THREADING HANDBOOK

ISCAR's Reference Guide for Threading Applications

Member IMC Group

ISCAR

www.iscar.com

Threading – Handbook Contents

INTRODUCTION

1 Introduction

A lot of things around us, whether it be everyday objects or industrial products, have a thread connection. The history of thread connections began many years ago.

The first fastening parts with threads were used in ancient Rome.
However, due to the high cost, they were only used for jewelry, medical instruments and other expensive products.

Bolts and nuts were widely used in the 15th century. They connected the mobile segments of armor and parts of watch mechanisms. The first printing machine, invented by Johannes Gutenberg between 1448 and 1450, had threaded connections - its parts were fastened with screws.

At the beginning of the 17th century, a threaded connection appeared similar to the type found today. Initially, the thread pitch was only in inches until the French introduced the metric thread only at the beginning of the 19th century.

At the present time, parts with threads are widely used in many different industries.

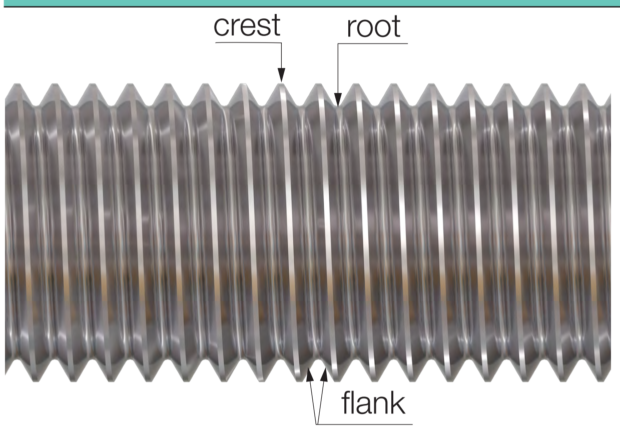
What is a Thread?
A thread is a surface formed by a helical movement of a flat contour along a helical line. The basis of threading is the principle of obtaining a helix. There are many different standards, types and ways of producing threads. In many cases, the thread process occurs in the final stages of manufacturing the part, thereby occupying a responsible role for obtaining quality parts. The key to high quality and efficient thread processing is a correct and well-composed technological process.

The assigned thread machining strategy is directly related to the correct selection of the cutting tool. It is the tool, a small and seemingly minor element in the production of threads that can significantly increase productivity and quality. **ISCAR** understands the role of the tool, particularly in threading and metal processing in general, and aims to provide our customers with a reliable tool that will meet their requirements.

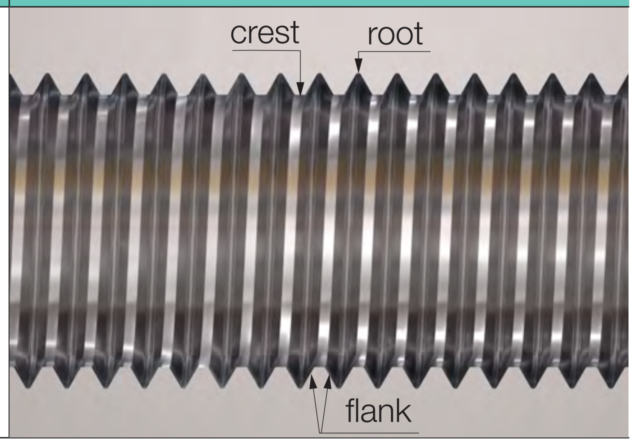
1.1 Thread Parameters

Thread can be defined as a continuous helical ridge on the nut (inner part) or screw (outer part) of a cylinder. The ridge is called a crest, and the dip or space between each crest is referred to as the root. The side of the thread surface that connects the crest and the root is called the flank.

Screw (Outer Part)



Nut (Inner Part)

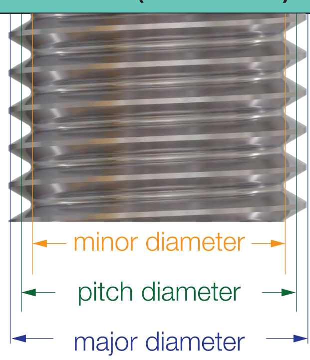


Thread geometry with value, angles, radiuses, etc. contain tolerances defined in thread standards. The main parameters of thread geometry and thread functionality are: diameters, pitch, lead, helix angle, lead angle, and truncation.

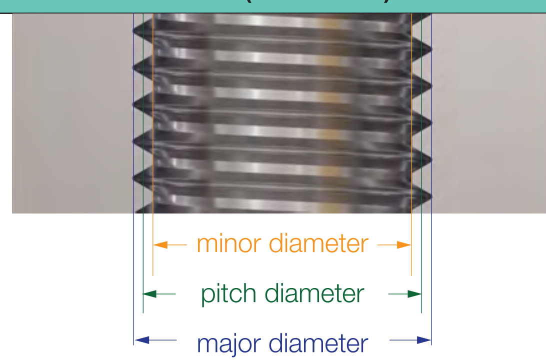
Diameters

There are three main thread diameters: major diameter, pitch dimeter and minor diameter. Value and tolerances for each diameter differ according to each thread standard.

Screw (Outer Part)



Nut (Inner Part)



- Major Diameter – the largest diameter of two extreme diameters.
  In external threads, the major diameter defines the end limit of a thread profile and in internal threads, the major diameter defines the start of a thread profile. Therefore, for external threads the major diameter is an outer thread diameter and for internal threads, the major diameter is an inner thread diameter. Usually the major diameter of external threads is smaller than the major diameter of internal threads, if the threads are designed to fit together.

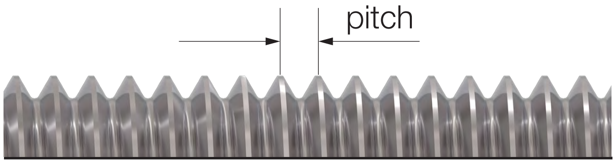
- Minor Diameter – the smallest diameter of two extreme diameters. In external threads, the minor diameter defines the start of a thread profile and in internal threads, the minor diameter defines the end limit of a thread profile. Therefore, for external threads the minor diameter is an inner thread diameter and for internal threads the minor diameter is an outer thread diameter. Space between the minor diameter of an external thread and the minor diameter of an internal thread should be minimized to ensure correct thread functionality, if the threads are designed to fit together.
- Pitch Diameter (Effective Diameter) – the pitch diameter is also known as an effective diameter, since this is the most probable area for the external and internal threads to engage. Pitch diameter is a theoretical diameter representing the place where the width of the basic thread profile is equal to half a pitch.

Pitch / Threads per Inch (TPI)

Pitch and Thread per Inch (TPI) define the same threading feature, only in different terms.

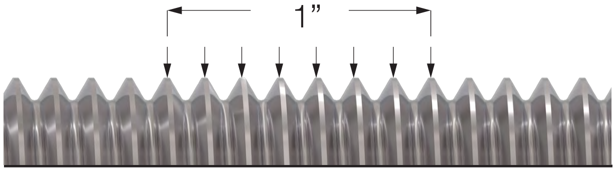
Pitch - a main and common parameter for all types of metric threads, usually expressed in millimeters. Pitch defines the distance along a line parallel to the axis of the thread length between the sides of the thread profile placed in the same axial plane on one side of the axis of rotation.

Pitch for Metric Threads



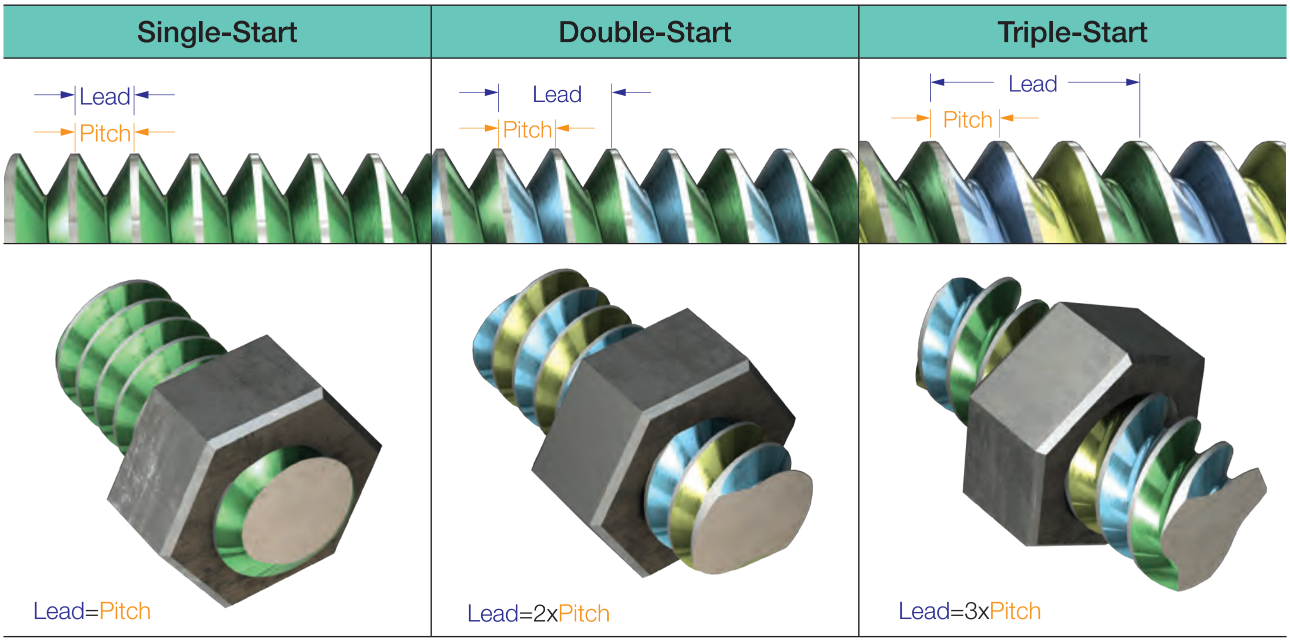
Thread per Inch (TPI) - a main and common parameter for all types of inch-based threads. TPI defines the count / number of threads per distance of 1 inch along the length of threads placed in the same axial plane on one side of the axis of rotation.

Theads per Inch (TPI)



Lead

Lead is the distance that defines an axial movement of any point moving in relative motion per one full turn (360°) along a line parallel to the thread axis. In a single-start thread, the lead is equal to the thread pitch. In a multi-start thread, the lead is equal to the thread pitch multiplied by the number of starts.



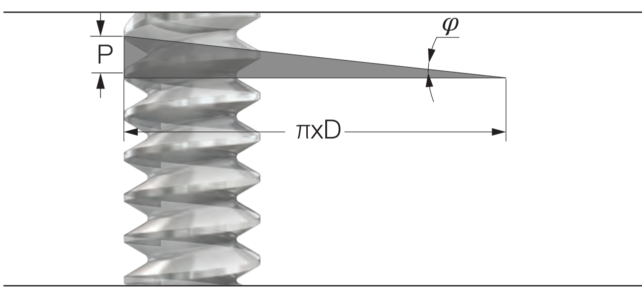
Helix Angle

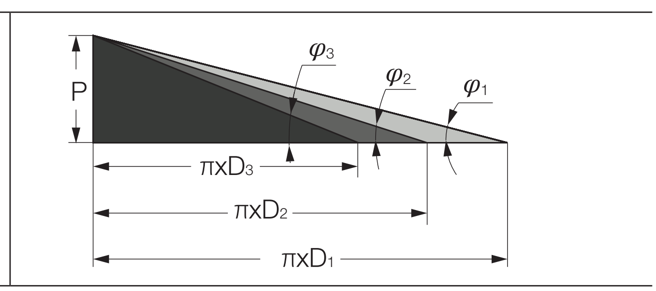
The helix angle of the thread influences thread efficiency and is necessary for calculating torque in thread applications. The helix angle of the thread can be defined by unraveling the helix from the thread, representing the section as a right triangle and calculating the angle that is formed.

$$\varphi = \arctan\left(\frac{P}{\pi \times Dpitch}\right)$$

When:

φ	=	Helix angle
P	=	Thread pitch
Dpitch	=	Pitch diameter (effective diameter of thread)
π	≈	3.142





Lead Angle

Lead angle is the angle between the helix of thread and a plane of rotation. The lead angle of the thread depends on the pitch diameter, thread pitch, and the number of thread starts. This parameter can be represented as a sweep of a right triangle.

The angle of the thread is calculated by the formula given below:

$$\varphi_L = \arctan\left(\frac{Lead}{\pi \times Dpitch}\right)$$

$$Lead = n \times P$$

When:

φ_L = Lead angle

Dpitch = Pitch diameter (effective diameter of thread)

P = Thread pitch

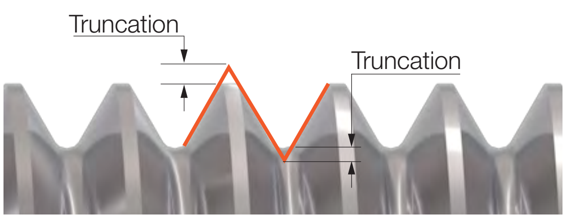
n = Number of thread starts

π ≈ 3.142

Where the thread is single-start, the lead angle is equal to the helix angle.

Truncation

Truncation is the perpendicular distance to the axis of the thread from the imaginary point of intersection of two adjacent sides of the thread profile to the nearest point of its top or bottom.



1.2 Thread Classifications

Threads can be classified by the following criteria:

Gender

Depending on the location of the surface, the thread may be external (cut on a rod) or internal (cut into a hole).

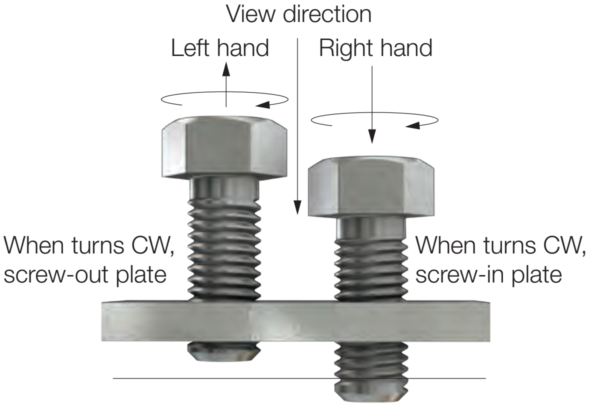
External Thread	Internal Thread
	

Designation

The threads are divided into fasteners or connection parts, running or kinematic (in a movable connection) by main application. Often the fastening threads carry a second function - sealing the threaded connection, ensuring its tightness.

Handedness

This represents the direction of the thread helix, which can twist in two possible directions: clockwise (CW) and counter-clockwise (CCW). When the thread is designed to be turned in a clockwise direction, it is known as a "right-handed (RH) thread." When the thread is designed to be turned in the opposite direction, it is known as a "left-handed (LH) thread."



Pitch

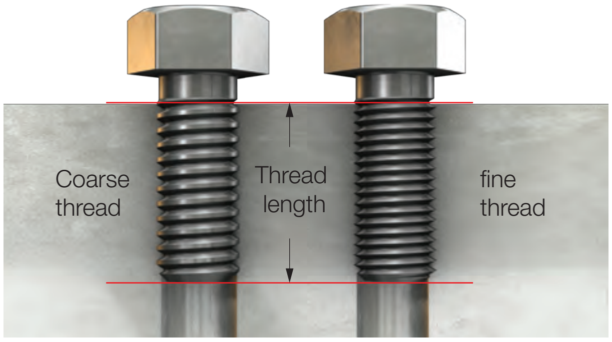
Thread pitch can be classified by "coarse pitch" and "fine pitch." The terms refer to the size of the threads relative to the screw diameter and do not imply differences in thread quality, tolerances, or cost. They can be compared as follows:

Coarse Pitch

- Fewer threads per axial distance
- Larger thread form relative to screw diameter
- More resistant to stripping and cross threading due to greater flank engagement
- Install much faster as they require fewer turns per unit length

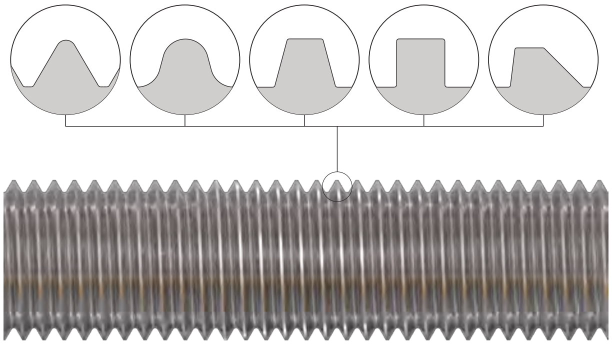
Fine Pitch

- More threads per axial distance
- Smaller thread form relative to screw diameter
- Stronger due to a larger stress area for the same diameter thread
- Less likely to vibrate loose as they have a smaller helix angle and allow finer adjustment
- Develop greater preload with less tightening torque



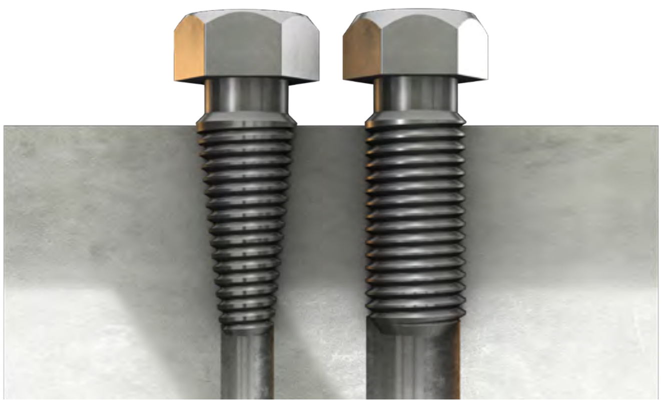
Profile

Thread profile, also called thread form, which refers to the cross-sectional shape of a thread. It may be square, triangular, trapezoidal, or other shapes.



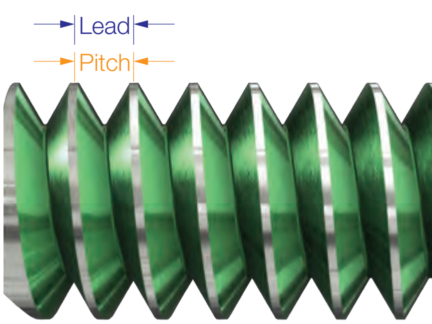
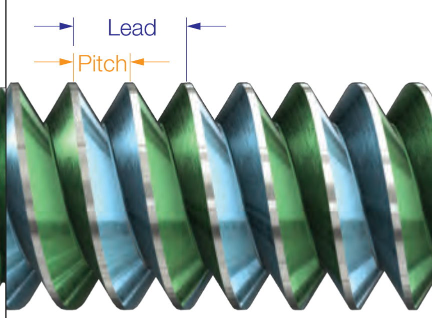
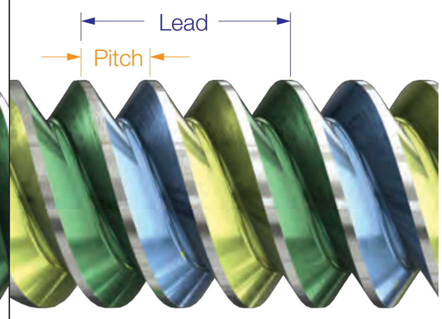
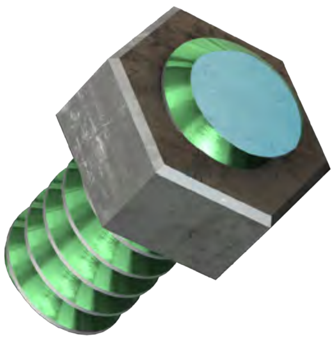
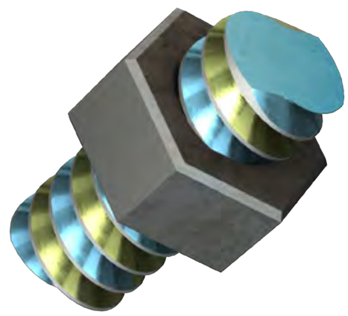
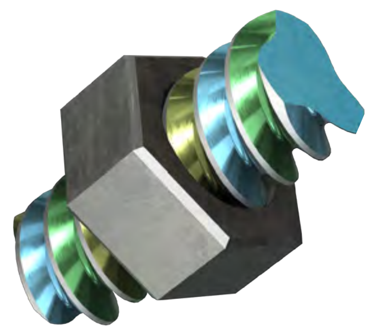
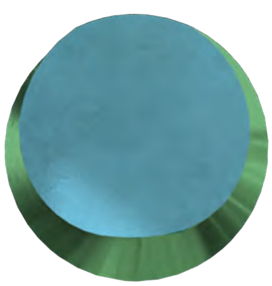
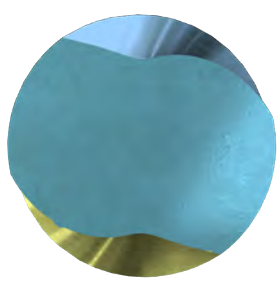
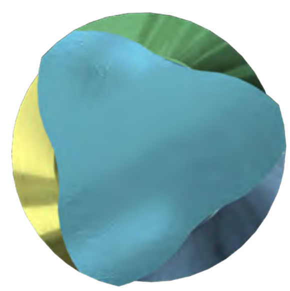
Surface Shape

The shape of the surface on which the thread is cut: it can be cylindrical or conical.

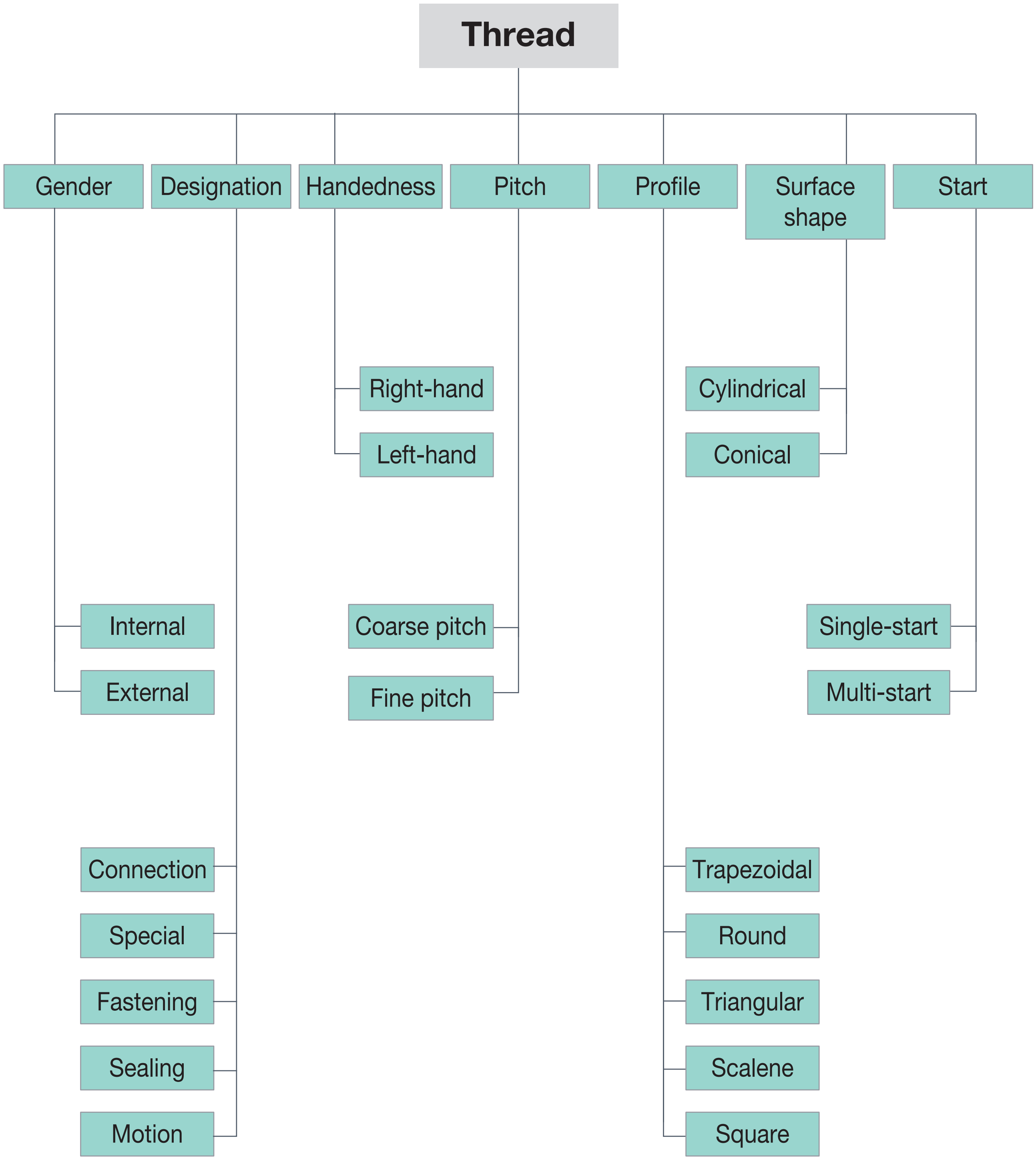


Starts

According to the number of starts, the threads are divided into single-start and multi-start threads. A single-start thread has one continuous thread running along the body of the screw. A multi-start thread consists of two or more intertwined threads running parallel to one another. The lead distance of a double-start thread is twice that of the single-start thread and a triple-start thread has triple that of the single-start thread. For example, if the end of the workpiece part is divided into two or three equal parts, and the threads start from each of these points, then this indicates double or triple thread starts.

Single-Start	Double-Start	Triple-Start
		
 Lead=Pitch	 Lead=2xPitch	 Lead=3xPitch
		

Thread Classifications



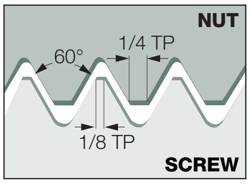
1.3 Thread Standards

To ensure the interchangeability of threaded products for the main parameters of thread profiles, it is necessary to set the appropriate standards.

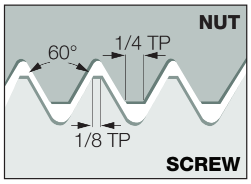
The Most Common Standards According to Their Purpose

Machinery and General Use

ISO

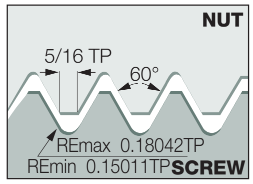


UN

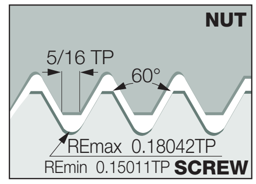


Aerospace Industry

UNJ

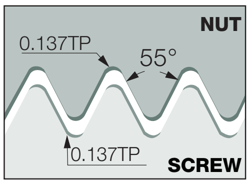


MJ

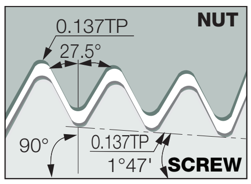


Pipe Threads (Connection, Fittings and Sealing)

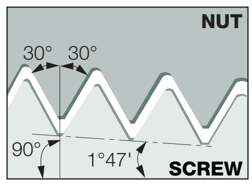
BSW



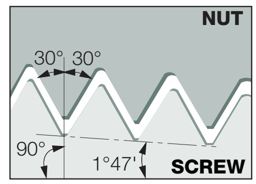
BSPT



NPT

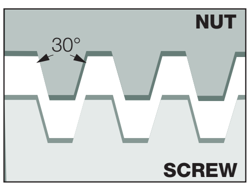


NPTF

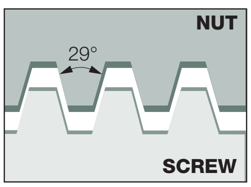


Trapezoidal Worm Threads for Power Transmission

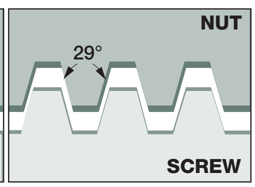
Trapeze



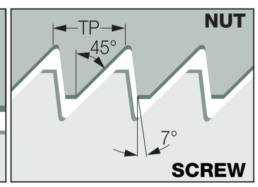
Acme



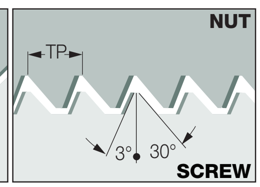
Stub Acme



American Buttress

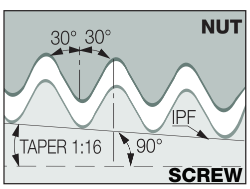


Metric Buttress

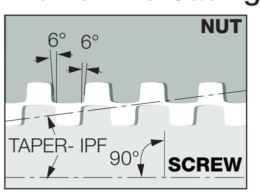


Oil & Gas Industry for Pipes and Couplings

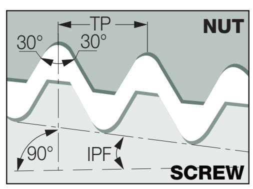
API Round



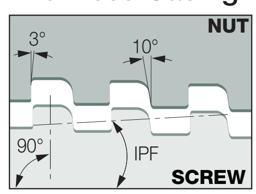
Exteme Line Casing



API

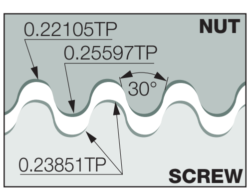


Buttress Casing



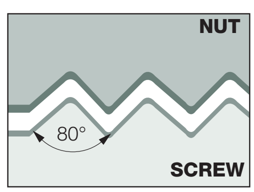
Fire Fighting and Food Industry Pipe Couplings

RND



Electric Cable Connectors - Join Pieces of Electrical Conduit and Cable Glands

PG



1.4 Thread Accuracy

In thread manufacturing, permissible limits are defined for the actual thread profile's deviations from the theoretical thread profile. To ensure correct threading operations, the thread profile cannot cross the theoretical profile, and therefore, this permissible limit is set by tolerances. The external and internal thread should only contact the sides of the threaded profile, therefore the main parameter that influences thread tolerance is the pitch diameter. Tolerances on major and minor diameters are set in such a way as to exclude the possibility of collision on the tops and bottoms of the thread. Each thread standard contains a different tolerance method.

ISCAR provides tools for thread production at all standards and in all accuracy classes

Tolerance System ISO Standard

In accordance with the ISO standard, threading accuracy is determined by the combination of tolerance grade and tolerance position.

Tolerance grades are classified by numbers according to major, pitch and minor diameters and are different for internal and external threads.

Internal Threads		External Threads	
Dimension	Tolerance grade	Dimension	Tolerance grade
Minor diameter	4, 5, 6, 7, 8	Major diameter	4, 6, 8
Pitch diameter	4, 5, 6, 7, 8	Pitch diameter	3, 4, 5, 6, 7, 8, 9

Tolerance positions are classified by letters and are different for external and internal threads.

Gender	Tolerance Position
Internal Threads	G, H
External Threads	e, f, g, h

Possible Combinations of Thread Tolerances:

Internal (Nut) Threads — more precise ↔ undersized

H	Pich Diameter	Minor Diameter
	8	8
	7	7
	6	6
	5	5
	4	4

G	Pich Diameter	Minor Diameter
	8	8
	7	7
	6	6
	5	5
	4	4

Basic Size

External (Screw) Threads — more precise ↔ undersized

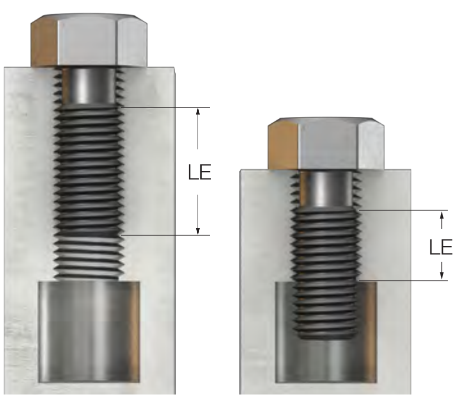
e	Pich Diameter	Major Diameter
	3	4
	4	6
	5	8
	6	-
	7	-
	8	-
	9	-

f	Pich Diameter	Major Diameter
	3	4
	4	6
	5	8
	6	-
	7	-
	8	-
	9	-

g	Pich Diameter	Major Diameter
	3	4
	4	6
	5	8
	6	-
	7	-
	8	-
	9	-

h	Pich Diameter	Major Diameter
	3	4
	4	6
	5	8
	6	-
	7	-
	8	-
	9	-

Thread accuracy can be classified by three classes: fine, medium, and coarse, depending on the length of thread engagement (the length of interaction between the fastener and nut member (i.e. nut or mating material for the screw) which is divided into three groups: short, normal, and long.



LE - length of thread engagement

Recommended tolerance classes for internal Threading

Tolerance Class	Position G			Position H		
	Short	Normal	Long	Short	Normal	Long
Fine	---	---	---	4H	5H	6H
Medium	5G	6G	7G	5H	**6H**	7H
Coarse	---	7G	8G	---	7H	8H

Recommended Tolerance Classes for External Threading

Tolerance Class	Position e			Position f			Position g			Position h		
	Short	Normal	Long	Short	Normal	Long	Short	Normal	Long	Short	Normal	Long
Fine	---	---	---	---	---	---	---	4g	5g4g	3h4h	4h	5h4h
Medium	---	6e	7e6e	---	6f	---	5g6g	**6g**	7g6g	5h6h	6h	7h6h
Coarse	---	8e	9e8e	---	---	---	---	8g	9g8g	---	---	---

When:

1st choice	2nd choice	3rd choice

** bold - most common

There are several options for thread description with accuracy class according to the ISO standard:

Internal Threading

Major Diameter X **Pitch** - **Tolerance Class for Pitch Diameter** **Tolerance Class for Minor Diameter**

M8X1.25 – 5H 6H

Major Diameter - **Tolerance Class for Pitch and Minor Diameter**

M8 – 6H

External Threading

Major Diameter X **Pitch** - **Tolerance Class for Pitch Diameter** **Tolerance Class for Major Diameter**

M8X1.25 – 5g 6g

Major Diameter - **Tolerance Class for Pitch and Major Diameter**

M8 – 6g

Tolerance System UN/ UNC/ UNJ/ UNR/ UNS/ UNRS/ UNF/ UNEF Standards

The UN/ UNJ/ UNR/ UNS/ UNRS/ UNF/ UNEF standards define 3 classes of accuracy for external threads and internal threads:

External Threading	Internal Threading
• 3A (Tight tolerance) • **2A (Medium tolerance)** • 1A (Loose tolerance)	• 3B (Tight tolerance) • **2B (Medium tolerance)** • 1B (Loose tolerance)

** bold - most common

The value and range of the tolerance according to accuracy class are described by tables, formulas, and charts in the UN standard.
Possible combinations are described in the UN standard.
Not all combinations exist in all three tolerance classes.

Examples for thread description according to UN/ UNC/ UNJ/ UNR/ UNS/ UNRS/ UNF/ UNEF standards with accuracy class:

Major Diameter	Thread per Inch (TPI)	Thread Standard	-	Accuracy Class

External Threading	Internal Threading
3/8 16 UNC – 3A	3/8 16 UNC – 3B
1/2 20 UNF – 2A	1/2 20 UNF – 2B
9/16 24 UNEF – 1A	9/16 24 UNEF – 1B

Useful information

- UN standard for external threading can be connected with UNJ and UN standards for internal threading.
- UNR standard for external threading can be connected with UNJ and UN standards for internal threading.
- UNJ standard for external threading can be connected with UNJ standard for internal threading only.
- UN standard for internal threading cannot be connected with UNJ standard for external threading.
- UNJ standard for internal threading can be connected with UN/ UNC/ UNJ/ UNR/ UNS/ UNRS/ UNF/ UNEF standards for external threading.

Tolerance System BSW Standard

The BSW standard defines 3 classes of accuracy for external threads and 2 classes of accuracy for internal threads:

External Threading	Internal Threading
• Close Class (Tight tolerance) • Medium Class (Medium tolerance) • Free Class (Loose tolerance)	• Medium Class (Medium tolerance) • Normal Class (Loose tolerance)

The value and range of the tolerance according to the accuracy class are described by tables, formulas, and charts in the BSW standard.

Recommended combinations:

- Close Class for external threading is intended for use with Medium Class for internal threading
- Medium Class for external threading is intended for use with Normal Class for internal threading
- Free Class for external threading is intended for use with Normal Class for internal threading

There are two options for thread description according to the BSW standard:

	Major Diameter	-	Thread per Inch (TPI)	B.S.W	(Accuracy Class)	Bolt (for External Threads) Nut (for Internal Threads)
W	Major Diameter	-	Thread per Inch (TPI)		(Accuracy Class)	Bolt (for External Threads) Nut (for Internal Threads)

Examples for thread description according to the BSW standard with accuracy class:

External Threading

- 5/16 -18 B.S.W. (close) bolt or W 5/16 -18 (close) bolt
- 1/2 -12 B.S.W. (medium) bolt or W 1/2 -12 (medium) bolt
- 11/8-7 B.S.W. (free) bolt or W 11/8-7 (free) bolt

Internal Threading

- 5/16 -18 B.S.W. (medium) nut or W 5/16 (medium) nut
- 11/8 -7 B.S.W. (normal) nut or W 11/8 (normal) nut

Useful formulas:

1 inch = 25.4 mm

$$\frac{25.4}{T.P.I} = \text{Pitch}_{\text{(mm)}}$$

1.5 Thread Production Methods

Threads can be produced by various methods according to thread size, accuracy, available equipment, size of requested part, material, workpiece geometry, production time, production cost, etc.

Main Methods for Thread Production

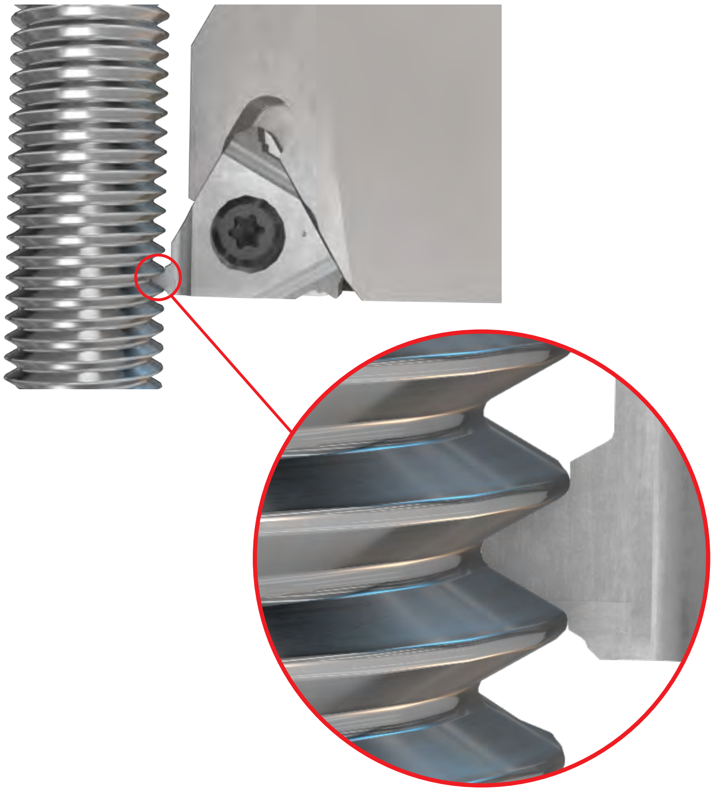
Machining Method	Deformation Method	Non-Traditional Method
• Thread Cutting • Thread Turning • Thread Milling • Thread Tapping • Thread Whirling • Thrilling • Helical Broaching (Punch Tapping) • Thread Grinding • Thread Lapping • Threading with EDM	• Rolling • Molding	• 3D printing

ISCAR offers solutions for thread production for most types of machining methods. The use of appropriate tools to produce threads is undoubtedly one of the main factors influencing the success of the process.

1.6 Tool Profiles for Thread Production

Tool profiles for thread production can be divided into three main types: full profile, partial profile, and multi-tooth.

Full Profile



Tools belonging to this group are designed to produce a full profile of the requested thread. Each full profile thread tool is suitable for a specific thread profile and pitch only. Full profile tools are recommended for mass production.

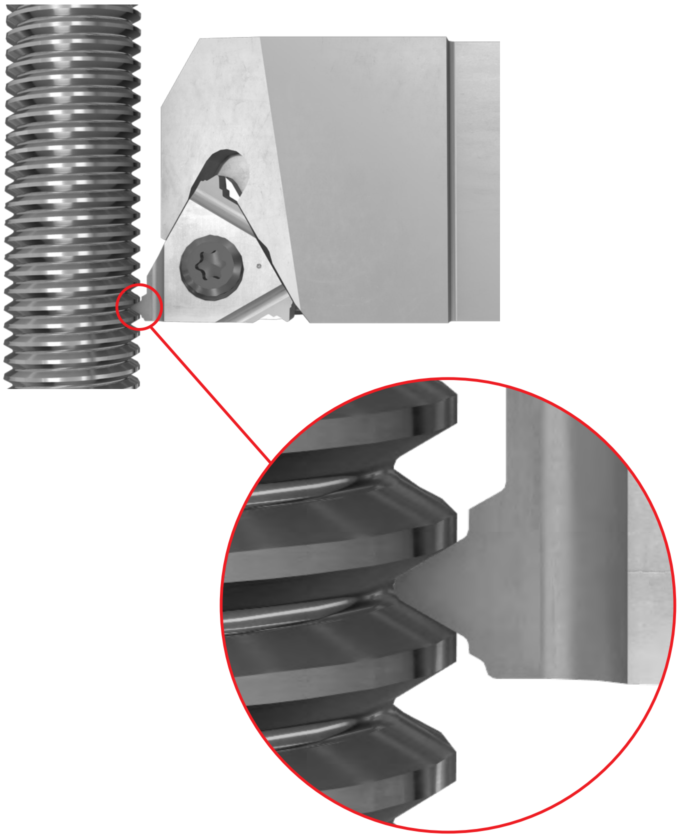
Advantages of Full Profile Tools

- Finish the thread in one operation
- Bigger corner radius means better tool life
- Ensures correct depth of thread
- No deburring

Disadvantages of Full Profile Tools

- Cutting edge is suitable for the relevant thread profile and pitch only
- Requires a wider variety of items in the workshop

Partial Profile



Tools belonging to this group do not produce the outer diameter (major diameter) of external threads or the inner diameter (minor diameter) of internal threads, which means that one or more additional operations are needed to complete the thread diameter. These tools are not recommended for mass production.

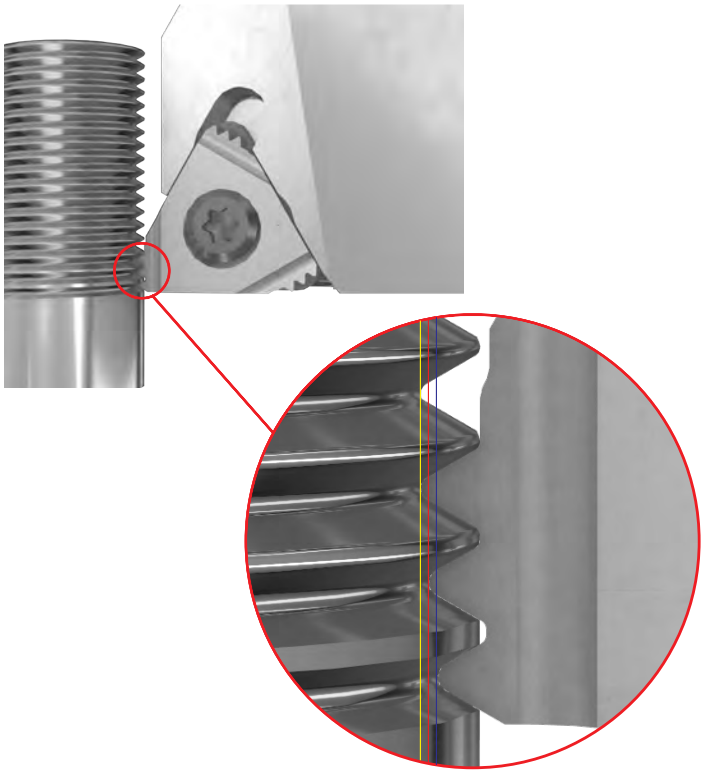
Advantages of Partial Profile Tools

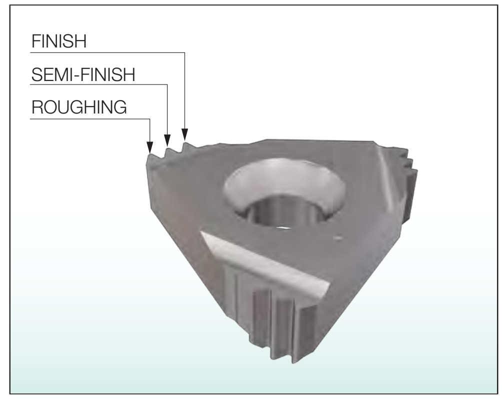
- Small corner radius, suitable for many pitch sizes
- Reduces stock of many different full profiled inserts

Disadvantages of Partial Profile Tools

- Small corner radius will result in shorter tool life
- Requires additional operation/s to the complete the outer (major) or inner (minor) diameter, depending on the thread gender

Multi-Tooth





Multi-tooth tools produce a full profile of the requested thread. These tools, usually have two or three cutting teeth. The thread profile is produced by the last tooth and the previous teeth (or tooth) are used for rough and semi-finish operations, thereby facilitating the work of the last tooth. These tools are recommended for mass production.

Advantages of Multi-Tooth Tools

- Finish the thread in one operation
- Reduces the number of passes for high productivity – multi-tooth tools are similar to full profile tools but have more than one cutting point (two-pointed tools give double productivity, three-pointed tools give triple, etc.)
- Ensures longer tool life
- Ensures correct depth of thread
- No deburring

Disadvantages of Multi-Tooth Tools

- Can not work next to shoulder and requires wide thread relief
- High cutting forces
- Requires a larger variety of items in the workshop

The **ISCAR** catalog of thread products contains all types of threading solutions.

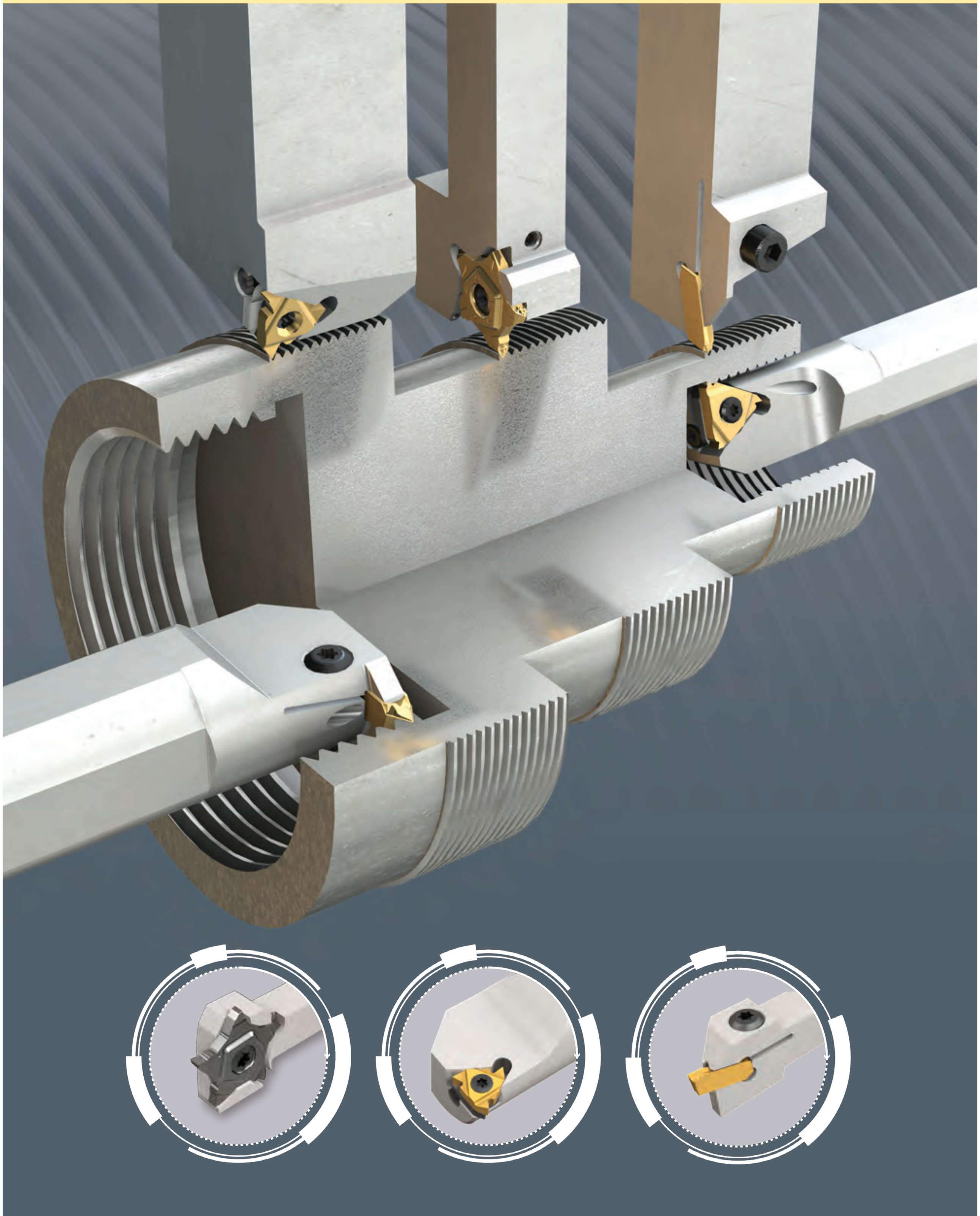
1.7 ISCAR Threading Products

ISCAR offers a wide range of threading tools for most industries and applications, covering internal and external processing and processing of small-sized parts. Whatever the method of processing, **ISCAR** will identify a suitable tool for the requested thread.

ISCAR Threading Products

- Non – Rotating Tools
  - Tools with Indexable Inserts
  - Solid Tools
- Rotating Tools
  - Taps
  - Tools with Indexable Inserts
  - Tools with Indexable Heads
  - Solid Tools
- Toolholders

THREAD TURNING

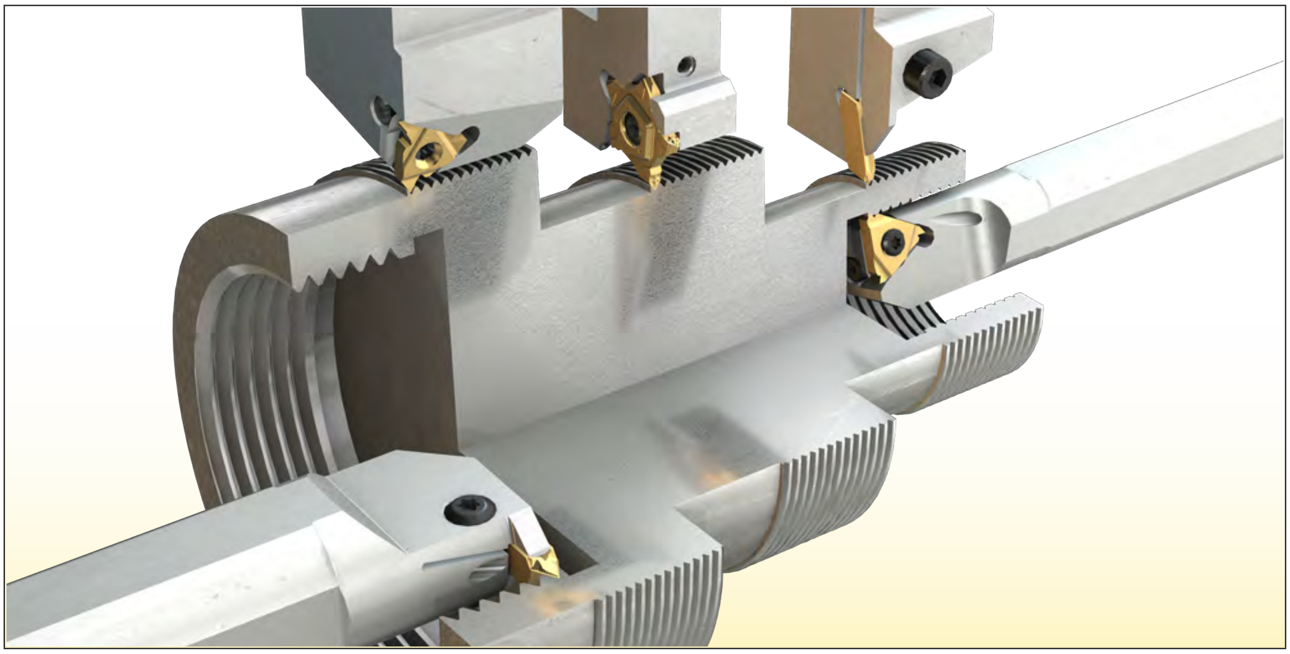


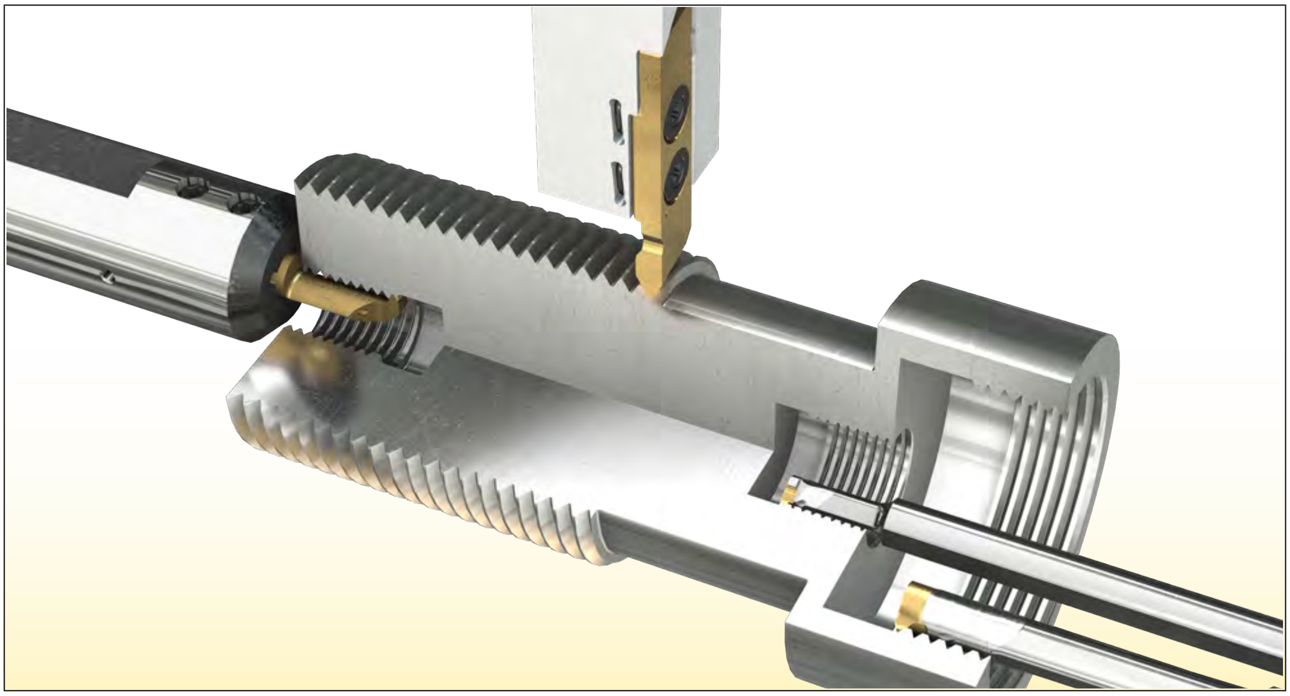
2 Thread Turning

Thread production by turning operation is possible for external and internal threading.

