TECHNICAL SPECIFICATION

ISO/TS 13399-202

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2015-08-15

Cutting tool data representation and exchange —

Part 202: Creation and exchange of 3D models — Irregular inserts

Représentation et échange des données relatives aux outils coupants —

Partie 202: Création et échange de modèles 3D — Plaquettes irrégulières

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Foreword

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

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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

ISO 13399 consists of the following parts, under the general title *Cutting tool data representation and exchange*:

— *Part 1: Overview, fundamental principles and general information model*

— *Part 2: Reference dictionary for the cutting items* [Technical Specification]

— *Part 3: Reference dictionary for tool items* [Technical Specification]

— *Part 4: Reference dictionary for adaptive items* [Technical Specification]

— *Part 5: Reference dictionary for assembly items* [Technical Specification]

— *Part 50: Reference dictionary for reference systems and common concepts* [Technical Specification]

— *Part 60: Reference dictionary for connection systems* [Technical Specification]

— *Part 80: Creation and exchange of 3D models — Overview and principles* [Technical Specification]

— *Part 100: Definitions, principles and methods for reference dictionaries* [Technical Specification]

— *Part 150: Usage guidelines* [Technical Specification]

— *Part 201: Creation and exchange of 3D models — Regular inserts* [Technical Specification]

— *Part 202: Creation and exchange of 3D models — Irregular inserts* [Technical Specification]

— *Part 203: Creation and exchange of 3D models — Replaceable inserts for drilling* [Technical Specification]

— *Part 301: Concept for the design of 3D models based on properties according to* ISO/TS 13399-3*: Modelling of thread-cutting taps, thread-forming taps and thread-cutting dies* [Technical Specification]

— *Part 302: Concept for the design of 3D models based on properties according to* ISO/TS 13399-3*: Modelling of solid drills and countersinking tools* [Technical Specification]

The following parts are under preparation:

— *Part 51: Designation system for customer solution cutting tools* [Technical Specification]

— *Part 70: Graphical data layout — Layer settings for tool designs* [Technical Specification]

— *Part 71: Graphical data layout — Creation of documents for the standardized data exchange — Graphical product information* [Technical Specification]

— *Part 72: Creation of documents for the standardized data exchange — Definition of properties for drawing header and their XML-data exchange* [Technical Specification]

— *Part 204: Creation and exchange of 3D models — Inserts for reaming* [Technical Specification]

— *Part 303: Creation and exchange of 3D models — Solid end mills* [Technical Specification]

— *Part 304: Creation and exchange of 3D models — Solid milling cutter with arbor hole [Technical Specification]*

— *Part 307: Creation and exchange of 3D models — End mills for indexable inserts* [Technical Specification]

— *Part 308: Creation and exchange of 3D models — Milling cutter with arbor hole for indexable inserts* [Technical Specification]

— *Part 309: Creation and exchange of 3D models — Tool holders for indexable inserts* [Technical Specification]

— *Part 311: Creation and exchange of 3D models — Solid reamers* [Technical Specification]

— *Part 312: Creation and exchange of 3D models — Reamers for indexable inserts* [Technical Specification]

— *Part 401: Creation and exchange of 3D models — Converting, extending and reducing adaptive items* [Technical Specification]

— *Part 405: Creation and exchange of 3D models — Collets* [Technical Specification]

Introduction

This part of ISO 13399 defines the concept, terms and definitions regarding the creation and exchange of simplified 3D models of irregular inserts that can be used with 3D models of cutting tools for NC-programming, simulation of manufacturing processes and the collision determination within machining processes. It is not intended to standardize the design of the indexable insert itself, nor the cutting tool.

An irregular insert is used in combination with a cutting tool 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 part of ISO 13399. The increasing demand providing the end-user with 3D models for the purposes defined above is the basis for the development of this series of International Standards.

The objective of ISO 13399 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/SC4 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/SC4/WG 2, *Standard for the neutral representation of standard parts* and IEC/TC 3, *Information structures, documentation and graphical symbols*, 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 202:
Creation and exchange of 3D models — Irregular inserts

1 Scope

This part of ISO 13399 specifies a concept for the design of cutting items, limited to any kind of irregular inserts, with the usage of the related properties and domains of values.

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

— definitions and identification of the design features of irregular inserts, with a link to the properties used;

— definitions and identification of the internal structure of the 3D model that represents the features and the properties of irregular inserts.

The following are outside the scope of this part of ISO 13399:

— applications where these standard data may be stored or referenced;

— creation and exchange of simplified 3D models for cutting tools;

— creation and exchange of simplified 3D models for tool items;

— creation and exchange of simplified 3D models for other cutting items not described in this part of ISO 13399;

— creation and exchange of simplified 3D models for adaptive items;

— creation and exchange of simplified 3D models for assembly items and auxiliary items.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1832, *Indexable inserts for cutting tools — Designation*

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

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

3 Starting elements, coordinate systems, planes

3.1 General

The creation of 3D models shall be done by means of nominal dimensions.

WARNING — There is no guarantee that the 3D model, created according to the methods described in this part of ISO 13399, is a true representation of the physical tool supplied by the tool manufacturer. If the models are used for simulation purposes, e.g. CAM simulation, it shall be taken into consideration that the real product dimensions can differ from those nominal dimensions.

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

3.2 Reference system

The reference system consists of the following standard elements:

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

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

— **three orthogonal axes**: axes built as intersections of the three orthogonal plane lines, respectively the x- axis (XA), y- axis (YA) and z-axis (ZA).

3.3 Coordinate system

3.3.1 General

In principle, an insert has two coordinate systems:

— the primary coordinate system, which determines the insert position in space — see Figure 1;

— the secondary coordinate system that helps to mount the insert on to a tool body — see Figure 2.

3.3.2 Coordinate system for insert location

The coordinate system PCS (primary coordinate system) defines the insert position in space. The determinations are as follows:

— the insert is located in the XY quadrant

— the cutting edges are colinear with the XY plane

— the cutting profile points in the negative Y direction

— the forward extremity of the cutting profile is on the positive x-axis

— the side extremity of the insert is on the positive y-axis

— the direction of the insert thickness is parallel to the negative z-axis

These determinations are valid for right handed inserts. Left-handed inserts shall be mirrored through the YZ plane.

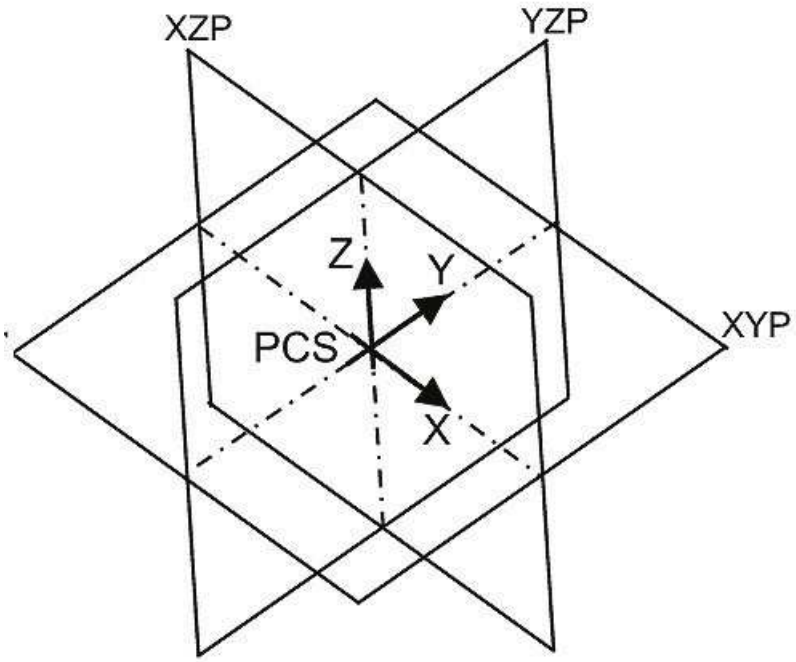


Figure 1 — Reference system PCS

3.3.3 Coordinate system for insert mounting

Due to the very different shapes of the irregular inserts, the location of the mounting coordinate system (MCS) will be defined in the appropriate clauses individually.

The MCS shall have the same orientation as the PCS.

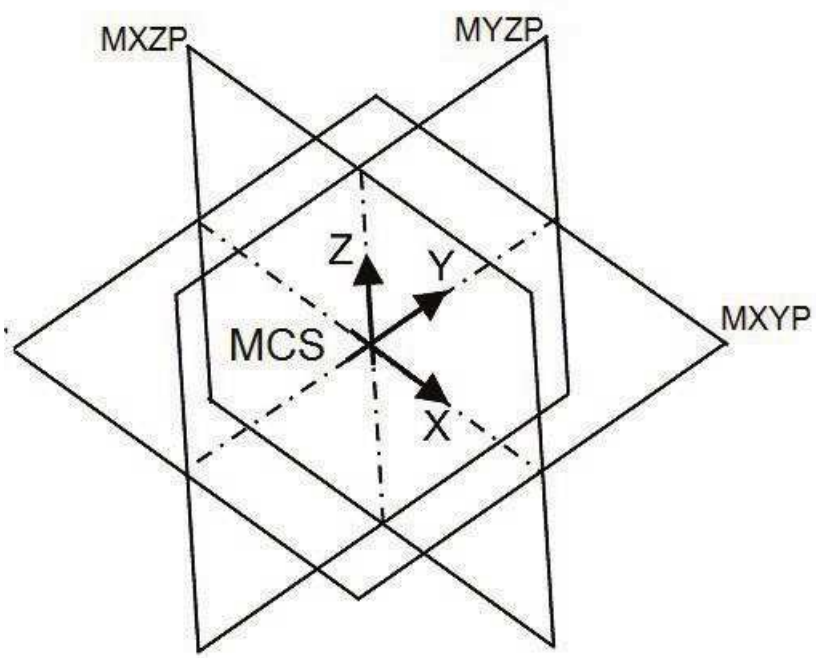


Figure 2 — Mounting coordinate system (MCS) — Orientation

3.4 Planes

To distinguish between the PCS and the MCS planes, the MCS planes shall be given the prefix “M”:

— XYP (PCS) → MXYP (MCS)

— XZP (PCS) → MXZP (MCS)

— YZP (PCS) → MYZP (MCS)

4 Design of the model

Due to the high variety of the designs of the basic shapes of irregular inserts, it is not possible to create design guidelines for this object group. The shapes of the irregular inserts are at the manufacturers discretion, but the manufacturers shall supply the geometrical data as a 3D file with the format in accordance with ISO 10303-242, which replaced ISO 10303-214, well known as the STEP AP 214 file. The level of detail shall be provided either with modifications to the native 3D file or with a newly designed simplified model, e.g. the chip former removed, if it is classified as propriety information. In any case, the cutting edge line shall be part of the exchange model.

For irregular inserts the basic shapes of the profile style is illustrated in Clause 5.

5 Geometrical determination of the insert

5.1 Basic shapes of the cutting profile

Example cutting profiles are shown in Figure 3.

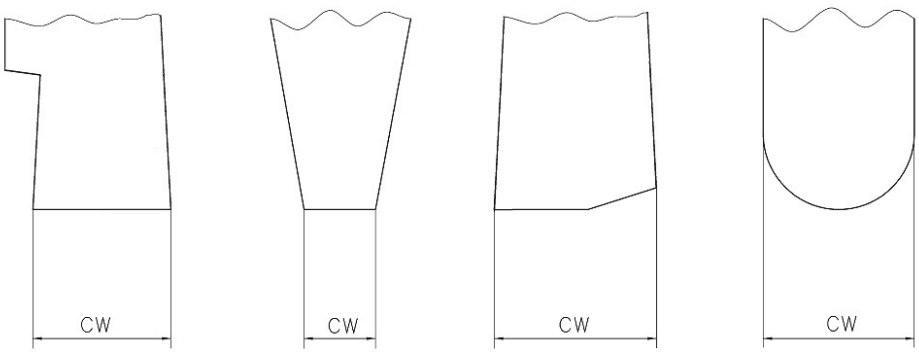


Figure 3 — Nominal dimension of the cutting width

Figure 4 shows the determination of thread pitch and profile included angle.

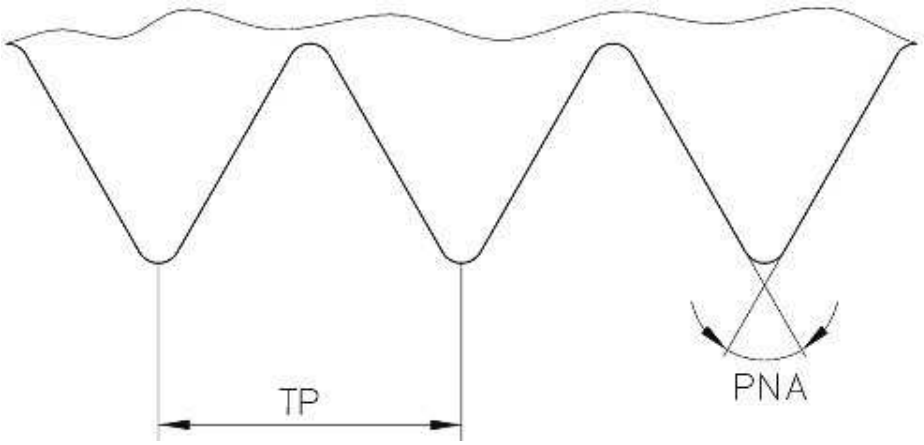


Figure 4 — Thread pitch

The properties for threads per inch (TPI) can be applied for inch threads. If the cutting profile is to be used as partial thread form for a range of thread pitches, the properties thread pitch minimum (TPN), thread pitch maximum (TPX), threads per inch minimum (TPIN) and threads per inch maximum (TPIX) shall be added to the list of properties.

Figure 5 shows the properties defining the profile angle right hand, profile angle left hand and their respective clearance angles.

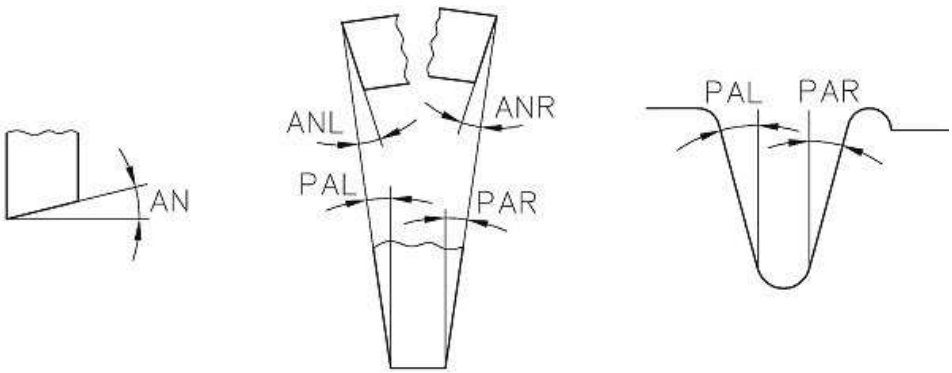


Figure 5 — Relief angle, clearance angle major cutting edge, relief clearance angle

In Figure 6 the properties defining the profile distances in X- and Y- direction to the origin point and the profile depth are shown.

