STP model built as one assembly object

The detailed STP model of a tooling system is built as one assembly object (see Figure 59 and Figure 60), containing the following:

a) assembly construction (component):

   1) axis systems:

      i) CIP;

   2) geometric set:

      i) CRP1;

      ii) CRP2;

b) adaptive item (component):

   1) solid body:

      i) NOCUT;

   2) axis systems:

      i) MCS;

      ii) PCS;

      iii) CSW CSWx or CSWx_1;

c) tool(*n) (assembly):

   1) assembly construction (component);

2) nocut (component);

i) solid body:

— NOCUT;

ii) axis systems:

— PCS;

— MCS;

— CSW CSWx or CSWx_1;

3) cut (component):

i) solid body:

— CUT;

ii) axis systems:

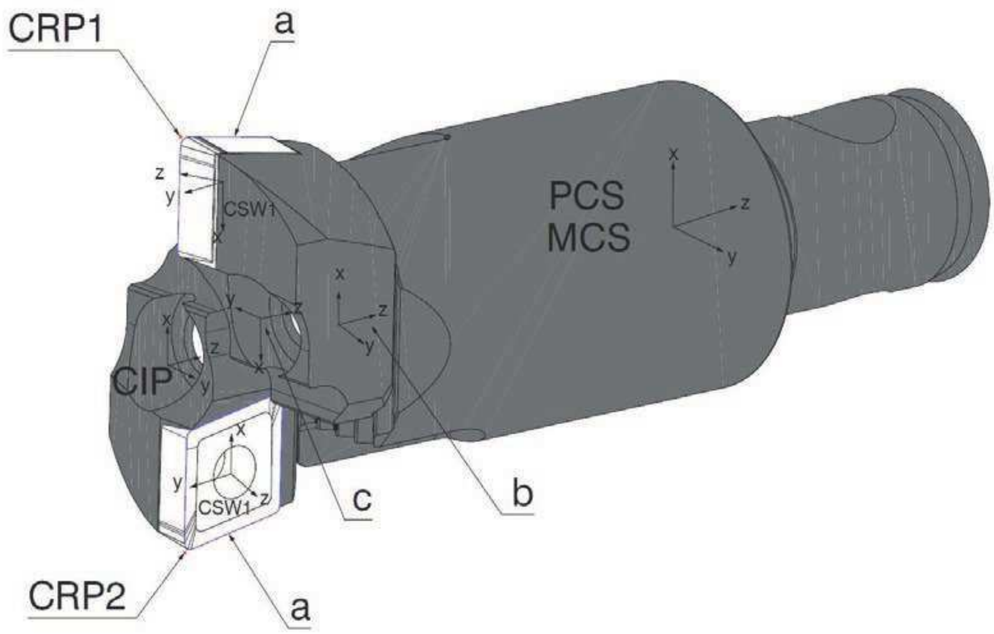
— PCS;

— MCS;

iii) geometric set:

— cutting edge line (composite curve).

NOTE 2 *n is the number of the tool.