The principle of thread production by turning operation is based on the constant linear movement of the tool/insert relative to the rotational movement of the workpiece.
The geometry of the threading profile is identical to the cutting edge profile. On lathes or turning stations, threads are cut into several passes, and after each pass the cutter moves back to its original position. The number of passes is determined by the material of the workpiece, type of cutter, threading type, requirements for accuracy, surface finish, etc.

ISCAR offers a wide range of tools and inserts for all types of threading.





2.1 ISCAR Product Families for Thread Turning

ISCAR offers product families that provide solutions for both external and internal threading according to most standards.

ISCAR's products for thread turning operations can be divided into three main groups, each containing several families/lines:

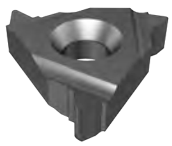
- Tools carrying **ISCAR** threading laydown inserts - used for both external and internal threading.

B-TYPE

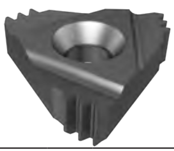
M-TYPE

U-TYPE

G - TYPE

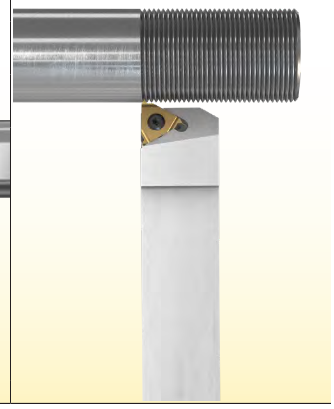


Multi-Tooth



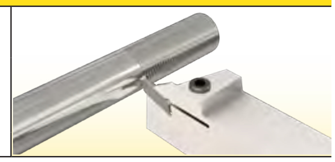
ISCAR Internal Threading

ISCAR External Threading

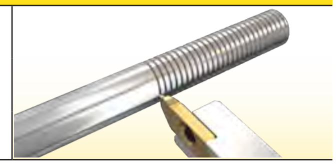


- Tools carrying **ISCAR** standard inserts - mainly used for external threading

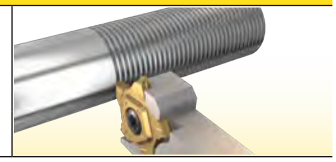
CUT-GRIP External



SWISSCUT External

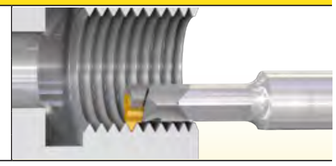


PENTACUT External



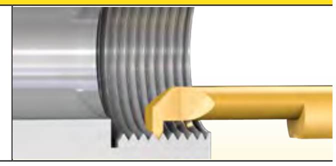
- Tools carrying **ISCAR** standard inserts - used for internal threading only

MINICHAM Internal



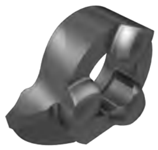
Minimum bore dia. 4 mm

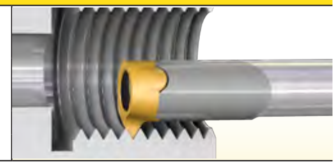
PICCOCUT Mini-Bar



Minimum bore dia. 2.4 mm

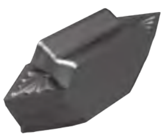
CHAMGROOVE Internal



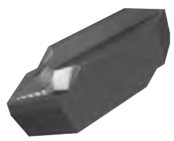


Minimum bore dia. 8.0 mm

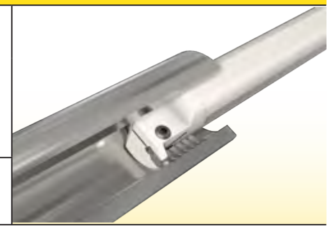
CUT-GRIP Internal



Minimum bore dia. 12.5 mm



Minimum bore dia. 20 mm



Partial profile

Full profile

2.2 Tools Carrying Threading Inserts

There are various types of tools that are used to machine external and internal threading. The difference between the tools and the choice of correct tools depends on machining connection type, threading type, requirements for accuracy, surface finish, etc.

External Threading

- Square Shank Tools with Bottom Fed High Pressure Coolant System
- Square Shank Tools with Coolant Channels
- Square Shank Tools without Coolant Channels
- Drophead Square Shank Tools without Coolant Channels
- Square Shank Tools with High Pressure Coolant System
- Interchangeable Adapters with Internal Channels for High Pressure Coolant
- Tools with CAMFIX/CAPTO Exchangeable Tapered Shanks with Coolant Channels
- Interchangeable Adapters with Internal Coolant Channels
- Interchangeable Adapters without Internal Coolant Channels
- Blades

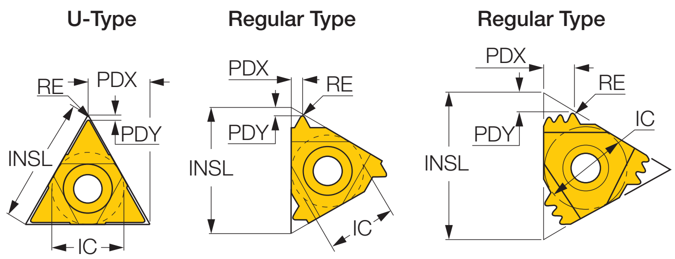
Internal Threading

- Tools with CAMFIX/CAPTO Exchangeable Tapered Shanks with Coolant Channels
- Threading Bars with Coolant Channels
- Square Shank Tools without Coolant Channels
- Multi-Use Holder
- Perpendicular Holder
- Interchangeable Heads with Internal Coolant Channels
- Interchangeable Heads without Internal Coolant Channels
- High Precision Holder with Coolant Channels

2.3.1 Laydown Inserts for External and Internal Threading

Laydown inserts belong to the **ISCAR** threading family. The geometry (length and IC) of these inserts is designed according to ISO Standard, and laydown insert can be used for internal and external threading.
The cutting edge profile of laydown inserts can be adjusted to most threading sizes of different threading standards. **ISCAR** classifies laydown inserts into 3 types: **B**-Type, **M**-Type, and **G** type. There are 2 configurations: **U**-Type and **Regular** type. The inserts are available with one tooth on each cutting edge or with a number of teeth on each cutting edge (multi-tooth inserts).

Basic Dimensions of Laydown Inserts



IC — Inscribe circle diameter

PDX — Distance between the insert and the corner radius

PDY — Gap between the corner radius and the theoretical triangular vertex

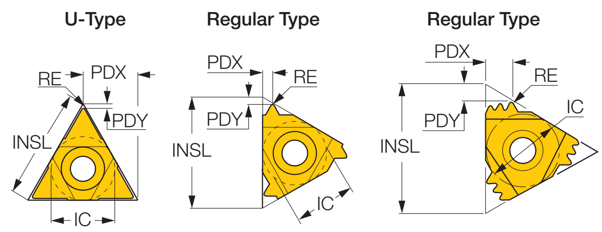
INSL — Insert length, triangular leg length

RE — Corner radius

Laydown Insert Description According to the Template Below

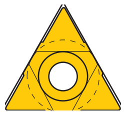
16	E	R	M	1.50	ISO	□	IC908
1	2	3	4	5	6	7	8

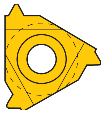
1 Insert length (INSL)



INSL (mm)	IC (Inch)
06	5⁄32 "
08	3⁄16 "
11	1⁄4 "
16	3⁄8 "
22	1⁄2 "
27	5⁄8 "

2 Insert configuration





U-Type	Regular Type
UE —U-Type for external threading	**E** —Regular type for external threading
UI —U-Type for internal threading	**I** —Regular type for internal threading
UEI —U-Type for external and internal threading	

* U-Type configuration is recommended for big threading profiles

3 Insert Clamp Direction

R —Right-hand

L —Left-hand

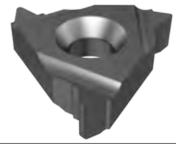
RL —Right and left-hand

4 Insert type

B —Pressed chipformer and peripheral ground profile

M—Pressed to size insert with pressed chipformer

☐—No indication, G type is an insert with pressed deflector

B-Type	M-Type	G-Type
		

5 Pitch

	mm	TPI
A	0.5-1.5	48-16
AG	0.5-3.0	48-8
G	1.75-3.0	14-8
N	3.5-5.0	7-5
Q	5.5-6.0	4.5-4
U	5.5-9.0	4.5-2.75

6 Threading Standard

60 —Partial Profile 60º

55 —Partial Profile 55º

ISO —ISO Metric

UN —American UN

W —Whitworth

BSPT —British BSPT

RND —Round DIN 405

TR —Trapeze DIN 103

ACME —ACME

STACME—Stub ACME

ABUT —American Buttress

UNJ —UNJ

NPT —NPT

API RD —API Round

BUT —API Buttress Casing

API —API

EL —Extreme Line Casing

MJ —ISO 5855

7 Number of teeth

☐ — Not indicated, 1 tooth

2M — 2 teeth

3M — 3 teeth

* Multi-Tooth inserts increase productivity and are recommended for mass production

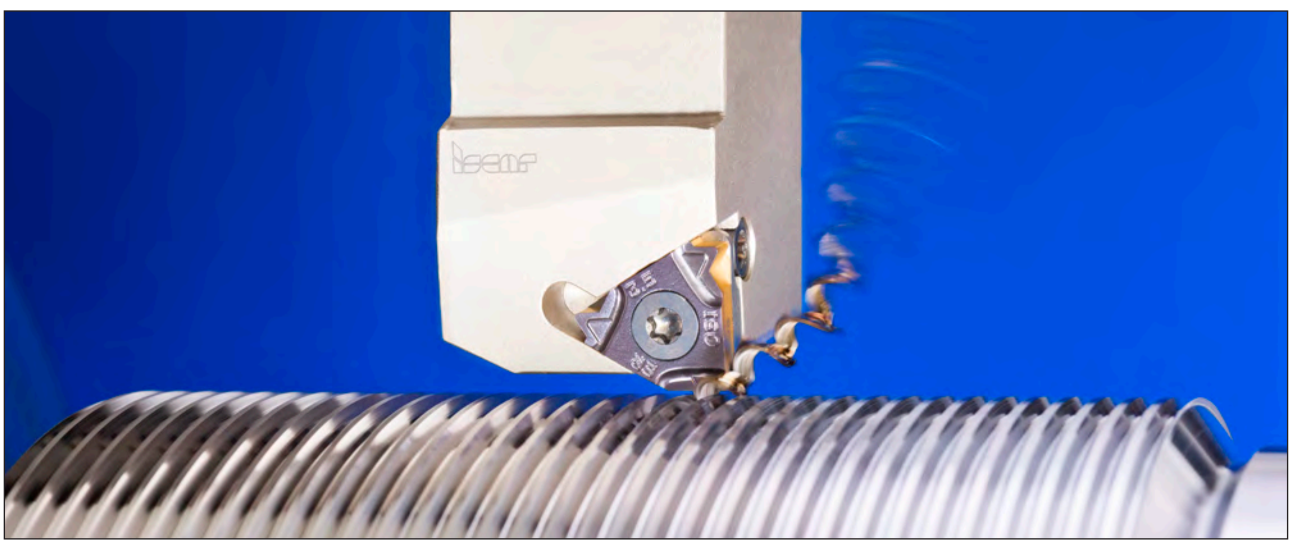
8 Grade

IC1007, IC908, IC808, IC508, IC250, IC228, IC50M, IC806

The insert type geometry recommended to select per material of workpiece is shown in the table below.

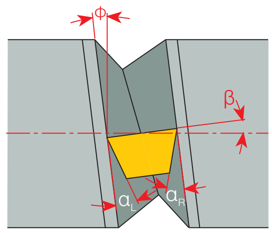
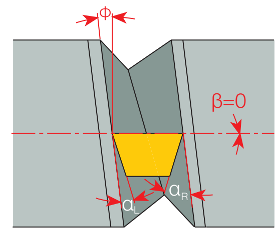
Insert Type Geometry per Material		ISCAR Threading Laydown Line		
		B-Type	M-Type	G-Type
Material	Steel	V	V	V
	Stainless Steel	V	○	V
	Cast Iron	○	V	•
	Nonferrous	•	○	V
	High Temp. Alloys	○	○	V
	Hardened Steel	○	○	V

Guidelines	Sign
Recommended (1st Choice)	V
Suitable (2nd Choice)	•
Can be Selected (Optional)	○



2.3.2 Anvils for Laydown Inserts

The parameter for tilting the threading insert relative to the helix angle of threading is of great importance when threading is produced. This parameter ensures proper operation of the insert during threading production in terms of equal load distribution applied to the insert, equal distribution of forces operating on the insert, development of uniform wear on both sides of the cutting edge, and avoiding friction of the insert with the side of the threading profile. If the side clearance insert angles (α) are not equal in relation to the helix angle (φ), the insert must be tilted. This is performed by using anvils.

Recommended	Less Recommended
$\alpha_L \neq \alpha_R$	$\alpha_L = \alpha_R$
	

Quick and Easy way to Select a Correct Anvil

Helix (Lead) angle calculation by formula

or

Helix (Lead) angle area from the graph

↓

Recommendation for an inclination angle (**β**°) according to the thread turning method definition and dependent on the thread standard

↓

Recommendation for a suitable anvil according to the insert size and type of toolholder (internal or external)

The anvil should be selected from the table according to the threading standard. The correct anvil depends on the right inclination angle (ß) and insert size. The inclination angle (ß) is obtained by selecting the thread turning method and finding the helix angle (φ) for single-start threading, or lead angle (φ_L) for the multi-start threading. The helix angle (φ) and the lead angle (φ_L) are determined as exact values by using the formula below or as a graph area (see below: Helix (Lead) angle area by using graph, depending on the threading diameter and lead.

Helix Angle (φ) Calculation by Using Formula Single-Start Threading	Lead Angle (φ_L) Calculation by Using Formula Multi-Start Threading
$\varphi=\arctan\left(\frac{Lead}{\pi\times Dpitch}\right)$	$\varphi_L=\arctan\left(\frac{Lead}{\pi\times Dpitch}\right)$ **Lead= n×P**
When: **φ** = Helix angle **Dpitch** = Pitch diameter* * effective diameter of threading **P** = Threading pitch **π** ≈ 3.142	**When:** **φ_L** = Lead angle **Dpitch** = Pitch diameter* * effective diameter of threading **P** = Threading pitch **n** = Number of threading starts **π** ≈ 3.142

Usable Formulas

$$\text{Lead (inch)}=\frac{1\ \text{inch}}{\text{TPI}}\times\text{No. of Starts}$$

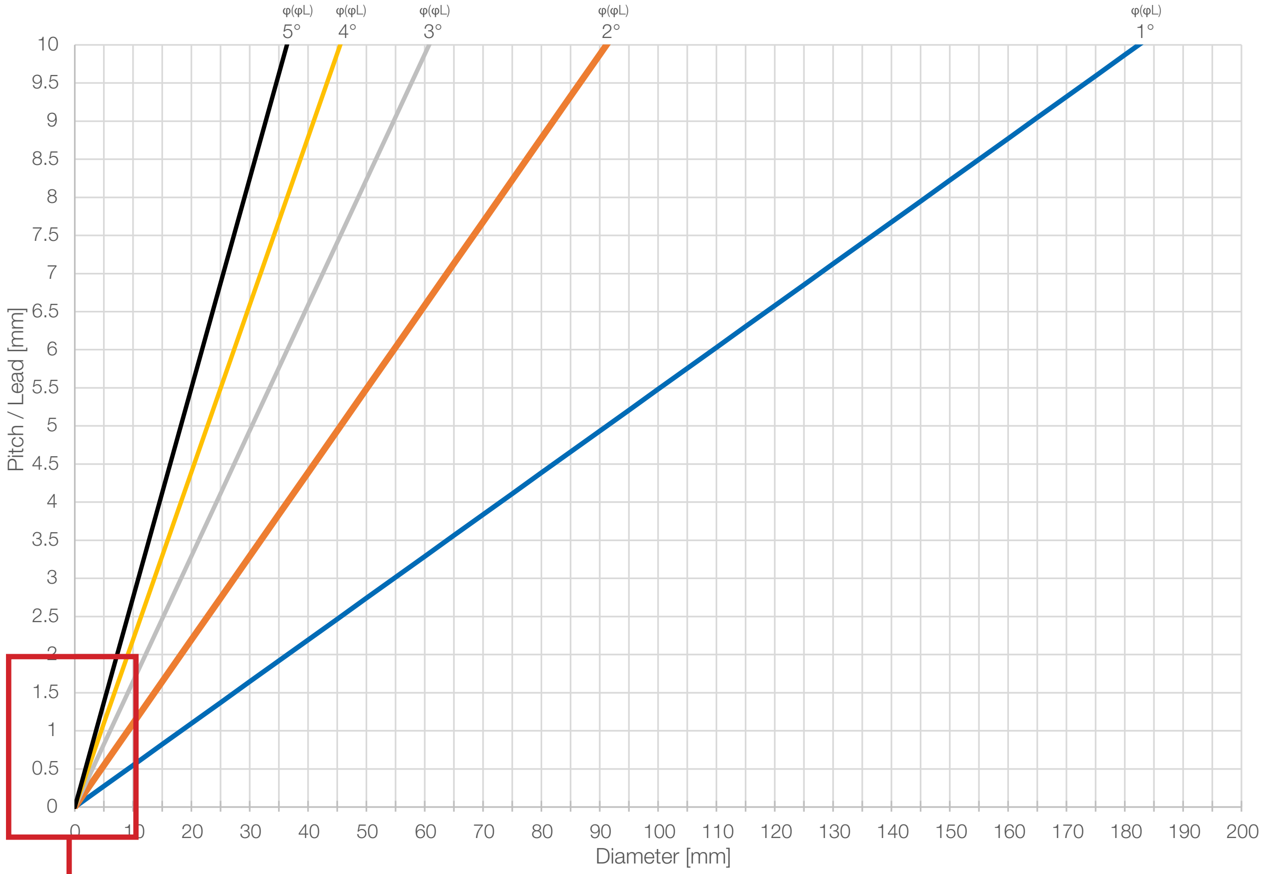
TPI = No. of threading per inch

1 inch = 25.4 mm

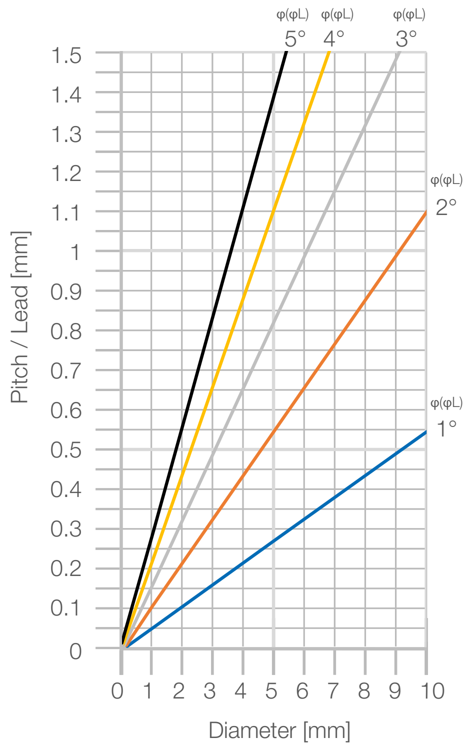
$$\text{Pitch (mm)}=\frac{25.4}{\text{TPI}}$$

Helix (Lead) Angle Area by Using Graph

Helix Angle Evaluation

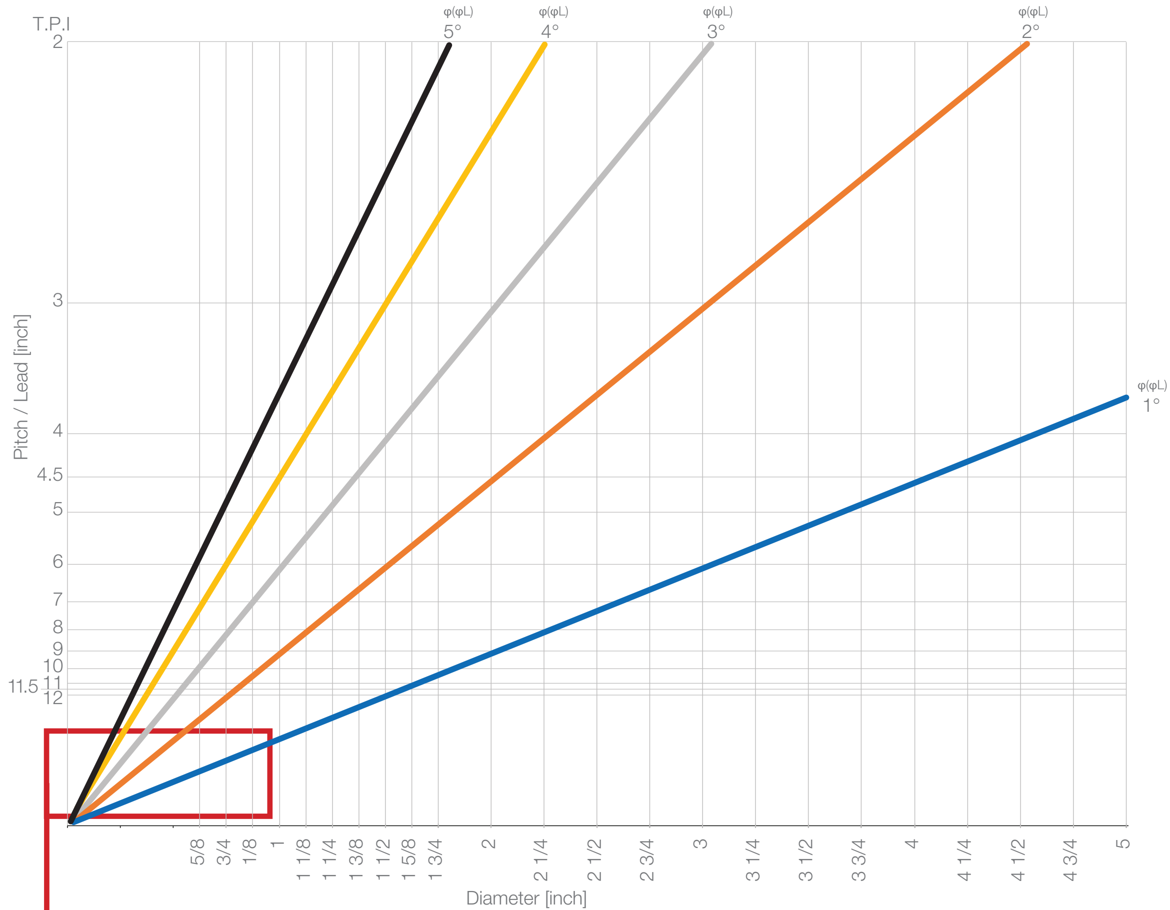


Detailed View for Small Pitch/Diameter

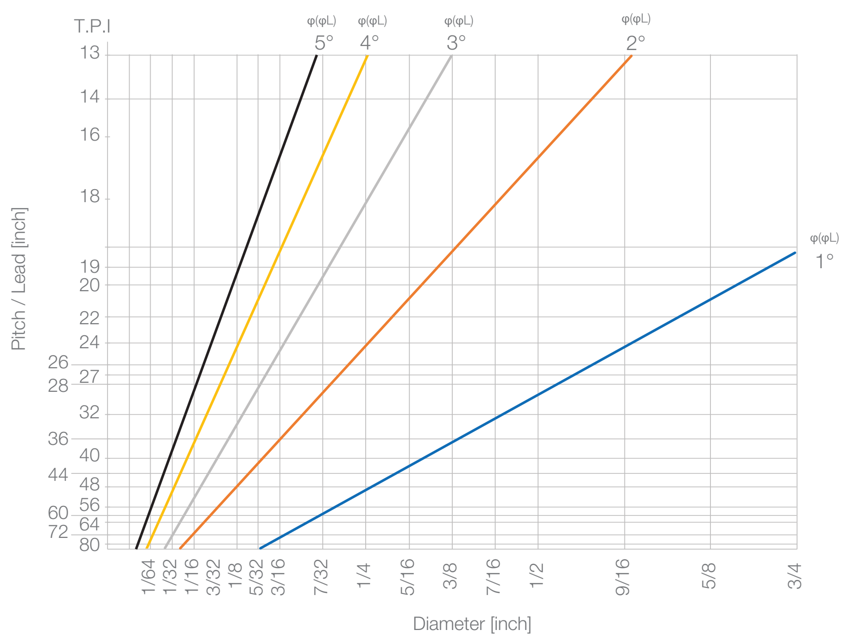


Helix (Lead) Angle Area by Using Graph

Helix Angle Evaluation



Detailed View for Small Pitch/Diameter

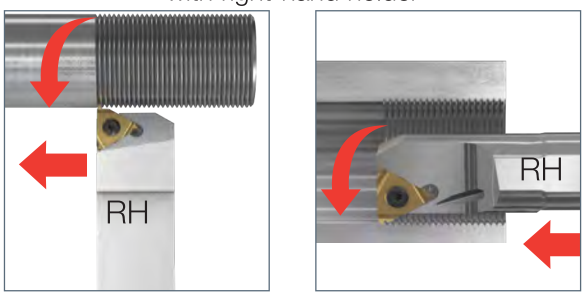
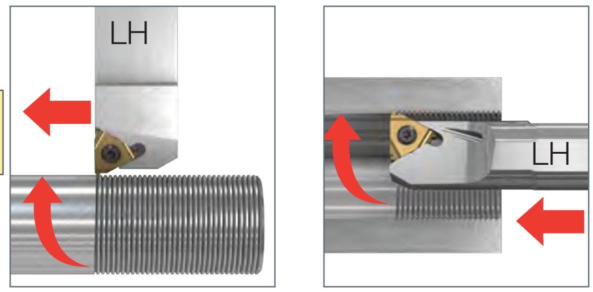


Anvil Selection for Symmetric Threading Profiles

The table below defines the recommended insert inclination angle (ß) and anvil selection according to the helix angle (φ) for single-start threading and the lead angle (φ_L) for multi-start threading, depending on the threading turning method for machining the following symmetric threading profiles:

- partial profile threading with angle profile of 60°, 55° only
- full profile threading according to ISO, UN, Whitworth, NPT, BSPT, Trapeze, ACME, RD standards only

Thread Turning Method

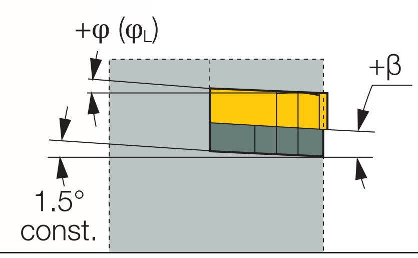
Production of right-hand threading with right-hand holder		Production of left-hand threading with left-hand holder
	or	

Anvil Selection							
			Positive Anvils				
Threading Helix (Lead) Angle φ (φ_L)		φ (φ_L)≥ 5°	4°≤φ (φ_L)<5°	3°<φ (φ_L)≤4°	2°<φ (φ_L)≤3°	1°<φ (φ_L)≤2°	0°<φ (φ_L)≤1°
Inclination Angle β			4.5°	3.5°	2.5°	1.5° (std)	0.5°
IC	Toolholder	Anvil Designation					
16 (3/8)	EX RH OR IN LH EX RH OR IN LH		AE 16+4.5 AI 16+4.5	AE 16+3.5 AI 16-3.5	AE 16+2.5 AI 16+2.5	* AE 16+1.5 * AI 16+1.5	AE 16+0.5 AI 16+0.5
22 (1/2)	EX RH OR IN LH EX RH OR IN LH		AE 22+4.5 AI 22+4.5	AE 22+3.5 AI 22+3.5	AE 22+2.5 AI 22+2.5	* AE 22+1.5 * AI 22+1.5	AE 22+0.5 AI 22+0.5
27 (5/8)	EX RH OR IN LH EX RH OR IN LH	special solution	AE 27-4.5 AI 27+4.5	AE 27+3.5 AI 27+3.5	AE 27+2.5 AI 27+2.5	* AE 27+1.5 * AI 27+1.5	AE 27+0.5 AI 27+0.5
22U (1/2U)	EX RH OR IN LH EX RH OR IN LH		AE 22U+4.5 AI 22U+4.5	AE 22U+3.5 AI 22U+3.5	AE 22U+2.5 AI 22U+2.5	* AE 22U+1.5 * AI 22U+1.5	AE 22U+0.5 AI 22U+0.5
27U (5/8U)	EX RH OR IN LH EX RH OR IN LH		AE 27U+4.5 AI 27U+4.5	AE 27U+3.5 AI 27U+3.5	AE 27U+2.5 AI 27U+2.5	* AE 27U+1.5 * AI 27U+1.5	AE 27U+0.5 AI 27U+0.5

* Standard anvil supplied with tool

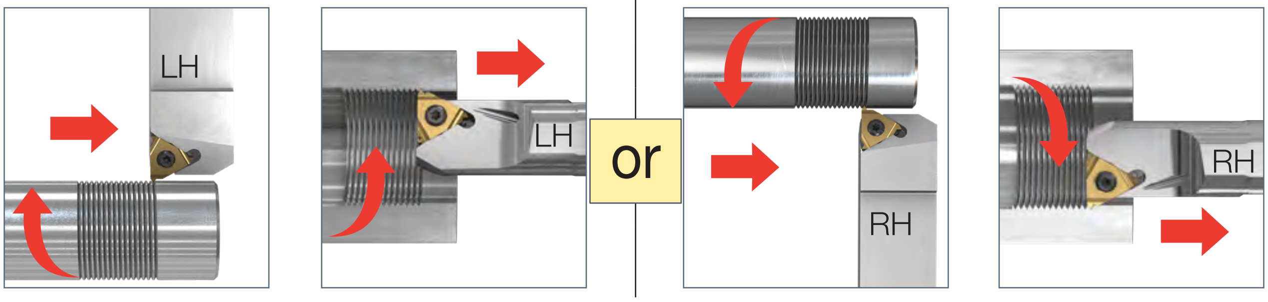
Positive Anvils

Feed Towards the Chuck



Thread Turning Method

Production of right-hand threading with left-hand holder	Production of right-hand threading with right-hand holder



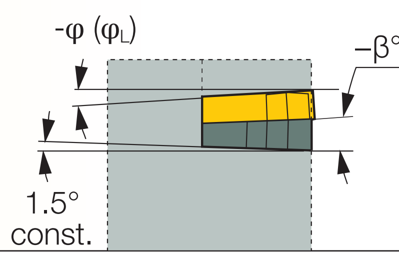
Anvil Selection

		Negative Anvils		
Threading Helix (Lead) Angle φ (φ_L)		0°<φ (φ_L)≤1°	1°<φ (φ_L)≤2°	φ (φ_L)≥2°
Inclination Angle β		-0.5°	-1.5°	
IC	Toolholder	Anvil Designation		
16 (3/8)	EX RH OR IN LH EX RH OR IN LH	AE 16-0.5 AI 16-0.5	AE 16-1.5 AI 16-1.5	special solution
22 (1/2)	EX RH OR IN LH EX RH OR IN LH	AE 22-0.5 AI 22-0.5	AE 22-1.5 AI 22-1.5	
27 (5/8)	EX RH OR IN LH EX RH OR IN LH	AE 27-0.5 AI 27-0.5	AE 27-1.5 AI 27-1.5	
22U (1/2U)	EX RH OR IN LH EX RH OR IN LH	AE 22U-0.5 AI 22U-0.5	AE22U-1.5 AI 22U-1.5	
27U (5/8U)	EX RH OR IN LH EX RH OR IN LH	AE 27U-0.5 AI 27U-0.5	AE 27U-1.5 AI 27U-1.5	

- EX - Anvil for external threading
- IN - Anvil for internal threading

Negative Anvils

Feed Towards the Tailstock

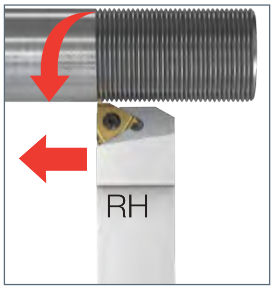


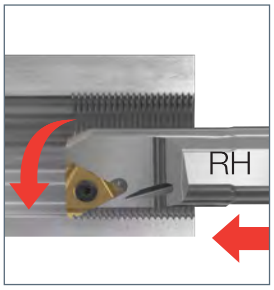
Anvil Selection for ABUT Threading Standard Only

The table below defines the recommended insert inclination angle (β) and anvil selection according to helix angle (φ) for single-start threading and according to lead angle (φ_L) for multi-start threading, depending on the threading turning method for machining asymmetric threading profile according to ABUT threading standard only.

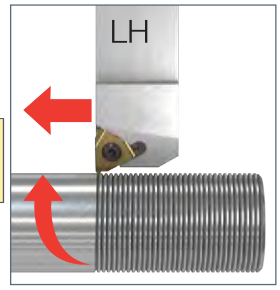
Threading Turning Method

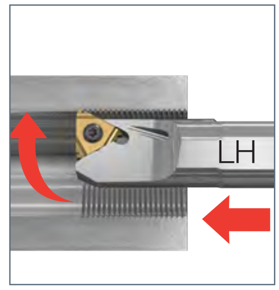
Production of right-hand threading with right-hand holder		Production of left-hand threading with left-hand holder





or



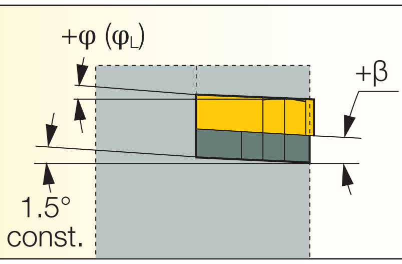


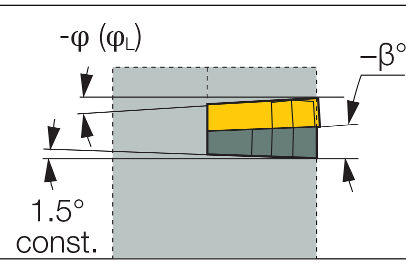
Anvil Selection

			Positive Anvils		Negative Anvils	
Threading Helix (Lead) Angle φ (φ_L)		φ (φ_L)>3.5°	3°<φ (φ_L)≤3.5°	2°<φ (φ_L)≤3°	1°<φ (φ_L)≤2°	0°<φ (φ_L)≤1°
Inclination Angle β			1.5° (std)	0.5	-0.5°	-1.5°
IC	Toolholder	Anvil Designation				
16 (3/8)	EX RH OR IN LH EX RH OR IN LH	special solution	* AE 16 +1.5 * AI16 +1.5	AE 16 +0.5 AI16 +0.5	AE 16 -0.5 AI 16 -0.5	AE 16 -1.5 AI 16 -1.5
22 (1/2)	EX RH OR IN LH EX RH OR IN LH		* AE 22 +1.5 * AI 22 +1.5	AE 22 +0.5 AI 22 +0.5	AE 22 -0.5 AI 22 -0.5	AE 22 -1.5 AI 22 -1.5
27 (5/8)	EX RH OR IN LH EX RH OR IN LH		* AE 27 +1.5 * AI 27 +1.5	AE 27 +0.5 AI 27 +0.5	AE 27 -0.5 AI 27 -0.5	AE 27 -1.5 AI 27 -1.5
22U (1/2U)	EX RH OR IN LH EX RH OR IN LH		* AE 22U +1.5 * AI 22U +1.5	AE 22U +0.5 AI 22U +0.5	AE 22U -0.5 AI 22U -0.5	AE 22U -1.5 AI 22U -1.5
27U (5/8U)	EX RH OR IN LH EX RH OR IN LH		* AE 27U +1.5 * AI 27U +1.5	AE 27U +0.5 AI 27U +0.5	AE 27U -0.5 AI 27U -0.5	AE 27U -1.5 AI 27U -1.5

* Standard anvil supplied with tool
- EX - Anvil for external threading
- IN - Anvil for internal threading

Positive Anvils	Negative Anvils
Feed Towards the Chuck	Feed Towards the Tailstock

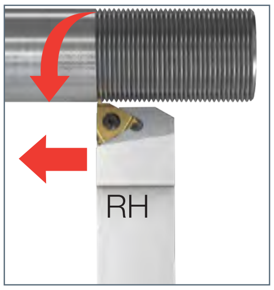
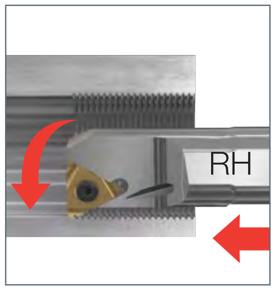
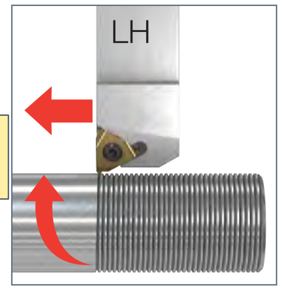
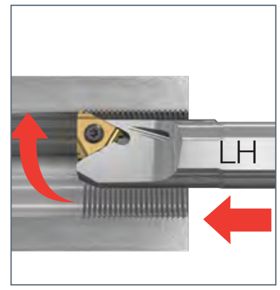




Anvil Selection for SAGE Threading Standard Only

The table below defines the recommended insert inclination angle (ß) and anvil selection according to helix angle (φ) for single-start threading and according to lead angle ($φ_L$) for multi-start threading, depending on the thread turning method for machining asymmetric threading profile according to SAGE thread standard only.

Thread Turning Method

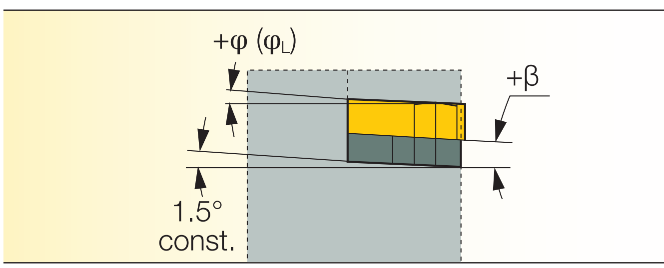
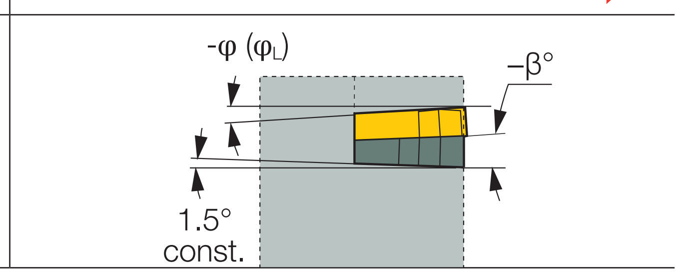
Production of right-hand threading with right-hand holder			Production of left-hand threading with left-hand holder	
		or		

Anvil Selection

			Positive Anvils			Negative Anvils	
Threading Helix (Lead) Angle φ ($φ_L$)		φ ($φ_L$)>5.6°	5°<φ ($φ_L$)≤5.6°	3°<φ ($φ_L$)≤5°	2°<φ ($φ_L$)≤3°	1°<φ ($φ_L$)≤2°	0°<φ ($φ_L$)≤1°
Inclination Angle β			2.5°	1.5°(std)	0.5°	-0.5°	-1.5°
IC	Toolholder	Anvil Designation					
16 (3/8)	EX RH OR IN LH EX RH OR IN LH	special solution	AE 16 +2.5 AI 16 +2.5	* AE 16 +1.5 * AI 16 +1.5	AE 16 +0.5 AI16 +0.5	AE 16 -0.5 AI 16 -0.5	AE 16 -1.5 AI 16 -1.5
22 (1/2)	EX RH OR IN LH EX RH OR IN LH		AE 22 +2.5 AI 22 +2.5	* AE 22 +1.5 * AI 22 +1.5	AE 22 +0.5 AI 22 +0.5	AE 22 -0.5 AI 22 -0.5	AE 22 -1.5 AI 22 -1.5
27 (5/8)	EX RH OR IN LH EX RH OR IN LH		AE 27 +2.5 AI 27 +2.5	* AE 27 +1.5 * AI 27 +1.5	AE 27 +0.5 AI 27 +0.5	AE 27 -0.5 AI 27 -0.5	AE 27 -1.5 AI 27 -1.5
22U (1/2U)	EX RH OR IN LH EX RH OR IN LH		AE 22U +2.5 AI 22U +2.5	* AE 22U +1.5 * AI 22U +1.5	AE 22U +0.5 AI 22U +0.5	AE 22U -0.5 AI 22U -0.5	AE 22U -1.5 AI 22U -1.5
27U (5/8U)	EX RH OR IN LH EX RH OR IN LH		AE 27U +2.5 AI 27U +2.5	* AE 27U +1.5 * AI 27U +1.5	AE 27U +0.5 AI 27U +0.5	AE 27U -0.5 AI 27U -0.5	AE 27U -1.5 AI 27U -1.5

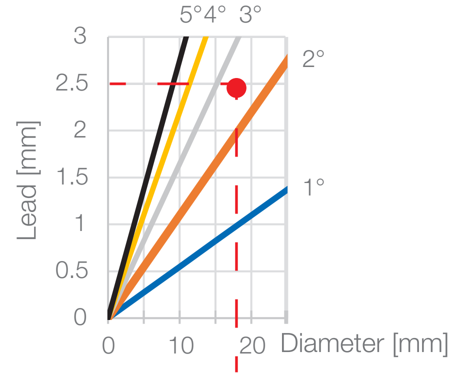
* Standard anvil supplied with tool

- EX - Anvil for external threading
- IN - Anvil for internal threading

Positive Anvils	Negative Anvils
Feed Towards the Chuck	Feed Towards the Tailstock
	

Example for Anvil Selection According to the Following Data

- External right-hand thread
- Threading profile: ISO standard
- Thread diameters: Major diameter: Ø20 mm, effective diameter: Ø18.376 mm
- No. of starts: 1
- Pitch: 2.5 mm
- Holder: SER 2020 K16
- Insert: 16ER 2.50 ISO IC908
- Thread Turning Method: Right-hand threading with right hand holder

Helix Angle Calculation (φ°) by Formula		Helix Angle Area From the Graph
$\varphi=\arctan\left(\frac{P}{\pi\times D_{pitch}}\right)$ $\varphi=\arctan\left(\frac{2.5}{\pi\times 18.376}\right)$ $\varphi\approx 2.5°$	or	

$2°<\varphi\leq 3°$

When:

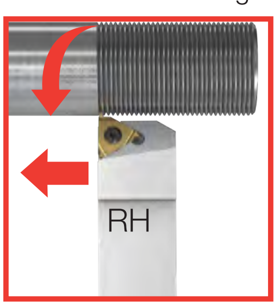
φ	=	Helix angle
Dpitch	=	18.376 mm
P	=	2.5 mm
π	≈	3.142

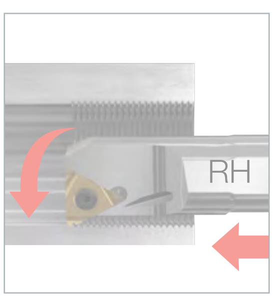
Recommendation for an Inclination Angle (β°) According to the Thread Turning Method Definition and Threading Standard

- Inclination Angle (β°) for symmetric profile according to the ISO threading standard for right-hand threading production with a right-hand holder and obtained helix angle (φ)
- Defined inclination angle: β=2.5 for range of helix angle 2°<φ≤3°

Thread Turning Method

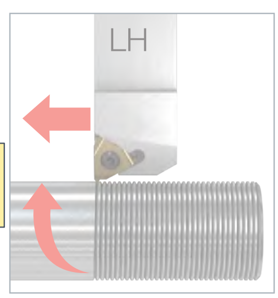
Production of right-hand threading with right-hand holder

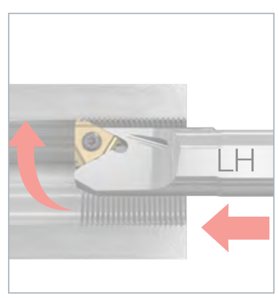




or

Production of left-hand threading with left-hand holder





Anvil Selection

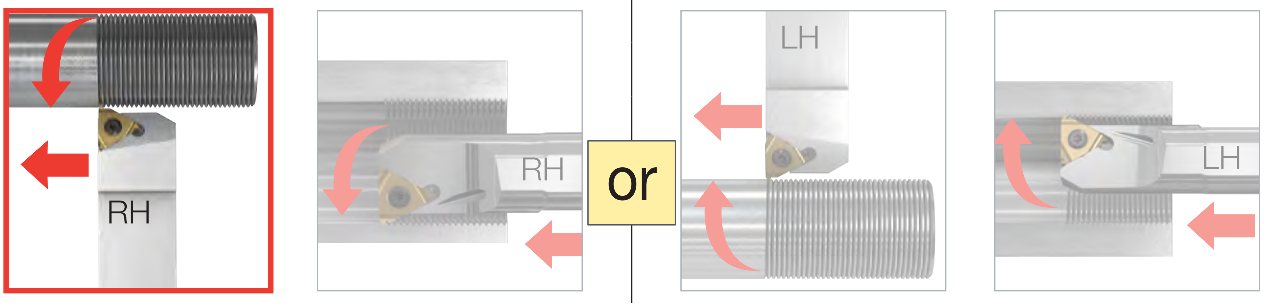
Threading Helix (Lead) Angle φ (φ_L)	φ (φ_L)≥5°	4°≤φ (φ_L)<5°	3°<φ (φ_L)≤4°	2°<φ (φ_L)≤3°	1°<φ (φ_L)≤2°	0°<φ (φ_L)≤1°
Inclination Angle β		4.5°	3.5°	2.5°	1.5° (std)	0.5°

Recommendation for a Suitable Anvil According to the Insert Size and Type of Toolholder

- Suitable anvil for external or internal toolholder depending on the insert size and considering the obtained Inclination Angle (β°)
- Defined anvils for Inclination Angle: β=2.5°

Thread Turning Method

Production of right-hand threading with right-hand holder	Production of left-hand threading with left-hand holder

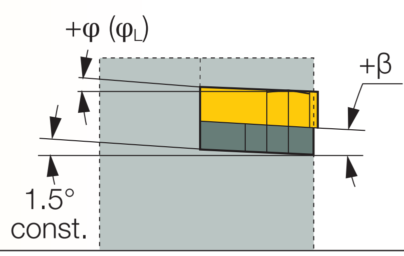


Anvil Selection

Threading Helix (Lead) Angle φ (φ_L)		φ (φ_L)≥5°	4°≤φ (φ_L)<5°	3°<φ (φ_L)≤4°	2°<φ (φ_L)≤3°	1°<φ (φ_L)≤2°	0°<φ (φ_L)≤1°
Inclination Angle β			4.5°	3.5°	2.5°	1.5° (std)	0.5°
I(d)	Toolholder	Anvil Designation					
16 (3/8)	EX RH OR IN LH EX RH OR IN LH	special solution	AE 16+4.5 AI 16+4.5	AE 16+3.5 AI 16-3.5	AE 16+2.5 AI 16+2.5	* AE 16+1.5 * AI 16+1.5	AE 16+0.5 AI 16+0.5
22 (1/2)	EX RH OR IN LH EX RH OR IN LH		AE 22+4.5 AI 22+4.5	AE 22+3.5 AI 22+3.5	AE 22+2.5 AI 22+2.5	* AE 22+1.5 * AI 22+1.5	AE 22+0.5 AI 22+0.5
27 (5/8)	EX RH OR IN LH EX RH OR IN LH		AE 27-4.5 AI 27+4.5	AE 27+3.5 AI 27+3.5	AE 27+2.5 AI 27+2.5	* AE 27+1.5 * AI 27+1.5	AE 27+0.5 AI 27+0.5
22U (1/2U)	EX RH OR IN LH EX RH OR IN LH		AE 22U+4.5 AI 22U+4.5	AE 22U+3.5 AI 22U+3.5	AE 22U+2.5 AI 22U+2.5	* AE 22U+1.5 * AI 22U+1.5	AE 22U+0.5 AI 22U+0.5
27U (5/8U)	EX RH OR IN LH EX RH OR IN LH		AE 27U+4.5 AI 27U+4.5	AE 27U+3.5 AI 27U+3.5	AE 27U+2.5 AI 27U+2.5	* AE 27U+1.5 * AI 27U+1.5	AE 27U+0.5 AI 27U+0.5

Positive Anvils

Feed Towards the Chuck



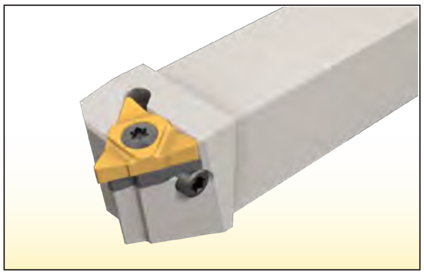
2.3.3 Tools Carrying Laydown Inserts

Solution for External and Internal Threading

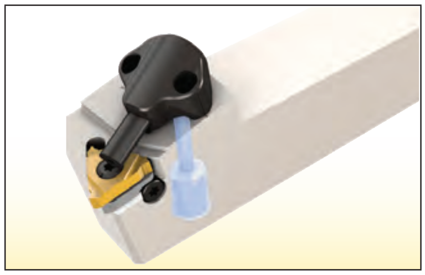
The **ISCAR** threading family includes 5 types of tools for the production of external threading and 3 types of tools for the production of internal threading.

All tools belong to the **ISCAR** threading family and are suitable for mounting laydown inserts.

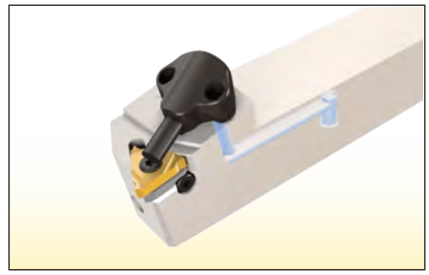
ISCAR Threading Tools for External Threading



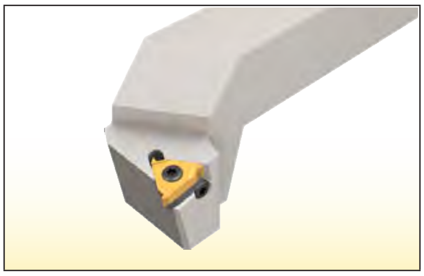
SER/L
Square Shank Tools



SER/L-JHP
Tools with High Pressure Coolant System



SER/L-JHP-MC
Tools with Bottom Fed High Pressure Coolant System

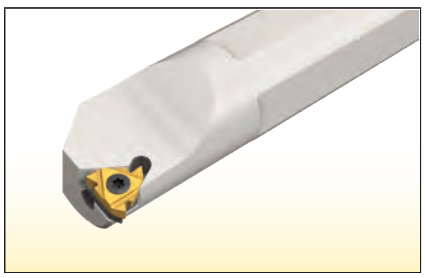


SER-D
Drophead Tools

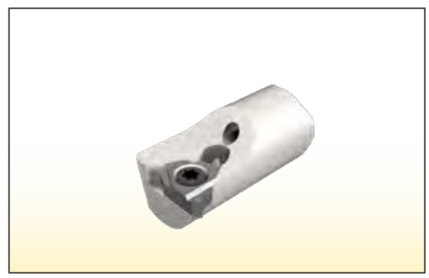
C#-SER/L
Tools with CAMFIX Shanks for Polygonal Taper Interface

ISCAR Threading Tools for Internal Threading

C#-SIR/L
Shanks for Polygonal Taper Interface



SIR/L
Internal Threading Bars



E-SIR-HEAD
Interchangeable Threading Heads

Description of ISCAR Threading Tools According to the Template Below

S	E	R	2020	K	16	□
1	2	3	4	5	6	7

1 Clamping System

S — Screw Clamping

2 Application

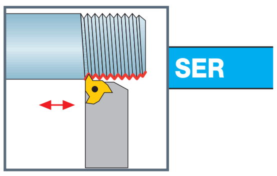
E — External

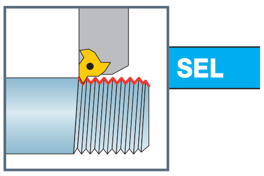
I — Internal

3 Hand of Tool

R — Right-hand

L — Left-hand



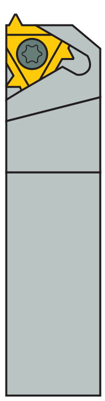


4 External Toolholders

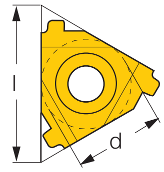
Shank: hxb 2020
20x20 mm

5 Tool Length

D — 60 mm
F — 80 mm
H — 100 mm
K — 125 mm
L — 140 mm
M — 150 mm
P — 170 mm
R — 200 mm
S — 250 mm
T — 300 mm
U — 350 mm
V — 400 mm



6 Insert Size



l (mm)	d
06	5/32"
08	3/16"
08U	3/16"
11	1/4"
16	3/8"
22	1/2"
22U	1/2"
27	5/8"
27U	5/8"

7 Optional Specifications

U — For U-Type inserts
B — Bore for coolant
C — Carbide shank
O — Offset style
D — Drop head
G — Gang tool
SP — Special

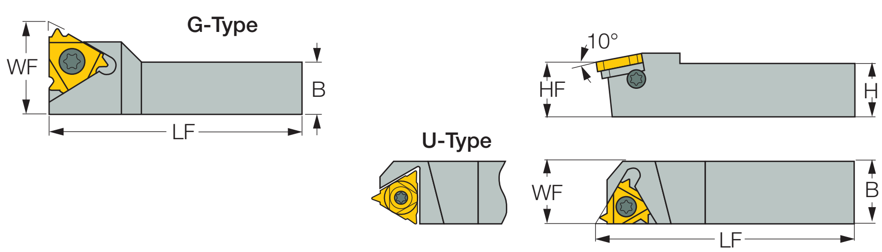
Optional Prefix

C - Chamfix Shank
HSK
KM
] Exchangeable Adaptation System

Square Shank Tools Suitable for External Threading

Threading square shank tools are designed according to the ISO standard. These are simple tools suitable for all types of lathe machines and do not have coolant channels. The coolant should be supplied from the turret.