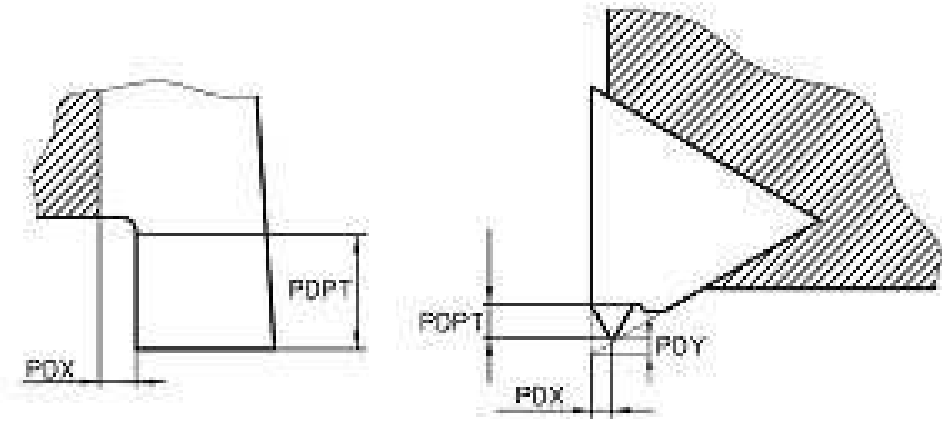


Figure 6 — Profile depth, profile distance x, profile distance y

Figure 7 illustrates the relief angles on the cutting profile as well as the both possible directions of the major cutting edge angle, if the angle is not perpendicular to the primary feed direction.

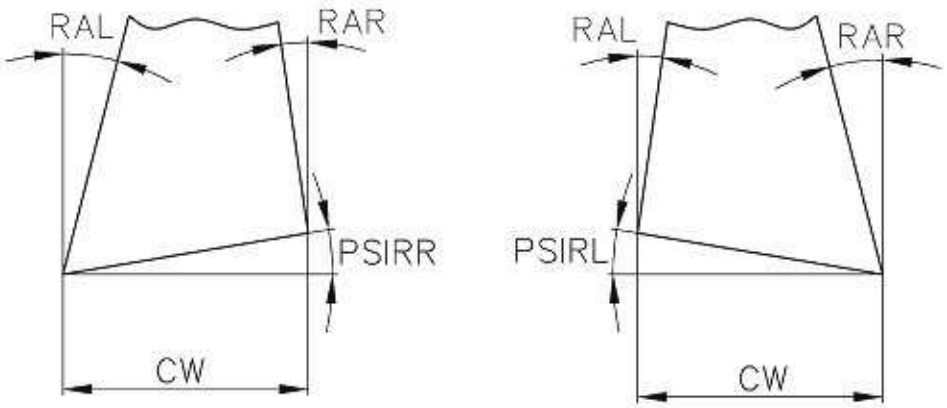


Figure 7 — Major cutting edge angle

The possible profiles of an irregular insert can have either roundings or chamfers on each corner. Figures 8, 9 and 10 show the graphical definition of the appropriate properties.

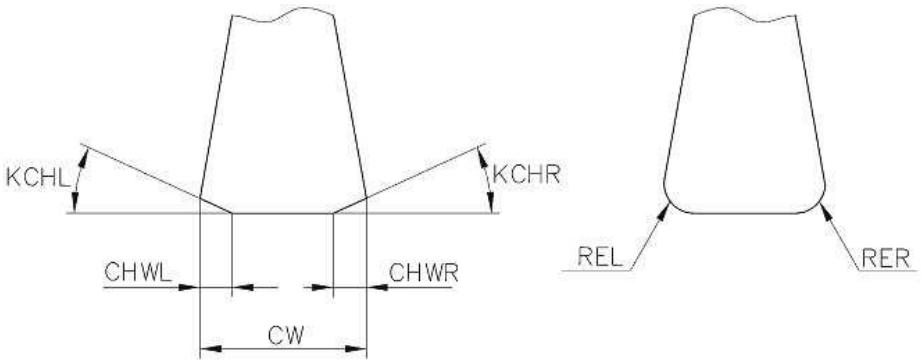


Figure 8 — Corner chamfer width, corner chamfer angle, corner radius

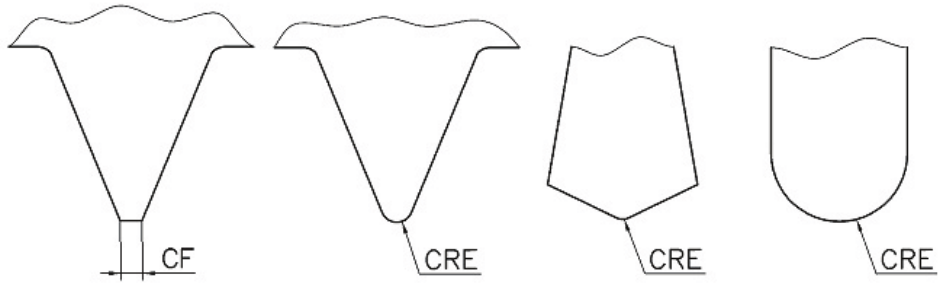


Figure 9 — Spot chamfer, spot radius

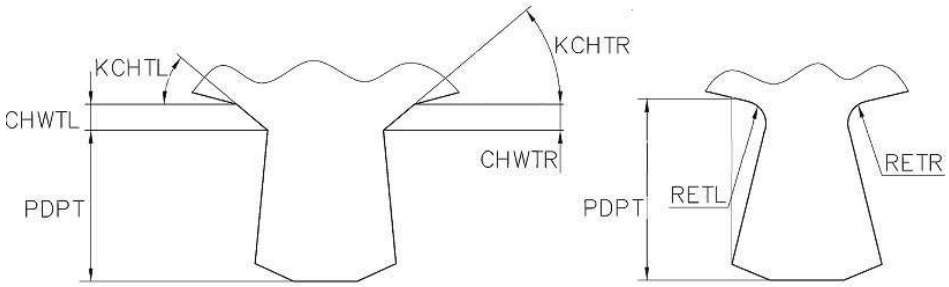


Figure 10 — Flank chamfer angle, flank chamfer width, flank radius, profile depth

5.2 Necessary properties

5.2.1 Necessary properties for the design of the cutting profile

To design the cutting profile of an irregular insert, properties in Table 1 shall be applied to the simplified model.

Table 1 — Properties for the modelling of cutting profiles on irregular inserts

Preferred name	Preferred symbol
Clearance angle major	AN
Clearance angle flank left hand	ANL
Clearance angle flank right hand	ANR
Spot chamfer	CF
Corner chamfer width left hand	CHWL
Corner chamfer width right hand	CHWR
Flank chamfer width left hand	CHWTL
Flank chamfer width right hand	CHWTR
Spot radius	CRE
Cutting width	CW
Corner chamfer angle left hand	KCHL
Corner chamfer angle right hand	KCHR
Flank chamfer angle left hand	KCHTL

[a] Property “threads per inch-TPI” shall be used for the calculation of the distance between two equivalent thread flanks of a non-metric thread that does not use the property “thread pitch-TP” to design the thread profile.

Table 1 *(continued)*

Preferred name	Preferred symbol
Flank chamfer angle right hand	KCHTR
Tooth count	NT
Profile angle left hand	PAL
Profile angle right hand	PAR
Profile depth insert	PDPT
Profile distance ex	PDX
Profile distance ey	PDY
Profile included angle	PNA
Cutting edge angle major left hand	PSIRL
Cutting edge angle major right hand	PSIRR
Relief angle left hand	RAL
Relief angle right hand	RAR
Corner radius left hand	REL
Corner radius right hand	RER
Flank radius left hand	RETL
Flank radius right hand	RETR
Thread form type	THFT
Thread pitch	TP
Threads per inch[a]	TPI
Thread type	TTP
[a] Property “threads per inch-TPI” shall be used for the calculation of the distance between two equivalent thread flanks of a non-metric thread that does not use the property “thread pitch-TP” to design the thread profile.	

5.2.2 Necessary properties for the design of the insert body

To design the body of an irregular insert, properties in Table 2 shall be applied to the simplified model.

Table 2 — Properties for the modelling of the insert body of an irregular insert

Preferred name	Preferred symbol
Insert body width[a]	BW
Chip breaker face count	CB
Insert included angle	EPSR
Insert rake angle	GAN
Inscribed circle diameter	IC
Insert hand	IH
Insert length	INSL
Insert index count	NOI
Insert thickness	S
Insert thickness total	S1
Insert width[a]	W1

[a] If the cutting profile is wider than that portion of the insert used for clamping, the property insert body width shall be used; otherwise "insert width" shall be used. The differences are shown in Figure 11.

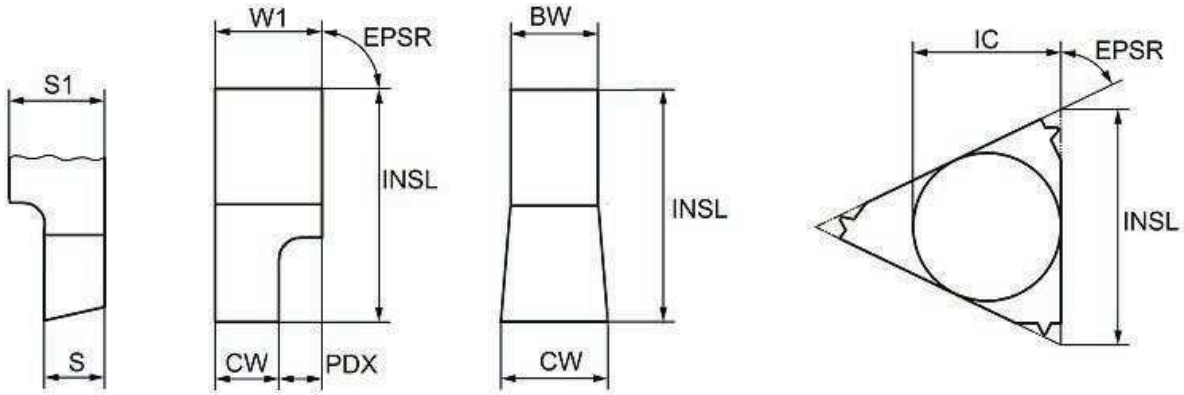


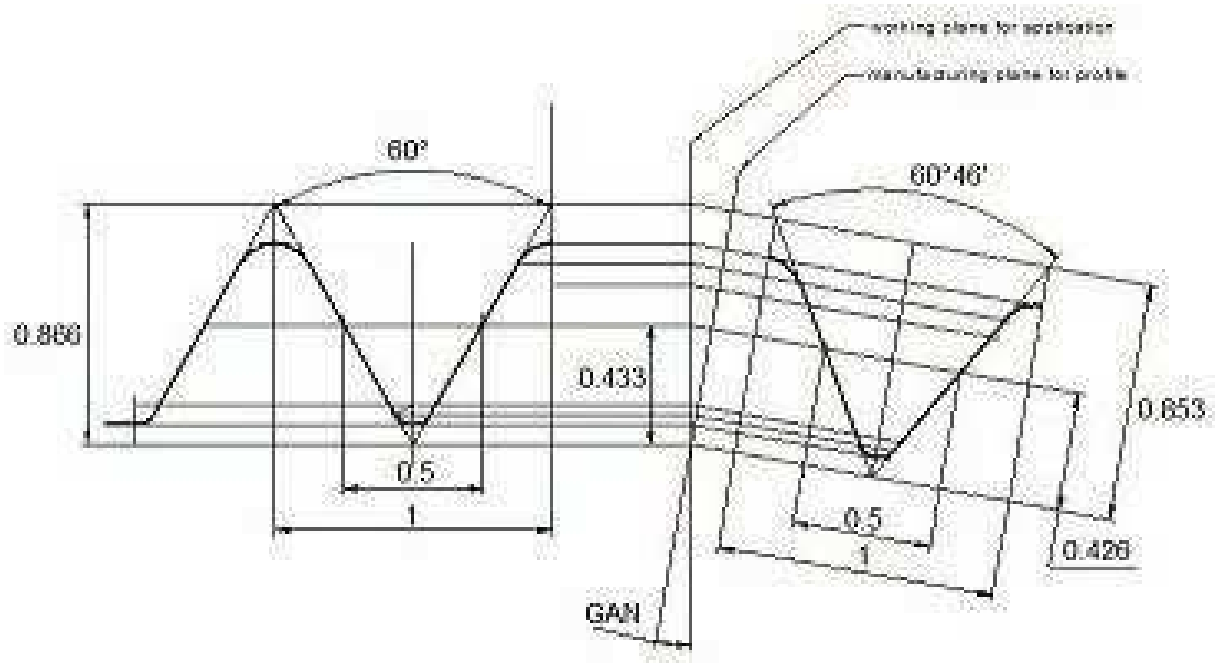
Figure 11 — Graphical determination of properties for the design of the irregular insert body

5.3 Design of the cutting profile

The cutting profile shall follow the requirements of the profile on the work piece. If an irregular insert shall be mounted with an inclined angle onto a tool-item, the profile has to be aligned for manufacturing.

As an example, Figure 12 shows the differences between the profile used for machining a metric thread with a pitch of 1 mm and the profile to be manufactured. All the length dimensions parallel to the Y axis of the primary coordinate system shall be shortened with the factor cos(GAN).

All other profiles shall follow this concept of design, if the insert will be mounted onto a tool having an inclined position.



True view on workpiece profile **True view on grinding profile**

Figure 12 — Profile design of metric thread — working view vs. manufacturing view

Because of the orientation of an irregular insert on a tool item the chip breaker shall be part of the data exchange model, if it is relevant for the cutting conditions as described above.

The level of detail is upon manufacturer's discretion, but the real cutting profile during the application shall be visible.

In the following clauses the specific design of the individual basic shapes will be described with examples.

6 Inserts for grooving and parting

6.1 Necessary properties for the profile of grooving and parting inserts

To design the profile of grooving and parting inserts, properties in Table 3 shall be applied to the simplified model.

Table 3 — Properties for the modelling of cutting profiles on grooving and parting inserts

Preferred name	Preferred symbol
Clearance angle major	AN
Clearance angle flank left hand	ANL
Clearance angle flank right hand	ANR
Spot chamfer	CF
Corner chamfer width left hand	CHWL
Corner chamfer width right hand	CHWR
Flank chamfer width left hand	CHWTL
Flank chamfer width right hand	CHWTR
Spot radius	CRE

Table 3 *(continued)*

Preferred name	Preferred symbol
Cutting width	CW
Corner chamfer angle left hand	KCHL
Corner chamfer angle right hand	KCHR
Flank chamfer angle left hand	KCHTL
Flank chamfer angle right hand	KCHTR
Profile angle left hand	PAL
Profile angle right hand	PAR
Profile depth insert	PDPT
Profile distance ex	PDX
Profile distance ey	PDY
Profile included angle	PNA
Cutting edge angle major left hand	PSIRL
Cutting edge angle major right hand	PSIRR
Relief angle left hand	RAL
Relief angle right hand	RAR
Corner radius left hand	REL
Corner radius right hand	RER
Flank radius left hand	RETL
Flank radius right hand	RETR

6.2 Insert, one cutting edge for grooving, screw mounting

Figure 13 indicates the properties needed for the design of grooving insert with one cutting edge.

Figure 16 shows the properties for cutting profile.