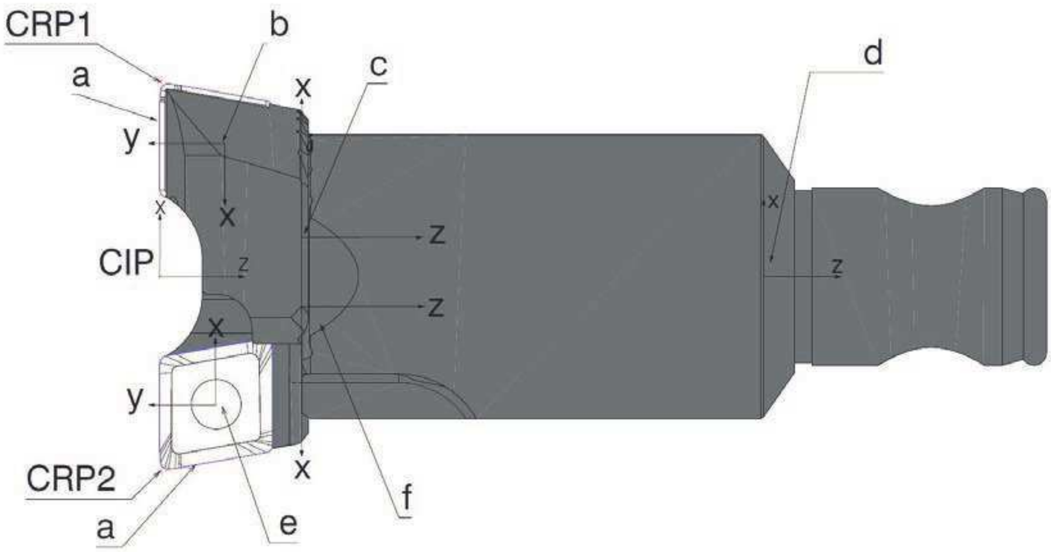
Key

a cutting edge line

b MCS (tool) ; CSW1_1 (adaptive item)

c MCS (tool) ; CSW1_2 (adaptive item)

Figure 59 — Detailed STP model built as one assembly object

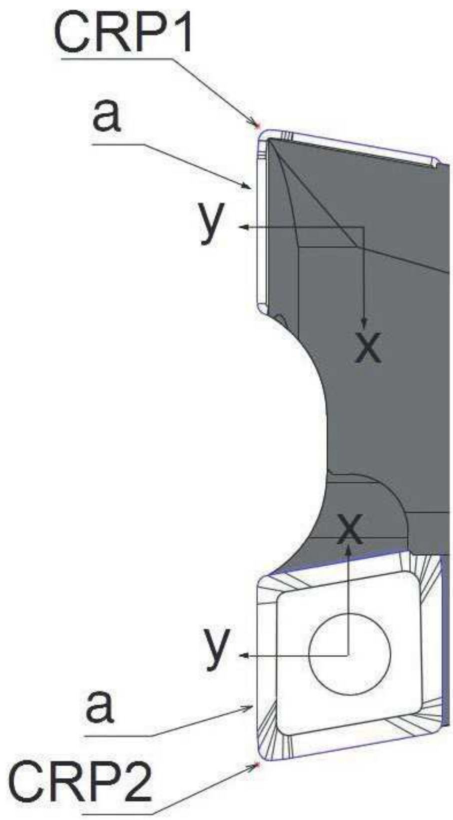


Key

a	cutting edge line	d	MCS (adaptive item) ; PCS (adaptive item)
b	MCS (insert) ; CSW1_1 (tool)	e	CSW1_1 (tool) ; MCS (insert)
c	MCS (tool) ; CSW1_1 (adaptive item)	f	CSW1_2 (adaptive item) ; MCS (tool)

Figure 60 — Detailed STP model built as one assembly object

Figure 61 and Figure 62 provide examples of the CRP point.

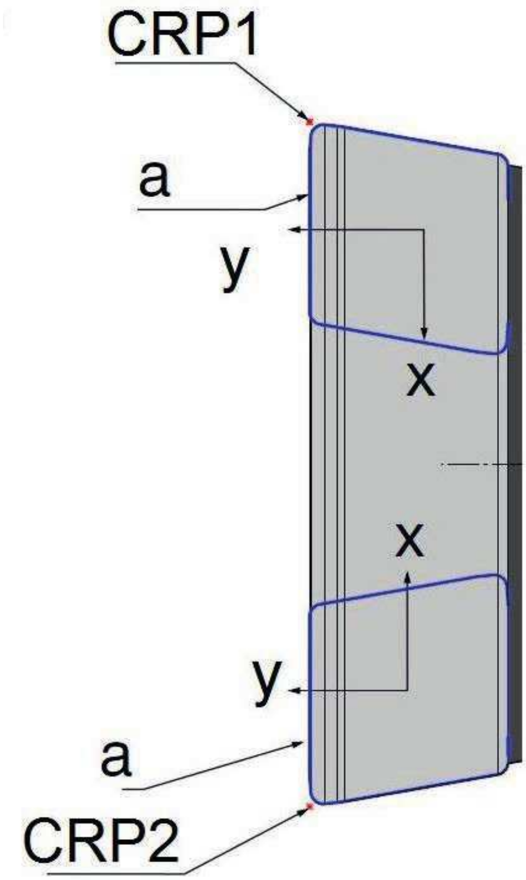


Key

a cutting edge line

NOTE If more than one level exists, CRP is defined as “CRP1”, “CRP2”.

