
**Cutting tool data representation and
exchange —**

Part 406:
**Creation and exchange of 3D models
— Modelling of connection interface**

*Représentation et échange des données relatives aux outils
coupants —*

*Partie 406: Création et échanges de modèles 3D — Conception
d'interfaces de connexion*

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
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Published in Switzerland

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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).

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

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

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

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

Introduction

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

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

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

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

Cutting tool data representation and exchange —

Part 406:

Creation and exchange of 3D models — Modelling of connection interface

1 Scope

This document defines the concept of how to design the connection interfaces for adaptive and tool items, limited to any kind of standardized connections, together with the usage of the related properties and domains of values.

This document specifies the requirements of simplified 3D models for data exchange of connection interface.

Not all dimensions given in this document are defined in the ISO 13399 series.

The following are outside the scope of this document:

- applications where these standard data can be stored or referenced;
- concept of 3D models for cutting tools;
- concept of 3D models for cutting items;
- concept of 3D models for other connection interfaces not being described in the scope of this document;
- concept of 3D models for adaptive items;
- 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 296, *Machine tools — Self-holding tapers for tool shanks*

ISO 239, *Drill chuck tapers*

ISO 3338 (all parts), *Cylindrical shanks for milling cutters*

ISO 5414-1, *Tool chucks (end mill holders) with clamp screws for flatted cylindrical shank tools — Part 1: Dimensions of the driving system of tool shanks*

ISO 5414-2, *Tool chucks (end mill holders) with clamp screws for flatted cylindrical shank tools — Part 2: Connecting dimensions of chucks and designation*

ISO 6462, *Face and shoulder milling cutters with indexable inserts — Dimensions*

ISO 7388 (all parts), *Tool shanks with 7/24 taper for automatic tool changers*

ISO 9270-1, *7/24 taper spindle noses for automatic tool changers — Part 1: Dimensions and designation of spindle noses of forms S and SF*

ISO 9270-2, *7/24 taper spindle noses for automatic tool changers — Part 2: Dimensions and designation of spindle noses of forms J and JF*

ISO 9766, *Drills with indexable inserts — Cylindrical shanks with a parallel flat*

ISO 10649-1, *Cutter arbors with parallel key and tenon drive — Part 1: General dimensions*

ISO 10897, *Collets for tool holders with taper ratio 1:10 — Collets, holders, nuts*

ISO 10889 (all parts), *Tool holders with cylindrical shank*

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

ISO 12164-2, *Hollow taper interface with flange contact surface — Part 2: Receivers — Dimensions*

ISO 12164-3, *Hollow taper interface with flange contact surface — Part 3: Dimensions of shanks for stationary tools*

ISO 12164-4, *Hollow taper interface with flange contact surface — Part 4: Dimensions of receivers for stationary tools*

ISO 15488, *Collets with 8 degree setting angle for tool shanks — Collets, nuts and fitting dimensions*

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

ISO/TS 13399-401, *Cutting tool data representation and exchange — Part 401: Creation and exchange of 3D models — Converting, extending and reducing adaptive items*

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

ISO 26622-2, *Modular taper interface with ball track system — Part 2: Dimensions and designation of receivers*

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

ISO 26623-2, *Polygonal taper interface with flange contact surface — Part 2: Dimensions and designation of receivers*

3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Abbreviated terms

DCONMS	connection diameter machine side
DM	polygonal diameter according to ISO 26623-1
DF	flange diameter
DIX	maximum body diameter according to the ISO 12164 series
MXA	X-axis of the MCS coordinate system

MYA	Y-axis of the MCS coordinate system
MZA	Z-axis of the MCS coordinate system
LPCON	connection protruding length
LPR	protruding length
LS	shank length
OAL	overall length

5 Starting elements, coordinate systems and planes

5.1 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](#). Deviations within the tolerances are allowed.

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

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

5.2 Reference system (PCS — Primary coordinate system)

The reference system consists of the following standard elements as shown in [Figure 1](#):

- **standard coordinate system:** right-handed rectangular Cartesian system in three dimensional space, called primary coordinate system (PCS);
- **3 orthogonal planes:** planes in the coordinate system that contain the axis of the system, named xy-plane (XYP), xz-plane (XZP) and yz-plane (YZP);
- **3 orthogonal axes:** axes built as intersections of the three orthogonal planes lines respectively, named x-axis (XA), y-axis (YA) and z-axis (ZA).

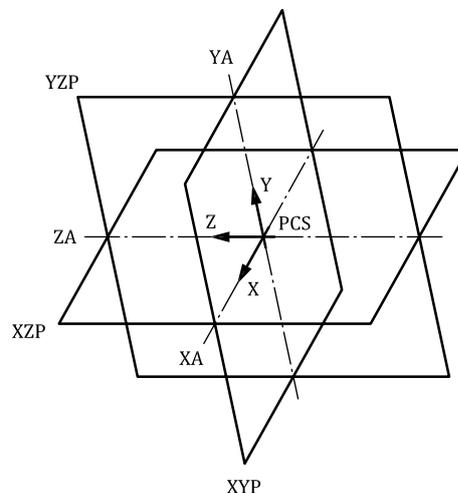


Figure 1 — Primary coordinate system

5.3 Position of the connection interface

5.3.1 General

The definition of the connection interface position — also called the PCS location — in 5.3.2 and 5.3.3 applies to right-handed adaptive or tool items. Left-handed items are as defined for right-handed items but mirrored through the yz-plane.

5.3.2 Prismatic connection interface

The prismatic connection interface shall be as follows:

- the base of the connection interface shall be coplanar with the xz-plane;
- the normal for the base of the connection interface 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 connection interface shall be coplanar with the xy-plane;
- the normal for the end of the connection interface shall be in the $+z$ direction.

5.3.3 Round connection interface

The round connection interface shall be as follows:

- the axis of the connection interface 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 connection interface and the gauge plane or the end of the cylindrical shank shall be coplanar with the xy-plane;
- if there is a bore, then the vector of the bore that points in the $-z$ direction shall also point towards the workpiece side.

5.4 Mounting coordinate system

For virtually mounting of e.g. adaptive items on to another adaptive item to create a complete cutting tool or directly into the machine tool, an additional reference system shall be defined. This reference system is called mounting coordinate system (MCS). It is located at the starting point of the protruding length of the adaptive item. This point is located at the contact surface of the coupling or the gauge plane, or at the standardized shank length of a cylindrical shank.

[Figure 2](#) shows an example of the location of the MCS in relation to the PCS.

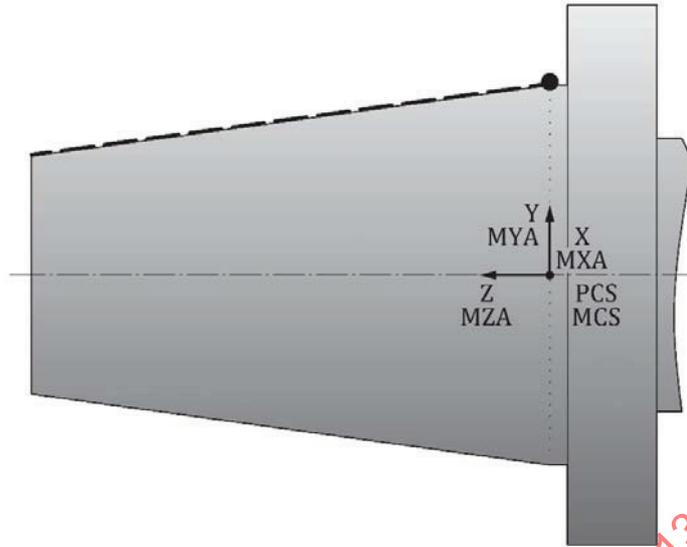


Figure 2 — Example of orientation and location of PCS and MCS

5.5 Planes

The modelling shall take place based on planes according to [Figure 3](#), used as reference, if applicable. Therefore it is assured to be able to vary the model or to suppress single features of independent design features by means of changing the value of one or more parameter of the model design. Furthermore, the identification of the different areas shall be simplified in using the plane concept, even if they contact each other with the same size, e.g. chip flute, shank.

For the 3D visualization of this kind of adaptive items defined in the scope the general planes shall be determined as follows:

- TEP: tool end plane 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;
- LSP: shank length plane referenced to TEP with distance of shank length (LS); it is only applicable if the connection is a kind of cylindrical shank.

Other planes, if necessary, shall be defined in the appropriate clauses. [Figure 3](#) shows an example of determined planes for the design.

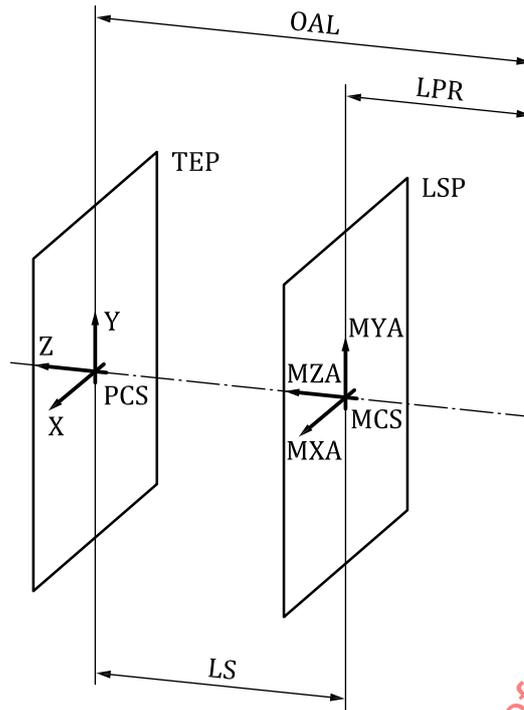


Figure 3 — Example of planes for the design

6 Design of the connection interface

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

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

Connection interfaces shall be built either as rotational symmetric design elements, if they are revolving about their axis, or as extrusion design, if they are designed non-symmetrically, both based on properties in accordance with the individual standards.

Within the following clauses the specific structure of the model of the defined basic shapes of connection interfaces is described.