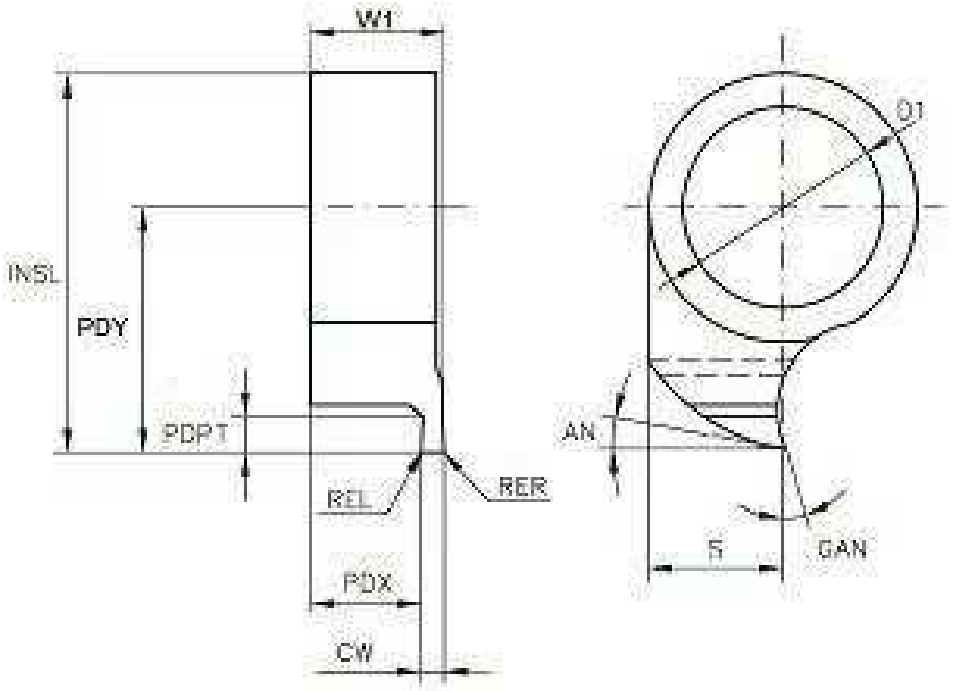


Figure 13 — Determination of properties for a grooving insert with one cutting edge

The model shall be designed using the appropriate properties for the cutting profile listed in Table 1 and for the insert body listed in Table 2.

For this kind of irregular insert, the MCS shall be located such that the MY axis is collinear with the y-axis of PCS, the MX axis is parallel to the x-axis of PCS and the MZ axis is parallel to the Z axis of PCS, see Figure 14 and Figure 15.

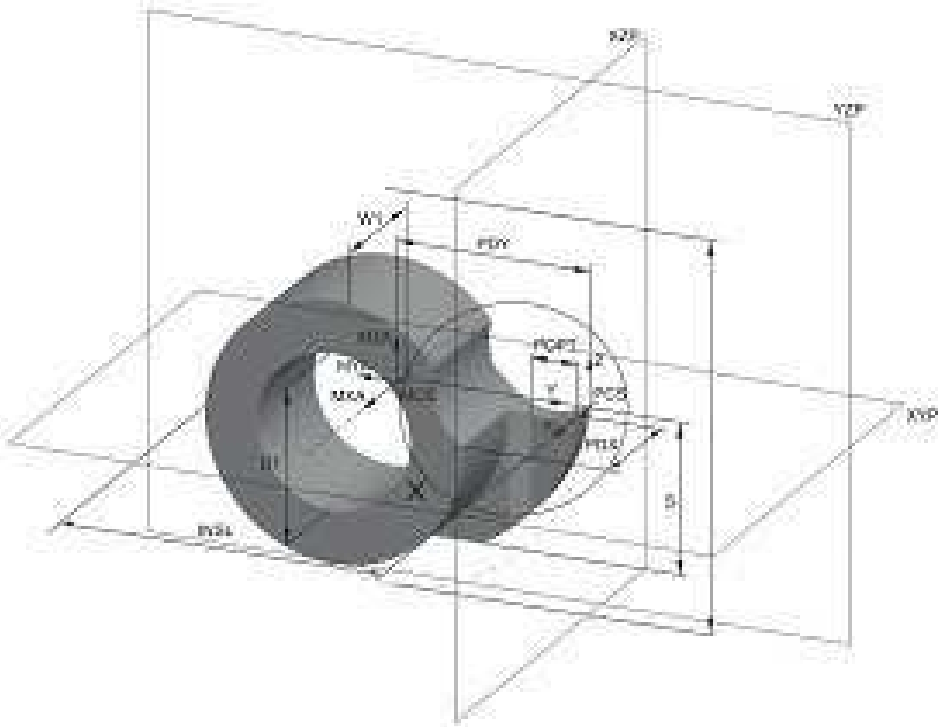


Figure 14 — Screw mounted grooving insert with one cutting edge: basic model

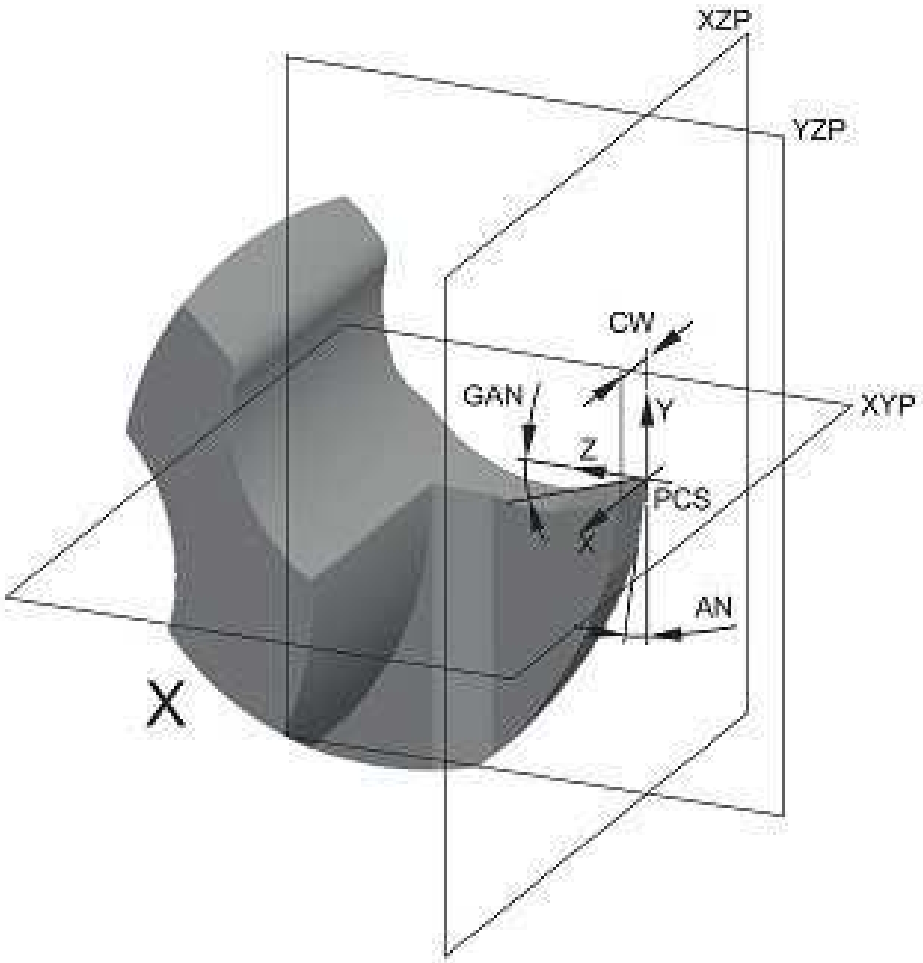


Figure 15 — Detail "X" of Figure 14

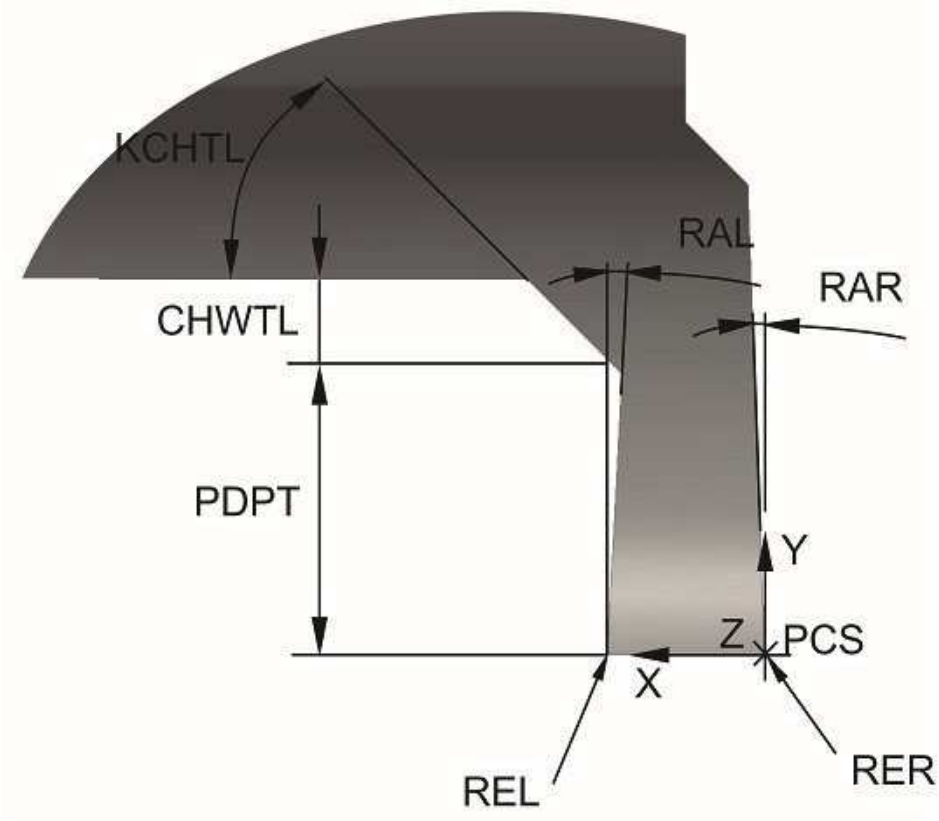


Figure 16 — Determination of properties for cutting profile

6.3 Insert, one cutting edge for grooving and parting, self-clamping

Figure 17 indicates the properties needed for the design self-clamping grooving insert with one cutting edge

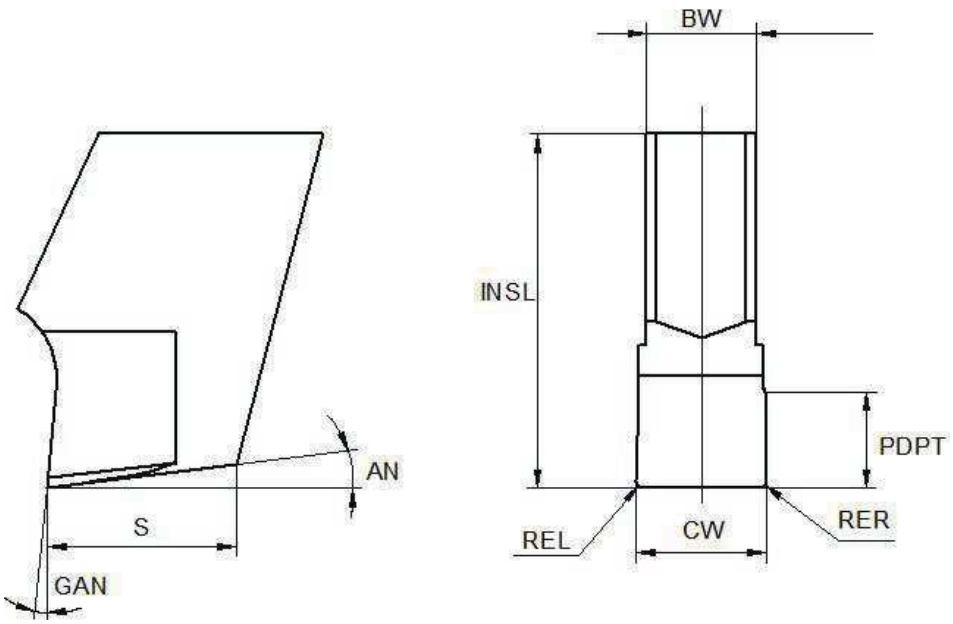


Figure 17 — Determination of properties for a self-clamping grooving insert with one cutting edge

For this kind of grooving and parting insert, the MCS shall be in the exact middle of the cutting width (CW); this allows mounting irregular inserts of the same insert size with different cutting widths onto the same tool item, see Figure 18.

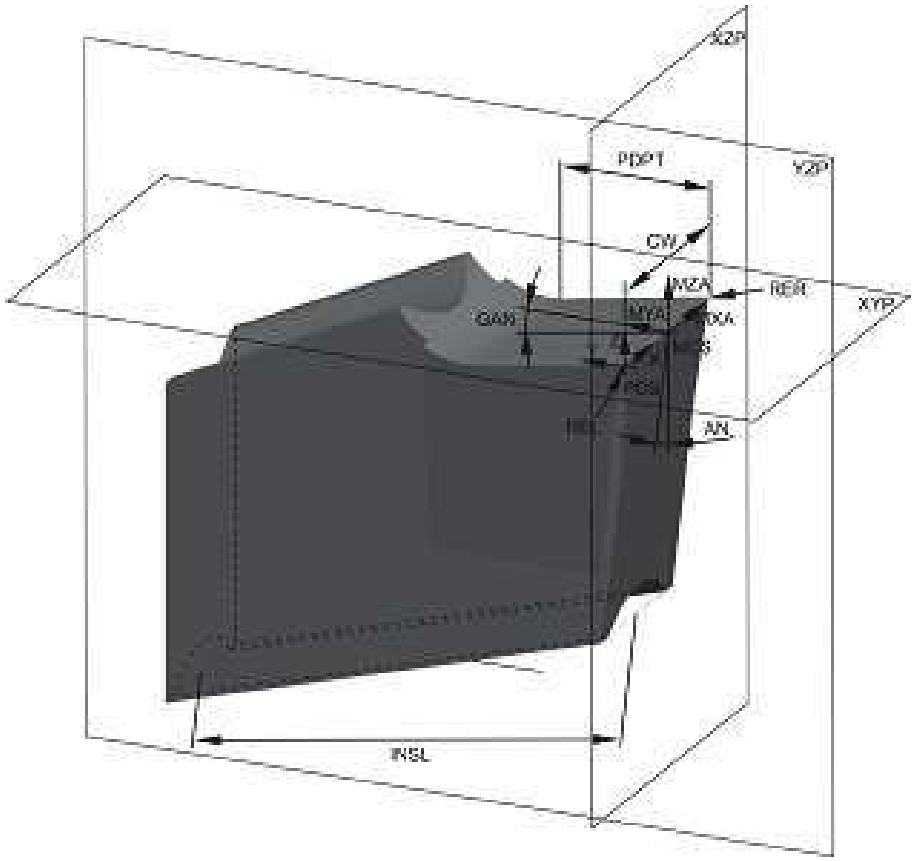


Figure 18 — Self-clamping grooving insert with one cutting edge: basic model

6.4 Insert, two cutting edges for grooving and parting, self-clamping

Figure 19 indicates the properties needed for the design of a self-clamping grooving insert with two cutting edges.