Basic Dimensions of Square Shank Tools



HF — Functional height

H — Shank height

B — Shank width

WF — Functional width

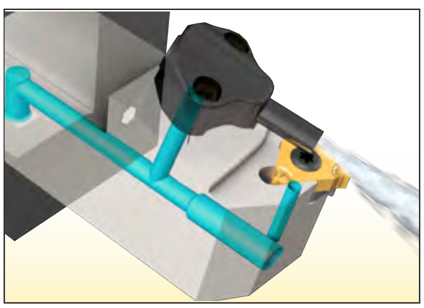
LF — Functional length

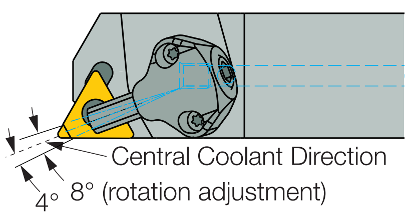
Main Advantage:
Suitable for all types of lathe machines

Tools with High Pressure Coolant Systems Suitable for External Threading

Threading tools with high pressure coolant systems (high pressure coolant is described in chapter 2.13) consist of a square shank according to the ISO standard and a unique cooling system (JHP) designed and patented by **ISCAR**.

The JHP system is composed of a static housing and telescopic tube to direct the coolant exactly to the cutting edge of the insert. The telescopic tube is embedded in the housing skews - right and left according to the working direction of the tool (see drawing below). The advantage of this system is that there is no need to detach the housing of the tool when changing an insert. This reduces setup time.



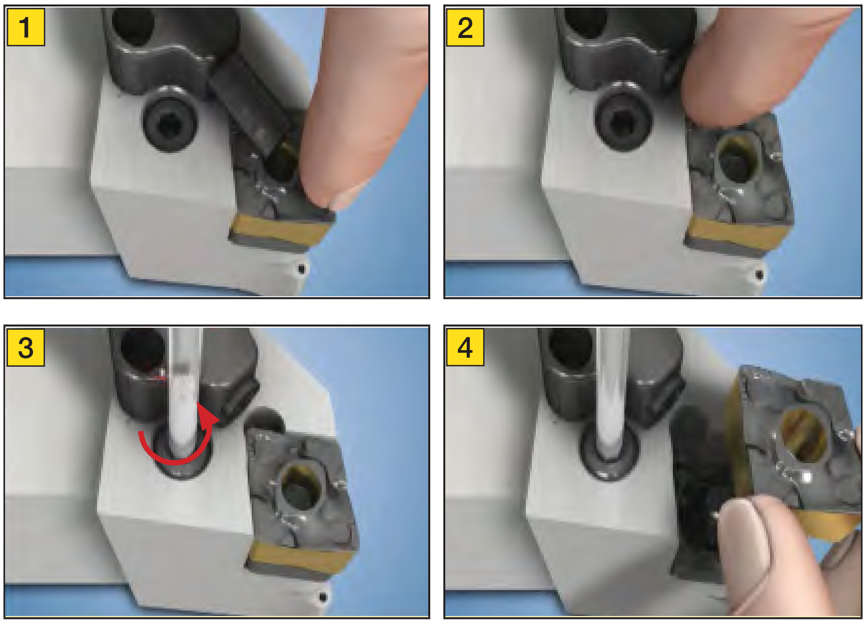


The use of high pressure coolant is growing as manufacturers are looking for ways to reduce cutting time, improve machining process reliability and achieve longer tool life.

ISCAR's JHP tools provide all these advantages. Shorter chips are easily managed and do not tangle around the work piece or machine parts, and therefore, there is no need to stop the process frequently. With conventional cooling, the chips usually prevent the coolant from reaching the insert rake face in the cutting zone. The coolant stream of the JHP tools is directed precisely between the insert rake face and the flowing chips. This results in longer tool life and a much more reliable process.

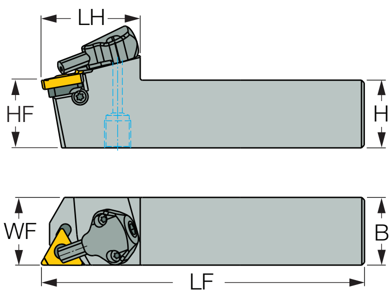
Changing or mounting inserts is done by pressing the telescopic tube in a backward direction. After indexing the insert cutting edge, starting the coolant will extract the tube automatically to its operating position.

Insert Indexing Procedue



Ensure maximum coolant in cutting area

Basic Dimensions of Threading Tools with High Pressure Coolant Systems



LH — Head length

HF — Functional height

H — Shank height

B — B - shank width

WF — Functional width

LF — Functional length

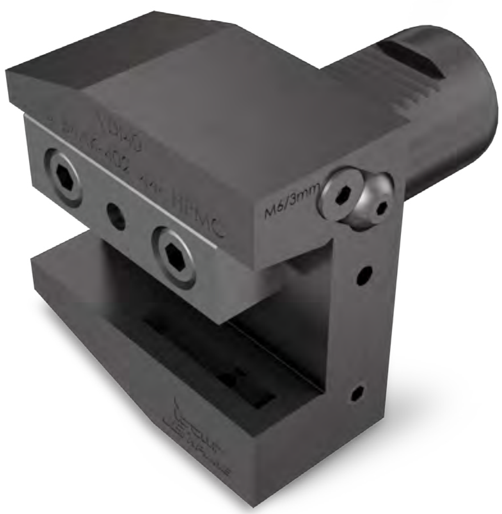
Main Advantages

- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

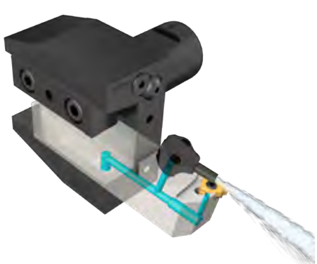
Tools with Bottom Fed High Pressure Coolant Systems Suitable for External Threading

NOTE: The shank lengths of the tools with bottom fed high pressure coolant systems are shorter than the lengths of equivalent standard tools - adjusted to the VDI Toolholders

Tools with bottom fed high pressure coolant systems belong to the Multi-Connection **JHP-MC** line and are suitable for mounting on **VDI DIN69880** Toolholders.



The tools include a bottom coolant inlet hole and the **VDI JHP-MC** Toolholders feature a long coolant outlet slot that enables adjustment of the tool's overhang.

Max. tool overhang	Min. tool overhang
	

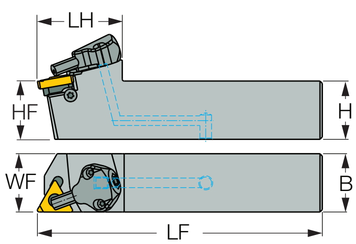
VDI DIN69880 is the most popular quick change adaptation system for CNC turning machines with disc-type turrets. This standard holder adaptation serves mainly stationary turning tools.

VDI DIN69880 Characteristics

- Easy and fast setup
- High stiffness, thanks to straight shank and flange face contact
- Rigid design due to a serrated clamping system
- High accuracy and center height repeatability
- Compact and light design
- Efficient coolant supply internally through the tool and externally through the flange

Multi-Connection **JHP-MC** Line for **VDI** Toolholders with a bottom fed coolant system to ensure maximum coolant in the cutting area

Basic Dimensions of Threading Tools with Bottom Fed High Pressure Coolant Systems



LH — Head length

F — Shank height

B — Shank width

WF — Functional width

LF — Functional length

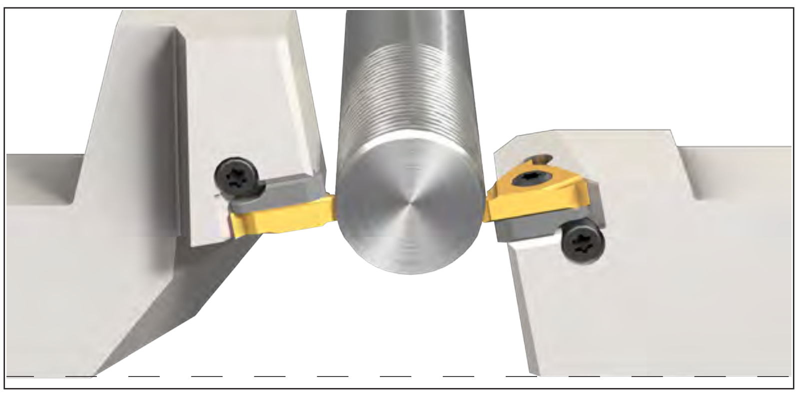
Main Advantages

- Reduce cutting time
- Provide longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enable better chip evacuation

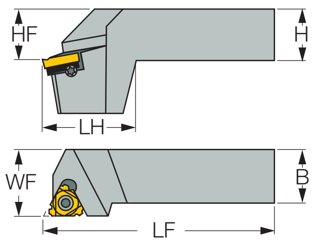
Drophead Tools Suitable for External Threading

Drophead tools are designed to be held in an upside-down position, keeping the height of the cutting edge at the same level as regular tools without having to change the clamping in the turret and allowing machining close to the tail stock.

In many operations, it is beneficial to use the drophead in an upside-down position to help remove chips more effectively.



Basic Dimensions of Drophead Tools



LH — Head length

HF — Functional height

H — Shank height

B — Shank width

WF — Functional width

LF — Functional length

Main Advantages

- Allows machining close to the tail stock
- Allows upside-down threading production

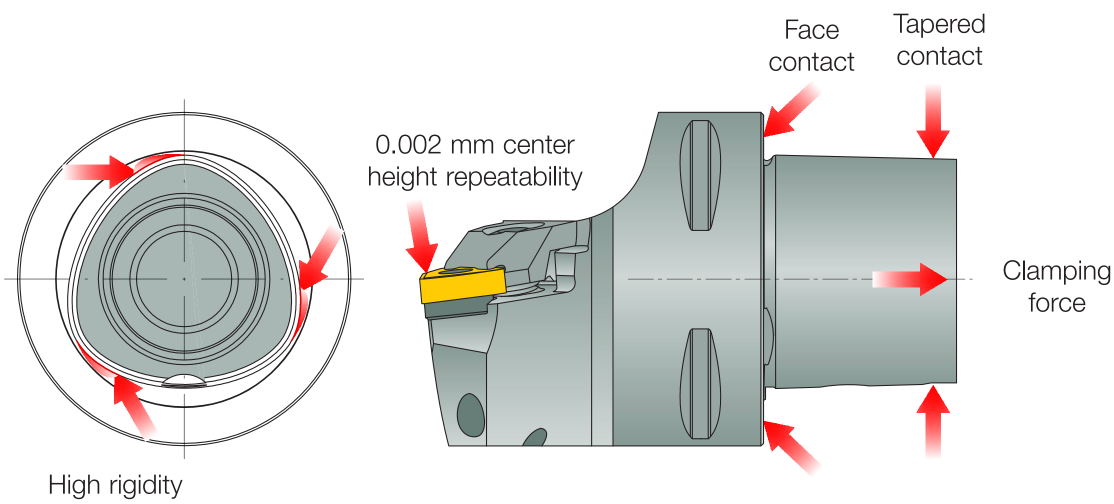
Tools with CAMFIX Shanks

for Polygonal Taper Interface Solution for External and Internal Threading

Tool for External Threading	Tool for Internal Threading
	

External and internal threading tools with **CAMFIX** shanks for polygonal taper interface (ISO 26623-1 standard) enable quick change and reduce setup time - most important for mass production industries. These threading tools feature coolant channels for efficient flushing of heat and chips from the cutting edges.

Polygonal Design-Self Centering

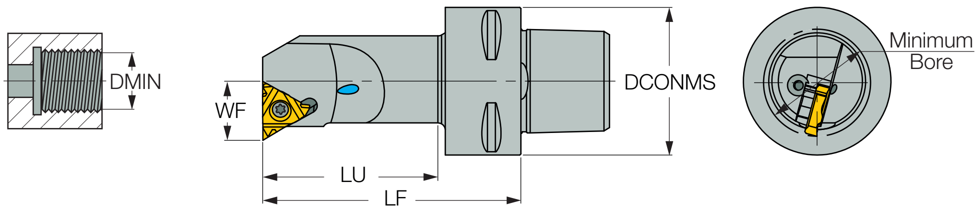


The **CAMFIX** system features high accuracy, excellent rigidity against bending forces, stability and high torque transfer. This is achieved due to the polygonal cone and face contact.

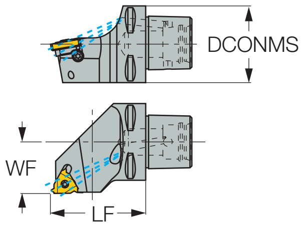
Multi-Connection **JHP-MC** Line for **VDI** Toolholders with a bottom fed coolant system to ensure maximum coolant in the cutting area

Basic Dimensions of Threading Tools with CAMFIX Shanks for Polygonal Taper Interface

Tool for Internal Threading



Tool for External Threading



LU — Usable length

DCONMS — Connection diameter of machine side

WF — Functional width

LF — Functional length

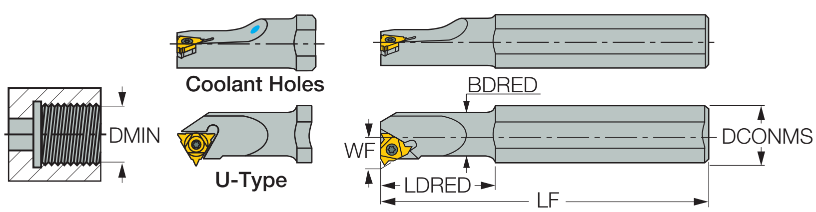
Main Advantages

- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

Bar Shank Type Holder Suitable for Internal Threading

Bar shank type holders for the production of internal threading are designed according to the ISO standard. These are simple tools suitable for all types of lathe machines and can be produced from steel or solid carbide.
These types of tools are available with and without coolant channels.

Basic Dimensions of Bar Shank Type Holders with Coolant Channels



DMIN — Minimum bore diameter
DCONMS — Connection diameter of machine side
BDRED — Body diameter
LDRED — Body length
WF — Functional width
LF — Functional length

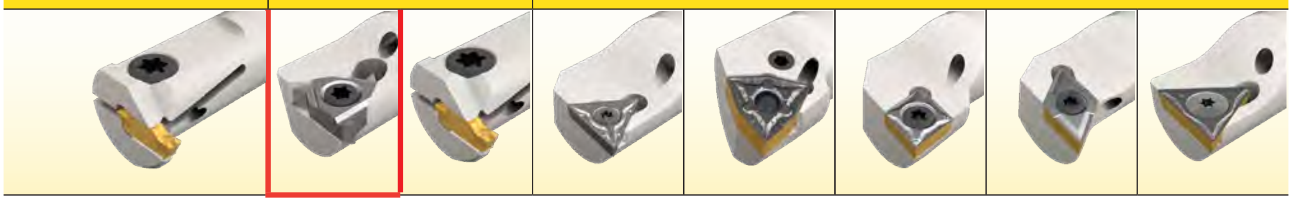
Main Advantage

Suitable for all types of lathe machines

Interchangeable Heads Suitable for Internal Threading

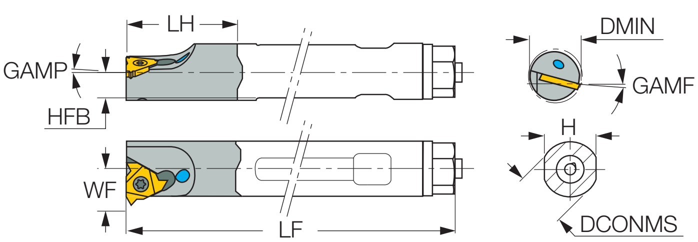
Interchangeable heads can carry laydown inserts and are mounted on solid carbide shanks. These heads are available with internal coolant and are suitable for the production of internal threading. Solid carbide shanks are used for economical boring with various interchangeable heads for internal threading, internal grooving, and internal turning.

Internal Grooving	Internal Threading	Internal Turning



Interchangeable heads - economical and diverse solution

Basic Dimensions of Interchangeable Heads with Coolant Channels



DMIN — Minimum bore diameter
DCONMS — Connection diameter of machine side
H — Shank height
LH — Head length
GAMP — Rake angle axial
GAMF — Rake angle radial
WF — Functional width
LF — Functional length
HFB — Functional height

Main Advantages

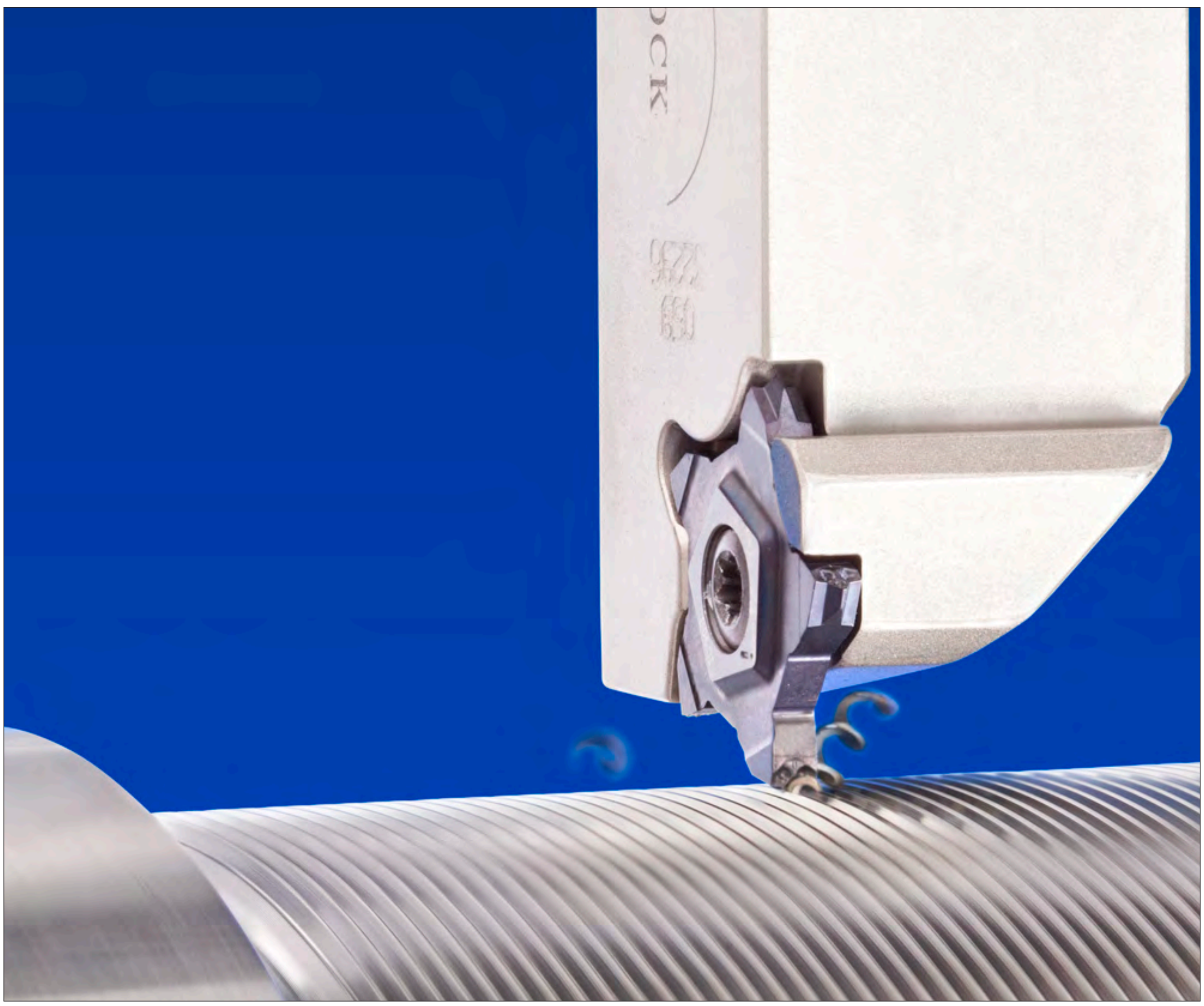
- One shank can carry various interchangeable heads
- Available with internal coolant
- Economical solution

2.4.1 PENTACUT Threading Insert with 5 Cutting Edges for External Threading

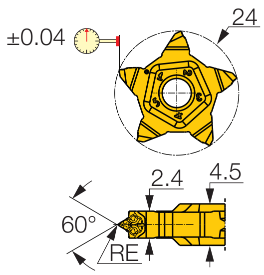
PENTA is an all ground insert where each cutting edge on the pentagonal shaped insert is equipped with a unique chipformer that provides excellent chip control, short and easily exposed chips, high accuracy and surface quality. The insert is tangentially mounted on a side of the holder, positioned against two peripheral contact surfaces to ensure accuracy of the center height. Clamping of the insert is by a side torx screw. The torx screw can be activated from either side of the holder to enable insert indexing (rotation) without having to remove the holder from the machine turret, i.e. easy and fast edge indexing from either side of the holder. In case of edge breakage, the tool will survive, and other cutting corners still can be used.

The **PENTACUT** line offers solutions for partial profiles and full profiles for most popular standards and is suitable for the production of external threading. The PENTA insert has a strong design and, combined with a very rigid clamping system, enables threading at very high machining parameters. This insert can be used for threading between walls to enable complete part production on bar feeder machines.

PENTACUT offers a very stable and economical solution



Basic Dimensions of PENTACUT Inserts



IC — Inscribe circle diameter

W — Width

CW — Insert width

RE — Corner radius

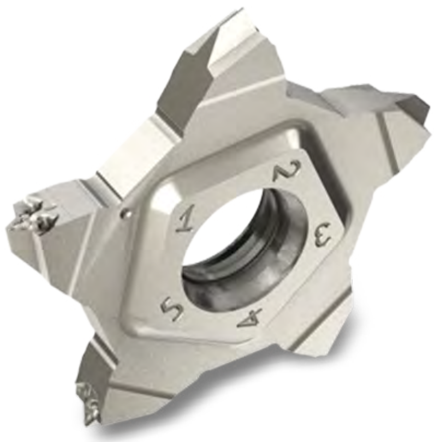
A — Angle of cutting edge

Main Advantages

- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Economical solution in calculating insert cost per cutting edges
- Rigid clamping system
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing
- Easy handling of insert

Notes

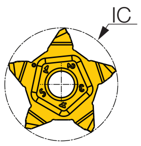
- Standard inserts are intended for symmetrical thread profiles
- Consider chip evacuation when working in big diameters, Ø200 mm and more.



Description of PENTACUT Inserts According to the Template Below

Partial Profile	PENTA	24	-	MT	-	0.05	IC908
		1		2		3	4

1 Inscribe circle diameter (IC)

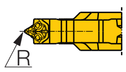


2 Angle of cutting edge (A)

WT — 55°

MT — 60°

3 Corner radius (RE)

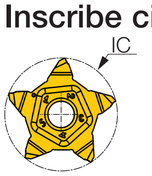


4 Grade

IC908

Full Profile	PENTA	24	-	1.25	-	ISO	IC908
		1		2		3	4

1 Inscribe circle diameter (IC)



2 Pitch

Value by number:
0.5 - 2.0 mm, 14 - 28 TPI

3 Threading standard

ISO — ISO Metric

UN — American UN

W — Whitworth

BSPT — British BSPT

NPT — National pipe threading

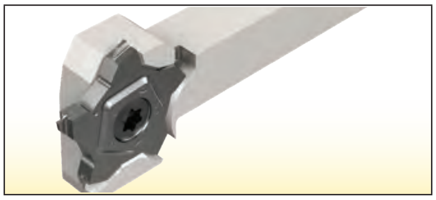
4 Grade

IC908

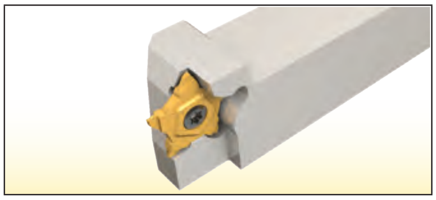
2.4.2 PENTACUT Tools for External Threading

The **PENTACUT** family is a combination of a very rigid clamping system and a strong insert design to enable machining at very high machining parameters. The **PENTACUT** family includes 6 types of tools for the production of external threading. All tools belong to the **PENTACUT** family and are suitable for mounting PENTA inserts with 5 cutting edges. All tools for PENTA inserts are designed for easy and fast edge indexing from either side of the holder. In case of edge breakage, the tool will survive and other cutting corners may still be used.

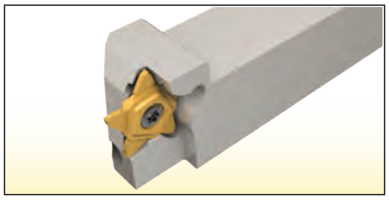
PENTACUT Tools for External Threading



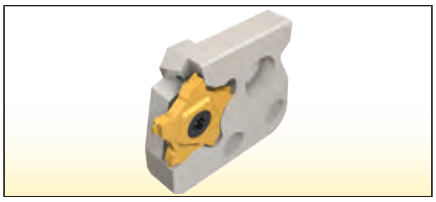
PCHR/L-24
Square Shank Tools



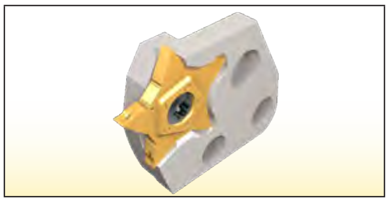
PCHR/L-24-JHP
Tools with High Pressure Coolant System



PCHR/L-24-JHP-MC
Tools with Bottom Fed High Pressure Coolant System



PCADR/L-JHP
Interchangeable Adapters with Internal Channels for High Pressure Coolant



PCADR/L
Interchangeable Adapters without Internal Coolant Channels

PCHBR/L
Double-ended Blades

Description of PENTACUT Tools for External Threading

PCHR	20	-	24	-	JHP	-	MC
1	2		3		4		5

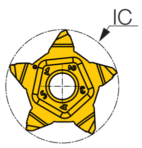
1 Hand of Tool

PCHR — Right-hand

PCHL — Left-hand

2 Shank dimensions

3 Inscribe circle diameter (IC)



4 JHP

With high pressure coolant channels

5 MC

Suitable for **VDI** adaptation system

Description of PENTACUT Interchangeable Adapters for External Threading

PC	AD	L	24	-	JHP
1	2	3	4		5

1 Insert type

PC - **PENTACUT** family

2 Tool type

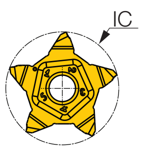
AD - Interchangeable Adapters

3 Hand of Tool

R — Right-hand

L — Left-hand

4 Inscribe circle diameter (IC)



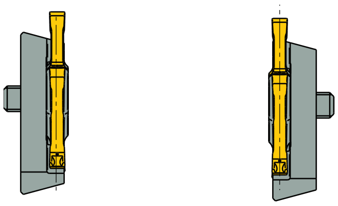
5 JHP

With high pressure coolant channels

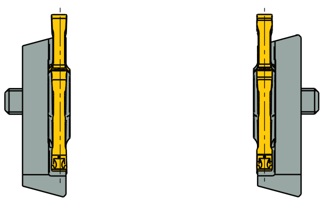
Description of PENTACUT Blades for External Threading

PCHBL	32	-	24	R
1	2		3	4

1 Blade Prism Direction

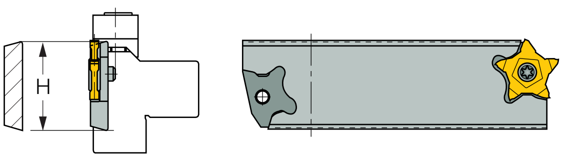


PCHBR — Right-hand

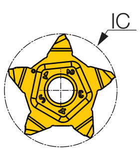


PCHBL — Left-hand

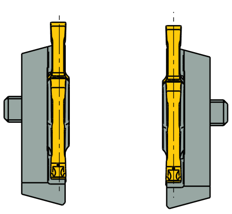
2 Blade height (H) (H)



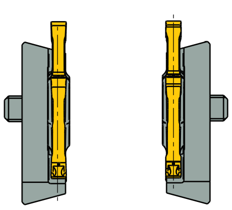
3 Inscribe circle diameter (IC)



4 Pocket location depending on Blade prism direction



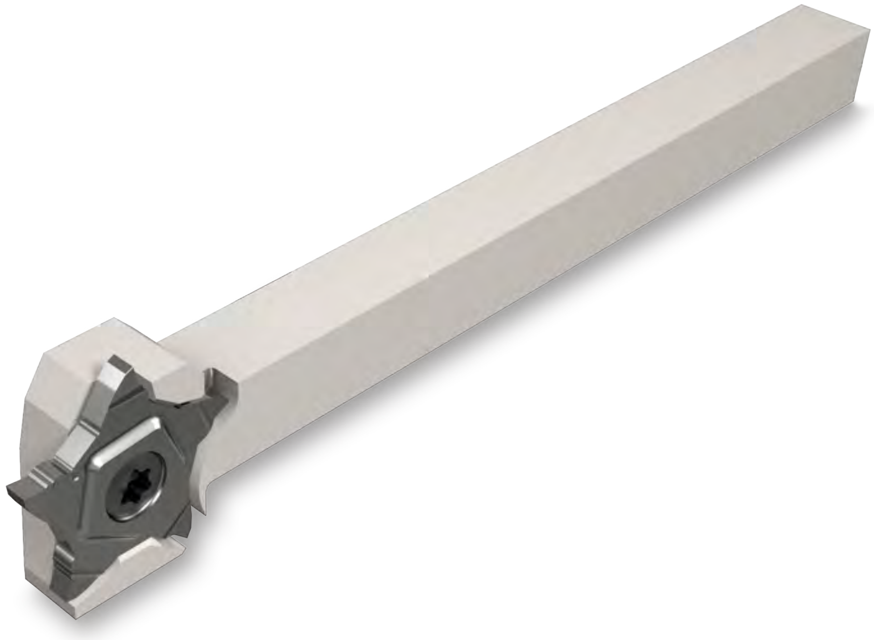
R — Right pocket



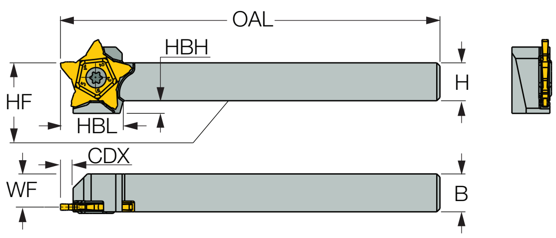
L — Left pocket

Square Shank Tools Suitable for External Threading

These are simple tools suitable for all types of lathe machines and are not equipped with coolant channels. The coolant should be supplied from the turret.



Basic Dimensions of Square Shank Threading Tools



HF — Functional height
H — Shank height
B — Shank width
WF — Functional width
OAL — Overall length
HBL — Head bottom length
HBH — Head bottom height
CDX — Insert overhang

Main Advantage
Suitable for all types of lathe machines

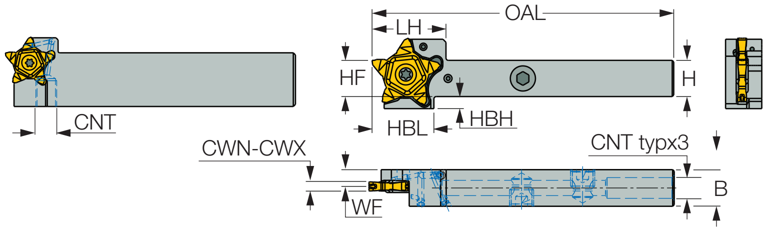
Tools with High Pressure Coolant System Suitable for External Threading

Threading square shank tools are designed to carry the PENTA inserts and feature coolant channels for the use of high-pressure coolant. 5 corner indexing can be performed by only a partial opening of the clamping screw, so the indexing action is short and easy and no setup operation is required. These tools are suitable for all types of lathe machines.

Maximum coolant in cutting area

NOTE: High Pressure Coolant is described in chapter 2.13

Basic Dimensions of Threading Tools with High Pressure Coolant System



OAL — Overall length

LH — Head length

HF — Functional height

HBL — Head bottom length

HBH — Head bottom height

H — Shank height

B — Shank width

WF — Functional width

CNT — Coolant entry threading size

Main Advantages

- Suitable for all types of lathe machines
- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Enables better chip evacuation

Tools with Bottom Fed High Pressure Coolant Systems Suitable for External Threading

NOTE: The shank lengths of the tools with bottom fed high pressure coolant systems are shorter than the lengths of equivalent standard tools - adjusted to the VDI Toolholders

Tools with bottom fed high pressure coolant systems belong to the Multi-Connection **JHP-MC** line and are suitable for mounting on **VDI DIN69880** Toolholders.

The tools include a bottom coolant inlet hole and the **VDI JHP-MC** Toolholders feature a long coolant outlet slot that enables adjustment of the tool's overhang.

Max. tool overhang	Min. tool overhang
	

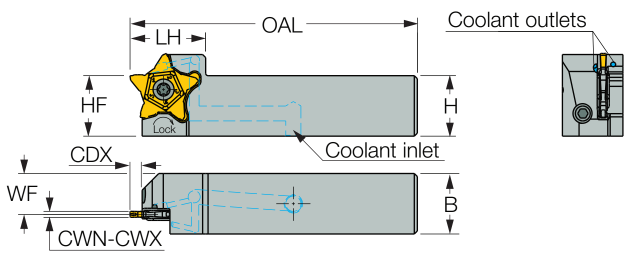
VDI DIN69880 is the most popular quick change adaptation system for CNC turning machines with disc-type turrets. This standard holder adaptation serves mainly stationary turning tools.

VDI DIN69880 Characteristics

- Easy and fast setup
- High stiffness, thanks to straight shank and flange face contact
- Rigid design due to a serrated clamping system
- High accuracy and center height repeatability
- Compact and light design
- Efficient coolant supply internally through the tool and externally through the flange

Multi-Connection **JHP-MC** Line for **VDI** Toolholders with a bottom fed coolant system ensures maximum coolant in the cutting area

Basic Dimensions of Threading Tools with a Bottom Fed High Pressure Coolant System



OAL — Overall length
LH — Head length
HF — Functional height
H — Shank height
B — Shank width
WF — Functional width
CDX — Insert overhang

Main Advantages

- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

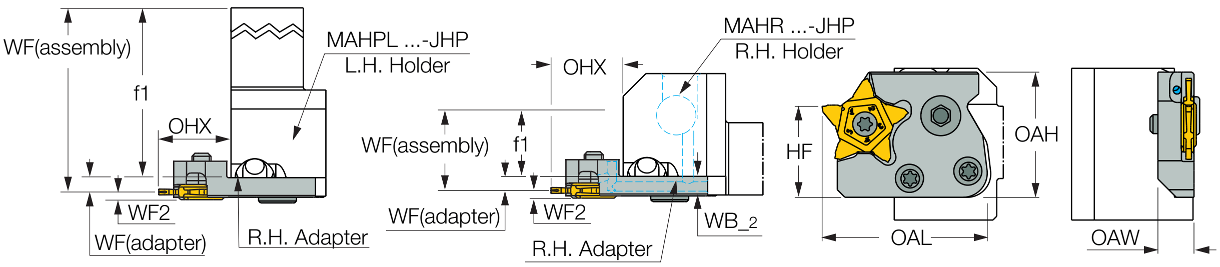
Interchangeable Adapters Suitable for External Threading

Interchangeable Adapters with Internal Coolant Channels	Interchangeable Adapters without Internal Coolant Channels
	

Interchangeable adapters can carry PENTA inserts with 5 threading corners for the production of external threading and can be mounted on different holders. These adapters are available with internal channels for high pressure coolant or without internal coolant channels. There are many types of holders that are suitable to carry these adapters when the holders differ in their adaptation and designation. These tools are suitable for various interchangeable adapters for external threading, external grooving, external parting and external turning.

Interchangeable adapters - an economical and diverse solution

Basic Dimensions for Interchangeable Adapters



WF (assembly)=WF (R.H. holder)+WF (R.H adapter)
WF (assembly)=WF (L.H. holder)+WF2 (R.H. adapter)

OAW — Overall width

OAH — Overall height

OAL — Overall length

HF — Functional height

WF — Functional width

WB — Body width

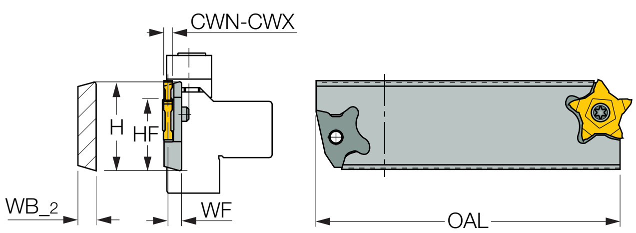
Main Advantages

- One holder can carry various interchangeable adapters
- Available with internal channels for high pressure coolant
- Economical solution
- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

BLADE Suitable for External Threading

The **PENTACUT** family includes a blade for large overhang applications. **PENTACUT** blades are double-ended and suitable for machines that can use standard blocks for blades.
The blades offer a preferred solution for external threading production between the walls in narrow grooves. If the blade's insert pocket is damaged, the other side of blade may still be used.

Basic Dimensions of the Blade



OAL — Overall length
HF — Functional height
H — Blade height
WF — Functional width
WB-2 — Blade width

Main Advantages

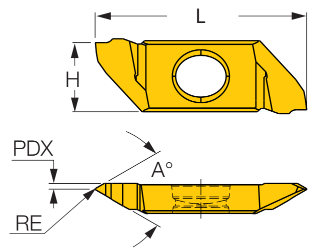
- Suitable for all types of lathe machines
- Suitable for large overhang applications
- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Economical double-ended blade solution
- Rigid clamping system
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing

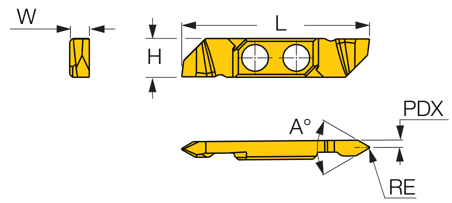
2.5.1 SWISSCUT System for Swiss-Type Lathe Inserts for External Threading

The **SWISSCUT** line is designed for Swiss-type lathes controlled by CNC and for Swiss-type automatics (known also as screw-type machines). The unique **SWISSCUT** line is characterized by ergonomic insert clamping and simple handling. This system is an important element for the high precision Swiss-type machine industry. The insert included in this line has two cutting edges and all ground. The **SWISSCUT** line includes two types of blades - the difference between them is the insert protrusion from the tool. The **SWISSCUT** line offers a solution for partial profiles and full profiles and is suitable for the production of external threading.

SWISSCUT - A User-Friendly System for Swiss-Type Lathes

Basic Dimensions of SWISSCUT Inserts





L —Insert length

H —Insert height

W —Insert width

A —Angle of cutting edge

PDX —The distance between the insert and the crest radius

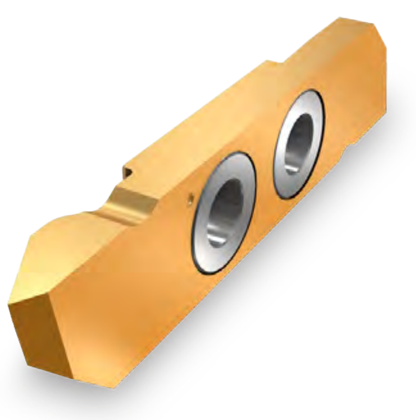
RE —Corner radius

Main Advantages

- Designed for Swiss-type lathes
- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing
- Easy handling of insert
- Precise geometry and excellent surface finish

Notes

- Standard inserts are intended for symmetrical thread profiles
- Without a chipformer



Description of SWISSCUT Inserts According to the Template Below

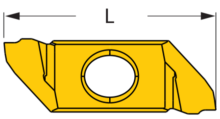
Partial Profile	SCIL	22	-	MT	R	007	IC1008
	1	2		3	4	5	6

1 Insert Clamp Direction

SCIR — Right-hand

SCIL — Left-hand

2 Insert length (mm)



3 Angle of cutting edge (A)

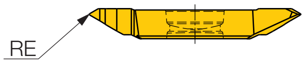
MT — 60°

4 Placement of cutting edge

R — Right-side

L — Left-side

5 Corner radius (RE)



6 Grade

IC1008

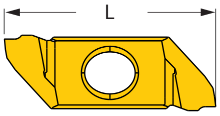
Full Profile	SCIR	22	-	MT	R	-	0.5	ISO	IC1008
	1	2		3	4		5	6	7

1 **Insert Clamp Direction**

SCIR — Right-hand

SCIL — Left-hand

2 **Insert length (mm)**



3 **Angle of cutting edge (A)**

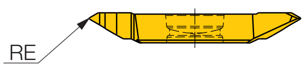
MT — 60°

4 **Placement of cutting edge**

R — Right-side

L — Left-side

5 **Corner radius (RE)**



6 **Threading standard**

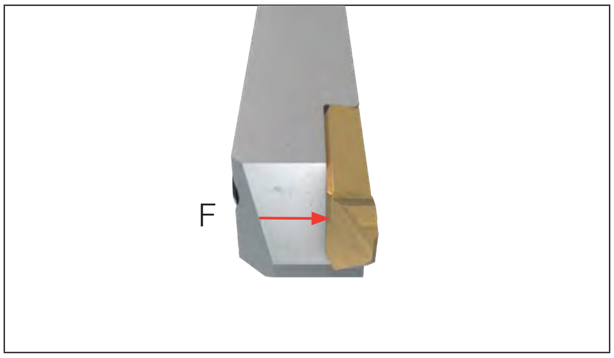
ISO — ISO Metric

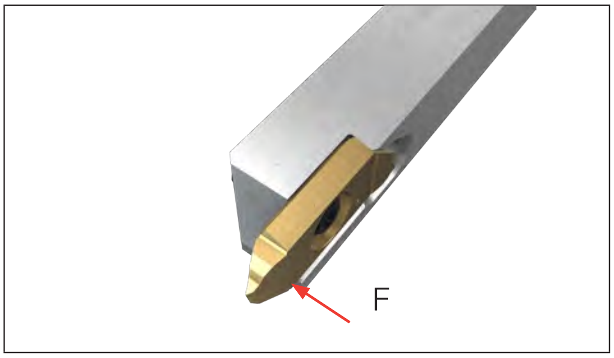
7 **Grade**

IC1008

2.5.2 SWISSCUT System for Swiss-Type Lathe Tools for External Threading

The compact **SWISSCUT** toolholder provides easy and accurate indexing of the insert. The very stable, tangentially clamped insert can be indexed without removing the screw and without removing the toolholder from the machine turret. In addition, clamping and releasing the insert can be accomplished from either side of the toolholder. Bottom and rear prisms provide high stability and precision when turning in alternating directions or where relatively high loads are applied.



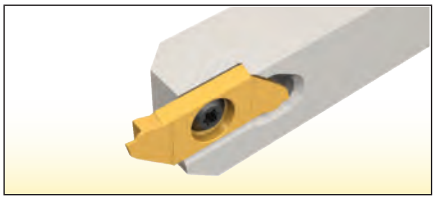


The back clamping option of the **SWISSCUT** enables the user to clamp the insert in the holder from the opposite side of the insert.
This B-Type (back) clamping style is enabled by using an insert with thread bushing.
The insert is clamped by a screw that pulls the insert into the pocket by thread bushing.
An O-ring mounted on the screw prevents the screw from falling out of the pocket while the insert is being replaced. The same tool and insert can be used in both clamping directions.
The clamping design uses a special screw that can be accessed and operated from both sides of the tool.

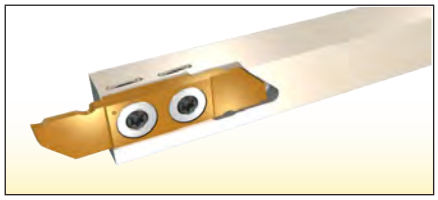
The **SWISSCUT** system is a part of **ISCAR**'s tools for Swiss-type machines and small lathes.

- The unique rigid tool design with small insert overhang provides excellent economical results especially for finishing and precision machining of small parts.
- The **SWISSCUT** family provides a good solution for practically any miniature part application.

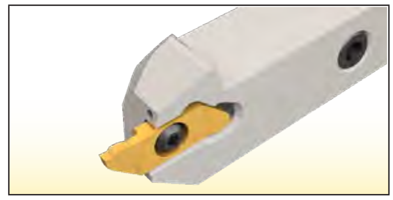
SWISSCUT Tools for External Threading



SCHR/L-22BF
Square Shank Tools with Back and Front Clamping for Swiss-type and Automatic Machines



SCHR/L-41BF
Square Shank Tools with Back and Front Clamping for Swiss-Type and Automatic Machines



SCHR/L-22BF-JHP
Tools with High Pressure Coolant Channels for Swiss-Type and Automatic Machines

Description of SWISSCUT Tools for External Threading

SCHL	08	10	- 22	- BF	- □
1	2	3	4	5	6

1 Hand of tool

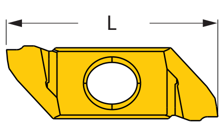
SCHR — Right-side

SCHL — Left-side

2 Shank height

3 Shank width

4 Insert length (mm)



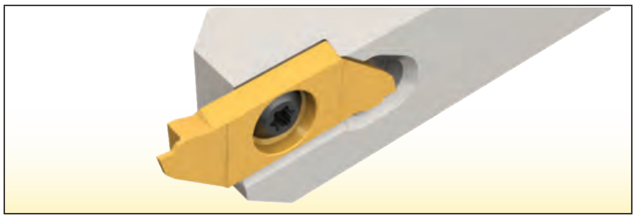
5 Clamping side

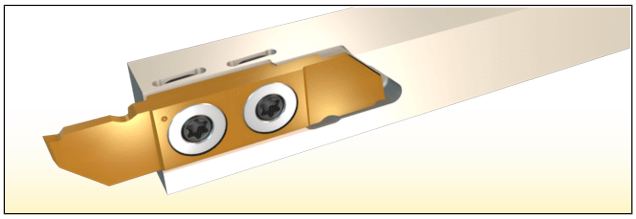
BF — Possibility for back and front clamping

6 JHP

With high pressure coolant channels

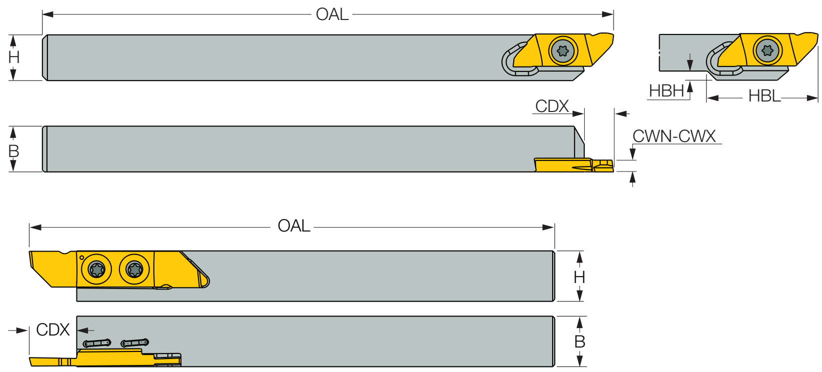
Square Shank Tools Suitable for External Threading





These square shank tools with back and front clamping are designed for Swiss-type lathes and also can be used on all types of lathe machines. They are not fitted with coolant channels.

Basic Dimensions of Square Shank Tools



HF — Functional height

H — Shank height

B — Shank width

OAL — Overall length

HBL — Head bottom length

HBH — Bottom height

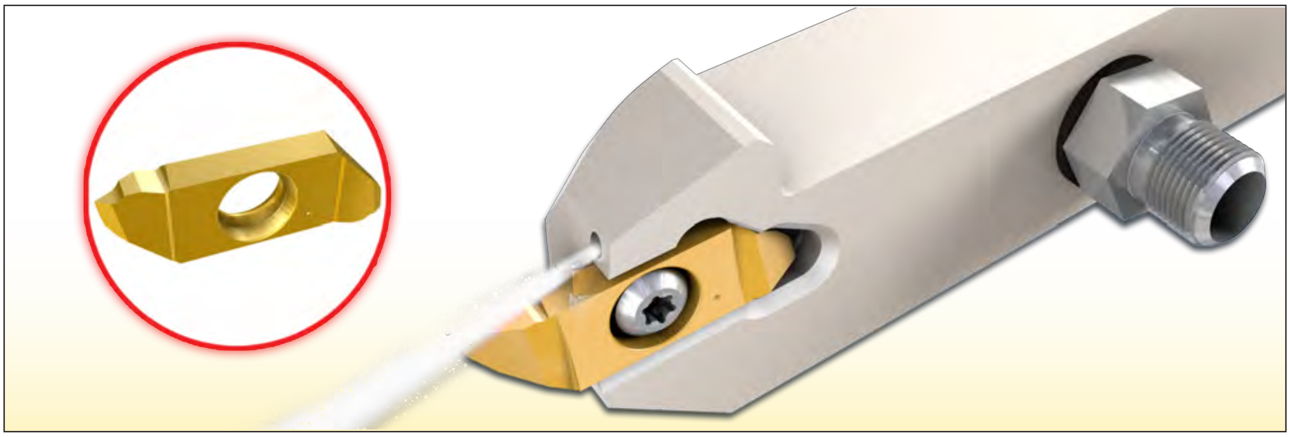
CDX — Insert overhang

Main Advantages

- Suitable for all types of lathe machines
- No need to remove a clamping screw for replace insert

Tools with High Pressure Coolant System Suitable for External Threading

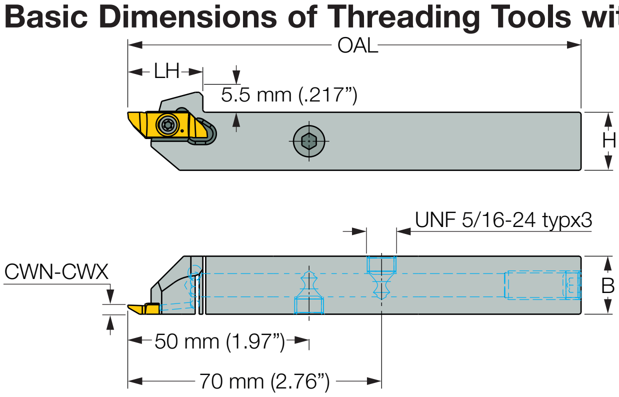
These threading square shank tools are designed to carry SCIR/SCIL inserts and feature coolant channels designed also for the use of high-pressure coolant. The high pressure coolant channels (JHP) are pinpointed directly to the cutting edge. Many modern Swiss-type machines are equipped with high pressure pumps and these tools will enable better performance on these machines. These tools are suitable for all types of lathe machines.



NOTE: High Pressure Coolant is described in chapter 2.13

Ensure maximum coolant in the cutting area

Basic Dimensions of Threading Tools with High Pressure Coolant System



OAL — Overall length

LH — Head length

H — Shank height

B — Shank width

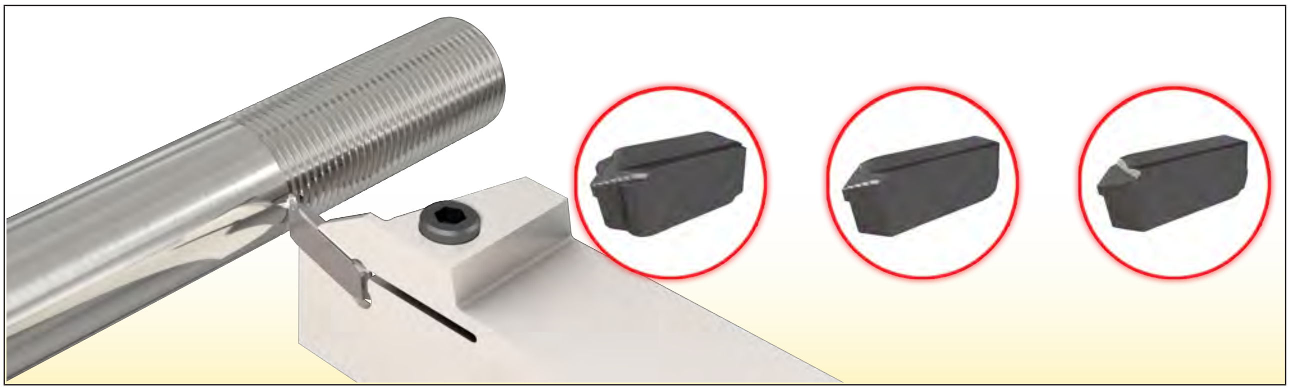
Main Advantages

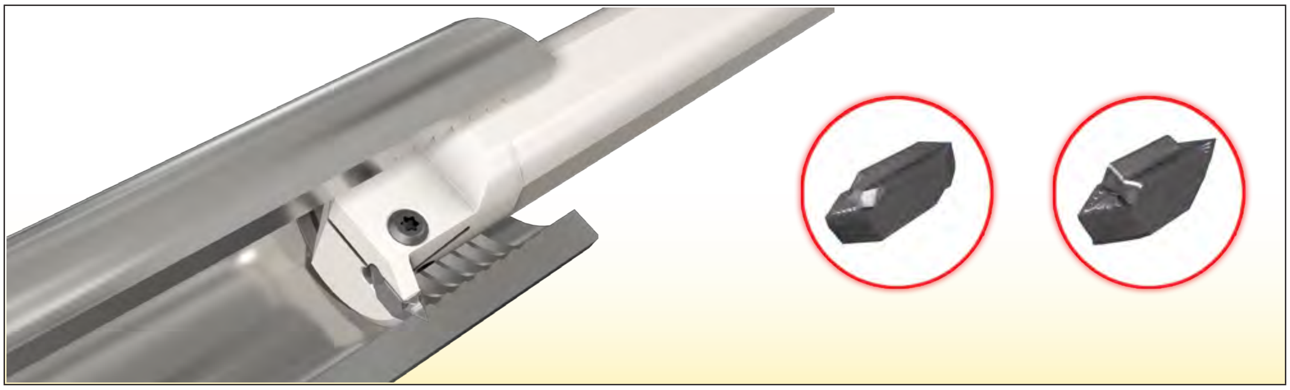
- Suitable for all types of lathe machines
- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Enables better chip evacuation

2.6.1 CUT-GRIP Inserts for External and Internal Threading

The **CUT-GRIP** line includes double-ended inserts for the production of external threading and internal threading.

CUT-GRIP is a stable and very rigid system





CUT-GRIP Line for External Threading

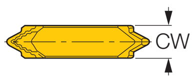
The TIP insert offers a solution for machining external threading. This is a peripheral ground insert available with a pressed chipformer and with a flat top rake (without chipformer).

TIP Double-Ended Peripheral Ground Insert with a Pressed Chipformer
Provides superior chip control and excellent performance when working with a large variety of workpiece materials. These types of inserts are available for partial profiles and full profiles in the most popular threading standards.