7 BFA-drill chuck taper

7.1 General

For the design of drill chuck tapers the appropriate standards shall be used. The design is shown on the example of the drill chuck taper according to the ISO 239 style of Morse taper.

7.2 Necessary properties

For the design of the drill chuck taper interface the dimensions for the shank and receiver shall be in accordance with ISO 239. Also, the symbols defined in ISO 239 shall be taken for the design.

7.3 Contours (sketches) for solid bodies

Figure 4 shows the design of the sketch of the shank and Figure 5 shows the sketch of the receiver. The sketches shall be revolved about their z-axis. The design of any details like chamfers, undercuts or roundings of the shank or the receiver shall be waived, if these features are not necessary for the function.

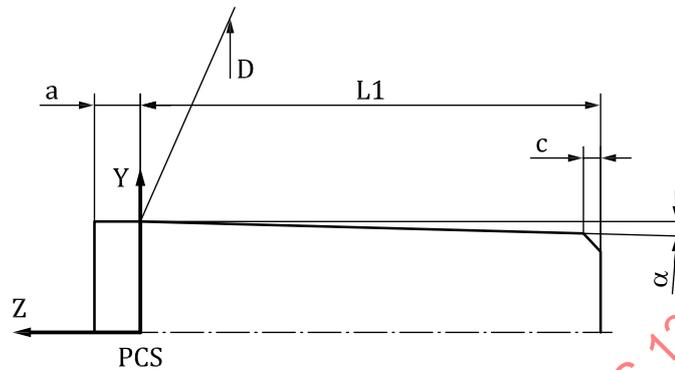


Figure 4 — Design of the sketch for male connection

The design of the flange is only necessary for the right positioning of the solid body for the subtraction from the body of the main item itself. Therefore the dimensions "da" and "b" on the flange are not given in the appropriate standard.

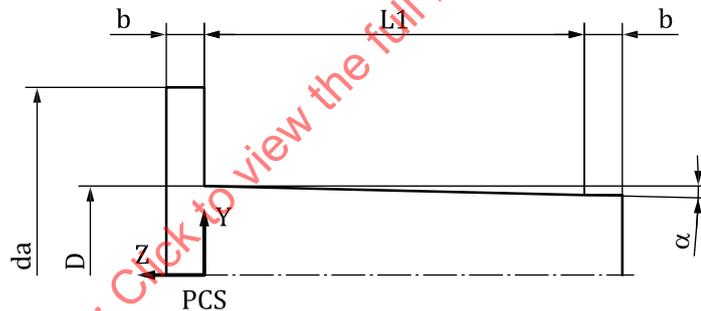


Figure 5 — Design of the sketch for female connection

7.4 Solid bodies of the drill chuck taper

The sketch of each of the connection shall be revolved about its z-axis. Figures 6 and 7 show the created solid body of the male taper and the female taper. The male taper shall be united with the body of the adaptive item while the female taper shall be subtracted from the main body of the tool item.

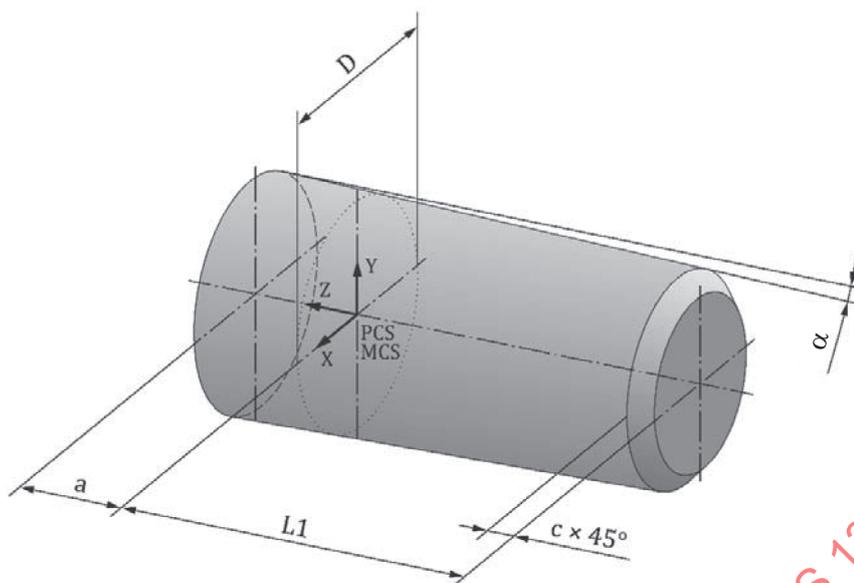


Figure 6 — Solid body of drill chuck taper — Male

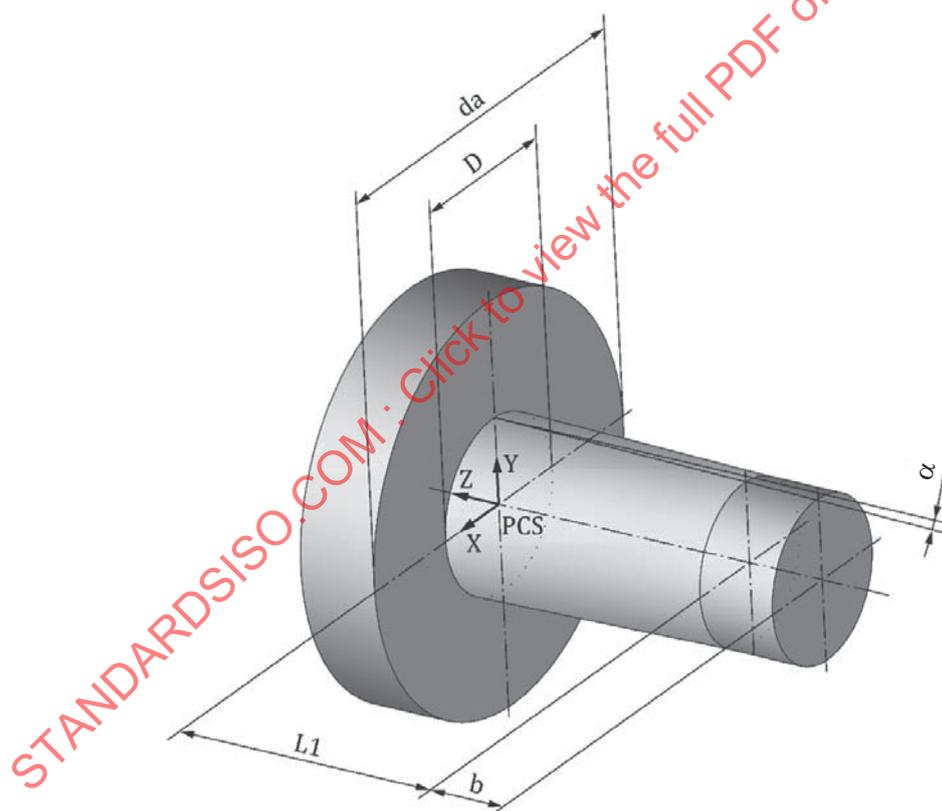


Figure 7 — Solid body of drill chuck taper — Female

[Figure 8](#) shows an example of the female part of a drill chuck taper.

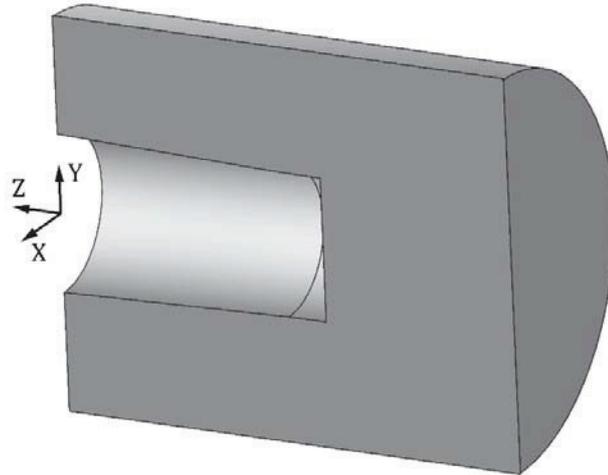


Figure 8 — Drill chuck taper example

8 CCS-polygonal taper interface with flange contact surface

8.1 General

For the design of the polygonal taper interface the dimensions shall be in accordance with ISO 26623-1 for the shank and ISO 26623-2 for the receiver. Also, the symbols defined in ISO 26623-1 and ISO 26623-2 shall be taken into account for the design.

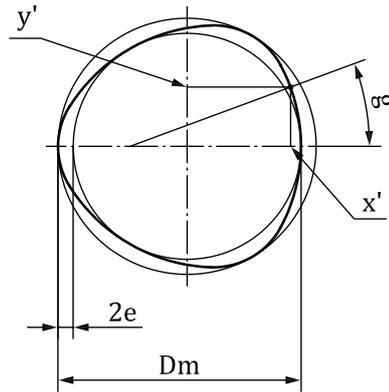
8.2 Necessary properties

See ISO 26623-1 and ISO 26623-2 for the properties needed for the design of the interface model

8.3 Contours (sketches) for solid bodies

8.3.1 Outside sketch

[Figure 9](#) shows the design of the polygonal cross section of the shank and receiver. The sketch shall be extruded to the given shank length or receiver depth. The design of any details like chamfers, undercuts or roundings of the shank or receiver shall be waived.



Key

$$x' = Dm / 2 * \cos(g) - 2 * e * \cos(2 * g) + e * \cos(4 * g)$$

$$y' = Dm / 2 * \sin(g) + 2 * e * \sin(2 * g) + e * \sin(4 * g)$$

Figure 9 — Design of the polygonal cross section of the taper

The extrusion of the tapered section of the shank shall be done in both directions along the z-axis starting at the distance L1 from the PCS:

- one part of the extrusion shall go in +Z-direction with the length of L2-L1;
- the second part shall go in -Z-direction with the length of L1.

Figure 10 shows the dimensions for the extrusion.