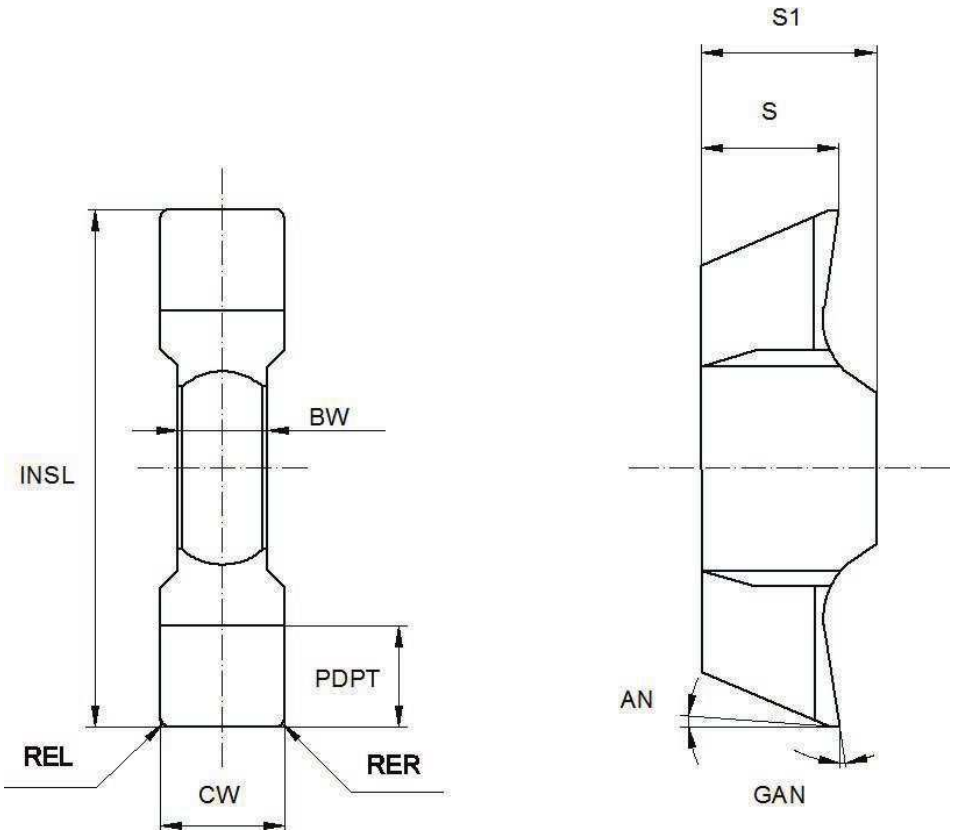


Figure 19 — Determination of properties for a self-clamping grooving insert with two cutting edges

For this kind of grooving and parting insert, the MCS shall be in the exact middle of the cutting width (CW); this allows mounting irregular inserts of the same insert size with different cutting widths onto the same tool item, see Figure 20 and Figure 21.

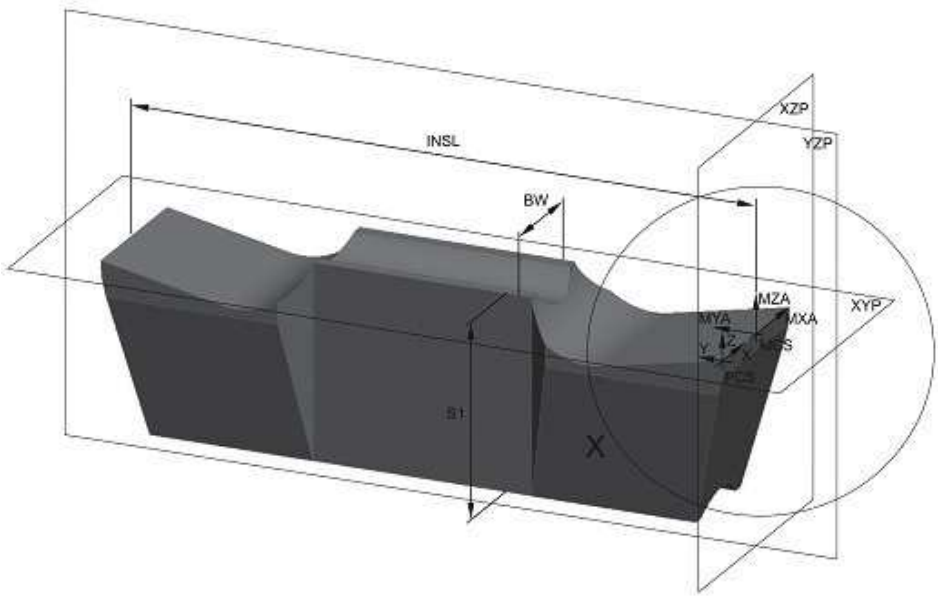


Figure 20 — Self-clamping grooving insert with two cutting edges: basic model

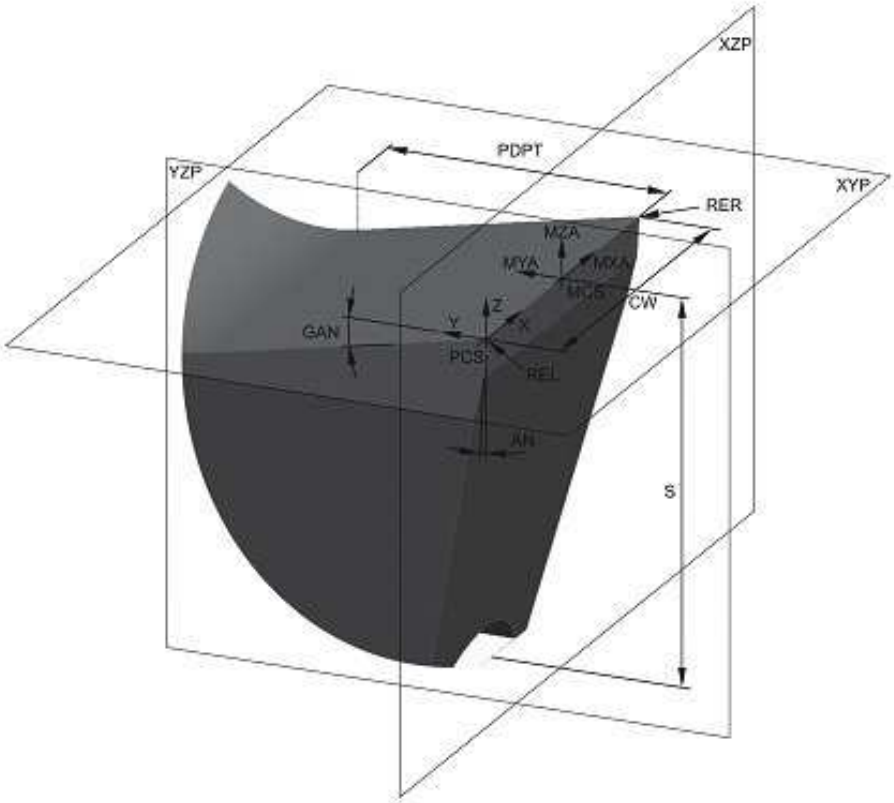


Figure 21 — Detail "X" of Figure 20

6.5 Insert, two cutting edges for parting, self-clamping

Figure 22 indicates the properties needed for the design of a self-clamping parting insert with two cutting edges.

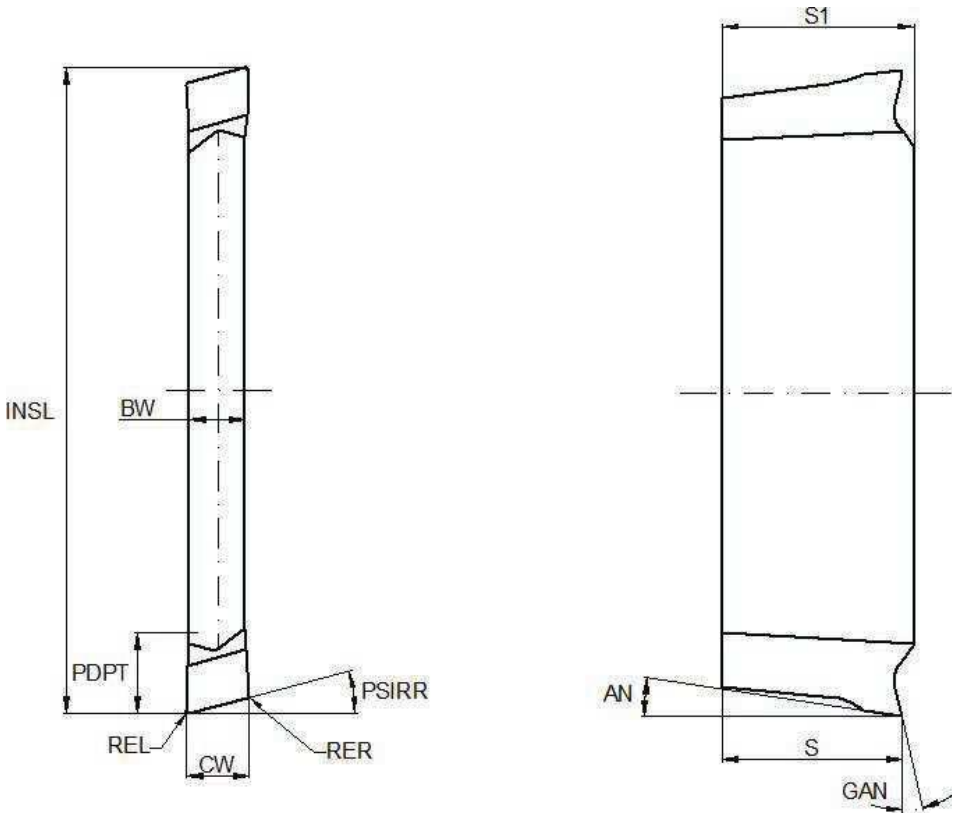


Figure 22 — Determination of properties for a self-clamping parting insert with two cutting edges

For this kind of parting insert, the MCS shall be in the exact middle of the cutting width (CW); this allows mounting irregular inserts of the same insert size with different cutting widths onto the same tool item, see Figure 23 and Figure 24.

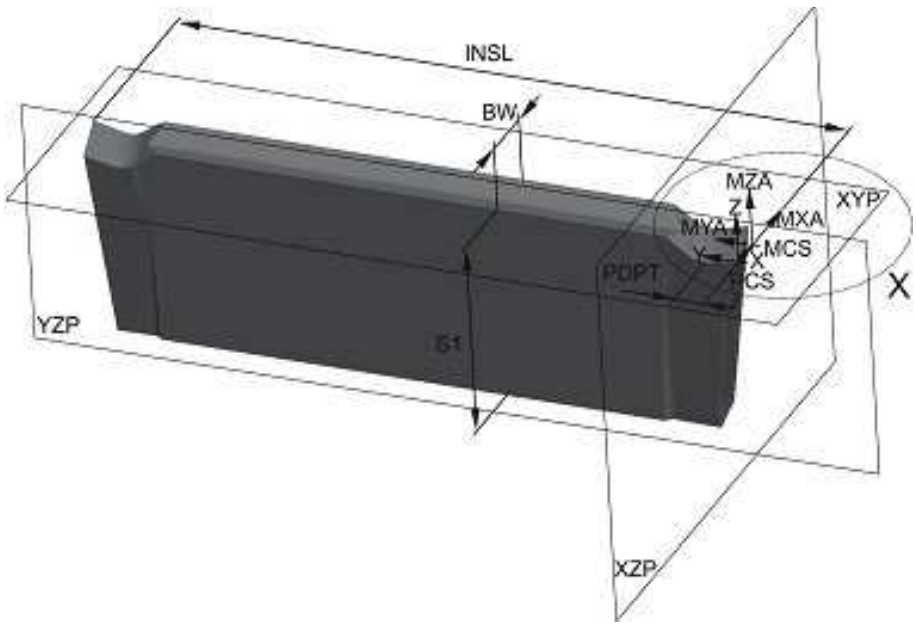


Figure 23 — Self-clamping parting insert with two cutting edges: basic model

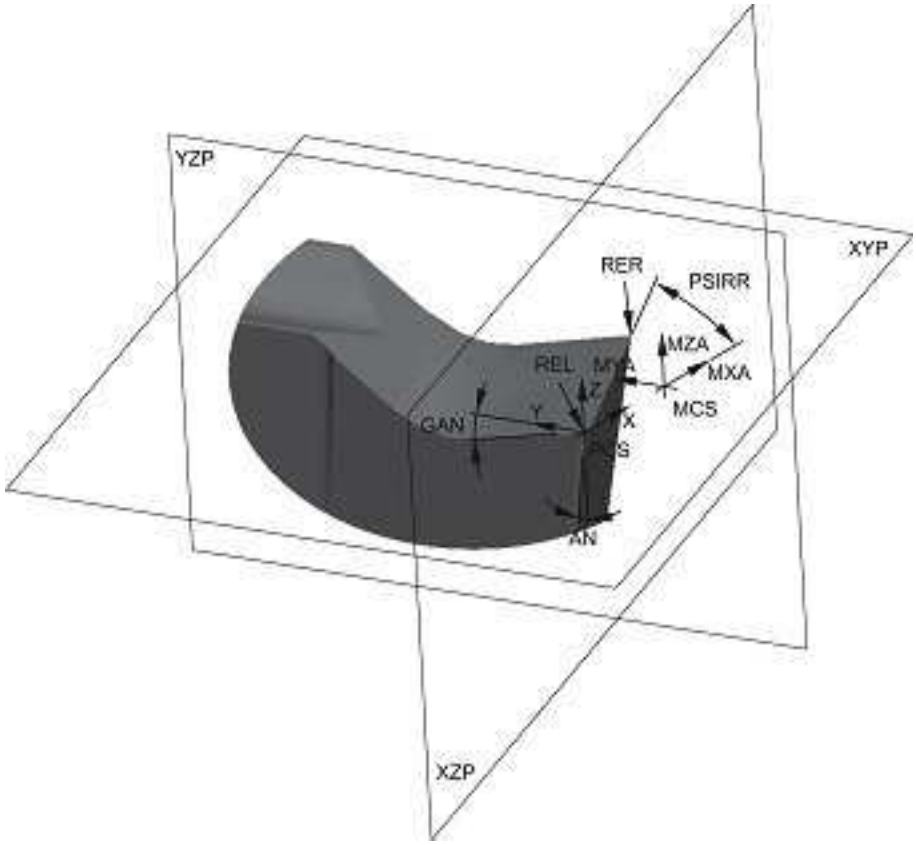


Figure 24 — Detail "X" of Figure 23

6.6 Insert, two cutting edges for profiling and partial threading

Figure 25 indicates the properties needed for the design of a profiling and partial threading insert with two cutting edges.

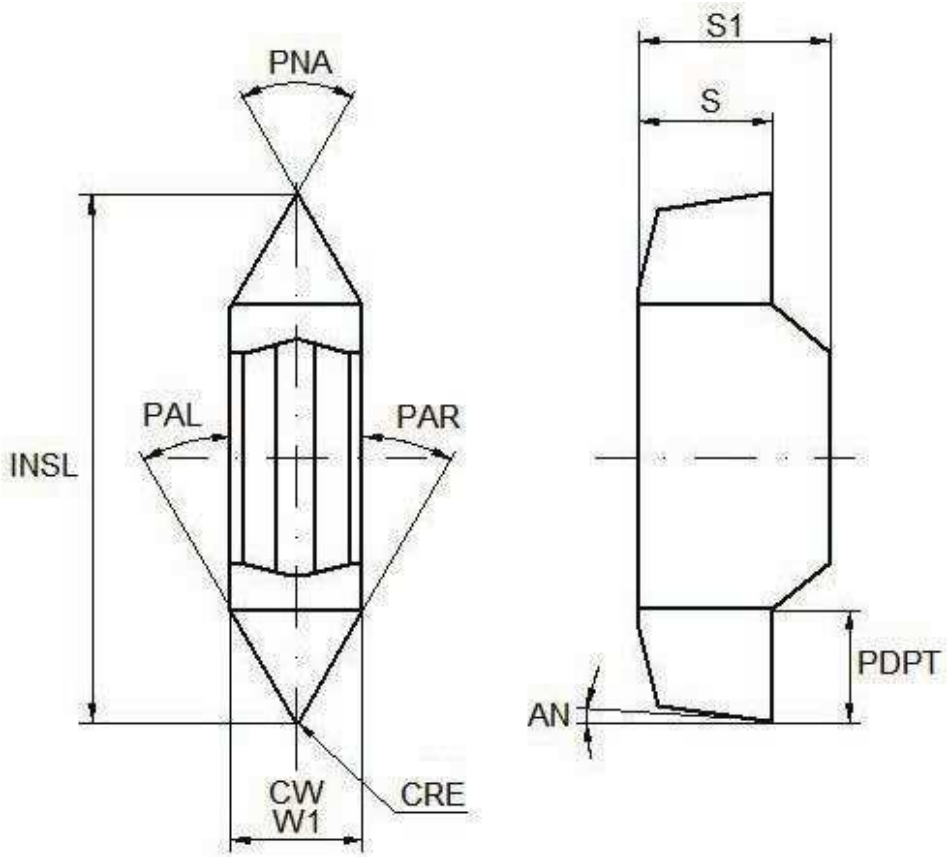


Figure 25 — Determination of properties for a profiling and partial threading insert with two cutting edges

For this kind of profiling insert, the y-axis of the MCS shall be colinear with the symmetry line of the insert; this allows mounting irregular inserts of the same insert size with different cutting profiles onto the same tool item, see Figure 26 and Figure 27.