Figure 61 — Examples of the CRP point — Detailed STP



Key

a cutting edge line

NOTE If more than one level exists, CRP is defined as “CRP1”, “CRP2”.

Figure 62 — Examples of the CRP point — Basic STP

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 shows examples of nominal dimensions and sizes.

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

Annex B
(informative)

STP structure

Extended STP diagram structures are given in Figure B.1 to Figure B.4.

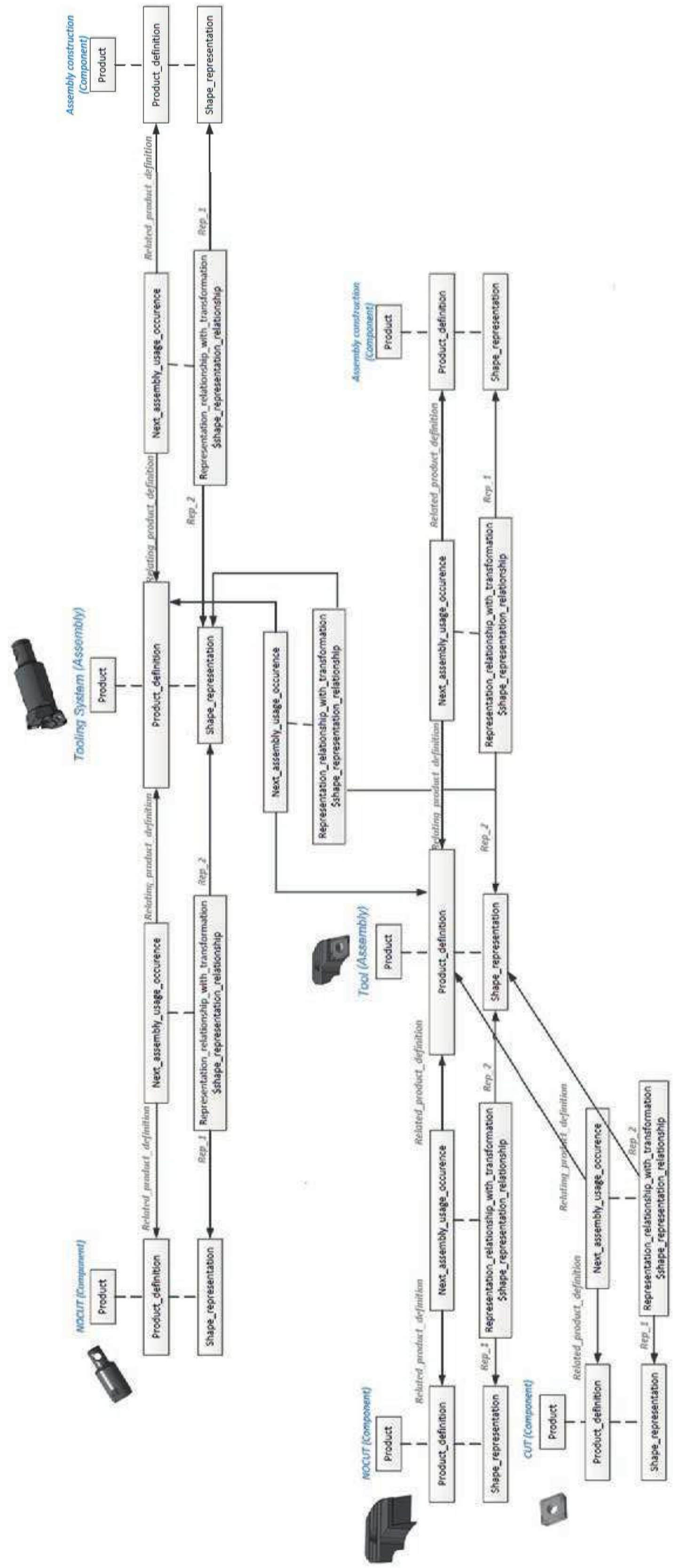
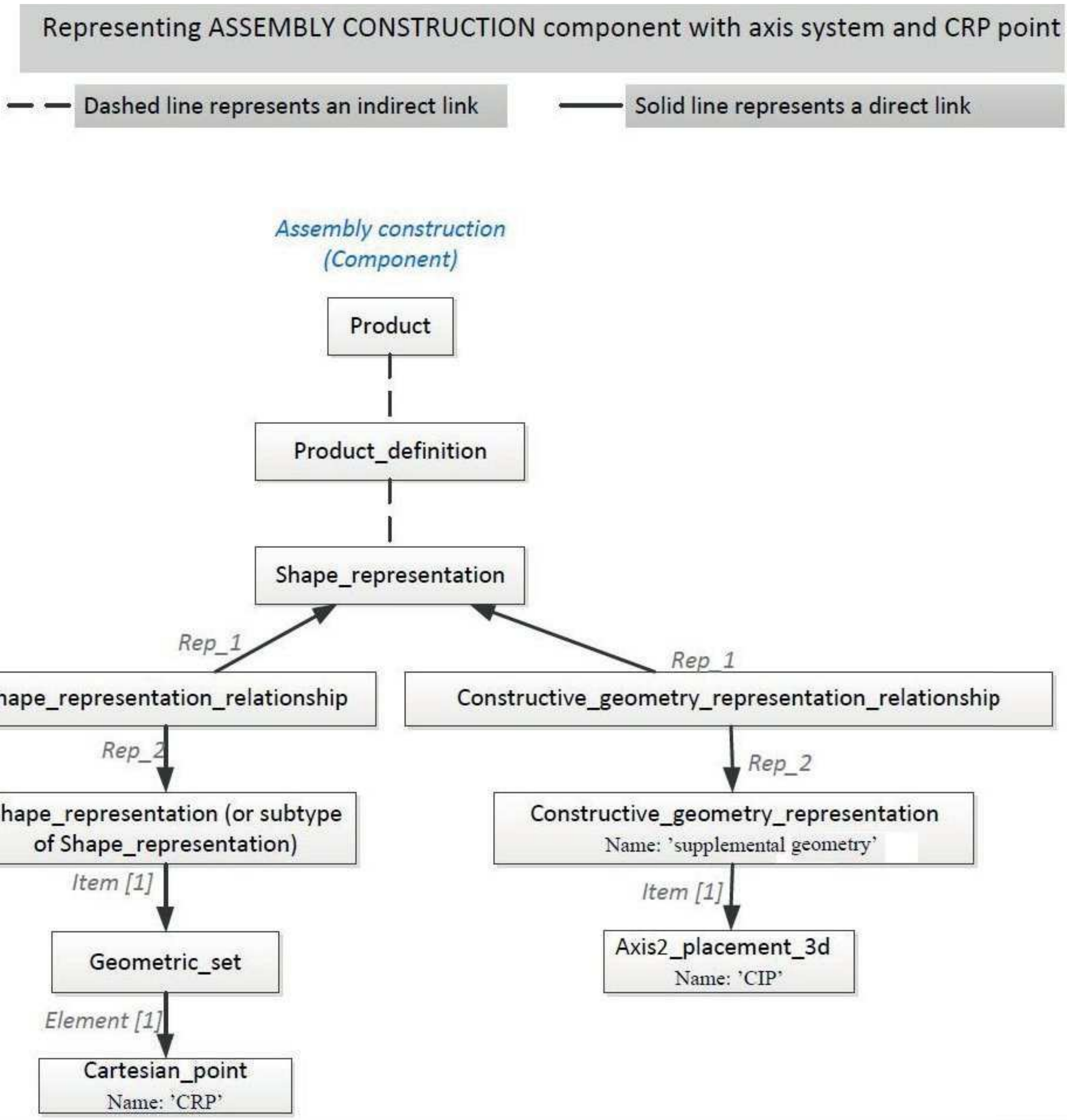
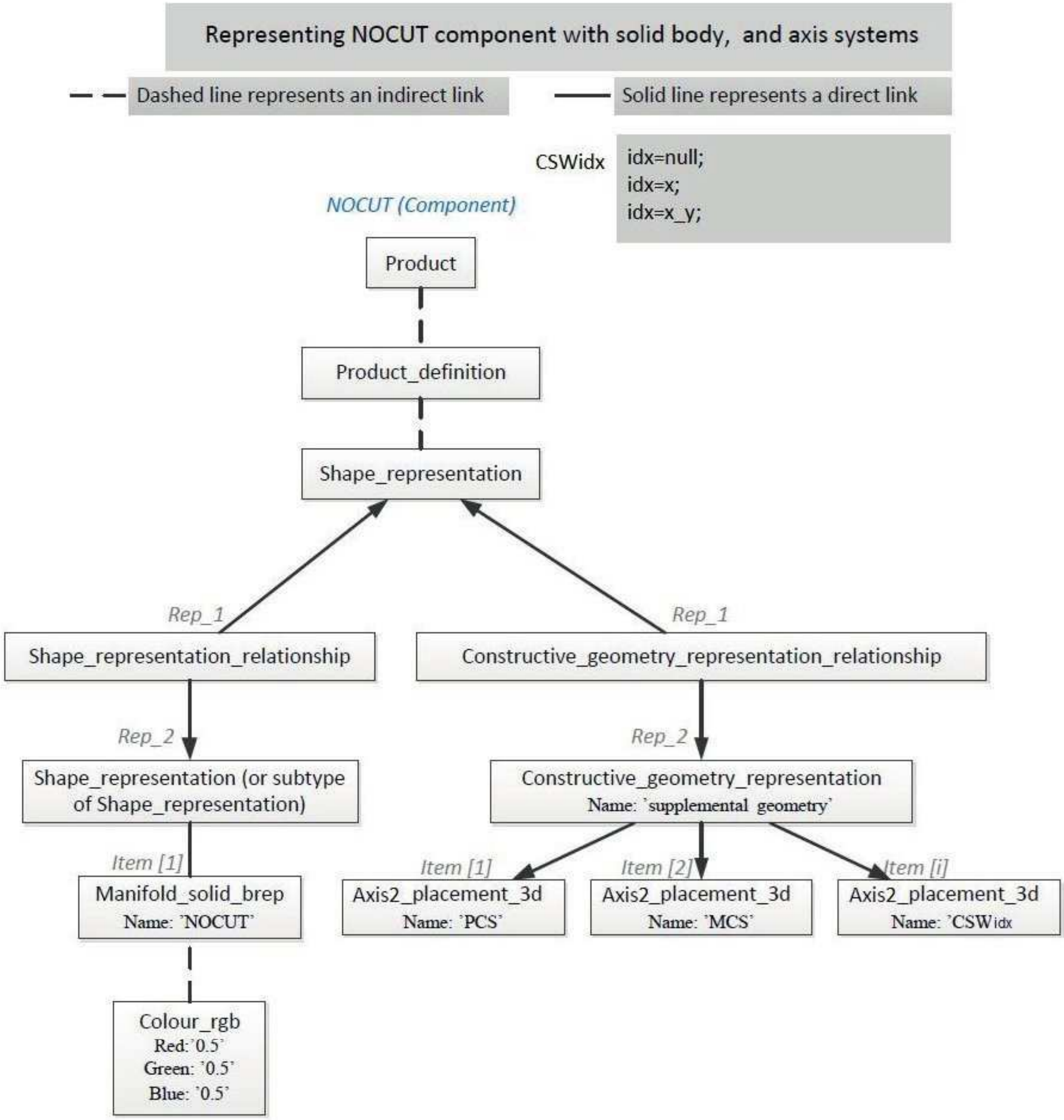