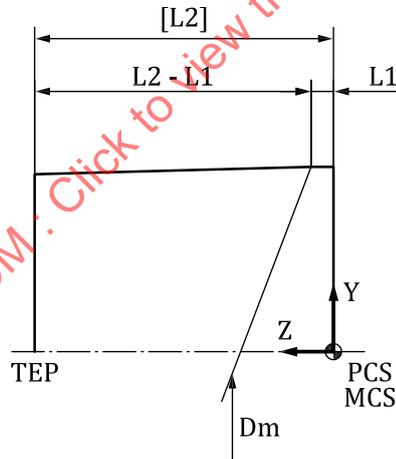


Figure 10 — Visualization of the extrusion of the taper cross section sketch

8.3.2 Inside sketch

If necessary, the sketch of the inside contour shall also be designed using the appropriate dimensions. Figure 11 shows the sketch that shall be revolved about its z-axis to get the body for subtraction from the outside body. Only the core hole of the thread shall be designed.

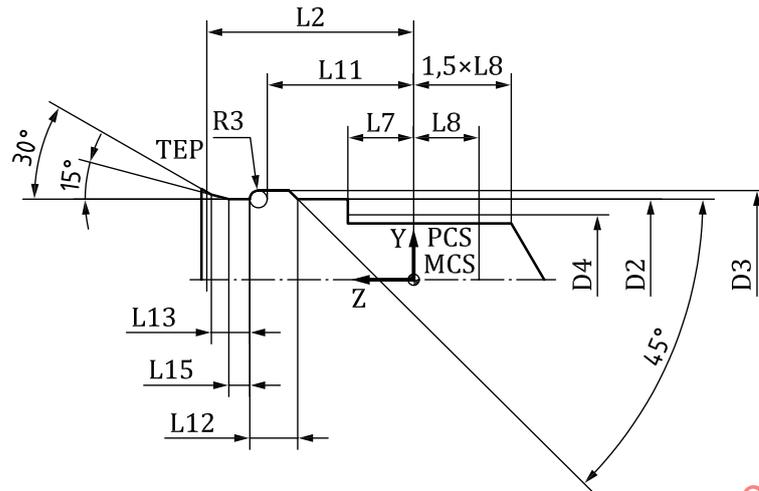


Figure 11 — Sketch of the inside contour

8.4 Solid bodies of the polygonal taper

8.4.1 Tapered shank

Both extruded bodies shall be united as shown in [Figure 12](#).

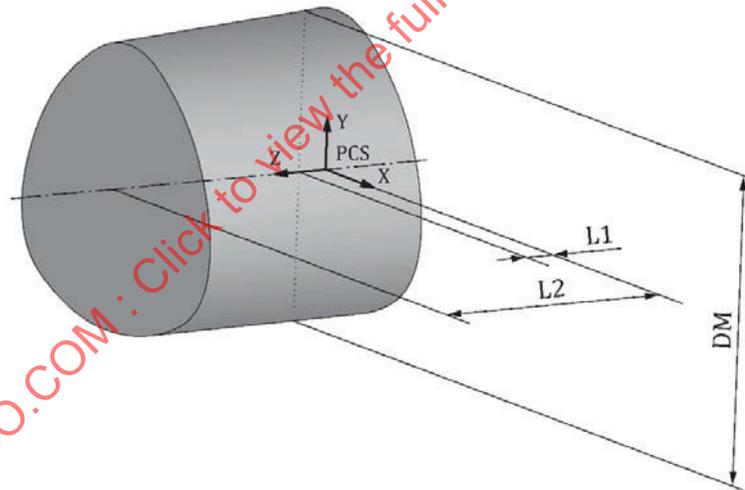


Figure 12 — Tapered shank

8.4.2 Internal contour

After revolving the sketch of the internal contour about its z-axis the body for subtraction is shown in [Figure 13](#). The internal contour shall be used only for the shank type connection.

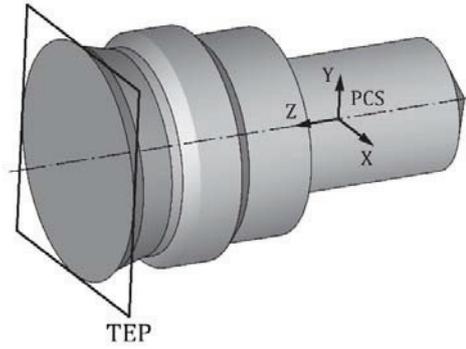


Figure 13 — Internal contour of polygonal taper

8.4.3 Flange and tool changer grooves

The flange of the connection with the tool changer grooves shall be united with the tapered shank. [Figure 14](#) shows the united connection. The distance from the MCS to the surface that is closest to the workpiece shall be named as connection protruding length. At that surface the solid body of the tool item or adaptive item shall be mated.

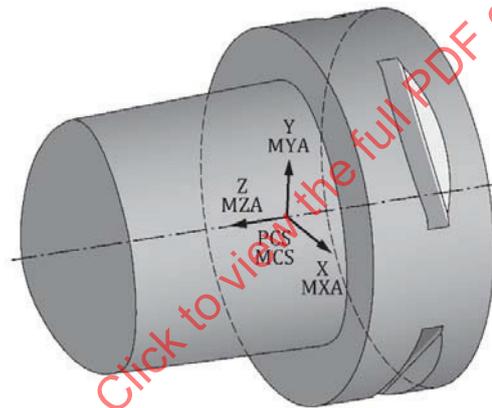


Figure 14 — Polygonal taper interface without internal contour

8.4.4 Completed polygonal taper shank

[Figure 15](#) shows the completed polygonal taper interface with the internal contour, flange and tool changer grooves. The dimensions shall be taken from ISO 26623-1, where $D_{CONMS} = d_1$ and $L_{PCON} = L_3$.

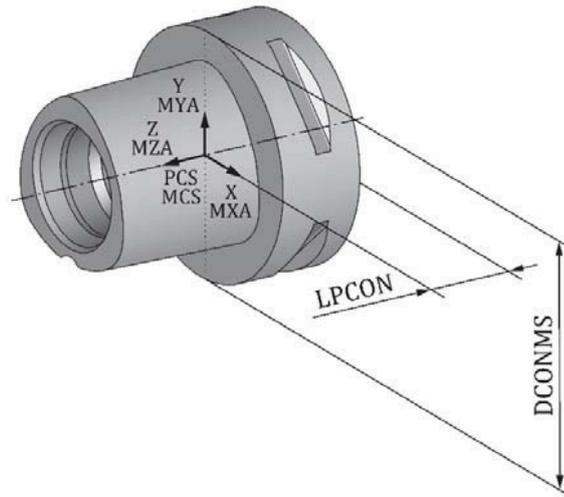


Figure 15 — Completed polygonal taper shank

8.4.5 Tapered hole of receiver

See [8.3.1](#) for the design of the sketch (contour) and [8.4.1](#) for extrusion of the tapered polygonal hole.

8.4.6 Completed polygonal receiver

For the design of a polygonal receiver the appropriate solid body shall be designed to be subtracted from the adaptive item. This solid body shall be filled as a feature for further usage. [Figure 16](#) shows the solid body for the subtraction.

The use of solid bodies of connections for subtraction on an adaptive item shall be in accordance with ISO/TS 13399-401.

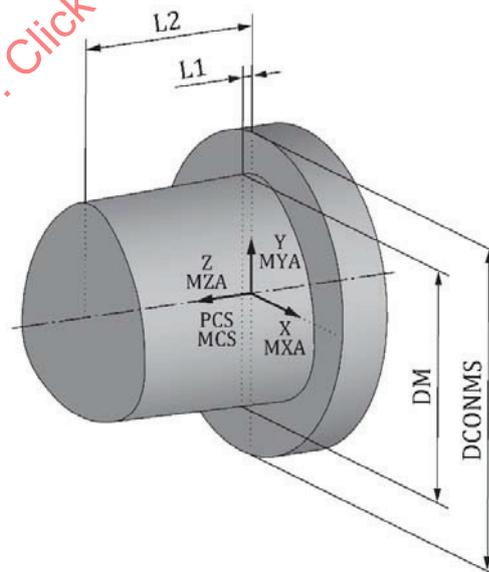


Figure 16 — Solid body for subtraction

An example of polygonal taper receiver is shown in [Figure 17](#).

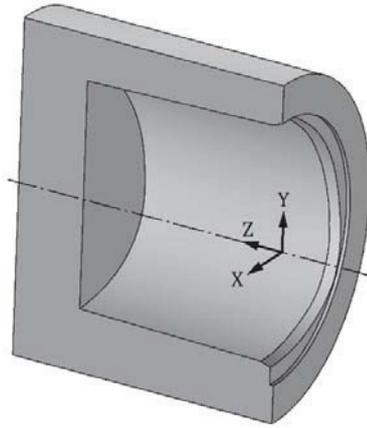


Figure 17 — Polygonal taper receiver example

9 FDA-milling arbour connection

9.1 General

The design of the milling arbour connection shall be in accordance with ISO 10649-1 for the connection on workpiece side and ISO 6462 for the connection on machine side.

9.2 Necessary properties

See ISO 6462 and ISO 10649-1 for the properties needed for the design of the connection interface features.

9.3 Contours (sketches) for solid bodies

9.3.1 Sketch for connection on workpiece side

Figure 18 shows the design of the sketch of the connection on workpiece side. The sketch shall be revolved about its z-axis. The design of any details like chamfers, undercuts or roundings of the connection shall be waived.

The dimension d_{3x} shall be the drilling diameter of the thread diameter d_3 .

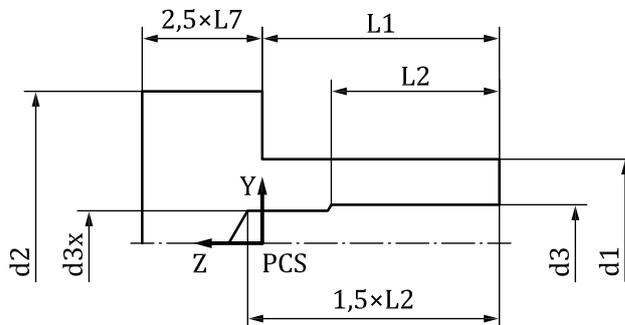


Figure 18 — Sketch of the contour

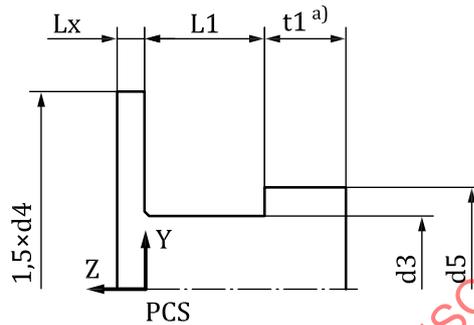
9.3.2 Sketch for connection on machine side

[Figure 19](#) shows the design of the sketch of the connection on machine side for the use of a cutter retaining screw.