Description of the TIP insert with a Pressed Chipformer According to the Template Below

Partial Profile	TIP	4	MT	-	0.20	IC908
		1	2		3	4

1 Insert width (CW)

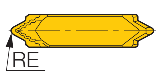


2 Angle of cutting edge (A)

MT — 60°

WT — 55°

3 Corner radius (RE)

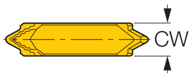


4 Grade

IC08, IC908

Full Profile	TIP	4	P	3.5	-	ISO	IC908
		1		2		3	4

1 Width of cutting edge (CW)



2 Pitch

Value by number:

0.5 - 2.0 mm

14 - 28 TPI

3 Threading standard

ISO — ISO Metric

UN — American UN

W — Whitworth

BSW — British BSPT

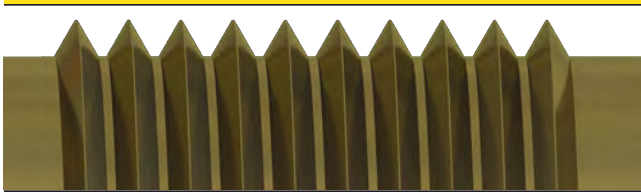
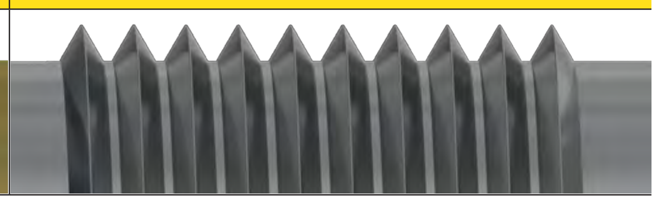
NPT — National pipe threading

4 Grade

IC08, IC908

TIP Double-Ended Peripheral Ground Insert with a Flat Top Rake (without Chipformer)

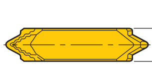
Designed for threading on short chipping materials such as brass and cast iron. The use of the flat top rake inserts on these materials results in improved surface quality and less chatter, compared to inserts with a chipformer. As a result, cutting speeds can be increased. The following picture shows the excellent surface quality obtained by using a TIP.... A-Type insert on a brass workpiece. These types of inserts are available for partial profile.

Brass	Cast Iron
	

Description of TIP with a Flat Top Rake (without Chipformer) According to the Template Below

TIP	2	-	A	MT	-	0.05	IC908
	1			2		3	4

1 Width of cutting edge (CW)



2 Angle of cutting edge (A)

MT — 60°

3 Corner radius (RE)

4 Grade

IC908

CUT-GRIP Line for Internal Threading

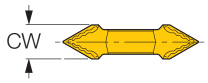
GEPI and TIPI inserts offer solutions for machining internal threading. They are peripheral ground inserts with a pressed chipformer. Both types of inserts are available for partial profiles with 55° and 60° angle of cutting edge.

- GEPI inserts are suitable for minimum bore diameter of 12.5 mm (0.492 inches).
- TIPI inserts are suitable for minimum bore diameter of 20 mm (0.787 inches).

Description of GEPI Inserts According to the Template Below

GEPI	2.5	-	MT	0.05	IC908
	1		2	3	4

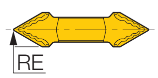
1 Width of cutting edge (CW)



2 Angle of cutting edge (A)

MT —60°, **WT** —55°

3 Corner radius (RE)



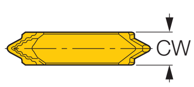
4 Grade

IC08, IC908

Description of TIPI Inserts According to the Template Below

TIPI	3.4	WT	-	0.10	IC908
	1	2		3	4

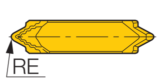
1 Width of cutting edge (CW)



2 Angle of cutting edge (A)

MT —60°, **WT** —55°

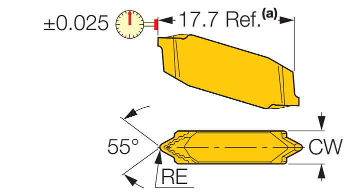
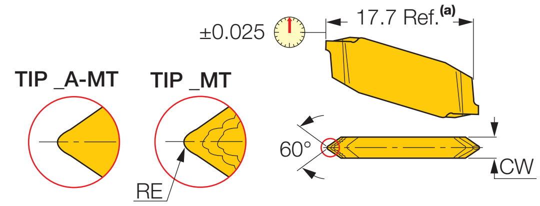
3 Corner radius (RE)

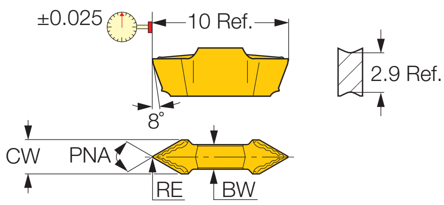
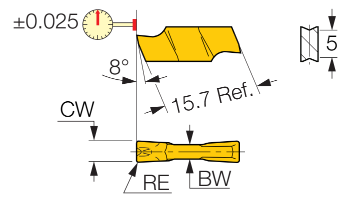
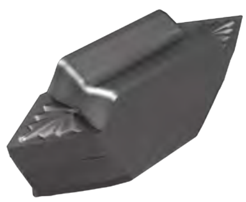
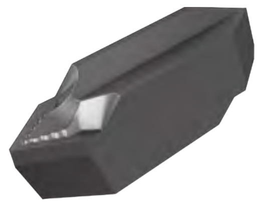


4 Grade

IC08, IC908

Basic Dimensions of CUT-GRIP Inserts

TIP with Pressed Chipformer	TIP with a Flat Top Rake (without Chipformer)
	
	

GEPI	TIPI
	
	

L — Insert length

CW — Insert width

A — Angle of cutting edge

RE — Corner radius

Main Advantages

- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing
- Easy handling of inserts
- Proven and reliable solution

Note

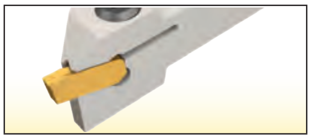
- Standard inserts are intended for symmetrical thread profiles

2.6.2 CUT-GRIP Tools for External and Internal Threading

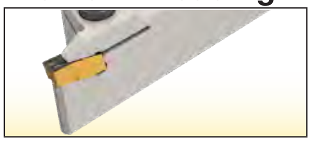
The **CUT-GRIP** family includes 14 types of tools for the production of external threading and 2 types of tools for the production of internal threading. All tools belong to the **CUT-GRIP** family and are suitable for mounting on all types of **CUT-GRIP** inserts.

CUT-GRIP is a stable and very rigid system

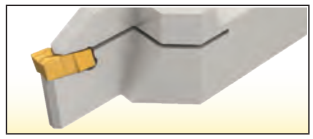
CUT-GRIP Tools for External Threading



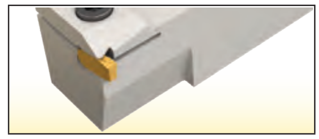
GHMR/L
Square Shank Tools



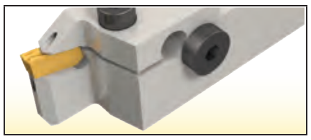
GHDR/L (Short Pocket)
Square Shank Tools



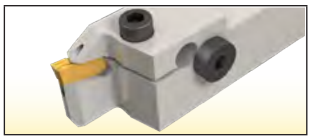
GHGR/L
Square Shank Tools



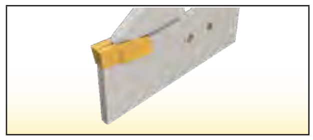
GHMPR/L
Perpendicular Square Shank Tools



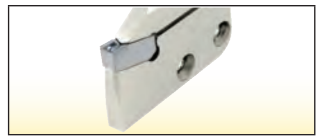
GHDR/L-JHP
(Short Pocket) Tools with High Pressure Coolant System



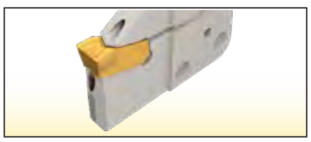
GHDR/L-JHP-MC
(Short Pocket) Tools with Bottom Fed High Pressure Coolant System



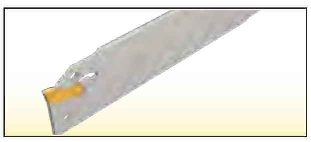
CGHN-S
Interchangeable Adapters without Internal Coolant Channels



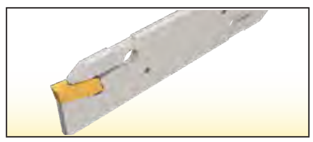
CGPAD
Interchangeable Adapters without Internal Coolant Channels



CGPAD-JHP
Interchangeable Adapters with Internal channels for High Pressure Coolant

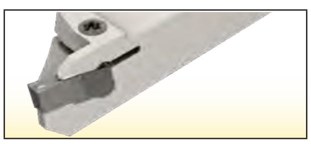


CGHN-DG
Double-Ended Blades with Self-Clamped Inserts

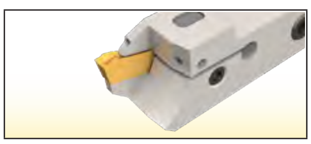


CGHN-D
Double-Ended Blades

C#-GHDR/L
Tools with CAMFIX Shanks for Polygonal Taper Interface



GHSR/L
Tools for Swiss-Type Lathes. Top Lock without Internal Coolant Channels



GHSR/L-JHP-SL
Tools for Swiss-Type Lathes. Side Lock with Internal Coolant Channels

CUT-GRIP Tools for Internal Threading

GEHIR/L
Internal Machining Bars with Coolant Holes for GEPI...inserts

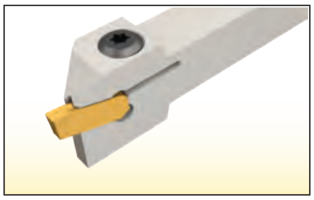
GEHIR/L-SC
Internal Machining Solid Carbide Bars with Coolant Holes for GEPI...inserts

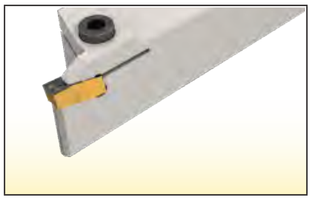
GHIR/L
Internal Machining Bars with Coolant Holes for TIPI...inserts

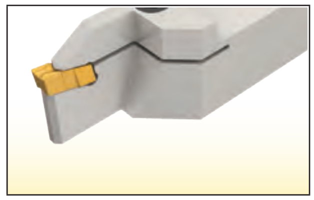
GHIR/L-SC
Internal Machining Solid Carbide Bars with Coolant Holes for TIPI...inserts

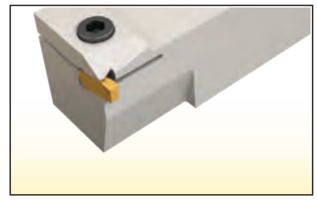
E-GEHIR / E-GHIR
Interchangeable Heads for GEPI...inserts

Square Shank Tools Suitable for External Threading



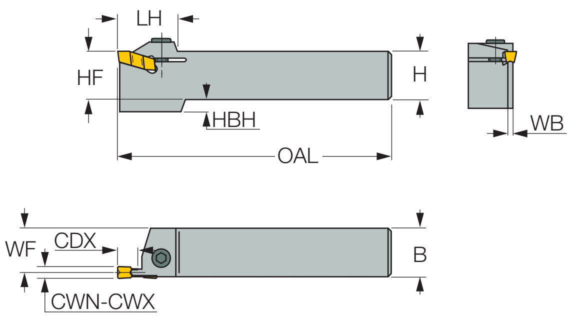


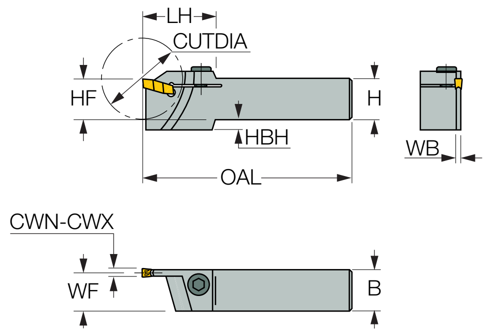


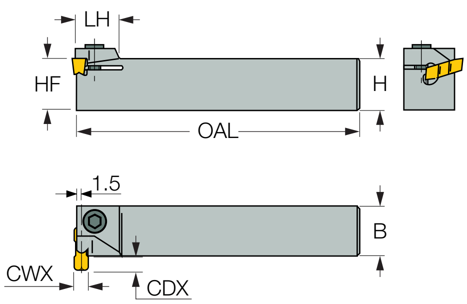


These simple tools are suitable for all types of lathe machines and come without coolant channels. The coolant should be supplied from the turret. There are 4 types of square shank tools available, with the difference between each being the possible depth of cut.

Basic Dimensions of Square Shank Threading Tools:







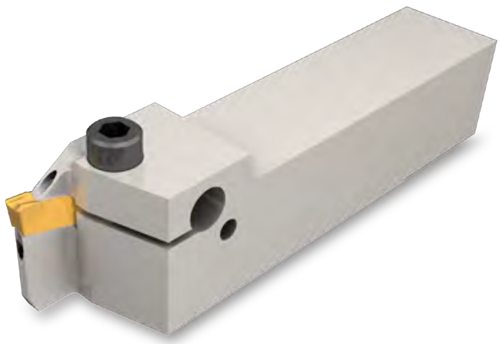
HBH	— Head bottom height
HF	— Functional height
H	— Shank height
B	— Shank width
WF	— Functional width
WB	— Seat width OAL - overall length
LH	— Head length
CDX	— Insert overhang
CUTDIA	— Minimum diameter of work piece

Main Advantages

- Suitable for all types of lathe machines

Tools with High Pressure Coolant System Suitable for External Threading

Threading square shank tools designed to carry the **CUT-GRIP** inserts and featuring coolant channels designed also for the use of high-pressure coolant. These tools are suitable for all types of lathe machines.

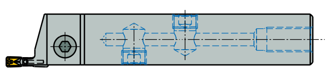


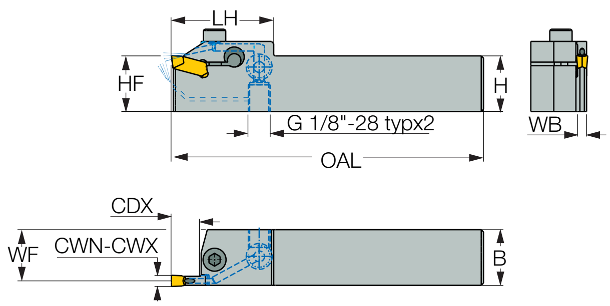
NOTE: High Pressure Coolant is described in chapter 2.13

Ensure maximum coolant in cutting area

Basic Dimensions of Threading Tools with High Pressure Coolant System

20 mm shank tools
(3 inlet ports)





OAL — Overall length
LH — Head length
HF — Functional height
H — Shank height
B — Shank width
WF — Functional width
WB — Seat width
CDX — Insert overhang

Main Advantages

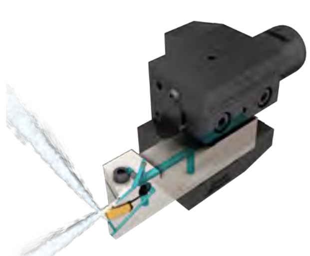
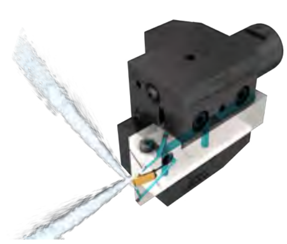
- Suitable for all types of lathe machines
- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Provides excellent chip breaking results on all materials
- Enables better chip evacuation

Tools with Bottom Fed High Pressure Coolant Systems Suitable for External Threading

NOTE: The shank lengths of the tools with bottom fed high pressure coolant systems are shorter than the lengths of equivalent standard tools - adjusted to the VDI Toolholders

Tools with bottom fed high pressure coolant systems belong to the multi-connection **JHP-MC** line and are suitable for mounting on **VDI DIN69880** Toolholders.

The tools include a bottom coolant inlet hole and the **VDI JHP-MC** Toolholders feature a long coolant outlet slot that enables adjustment of the tool's overhang.

Max. tool overhang	Min. tool overhang
	

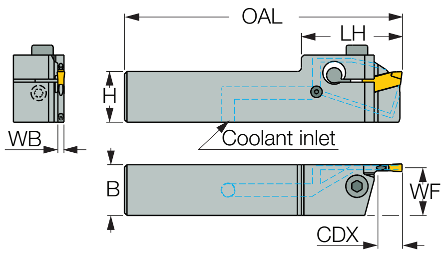
VDI DIN69880 is the most popular quick change adaptation system for CNC turning machines with disc-type turrets. This standard holder adaptation serves mainly stationary turning tools.

VDI DIN69880 Characteristics

- Easy and fast setup
- High stiffness, thanks to straight shank and flange face contact
- Rigid design due to a serrated clamping system
- High accuracy and center height repeatability
- Compact and light design
- Efficient coolant supply internally through the tool and externally through the flange

Multi-Connection **JHP-MC** Line for **VDI** Toolholders with a bottom fed coolant system ensure maximum coolant in the cutting area

Basic dimensions of threading tools with high pressure coolant system



OAL — Overall length

LH — Head length

H — Shank height

B — Shank width

WB — Seat width

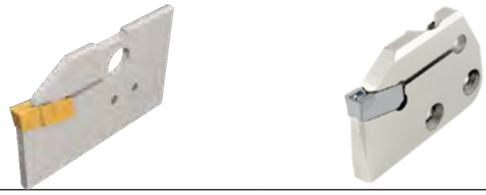
WF — Functional width

CDX — Insert overhang

Main Advantages

- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

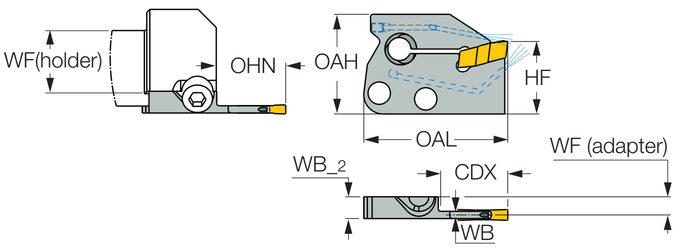
Interchangeable Adapters Suitable for External Threading

Single-Ended Interchangeable Adapters without Internal Coolant Channels	Single-Ended Interchangeable Adapters with Internal Channels for High Pressure Coolant
	

Interchangeable adapters can carry **CUT-GRIP** inserts with 2 threading corners for the production of external threading mounted on different holders. These adapters are available with internal channels for high pressure coolant or without internal coolant channels. There are many types of holders that are suitable to carry these adapters when the holders differ in their adaptation and designation. These tools are suitable for various interchangeable adapters for external threading, external grooving, external parting and external turning.

Interchangeable adapters - economical and diverse solution

Basic Dimensions of Interchangeable Adapters with Internal Coolant Channels

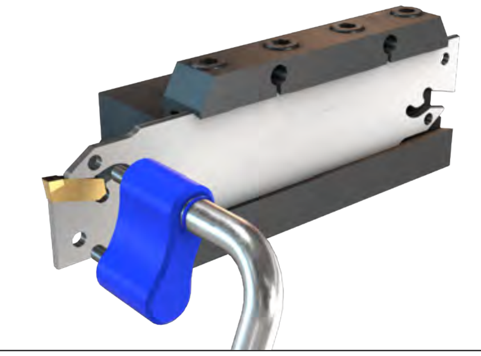
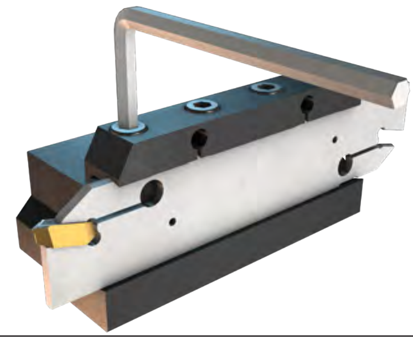


OAH — Overall height
OAL — Overall length
HF — Functional height
WF — Functional width
WB — Seat width
WB-2 — Body width
CDX — Insert overhang
OHN Minimum overhang

Main Advantages

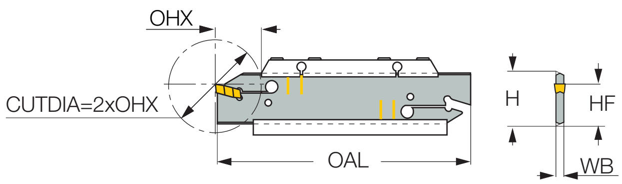
- One holder can carry various interchangeable adapters
- Available with internal channels for high pressure coolant
- Economical solution
- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

BLADE Suitable for External Threading

Self-Clamped	Screw-Clamped
	

The **CUT-GRIP** family includes blades for large overhang applications.
CUT-GRIP blades are double-ended and suitable for machines that can use standard blocks for blades. These blades can offer a preferred solution for external threading production between the walls in narrow grooves. If the blade's insert pocket is damaged, the other side of blade may still be used.

Basic Dimensions of Blade



OAL — Overall length
HF — Functional height
H — Blade height
OHX — Maximum overhang
WB — Blade width

Main Advantages

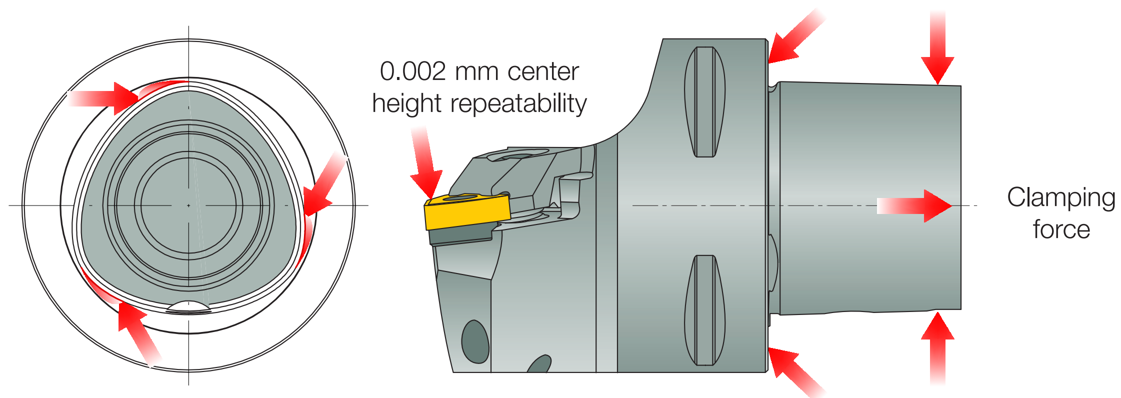
- Suitable for all types of lathe machines
- Suitable for large overhang applications
- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Economical solution - double-ended
- Rigid clamping system
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing

Tools with CAMFIX Shanks for Polygonal Taper Interface Solution for External Threading

External threading tools with **CAMFIX** shanks for polygonal taper interface (ISO 26623-1 standard) enable quick change and reduce setup time - most important for mass production industries. These threading tools feature coolant channels for efficient flushing of heat and chips from the cutting edges.

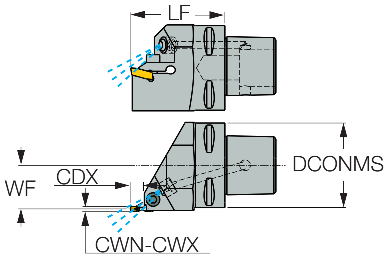
CAMFIX Features for Turning Applications

Polygonal design-self centering



The **CAMFIX** system features high accuracy, excellent rigidity against bending forces, stability and high torque transfer.
This is achieved due to the polygonal cone and face contact.

Basic Dimensions of Threading Tools with CAMFIX Shanks for Polygonal Taper Interface



LF — Functional length

DCONMS — Connection diameter of machine side

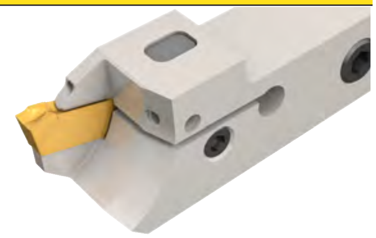
WF — Functional width

CDX — Cutting depth maximum

Main Advantages

- Reduces cutting time
- Provides longer tool life of cutting edge
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Enables better chip evacuation

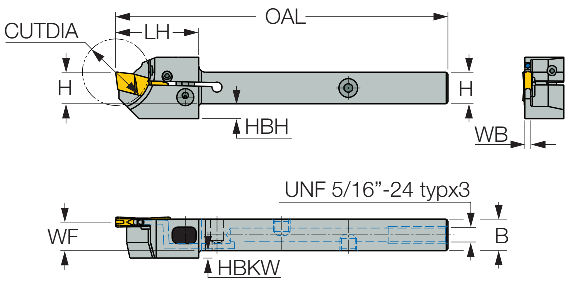
Tools for Swiss-Type Lathes Solution for External Threading

Top Lock without Internal Coolant Channels	Side Lock with Internal Coolant Channels
	

The **CUT-GRIP** family includes tools designed especially for Swiss-type lathes.
These tools are available with internal channels for high pressure coolant or without internal coolant channels. The clamping system of the insert into the tool can be from the top and from the side.

NOTE: High Pressure Coolant is described in chapter 2.13

Basic Dimensions of Tools for Swiss-Type Lathes



OAL — Overall length
LH — Head length
HBH — Head bottom height
H — Shank height
B — Shank width
WF — Functional width
WB — Seat width
HBKW — Head back width
CUTDIA — Maximum diameter of work piece

Main Advantages

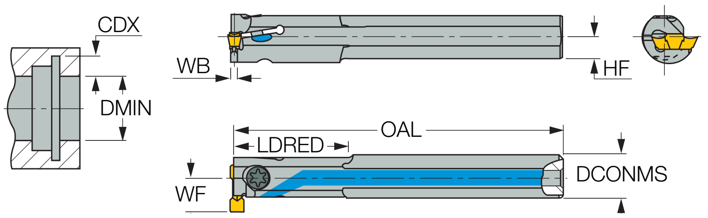
- Designed for Swiss-type lathes
- Available with internal coolant channels
- Available with side lock system
- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing
- Easy handling of insert

Threading Bars Solution for Internal Threading

Related Tools for GEPI ... Inserts		Related Tools for TIPI ... Inserts	
			
GEHIR/L Internal Machining Bars with Coolant Holes for GEPI...inserts	**GEHIR/L-SC** Internal Machining Solid Carbide Bars with Coolant Holes for GEPI...inserts	**GHIR/L** Internal Machining Bars with Coolant Holes for TIPI...inserts	**GHIR/L-SC** Internal Machining Solid Carbide Bars with Coolant Holes for TIPI...inserts

These are simple tools suitable for all types of lathe machines, available with and without coolant channels. There are 2 types of boring bars for GEPI inserts and 2 types of boring bars for TIPI inserts. The bars (in the **CUT-GRIP** family) can be produced from steel or solid carbide. The solid carbide boring bars expand the current boring overhang range and provide improved performance due to their high rigidity feature.

Basic Dimensions of Boring Bars



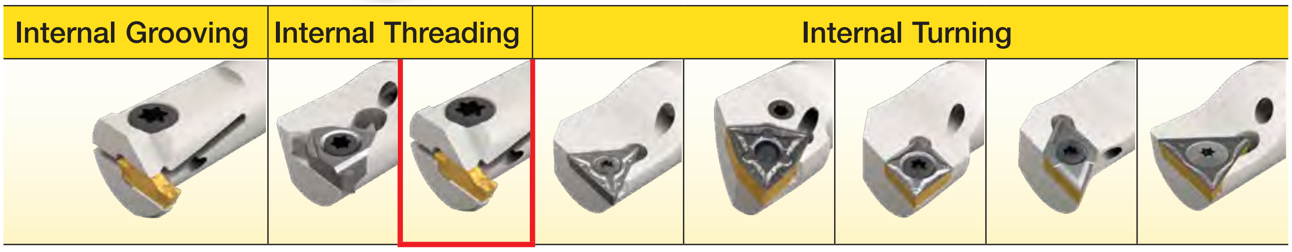
OAL — Overall length
WF — Functional width
WB — Seat width
DCONMS — Connection diameter machine size
HF — Functional height
LDRED — Body diameter length
CND — Coolant entry diameter
CDX — Cutting depth maximum
DMIN — Minimum bore diameter

Main Advantages

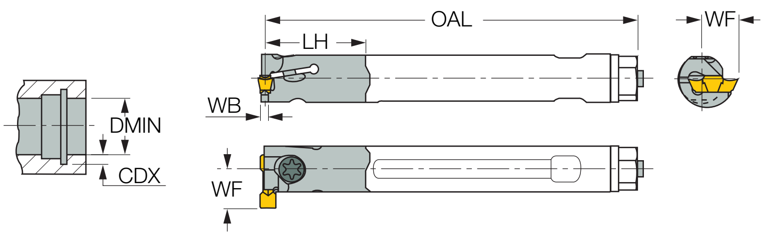
- Available with internal coolant channels
- Suitable for work next to shoulder
- Easy and fast insert mounting and cutting edge indexing
- No setup needed after each insert indexing
- Easy handling of insert
- Suitable for all types of lathe machines

Interchangeable Heads Solution for Internal Threading

Interchangeable heads can carry GEPI inserts and are mounted on solid carbide shanks. These heads are suitable for the production of internal threads with high overhang. Solid carbide shanks are used for economical boring with various interchangeable heads for internal threading, internal grooving, and internal turning. The solid carbide boring bar expands the current boring overhang range and provides improved performance due to their high rigidity feature.



Basic Dimensions of Interchangeable Heads



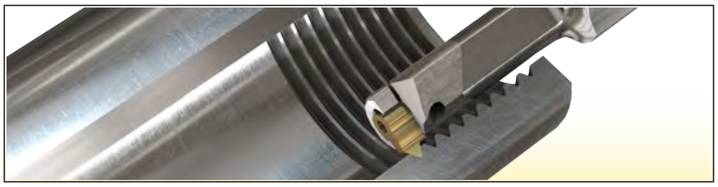
OAL	–	Overall length
LH	–	Head length
WF	–	Functional width
WB	–	Seat width
CDX	–	Cutting depth maximum
DMIN	–	Minimum bore diameter

Main Advantages:

- One shank can carry various interchangeable heads
- Recommended for internal threading with high overhang
- Economical solution

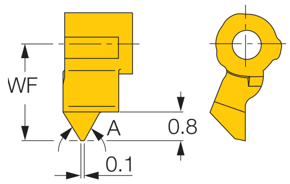
2.7.1 MINICHAM Inserts for Internal Threading

The **MINICHAM** line includes single-sided mini indexable inserts for internal threading. This line is available for partial profile and can produce internal threads in minimum bore diameter of 4.0 mm (0.157 inches). The inserts in this line are peripheral ground with a pressed deflector for chip evacuation. The clamping concept of the insert into the holder is based on self-clamping (without clamping screw).



Indexable solution for internal threading in minimum bore diameter of 4.0 mm (0.157 inches)

Basic Dimensions of MINICHAM Inserts



WF —Functional length, A —Angle of cutting edge

Main Advantages

- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Economical solution relative to solid products
- Easy and fast insert mounting
- No setup needed after each insert indexing
- Easy handling of very small inserts
- No spare parts

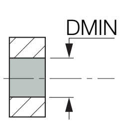
Notes

- Standard inserts are intended for symmetrical thread profiles
- No chipformer

MINICHAM Insert Description According to the Template Below

UMGR	4.0	-	A60	IC508
	1		2	3

1 **Minimum bore diameter (mm)**



2 **Angle of cutting edge (A)**

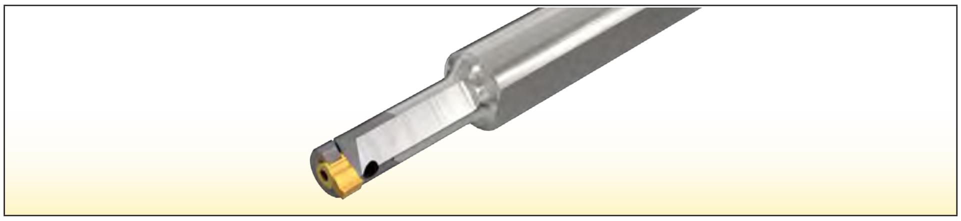
A55 - 55°, A60 - 60°

3 **Grade**

IC508

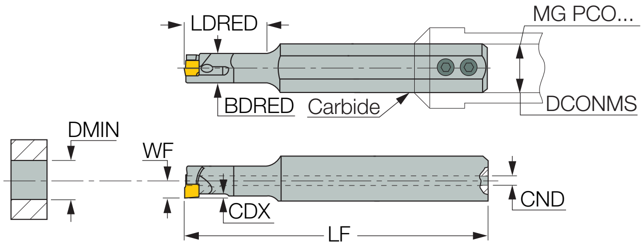
2.7.2 MINICHAM Threading Bars for Internal Threading

The **MINICHAM** line includes solid carbide bars with coolant channels for producing internal threading at 4 mm minimum bore diameter. The solid carbide boring bars expand the current boring overhang range and provide improved performance relative to steel bars due to their high rigidity feature. The concept is based on a self-clamping miniature insert mounted on a 6mm diameter solid carbide bar that fits into **ISCAR**'s PASSPORT holders MG PCO-... -6-8. The mini bars for right-hand machining are supplied with shank extensions of 10mm or 20mm.



Bars with unique self-clamping system

Basic Dimensions of Boring Bars



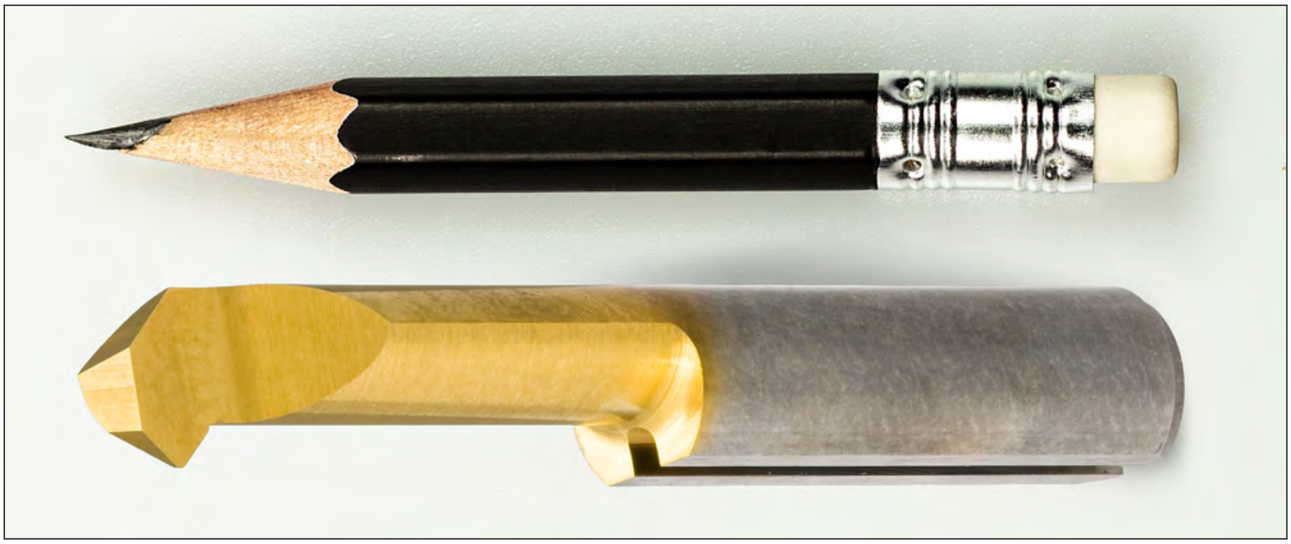
LF — Functional length
WF — Functional width
LDRED — Body diameter length
BDRED — Reduced body diameter
CND — Coolant entry diameter
CDX — Cutting depth maximum
DMIN — Minimum bore diameter
DCONMS — Connection diameter of machine side

Main Advantages

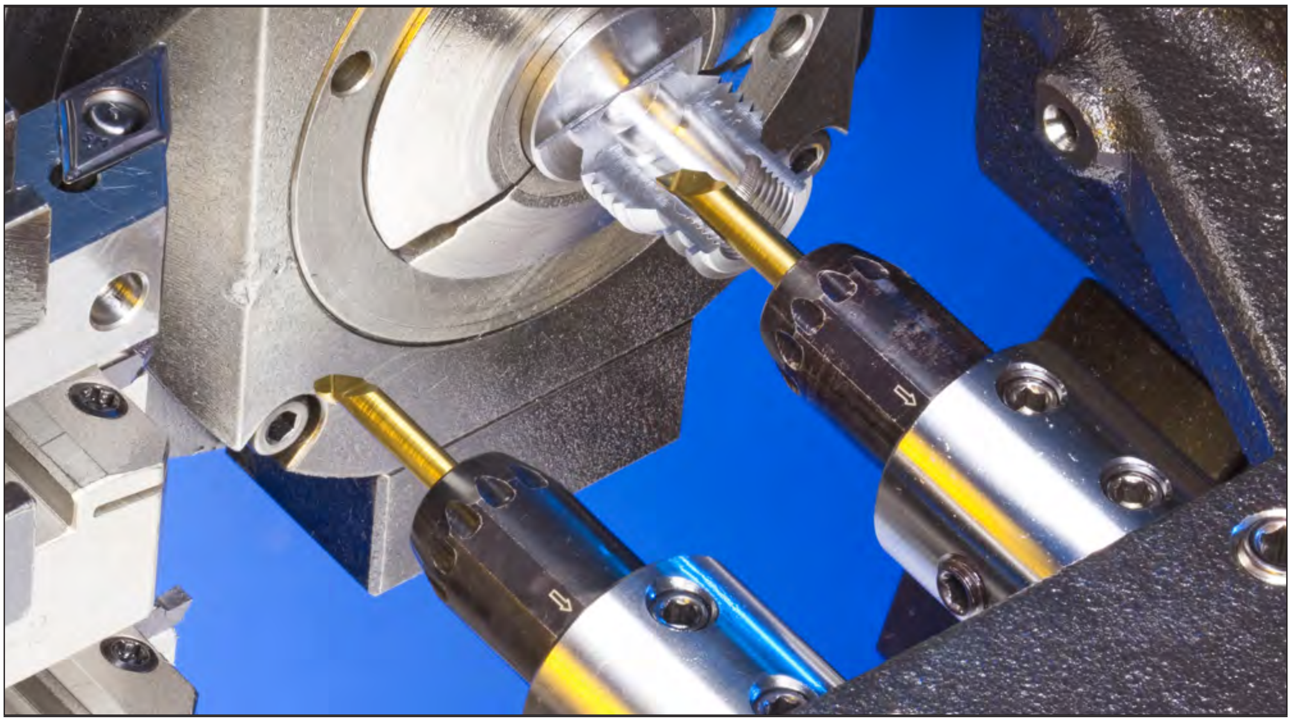
- Available with internal coolant channels
- Suitable for work next to shoulder
- Easy and fast insert mounting
- No setup needed after each insert indexing
- Easy handling of insert
- Suitable for all types of lathe machines
- No spare parts

2.8.1 PICCOCUT Inserts for Internal Threading

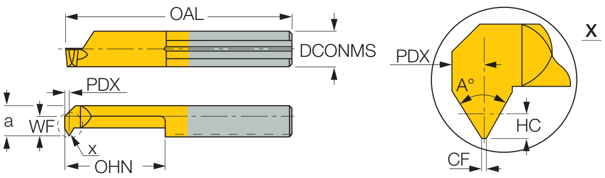
PICCO is an all ground solid carbide tool with a chipformer and an internal coolant channel. A ground chipformer provides excellent chip forming and improved tool life, enabling short controlled chips and facilitating continuous non-stop machining. The chipformer reduces the cutting force, resulting in lower plastic deformation on the cutting edge and extending tool life. The **PICCOCUT** line offers a solution for internal threading and is suitable for minimum bore diameter of 2.4 mm (0.094 inch). PICCO inserts are available for partial profiles and full profiles according to ISO standard.



Solid tools for internal threading in minimum bore diameter of 2.4 mm (0.094 inch)



Basic Dimensions of PICCOCUT Inserts



OAL — Overall length

DCONMS — Connection diameter

PDX — Distance between the insert and the crest area

a — Front length

WF — Functional length

OHN — Overhang distance

A — Angle of cutting edge

HC — Actual threading height

CF — Central flat

Main Advantages

- Suitable for work next to shoulder
- Suitable for threading between the walls in narrow grooves
- Easy and fast insert mounting
- High repeatability - no setup needed after each tool indexing
- Easy handling
- High rigidity (one piece)
- Less tolerance accumulation relative to indexable solution

Notes

- Cannot produce unsymmetrical threading profiles for standards tools only
- Expensive solution relative to indexable products

PICCOCUT Insert Description

PICCO	R	005.0407	-	15
	1	2		3

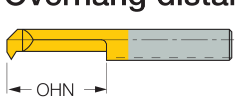
1 **Hand of Tool**

R Right-hand

L Left-hand

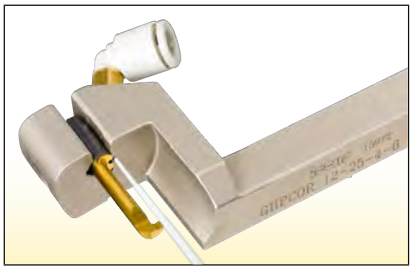
2 **Identification number**

3 **Overhang distance (OHN)**



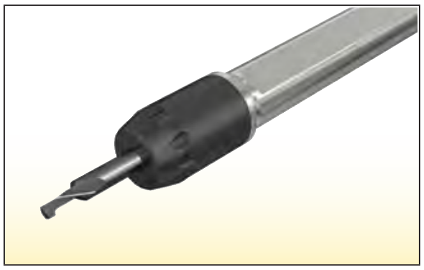
2.8.2 PICCOCUT Holders for Internal Threading

The **PICCOCUT** family includes 3 types of holders for internal threading.



GHPCOR

Perpendicular Square-Shank Tools for Use on Cross Slide Units of Swiss-Type and Automatic Machines



PICCO ACE

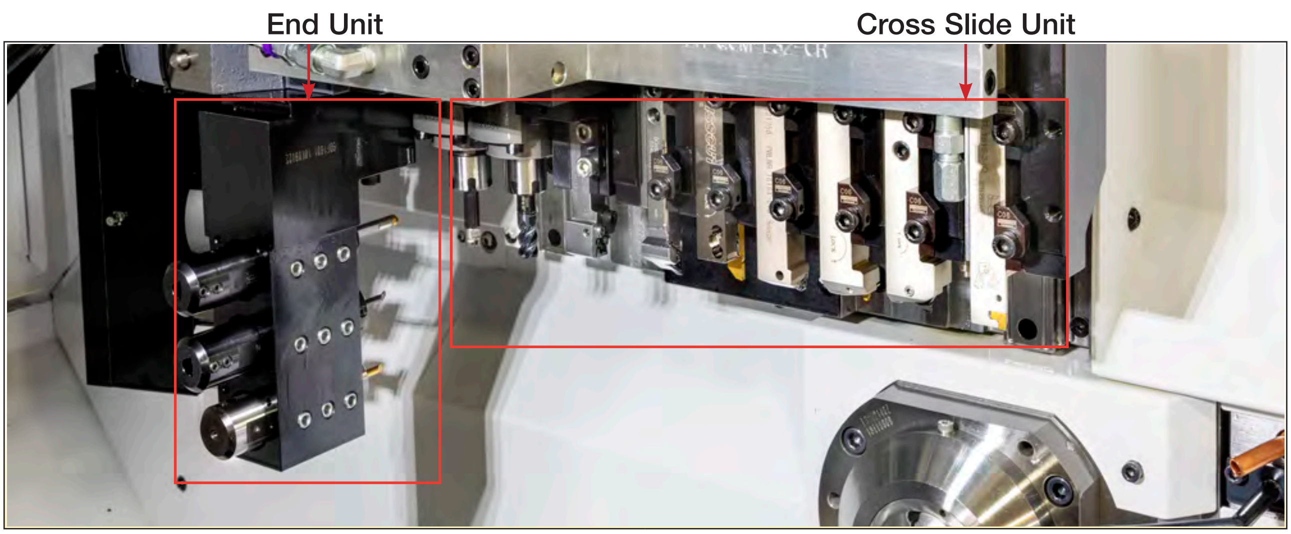
Holders for PICCOCUT Inserts Featuring Extremely High Clamping Repeatability

PICCO/MG PCO (Holder)

Holders for PICCO Inserts and Small Diameter Boring Bars

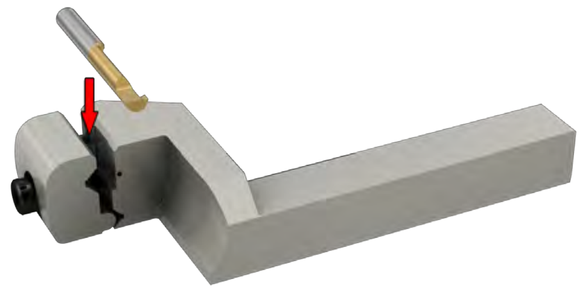
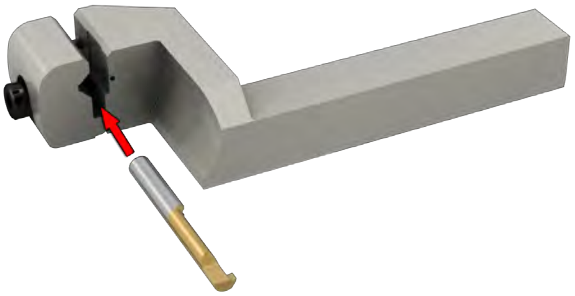
Perpendicular Holder for Swiss-Type Lathes
Solution for Internal Threading

ISCAR designed perpendicular holders for PICCO-CUT inserts used on Swiss-type machines. Unlike the round shank toolholders (PICCO/MG PCO), which could be mounted only on the end units, **ISCAR** designed perpendicular square-shank tools to be used on cross slide units.

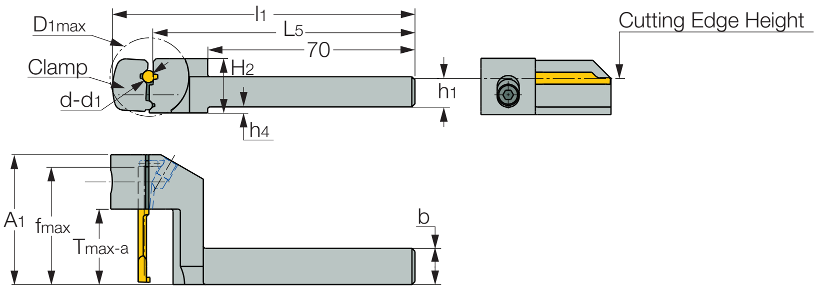


Each toolholder has been designed to fit several PICCO insert shank diameters. The toolholder features an internal coolant hole directed to the machining area. This reduces temperature and wear, and improves chip evacuation. The supplied coolant fitting allows for a maximum coolant pressure of 10 bar. If a higher coolant pressure is required, a suitable fitting/pipe should be used. Very rigid clamping ensures stable and efficient threading machining.

On **ISCAR** tools, it is possible to mount the insert into the pocket from the frontal side and from the top side. This is a major advantage on machines where it is not possible to index the insert from the front and the tool must be removed from the machine (note: standard round tools such as drills and taps can also be clamped).

Indexing from the Top	Indexing from the Front
	

Basic Dimensions of Perpendicular Holders



OAL — Overall length

OAH — Overall height

OAW — Overall width

OHX — Maximum overhang

HBH — Offset height of bottom head

H — Shank height

B — Shank width

L5 — Body length

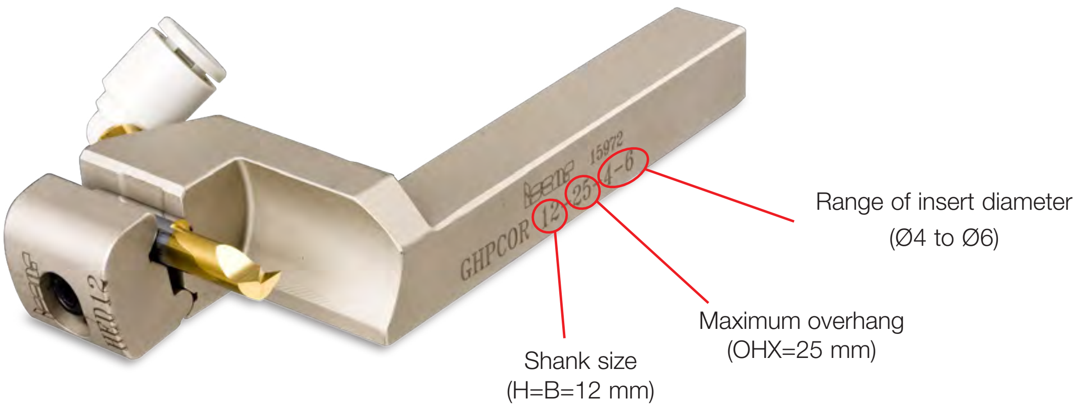
D1max — Maximum diameter limit of axial groove

f max — Maximum insert to shank reference

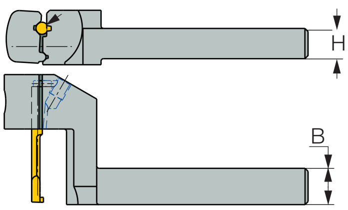
DCONNWS DCONXWS — Insert diameter

Description of Perpendicular Holders

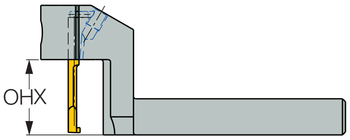
GHPCOR	12	-	25	-	4-6
	1		2		3



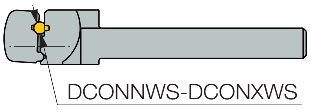
1 Shank size



2 Maximum overhang



3 Range of insert diameter



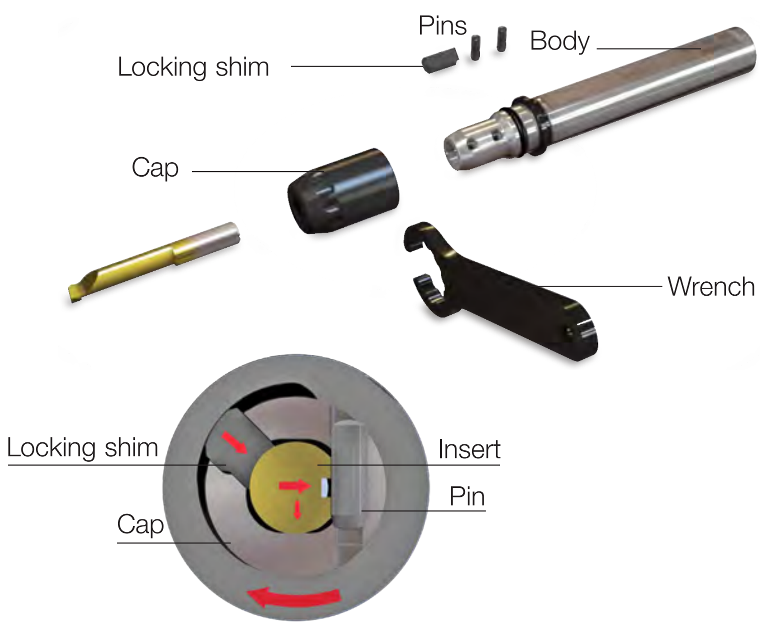
Main Advantages

- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Provides excellent chip breaking results on all materials
- Enables better chip evacuation
- Quick and user-friendly indexing mechanism
- Insert can also be mounted from the top

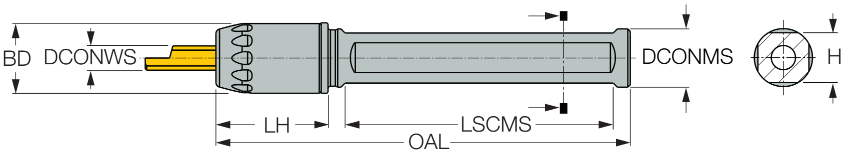
High Precision Holder for Swiss-Type Lathes Solution for Internal Threading

The growing demands for high accuracy and flexibility in clamping orientation have led **ISCAR** to develop an advanced line of PICCO holders. The **PICCOACE** features a unique clamping system which sets new standards for three highly important properties: accuracy, rigidity and clamping orientation flexibility. The **PICCOACE** holders are available with coolant channels and provide a solution for internal threading. The large variety of Swiss-type machines has increased the demand for multi-orientation clamping. Most of the available tools in the market provide a single clamping orientation, whereas **ISCAR**'s **PICCOACE** offers a solution suitable for all Swiss-type machines, which enables the operator to mount/ dismount the insert from any desired orientation. **PICCOACE**'s clamping method saves precious time when replacing an insert. Superb rigidity is achieved due to the advanced clamping mechanism, which locates the insert in a specific position that ensures optimal contact points. The clamping system assures extremely high clamping repeatability of 0.005 mm.

How does it work? The **PICCOACE** consists of two main parts: a body and an eccentric cap. When the cap is turned (using the wrench), the excentre moves a special locking shim that presses on the insert and locks it into a precise position.