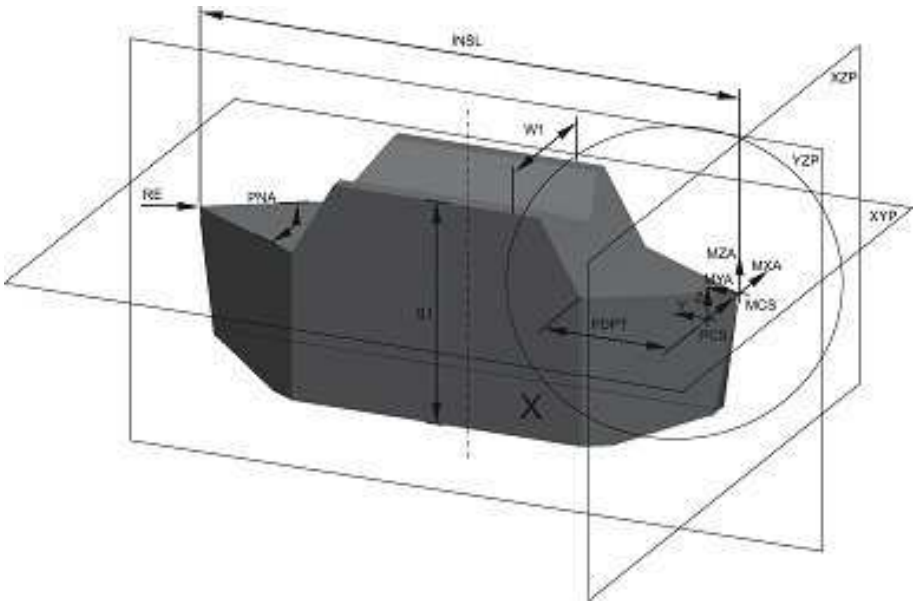


Figure 26 — Profiling and partial threading insert with two cutting edges: basic model

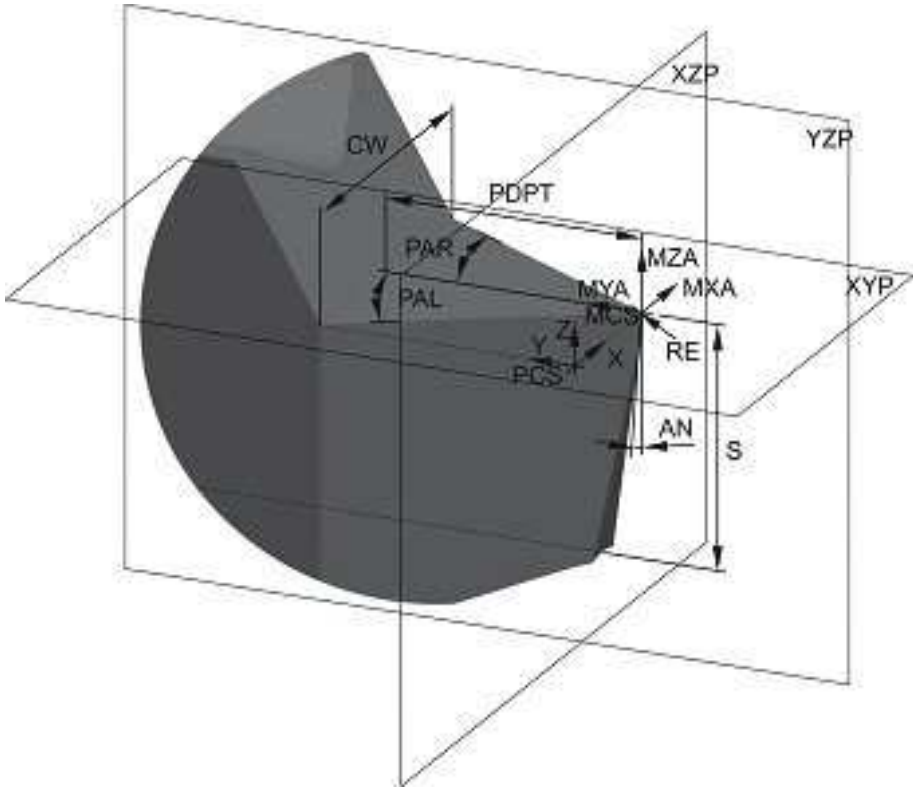


Figure 27 — Detail "X" of Figure 26

6.7 Insert, two cutting edges for profiling

Figure 28 indicates the properties needed for the design of a profiling insert with two cutting edges.

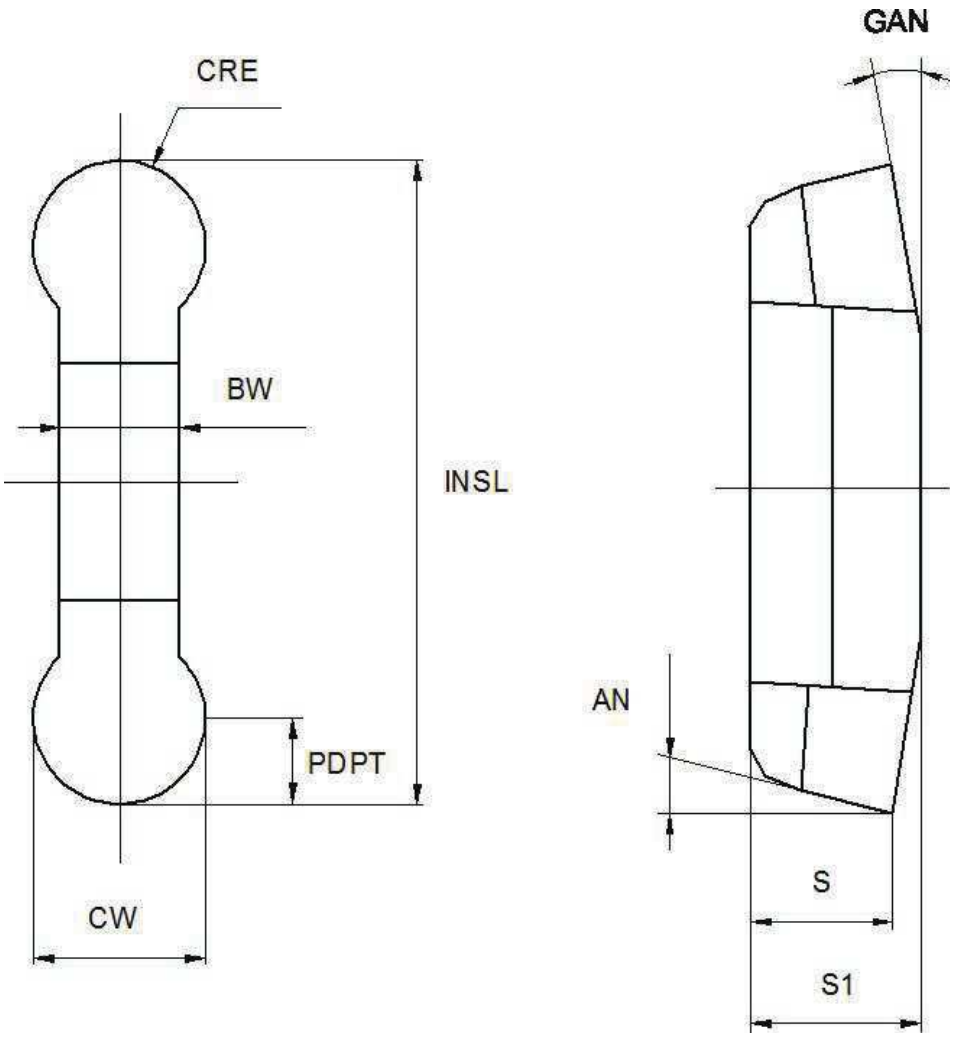


Figure 28 — Determination of properties for a profiling insert with two cutting edges

For this kind of profiling insert, the y-axis of the MCS shall be colinear with the symmetry line of the insert; this allows mounting irregular inserts of the same insert size with different cutting profiles onto the same tool item, see Figure 29 and Figure 30.

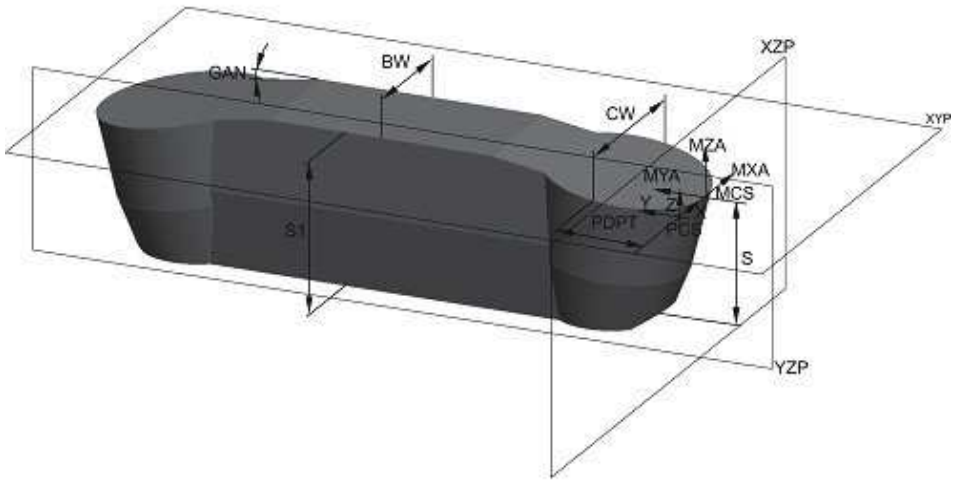


Figure 29 — Profiling insert with two cutting edges: basic model

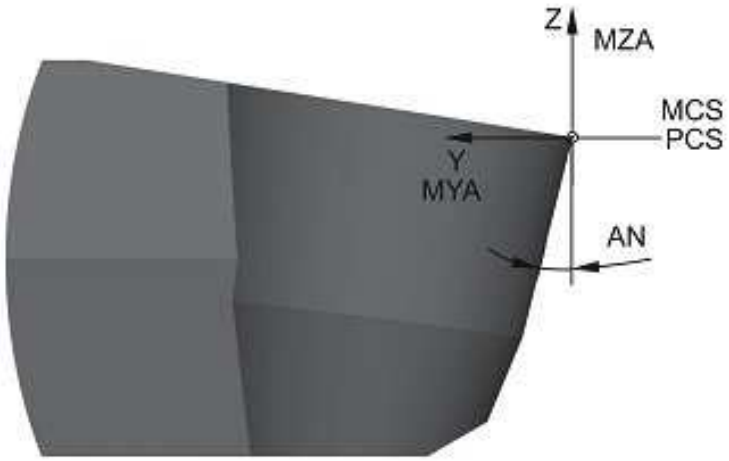


Figure 30 — Detail "X" of Figure 29 and orientation of MCS

6.8 Insert, multiple cutting edges for grooving and parting

Figures 31, 32 and 33 indicate the properties needed for the design of a grooving and parting insert with multiple cutting edges.

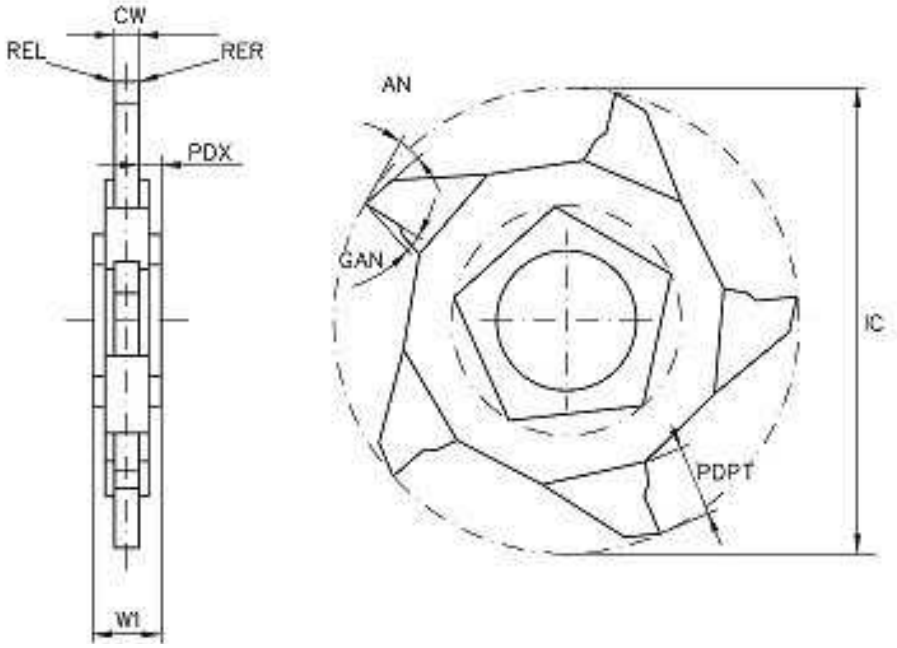


Figure 31 — Determination of properties for a grooving and parting insert with multiple cutting edges