[Figure 20](#) shows the sketch of the same connection, but for the use of a head cap screw.

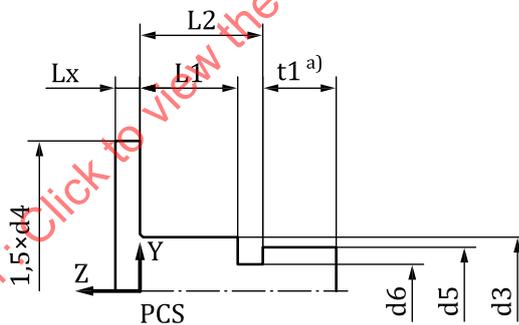
[Figure 21](#) shows the sketch of the connection for the use on full or half side face milling cutters with the use of a nut on milling machine arbours.

The dimension L_x shall be taken upon the designer's discretion.



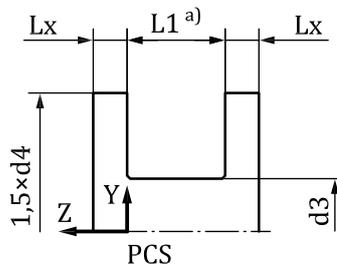
^a Variable: cutter overall length minus L_1 .

Figure 19 — Sketch of connection for cutter retaining screw



^a Variable: cutter overall length minus L_2 .

Figure 20 — Sketch of connection for head cap screw



^a Variable: cutter overall length.

Figure 21 — Sketch of connection for the use of arbour nuts

9.4 Solid bodies of the connection

9.4.1 Solid body for connection on workpiece side

After revolving the sketch (see [Figure 18](#)) about its z-axis the solid model of the milling arbour connection with longitudinal key drive is shown in [Figure 22](#) and the milling arbour with transverse drive key is shown in [Figure 23](#).

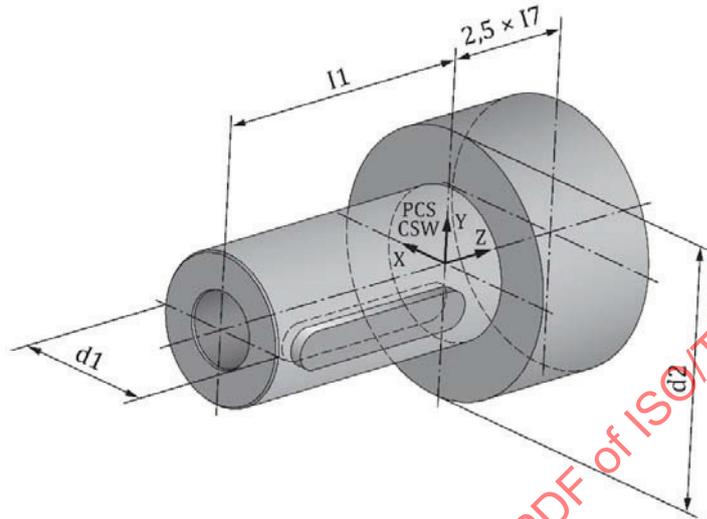


Figure 22 — FDA-connection workpiece side with longitudinal drive key

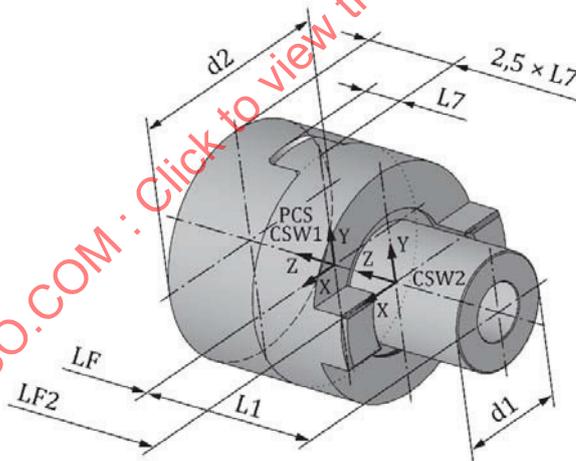


Figure 23 — FDA-connection workpiece side with transverse drive key

9.4.2 Solid body for connection on machine side

In case of similar design method only the design of an FDA-connection on machine side for the use of cutter retaining screw is described. The other possible styles of this connection shall follow the same design method.

[Figure 24](#) shows the solid model of the FDA connection for the subtraction from the basic model of a milling cutter.

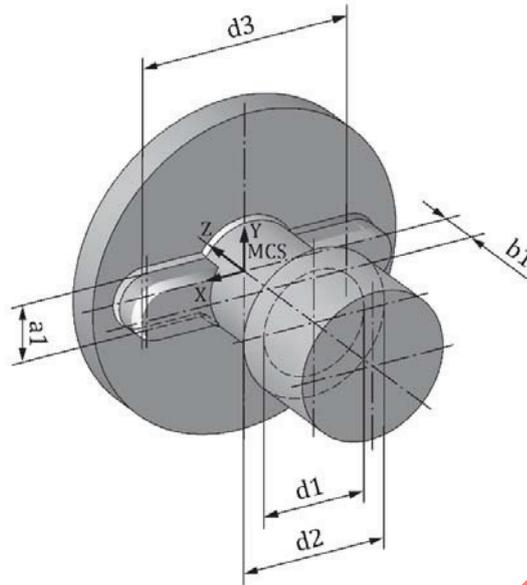


Figure 24 — Subtraction model of FDA connection

Figure 25 shows the example of a variant FDA-02 milling arbour connection on a face and side milling cutter after the subtraction of the solid model of the connection.



Figure 25 — Variant FDA-02 after subtraction from milling cutter body

10 HSK-hollow taper interface with flange contact

10.1 General

For the design of the hollow taper interface the dimensions shall be in accordance with:

- ISO 12164-1 for the shank and ISO 12164-2 for the receiver on rotational tools, or
- ISO 12164-3 for the shank and ISO 12164-4 for the receiver on stationary tools.

Also, the symbols defined in the ISO 12164 series shall be taken into account for the design. The difference between rotationally and stationary HSK connection for automatic tool change is the tolerance of the drive key and therefore the design of this variant is not shown.

10.2 Necessary properties

See the ISO 12164 series for the properties needed for the design of the interface model.

10.3 Contours (sketches) for solid bodies

10.3.1 Outside sketch

Figure 26 shows the design of the sketch of the shank and Figure 27 shows the design of the sketch of the receiver. The sketches shall be revolved about their z-axis. The design of any details like chamfers, undercuts or roundings of the shank or the receiver shall be waived, if these details are not listed in the tables. Missing dimensions for the design of the sketch shall be taken from the ISO 12164 series.

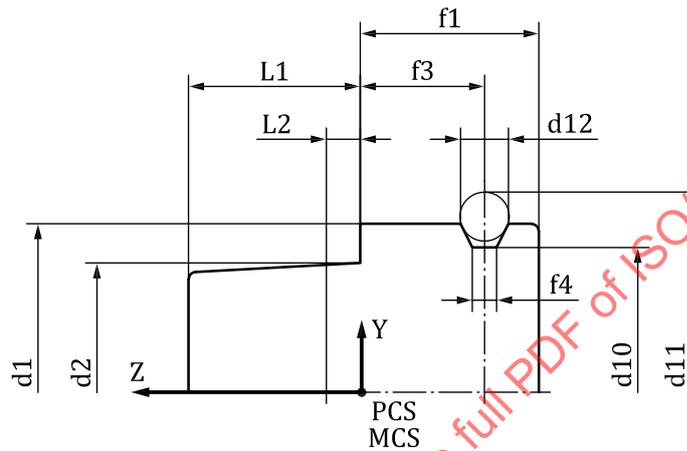


Figure 26 — Design of the sketch for the male connection

The design of the flange on the female connection is only necessary for the right positioning of the solid body for the subtraction from the body of the main item itself. Therefore the dimensions “da” and “b” on the flange are not given in the appropriate standard, however it is recommended to calculate them as follows:

$$da = 1,5 \times DCONMS$$

$$b = 0,1 \times DCONMS$$

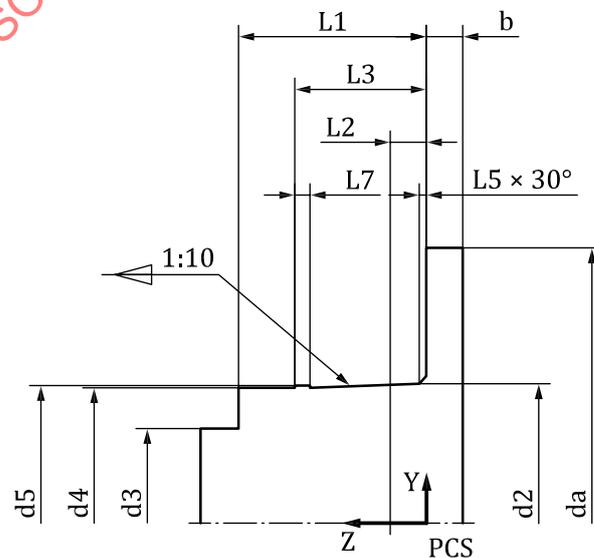


Figure 27 — Design of the sketch for the female connection

10.3.2 Inside sketch

If necessary, the sketch of the inside contour shall also be designed using the appropriate dimensions. [Figure 28](#) shows the sketch to be revolved about its z-axis to get the body for subtraction from the outside body. Only the core hole of the thread shall be designed.