Basic Dimensions of Perpendicular Holders



OAL — Overall length

LH — Length

LSCMS — Clamping length machine side

DCONMS — Connection diameter machine size

DCONWS — Connection diameter insert size

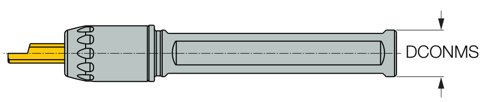
BD — Body diameter

H — Shank height

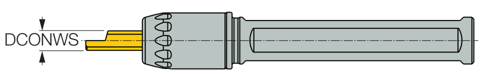
Description of Perpendicular Holders

PICCO ACE	16	-	5
	1		2

1 Connection diameter machine size



2 Connection diameter insert size

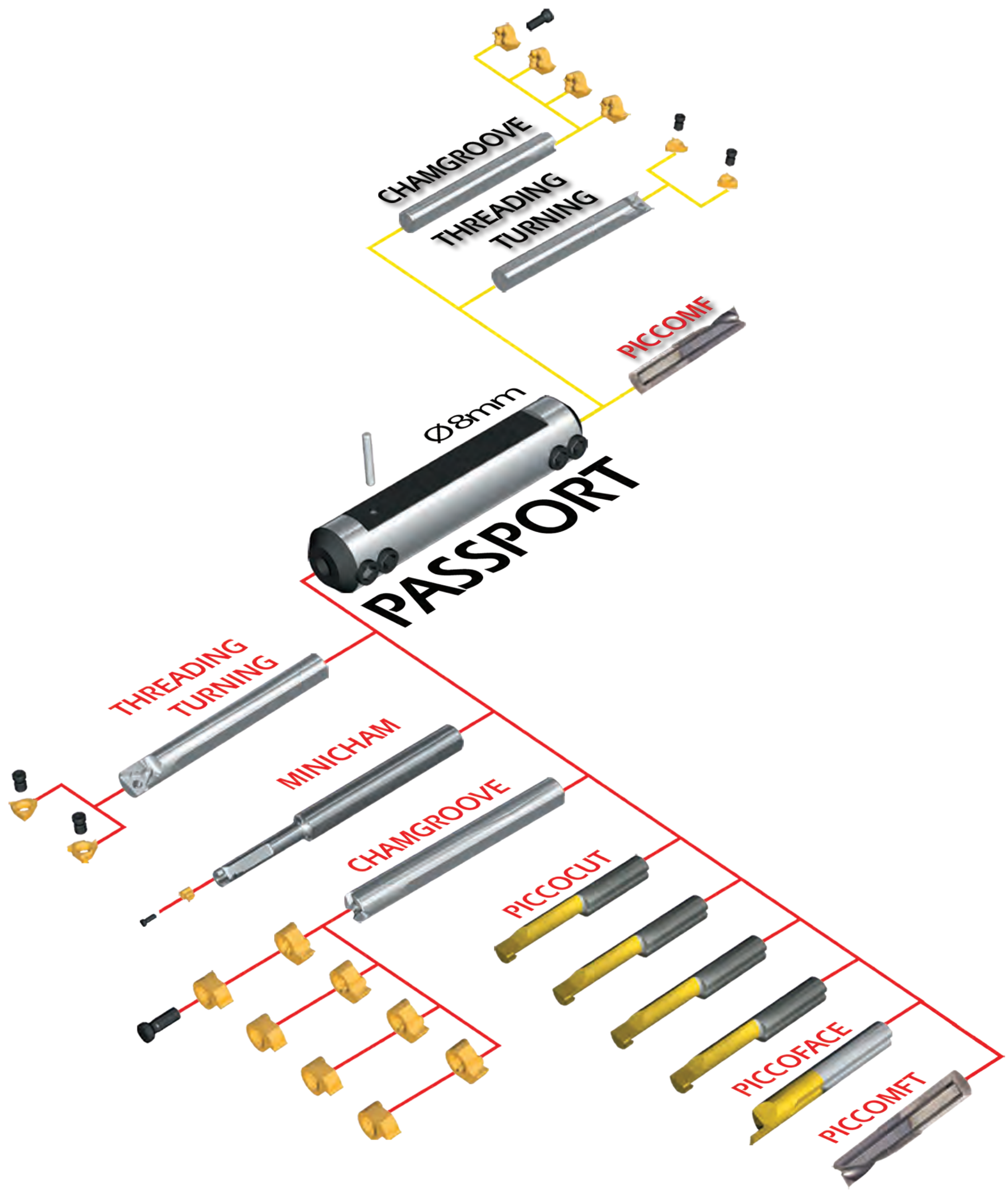


Main Advantages

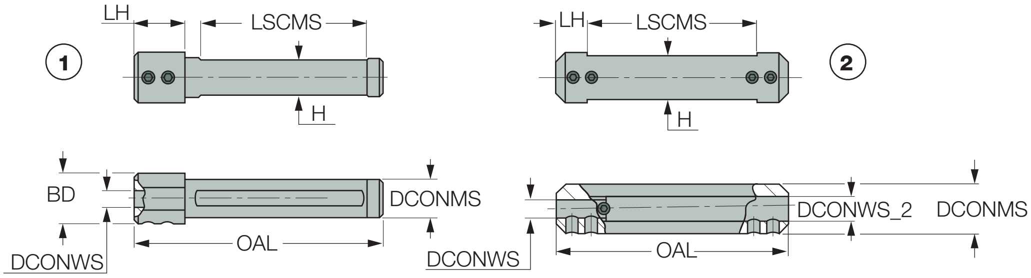
- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Provides excellent chip breaking results on all materials
- Enables better chip evacuation
- Quick and user-friendly indexing mechanism

Multi-use Holder Solution for Internal Threading

A multi-use holder is a single bushing toolholder that can hold a full set of carbide shank boring bars capable of grooving, turning, threading, profiling and recessing. The carbide shanks provide excellent rigidity and a high length-to-diameter (L/D) ratio. This allows the boring bar overhang to be adjusted to the best rigidity for each job. The new bushing holders incorporate special stoppers, useful in many applications with **ISCAR**'s **CHAMGROOVE** system and PICCO bars. Utilizing the stoppers eliminates resetting the tool after every indexing. This versatile system replaces many expensive boring bars needed to perform the variety of applications, which are now possible with this single bushing holder. These holders are available with coolant channels.



Basic Dimensions of Perpendicular Holders

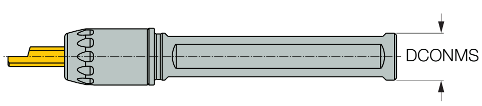


OAL — Overall length
LH — Head length
LSCMS — Clamping length machine side
DCONMS — Connection diameter machine size
DCONWS — Connection diameter insert size
BD — Body diameter
H — Shank height

Description of Perpendicular Holders

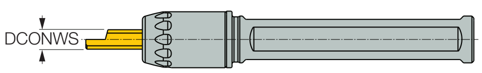
PICCO	20	-	4	-	5
	1		**2**		**3**

1 Connection diameter machine size



2 Min. connection diameter insert size

3 Max. connection diameter insert size



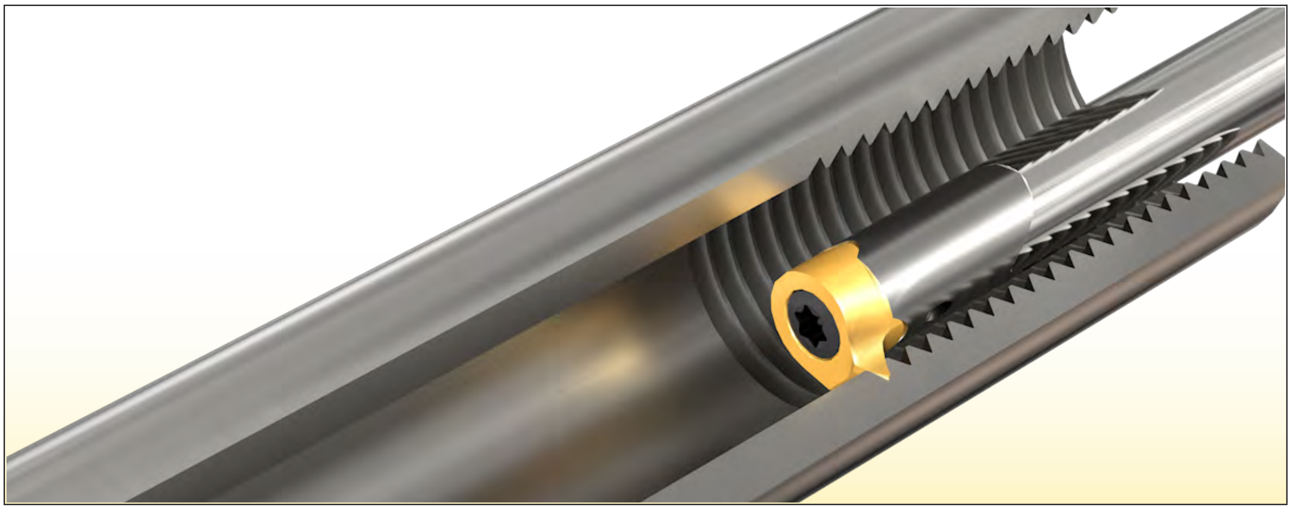
Main Advantages

- Internal coolant
- Reduces cutting time
- Provides longer tool life of cutting edge
- Provides excellent chip breaking results on all materials
- Enables better chip evacuation
- Quick and user-friendly indexing mechanism

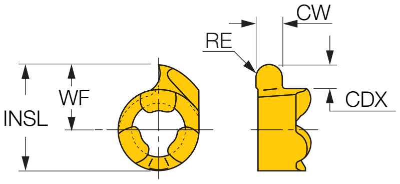
2.9.1 CHAMGROOVE Inserts for Internal Threading

The **CHAMGROOVE** line includes one sided peripheral ground inserts with pressed deflector. The placement of the insert is determined by 3 protrusions on the tool and clamped with a screw. The **CHAMGROOVE** line provides a solution for partial profiles and is suitable for internal threading in minimum bore diameter of 8 mm (0.315 inch).

Stable and rigid indexable system for internal threading in minimum bore diameter of 8 mm (0.315 inch).



Basic Dimensions of CHAMGROOVE Inserts



L — Insert length

WF — Functional length

A — Angle of cutting edge

RE — Corner radius

PDPT — Profile depth

Main Advantages

- Suitable for work next to shoulder
- Suitable for threading production between the walls in narrow grooves
- Economical solution relative to solid products
- Easy and fast insert mounting
- No setup needed after each insert indexing
- Easy handling of small inserts

Notes

- Standard inserts are intended for symmetrical thread profiles
- No chipformer

CHAMGROOVE Insert Description According to the Template Below

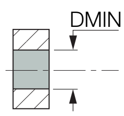
GIQR	8	-	MT	-	0.05		IC528
1	2		3		4		5

1 Hand of Tool

GIQR — Right-hand

GIQL — Left-hand

2 Minimum bore diameter (mm)

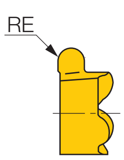


3 Angle of cutting edge (A)

WT — 55°

MT — 60°

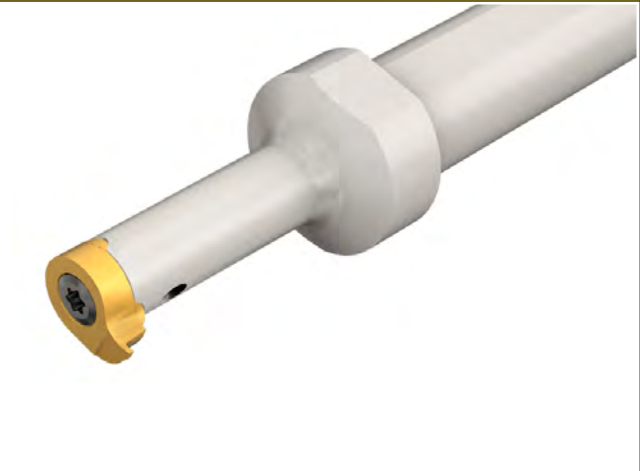
4 Corner radius (RE)



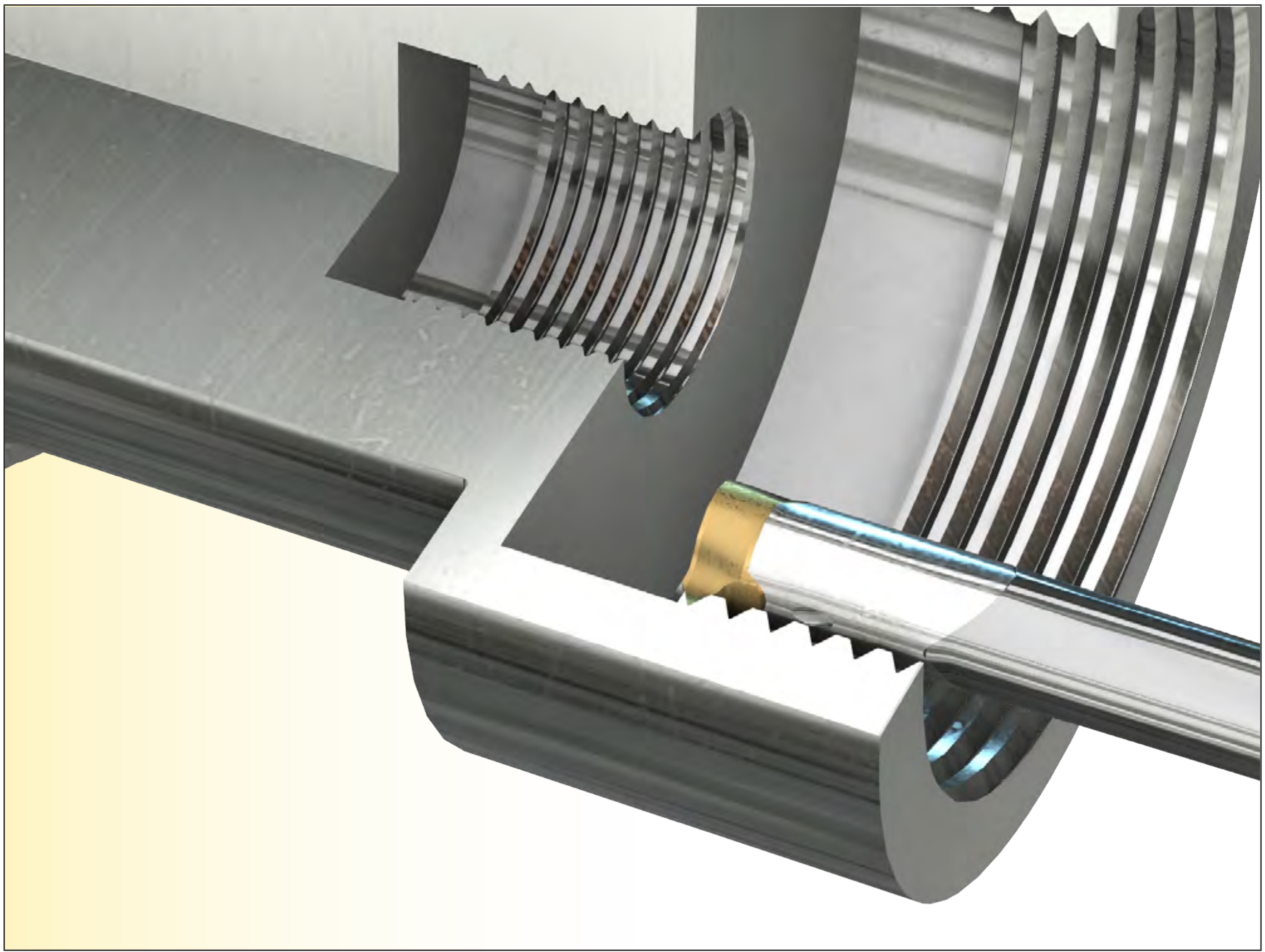
5 Grade

IC528

2.9.2 CHAMGROOVE Threading Bars for Internal Threading

Steel Bar with Coolant Channels	Solid Carbide Bar with and without Coolant Channels
	

The **CHAMGROOVE** family includes two types of bars for internal threading. The bars can be produced from steel or solid carbide. The solid carbide boring bars expand the current boring overhang range and provide improved performance due to their high rigidity feature. All steel bars include coolant channels and solid carbide bars are available with and without coolant channels.

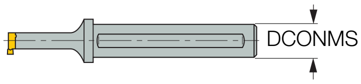


Description of CHAMGROOVE Bars for Internal threading

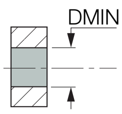
Steel Bar with Coolant Channels

MG	12	-	08	C	23
	1		2	3	4

1 Connection diameter machine size



2 Minimum bore diameter

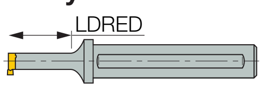


3 Coolant channels

C — Include coolant channels

□ — Without coolant channels

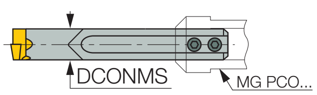
4 Body diameter length



Solid Carbide Bar with and without Coolant Channels

MGCH	06	□	-	L100
	1	2		3

5 Connection diameter machine size

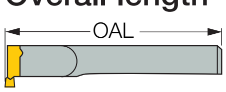


6 Coolant channels

C Include coolant channels

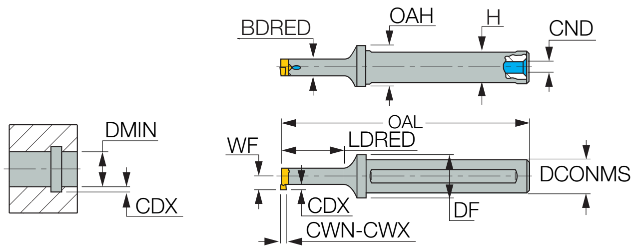
□ Without coolant channels

7 Overall length

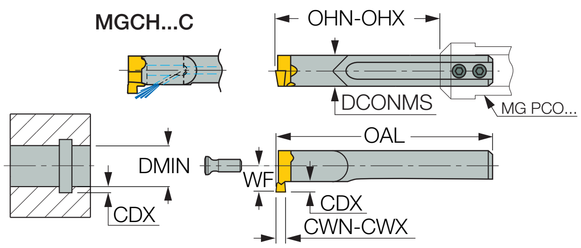


Basic dimensions of threading bars

Steel Bar



Solid Carbide Bar



OAL — Overall length

LDRED — Body diameter length

BDRED — Reduced body diameter

CDX — Cutting depth maximum

OAH — Overall height

DF — Flange diameter

H — Shank height

DCONMS — Connection diameter machine size

WF — Functional width

CND — Coolant entry diameter

DMIN — Minimum bore diameter

Main Advantages

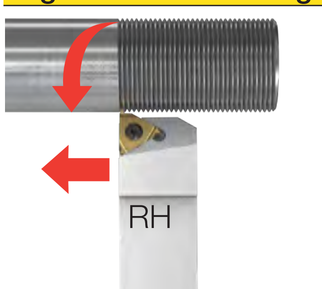
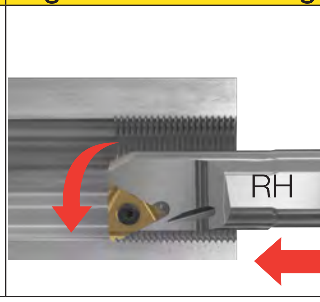
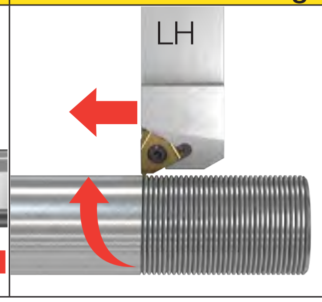
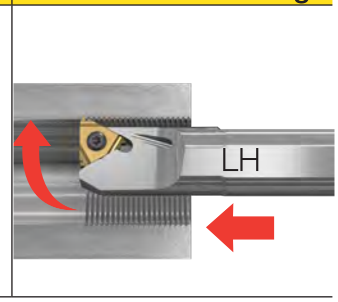
- Available with internal coolant channels
- Suitable for work next to shoulder
- Easy and fast insert mounting
- No setup needed after each insert indexing
- Easy handling of insert
- Suitable for all types of lathe machines

2.10 Thread Turning Methods

There are several methods for thread machining by turning operations. The workpiece can rotate clockwise or counterclockwise and the cutting tool is fed toward or away from the chuck.

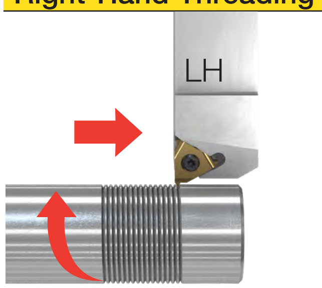
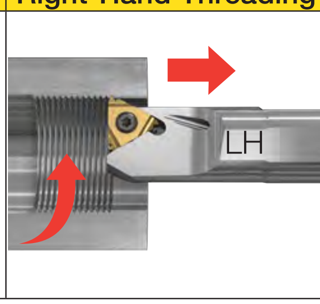
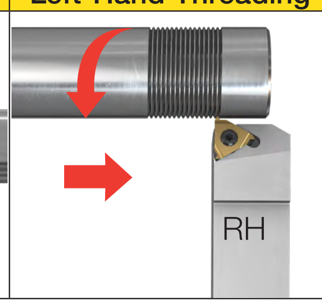
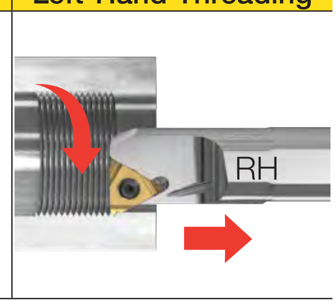
The most common and recommended methods for external and internal, right-hand and left-hand threading is shown in the sketch below.

Recommended Thread Turning Methods

External Right-Hand Threading	Internal Right-Hand Threading	External Left-Hand Threading	Internal Left-Hand Threading
			

The alternative methods for external and internal, right-hand and left-hand threading shown in the drawing below are not recommended. By using the alternative method, the tool is less stable during thread machining, which can cause vibration, poor surface finish and decrease tool life.

Not Recommended Thread Turning Methods

External Right-Hand Threading	Internal Right-Hand Threading	External Left-Hand Threading	Internal Left-Hand Threading
			

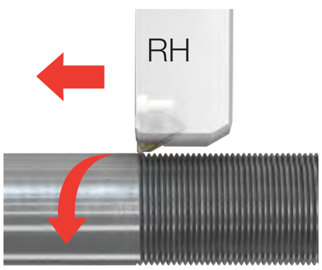
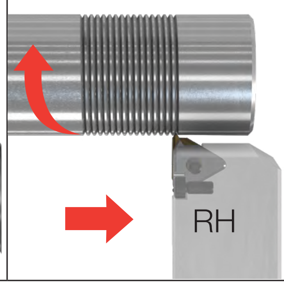
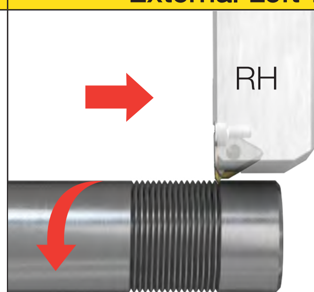
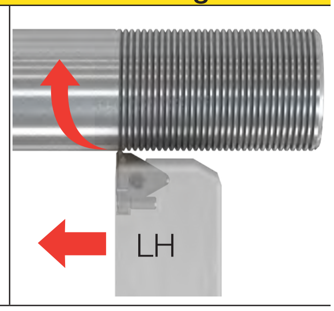
The threading tool is adjusted according to the production method. The cutting tools differ in the direction in which they are recommended to work.

LH Left- Hand Tool	RH Right-Hand Tool
	

Right-hand tools are recommended to work from right to left and left-hand tools are recommended to work from left to right, so that the sides of the pocket prevent movement of the insert during the turning operation.

The tool can be positioned upside down to allow easier chip evacuation.

Thread Turning Methods

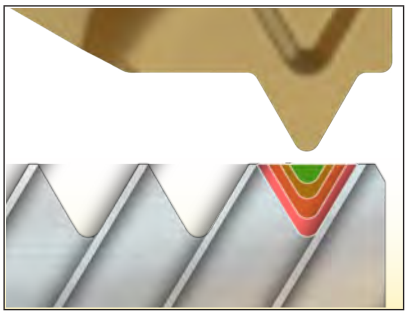
External Right-Hand Threading		External Left-Hand Threading	
			

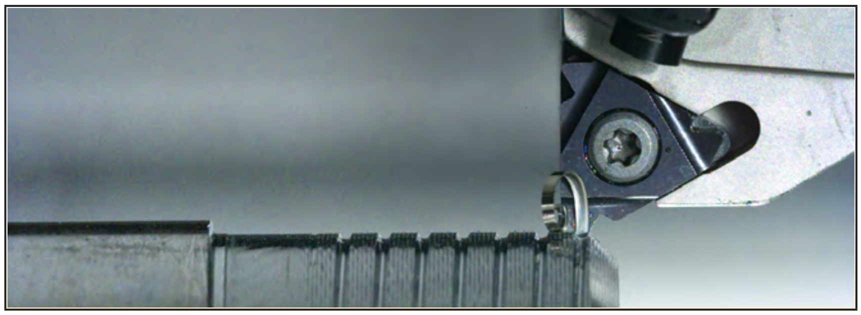
2.11 Infeed Methods - Entering the Cutter Into the Workpiece

There are several methods of entering the cutter into the workpiece. Each method defines the position of the cutter relative to the cutting thread profile.
The chosen method will affect chip form, chip evacuation direction, cutting edge wear, tool life, and threading surface quality. Choosing the correct method for entering the cutter into the workpiece depends on equipment type, workpiece material, cutter geometry, and threading pitch.

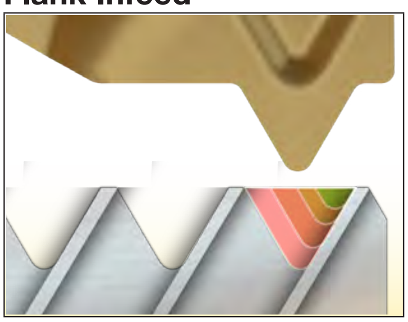
Possible methods of entering the cutter into the workpiece include:

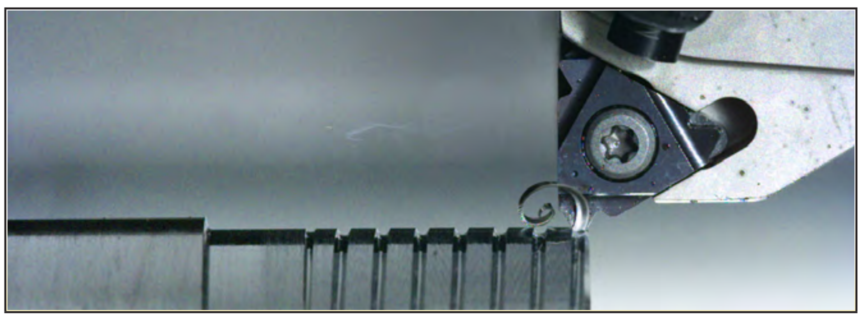
Radial Infeed



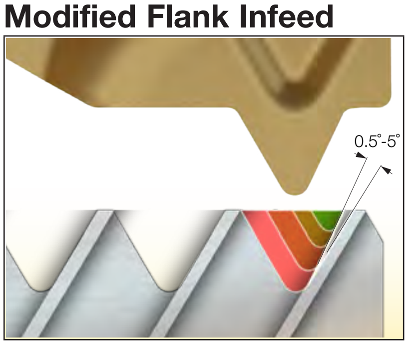


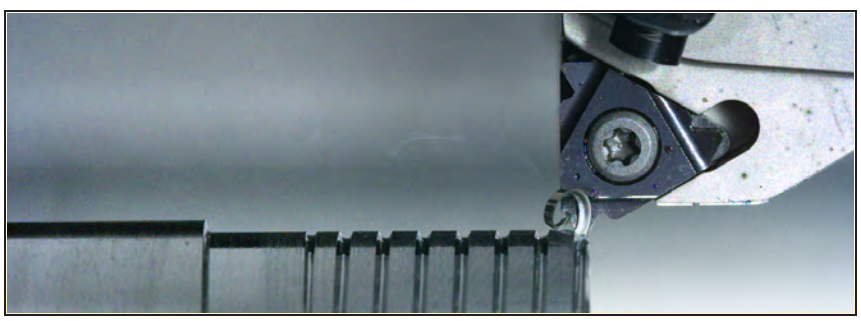
Flank Infeed



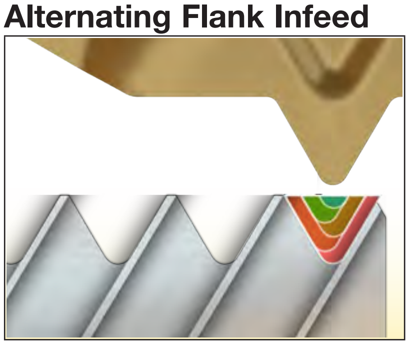


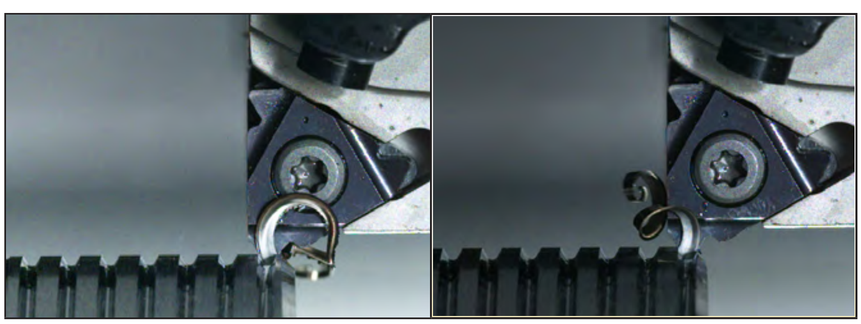
Modified Flank Infeed





Alternating Flank Infeed





Radial Infeed

With radial infeed, the thread is machined simultaneously and symmetrically with two cutting edges. In this processing method, the chip tends to bend on either side of the cutting edge against each other, as a result of the chip winding process, and the removal of the chip becomes more difficult. This method creates large forces on the cutting edge and warming of cutting edges which causes short tool life and limits the possible depth of cut. Cutter wear is uniform on both sides of the cutting edge. Radial infeed is acceptable in the production of fine pitch threading or finish passes, to ensure threading profile accuracy.

Flank Infeed

With the flank infeed method, the cutting edge moves parallel to one of the sides of the threading profile. The threading is produced mainly by one side of the cutting edge. The chips are cut off with one cutting edge of the cutter, which improves chip evacuation relative to the radial method, and therefore the cutting depth per each pass can be bigger. Using the flank method provides better heat dissipation, which improves tool life but causes uneven wear of the cutter's cutting edges. As cutting is done mainly with one cutting edge, friction is created between the cutting edge and the side of the threading profile, which causes poor surface quality and possible vibration.

Modified Flank Infeed (Recommended)

Modified flank infeed is very similar to the flank infeed method, but the angle between the cutting edge to the side of the threading profile can be between 0.5° to 5°.

In this method, all the advantages of flank infeed are retained while the disadvantages caused from friction between the cutting edge and the side of the threading profile are prevented. Modified flank infeed is the recommended method for all thread turning operations and is suitable for all insert types.

Alternating Flank Infeed

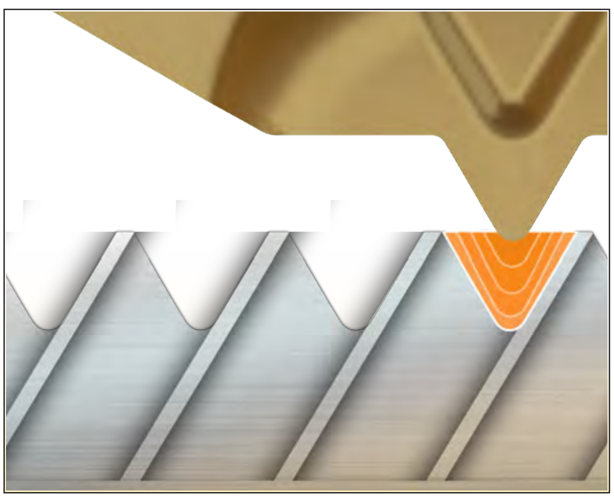
In this method, cutting edges work alternately, i.e. each time the cut is performed by another side of the cutting edge. This method can significantly increase tool life due to two cutting edges taking part in the threading production. Constant changing of the chip evacuation direction can result in poor surface quality. This method is usually used for very large pitches and for threading forms such as Acme and Trapeze.

2.12 Depth per Pass and Number of Passes

In order to produce threads, the cutting tool needs to make several numbers of cuts along the workpiece surface. The parameters of depth per pass and number of passes have a very important role in threading production. These parameters have a direct effect on cutting edge wear, tool life, threading surface quality, and threading production stability.
The two methods most common in determining the depth per pass and the number of passes are constant chip area by decreasing depth per pass or constant depth per pass. The choice of method does not depend on the selected infeed methods (radial infeed, flank infeed, modified flank infeed, alternating flank infeed), which are described in chapter 2.12. The depth per pass and number of passes parameters depend on the type of equipment, tool overhang, machine stability, workpiece material, cutter geometry and the threading depth required.

Constant Chip Area by Decreasing Depth per Pass (Recommended)

This is the most common method and is generally recommended, as in most cases it ensures high productivity. The principle of this method is that the initial cutting depth at the first pass is the largest, and then gradually decreases at each pass to ensure material removal within a constant chip area. The calculation of passes is designed so that the last pass, which is destined to be a finish pass, will be 0.05 - 0.1 mm (0.0019 - 0.0039 inches). Using this method ensures constant loads on cutting edge and uniform wear, which increases tool life.



Formula for Calculation of Depth per Pass

$$\Delta a_{p(i)} = \frac{a_p}{\sqrt{n_a - 1}} \times \sqrt{C}$$

When:

$\Delta a_p(i)$ — Depth of cut i pass ($i = 1 \ldots n_a$)

i — Pass

a_p — Total depth of cut

n_a — Number of passes

C — Constant value:
For 1st pass: C=0.3; For 2nd pass: C=1; For 3rd pass and higher: C = i – 1

Example
Pitch - 1.25 mm
Total depth of cut: a_p=0.78 mm
Number of passes: n_a = 6

- Calculation depth of cut for 1st pass:
  For 1st pass: C=0.3

$$\Delta a_{p(1)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{0.3} = 0.19$$

Depth of cut for 1st pass: 0.19 mm

- Calculation depth of cut for 2nd pass:
  For 2nd pass: C=1

$$\Delta a_{p(2)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{1} = 0.35$$

Depth of cut for 2nd pass: 0.35-0.19=0.16 mm

- Calculation depth of cut for 3rd pass:
  For 3rd pass: C=3-1=2

$$\Delta a_{p(3)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{2} = 0.49$$

Depth of cut for 3rd pass: 0.49-0.35=0.14 mm

- Calculation depth of cut for 4th pass:
  For 4th pass: C=4-1=3

$$\Delta a_{p(4)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{3} = 0.6$$

Depth of cut for 4th pass: 0.6-0.49=0.11 mm

- Calculation depth of cut for 5th pass:
  For 5th pass: C=5-1=4

$$\Delta a_{p(5)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{4} = 0.7$$

Depth of cut for 5th pass: 0.7-0.6=0.1 mm

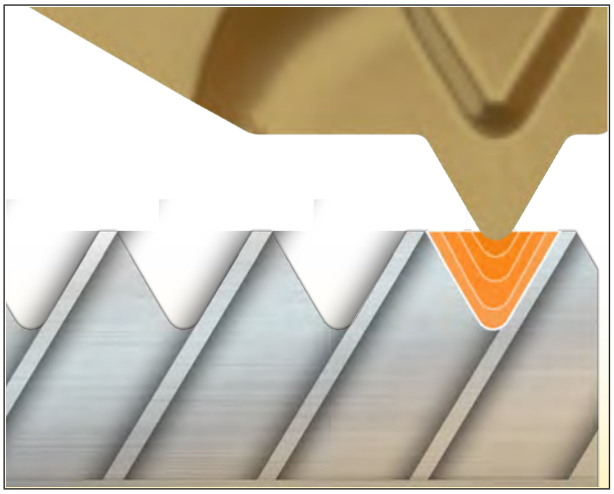
- Calculation depth of cut for 6th pass:
  For 6th pass: C=6-1=5

$$\Delta a_{p(6)} = \frac{0.78}{\sqrt{6-1}} \times \sqrt{5} = 0.78$$

Depth of cut for 6th pass: 0.78-0.7=0.08 mm

Constant Depth per Pass

This method defines constant depth per pass (except for the last pass), regardless of the number of passes. The last pass for the finish operation is recommended to be 0.05 - 0.1 mm (0.0019 - 0.0039 inches). This method is less productive than the previous method, as it causes a larger number of passes and is usually used in cases of problems with chip control. The chip thickness is constant on each pass, but the chip area on subsequent passes is larger, respectively, and the load on the tool and material removal rate increase on each pass. For example, when cutting a 60-degree threading with a constant depth of 0.25 mm per pass, the second pass removes three times more metal than the first. And with each passing pass, the value of metal removed increases exponentially.



Number of Passes

The optimal number of passes should be checked in each specific case in order to achieve maximum effectiveness but, in any case, any pass should not be less than 0.05 mm. **ISCAR**'s consultants will be glad to identify the best solution according to the customer's threading requirements and production process.

2.13 High Pressure Coolant

The high pressure coolant feature has been in existence for a long time in the metal removal world, taking a bigger role in today's machining.

ISCAR was one of the first cutting tool companies to respond to market needs by designing and producing tools for ultra high and high pressure coolant flow.
High pressure coolant was initially implemented mainly for difficult-to-machine materials such as titanium, Inconel and other heat resistant alloys.

Later it was found that tool life, productivity and chip control can be improved when machining stainless and alloyed steel.

Jet high pressure (JHP) tools are particularly important in the aviation, aerospace and medical industries.

The usage of high pressure coolant is growing as manufacturers are looking for ways to reduce cutting time, improve machining process reliability and achieve longer tool life. **ISCAR**'s JHP tools provide all of these advantages.

How Does it Work?

The stream velocity of the coolant emitted from the pump increases as the coolant holes become smaller.

When it emerges out of the tool through the nozzle, the velocity is very high, exerting considerable force on the chips, lowering their temperature and protecting the cutting edge from thermal shock.

High temperature alloys produce a very high temperature as they are being cut. By effectively removing the heat, the chips become less ductile and easier to break.

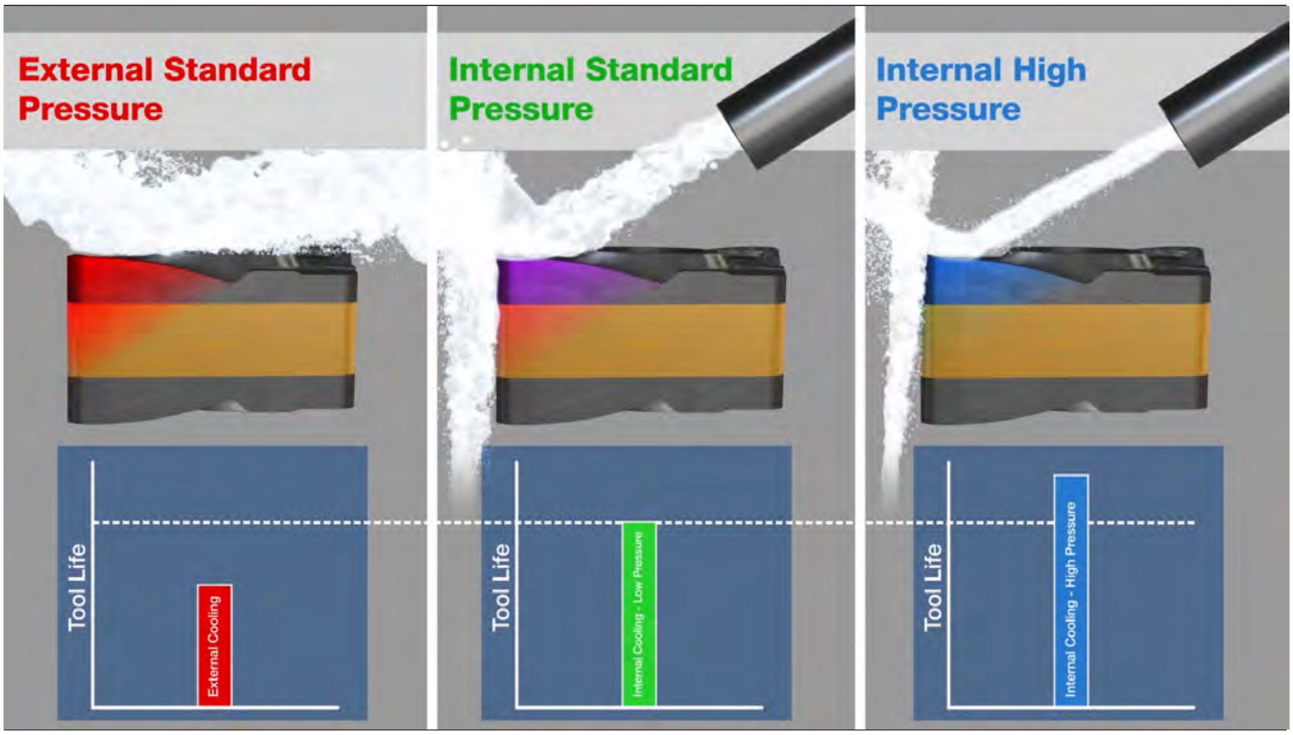
Shorter chips are easily managed - they do not tangle around the workpiece or machine parts, so there is no need to stop the process frequently.

Usually in conventional cooling the chip prevents the coolant from reaching the insert rake face in the cutting zone. The coolant stream of the JHP tools is directed precisely between the insert rake face and the flowing chip. This results in longer tool life and a much more reliable process.

The coolant channels of the JHP tools feature outlets very close to the cutting edges, with the following advantages:

- Shorter machining time - cutting speed may be increased by up to 200% when machining titanium and heat resistant alloys
- Longer tool life - tool life increases by up to 100% not only on titanium and heat resistant alloys, but also on stainless and alloy steels
- Improved chip control - even on the most ductile and problematic materials, small chips can be obtained
- Very effective cooling down of the cutting edge, reducing sensitivity to heat fluctuations
- Safer and more stable process JHP tools provide advantageous performance also when conventional pressure is applied

Note: The through-tool coolant provides improved tool life, chip control and productivity advantages when high pressure coolant is induced. In addition, the 10-15 bar standard pressure provides better performance when compared to external cooling results.



General Information

- Up to 30 bar; low pressure (LP), may provide tool life improvement and usually will not have an effect on chip control
- 30 - 120 bar; high pressure (HP), the most commonly used pressure range used with JHP tools. Increases tool life, increase in cutting speeds, improved chip control
- 120 - 400 bar - ultra high pressure (UHP), requires special tool design to take advantage of the extra pressure. Minor increase in tool life compared to HP range. Ultra high pressure coolant is usually implemented for machining titanium and heat resistant alloys when there is a need for very small chips and higher machining rates.

  ISCAR provides hundreds of special tools featuring ultra high pressure coolant capability for various customers and applications.

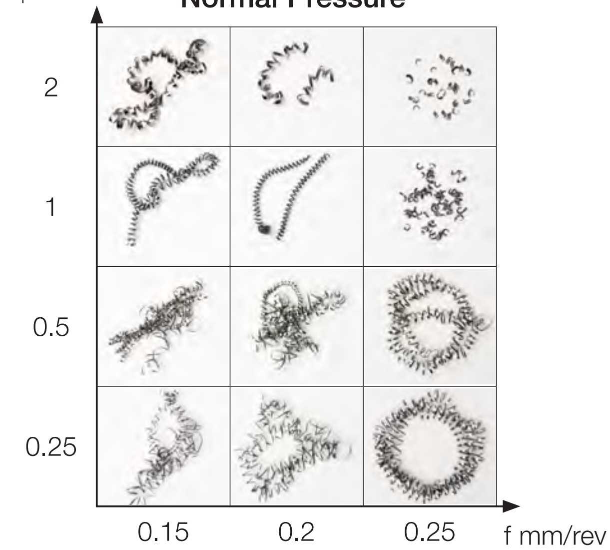
- **Pressure vs. Flow**
  Each JHP tool is designed to work at a certain flow rate, depending on the pressure. Flow rates for each tool are listed in **ISCAR**'s Complete Machining Solutions catalogs and E-CAT, **ISCAR**'s online electronic catalog. The user should verify that the pump can supply the required flow in order to achieve optimal results. The pump data sheet will usually list the maximum flow rate for each pressure range.

- **Chips and Pressure**
  The coolant flow will start to break the chips at a certain pressure, depending on the specific tool and the workpiece material. If the chips are not breaking, the pressure should be increased until chip control is achieved. Above this pressure, as it is increased the chips become smaller and smaller. It is possible to control the size of the chips by modifying the pressure in order to achieve the desired chip size.

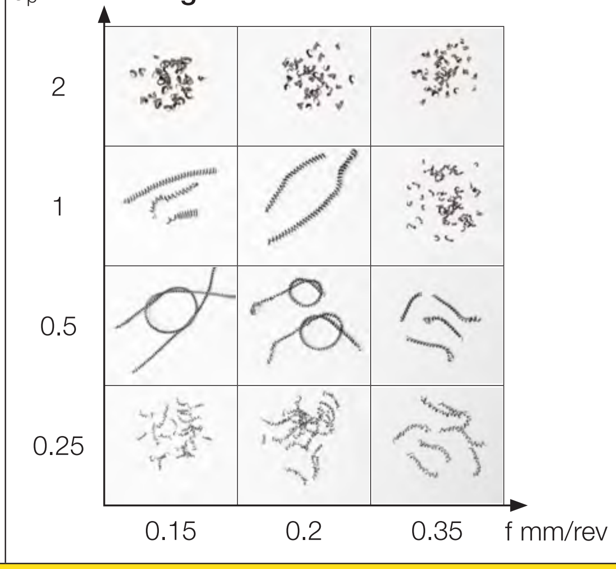
Examples of Normal Pressure vs. High Pressure for Chip Control

Inconel 718 - Chip Control with CNMX 120708-HMW IC807 V_c = m/min

Normal Pressure

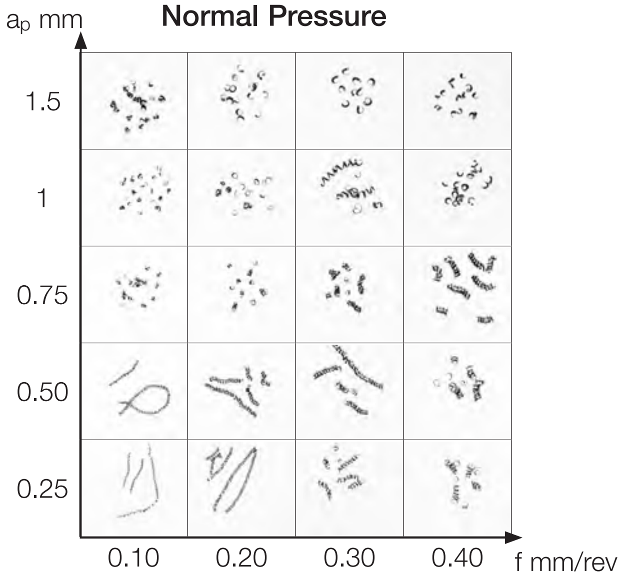


High Pressure 80 bar

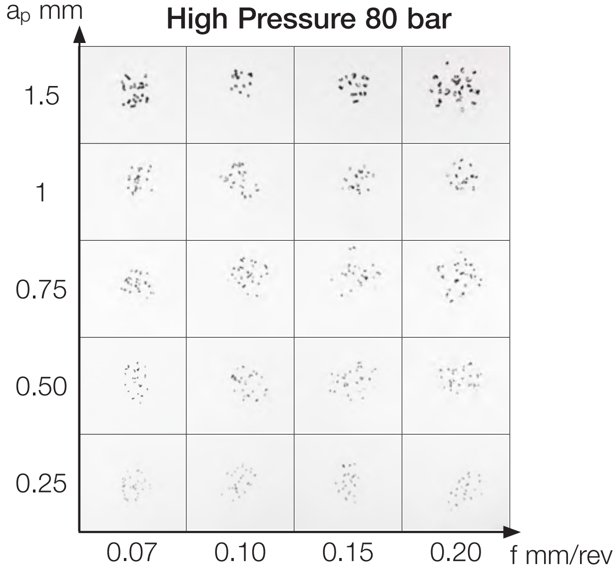


Titanium Ti6Al4V - Chip Control with CNMG 120408-TF IC807 V_c = 60 m/min

Normal Pressure

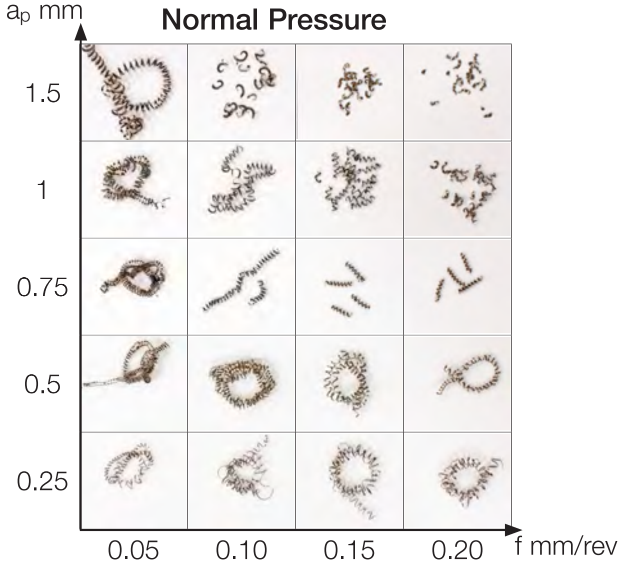


High Pressure 80 bar

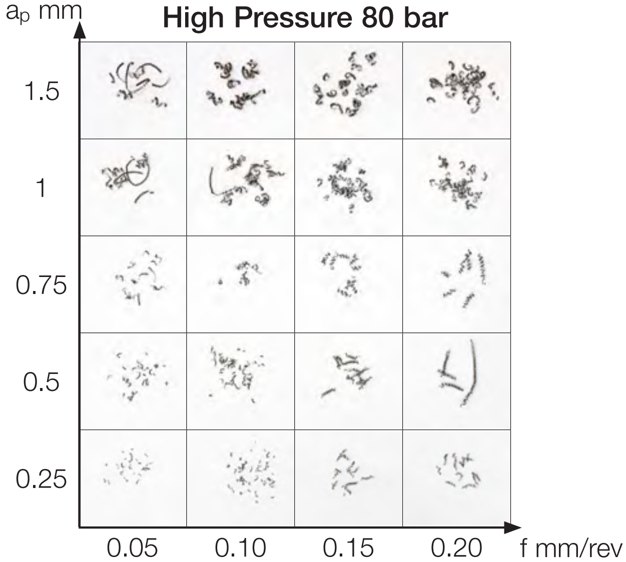


Stainless Steel 316L - Chip Control with CNMG 120408-TF IC807 V_c = 200 m/min

Normal Pressure



High Pressure 80 bar



2.14 Quick and Easy way to Select a Correct Solution

Cost per unit for a part that is machined by the tool is a significant issue and the tool's indirect influence on reducing cost per unit can be considerable.

Although a small part of the manufacturing process, the tool can represent the single obstacle to a machine tool running faster and cutting machining time. For better productivity and lower cost per part, the most efficient tool needs to be selected and used. Applying the following analysis Application -Tool Configuration- Tool Material - Economical Consideration is recommended for optimal tool selection:

Application

Gender of Thread
↓
Threading Profile/Standard
↓
Pitch/Tpi
↓
Machining Diameter
↓
Coolant
↓
Tool Adaptor
↓
Overhang
↓

Tool Configuration

Cutting Geometry
↓
Cutting Tool Design
↓

Tool Material

Grade
↓

Economical Consideration

Economical Efficiency

Points to Consider

Application	
Gender of Thread	• Is external or internal threading required?
Threading Profile/Standard	• Is full profile or partial profile required? • What is the threading profile? (square, triangular, trapezoidal or other)? • What is the threading standard?
Pitch/TPI	• What is the threading pitch/TPI?
Machining Diameter	• What is the machining diameter?
Operation Stability	• Does the threading machine have good or bad stability?
Coolant	• What type of coolant is available (external coolant, internal coolant, possibility for high pressure coolant)?
Tool Adaptor	• What type of tool adaptor is available?
Overhang	• What is the overhang of the required tool forthreading? (This question usually refers to internal threading)

Tool Configuration	
Cutting Geometry	• What top rake geometry is recommended for threading?
Cutting Tool Design	• What is the preferred orientation of the insert into the tool?

Tool Material	
Grade	• Which cutting tool grade is most suitable for threading?

Economical Consideration	
Economical Efficiency	• What are the number of cutting edges on the insert?

Points to Consider - ISCAR Recommendations

Application	
Gender of Thread	• Is external or internal threading required?

ISCAR product families offer solutions for both external and internal threading according to most standards. Dividing **ISCAR** families per gender of thread is shown in table below.

Family/Line	External Threading	Internal Threading
ISCAR Threading Laydown Line	V	V
PENTACUT	V	
SWISSCUT	V	
CUT-GRIP	V	V
PICCOCUT		V
MINICHAM		V
CHAMGROOVE		V

Application	
Threading Profile/Standard	• Is full profile or partial profile required? • What is the threading profile (square, triangular, trapezoidal or other)? • What is the threading standard?

Depending on the answers to the questions in this section, it is possible to check which of the families meet the threading profile/standard requirements.

Threading Family for Partial Profile

Family		Standard	
		Partial Profile - 55°	Partial Profile - 60°
CUT-GRIP		V	V
PENTACUT		V	V
SWISSCUT			V
ISCAR Threading Laydown Line	B-Type	V	V
	M-Type	V	V
	G-Type	V	V
	U-Type	V	V

Threading Family for Full Profile per Threading Standard

Family/Subfamily		Threading Standard									
		ISO	UN	NPT	Whitworth	NPTF	BSPT	STACME	ACME	API RD	API
CUT-GRIP		V	V	V	V		V				
PENTACUT		V	V	V	V		V				
SWISSCUT		V									
ISCAR Threading Laydown Line	B-Type	V	V	V	V		V				
	M-Type	V	V	V	V		V				
	G-Type	V	V	V	V	V	V	V	V	V	V
	U-Type	V		V					V		
	Multi-Tooth	V	V	V	V					V	

Family/Subfamily		Threading Standard								
		TR	PG	SAGE	ABUT	UNJ	MJ	BUT	EL	RND
ISCAR Threading Laydown Line	G-Type	V	V	V	V	V	V	V	V	V
	U-Type	V		V	V					

Application

Pitch/TPI	• What is the threading pitch/TPI?

Depending on the tables below, it is possible to check which families can produce a requested pitch/TPI.