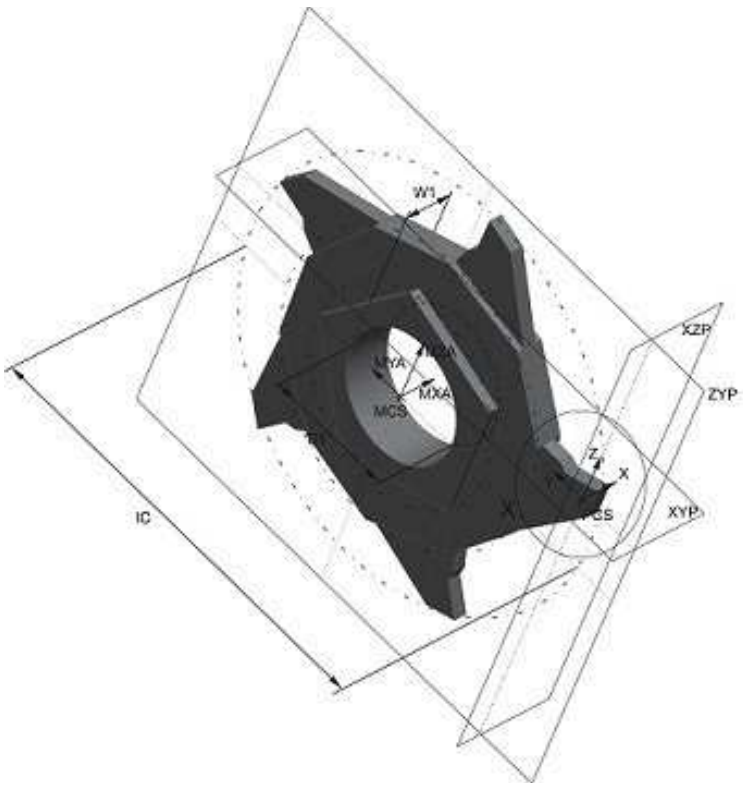


Figure 32 — Grooving and parting insert with multiple cutting edges: basic model

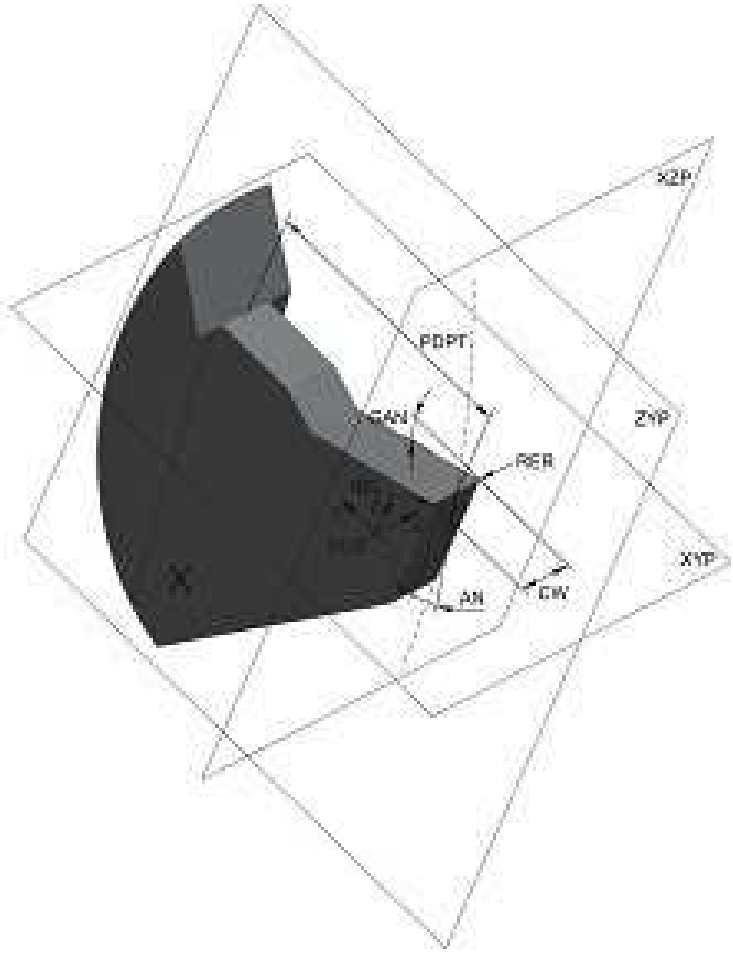


Figure 33 — Detail "X" of Figure 32

7 Inserts for threading

7.1 Necessary properties for the profile of threading inserts

To design the profile of threading inserts, properties in Table 4 shall be applied to the simplified model.

Table 4 — Properties for the modelling of cutting profiles on threading inserts

Preferred name	Preferred symbol
Clearance angle major	AN
Spot chamfer	CF
Spot radius	CRE
Tooth count	NT
Profile angle left hand	PAL
Profile angle right hand	PAR
Profile depth insert	PDPT
Profile distance ex	PDX

[a] Property "threads per inch-TPI" shall be used for the calculation of the distance between two equivalent thread flanks of a non-metric thread that does not use the property "thread pitch-TP" to be able to design the thread profile.

Table 4 *(continued)*

Preferred name	Preferred symbol
Profile distance ey	PDY
Profile included angle	PNA
Cutting edge angle major left hand	PSIRL
Cutting edge angle major right hand	PSIRR
Corner radius left hand	REL
Corner radius right hand	RER
Flank radius left hand	RETL
Flank radius right hand	RETR
Thread form type	THFT
Thread pitch	TP
Threads per inch[a]	TPI
Thread type	TTP

[a] Property "threads per inch-TPI" shall be used for the calculation of the distance between two equivalent thread flanks of a non-metric thread that does not use the property "thread pitch-TP" to be able to design the thread profile.

Not all of the properties in Table 4 will contain values because the parameters of a thread profile are dependent on the thread design; e.g. either the thread pitch or the threads per inch are used, not both.

The properties for the insert body are listed in Table 2 in 5.2.2

For equilateral, equiangular and equilateral, non-equiangular basic insert shapes, the mounting coordinate system is located at the centre point of the inscribed circle.

Threading inserts shall be placed on the tool item at the nominal rake angle.

7.2 Lay-down threading insert, triangle shape, three cutting edges, one tooth

Figures 34, 35, 36 and 37 indicate the properties needed for the design of a laydown threading insert with triangular basic shape.

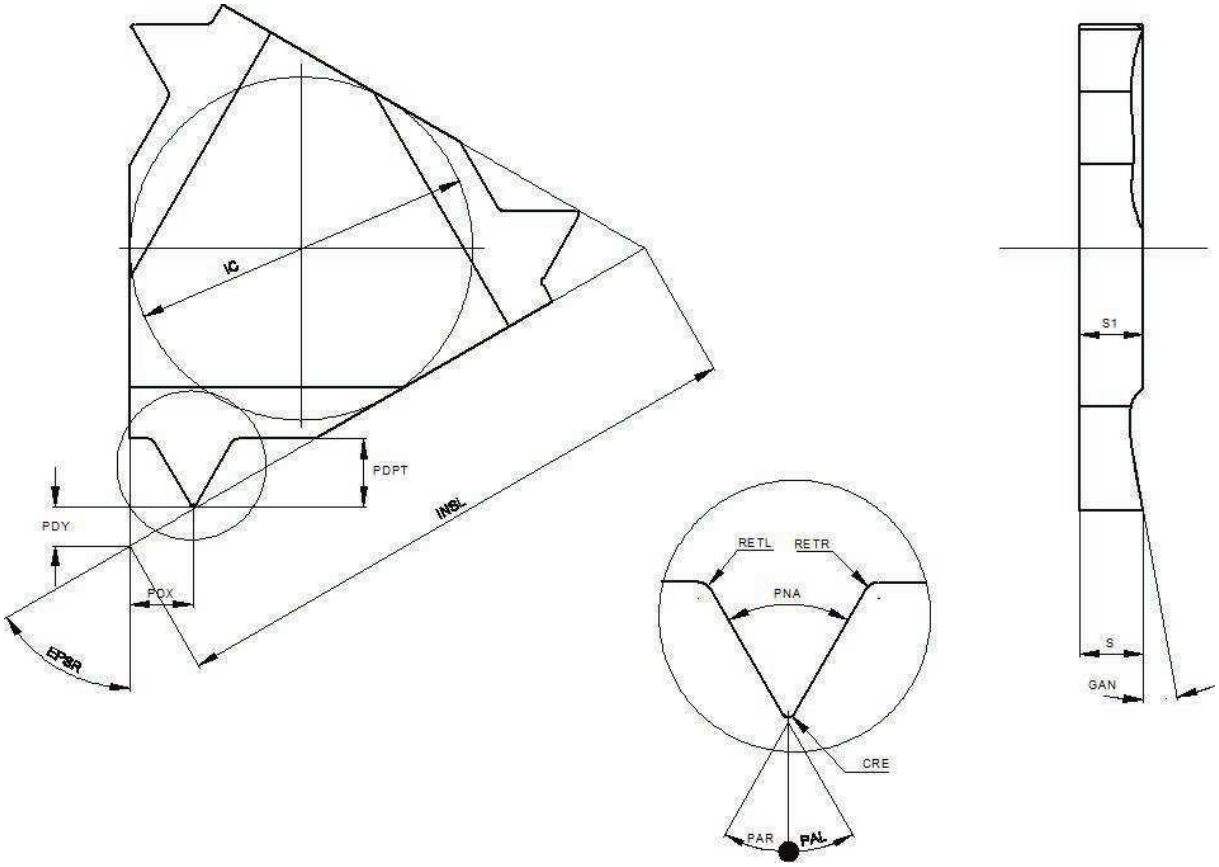


Figure 34 — Determination of properties for a laydown threading insert with triangular basic shape

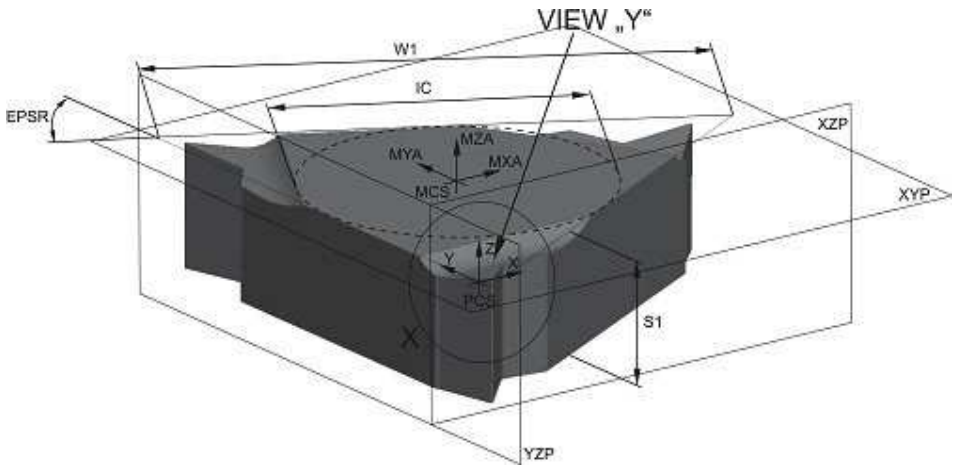


Figure 35 — Threading insert with three cutting edges, one tooth: basic model

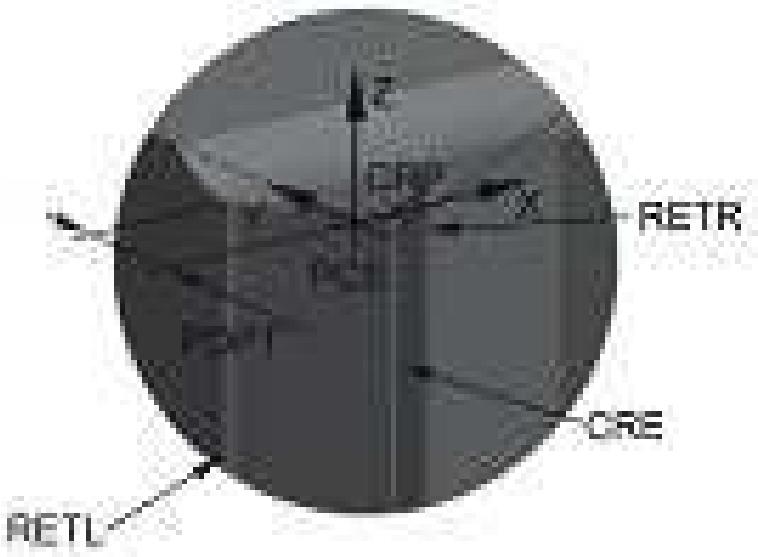


Figure 36 — Detail "X" of Figure 35

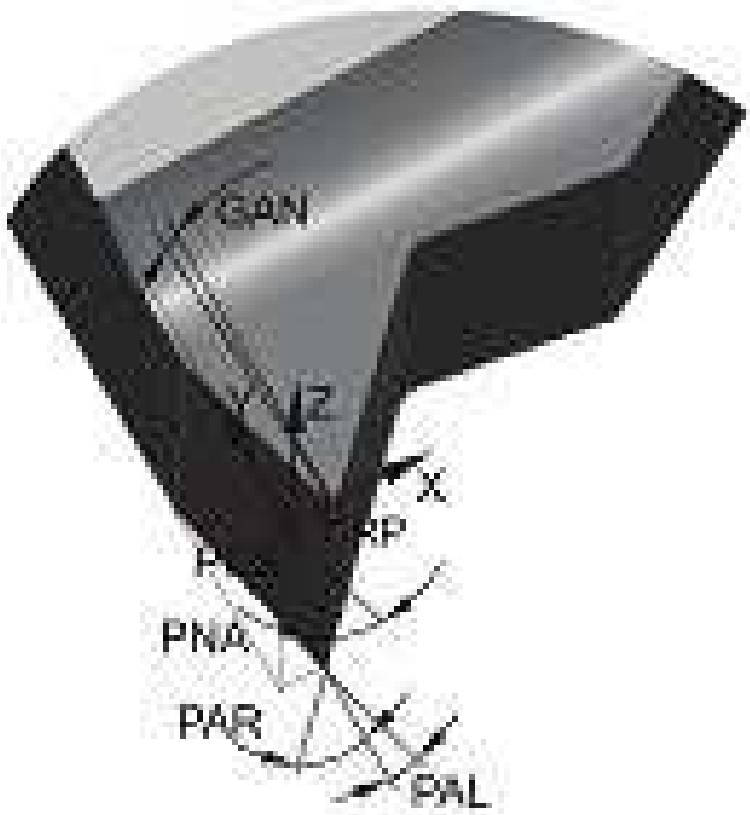


Figure 37 — View "Y" of Figure 35

7.3 Lay-down threading insert, triangle shape, three cutting edges, three teeth

Figures 38, 39, 40 and 41 indicate the properties needed for the design of a laydown multi teeth threading insert with triangular basic shape.

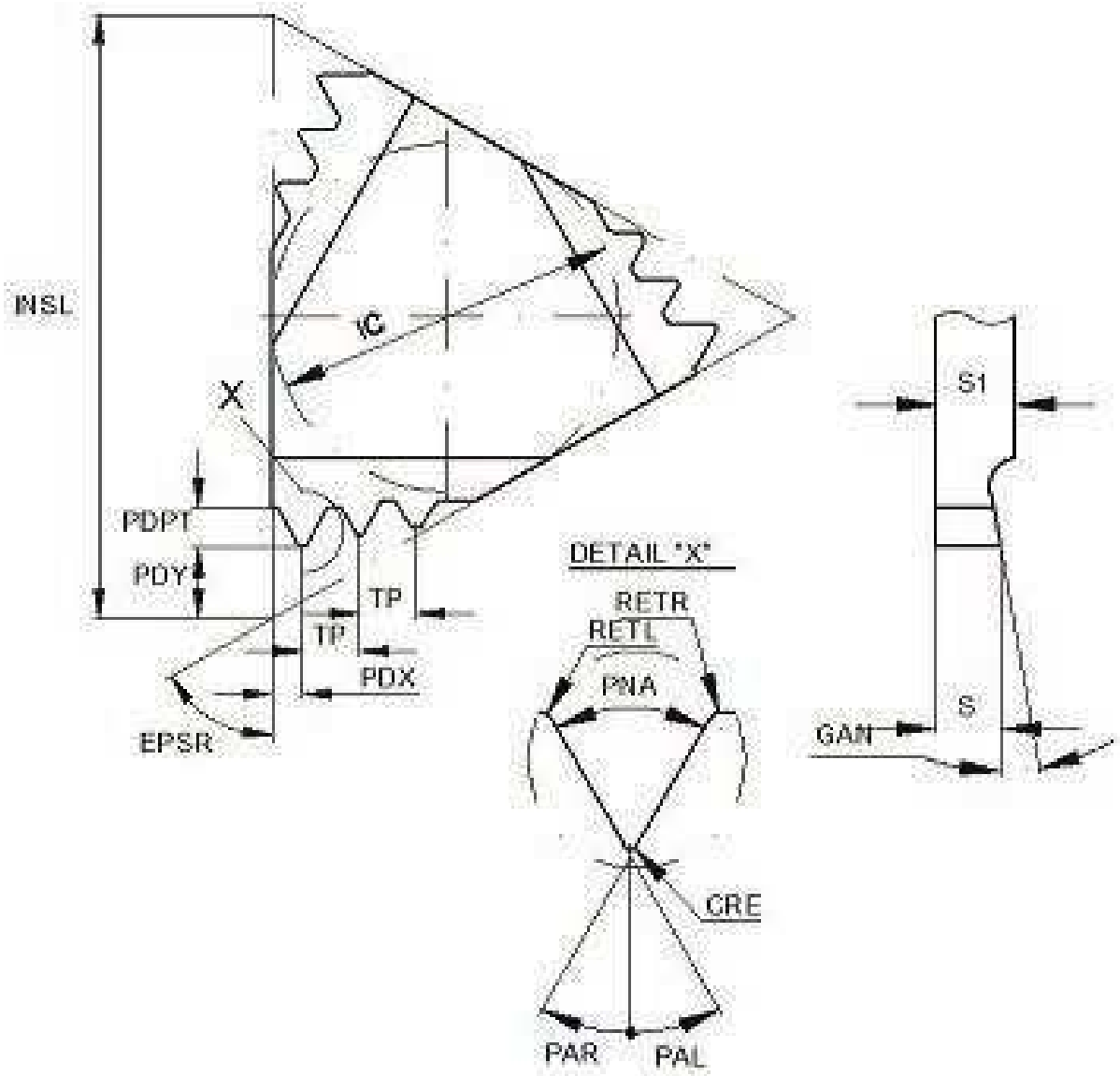


Figure 38 — Determination of properties for a laydown multi teeth threading insert with triangular basic shape