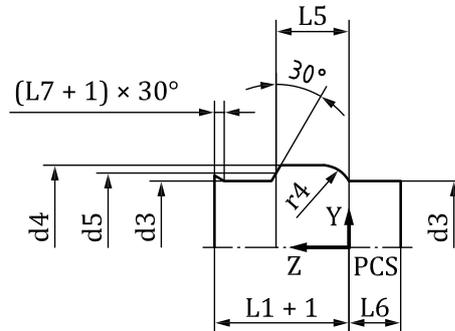


Figure 28 — Sketch of the inside contour

10.4 Solid bodies of the hollow taper interface with flange contact

10.4.1 Solid body for connection on machine side

The revolved body of the HSK connection without the internal contour is shown in [Figure 29](#). The distance from the MCS to the surface that is closest to the workpiece shall be named as connection protruding length. At that surface the solid body of the tool item or adaptive item shall be mated.

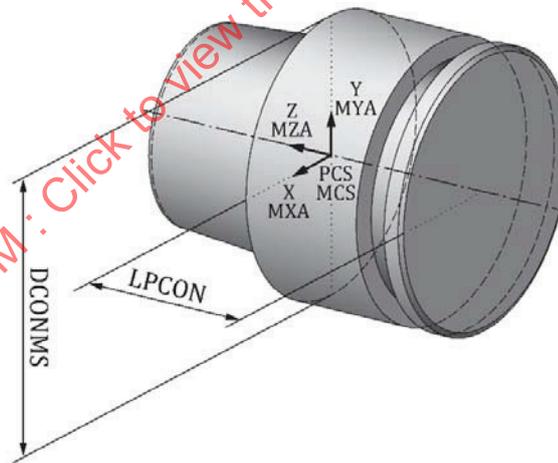


Figure 29 — Hollow taper interface without internal contour

After revolving the sketch of the internal contour about its z-axis the body for subtraction is shown in [Figure 30](#). The internal contour shall be used only for the shank type connection.

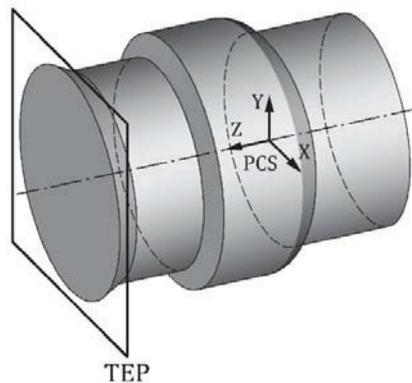


Figure 30 — Internal contour of hollow taper shank

Figure 31 shows the completed hollow taper interface with the internal contour, flange and tool changer grooves. The dimensions shall be in accordance with ISO 12164-1 or ISO 12164-3, where $DCONMS = d1$ and $LPCON = f1$. The model is shown with its drive key and tool change feature.

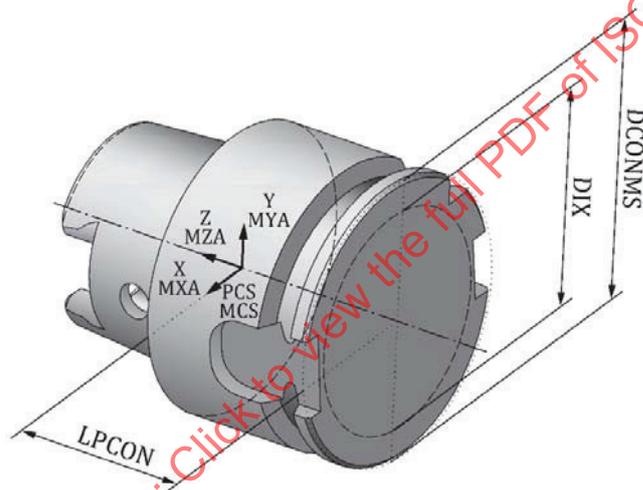


Figure 31 — Completed hollow taper shank

10.4.2 Solid body for connection on workpiece side

For the design of a hollow taper receiver the appropriate solid body shall be designed to be subtracted from the adaptive item. This solid body shall be filled as a feature for further usage.

Figure 32 shows the solid body for the subtraction, created from the sketch and revolved about its z-axis.

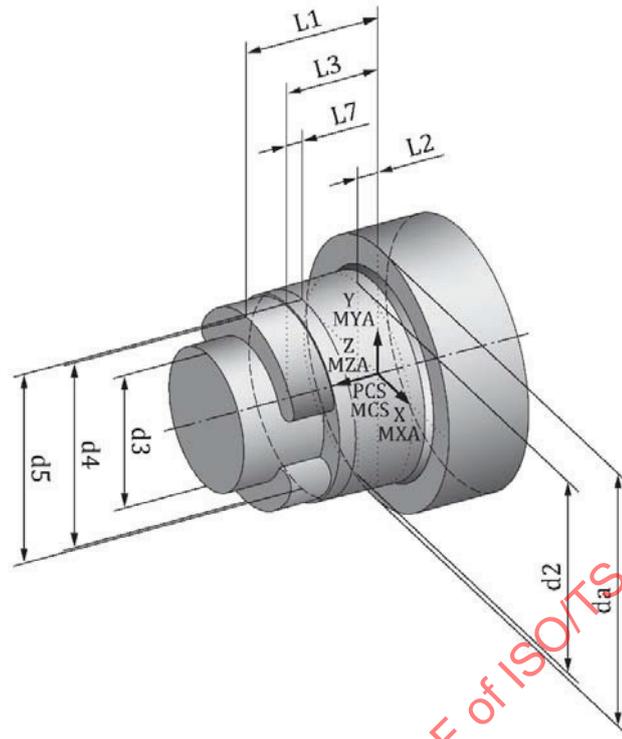


Figure 32 — Solid body for subtraction

One example of a hollow taper receiver is shown in [Figure 33](#).

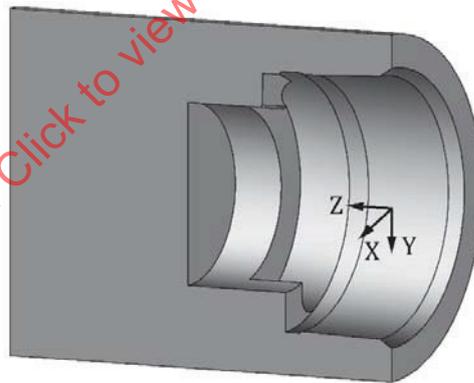


Figure 33 — Hollow taper receiver

11 KMT-modular taper interface with ball track system

11.1 General

For the design of the modular taper with ball track system interface the dimensions shall be in accordance with ISO 26622-1 for the shank and ISO 26622-2 for the receiver. Also, the symbols defined in ISO 26622-1 and ISO 26622-2 shall be taken into account for the design.

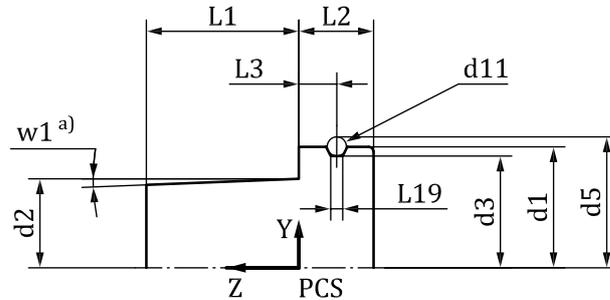
11.2 Necessary properties

See ISO 26622-1 and ISO 26622-2 for the properties needed for the design of the interface model.

11.3 Contours (sketches) for solid bodies

11.3.1 Outside sketch

Figure 34 shows the design of the sketch of the shank and Figure 35 shows the design of the sketch of the receiver. The sketches shall be revolved about their z-axis. The design of any details like chamfers, undercuts or roundings of the shank or the receiver shall be waived. Missing dimensions for the design of the sketch shall be in accordance with ISO 26622-1 and ISO 26622-2.



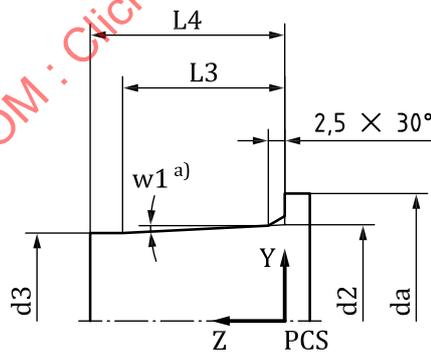
a Half taper angle from ISO 26622-1:2017, Figure 1.

Figure 34 — Design of the sketch for the male connection

The design of the flange on the female connection is only necessary for the right positioning of the solid body for the subtraction from the body of the main item itself. Therefore the dimensions “da” and “b” on the flange are not given in the appropriate standard, but it is recommended to calculate them as follows:

$$da = 1,5 \times DCONMS$$

$$b = 0,1 \times DCONMS$$

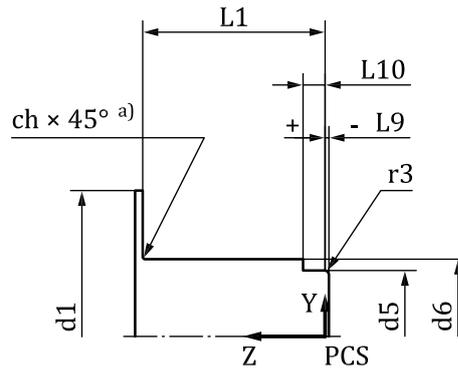


a Half taper angle from ISO 26622-2:2018, Figure 1.

Figure 35 — Design of the sketch for the female connection

11.3.2 Inside sketch

If necessary, the sketch of the inside contour shall also be designed using the appropriate dimensions. Figure 36 shows the sketch that shall be revolved about its z-axis to get the body for subtraction from the outside body. Only the core hole of the thread shall be designed.



a $ch \times 45^\circ$ is not given in ISO 26622-1; it is upon the designer's discretion.