Partial Profile 55° Solution for External Threading

Family/Pitch (mm)		...	2.75	...	4	...	4.5	...	5	...	6	...	7	...	8
CUT-GRIP											◄	—	—	—	►
PENTACUT															
SWISSCUT															
ISCAR Threading Laydown Line	B-Type														↔
	M-Type														↔
	G-Type				◄	—	►		◄	—	—	—	►		↔
	U-Type		◄	—	—	—	►								

Family/Pitch (mm)		8	...	14	...	16	...	48	...	54
CUT-GRIP		◄	—	—	—	—	—	—	—	►
PENTACUT				◄	—	—	—	►		
SWISSCUT										
ISCAR Threading Laydown Line	B-Type	◄	—	—	—	—	—	►		
	M-Type	◄	—	—	—	—	—	►		
	G-Type	◄	—	—	—	—	—	►		
	U-Type									

Partial Profile 60° Solution for External Threading

Family/Pitch (mm)		...	0.3	...	0.45	...	0.5	...	1.5	...	1.7	...	1.75	...	3
CUT-GRIP					◄	—	—	—	—	—	—	—	—	—	►
PENTACUT							◄	—	—	—	—	—	►		
SWISSCUT			◄	—	—	—	—	—	—	—	►				
ISCAR Threading Laydown Line	B-Type						◄	—	—	—	—	—	—	—	►
	M-Type						◄	—	—	—	—	—	—	—	►
	G-Type						◄	—	—	—	—	—	—	—	►

Family/Pitch (mm)		3	...	3.5	...	5	...	5.1	...	5.5	...	6	...	9
CUT-GRIP		◄	—	—	—	—	—	►						
PENTACUT														
SWISSCUT														
ISCAR Threading Laydown Line	B-Type	↔												
	M-Type	↔		◄	—	►								
	G-Type	↔		◄	—	►				◄	—	►		
	U-Type									◄	—	—	—	►

Full Profile Solution for External Threading

Family/Pitch (mm)		0.3	0.35	0.4	0.45	0.5	0.6	0.7	0.75	0.8
CUT-GRIP						ISO			ISO	ISO
PENTACUT						ISO			ISO	ISO
SWISSCUT		ISO		ISO		ISO			ISO	
ISCAR Threading Laydown Line	B-Type									ISO
	M-Type								ISO	
	G-Type		ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO
	Multi-Tooth								ISO	

Family/Pitch (mm)		1	1.25	1.5	1.75	2	2.5	3	3.5	4
CUT-GRIP		ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO
PENTACUT		ISO	ISO	ISO	ISO	ISO				
SWISSCUT		ISO		ISO						
ISCAR Threading Laydown Line	B-Type	ISO	ISO	ISO	ISO			ISO		
	M-Type	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO
	G-Type	ISO MJ	ISO MJ	ISO MJ TR	ISO	ISO MJ TR SAGE	ISO	ISO TR SAGE	ISO	ISO TR SAGE
	Multi-Tooth	ISO		ISO		ISO		ISO		

Family/Pitch (mm)		4.5	5	5.5	6	7	8	9	10
CUT-GRIP			ISO						
ISCAR Threading Laydown Line	G-Type	ISO	ISO TR	ISO	ISO TR	TR			
	U-Type		SAGE	ISO	ISO TR SAGE	TR	ISO TR	TR	TR

Full Profile Solution for External Threading

Family/TPI		3	3.5	4	4.5	5	6	7	8
CUT-GRIP									UN NPT
ISCAR Threading Laydown Line	B-Type								UN NPT
	M-Type								UN NPT
	G-Type	STACME		UN Whitworth STACME API RND	UN Whitworth	UN Whitworth STACME API BUT EL	UN Whitworth STACME ABUT EL RND	UN Whitworth	UN Whitworth NPT STACME UNJ ABUT API RD RND
	U-Type	Whitworth ABUT	Whitworth	Whitworth ABUT	Whitworth				
	Multi-Tooth								UN NPT

Family/TPI		9	10	11	11.5	12	13	14	16
CUT-GRIP			UN Whitworth	UN Whitworth BSPT	NPT	UN Whitworth	UN	UN Whitworth NPT BSPT	UN Whitworth
PENTACUT								UN Whitworth NPT BSPT	UN
ISCAR Threading Laydown Line	B-Type	UN	UN Whitworth	UN Whitworth BSPT	NPT	UN	UN	UN Whitworth NPT BSPT	UN Whitworth
	M-Type			UN Whitworth BSPT	NPT	UN	UN	UN Whitworth NPT BSPT	UN Whitworth
	G-Type	UN Whitworth	UN Whitworth STACME UNJ ABUT API RD RND	UN Whitworth BSPT UNJ	UN NPT NPTF	UN Whitworth STACME UNJ ABUT	UN UNJ	UN Whitworth NPT NPTF BSPT STACME UNJ	UN Whitworth STACME UNJ PG ABUT
	Multi-Tooth				NPT	UN		UN Whitworth	UN

Full Profile Solution for External Threading

<table>
<tr><th colspan="2">Family/TPI</th><th>18</th><th>19</th><th>20</th><th>22</th><th>24</th><th>26</th><th>27</th><th>28</th></tr>
<tr><td colspan="2">CUT-GRIP</td><td>UN
Whitworth
NPT</td><td>Whitworth
BSPT</td><td>UN
Whitworth</td><td></td><td>UN
Whitworth</td><td>UN
Whitworth</td><td>NPT</td><td>UN
Whitworth
BSPT</td></tr>
<tr><td colspan="2">PENTACUT</td><td>UN NPT</td><td>Whitworth
BSPT</td><td>UN</td><td></td><td>UN</td><td></td><td></td><td>Whitworth</td></tr>
<tr><td rowspan="3">ISCAR Threading Laydown Line</td><td>B-Type</td><td>UN NPT</td><td>Whitworth</td><td>UN</td><td></td><td>UN</td><td></td><td></td><td></td></tr>
<tr><td>M-Type</td><td>UN NPT</td><td>Whitworth</td><td>UN</td><td></td><td>UN</td><td></td><td></td><td></td></tr>
<tr><td>G-Type</td><td>UN
Whitworth
NPT NPTF
UNJ PG</td><td>Whitworth
BSPT</td><td>UN
Whitworth
UNJ PG
ABUT</td><td>Whitworth</td><td>UN
Whitworth
UNJ</td><td>UN
Whitworth</td><td>UN NPT
NPTF</td><td>UN BSPT
UNJ</td></tr>
</table>

<table>
<tr><th colspan="2">Family/TPI</th><th>32</th><th>36</th><th>40</th><th>44</th><th>48</th><th>56</th><th>72</th></tr>
<tr><td colspan="2">CUT-GRIP</td><td>UN</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>ISCAR Threading Laydown Line</td><td>G-Type</td><td>UN
Whitworth
UNJ</td><td>UN
Whitworth
UNJ</td><td>UN
Whitworth
UNJ</td><td>UN UNJ</td><td>UN UNJ</td><td>UN</td><td>UN</td></tr>
</table>

Partial Profile 55° Solution for Internal Threading

<table>
<tr><th colspan="2">Family/TPI</th><th>...</th><th>4</th><th>...</th><th>4.5</th><th>...</th><th>5</th><th>...</th><th>5.5</th><th>...</th><th>7</th><th>...</th><th>8</th><th>...</th><th>9</th><th>...</th><th>11</th></tr>
<tr><td colspan="2">CUT-GRIP</td><td></td><td></td><td></td><td></td><td></td><td colspan="11">←→</td></tr>
<tr><td colspan="2">PICCOCUT</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">MINICHAM</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">CHAMGROOVE</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>←→</td></tr>
<tr><td rowspan="4">ISCAR Threading Laydown Line</td><td>B-Type</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">←→</td></tr>
<tr><td>M-Type</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">←→</td></tr>
<tr><td>G-Type</td><td></td><td colspan="3">←→</td><td></td><td colspan="5">←→</td><td></td><td colspan="5">←→</td></tr>
<tr><td>U-Type</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="7">←→</td><td></td><td>←→</td></tr>
</table>

<table>
<tr><th colspan="2">Family/TPI</th><th>11</th><th>...</th><th>14</th><th>...</th><th>15</th><th>...</th><th>16</th><th>...</th><th>18</th><th>...</th><th>48</th><th>...</th><th>50</th><th>...</th><th>54</th></tr>
<tr><td colspan="2">CUT-GRIP</td><td colspan="15">←→</td></tr>
<tr><td colspan="2">PICCOCUT</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">←→</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">MINICHAM</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">←→</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">CHAMGROOVE</td><td colspan="13">←→</td><td></td><td></td></tr>
<tr><td rowspan="4">ISCAR Threading Laydown Line</td><td>B-Type</td><td colspan="11">←→</td><td></td><td></td><td></td><td></td></tr>
<tr><td>M-Type</td><td colspan="11">←→</td><td></td><td></td><td></td><td></td></tr>
<tr><td>G-Type</td><td colspan="11">←→</td><td></td><td></td><td></td><td></td></tr>
<tr><td>U-Type</td><td colspan="3">←→</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Partial Profile 60° Solution for Internal Threading

Family/Pitch (mm)		...	0.5	...	0.9	...	1.25	...	1.75	...	2	...	2.3	...	3
CUT-GRIP					←	—	—	—	—	—	—	—	—	—	→
PICCOCUT			←	—	—	—	—	—	→						
MINICHAM			←	—	—	—	→								
CHAMGROOVE			←	—	—	—	—	—	—	—	—	—	→		
ISCAR Threading Laydown Line	B-Type		←	—	—	—	—	—	—	—	—	—	—	—	→
	M-Type		←	—	—	—	—	—	—	—	—	—	—	—	→
	G-Type		←	—	—	—	—	—	—	—	—	—	—	—	→
	U-Type								←	—	→				

Family/Pitch (mm)		3	...	3.5	...	5	...	5.1	...	5.5	...	6	...	9
CUT-GRIP		←	—	—	—	—	—	→						
PICCOCUT														
MINICHAM														
CHAMGROOVE														
ISCAR Threading Laydown Line	B-Type	↔												
	M-Type	↔		←	—	→								
	G-Type	↔		←	—	→				←	—	→		
	U-Type									←	—	—	—	→

Full Profile Solution for Internal Threading

Family/Pitch (mm)		0.35	0.4	0.45	0.5	0.6	0.7	0.75	0.8	1	1.25	1.5	1.75	2	2.5
PICCOCUT					ISO			ISO		ISO	ISO	ISO			
ISCAR Threading Laydown Line	B-Type							ISO	ISO	ISO MJ	ISO	ISO MJ	ISO	ISO	
	M-Type									ISO	ISO	ISO	ISO	ISO	ISO
	G-Type	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO MJ	ISO MJ	ISO MJ TR	ISO	ISO MJ TR SAGE	ISO
	U-Type													ISO TR	
	Multi-Tooth									ISO		ISO		ISO	

Family/Pitch (mm)		3	3.5	4	4.5	5	5.5	6	7	8	9	10	16	18	20
ISCAR Threading Laydown Line	B-Type	ISO													
	M-Type	ISO													
	G-Type	ISO TR SAGE	ISO	ISO TR SAGE	ISO	ISO TR	ISO	ISO TR	TR						
	U-Type						ISO	ISO TR	TR	TR	TR	TR	PG	PG	PG
	Multi-Tooth	ISO													

Full Profile Solution for Internal Threading with ISCAR Threading Laydown Line

Family/TPI	3	4	4.5	5	6	7	8	9
B-Type							UN NPT	
M-Type					RND		UN NPT RND	
G-Type	STACME	UN Whitworth STACME ACME API RND	UN Whitworth	UN Whitworth STACME ACME API BUT EL	UN Whitworth STACME ACME ABUT EL RND	UN Whitworth	UN Whitworth NPT STACME ACME UNJ ABUT API RD RND	UN Whitworth
U-Type	STACME ACME ABUT	UN ACME ABUT	UN					
Multi-Tooth							UN NPT API RD	

Family/TPI	10	11	11.5	12	13	14	16	18
B-Type	UN Whitworth	Whitworth BSPT	NPT	UN		UN Whitworth NPT BSPT UNJ	UN Whitworth UNJ	UN Whitworth NPT NPTF UNJ
M-Type		Whitworth BSPT	NPT	UN		UN Whitworth NPT BSPT	UN Whitworth	UN
G-Type	UN Whitworth STACME ACME ABUT API RD RND	UN Whitworth BSPT	UN NPT NPTF	UN Whitworth STACME ACME UNJ ABUT	UN	UN Whitworth NPT NPTF BSPT STACME ACME UNJ	UN Whitworth STACME ACME UNJ ABUT	UN Whitworth NPT NPTF UNJ
U-Type		UN		UN Whitworth	UN			
Multi-Tooth	API RD	Whitworth	NPT	UN		Whitworth	UN	

Family/TPI	19	20	22	24	26	27	28	32
B-Type	Whitworth BSPT	UN Whitworth UNJ		UN Whitworth UNJ			UN Whitworth UNJ	UN UNJ
M-Type	Whitworth	UN Whitworth						
G-Type	Whitworth BSPT	UN Whitworth UNJ ABUT	Whitworth	UN Whitworth UNJ	Whitworth	UN NPT NPTF	UN Whitworth BSPT UNJ	UN Whitworth UNJ

Family/TPI	36	40	44	48	64
G-Type	UN Whitworth	Whitworth			UN

Application

Machining Diameter	• What is the machining diameter?

The tables below define the recommended maximum possible workpiece diameters for external threading, and the recommended minimum possible bore workpiece diameter for internal threading based on **ISCAR**'s threading families.

External Threading

Family/Application	Up to Ø20 mm	Up to Ø50 mm	Up to Ø250 mm	Unlimited
CUT-GRIP	●	●	○	●
PENTACUT	V	V	●	○
SWISSCUT	V	●	○	○
ISCAR Threading Laydown Line	V	●	V	V

V - Recommended (1st choice); • - Suitable (2nd choice); o - Can be selected (optional)

Internal Threading

Family/Application		From Ø2.4 mm	From Ø4 mm	From Ø7 mm	From Ø8 mm	From Ø12.5 mm	From Ø20 mm
CUT-GRIP	**GEPI Line**	---	---	---	---	○	V
	TIPI Line	---	---	---	---	---	V
PICCOCUT		V	V	V	V	V	V
MINICHAM		---	●	○	○	○	○
CHAMGROOVE		---	---	---	●	V	●
ISCAR Threading Laydown Line		---	---	○	○	V	V

V - Recommended (1st choice); • - Suitable (2nd choice); o - Can be selected (optional)

Application

Operation Stability	• Does the threading machine have good or bad stability?

The possibility of increasing tool life, especially when the threading process is unstable, can be expedited by positioning and clamping the insert into the pocket of the holder. **ISCAR**'s recommendation for interrupted machining, expected vibrations, etc., is to use a more rigid clamping system. For external threading, you can use the table below, whereas for internal threading, contact an **ISCAR** consultant.

External Threading

Family/Application	Unstable Applications
CUT-GRIP	
PENTACUT	
ISCAR Threading Laydown Line	
SWISSCUT	
Family/Application	Stable Applications

Application	
Coolant	• What type of coolant is available (external coolant, internal coolant, possibility for high pressure coolant)?
↓	
Tool Adaptor	• What type of tool adaptor is available?

ISCAR receommends always using coolant when threading, but this also depends on the type of machine that's available. **ISCAR**'s recommendation for coolant priority is shown in table below.

High Pressure Coolant	Internal Coolant	External Coolant
Recommended (1st choice)	Suitable (2nd choice)	Can be selected (optional)

Tool adaptation selection, like coolant selection, depends on the type of machine that's available. **ISCAR** provides a wide range of tools with different adaptations and with different cooling methods in accordance with the threading family/line, as shown in the table below.

External Threading

	CUT-GRIP	PENTACUT	SWISSCUT	ISCAR Threading Laydown Line
Square Shank Tools without Coolant Channels	V	V	V	V
Square Shank Tools with Coolant Channels				V
Square Shank Tools with High Pressure Coolant System	V	V	V	V
Square Shank Tools with Bottom Fed High Pressure Coolant System	V	V		V
Drophead Square Shank Tools without Coolant Channels				V
Tools with CAMFIX shanks for polygonal taper interface with Coolant Channels	V			V
Interchangeable Adaptors with Internal Channels for High Pressure Coolant				
Interchangeable Adaptors with Internal Coolant Channels	V	V		
Interchangeable Adaptors without Internal Coolant Channels	V	V		
Blade	V	V		

Internal Threading

	CUT-GRIP	PICCOCUT	MINICHAM	CHAMGROOVE	ISCAR Threading Laydown Line
Threading Bars without Coolant Channels	V			V	V
Threading Bars with Coolant Channels	V		V	V	V
Tools with CAMFIX shanks for polygonal taper interface with Coolant Channels	V				V
Interchangeable Heads with Internal Coolant Channels					V
Interchangeable Heads without Internal Coolant Channels					V
Perpendicular Holder		V			
High Precision Holder with Coolant Channels		V			
Multi-use Holder		V			

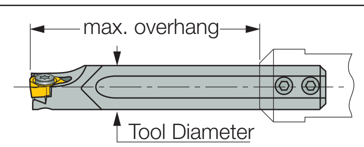
Application	
Overhang	• What is the overhang of the required tool for threading? (This question usually refers to internal theads)

The threading tools can be produced from steel or solid carbide. When threading with high overhang, a highly rigid tool system is required to maintain stable production.

If overhang is 4 X tool diameter, **ISCAR** recommends using solid carbide tools to improve performance due to their high rigidity features.

Every **ISCAR** threading family for internal threading includes steel and solid carbide tools.

Tool Material	Overhang
Steel Tool	Up to 3 x Tool diameter
Solid Carbide Tool	4 - 7 x Tool Diameter



Tool Configuration

Cutting Geometry	• What top rake geometry is the recommended for threading?

Chip control is very important during threading production in order to prevent the chips from curling on the tool, which necessitates stopping the machine to clean the chips from the cutting area. In addition, non-breaking chips cause poor surface quality of the workpiece in its cutting area. In view of the above, **ISCAR**'s recommendation in most cases is to select inserts with a chipformer to form the chips into shapes that will break them into small segments or, to select inserts with a deflector whose purpose is to direct the chips outside the cutting area. For brittle materials such as cast iron or for short depth cutting, it is possible to use inserts with a flat top area. The tables below show the top rake insert geometry for each threading family.

Available Top Rake Geometry for Production of Internal Threading

Family/Top Insert Area		Deflector	Chipformer
CUT-GRIP			V
PICCOCUT		V	
MINICHAM		V	
CHAMGROOVE		V	
ISCAR Threading Laydown Line	B-Type		V
	M-Type		V
	G-Type	V	
	U-Type		V
	Multi-Tooth	V	

Available Top Rake Geometry for Production of External Threading

Family/Top Insert Area		Flat	Deflector	Chipformer
CUT-GRIP		V		V
PENTACUT				V
SWISSCUT		V		
ISCAR Threading Laydown Line	B-Type			V
	M-Type			V
	G-Type		V	
	U-Type			V
	Multi-Tooth		V	

Tool Configuration	
Cutting Tool Design	• What is the preferred orientation of the insert into the tool?

What is more effective - tangential clamping or laydown clamping? This can often lead the user to hesitate when selecting the right cutting tool when there are threading cutters with laydown inserts and tangentially clamped inserts.

In general, laydown clamping is recommended in threading production on large diameters (Ø200 mm and above) and/or when using ductile materials as this solution allows the chips to flow (to be evacuated) without interference, easily and efficiently. In other cases, tangential clamping is recommended.

In either event, the question of using the cutters with tangential or laydown clamping inserts should be resolved specifically. The **ISCAR** application specialists will be glad to advise you of the best choice.

Tool Material

Grade	• Which cutting tool grade is most suitable for threading?

Selecting a grade is strongly connected with the cutting geometry of a tool and other factors. The following tables show the correct choice: they visualize a grade position in the field of application in accordance with standard ISO 513 and characterize the grade properties compared with other grades.

The tables provide summary data about grade application in coordinates of classification numbers from standard ISO 513 and availability of each grade per threading family.

There are main and complementary grades. The main grades are more popular in machining a considered class of engineering materials, but in specific cases the complementary grades can be effective as well. In situations when a product produced from a main grade is not available, a complementary grade provides an acceptable alternative.

		Material					
		Steel	Stainless Steel	Cast Iron	Nonferrous	High Temp. Allows	Hardened Steel
		Material Field					
Grade (Tough ↑)	IC28	P30 - P50	M30 - M40		N10 - N30	S20 - S25	
	IC228	P25 - P50[2]	M30 - M40[2]	K20 - K50	N20 - N40	S25 - S30	
	IC528	P25 - P45	M30 - M40			S15 - S30	
	IC928	P20 - P50					
	IC50M	P20 - P30					
	IC250	P15 - P35[2]	M20 - M40				
	IC08		M10 - M30		N10 - N25[1]	S10 - S30	
	IC508	P20 - P40	M20 - M30	K20 - K30	N10 - N30	S10 - S40	H10 - H20
	IC808	P15 - P30[1]	M20 - M30	K20 - K30[2]		S10 - S25[2]	H20 - H30[2]
	IC908	P15 - P30[1]	M20 - M30[2]	K20 - K30[2]		S10 - S25[2]	H20 - H30[2]
	IC806					S15 - S25[1]	
	IC1007	P10 - P30[2]	M05 - M20[1]	K20 - K40[1]		S05 - S20[2]	H05 - H15[1]
(Hard ↓)	IC1008	P20 - P50	M20 - M40	K15 - K40	N05 - N25	S15 - S25	H20 - H30

[1] Recommended; [2] Suitable

Threading Family for Partial Profile per Available Grades			
Family		Available Grades	
		Partial Profile - 55°	Partial Profile - 60°
CUT-GRIP		IC08, IC908	IC08, IC908
PENTACUT		IC908	IC908
SWISSCUT			IC1008
ISCAR Threading Laydown Line	B-Type	IC908	IC08, IC908
	M-Type	IC50M, IC250, IC808, IC908, IC1007	IC50M, IC250, IC508, IC808, IC908, IC1007
	G-Type	IC228, IC50M, IC250, IC508, IC908, IC1007	IC228, IC50M, IC250, IC08, IC508, IC908, IC1007
	U-Type	IC50M, IC250	IC50M, IC250, IC908
PICCOCUT		IC228, IC908	IC228, IC908
MINICHAM		IC508	IC508
CHAMGROOVE		IC528	IC528

Threading Family for Full Profile per Available Grades								
Family		Available Grades - Threading Standard						
ISCAR Threading Laydown Line		BUT (Oil Threading Profile - Buttres Casing)	RND (DIN 405 - Fire Fighting and Food Industry Pipe Coupling)	API (Oil Threading Profile)	EL (Extreme Line Oil Threading)	UNJ	MJ	PG
	G-Type	IC50M, IC250, IC908	IC228, IC50M, IC250, IC508, IC908	IC50M, IC250, IC908	IC250, IC908	IC50M, IC250, IC08, IC508, IC908, IC806, IC1007	IC250, IC908	IC08, IC908

Threading Family for Full Profile per Available Grades				
Family		Available Grades - Threading Standard		
		ISO	UN (UN, UNC, UNF, UNEF)	Whitworth (BSW, BSF, BSP)
CUT-GRIP		IC08, IC908	IC08, IC808, IC908	IC08, IC908
PENTACUT		IC908	IC908	IC908
SWISSCUT		IC1008		
ISCAR threading Laydown Line	B-Type	IC908	IC908	IC908
	M-Type	IC50M, IC250, IC508, IC808, IC908, IC1007	IC50M, IC250, IC808, IC908, IC1007	IC50M, IC250, IC508, IC808, IC908, IC1007
	G-Type	IC228, IC50M, IC250, IC08, IC508, IC908, IC1007	IC228, IC50M, IC250, IC08, IC508, IC908, IC1007	IC228, IC50M, IC250, IC508, IC908, IC1007
	U-Type	IC228, IC50M, IC250, IC908		IC50M, IC250, IC908
	Multi-Tooth	IC228, IC250, IC950, IC908, IC1007	IC50M, IC908	IC908
PICCOCUT		IC908		

Threading Family for Full Profile per Available Grades						
Family		Available Grades - Threading Standard				
		NPT (National Pipe Threading)	NPTF (National Pipe Threading)	BSPT (British Standard Pipe)	API RD (Oil Threading Round Profile)
CUT-GRIP		IC08, IC908		IC08, IC908	
PENTACUT		IC908		IC908	
ISCAR Threading Laydown Line	B-Type	IC908		IC908	
ISCAR Threading Laydown Line	M-Type	IC50M, IC250, IC808, IC908, IC1007		IC808, IC908, IC1007	
ISCAR Threading Laydown Line	G-Type	IC228, IC50M, IC250, IC508, IC908, IC1007	IC50M, IC250, IC908	IC50M, IC250, IC508, IC908, IC1007	IC50M, IC250, IC508, IC908
ISCAR Threading Laydown Line	Multi-Tooth	IC908			IC908

Threading Family for Full Profile per Available Grades						
	Family	Available Grades - Threading Standard				
		STACME (STUB ACME)	ACME	SAGE (Sagengenwinde)	ABUT (American Butress)	TR (Trapeze Shaped DIN103)
ISCAR Threading Laydown Line	G-Type	IC228, IC50M, IC250, IC908	IC250, IC908	IC250, IC908	IC50M, IC250, IC08, IC908	IC228, IC50M, IC250, IC508, IC908, IC1007
ISCAR Threading Laydown Line	U-Type		IC250, IC908	IC250, IC908	IC50M, IC250, IC908	IC228, IC50M, IC250, IC908

Economical Consideration

Economical Efficiency	• What are the number of cutting edges on the insert?

The parameter for a number of cutting edges is an economic consideration.
The more cutting edges on an insert, the lower the cost per insert cutting edge.

Example for a Quick and Easy way to Select a Correct Solution

Requirements:

- M100x1.75 according to ISO Standard
- External threads
- Partial profile
- AISI 316 stainless steel bar

The threading machine has good stability, available high-pressure coolant, and square shank tool adaptation

Application	
Gender of Thread	• Is external or internal threading required?

Family/Line	External Threading
ISCAR Threading Laydown Line	V
PENTACUT	V
SWISSCUT	V
CUT-GRIP	V

Conclusion: **ISCAR** Threading Laydown Line, **PENTACUT**, **SWISSCUT**, and **CUT-GRIP** can produce external threading. Only these families are relevant.

Application	
Threading Profile/Standard	• Is full profile or partial profile required? • What is the threading profile? (square, triangular, trapezoidal or other)? • What is the threading standard?

Requested partial profile of threading M100x1.75 - triangular threading form with angle 60°

Family		Standard
		Partial Profile - 60°
CUT-GRIP		V
PENTACUT		V
SWISSCUT		V
ISCAR Threading Laydown Line	B-Type	V
	M-Type	V
	G-Type	V
	U-Type	V

Conclusion: **CUT-GRIP**, **PENTACUT**, **SWISSCUT** and **ISCAR** Threading Laydown Line (B-Type, M-Type, G-Type and U-Type) can produce triangular threading with a 60° angle.

Application

Pitch/TPI	• What is the threading pitch/TPI?

According to the table below, it is possible to check which families can produce a requested pitch of 1.75 mm.

Family/Pitch (mm)		…	0.3	…	0.45	…	0.5	…	1.5	…	1.7	…	1.75	…	3
CUT-GRIP					◄	—	—	—	—	—	—	—	—	—	►
PENTACUT							◄	—	—	—	—	—	►		
SWISSCUT			◄	—	—	—	—	—	—	—	►				
ISCAR Threading Laydown Line	B-Type						◄	—	—	—	—	—	—	—	►
	M-Type						◄	—	—	—	—	—	—	—	►
	G-Type						◄	—	—	—	—	—	—	—	►

Conclusion: **CUT-GRIP** Thread Family , **PENTACUT** Thread Family and **ISCAR** Threading Laydown Line (B-Type, M-Type and G-Type) can produce the requested threading.
Only these families will be examined.

Application

Machining Diameter	• What is the machining diameter?

Bar diameter is 100 mm. The table below shows the recommended threading families for production of the requested threading.

Family/Application	Up to Ø250 mm	Note
CUT-GRIP	○	Optionally
PENTACUT	●	Suitable (2nd choice)
ISCAR Threading Laydown Line	V	Recommended (1st choice)

ISCAR's recommendation depends on the machining diameter.

Conclusion: **ISCAR**'s recommended threading family in order of priority;

1st choice - **ISCAR** Threading Laydown Line

2nd choice - **PENTACUT** Thread Family

3rd choice - **CUT-GRIP** Thread Family

Application	
Operation Stability	• Does the threading machine have good or bad stability?

Family/Application	Unstable Applications
CUT-GRIP	↑
PENTACUT	
ISCAR Threading Laydown Line	↓
Family/Application	Stable Applications

Conclusion: According to **ISCAR**'s recommendations, the threading families order of priority has not changed from the previous section.

Application	
Coolant	• What type of coolant is available (external coolant, internal coolant, possibility for high pressure coolant)?
↓	
Tool Adaptor	• What type of tool adaptor is available?

High Pressure Coolant	Internal Coolant	External Coolant
Recommended (1st choice)	Suitable (2nd choice)	Can be selected (optional)

	CUT-GRIP	PENTACUT	ISCAR Threading Laydown Line
Square Shank Tools with High Pressure Coolant System	V	V	V

Conclusion: According to **ISCAR**'s recommendations, the threading families order of priority has not changed from the previous section.

Tool Configuration	
Overhang	• Which cutting geometry is recommended for machining requested threading?

Family/Top Insert Area		Flat	Deflector	Chip Breaker
CUT-GRIP		V		V
PENTACUT				V
ISCAR Threading Laydown Line	B-Type			V
	M-Type			V
	G-Type		V	

Conclusion: **ISCAR**'s recommended threading family in order of priority;

1st choice - **ISCAR** Threading Laydown Line, B-Type or M-Type insert

2nd choice - **PENTACUT** Thread Family or **ISCAR** Threading Laydown Line, G-Type insert

3rd choice - **CUT-GRIP** Thread Family

Tool Material

Grade	• Which cutting tool grade is most suitable for threading?

Grade		Steel	Stainless Steel	Cast Iron	Nonferrous	High Temp. Allows	Hardened Steel
		Material Field					
Tough	IC28	P30 - P50	M30 - M40		N10 - N30	S20 - S25	
	IC228	P25 - P50(2)	M30 - M40(2)	K20 - K50	N20 - N40	S25 - S30	
	IC528	P25 - P45	M30 - M40			S15 - S30	
	IC928	P20 - P50					
	IC50M	P20 - P30					
	IC250	P15 - P35(2)	M20 - M40				
	IC08		M10 - M30		N10 - N25(1)	S10 - S30	
	IC508	P20 - P40	M20 - M30	K20 - K30	N10 - N30	S10 - S40	H10 - H20
	IC808	P15 - P30(1)	M20 - M30	K20 - K30(2)		S10 - S25(2)	H20 - H30(2)
	IC908	P15 - P30(1)	M20 - M30(2)	K20 - K30(2)		S10 - S25(2)	H20 - H30(2)
	IC806					S15 - S25(1)	
	IC1007	P10 - P30(2)	M05 - M20(1)	K20 - K40(1)		S05 - S20(2)	H05 - H15(1)
Hard	IC1008	P20 - P50	M20 - M40	K15 - K40	N05 - N25	S15 - S25	H20 - H30

(1) Recommended; (2) Suitable

Family		Available Grades Partial Profile - 60°
CUT-GRIP		IC08, IC908
PENTACUT		IC908
ISCAR Threading Laydown Line	B-Type	IC08, IC908
	M-Type	IC50M, IC250, IC508, IC808, IC908, IC1007
	G-Type	IC228, IC50M, IC250, IC08, IC508, IC908, IC1007

Conclusion: **ISCAR**'s recommended threading family in order of priority;

1st choice - **ISCAR** Threading Laydown Line, M-Type insert

2nd choice - **PENTACUT** Thread Family, **ISCAR** Threading Laydown Line, B-Type or G-Type insert

3rd choice **CUT-GRIP** Thread Family

Economical Consideration

Economical Efficiency	• What are the number of cutting edges on the insert?

- **ISCAR** Threading Laydown Line inserts have 3 cutting edges.
- **PENTACUT** inserts have 5 cutting edges
- **CUT-GRIP** inserts have 2 cutting edges

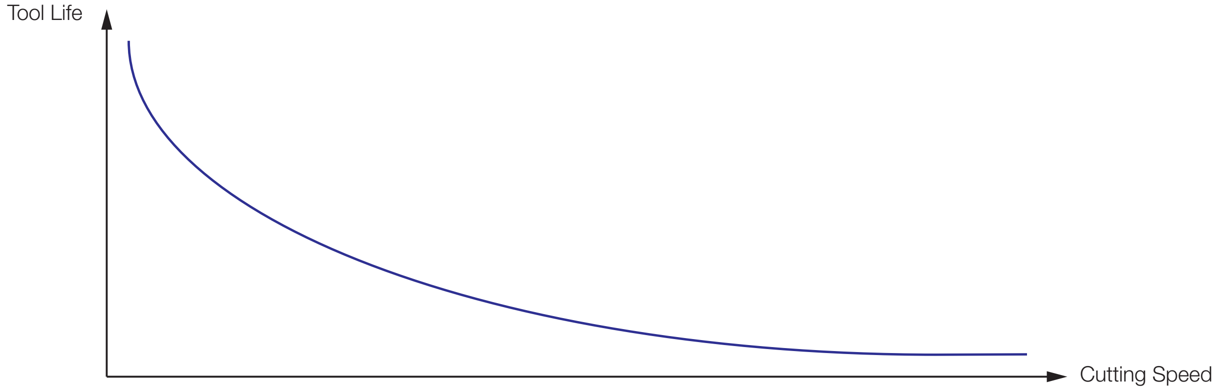
Conclusion: The decision to choose any of the selected tools is not only based on the technical parameters of the tool, but also on other important factors such as stock availability, cost, terms and conditions of deliver, etc.

2.15 Cutting Conditions

The key cutting parameters in threading are cutting speed (V_c) and feed per revolution (f). If feed per revolution (f) is a constant value equal to the threading pitch, then the cutting speed (V_c) is affected by various factors.

It should be noted that a harder carbide grade has higher wear resistance and enables higher cutting speed, and a tougher carbide grade with its better impact strength is intended for lower speed but enables higher feed.

There is also a relationship between insert tool life and cutting speed, which roughly be described in accordance with the chart below.



This graph represents the most reasonable cutting speeds.
The velocities at the high and low ranges do not necessary exhibit the same relationship

The machinability factor should be taken into consideration as machinability of each engineering material is different, and even the same material can be substantially different in its machinability (for example, machining threading in a tool steel will be with different cutting conditions for annealed, pre-hardened and hardened). Therefore, a specific force needed to remove a unit of a chip section, and load acting on an insert, differ too.

The threading tool body is also important. A durable design of the body, position of the insert into the tool, and a reliable insert clamping method ensure machining under high cutting data.

Other limitations such as unstable machining conditions and large overhang, improper workpiece clamping, machine axis backlash, workpiece with a thin wall, and varied hardness of workpieces, can lead to decreasing the cutting speed.

Machine tool and tool holding also represent a constraint. Poor machine conditions and non rigid toolholders create an additional barrier for increased cutting data.

The mentioned arguments are very general and no doubt everyone who is involved in metal cutting is familiar with them. They are good illustration of complex dependence or the cutting data on different attributes. How to go from the generalities to the particulars and specify the starting cutting data?

The following cutting recommendations have been developed by **ISCAR** specialists and accordingly apply to **ISCAR** products.

Feed (F)

Feed per revolution (F) always is a constant value that equal to the threading pitch.

For example:

- In order to produce threading with a 2 mm pitch, the feed will be 2 mm/rev (mm per revolution).
- In order to produce threading with 14 TPI, the feed will be 1.8 mm/rev (mm per revolution). In this case, the definition of the value of the feed per revolution (F) is required to convert a value of TPI to pitch in mm, i.e.

$$\frac{25.4}{14\ \text{TPI}} \approx 1.8\ \text{mm}$$

Usable Formulas

$$1\ \text{inch} = 25.4\ \text{mm}$$

$$\frac{25.4}{\text{T.P.I}} = \text{Pitch (mm)}$$

Cutting Speed (V_c)

The starting cutting speed can be defined as the following formula:

$$Vc = Ks \times Vo$$

When:

V_c — Starting cutting speed

Ks — Stability factor

Vo — Basic cutting speed

Stability Factor (Ks) is defined by the below estimate of threading operation stability:

For normal stability: Ks=1

For unstable operations such as: high overhang, poor clamping and etc.: Ks=0.7

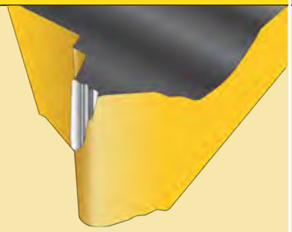
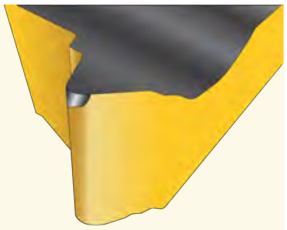
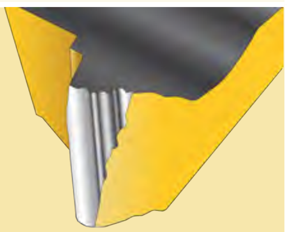
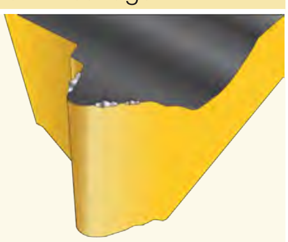
- Basic cutting speed (Vo) is determined in the table below, according to carbide grade and workpiece material.

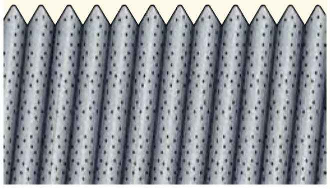
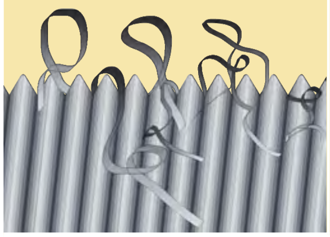
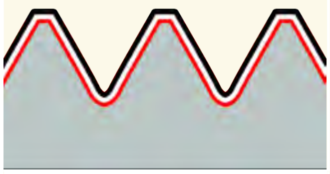
Machining Data for Threading

ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1
		>= 0.25 %C	Annealed	650	190	2
		< 0.55 %C	Quenched and tempered	850	250	3
		>= 0.55 %C	Annealed	750	220	4
			Quenched and tempered	1000	300	5
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	200	6
			Quenched and tempered	930	275	7
				1000	300	8
				1200	350	9
	High alloyed steel, cast steel, and tool steel		Annealed	680	200	10
			Quenched and tempered	1100	325	11
	Stainless steel and cast steel		Ferritic/martensitic	680	200	12
			Martensitic	820	240	13
M	Stainless steel		Austenitic	600	180	14
K	Grey cast iron (GG)		Ferritic/pearlitic		180	15
			Pearlitic		260	16
	Nodular cast iron (GGG)		Ferritic		160	17
			Pearlitic		250	18
	Malleable cast iron		Ferritic		130	19
			Pearlitic		230	20
N	Aluminum- wrought alloy		Not cureable		60	21
			Cured		100	22
	Aluminum-cast, alloyed	<=12% Si	Not cureable		75	23
			Cured		90	24
		>12% Si	High temperature		130	25
	Copper alloys	>1% Pb	Free cutting		110	26
			Brass		90	27
			Electrolitic copper		100	28
	Non-metallic		Duroplastics, fiber plastics			29
			Hard rubber			30
S	High temp. alloys	Fe based	Annealed		200	31
			Cured		280	32
		Ni or Co based	Annealed		250	33
			Cured		350	34
			Cast		320	35
	Titanium Ti alloys			Rm 400		36
			Alpha+beta alloys cured	Rm 1050		37
H	Hardened steel		Hardened		55 HRC	38
			Hardened		60 HRC	39
	Chilled cast iron		Cast		400	40
	Cast iron		Hardened		55 HRC	41

Coated							
IC228		IC908		IC808		IC1007	
Cutting Speed							
m/min	SFM	m/min	SFM	m/min	SFM	m/min	SFM
60-100	200 - 330	115-190	380 - 620	125 - 205	410 - 670	135-230	440 - 750
60-95	200 - 310	110-180	360 - 590	120 - 195	390 - 640	130-220	430 - 720
50-90	160 - 300	100-175	330 - 570	105 - 185	340 - 610	120-210	390 - 690
45-85	150 - 280	90-165	300 - 540	95 - 175	310 - 570	110-200	360 - 660
45-85	150 - 280	90-165	300 - 540	95 - 175	310 - 570	110-200	360 - 660
50-95	160 - 310	100-180	330 - 590	105 - 195	340 - 640	120-215	390 - 710
40-75	130 - 250	75-140	250 - 460	80 - 150	260 - 490	90-170	300 - 560
35-70	110 - 230	70-135	230 - 440	75 - 145	250 - 480	85-160	280 - 520
35-70	110 - 230	70-135	230 - 440	75 - 145	250 - 480	85-160	280 - 520
40-65	130 - 210	80-120	260 - 390	85 - 130	280 - 430	95-145	310 - 480
25-50	80 - 160	50-100	160 - 330	55 - 105	180 - 340	60-120	200 - 390
35-70	110 - 230	70-130	230 - 430	75 - 140	250 - 460	85-155	280 - 510
45-60	150 - 200	85-110	280 - 360	90 - 120	300 - 390	100-130	330 - 430
45-75	150 - 250	90-140	300 - 460	95 - 150	310 - 490	110-170	360 - 560
65-85	210 - 280	125-160	410 - 520	135 - 170	440 - 560	150-190	490 - 620
45-65	150 - 210	90-120	300 - 390	95 - 130	310 - 430	110-145	360 - 480
35-70	110 - 230	70-130	230 - 430	75 - 140	250 - 460	85-155	280 - 510
30-60	100 - 200	60-115	200 - 380	65 - 125	210 - 410	70-140	230 - 460
30-35	100 - 110	60-70	200 - 230	65 - 75	210 - 250	70-85	230 - 280
30-75	100 - 250	60-145	200 - 480	65 - 155	210 - 510	70-175	230 - 570
50-195	160 - 640	100-365	330 - 1200	105 - 390	340 - 1280	120-440	390 - 1440
40-115	130 - 380	80-220	260 - 720	85 - 235	280 - 770	95-265	310 - 870
105-215	340 - 710	200-400	660 - 1310	215 - 430	710 - 1410	240-480	790 - 1570
105-150	340 - 490	200-280	660 - 920	215 - 300	710 - 980	240-335	790 - 1100
105-150	340 - 490	200-280	660 - 920	215 - 300	710 - 980	240-335	790 - 1100
40-135	130 - 440	80-255	260 - 840	85 - 275	280 - 900	95-305	310 - 1000
40-135	130 - 440	80-255	260 - 840	85 - 275	280 - 900	95-305	310 - 1000
40-130	130 - 440	80-255	260 - 840	85 - 275	280 - 900	95-305	310 - 1000
40-130	130 - 430	80-250	260 - 820	85 - 265	280 - 870	95-300	310 - 980
40-130	130 - 430	80-250	260 - 820	85 - 265	280 - 870	95-300	310 - 980
25-30	80 - 100	45-60	150 - 200	50 - 65	160 - 210	55-70	180 - 230
15-25	50 - 80	35-50	110 - 160	35 - 55	110 - 180	40-60	130 - 200
10-15	30 - 50	20-30	70 - 100	20 - 30	70 - 100	25-35	80 - 110
5-10	20 - 30	15-25	50 - 80	15 - 25	50 - 80	18-30	60 - 100
5-10	20 - 30	15-25	50 - 80	15 - 25	50 - 80	18-30	60 - 100
75-90	250 - 300	140-170	460 - 560	150 - 180	490 - 590	170-205	560 - 670
25-35	80 - 110	50-70	160 - 230	55 - 75	180 - 250	60-85	200 - 280
25-30	80 - 100	45-60	150 - 200	50 - 65	160 - 210	55-70	180 - 230
25-30	80 - 100	45-60	150 - 200	50 - 65	160 - 210	55-70	180 - 230
25-30	80 - 100	45-60	150 - 200	50 - 65	160 - 210	55-70	180 - 230
25-30	80 - 100	45-60	150 - 200	50 - 65	160 - 210	55-70	180 - 230

2.16 Troubleshooting

Problem	Cause	Solution
 Plastic Deformation	• Excessive heat in cutting zone • Wrong Grade • Inadequate coolant supply • Depth of cut too large • Cutting speed too high • Nose radius too small	• Reduce RPM/reduce depth of cut/check turned dia. • Use coated grade/use harder grade • Apply coolant • Reduce depth of cut /increase no. of passes • Reduce cutting speed • If possible use insert with larger radius
 Premature Wear	• Cutting speed too high • Infeed depth too small • Highly abrasive material • Inadequate coolant supply • Wrong inclination anvil • Wrong turned dia. prior to threading • Insert is above center line	• Reduce RPM • Modify flank infeed /increase depth of cut • Use coated grade • Apply coolant • Reselect anvil • Check turned dia. • Check center height
 Insert Breakage	• Wrong turned dia. prior to threading • Wrong Grade • Poor chip control • Incorrect center height	• Check turned dia. • Use tougher grade • Change to M/B-Type inserts and use modified flank infeed • Check center height
 Built-up Edge	• Cutting edge too cold • Wrong grade • Inadequate coolant supply • Incorrect cutting speed	• Increase RPM /increase depth of cut • Use coated grade • Apply coolant • Change cutting speed
 Vibration	• Incorrect workpiece clamping • Incorrect tool setup • Incorrect cutting speed • Incorrect center height	• Use soft jaws • Check tool overhang / use anti vibration bars • Increase cutting speed • Check center height

Problem	Cause	Solution
Poor Surface Finish 	• Wrong cutting speed • Excessive heat in cutting zone • Poor chip control • Inadequate coolant supply • Wrong inclination anvil • Tool overhang too long • Incorrect center height	• Increase/reduce RPM • Reduce depth of cut • Modify flank infeed • Apply coolant • Reselect anvil • Reduce tool overhang • Check center height
Poor Chip Control 	• Excessive heat in cutting zone • Wrong grade • Inadequate coolant supply • Wrong turned dia. prior to threading • Incorrect method of infeed	• Reduce RPM /change depth of cut /check turned dia. • Use coated grade /check turned dia./use M/B-Type inserts • Apply coolant • Check turned dia. • Modified flank infeed 3-5°
Threading Profile is Too Shallow 	• Incorrect center height • Worn insert • Insert isn't machining the thread crest • Excessive wear	• Check center height • Change to new cutting edge sooner • Check the workpiece dia. • Increase radial infeed
Broken Nose During First Pass	• Cutting edge too cold • Depth of cut too large • Wrong grade • Wrong turned dia. prior to threading • Incorrect center height • Infeed depth too shallow • Wrong inclination anvil • Tool overhang tool long	• Increase RPM • Reduce depth of cut/increase number of infeed passes • Use tougher grade • Check turned dia. • Adjust center height • Modify flank infeed • Reselect anvil • Reduce tool overhang
Incorrect threading Profile	• Unsuitable threading profile • Incorrect center height • Incorrect pitch in the program	• Adjust to correct tool ,anvil and insert • Adjust center height • Change the program

2.17 Special Request Form Thread Turning

Project Information

Customer ________________ Industry ______________________ Country ____________________

Customer Goal (Productivity, Economy, etc.): ____

Proposal for: ☐ Finish Insert ☐ Rough Insert ☐ Holder ☐ Machining Concept

ISCAR Representative: Email: _________________________ Tel: ____________________

Competitors: ______________ Target Price: ___________________ Annual Consumption: ___________

Threading

Designation ______ Pitch ________________ Standard __________ Tolerance Clas ______________

Major Dia. _________ Minor Dia. __________ Pitch Dia. __________ Number of Starts ______________

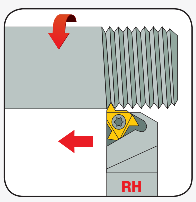
Threading Depth __________________________ ☐ Through Hole ☐ Blind Hole

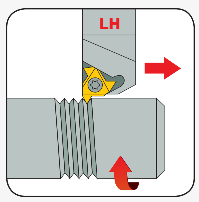
Special Form ____

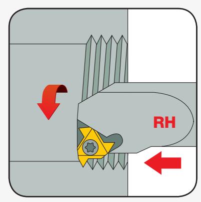
For non-standard profiles, detailed information must be supplied (drawing, dimensions & tolerances)

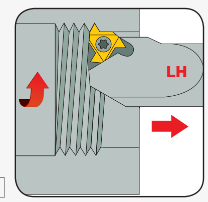
Application Part ________________________ Material _____________________ Hardness _____________

RH
Right-hand Threading

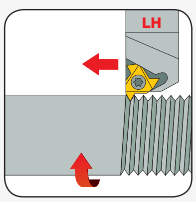
☐ 

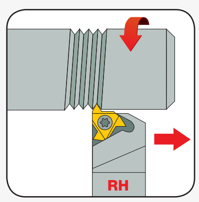
☐ 

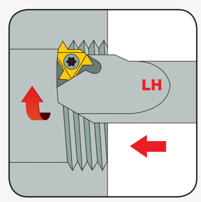
☐ 

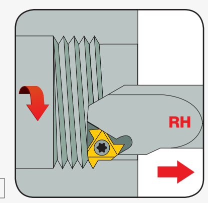
☐ 

LH
Left-hand Threading

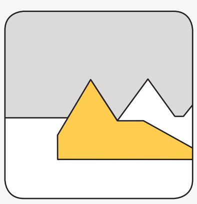
☐ 

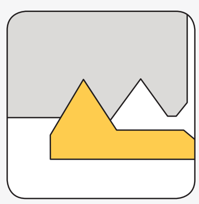
☐ 

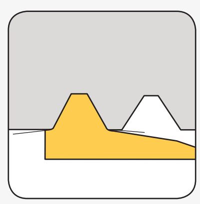
☐ 

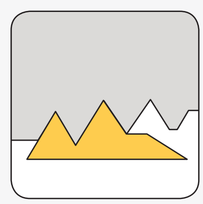
☐ 

Insert Profile:

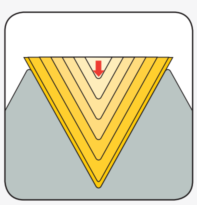

☐ Full

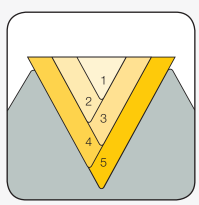

☐ Partial


☐ Semi-Partial

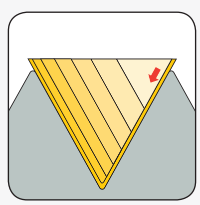

☐ Multi-Point

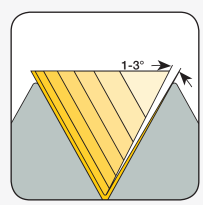
Infeed:


☐ Radial



☐ Incremental


☐ Flank



☐ Modified Flank

Attachments ☐ Drawing ☐ Model ☐ Sketch ☐ Photo

Machine

Model ______________ Shank Type/Size ____

Coolant: ☐ Internal ☐ External ☐ None Type: ______________________________

Remarks: ____

THREAD MILLING

3 Thread Milling

Today, thread milling is increasingly used to produce external and internal threads.
Some of the many advantages include:

- One tool is used for external and internal production and for right-and left-hand threading in through or blind holes
- No need to change the tool for production of different thread diameters - one tool is suitable for various thread milling diameters
- Thread length milling in one pass
- Short machining time
- Thread milling next to the bottom of blind hole
- Bottom thread relief not required
- Excellent and controlled thread surface finish
- Indexability and repeatability when changing or replacing cutter
- No problems with removing and replacing a broken tool: it is possible to extract the broken tool without damaging the part
- Easy and efficient machining for thread milling in CNC milling machining centers
- Threading in asymmetric parts
- There is no limit to the size of the part where threading is required

ISCAR offers a wide range of cutter diameters for all types of threads.

The Principle of Thread Milling Production is Based on the Following:
The cutter is located parallel to the part axis along the required thread. The cutter rotates around itself and enters into the part radially or tangentially until reaching the required depth depending on the thread type. Simultaneously, rotary motion of the cutter around its axis moves spirally along the whole length of the requested thread. The cutter movement along the thread length while completing one round around the part is equal to the pitch of requested thread. In this way, the threading is done while completing 1-1.3 turns of the tool around the workpiece; 0.3 turn is necessary for a full plunge of the cutter to the thread depth (at start thread production) and overlap the plunge location of cutting (at end thread production).

3.1 ISCAR Product Families for Thread Milling

ISCAR offers a wide range of thread milling cutters that provide solutions for both external and internal threading according to most standards.

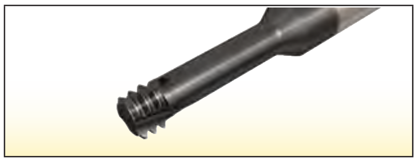
The Design of the **ISCAR** Cutter for Thread Milling Operations contain:

- Solid tools
- Asembled carrying indexable inserts
- Assembled with exchangeable cutting heads

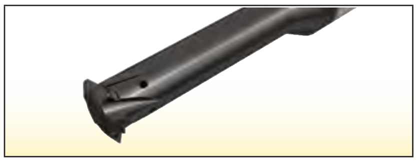
The cutting area is suitable for multi-threads as well as one-thread. The thread profile is divided into full- and partial-profile tools. Similar to common milling tools, these thread milling cutters have a shell mill (with a central bore) and an endmill (with shank) design configurations. **ISCAR**'s products for thread milling operations can be divided into four main groups, each containing several families / lines:

SOLIDTHREAD

MTEC, MTECB MTECZ, MTECQ

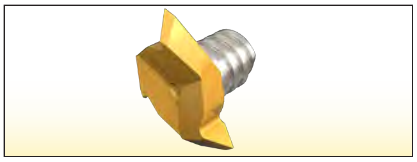


MTECS, MTECSH



MTECI-A60

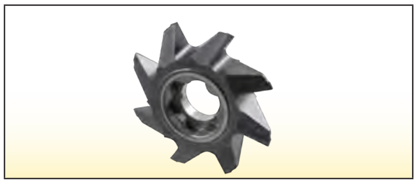
MULTI-MASTER



MM TRD

MT-...-MM

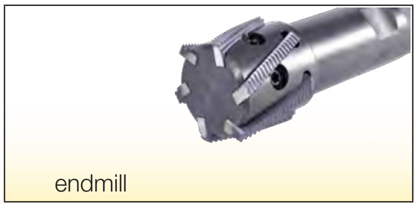
T-SLOT



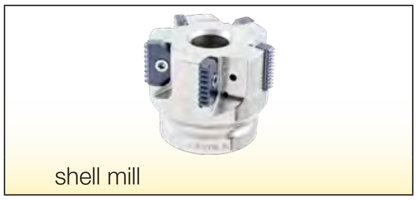
SD TRD

MILLTHREAD

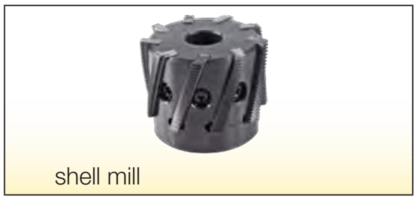
MTE



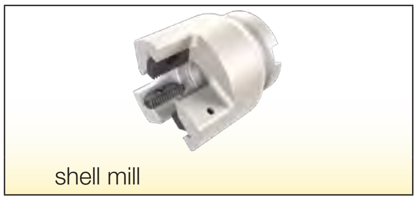
MTSRH



MTF-MULTI



MTSRH



MTFL

3.2 SOLIDTHREAD – Solid Carbide Endmills

ISCAR offers a rich line of solid carbide endmills for thread milling operations. These tools, with nominal diameters from 0.72 mm to 20 mm by metric system or from 0.045 inch to 0.75 inch by imperial and United States customary systems and varied in form, are intended for machining all types of materials such as: steel, stainless steel, cast iron, etc.
The tools differ in cutting geometry, helix angle, number of flutes, length and grades.

ISCAR catalogs and leaflets contain detailed guidelines for using the solid carbide endmills in thread milling. Commonly, tool selection and cutting data depend on application requirements and workpiece material.

Cutting tool manufacturers, from small shops to world-known companies, produce solid carbide endmills of the same sizes that often seem like copies of each other.
However, despite a formal resemblance, there is a great difference in performance and tool life of the cutters. The reason lies in carbide grades, grinding technology and cutting geometry features.