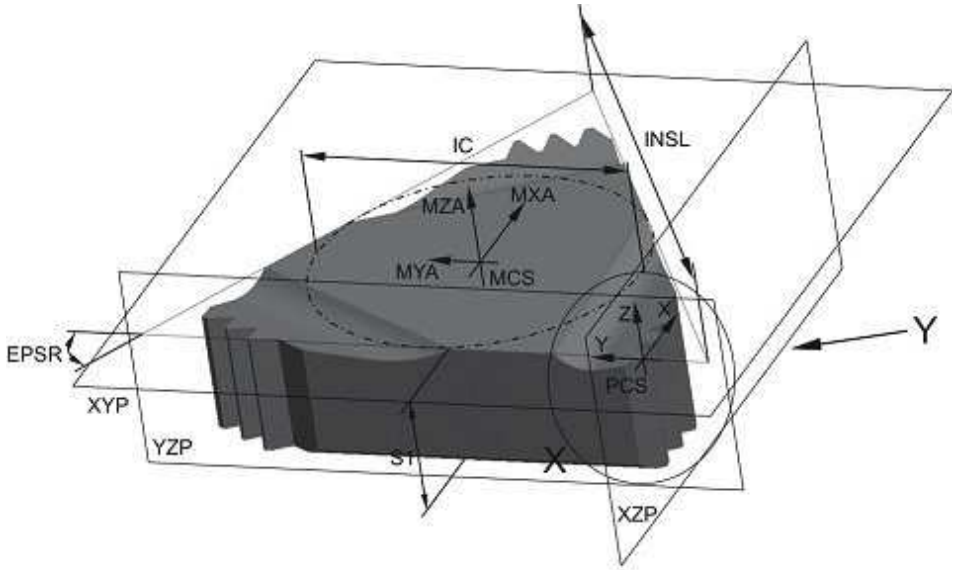


Figure 39 — Threading insert with three cutting edges, three teeth: basic model

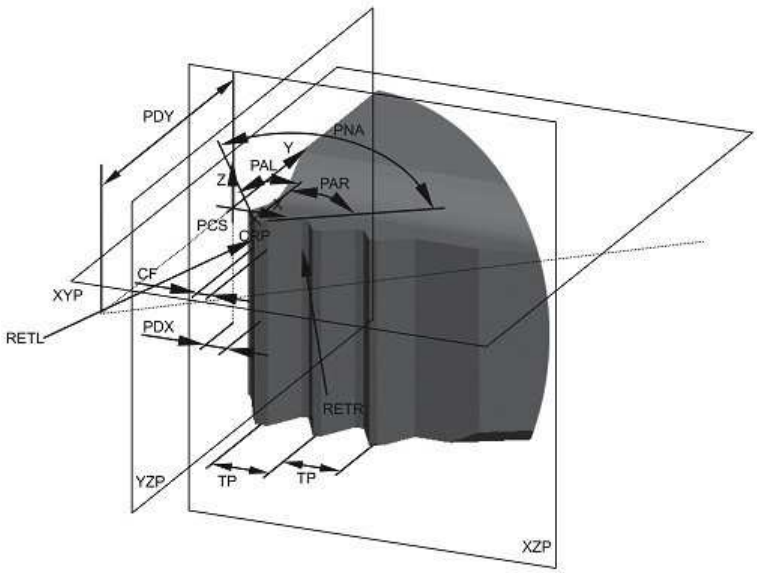


Figure 40 — Detail "X" of Figure 39 in view "Y"

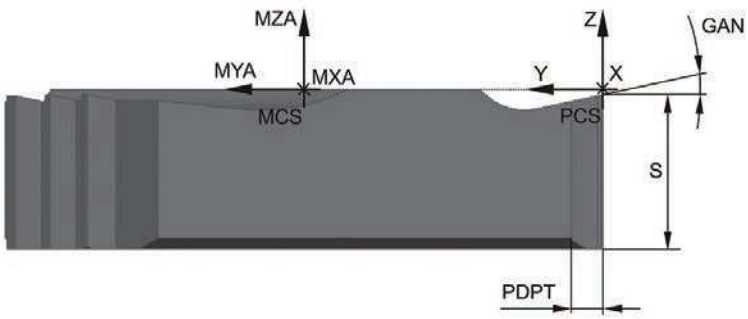


Figure 41 — "YZ-plane view" of Figure 39

7.4 Threading insert with two cutting edges

Figure 42 indicates the properties needed for the design of a threading insert with two cutting edges.

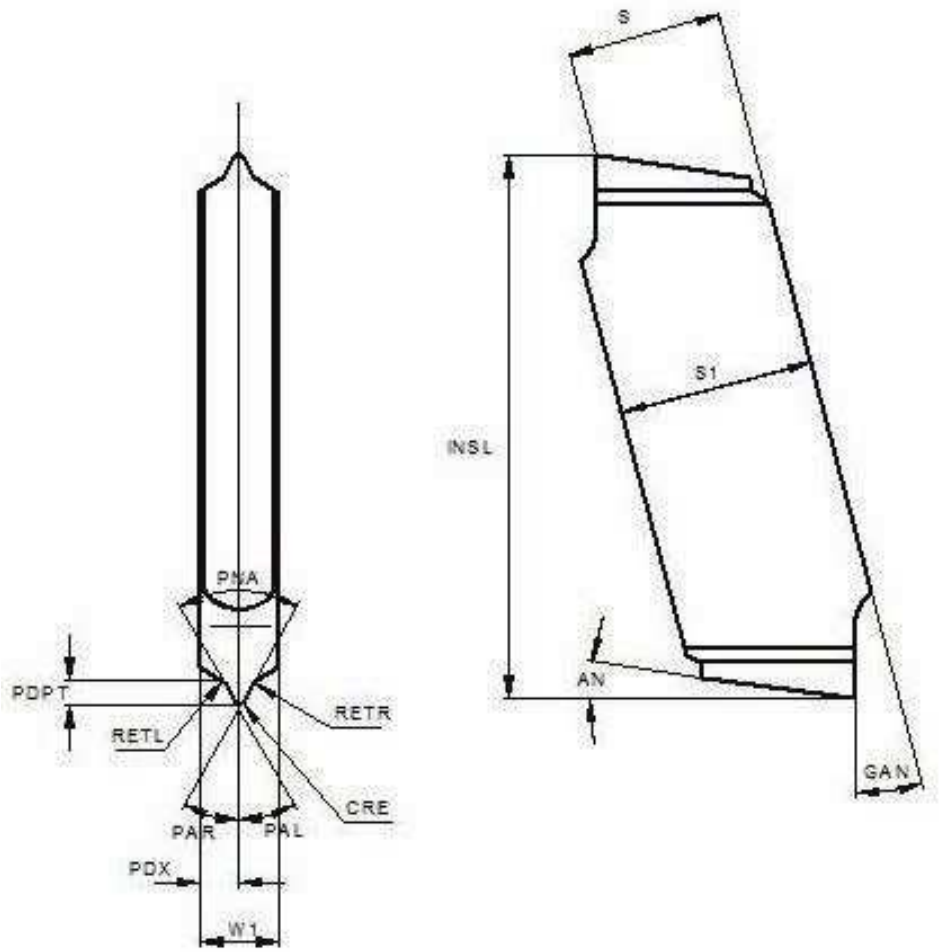


Figure 42 — Determination of properties for a threading insert with two cutting edges

For this kind of threading insert, the y-axis of the MCS shall be colinear with the symmetry line of the insert; this allows mounting irregular inserts of the same insert size with different thread profiles onto the same tool item, see Figure 43 and Figure 44.

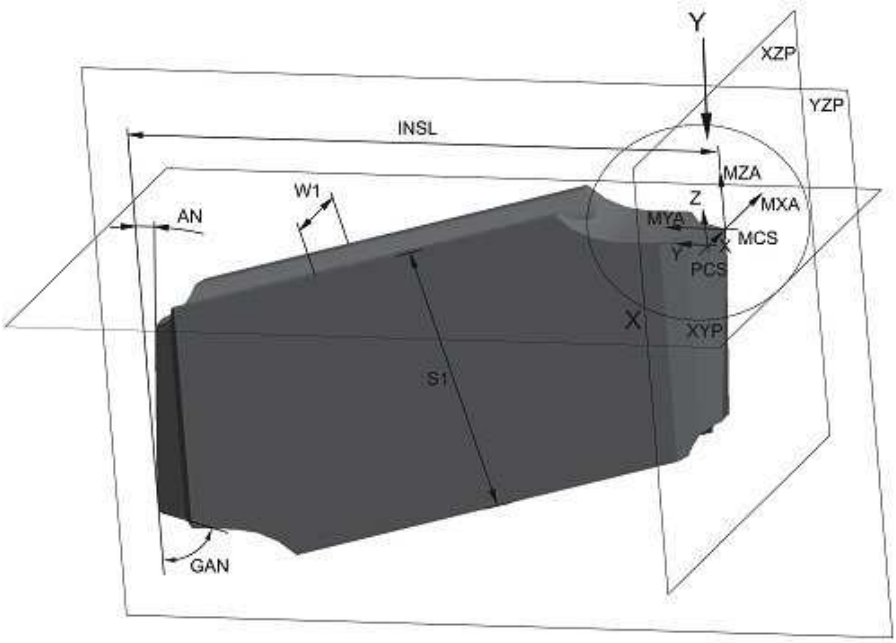


Figure 43 — Threading insert with two cutting edges: basic model

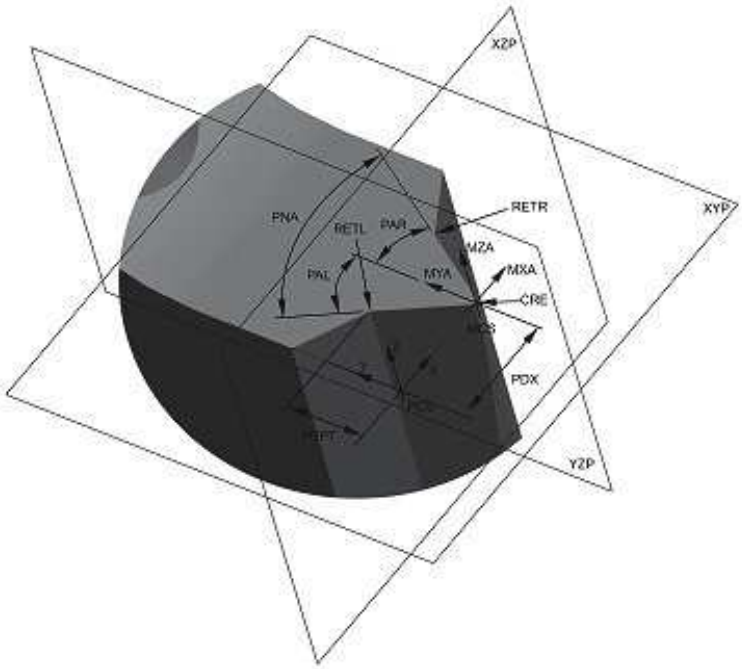


Figure 44 — Detail "X" of Figure 43 in view "Y"

7.5 Thread chaser

Figure 45 indicates the properties needed for the design of a thread chaser

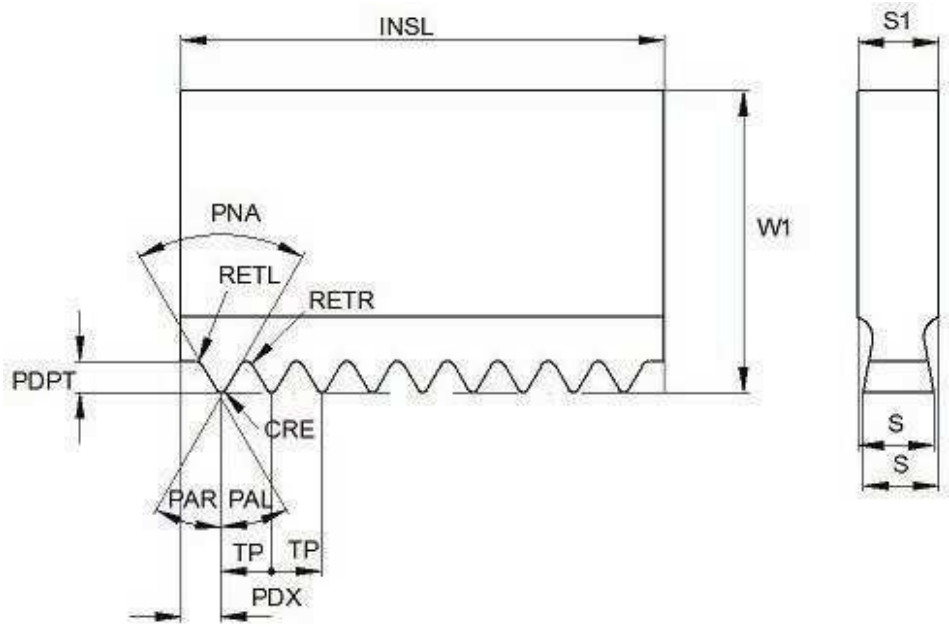


Figure 45 — Determination of properties for a thread chaser

For this kind of threading insert, the y-axis of the MCS shall be colinear with the y-axis of PCS, the MX axis shall be parallel to the x-axis of PCS with a distance of W1 and the MZ axis shall be parallel to the Z axis of PCS, see Figure 46 and Figure 47.