Figure 36 — Sketch of the inside contour

11.4 Solid bodies of the modular taper with ball track system

11.4.1 Solid body for connection on machine side

The revolved body of the KMT connection without the internal contour is shown in [Figure 37](#). The distance from the MCS to the surface that is closest to the workpiece shall be named as connection protruding length. At that surface the solid body of the tool item or adaptive item shall be mated.

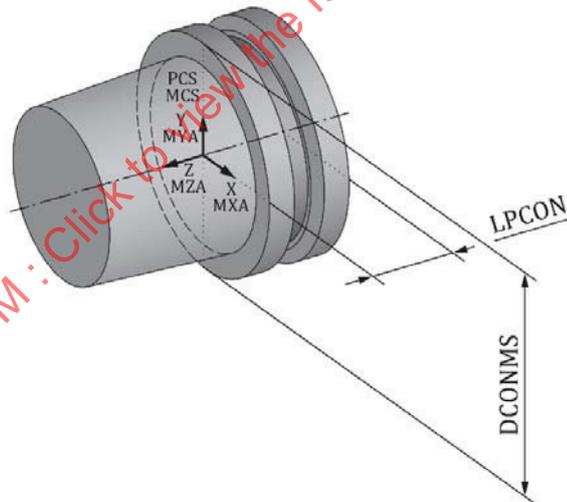


Figure 37 — Modular taper interface without internal contour

After revolving the sketch of the internal contour about its z-axis the body for subtraction is shown in [Figure 38](#). The internal contour shall be used only for the shank type connection.

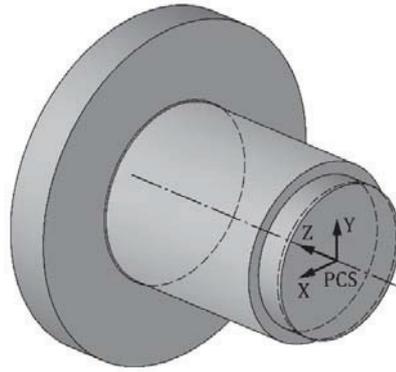


Figure 38 — Internal contour of modular taper shank

Figure 39 shows the completed modular taper interface with the internal contour, flange and tool changer grooves. The dimensions shall be in accordance with ISO 26622-1 or ISO 26622-2, where $DCONMS = d1$ and $LPCON = L2$. The model is shown with its drive key and tool change feature.

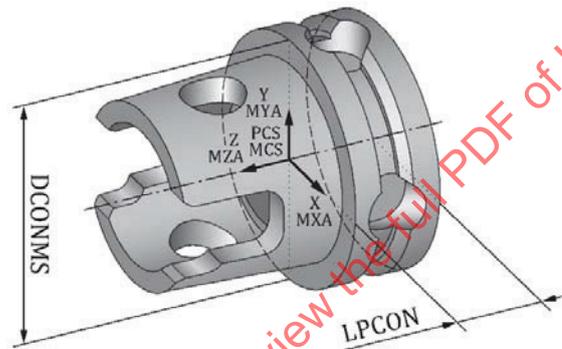


Figure 39 — Completed modular taper with ball track system

11.4.2 Solid body for connection on workpiece side

For the design of a modular taper receiver the appropriate solid body shall be designed to be subtracted from the adaptive item. This solid body shall be filled as a feature for further usage. Figure 40 shows the solid body for the subtraction, created from the sketch and revolved about its z-axis.

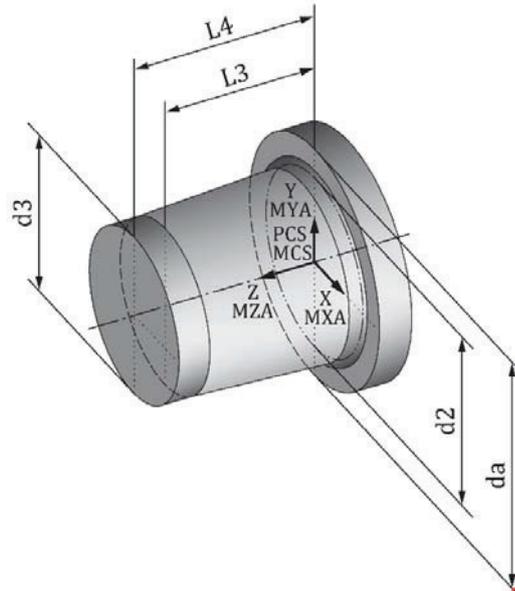


Figure 40 — Solid body for subtraction

One example of a modular taper receiver is shown in [Figure 41](#).

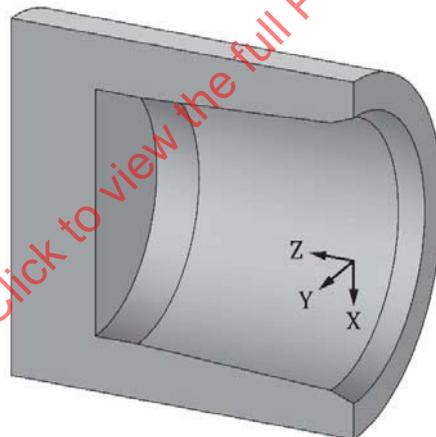


Figure 41 — Modular taper receiver

12 MEG/MKG-metric/Morse taper

12.1 General

For the design of the metric or Morse taper interface the dimensions for the shank and the receiver shall be in accordance with ISO 296. Also, the symbols defined in ISO 296 shall be taken into account for the design.

For the illustration of the design of the model only the Morse taper with tapped hole is shown. Other styles shall be designed accordingly.

12.2 Necessary properties

See ISO 296 for the properties needed for the design of the interface model.

12.3 Contours (sketches) for solid bodies

12.3.1 Outside sketch

Figure 42 shows the design of the sketch of the shank and Figure 43 shows the design of the sketch of the receiver. The sketches shall be revolved about their z-axis. The design of any details like chamfers, undercuts or roundings of the shank or the receiver shall be waived, if these details are not listed in the tables. Missing dimensions for the design of the sketch shall be taken from ISO 296.

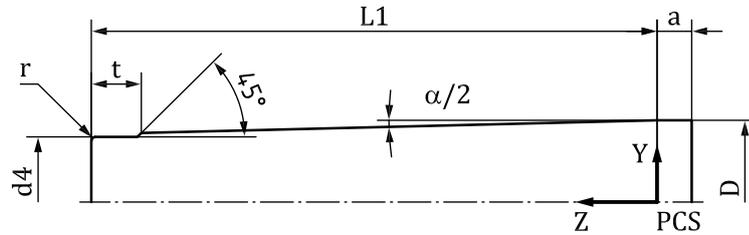


Figure 42 — Design of the sketch for the male connection

The design of the flange on the female connection is only necessary for the right positioning of the solid body for the subtraction from the body of the main item itself. Therefore the dimensions “da” and “b” on the flange are not given in the appropriate standard, but it is recommended to calculate them as follows:

$$da = 2 \times D$$

$$b = 0,1 \times D$$

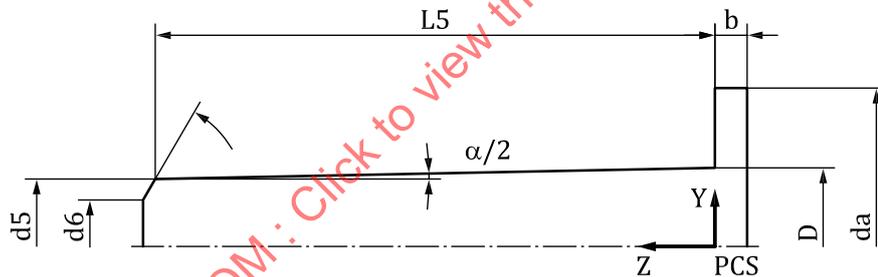
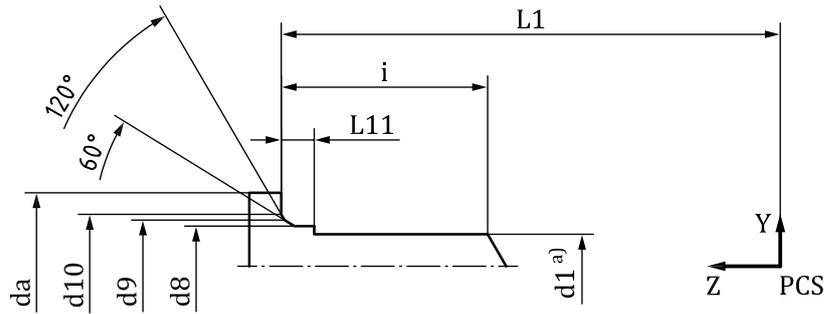


Figure 43 — Design of the sketch for the female connection

12.3.2 Inside sketch

If necessary, the sketch of the inside contour shall also be designed using the appropriate dimensions. Figure 44 shows the sketch that shall be revolved about its z-axis to get the body for subtraction from the outside body. Only the core hole of the thread shall be designed.



a Core hole of thread.

Figure 44 — Sketch of the inside contour

12.4 Solid bodies of the metric or Morse taper

12.4.1 Solid body for connection on machine side

The revolved body of the MKG connection with tapped hole, but without the internal contour, is shown in [Figure 45](#). The distance from the MCS to the surface that is closest to the workpiece shall be named as connection protruding length. At that surface the solid body of the tool item or adaptive item shall be mated.