SOLIDTHREAD – Designation Code Key

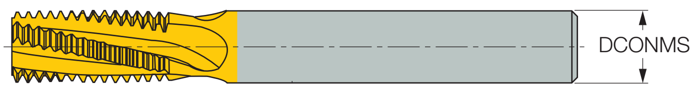
MTEC	B	10	10	D	24	1.0	ISO	IC908
	1	2	3	4	5	6	7	8

MTEC – Mill Thread Endmill Carbide

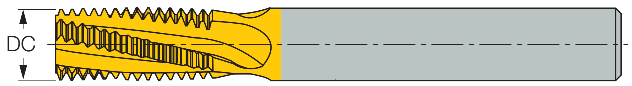
1 Endmill type

☐ — Without coolant channel
B — Central coolant channel
Z — Coolant holes in flutes
Q — Central coolant hole and reduced neck diameter
S — For small internal threads for general use
SH — For small internal threads in hard materials
I — Single-point design of cutting head

2 Shank diameter (DCONMS)



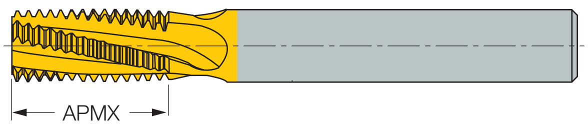
3 Cutting diameter (Dc)



4 No. of flutes

C — 3 flutes
D — 4 flutes
E — 5 flutes
F — 6 flutes

5 Length of thread (APMX)



6 Thread pitch

Value by number

- For metric threading in mm
- For inch threading in TPI

7 Thread standard

ISO — ISO Metric

UN — American UN

W — Whitworth

BSPT — British Standard Pipe Thread

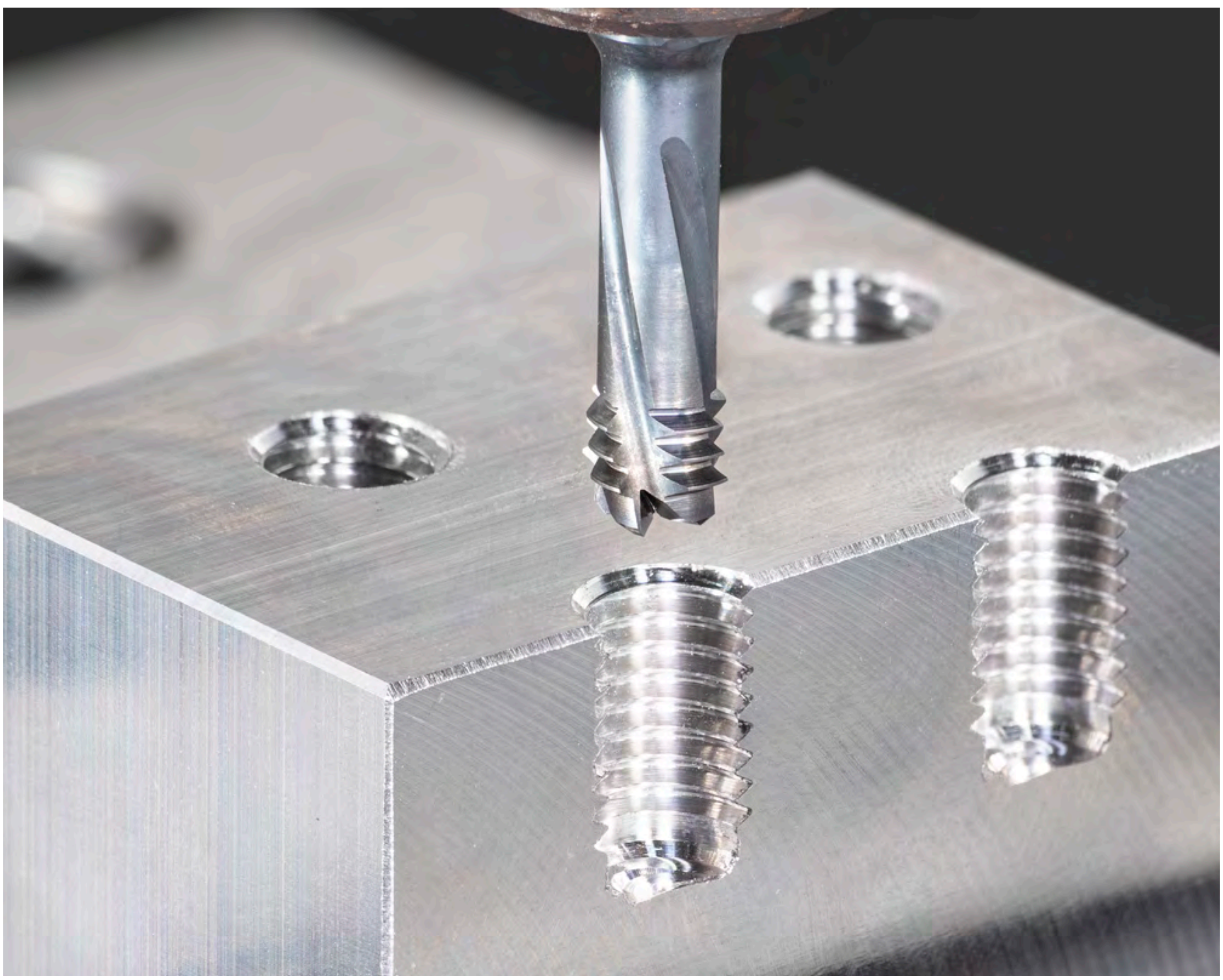
NPT — American National Pipe Thread

8 Grade

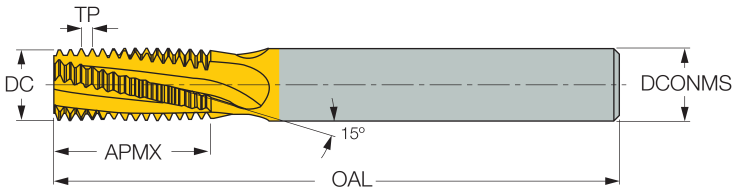
IC908, IC903, IC902

Main Advantages:

- Complete thread length by one axial pass
- Reduce cutting time due to large number of flutes relative to the endmill diameter
- Thread relief in the bottom of a blind hole is not required
- Same endmill used for right and left-hand thread
- Excellent surface finish
- Same endmill can be used for variety of materials

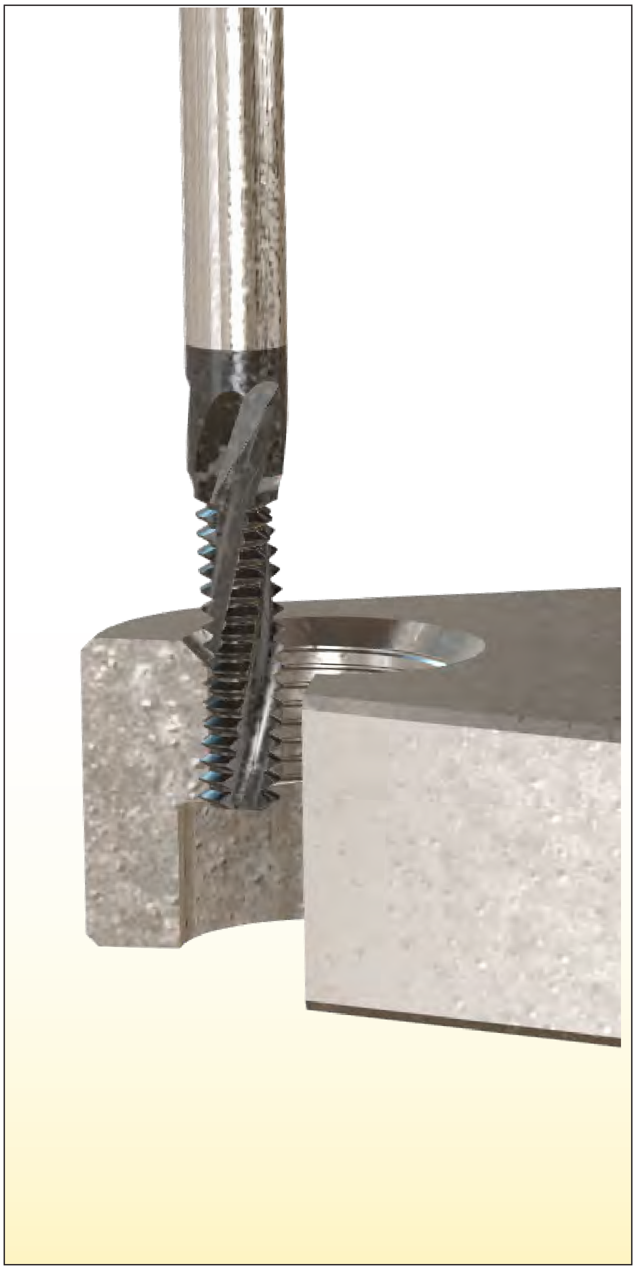


3.2.1 MTEC

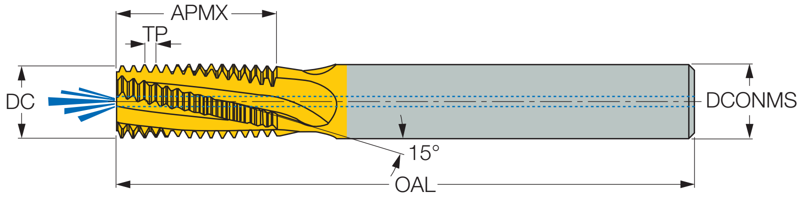


MTEC (Mill Thread Endmills Carbide) Family - solid carbide thread mills without coolant channels, suitable for internal and external thread milling. This family can be used in thread production of all types materials except gummy and sticky materials.

MTEC endmills are available with cutting diameters from 2.2 mm up to 20 mm by metric system or from 0.087 inch to 0.75 inch by imperial and United States customary systems. This product line offers a solution for full profiles for most popular standards.



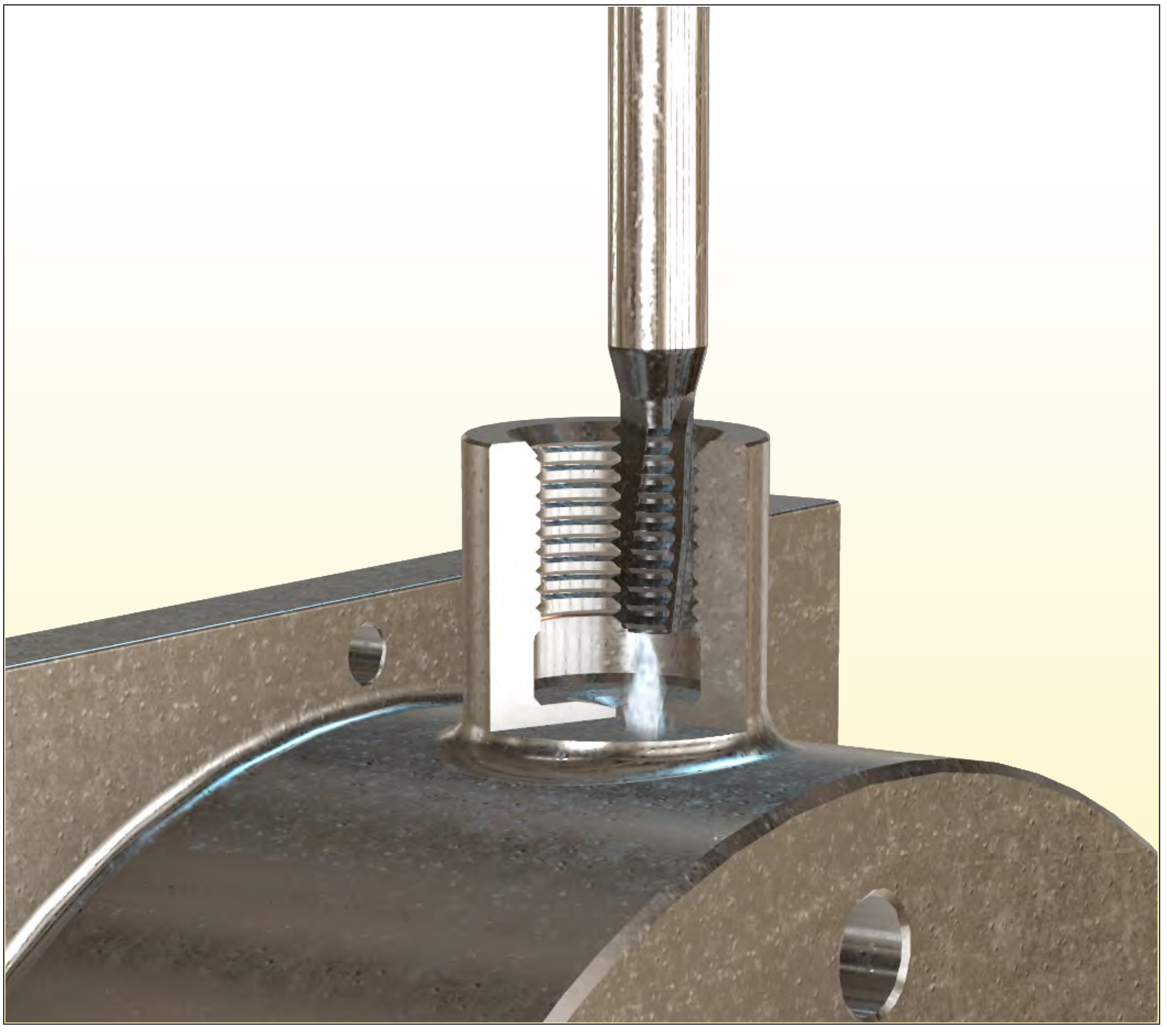
3.2.2 MTECB



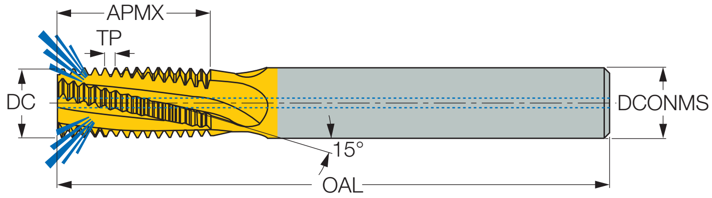
MTECB (Mill Thread Endmills Carbide Bore) Family - solid carbide thread mills with coolant hole, recommended for internal thread milling in blind holes and can also be used for production of external thread milling.

The coolant holes improve tool life in all thread milling applications. In blind holes where the chips of especially soft materials (stainless steel and high-temp alloys) tend to be re-cut and stick to the machined area, the coolant stream coming from the bottom in an upward direction flushes them out of the hole very efficiently.

MTECB endmills are available with cutting diameters from 3.1 mm up to
20 mm by metric system or from 0.181 inch to 0.75 inch by imperial and United States customary systems.
This line offers a solution for full profiles for most popular standards.



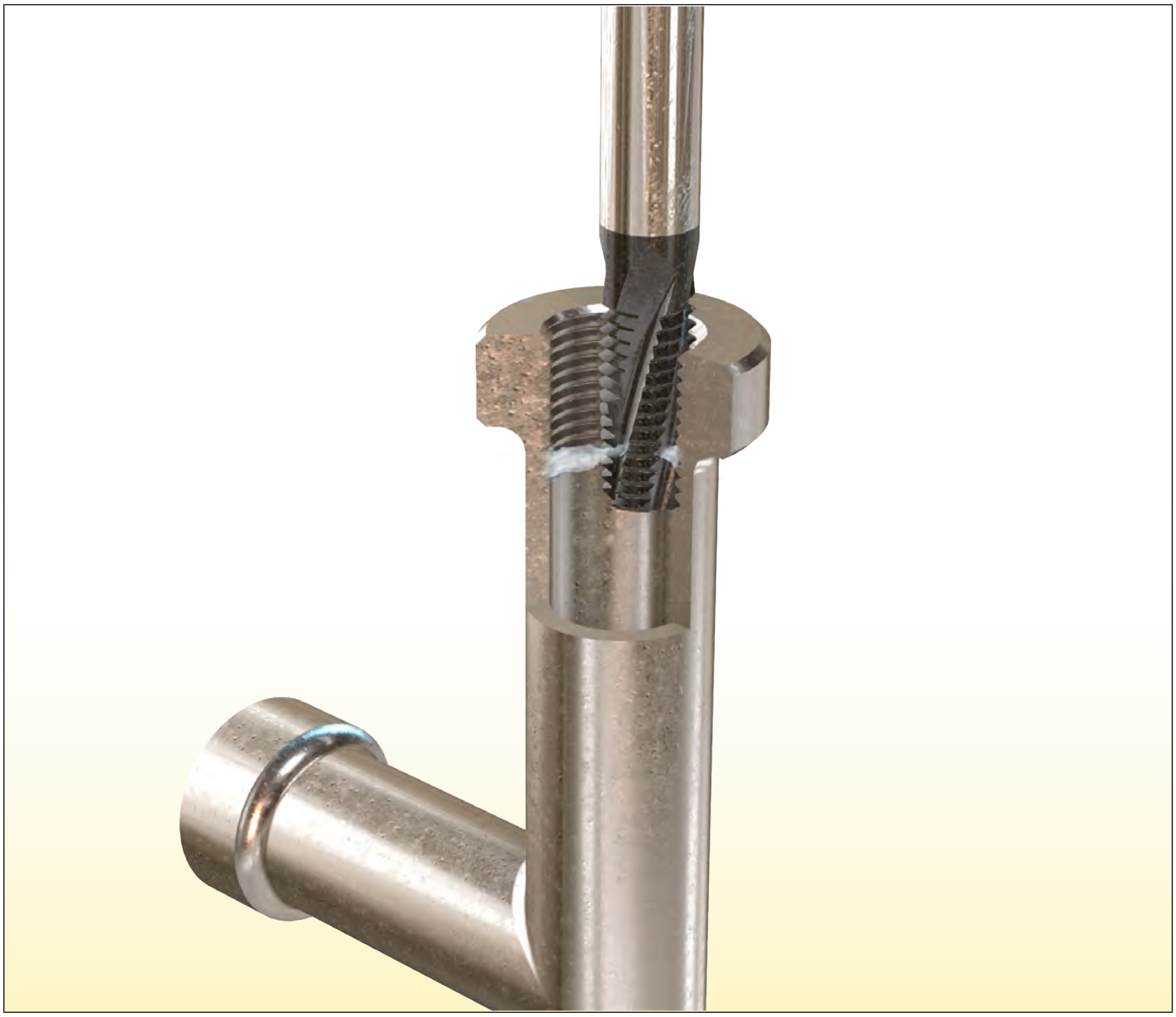
3.2.3 MTECZ



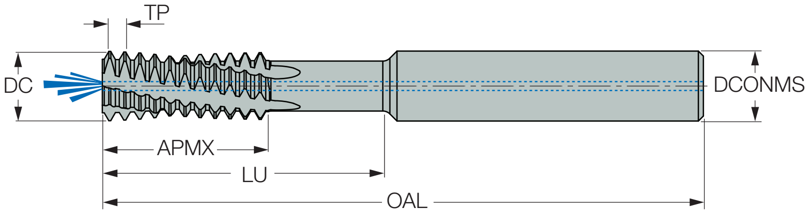
MTECZ (Mill Thread Endmills Carbide Bore) - these are solid carbide thread mills with internal coolant holes directed to the cutting edges along the flutes. The endmills should be used on machines with coolant through the spindle, for applications of through hole, where the tools with frontal cooling holes (MTECB) are inefficient. MTECZ also can be used for production internal thread in blind holes and for external thread milling.

The coolant holes improve tool life in all thread milling applications. The coolant stream flushes the chips from the cutting very efficiently, particularly in soft materials (stainless steel and high-temp alloys) where the chips tend to be re-cut and stick to the machined area.

MTECZ endmills are available with cutting diameters from 7.6 mm up to 16 mm by metric system or from 0.394 inch to 0.63 inch by imperial and United States customary systems. This product line offers a solution for full profiles for most popular thread standards.



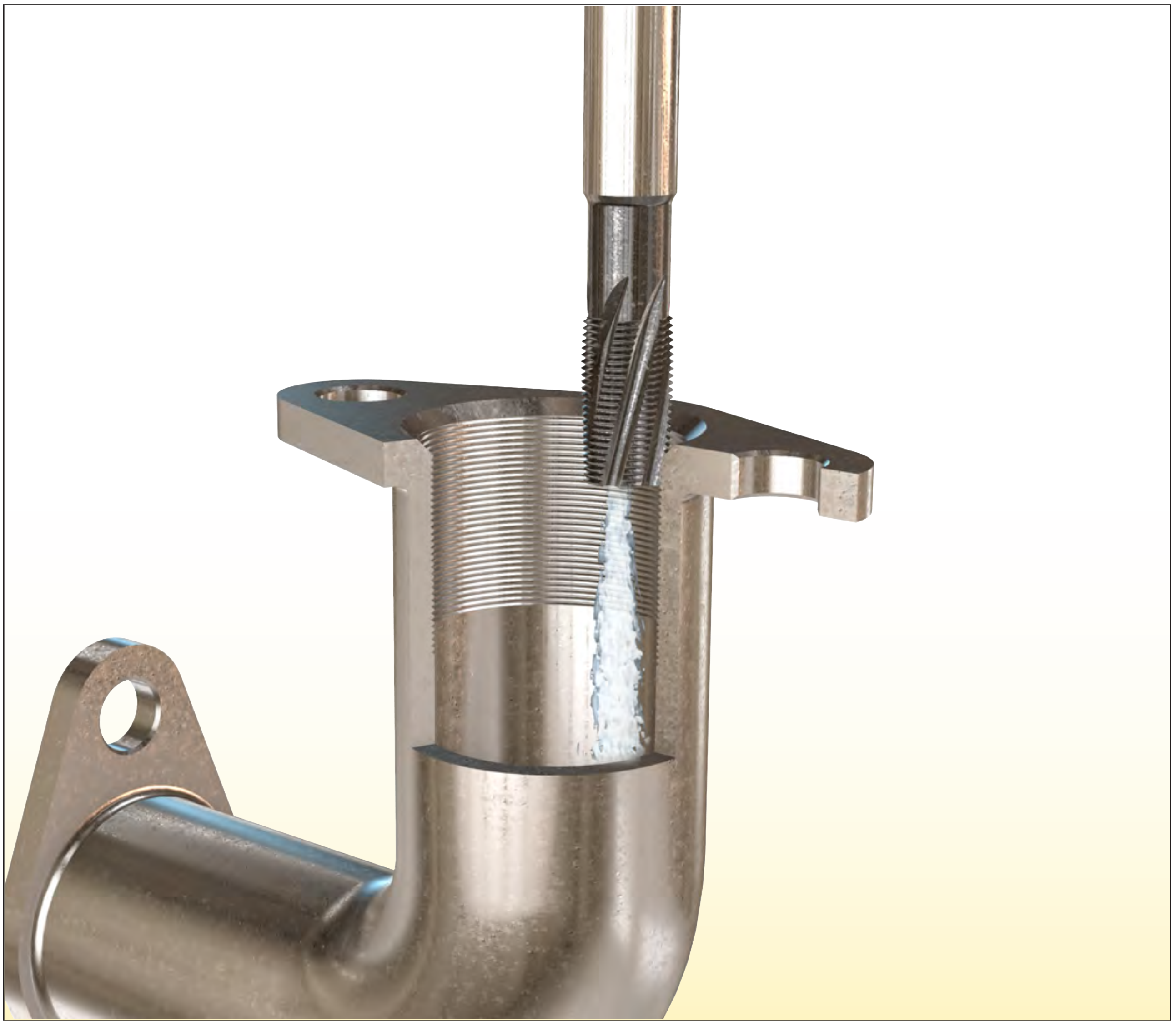
3.2.4 MTECQ



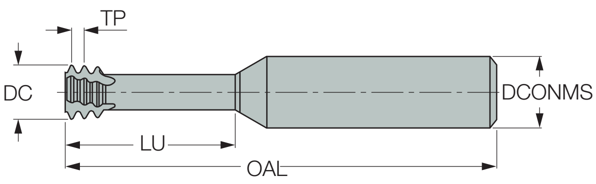
MTECQ (Mill Thread Endmills Carbide Q) Family - solid carbide thread mills with coolant hole and reduced neck diameter between the cutting zone and the shank, recommended for internal deep thread milling and can also be used for external deep thread milling.
This family can machine thread lengths up to 3.2 x DC (thread length = 3.2 x cutting diameter of endmill).

The coolant holes improve tool life in all thread milling applications. In blind holes where the chips of especially soft materials (stainless steel and high-temp alloys) tend to be re-cut and stick to the machined area, the coolant stream coming from the bottom in an upward direction flushes them out of the hole very efficiently.

MTECQ endmills are available with cutting diameters from 12 mm up to 20 mm. This line offers a solution for full profiles for ISO standard.



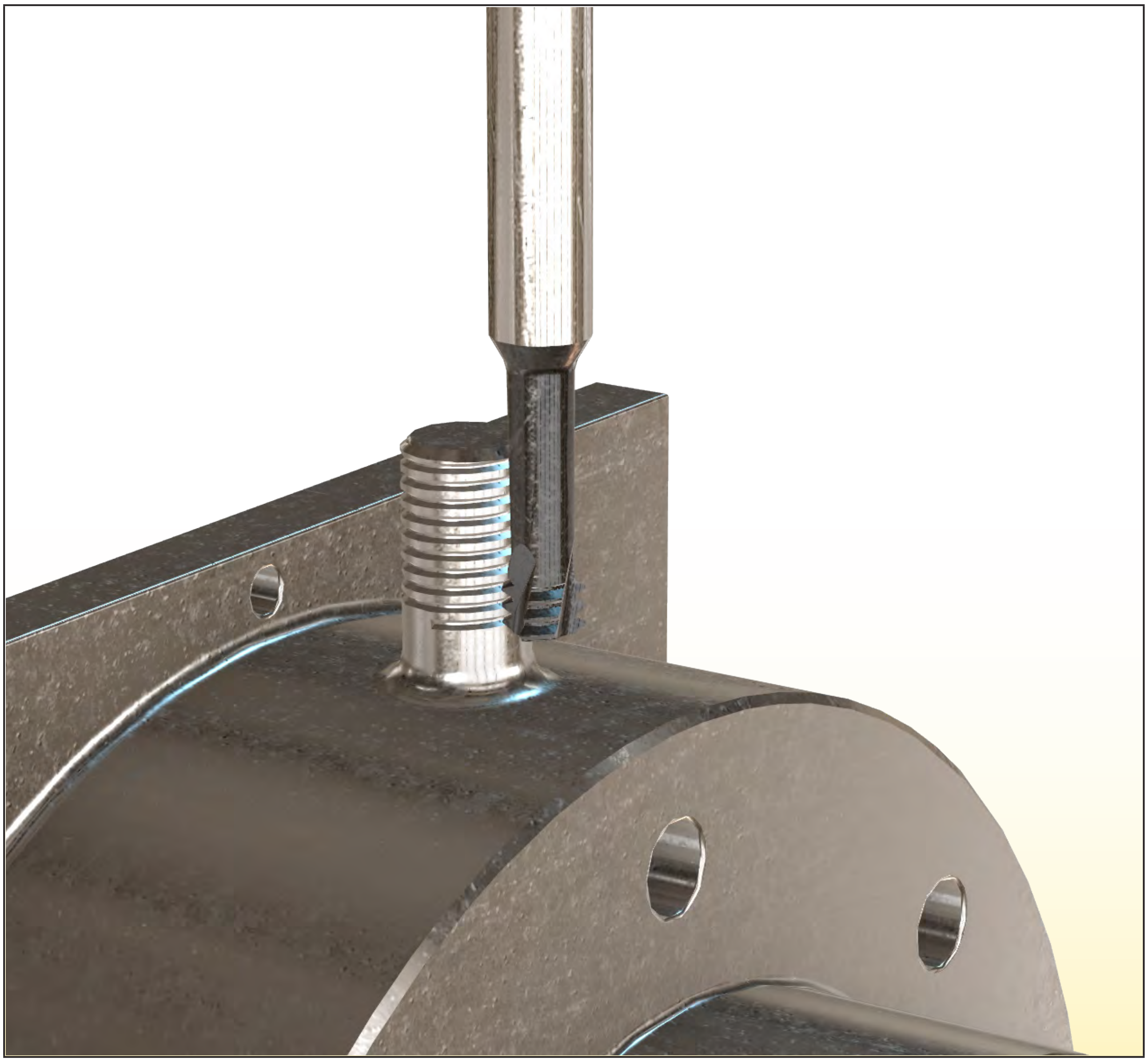
3.2.5 MTECS



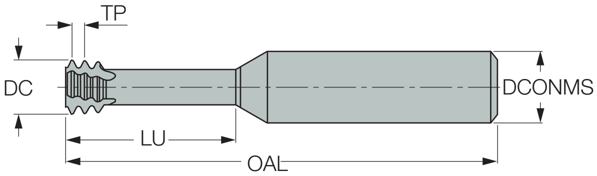
MTECS (Mill Thread Endmills Carbide Short) solid carbide thread mills for the production of small internal threads. These thread mills feature a short 3-tooth cutting zone with 3 flutes and a released neck between the cutting zone and the shank.

This unique tool design offers very precise profiles and a high performance. The very short profile exerts a low force which minimizes tool bending. This facilitates parallel and high thread precision for the entire length.

MTECS endmills are available with cutting diameters from 0.72 mm up to 12 mm by metric system or from 0.045 inch to 0.449 inch by imperial and United States customary systems. This line offers a solution for full profiles for most popular standards.



3.2.6 MTECSH

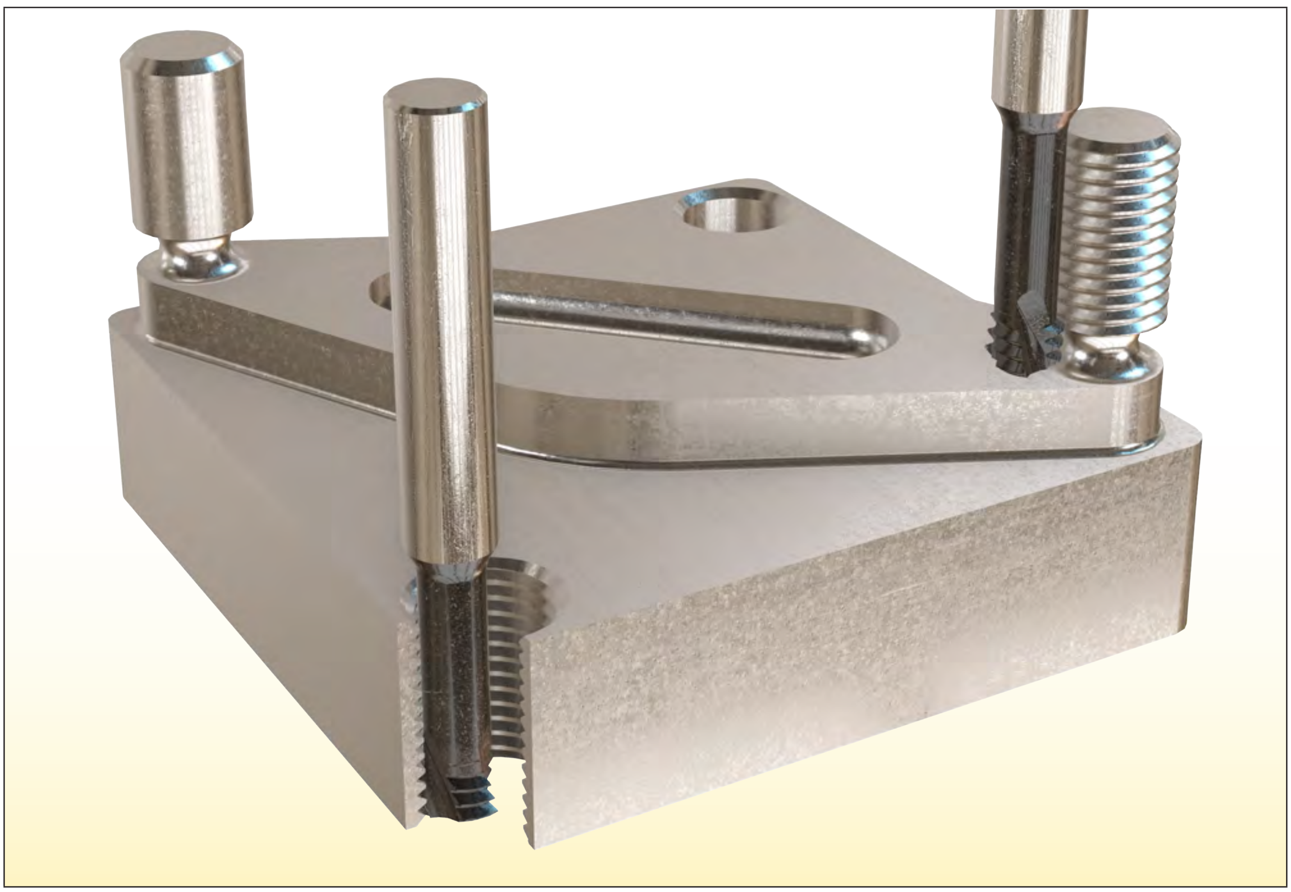


MTECSH (Mill Thread Endmills Carbide Short Hard Material) solid carbide thread mills for the production of small internal threads in hard materials. These thread mills feature a short 3-tooth cutting with 3 flutes and a released neck between the cutting zone and the shank.

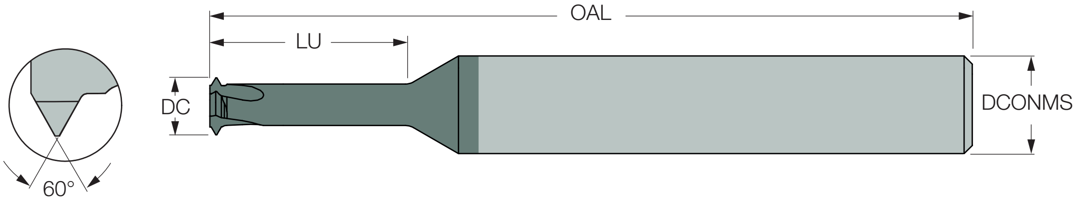
This family is suitable for machining hardened materials up to HRC 62. Apart from hardened steel, they can be used on titanium, nickel-based alloys and stainless steel at high speeds and medium feeds. The short cutting profile of the tool exerts low forces. The tools provide the possibility to machine materials with a higher tensile strength and hardness using relatively high cutting data. The tools are used for left-hand cutting, enabling climb milling, and can function well in blind holes. The same tool can be used for producing right-hand and left-hand threads.

This unique tool design offers very precise profiles and a high performance. The very short profile exerts a low force which minimizes tool bending. This facilitates parallel and high thread precision for the entire length.

MTECSH endmills are available with cutting diameters from 0.72 mm up to 12 mm by metric system or from 0.057 inch to 0.362 inch by imperial and United States customary systems. This line offers a solution for full profiles for most popular standards.



3.2.7 MTECI



MTECI (Mill Thread Endmills Carbide I) solid carbide thread mills for the production of small internal threads. These thread mills feature a Single-Point cutting head design and a released neck between the cutting zone and the shank. This family can machine Thread lengths up to 5 x DC (thread length = 5 x cutting diameter of endmill).

MTECI products are recommended for internal deep thread milling and can be used for external deep thread milling. This family can also machine threads near thin walls.

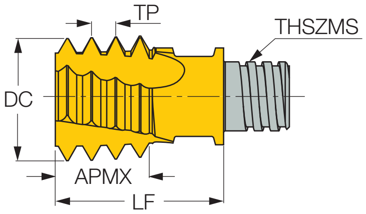
This unique tool design offers very precise profiles and a high performance. The very short profile exerts a low force which minimizes tool bending. This facilitates parallel and high thread precision for the entire length.

MTECI endmills are available with cutting diameters 0.72 mm up to 16 mm. This line offers a solution for partial profile 60° and full profiles for ISO standards.

3.3 MULTI-MASTER

- **MULTI-MASTER** is a family of tools with shanks and interchangeable cutting heads for a variety of machining applications for thread milling.
- The **MULTI-MASTER** design approach is based on a thread profile system, centered by a short precise taper and face contact.
  A **MULTI-MASTER** head has a cutting part and a back connection with external thread and taper, which screws into a shank with the corresponding internal thread and a taper, until final securing when the back face of the head cutting part makes contact with the shank face.
- This principle of coupling ensures straight and rigid clamping of a wide range of interchangeable heads. **MULTI-MASTER** tools meet the requirements of high accuracy because the geometry is finished by precise grinding and the connection guarantees high concentricity within a very close limit. In addition, the tools are simple to operate because the heads are quickly replaced by easy rotation of an applied key. Moreover, they conform to strict repeatability requirements and replacement of the heads does not require additional adjustment.
- The basic concept of the **MULTI-MASTER** Family is that a shank can carry heads of different shapes and accuracy, allowing dramatic increase of tool versatility and fewer needs for special tools. Resharpening of cutting edges is no longer needed as a worn out cutting head is simply replaced. The **MULTI-MASTER** Family provides a range of possible tools by an unlimited combination of heads and shanks, which answers to any thread making requirement and reduces procurement costs.

3.3.1 MT-…-MM



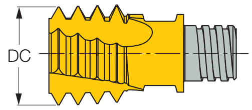
The MT-…-MM line contains solid carbide interchangeable heads with **MULTI-MASTER** connections for thread milling applications. Heads included in this line have several layers of teeth which shortens threading time. This line is available in three thread standards: ISO and UN for internal threads, and Whitworth for internal and external threads. MT-…-MM heads are suitable for machining full profile threads with different overhangs depending on the selected shank.

MT-...-MM – Designation Code Key

MT	10	D	6	1.5	ISO	-	MM	T05	IC908
	1	2	3	4	5			6	7

MT - **MULTI-MASTER** Thread Mill

1 Cutting diameter (Dc)



2 No. of flutes

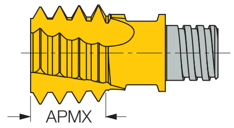
C — 3 flutes

D — 4 flutes

E — 5 flutes

F — 6 flutes

3 Length of thread (APMX)



4 Thread pitch

Value by number

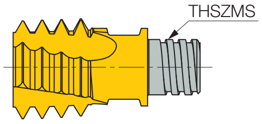
- For metric threading in mm
- For inch threading in TPI

5 Thread standard

ISO — ISO Metric UN - American UN

W — Whitworth

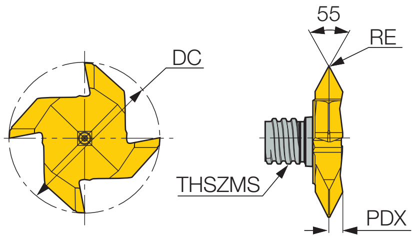
6 Connection size



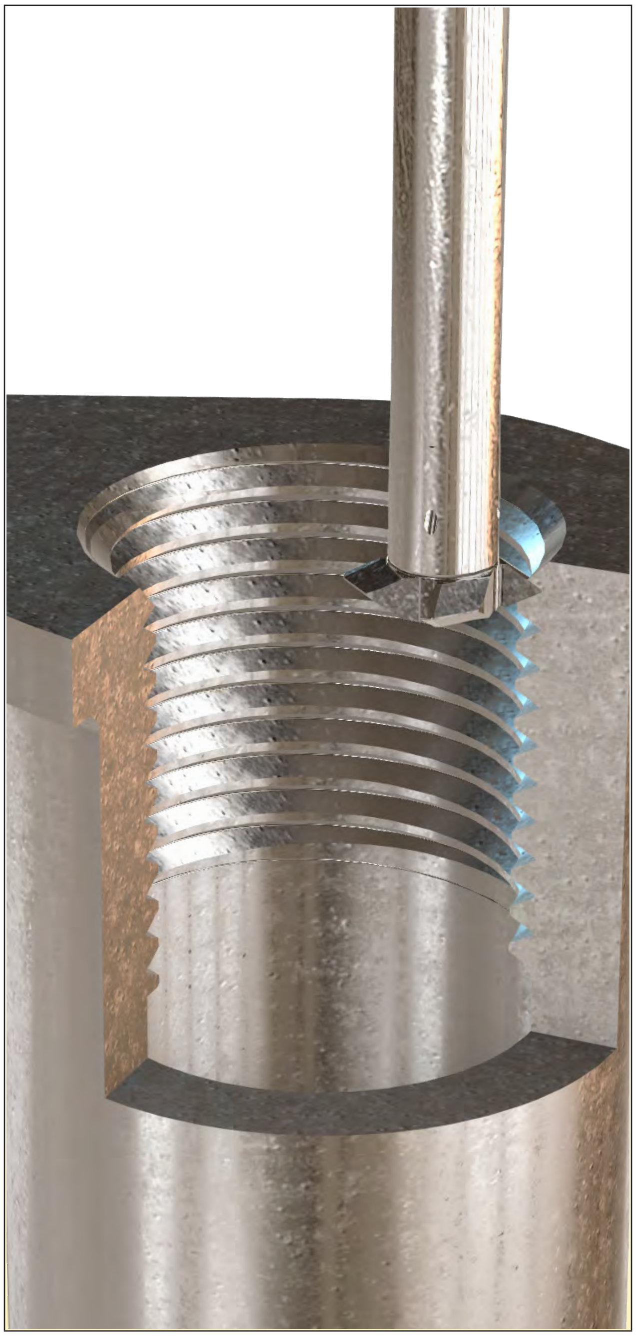
7 Grade

IC908

3.3.2 MM TRD



The MT TRD line contains solid carbide interchangeable heads with **MULTI-MASTER** connection for thread milling applications. Heads included in this line feature a Single-Point cutting head design. MT TRD heads are suitable for machining external and internal threads with different overhangs depending on the selected shank. This family can also machine threads near thin walls and offers a solution for partial profiles of 55° and 60°.

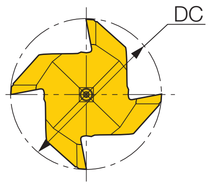


MM TRD – Designation Code Key

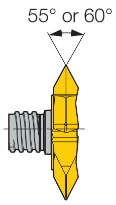
MM	TRD	16	-	M60	-	15P	3	T06	IC528
		1		2		3	4	5	6

MM - **MULTI-MASTER**
TRD – Thread Mill Diameter

1 Cutting diameter (DC)



2 Profile angle



W55 — 55°

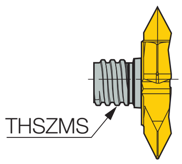
M60 — 60°

3 Thread pitch value by number

- For metric threading in mm
- For inch threading in TPI

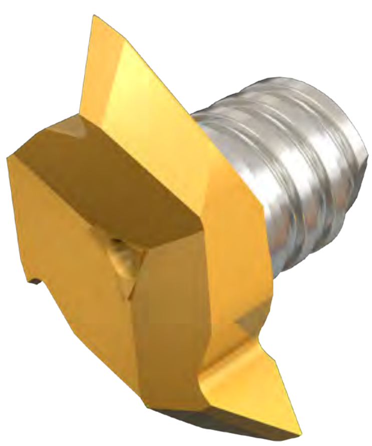
4 No. of flutes value by number

5 Connection size



6 Grade

IC528



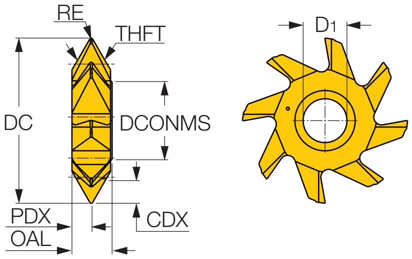
3.4 T-SLOT

The **T-SLOT** family includes interchangeable cutting heads for thread milling applications. The cutters consist of solid carbide heads and cylindrical steel or solid carbide shanks by means of a unique spline connection. Also available is an adapter with the SP spline connection on one side and **MULTI-MASTER** threaded connection on the other side, which enables using all standard **MULTI-MASTER** shanks.

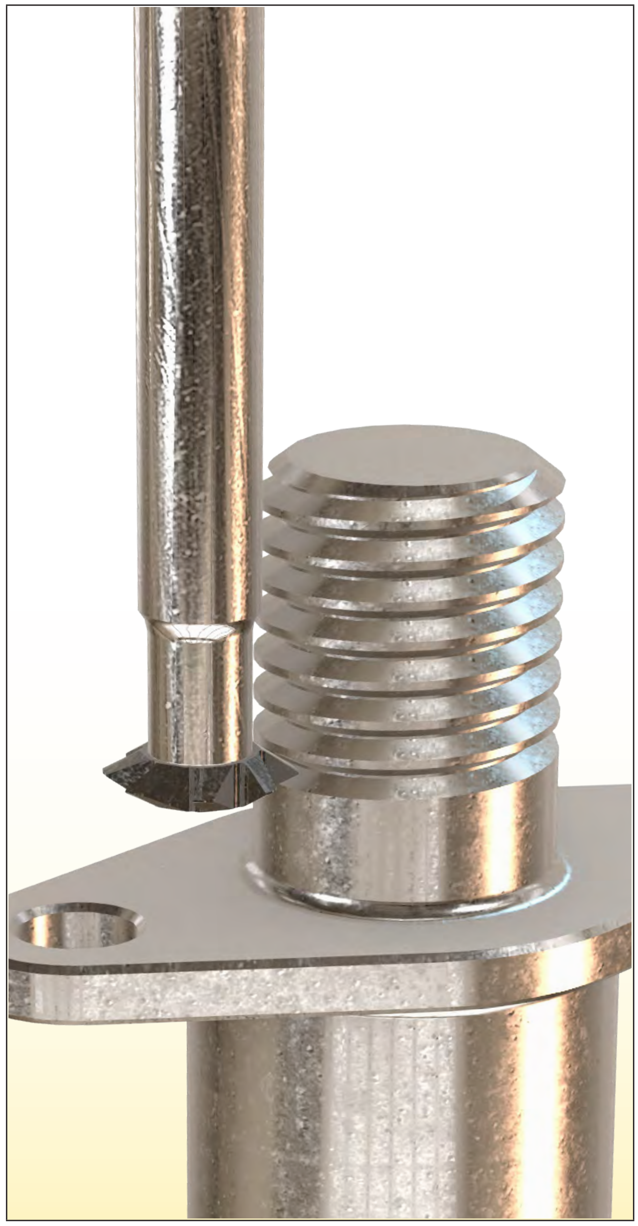
SD TRD Solid Carbide Head with MULTI-MASTER Shanks	SD TRD Solid Carbide Head with Cylindrical SD Shanks
	

The spline connection is used to transmit the torque in the best way. It ensures very durable assembly to withstand cutting forces during thread milling and bending forces caused by long reach overhang.

3.4.1 SD TRD



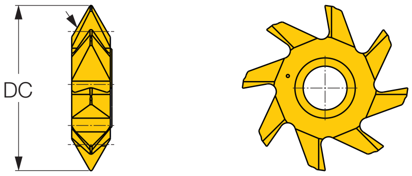
The SD TRD line contains solid carbide heads with 10 effective teeth for a 40 mm (1.563 inch) cutting head diameter and 8 effective teeth for a 32 mm (1.248 inch) cutting head diameter. This line enables a reduction in cutting time by increasing feed due to the large number of effective teeth. The cutter heads feature an internal spline mounted on a matching external spline on the shank, secured by a central screw. SD TRD heads are used for machining external and internal threads with different overhangs depending on the selected shank. This line offers a solution for partial profiles of 55° and 60°.



SD TRD – Designation Code Key

SD	TRD	32	-	M60	-	6P	-	SP15	IC908
		1		2		3		4	5

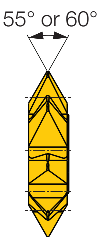
1 Cutting diameter (DC)



2 Profile angle

W55 — 55°

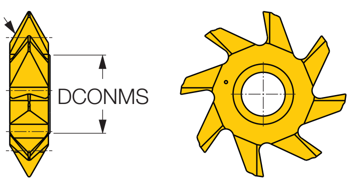
M60 — 60°



3 Thread pitch value by number

- For metric threading in mm
- For inch threading in TPI

4 Connection size



5 Grade

IC908

3.5 MILLTHREAD – Indexable Solution

The **MILLTHREAD** is an indexable solution for thread milling applications.
The main features of this indexable solution are cost effectiveness and functionality.

All advantages of indexable solution are known and proven themselves over time.

The **MILLTHREAD** family includes 5 lines of indexable cutters:

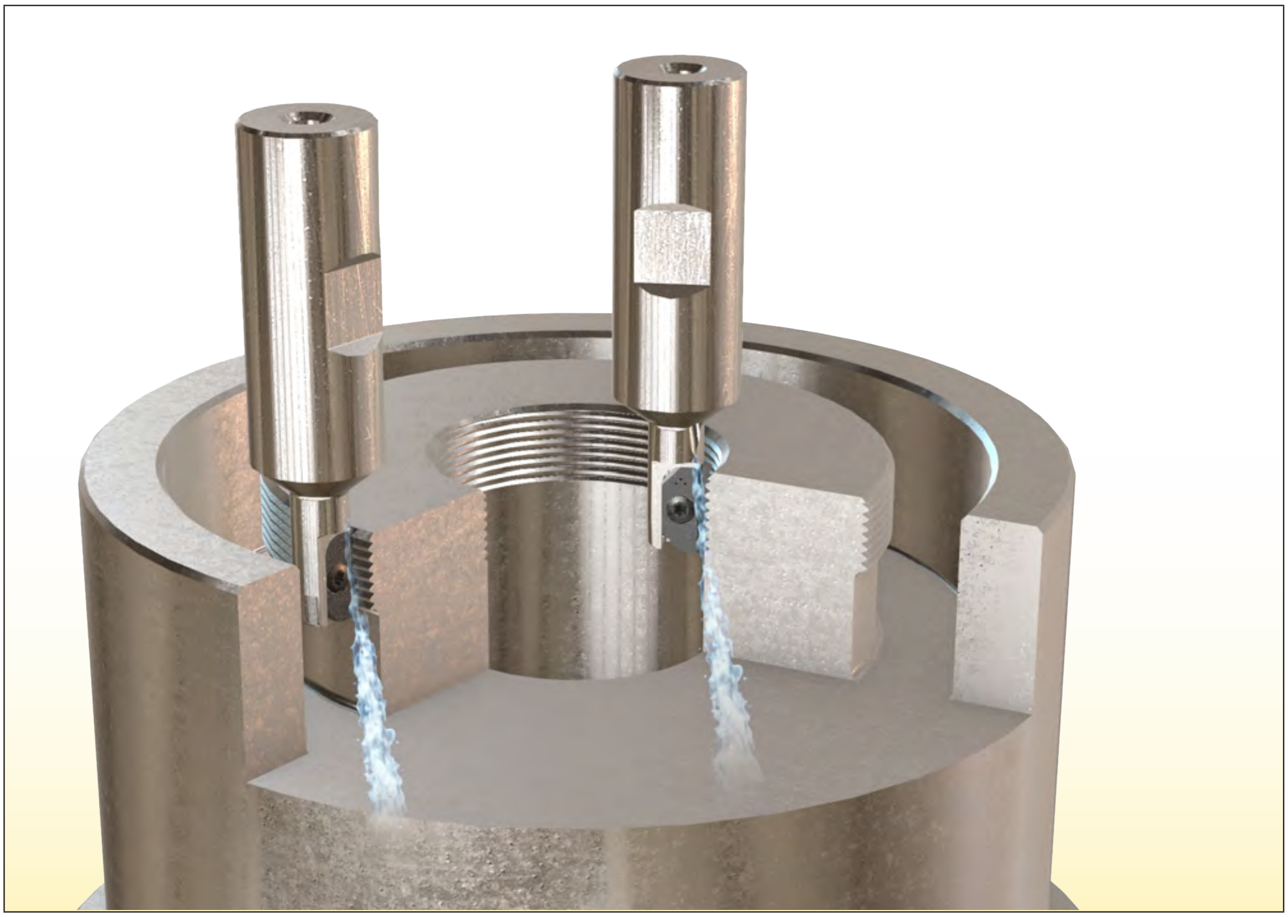
MTE, MTF, MTFLE, MTSRH, MTSRH (shell mill). Each line contains toolholders and indexable inserts. All toolholders have internal coolant, accurate pocket for insert position and a user-friendly clamping mechanism. **ISCAR** offers a wide range of inserts for the most popular thread standards, which can produce threads in different materials.
The **MILLTHREAD** family lines offer a solution for internal and external, right-hand and left-hand threading.

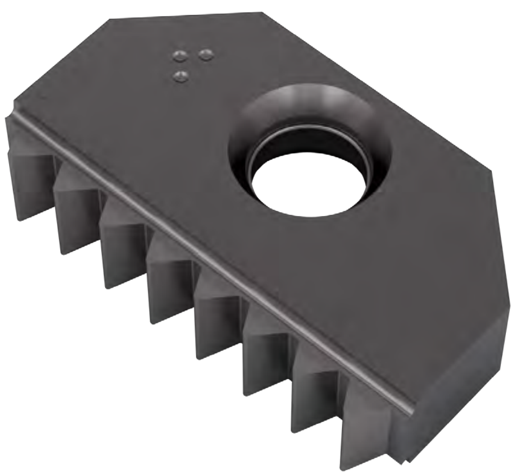
3.5.1 MTE and MTF – Endmill and Shell Mill for Indexable Inserts

Endmill (MTE) and shell mill (MTF) are tools for indexable inserts used for thread milling applications. These tools can mount various thread inserts with different profiles, meaning that one tool is suitable for production of a wide range of thread standards. The same tool can be used for production of external and internal, right-hand and left-hand threads. All tools in this line have internal coolant directed to the cutting area.

Endmill MTE Type

MTE endmills can be produced from steel or solid carbide.
The solid carbide shanks expand the current overhang range and provide improved performance due to their high rigidity feature.



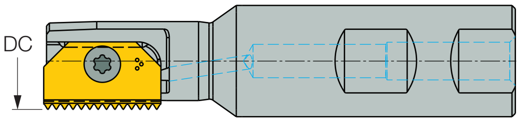


MTE – Designation Code Key:

MTE	D09.5	-	1	-	W	20	-	12
	1		2		3	4		5

MTE – endmills for indexable inserts

1 Cutting diameter (DC)



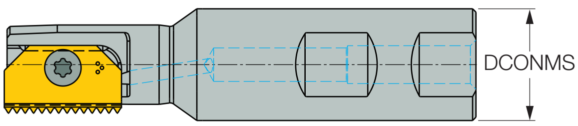
2 Number of flutes

3 Shank type

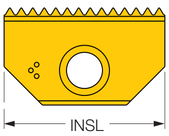
C — Cylindrical shank

W — Weldon shank

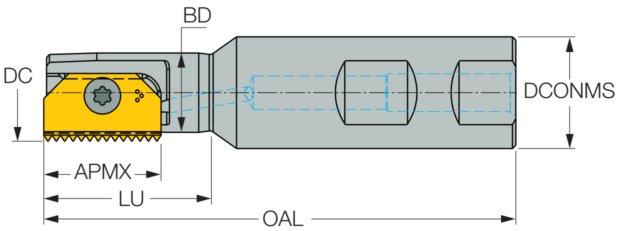
4 Shank diameter (DCONMS)



5 Insert size (INSL)



Basic Dimensions of MTE Tools:



DC — Cutting diameter

APMX — Maximum depth of cut

OAL — Overall length

DCONMS — Connection diameter machine size

LU — Usable length

BD — Body diameter

Endmill MTF Type

MTF shell mills are recommended for large thread diameters.

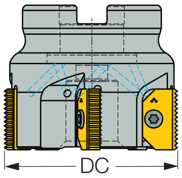
This type of tool is suitable for thread production with long overhang. The pockets for inserts are produced with high accuracy and uniformity, meaning there is no need to select or adjust inserts for thread milling operations. MTF tools are mounted on standard shell mill adapters.