Figure B.1 — Extended STP diagram structure



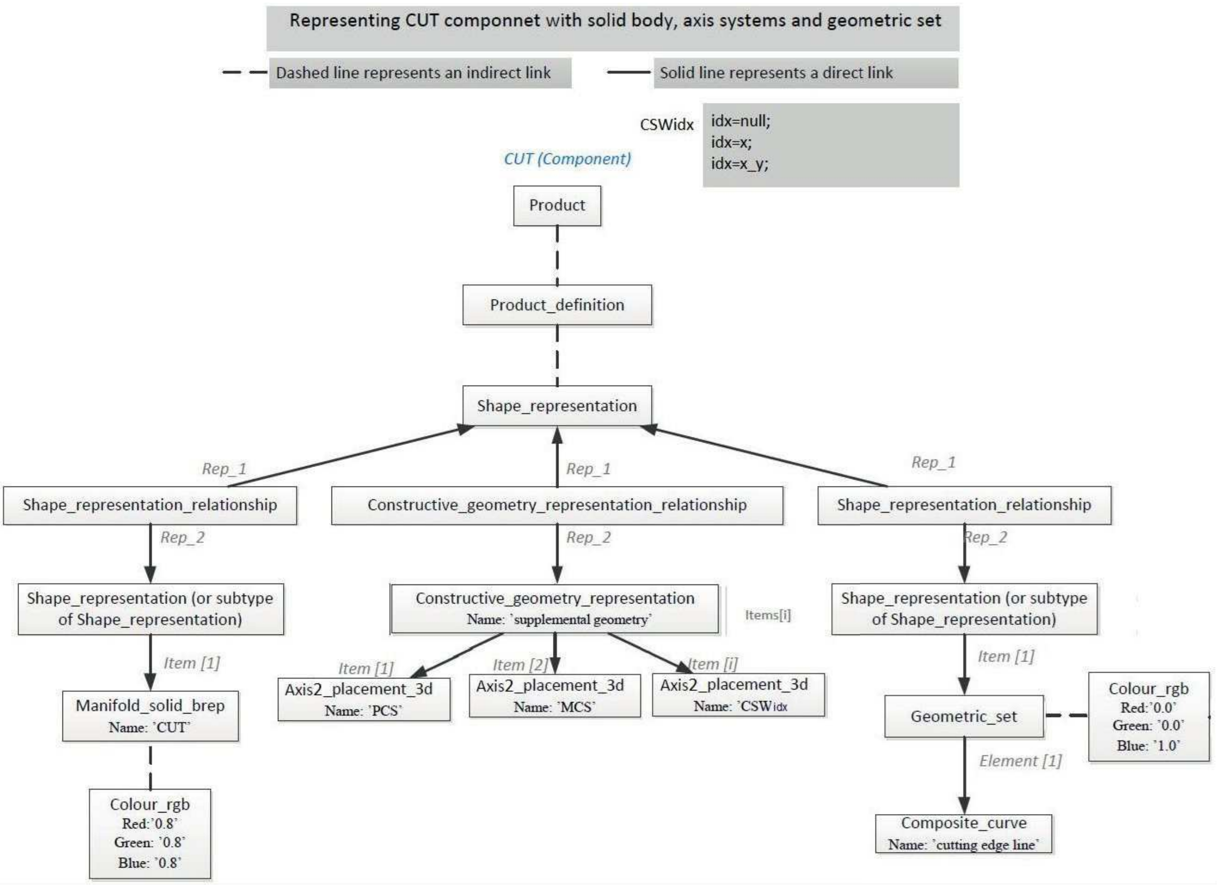
NOTE A solid line represents a direct link. A dashed line represents an indirect link.

Figure B.2 — Assembly construction component with axis system and CRP point



NOTE A solid line represents a direct link. A dashed line represents an indirect link.

Figure B.3 — NOCUT component with solid body and axis systems



NOTE A solid line represents a direct link. A dashed line represents an indirect link.

Figure B.4 — CUT component with solid body, axis systems and geometric set

Bibliography

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

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

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

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

[5] ISO/TS 13399-5, *Cutting tool data representation and exchange — Part 5: Reference dictionary for assembly items*

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

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

[8] ISO/TS 13399-100, *Cutting tool data representation and exchange — Part 100: Definitions, principles and methods for reference dictionaries*

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

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

[11] 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*

[12] ISO 10303-242, *Industrial automation systems and integration — Product data representation and exchange — Part 242: Application protocol: Managed model-based 3D engineering*

ICS 25.100.01; 35.240.50
Price based on 73 pages