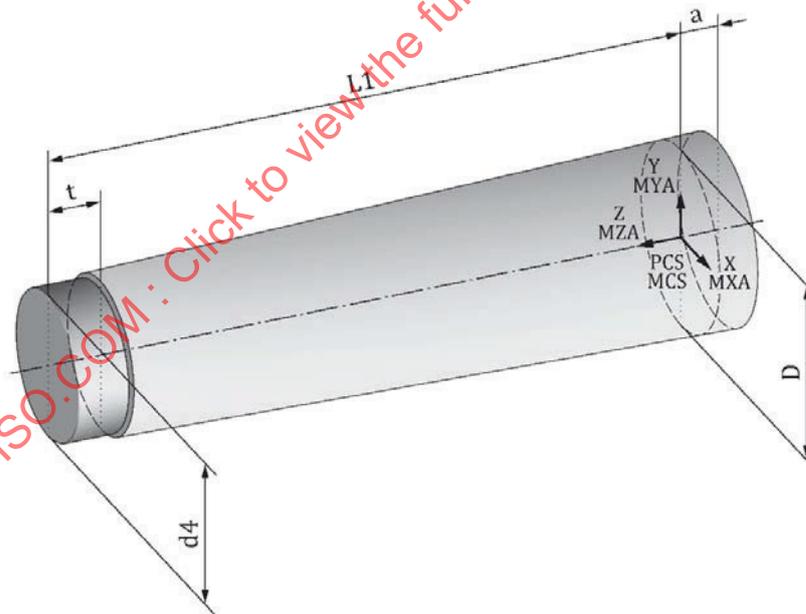


Figure 45 — Morse taper interface with attachment thread and without internal contour

After revolving the sketch of the internal contour about its z-axis the body for subtraction is shown in [Figure 46](#). The internal contour shall be used only for the shank type connection.

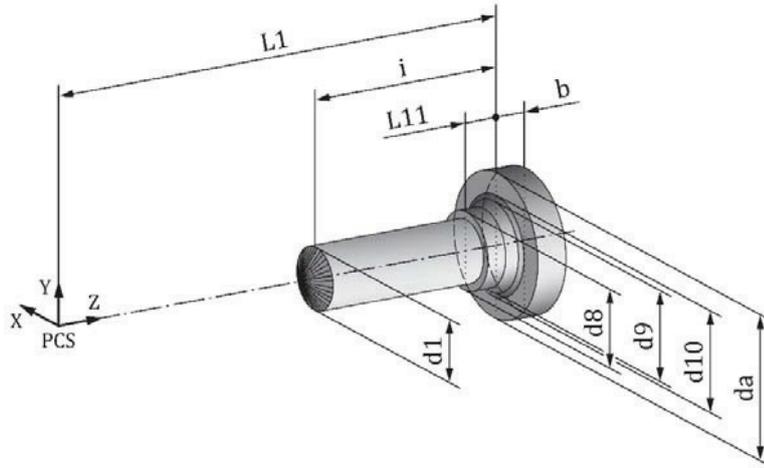


Figure 46 — Internal contour of Morse taper shank

Figure 47 shows the completed Morse taper interface with the internal contour. The dimensions shall be in accordance with ISO 296, where $DCONMS = D$ and $LPCON = a$.

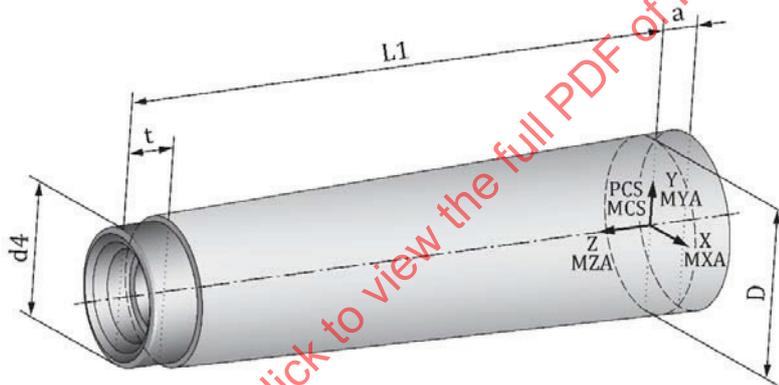


Figure 47 — Completed Morse taper shank

12.4.2 Solid body for connection on workpiece side

For the design of a Morse taper receiver the appropriate solid body shall be designed to be subtracted from the adaptive item. This solid body shall be filled as a feature for further usage. Figure 48 shows the solid body for the subtraction, which is created from the sketch and revolved about its z-axis.

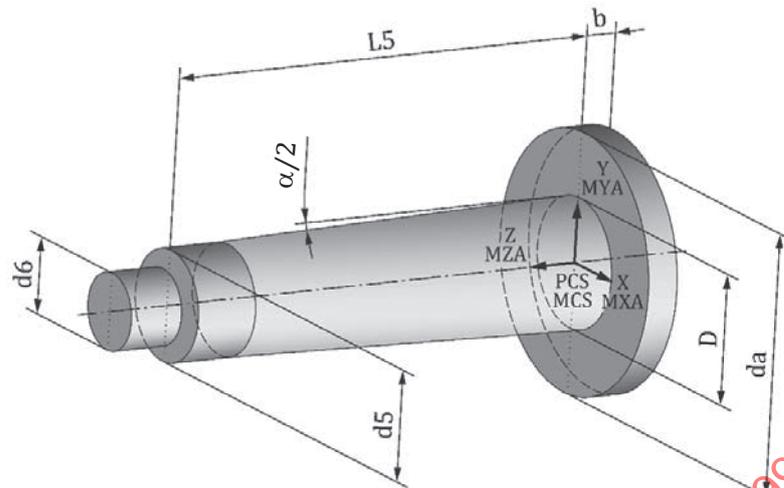


Figure 48 — Solid body for subtraction

Figure 49 shows an example of Morse taper receiver.

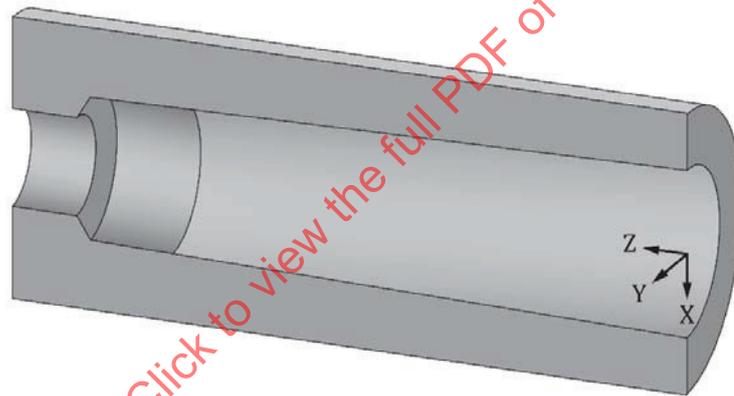


Figure 49 — Morse taper receiver

13 SKG-tool shanks with 7/24 and steep tapers

13.1 General

For the design of the 7/24 taper interface, the dimensions shall be in accordance with the ISO 7388 series for the shank and ISO 9270-1 and ISO 9270-2 for the receiver. Also, the symbols defined in the ISO 7388 series, ISO 9270-1 and ISO 9270-2 shall be taken into account for the design.

For the illustration of the design of the model only the steep taper according to ISO 7388-1, style A and ISO 9270-1, style S is shown. Other styles shall be designed accordingly.

13.2 Necessary properties

See the ISO 7388 series, ISO 9270-1 and ISO 9270-2 for the properties needed for the design of the interface model.

13.3 Contours (sketches) for solid bodies

13.3.1 Outside sketch

Figure 50 shows the design of the sketch of the shank and Figure 51 shows the design of the sketch of the receiver. The sketches shall be revolved about their z-axis. The design of any details like chamfers, undercuts or roundings of the shank or the receiver shall be waived, if these details are not listed in the tables. Missing dimensions for the design of the sketch shall be taken from ISO 7388-1 or ISO 7388-2 for the shank and from ISO 9270-1 or ISO 9270-2 for the receiver.

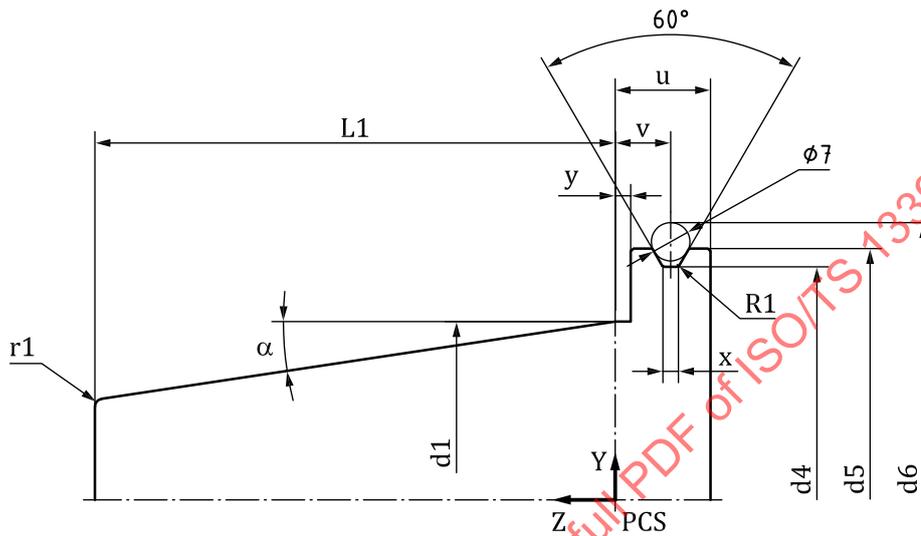
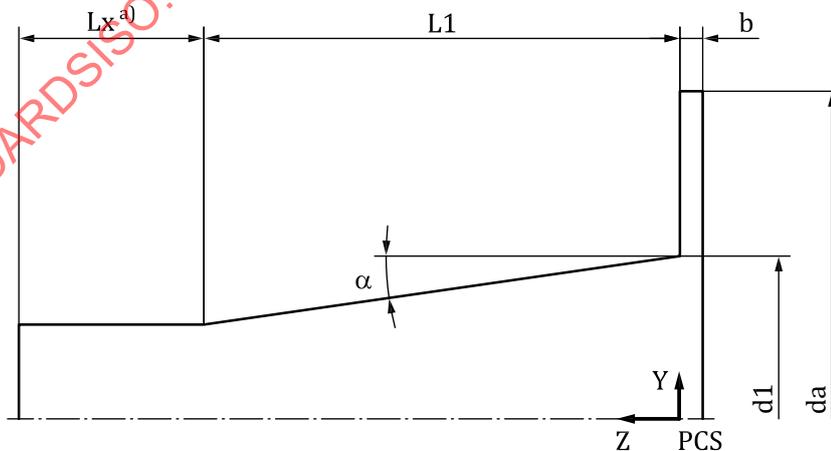