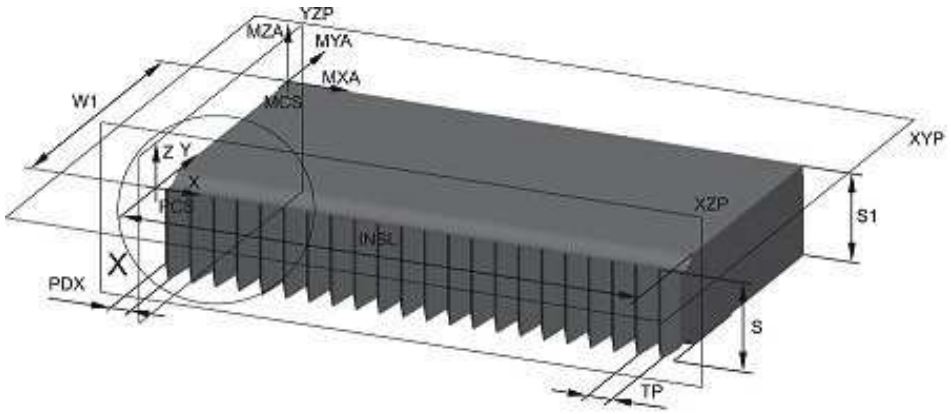


Figure 46 — Thread chaser with two cutting edges: basic model

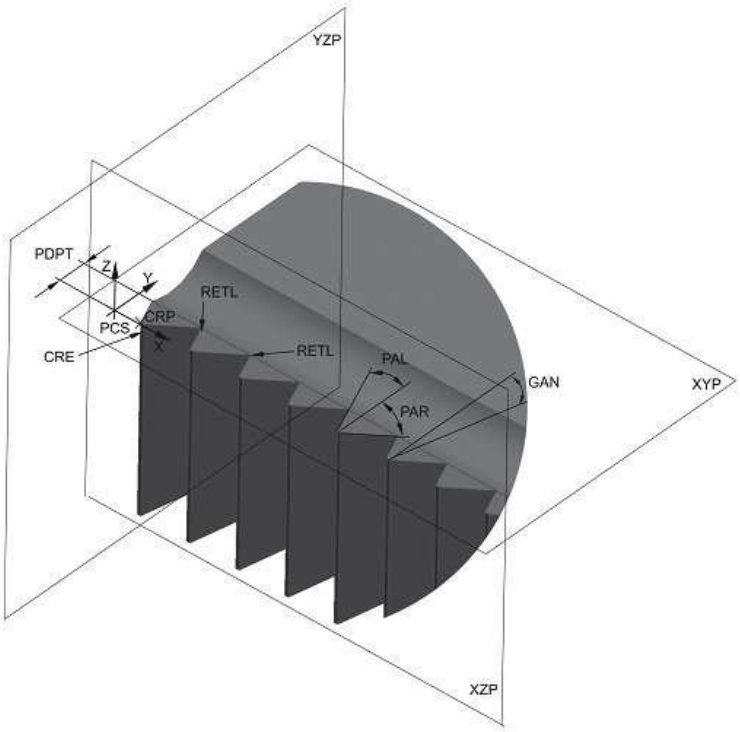


Figure 47 — Detail "X" of Figure 46

8 Fixing hole geometry of the inserts

8.1 General

The geometry of the fixing hole is dependent on the property "insert mounting style code" with the preferred symbol "IFS".

Except self-clamping inserts all other shapes of irregular inserts can have one of geometries defined in Table 5.

Table 5 — Insert mounting style code

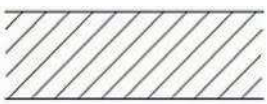
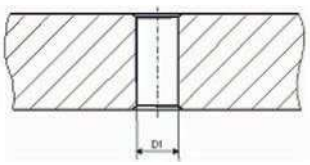
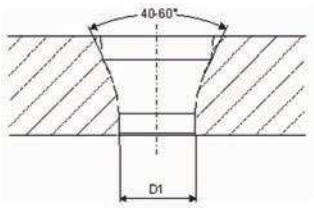
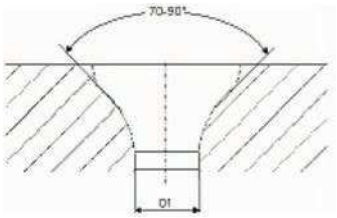
Code	Picture	Mounting style
1		Without fixing hole
2		Cylindrical hole
3		Partly cylindrical hole with 40° to 60° countersunk

Table 5 *(continued)*

Code	Picture	Mounting style
4		Partly cylindrical hole with 70° to 90° countersunk

If it is necessary to design the mounting hole, the properties given in Table 6 shall be used.

Table 6 — Fixing hole properties

Preferred name	Preferred symbol
Fixing hole diameter	D1
Insert mounting style code	IFS

In order to design the mounting hole, some additional properties are necessary. These properties shall not be part of the data exchange and representation, but to name them as parameters within the CAD design, the properties shall be labelled as indicated in Table 7.

Table 7 — Additional fixing hole properties

Preferred name	Preferred symbol
Fixing hole chamfer angle	FHCA
Fixing hole countersunk angle	FHCSA
Fixing hole countersunk diameter	FHCSD
Fixing hole countersunk depth	FHCSDP
Fixing hole countersunk radius	FHCSR
Fixing hole chamfer width	FHCW

With the additional properties shown in Table 7 it is possible to design the geometry of the fixing holes as illustrated in Figure 48 and Figure 49.

8.2 Fixing hole styles

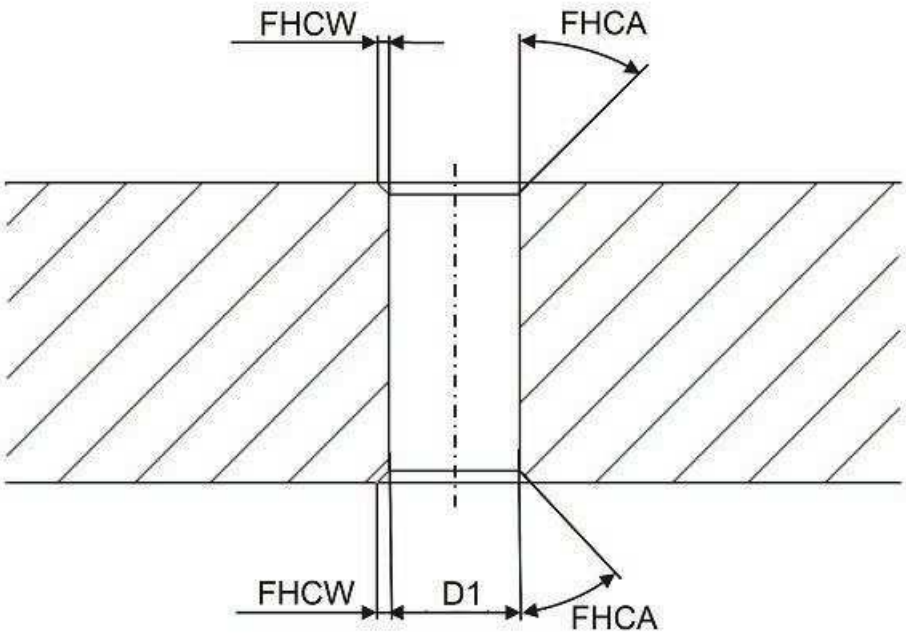


Figure 48 — Cylindrical fixing hole style 2

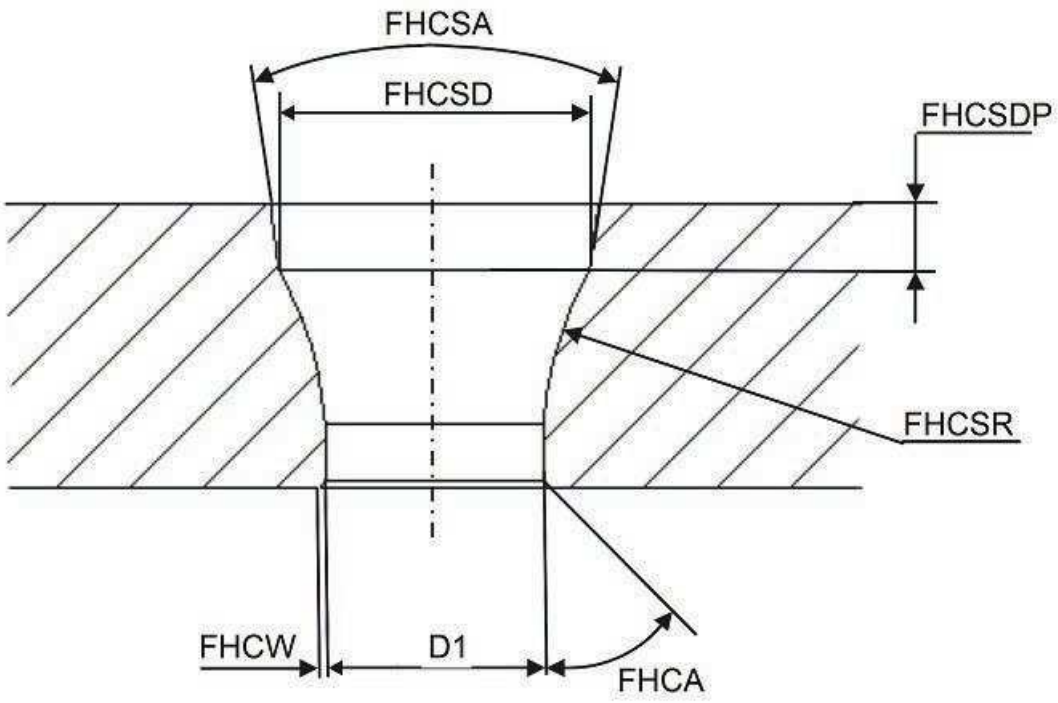


Figure 49 — Partly cylindrical fixing hole style 3 or 4

8.3 Fixing hole model

The model shall be designed by means of creating a sketch that is rotated 360 degrees about the Z-axis of the PCS and placed onto its location on the insert, which is basically the position of MCS. The sketch should not contain any manufacturing proprietary information, but shall be as detailed as needed for mounting information. The height of the model is dependent on the property *insert thickness* or the

property *insert thickness total*. The fixing hole style may also be valid for inserts having the countersunk geometry on both sides — see letter symbol "Q", "U", C" or "J" in ISO 1832:2012, Table 6.

9 Attributes of surfaces — Visualization of the model features

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

10 Structure of the design elements (tree of model)

10.1 General

For irregular inserts, the entire body shall be named as cutting part, i.e. the body is included in the group "CUT". Therefore the group "NOCUT" does not exist.

The inserts shall be designed in a simplified manner. Hereby, an approximate cutting edge is the result of this design. From this approximate cutting edge, a cutting edge line shall be created with the appropriate CAD functionality. This cutting edge line may either be an open or a closed polyline.

Some CAD systems give the possibility to suppress the detailed geometry of the irregular insert in dependency of the parameters and design elements. Therefore a group "DETAILS" will not be necessary.

In some cases threading inserts are mounted onto a tool item with a defined rake angle, and therefore these inserts also have the same value of this rake. To be able to show the "true" thread profile, those inserts shall have a simplified chip breaker in the model.

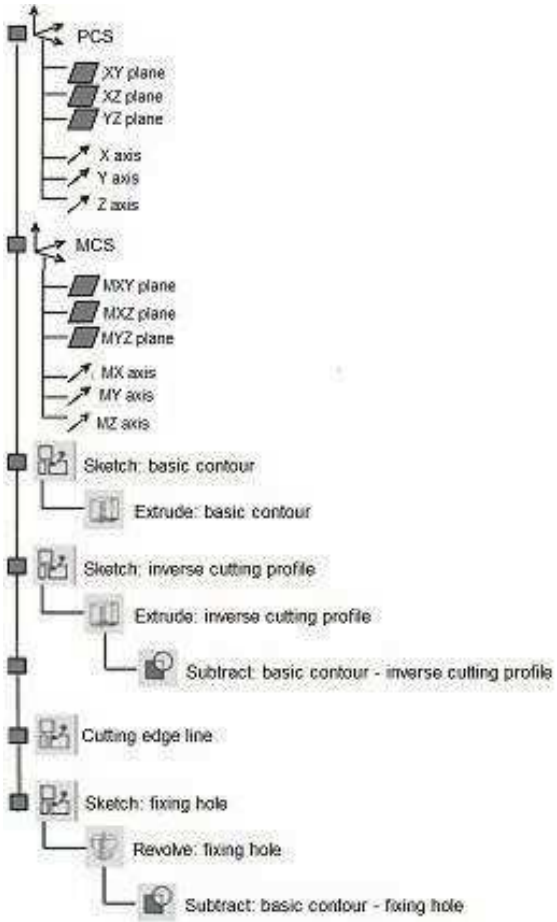


Figure 50 — Structure of an irregular insert

11 Data exchange model

Figure 51 and Figure 52 show the models for the data exchange according to ISO 10303-242, which replaced ISO 10303-214. These models contain all relevant features that are important for the collision examination (interference contour), the appropriate coordinate systems and the cutting edge line.

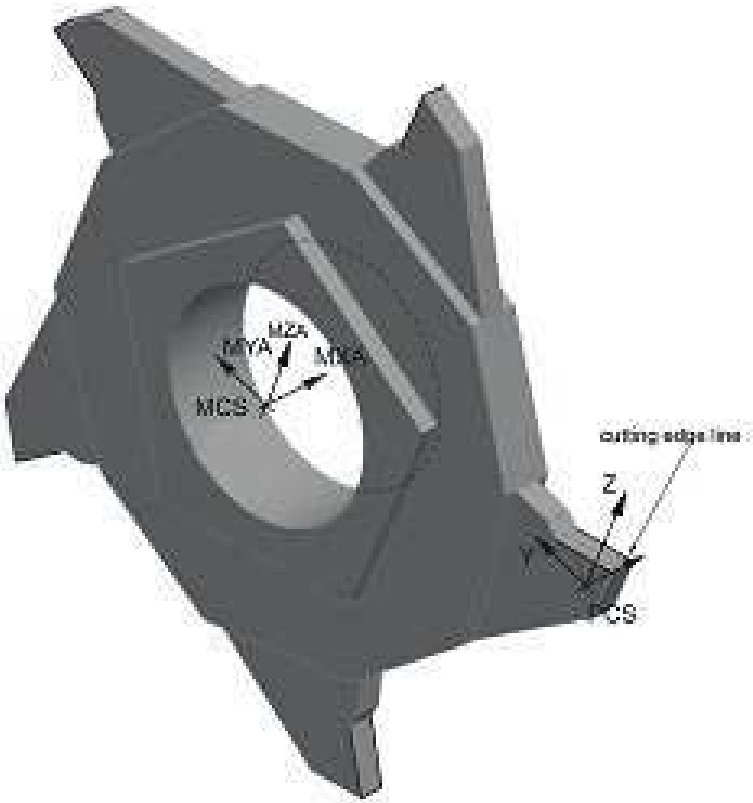


Figure 51 — Example 1 — Grooving and parting insert with multiple cutting edges — Data exchange model

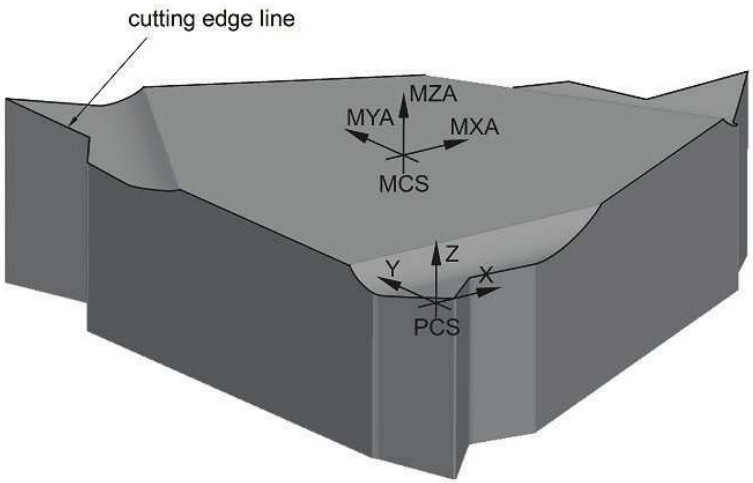


Figure 52 — Example 2 — Threading insert with three cutting edges, one tooth — Data exchange model

Bibliography

[1] ISO 513, *Classification and application of hard cutting materials for metal removal with defined cutting edges — Designation of the main groups and groups of application*

[2] ISO 10910, *Classification and designation of approximate chip control zones for indexable inserts with chipbreakers*

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

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

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

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

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

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

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