Figure 50 — Design of the sketch for the male connection

The design of the flange on the female connection is only necessary for the right positioning of the solid body for the subtraction from the body of the main item itself. Therefore the dimensions “da” and “b” on the flange are not given in the appropriate standard, but it is recommended to calculate them as follows:

$$da = 2 \times D$$

$$b = 0,1 \times D$$

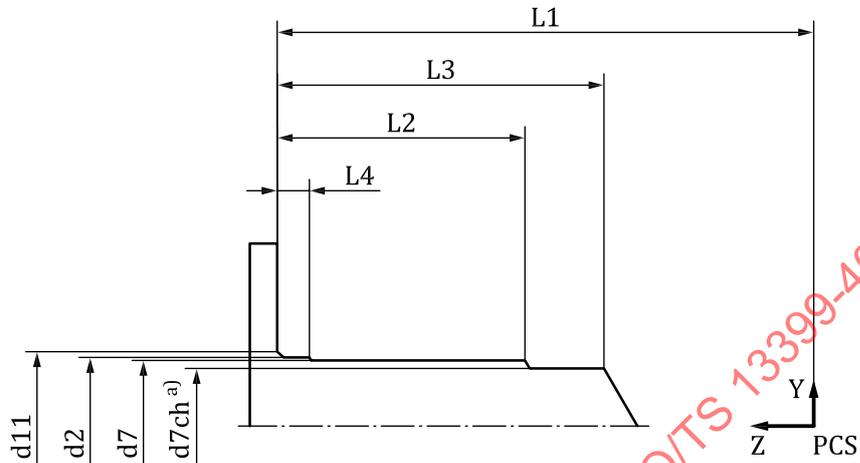


a Upon the designer's discretion.

Figure 51 — Design of the sketch for the female connection

13.3.2 Inside sketch

If necessary, the sketch of the inside contour shall also be designed using the appropriate dimensions. [Figure 52](#) shows the sketch that shall be revolved about its z-axis to get the body for subtraction from the outside body.



a Core hole of thread.

Figure 52 — Sketch of the inside contour

13.4 Solid bodies of the 7/24 taper

13.4.1 Solid body for connection on machine side

The revolved body of the SKG connection with tapped hole, but without the internal contour is shown in [Figure 53](#). The distance from the MCS to the surface that is closest to the workpiece shall be named as connection protruding length. At that surface the solid body of the tool item or adaptive item shall be mated.

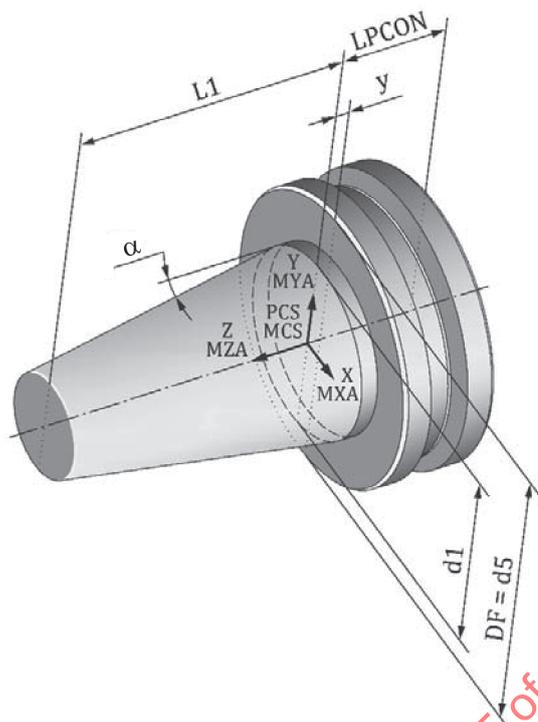


Figure 53 — 7/24 taper interface without internal contour

After revolving the sketch of the internal contour about its z-axis the body for subtraction is shown in [Figure 54](#). The internal contour shall be used only for the shank type connection.

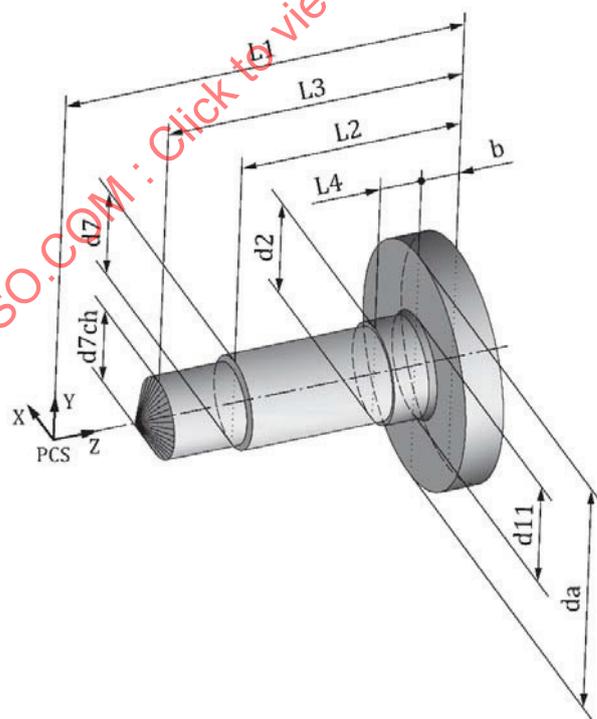


Figure 54 — Internal contour of 7/24 taper shank

Figure 55 shows the completed 7/24 taper interface with the internal contour. The dimensions shall be taken from ISO 7388-1 or ISO 7388-2, where $LPCON = u$. The size and position of the key ways and the position corner shall be taken in accordance to the different styles of the taper listed in the ISO 7388 series.

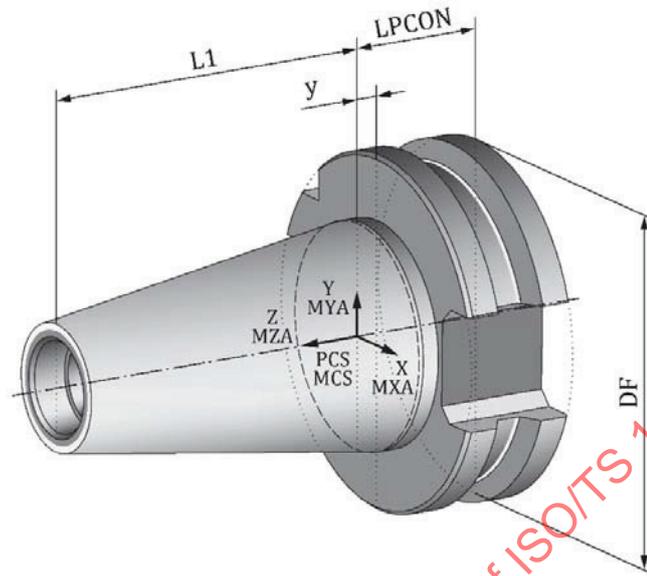


Figure 55 — Completed 7/24 taper shank

13.4.2 Solid body for connection on workpiece side

For the design of a 7/24 taper receiver the appropriate solid body shall be designed to be subtracted from the adaptive item. This solid body shall be filled as a feature for further usage. Figure 56 shows the solid body for the subtraction, which is created from the sketch and revolved about its z-axis. The key ways shall be added to the revolved body. After the solid had been subtracted from the adaptive item, the drive keys shall be added. The dimensions for the size and position of the drive keys shall be in accordance with ISO 9270-1 and ISO 9270-2.

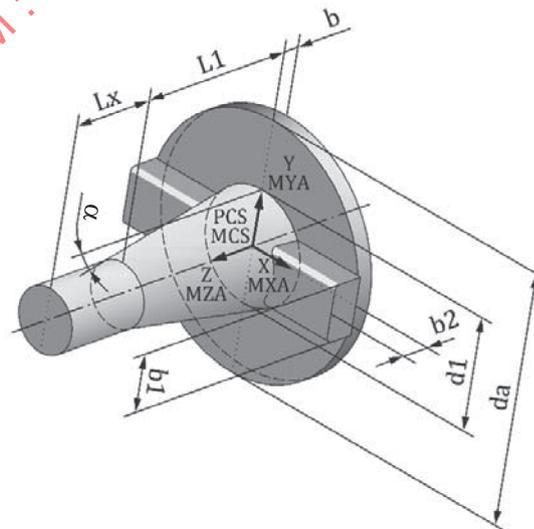


Figure 56 — Solid body for subtraction

Figure 57 shows an example of a 7/24 taper receiver.

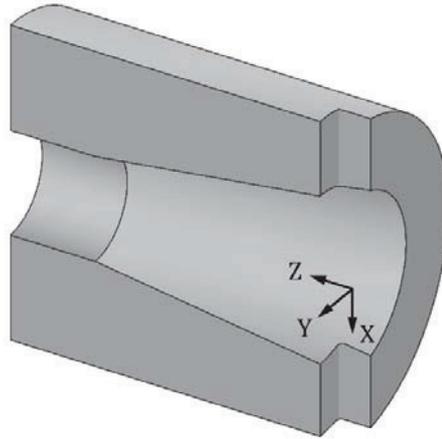


Figure 57 — 7/24 taper receiver

14 SZD-collet standard connection

14.1 General

For the design of the collet receiver interface the dimensions defined in ISO 10897 or ISO 15488 shall be taken into account. Also, the symbols defined in ISO 10897 and ISO 15488 shall be taken into account for the design. Other standards for collets may be taken into account on demand.

For the illustration of the design of the model only the collet receiver described in ISO 10897 is shown in this standard. Other collet receiver styles shall be designed accordingly.

14.2 Necessary properties

For the design of the example of a collet receiver see ISO 10897 for the properties needed for the interface model.

14.3 Contour (sketch) for solid body

[Figure 58](#) shows the design of the sketch of the receiver. The sketch shall be revolved about its z-axis. The design of any details like chamfers, undercuts or roundings of the receiver shall be waived, if these details are not listed in the tables. Missing dimensions for the design of the sketch shall be taken from ISO 10897.