MTF – Designation Code Key:

MTF	D080	-	4	-	27	-	30
	1		2		3		4

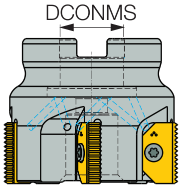
MTF – shell mills for indexable inserts

1 Cutting diameter (DC)

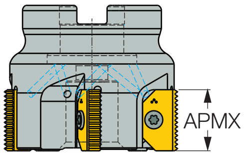


2 Number of flutes

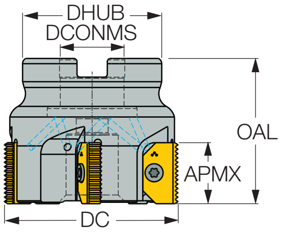
3 Connection diameter (DCONMS)



4 Depth of cut (APMX)



Basic Dimensions of MTE Tools:



DC — Cutting diameter

APMX — Maximum depth of cut

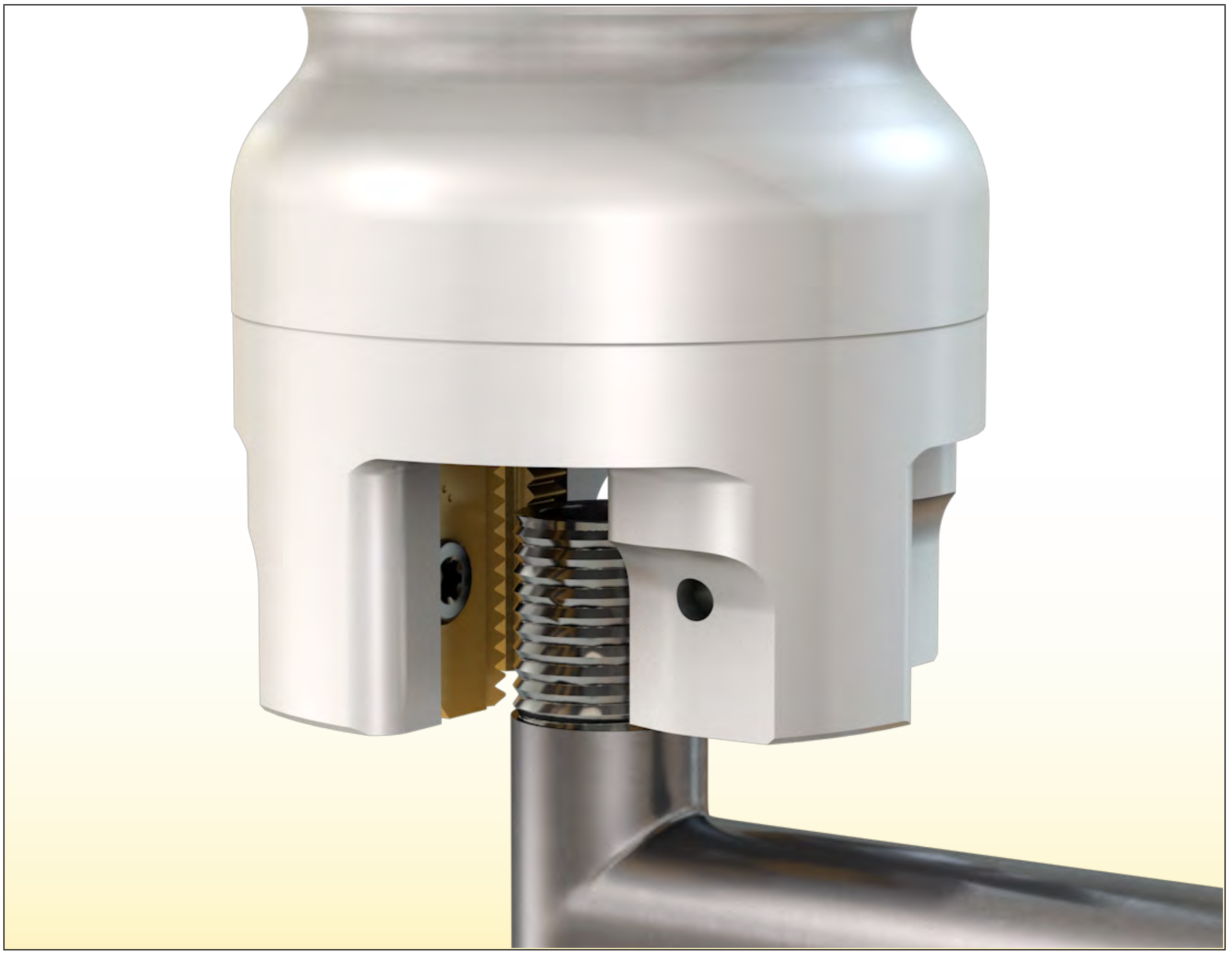
OAL — Overall length

DCONMS — Connection diameter machine size

DHUB — Flange diameter

3.5.2 MTFLE– Shell Mill for Indexable Inserts

MTFLE is a multi-tooth shell mill toolholder with indexable inserts used for thread milling applications of external threads. These tools can mount various thread inserts with different profiles, meaning that one tool is suitable for production of a wide range of thread standards. The same tool can be used for producing right-hand and left-hand threads. All MTFLE tools have internal coolant directed to the cutting area. This type of tool is suitable for thread production with long overhang.
The pockets for inserts are produced with high accuracy and uniformity, meaning there is no need to select or adjust inserts for thread milling operations. MTFLE tools are mounted on standard shell mill adapters. The MTFLE tool design with a multi-tooth insert position enables a significant reduction in thread production time.

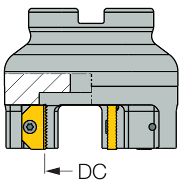


MTFLE – Designation Code Key:

MTFLE	D20	-	3	-	22	-	21
	1		2		3		4

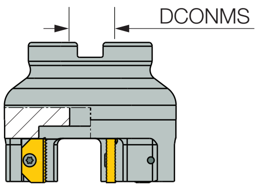
MTFLE - shell mills for indexable inserts for external threading

1 **Cutting diameter (DC)**

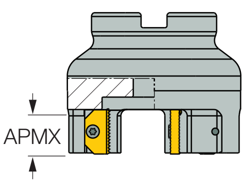


2 **Number of flutes**

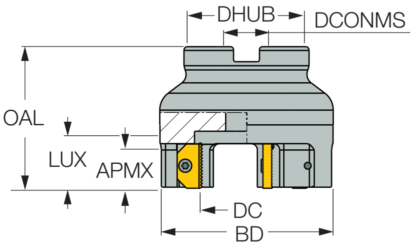
3 **Connection diameter (DCONMS)**



4 **Depth of cut (APMX)**



Basic Dimensions of MTE Tools:



DC — Cutting diameter

APMX — Maximum depth of cut

OAL — Overall length

DCONMS — Connection diameter machine size

DHUB — Flange diameter

LUX — Maximum usable length

3.5.3 MTSRH – Endmill and Shell Mill for Helical Indexable Inserts

Endmills and shell mills for helical indexable inserts (27-38 mm) are the ultimate solution for very fast and efficient thread milling. The helical inserts engage with the workpiece smoothly and, when compared with straight, negative axial tools, exert lower cutting forces and reduce vibration.

MTSRH tools are available with internal coolant channels directed to the cutting area. These tools can be used for production of internal and external threading. The tools carry up to 9 inserts depending on the tool diameter, which enables machining at very high feeds and produces a high-quality surface finish.

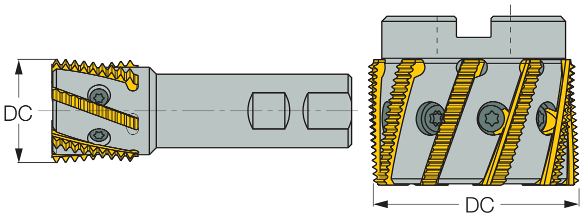
A simple and very convenient screw clamping mechanism makes insert indexing accurate and user-friendly. By using these thread milling tools, thread production time can be very short.

MTSRH – Designation Code Key:

MTSRH	45	-	6
	1		2

MTSRH – endmills and shell mills for helical indexable inserts

1 **Cutting diameter (DC)**



2 **Number of flutes**

Basic Dimensions of MTSRH Tools:

DC — Cutting diameter
APMX — Maximum depth of cut
OAL — Overall length
DCONMS — Connection diameter machine size
LU — Usable length
DHUB — Hub diameter

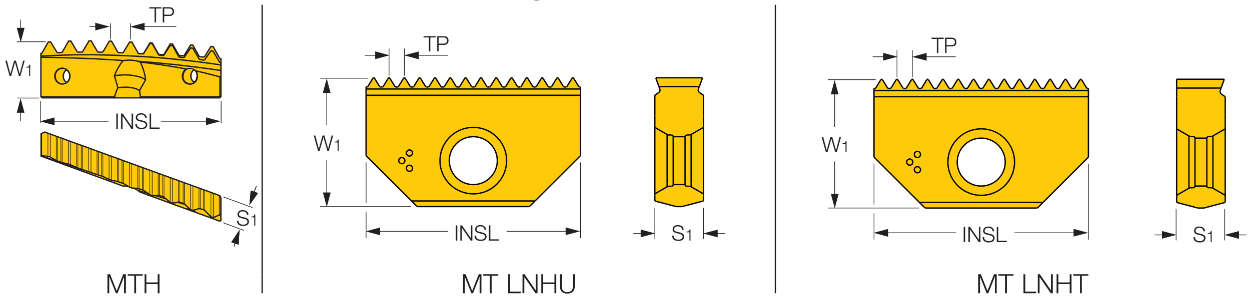
3.5.4 Indexable Inserts for Thread Milling

Indexable inserts for thread milling are available for production of internal and external, and right and left-hand full profile threads in most popular standards. These inserts have a deflector that provides excellent chip control and ground profiles to achieve high accuracy and surface quality. The thread milling inserts are made from grade IC908, which is a PVD TiAlN coated tough grade. They are suitable for milling stainless steel, high temperature alloys and other alloy steels. **ISCAR** offers three types of indexable thread milling inserts:

- MT LNHT – single-sided indexable thread milling inserts
- MT LNHU – double-sided indexable thread milling inserts
- MTH – helical indexable thread milling inserts. These inserts may also be used for high shoulder finish milling applications or for machining various specially tailored profiles

ISCAR can also provide special profile inserts on request

Basic Dimensions of Thread Milling Inserts:



W1 — Insert width

TP — Thread pitch

INSL — Insert length

S1 — Insert thickness

MT LNHT and MT LNHU – Designation Code Key:

MT	LNHU	21	04	I	1.5	ISO	IC908
	1	2	3	4	5	6	7

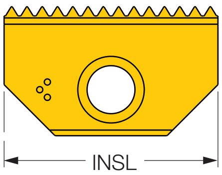
MT – **MILLTHREAD** family

1 Number of cutting edges

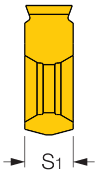
LNHT — Single-sided

LNHU — Double-sided

2 Insert length (INSL)



3 Insert thickness (S1)



4 Thread gender

I — Internal thread

E — External thread

5 Pitch Value by number:

1.0 – 6.0 mm

4 - 32 TPI

6 Thread standard

ISO — ISO Metric

UN — American UN

W — Whitworth

BSPT — British BSPT

NPT — National pipe thread

NPTF — National pipe taper fuel

7 Grade

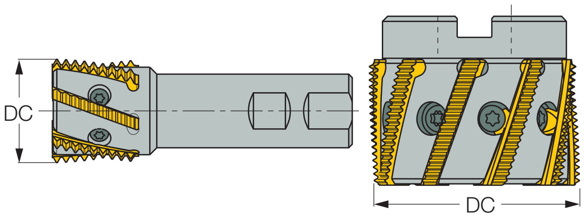
IC908

MTH – Designation Code Key:

MTH	45	I	1.5	ISO	IC908
	1	2	3	4	5

MTH – **MILLTHREAD**, helical indexable inserts

1 Tool cutting diameter (DC)



2 Thread gender

I — Internal thread

E — External thread

3 Pitch Value by number:

1.0 – 6.0 mm

4 - 32 TPI

4 Thread standard

ISO — ISO Metric

UN — American UN

W — Whitworth

BSPT — British BSPT

NPT — National pipe thread

NPTF — National pipe taper fuel

5 Grade

IC908

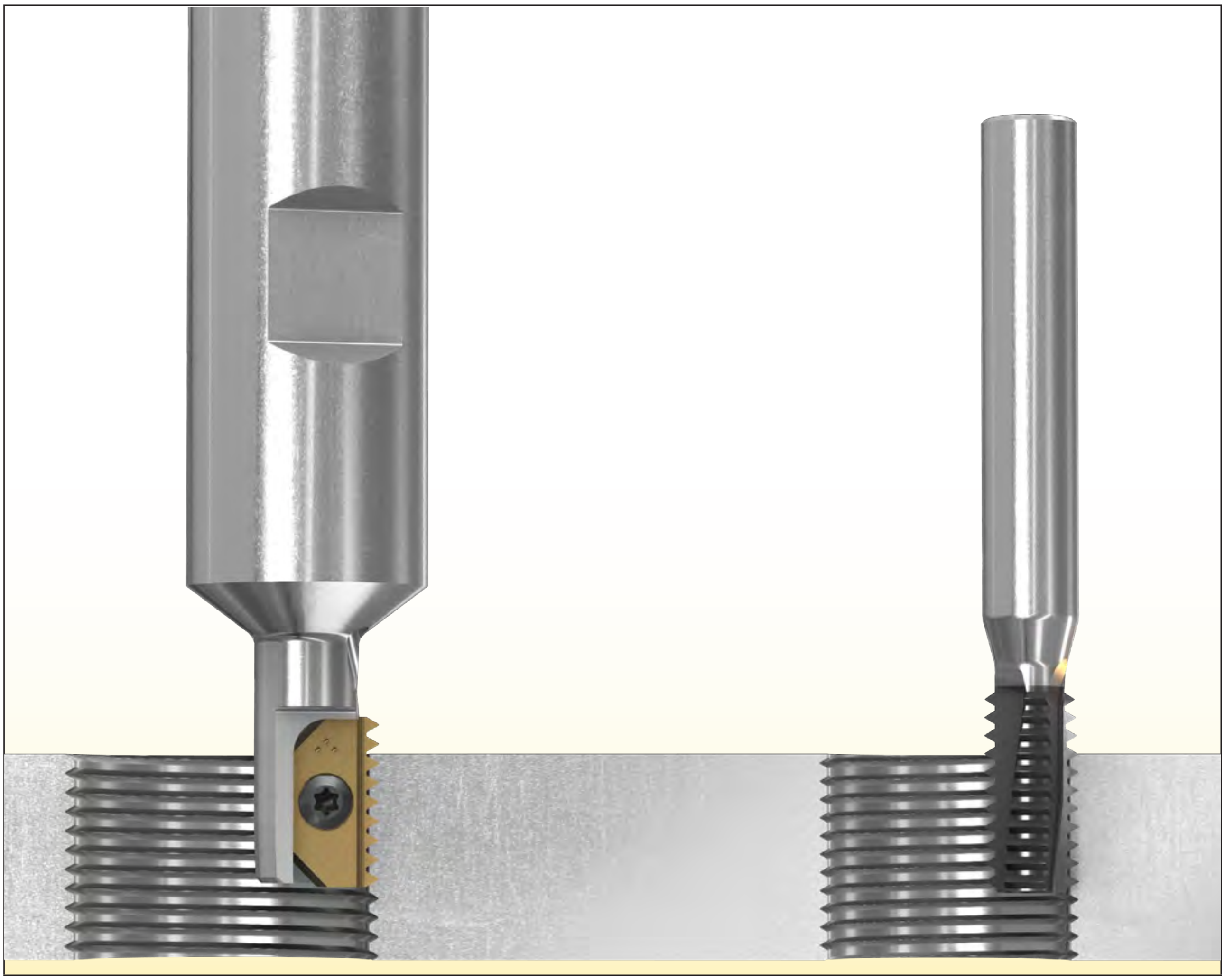
3.6 Indexable Thread Milling Tools vs. Solid Tools

The range of capabilities of thread milling tools can be increased significantly by using indexable inserts. The indexable inserts can be made of various alloys. Selection of a suitable insert depends on a variety of factors: cutting parameters, thread form, and the type of cutting material. Indexable inserts are characterized by the following advantages:

- Quick change of cutting edge - If the cutting edge is damaged or worn, it is not necessary to replace the whole tool, but just the cutting part (insert).
- Wide range of capabilities - By changing inserts, a variety of threads in various materials can be produced using one tool only.
- Low cost – Using inserts can significantly reduce costs since the insert is cheaper than a solid tool.

Solid tools are advantageous when it comes to small tools. The main advantages of solid tools include:

- More productivity - The number of cutting edges that can be placed in solid tools for small and medium diameters is greater than the number of inserts that can be mounted in small and medium tools, which causes higher productivity.
- Internal threads in small diameters – Internal threading in small diameters (less than Ø9.5) is not possible with indexable inserts, but only with solid tools.



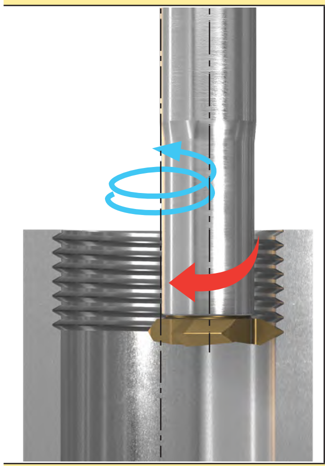
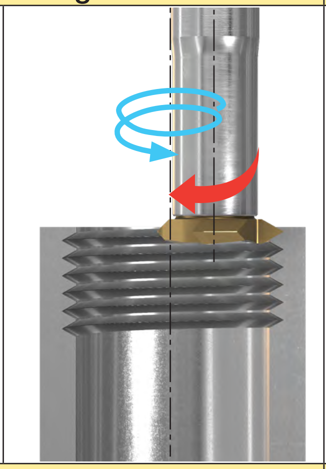
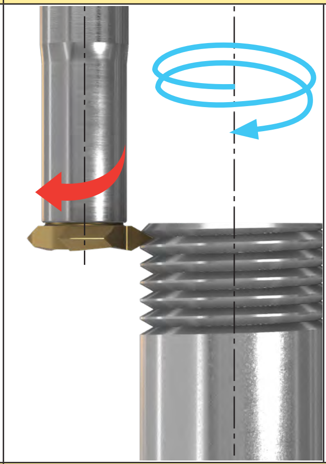
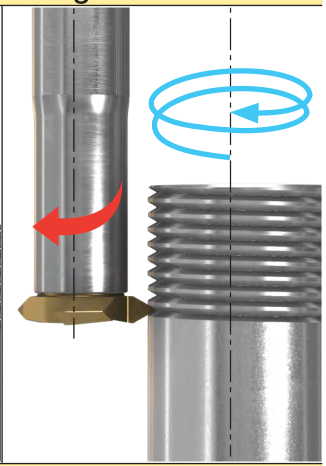
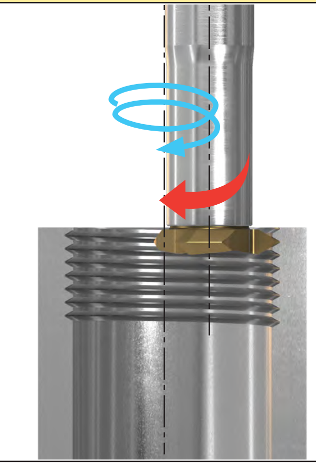
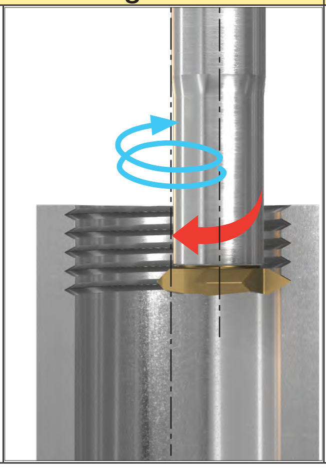
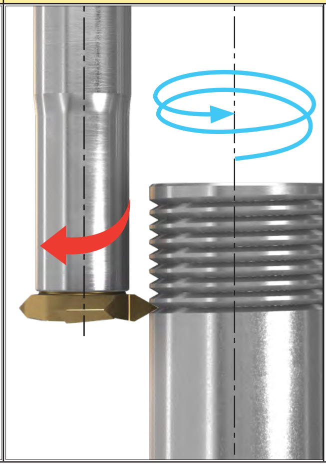
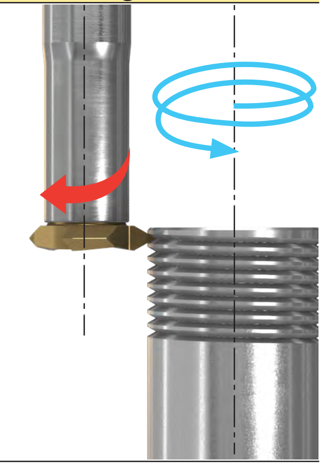
3.7 Straight vs. Helical Cutting Shape

The table below describes the differences between the use of tools with helical cutting edges and tools with straight cutting edges.

Straight Cutting Edges	Helical Cutting Edges
	
• Radial cutting forces act on a plane. • The same size inserts can fit to several cutter diameters. • Double-sided inserts - available inserts with two cutting edges	• Radial cutting forces are distributed along a helical curve. • Each insert size is dedicated to a specific cutter diameter. • Single-sided inserts - available inserts with one cutting edge only. • Reduces vibration

3.8 Thread Milling Methods

There are several methods used for thread milling operations. The cutter usually rotates clockwise, except in special cases where the tool rotates counterclockwise. The spiral movement of the cutter can be clockwise or counterclockwise, and the tool can produce a thread by top-down or bottom-up. The combination of these movements depends on the type of thread required to produce; left-hand or right-hand threads.

Internal		External	
Right-Hand Threading	Left-Hand Threading	Right-Hand Threading	Left-Hand Threading
Climb Milling		Climb Milling	
			
Conventional Milling		Conventional Milling	
			

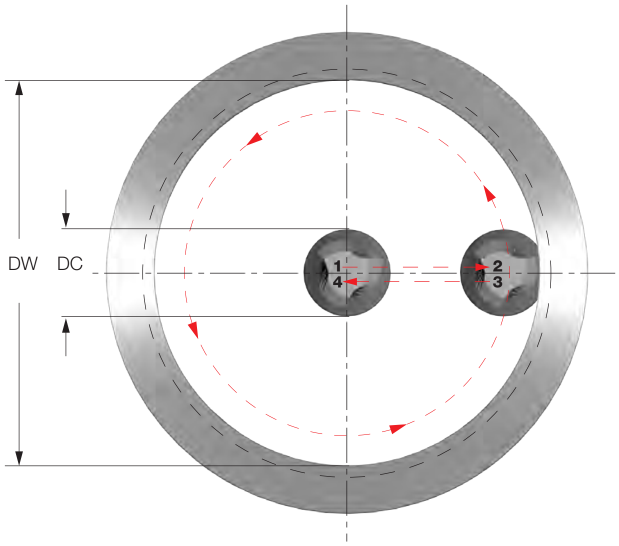
3.9 Entering the Workpiece

A sudden load is applied to the cutter when it enters the workpiece and as a result the cutter may be broken, or a mark will remain. If entering is smooth, then the load on the tool will increase gradually and the surface will remain "clean". There are three ways to initially enter the workpiece: radial entering, tangential entering by arc, tangential entering by line.

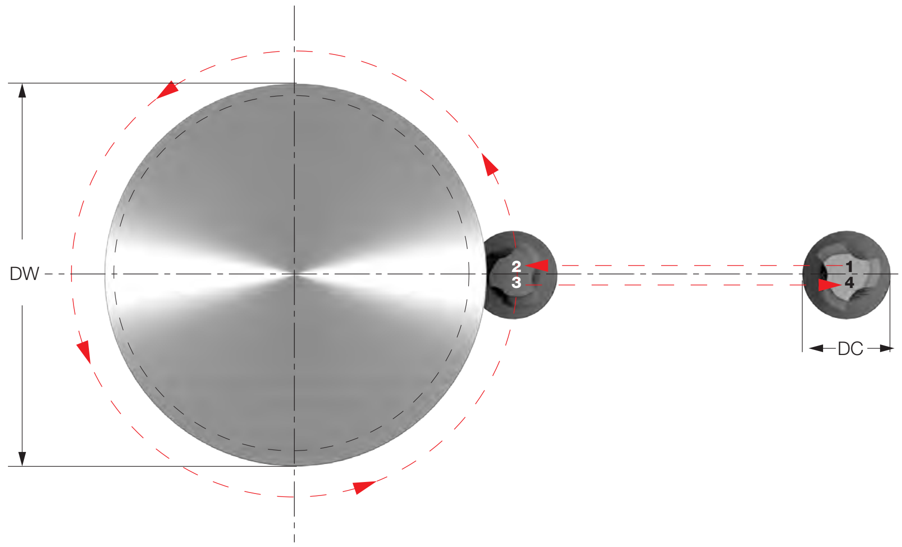
Radial Entering

The cutter enters the workpiece in a straight line to the center workpiece axis.
This is the simplest method, but also the least recommended, because the angle of the hugging is too large.

Internal Threading



External Threading

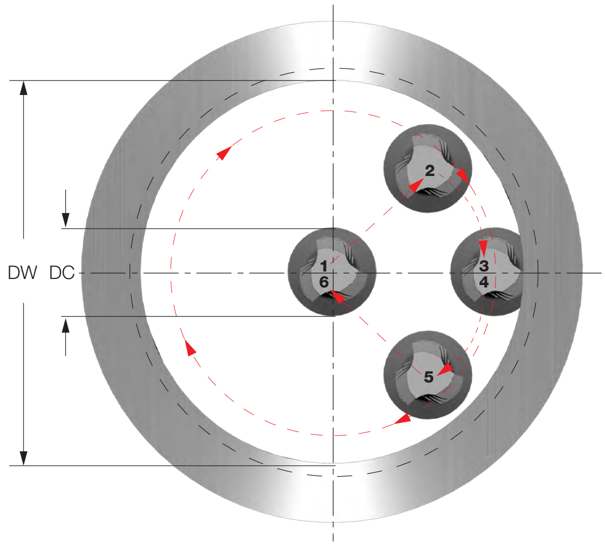


DW - Workpiece diameter
DC - Cutter Diameter
1-2: Straight line entry
2-3: Helical movement during one full orbit (360°)
3-4: Straight line exit

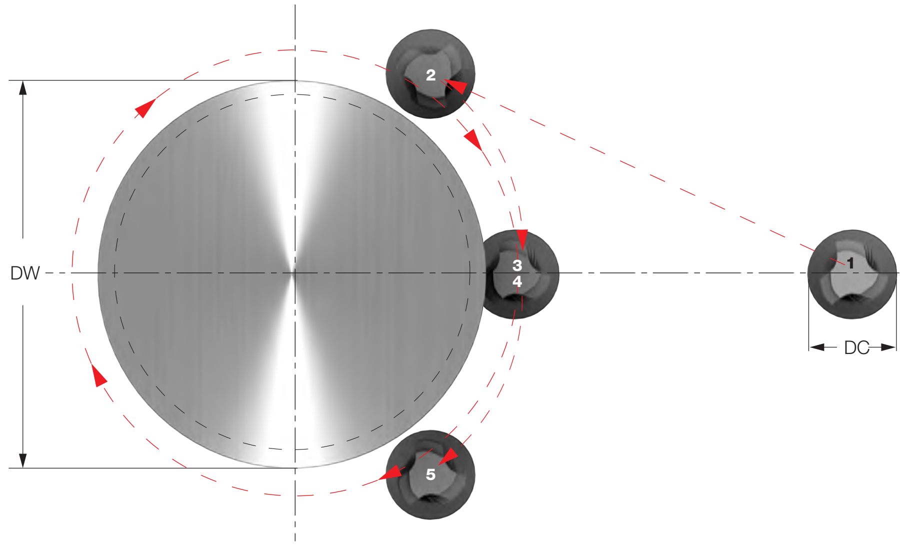
Tangential Entering by arc (Recommended)

The tool enters the material in an arc movement, and at the end of the thread the tool also extends in an arc movement from the material. This method is recommended because the cutter gradually enters the material and the load on the tool increases gradually.

Internal Threading



External Threading

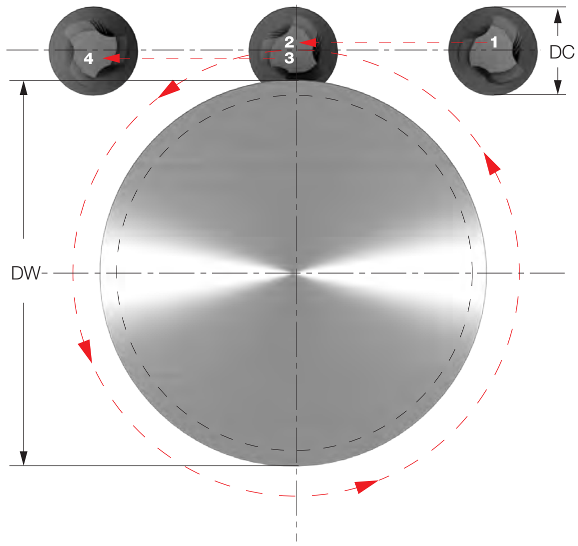


DW - Workpiece diameter
DC - Cutter Diameter
1-2: Rapid approach
2-3: Tangential entry by arc
3-4: Helical movement during one full orbit (360°)
4-5: Tangential exit by arc
5-6: Rapid return

Tangential Entering by Line

This method is very simple, with all the advantages of the tangential entering by arc method, but is used only for external threading.

External Threading



DW - Workpiece diameter
DC - Cutter Diameter
1-2: Tangential line entry
2-3: Helical movement during one full orbit (360°)
3-4: Tangential line exit

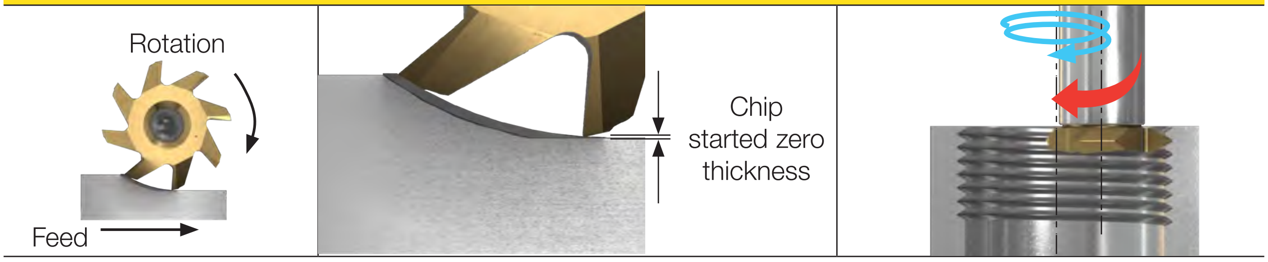
3.10 Climb Milling vs. Conventional Milling

There are two milling methods that also apply to thread milling: conventional milling (up milling) and climb milling (down milling). The difference between the two methods lies in the relationship of cutter rotational direction relative to the feeding direction.

Conventional Milling (Up Milling)

Cutter rotation direction is against feed direction. The thickness of a chip increases as the tooth of the cutter enters the material and reaches its maximal size when the same tooth of the cutter exits the material. This method causes heat to be generated in the cut area and a sudden heavy load on the cutter in initial contact of the tooth with the workpiece. As a result, wear is faster and tool life decreases significantly. Chips are carried upward by the tooth and fall in front of the cutter creating a flawed finish and re-cutting of chips.

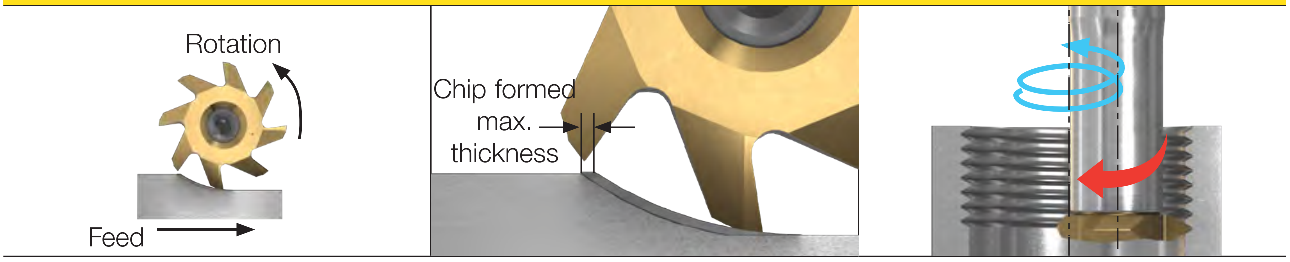
Convetional Milling



Climb Milling (Down Milling)

cutter direction is the same as feed direction.
Climb milling is a recommended method for all milling applications. The thickness of the chip starts from maximum and decreases, so heat is more likely to be transferred to the chip and not to the cutter. As a result, wear is slower and tool life increased. Chips are removed behind the cutter, which reduces the chance of re-cutting. In this way the machined surface stays clean and smooth.

Climb Milling



When to Choose Conventional or Climb Milling?

Climb milling in most cases is the preferred way for machining threads due to a lower load on the cutter, longer tool life, and better surface finish.
During conventional milling, the cutter can dig into the workpiece and may cause the part to be machined out of the tolerance. However, there are cases in which conventional milling is the preferable way and even necessary. If the machine does not counteract backlash, then conventional milling is recommended. In addition, conventional milling is preferable for machining cast iron or hardened materials (as the cut begins under the surface of the material).

3.11 Selecting Endmill Outer Diameter for Best Effect

A thread milling endmill is designed with annular cutting edges without helix angles. Thread milling is performed when the axis of the cutter and the axis of thread direction are parallel to each other. An incompatibility in the direction of the cutting edges with the threading direction causes geometrical distortions during thread machining. The geometrical distortion of the thread profile increases as the thread pitch increases and the endmill diameter increases, which can be explained by an increase in the contact angle of the endmill with the workpiece. Therefore, if the endmill diameter is smaller, then the thread profile is more accurate.

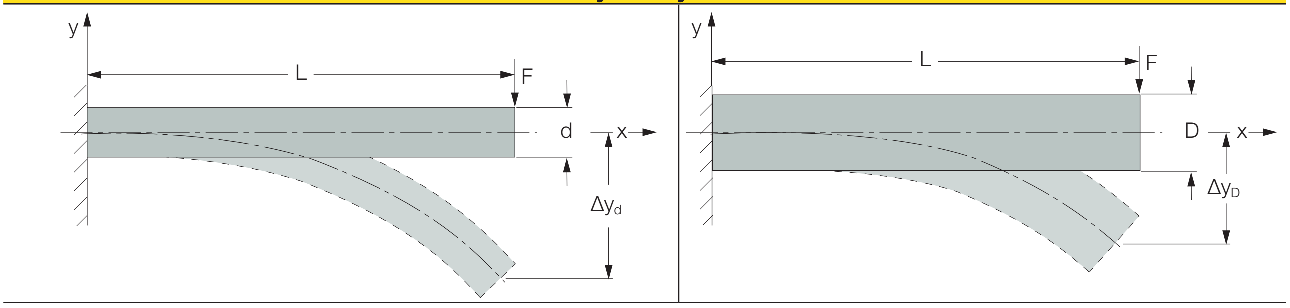
Small Tool Diameter	Large Tool Diameter

At the same time, a larger endmill diameter usually causes bending stiffness and this enables a more stable machining process such as: thread milling with high overhang, better resistance to vibrations, etc. A large tool diameter can significantly improve productivity as it allows machining with hard cutting conditions.

Accordingly, to improve the thread milling process it is necessary to increase the diameter of the tool while taking into consideration the restrictions of the thread profile accuracy.

$d < D$

$\Delta y_d > \Delta y_D$



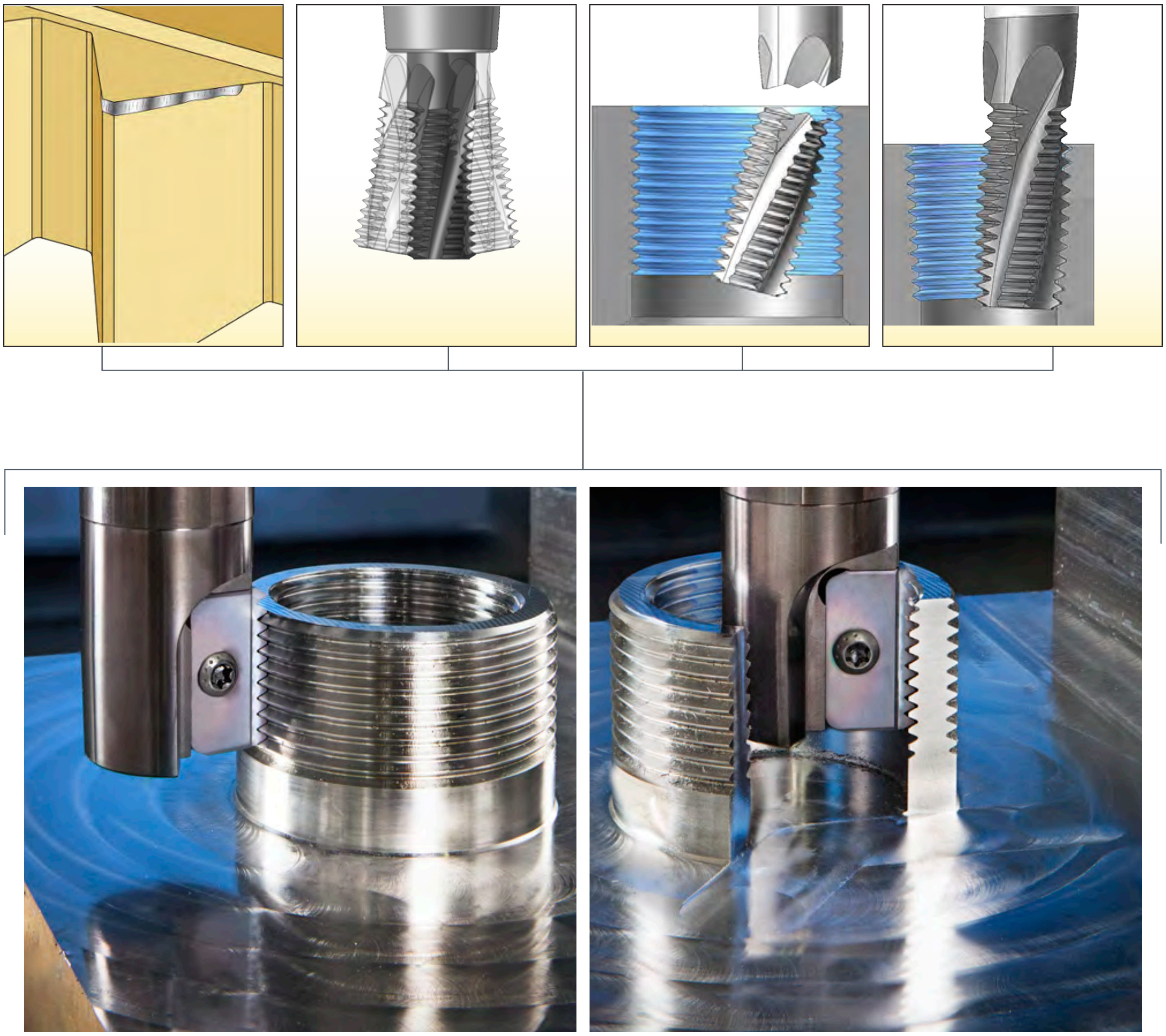
L- Tool overhang
F-Bending force
D;d=Tool diameters
Δy=max. deflection in bending

Based on the analysis performed of selecting initial outer diameter of the endmill, the following conclusions can be assumed:

- For internal thread milling, in most cases the initial endmill diameter is recommended to be up to 70% of the thread major diameter.
- For external thread milling, in most cases the initial endmill diameter can be over 70% of the thread major diameter.

3.12 Depth per Pass and Number of Radial Passes

The parameters of depth per pass and number of passes have a very important role in thread production. These parameters have a direct effect on cutting edge wear, tool life, thread surface quality, and thread production stability. The depth per pass and number of passes parameters depend on the type of equipment, tool overhang, machine stability, workpiece material, cutter geometry and the thread depth required.



Number of Radial Passes

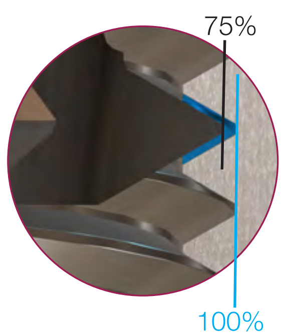
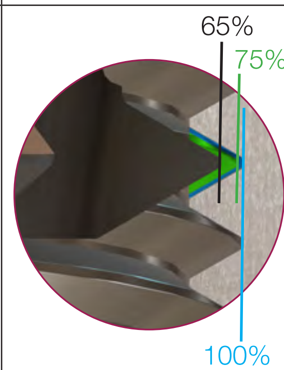
In order to produce a thread in some cases, one radial pass is sufficient, but in some cases a number of radial passes is required. The table below presents **ISCAR**'s recommendations for the number of radial passes depending on the material and lead.

ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.	Lead (mm) 0.25-1.00	1.25-1.50	1.75-2.00	2.50-6.00
							Number of Passes			
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1	1	1	2	3
		>= 0.25 %C	Annealed	650	190	2				
		< 0.55 %C	Quenched and tempered	850	250	3				
		>= 0.55 %C	Annealed	750	220	4				
			Quenched and tempered	1000	300	5				
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	200	6				
			Quenched and tempered	930	275	7				
				1000	300	8				
				1200	350	9				
	High alloyed steel, cast steel,and tool steel		Annealed	680	200	10				
			Quenched and tempered	1100	325	11				
	Stainless steel and cast steel		Ferritic/ martensitic	680	200	12				
			Martensitic	820	240	13				
M	Stainless steel		Austenitic, duplex	600	180	14	1	1	2	3
K	Grey cast iron (GG)		Ferritic/pearlitic		180	15	1	1	2	3
			Pearlitic		260	16				
	Nodular cast iron (GGG)		Ferritic		160	17				
			Pearlitic		250	18				
	Malleable cast iron		Ferritic		130	19				
			Pearlitic		230	20				
N	Aluminum- wrought alloy		Not hardenable		60	21	1	1	1	1
			Hardenable		100	22				
	Aluminum-cast, alloyed	<=12% Si	Not hardenable		75	23				
			Hardenable		90	24				
		>12% Si	High temperature		130	25	1	1	2	3
	Copper alloys	>1% Pb	Free cutting		110	26	1	1	1	1
			Brass		90	27				
			Electrolytic copper		100	28				
	Non metallic		Duroplastics, fiber plastics			29				
			Hard rubber			30				
S	High temperature alloys	Fe based	Annealed		200	31	2	2	2	3
			Hardened		280	32				
		Ni or Co based	Annealed		250	33				
			Hardened		350	34				
			Cast		320	35				
	Titanium alloys		Pure	Rm 400		36				
			Alpha+ beta alloys hardened	Rm 1050		37				
H	Hardened steel		Hardened		55 HRC	38				
			Hardened		60 HRC	39				
	Chilled cast iron		Cast		400	40	3	3	3	3
	Cast iron		Hardened		55 HRC	41	2	2	2	3

Rm - ultimate tensile strength, MPa

Depth Per Pass

Based on the number of passes, the table below presents **ISCAR**'s recommendations for depth per pass, which is expressed as a percentage according to the total depth that is required to be removed.

	Number of Radial Passes		
			
	1 pass	2 passes	3 passes
Depth per pass			

3.13 How to Choose Correct Solution?

A major consideration in selecting the desired solution is the cost per unit for a part that is machined by the tool. In spite of the fact that the tooling cost share in cost per unit is minor, the tool's indirect influence on cost per unit reduction can be considerable. The tool, even though it is a small part of manufacturing process, can sometimes represent an obstacle to a machine tool running faster and cutting machining time. Therefore, tools with the highest efficiency should be used for better productivity and, as a result, lower cost per part.

Tool selection should be considered by applying this analysis: Application -Tool Configuration – Tool Material – Economical Consideration.

Application

Gender of Thread

↓

Thread Profile/ Thread Standard / Pitch or TPI

↓

Depth of Thread

↓

Machining Diameter

↓

Coolant

↓

Tool Adaptor

↓

Tool Configuration

Machining Load / Application Stability

↓

Tool Material

Grade

↓

Economical Consideration

Economical Efficiency

Application	
Gender of Thread	• Is external or internal threading required?
↓	
Thread Profile/ Thread Standard / Pitch or TPI	• Is full profile or partial profile required? • What is the threading profile (square, triangular, trapezoidal or the other)? • What is the threading standard? • What is the threading pitch / TPI?
↓	
Depth of thread	• What is the depth of thread?
↓	
Machining Diameter	• What is the machining diameter?
↓	
Coolant	• What type of coolant is available (external / internal coolant)?
↓	
Tool Adaptor	• What type of tool adaptor is available?

Tool Configuration	
Machining Load / Application Stability	• Are there geometrical limitations in the part that requires small cutting forces, such as thin walls, high overhang?

Tool Material	
Grade	• Which cutting tool grade is most suitable for threading?

Economical Consideration	
Economical Efficiency	• Which tool should be used; indexable insert, indexable head or solid cutter? • What are the number of cutting edges?

Application

Gender of Thread	• Is external or internal threading required?

ISCAR product families offer solutions for both external and internal threading according to most standards. Dividing **ISCAR** families per gender of thread is shown in table below.

Thread Milling		Application		
Family	Subfamily	Internal Threading		External Threading
		Through Hole	Blind Hole	
SOLIDTHREAD	MTECS	V	●	○
	MTECSH	V	●	○
	MTEC	V	●	○
	MTECB	●	V	○
	MTECZ	V	V	V
	MTECQ	●	V	○
MULTI-MASTER	MT-…-MM	V	●	○
	MM TRD	V	●	○
T-SLOT	SD TRD	V	●	○
MILLTHREAD	MTE	V	●	○
	MTF	V	●	○
	MTFLE	---	---	V
	MTSRH endmill	V	●	○
	MTSRH shell mill	V	●	○

Guide Lines	Sign
Recommended (1st choice)	V
Suitable (2nd choice)	●
Can be selected (optional)	○

Application

Thread Profile / Standard depend Pitch / TPI	• Is full profile or partial profile required? • What is the threading profile (square, triangular, trapezoidal or other)? • What is the threading standard? • What is the threading pitch / TPI?

Depending on the answers to the questions in this section, it is possible to check which of the families meet the thread profile / standard depend pitch / TPI requirements.

Available Standards - Full and Partial Profile - Solution for Internal Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.60**	**0.70**	**0.75**	**0.80**	**1.00**	**1.25**
SOLIDTHREAD	MTECS	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO MJ	ISO	ISO MJ	ISO MJ	ISO MJ
	MTECSH			ISO	ISO	ISO	ISO	ISO	ISO		ISO	ISO	ISO
	MTEC						ISO		ISO	ISO	ISO	ISO	ISO
	MTECB						ISO		ISO	ISO	ISO	ISO	ISO
	MTECZ											ISO	ISO
	MTECQ											ISO	
	MTECI			Partial profile - 60°									
MULTI-MASTER	MT-…-MM						ISO			ISO		ISO	ISO
	MM TRD						Partial profile - 60°						
T-SLOT	SD TRD												
MILLTHREAD	MTE						ISO			ISO		ISO	ISO
	MTF											ISO	
	MTSRH endmill											ISO	
	MTSRH shell mill											ISO	

Available Standards - Full and Partial Profile - Solution for Internal Threading

Thread Milling		Pitch (mm)										
Family	**Subfamily**	**1.50**	**1.75**	**2.00**	**2.50**	**3.00**	**3.50**	**4.00**	**4.50**	**5.00**	**5.50**	**6.00**
SOLIDTHREAD	MTECS	ISO	ISO MJ	ISO	ISO							
	MTECSH	ISO	ISO	ISO								
	MTEC	ISO	ISO	ISO	ISO	ISO						
	MTECB	ISO	ISO	ISO	ISO	ISO						
	MTECZ	ISO	ISO	ISO								
	MTECQ	ISO		ISO			ISO					
	MTECI	Partial profile - 60°		Partial profile - 60°								
MULTI-MASTER	MT-…-MM	ISO	ISO	ISO	ISO	ISO	ISO					
	MM TRD	Partial profile - 60°				Partial profile - 60°						
T-SLOT	SD TRD							Partial profile - 60°				
MILLTHREAD	MTE	ISO	ISO	ISO	ISO							
	MTF	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO
	MTSRH endmill	ISO		ISO		ISO	ISO	ISO	ISO	ISO	ISO	ISO
	MTSRH shell mill	ISO		ISO		ISO	ISO	ISO	ISO	ISO	ISO	ISO

Available Standards - Full and Partial Profile - Solution for External Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**0.35**	**0.40**	**0.45**	**0.50**	**0.60**	**0.70**	**0.75**	**0.80**	**1.00**	**1.25**	**1.50**	**1.75**
SOLIDTHREAD	MTEC									ISO	ISO	ISO	ISO
	MTECI	Partial profile - 60°											
MULTI-MASTER	MM TRD				Partial profile - 60°								
T-SLOT	SD TRD												
MILLTHREAD	MTE							ISO		ISO	ISO	ISO	ISO
	MTF									ISO		ISO	
	MTFLE									ISO		ISO	
	MTSRH endmill									ISO		ISO	
	MTSRH shell mill											ISO	

Available Standards - Full and Partial Profile - Solution for External Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**1.50**	**1.75**	**2.00**	**2.50**	**3.00**	**3.50**	**4.00**	**4.50**	**5.00**	**5.50**	**6.00**	**8.00**
SOLIDTHREAD	MTEC	ISO	ISO	ISO									
	MTECI	Partial profile - 60°		Partial profile - 60°									
MULTI-MASTER	MM TRD	Partial profile - 60°				Partial profile - 60°							
T-SLOT	SD TRD							Partial profile - 60°					
MILLTHREAD	MTE	ISO	ISO	ISO	ISO	ISO	ISO	ISO		ISO			
	MTF	ISO		ISO	ISO	ISO	ISO	ISO		ISO			
	MTFLE	ISO		ISO	ISO	ISO							
	MTSRH endmill	ISO		ISO		ISO		ISO					
	MTSRH shell mill	ISO		ISO		ISO		ISO					

Available Standards - Full and Partial Profile - Solution for Internal Threading

Thread Milling		TPI									
Family	**Subfamily**	**80**	**72**	**56**	**48**	**40**	**36**	**32**	**28**	**27**	**24**
SOLIDTHREAD	MTECS	UN	UN	UN	UN	UN	UN	UN UNJ	UN Whitworth UNJ		UN UNJ
	MTECSH	UN		UN	UN	UN		UN	UN		UN
	MTEC							UN	UN Whitworth, BSPT	NPT NPTF	UN
	MTECB							UN	UN Whitworth	NPT	UN
	MTECZ								Whitworth	NPTF	
	MTECQ										
MULTI-MASTER	MT-…-MM							UN	UN		UN
	MM TRD										
T-SLOT	SD TRD										
MILLTHREAD	MTE							UN	UN	UN	UN Whitworth
	MTF										UN
	MTSRH endmill							UN			UN
	MTSRH shell mill										

Available Standards - Full and Partial Profile - Solution for Internal Threading

Thread Milling		TPI									
Family	**Subfamily**	**20**	**19**	**18**	**16**	**14**	**13**	**12**	**11.5**	**11**	**10**
SOLIDTHREAD	MTECS	UN UNJ	Whitworth	UN UNJ	UN UNJ	UN Whitworth	UN UNJ			UN	
	MTECSH	UN		UN	UN	UN	UN			UN	
	MTEC	UN	Whitworth BSPT	UN NPT NPTF	UN	UN Whitworth BSPT NPT NPTF	UN	UN	NPT	UN Whitworth BSPT	UN
	MTECB	UN	Whitworth	UN NPT	UN	UN Whitworth NPT	UN			UN Whitworth	UN
	MTECZ	UN	Whitworth	UN NPTF	UN	Whitworth					UN
	MTECQ										
MULTI-MASTER	MT-…-MM	UN	Whitworth	UN	UN	UN Whitworth		UN		Whitworth	UN
	MM TRD					Partial profile - 55°					
T-SLOT	SD TRD										
MILLTHREAD	MTE	UN Whitworth	Whitworth BSPT	UN NPT NPTF NPS NPSF PG	UN Whitworth ABUT PG	UN Whitworth NPT NPTF BSPT NPS NPSF		UN ABUT ACME	NPT NPTF NPS NPSF	UN Whitworth BSPT	UN ABUT ACME
	MTF	UN Whitworth	Whitworth	UN PG	UN Whitworth ABUT PG	UN Whitworth NPT NPTF BSPT NPS NPSF		UN ABUT ACME	NPT NPTF NPS NPSF	Whitworth BSPT	UN ABUT ACME
	MTSRH endmill	UN		UN	UN	UN Whitworth		UN	NPT NPTF	Whitworth BSPT	UN
	MTSRH shell mill	UN		UN	UN	Whitworth		UN	NPT NPTF	Whitworth BSPT	

Available Standards - Full and Partial Profile - Solution for Internal Threading

Thread Milling		TPI								
Family	Subfamily	9	8	7	6	5	4.5	4	3.5	3
SOLIDTHREAD	MTECS									
	MTECSH									
	MTEC	UN	UN NPT							
	MTECB		UN							
	MTECZ									
	MTECQ									
MULTI-MASTER	MT-…-MM	UN	UN	UN						
	MM TRD									
T-SLOT	SD TRD				Partial profile - 55°					
MILLTHREAD	MTE		UN Whitworth NPT NPTF NPS NPSF ABUT ACME	UN	UN ABUT ACME	UN ACME	UN	UN ABUT ACME	ACME	ACME
	MTF		UN Whitworth NPT NPTF NPS NPSF ABUT ACME	UN	UN ABUT ACME	UN ACME	UN	UN ABUT ACME	ACME	ACME
	MTSRH endmill		UN NPT	UN	UN	UN	UN	UN		
	MTSRH shell mill		UN NPT	UN	UN	UN	UN	UN		

Available Standards - Full and Partial Profile - Solution for External Threading

Thread Milling		TPI							
Family	Subfamily	32	28	27	24	20	19	18	16
SOLIDTHREAD	MTECS		Whitworth				Whitworth		
	MTECSH								
	MTEC		Whitworth BSPT	NPT NPTF			Whitworth BSPT	NPT NPTF	
	MTECB		Whitworth	NPT			Whitworth	NPT	
	MTECZ		Whitworth	NPTF			Whitworth	NPTF	
	MTECQ								
MULTI-MASTER	MT-…-MM						Whitworth		
	MM TRD								
T-SLOT	SD TRD								
MILLTHREAD	MTE	UN	UN		UN Whitworth	UN Whitworth	Whitworth BSPT	UN NPT NPTF NPS NPSF PG	UN Whitworth ABUT PG
	MTF				UN	UN Whitworth	Whitworth	UN PG	UN Whitworth ABUT PG
	MTFL				UN	UN Whitworth	Whitworth	UN PG	UN Whitworth ABUT PG
	MTSRH endmill				UN	UN		UN	UN
	MTSRH shell mill				UN	UN		UN	UN

Available Standards - Full and Partial Profile - Solution for External Threading										
Thread Milling		TPI								
Family	**Subfamily**	**14**	**12**	**11.5**	**11**	**10**	**8**	**7**	**6**	**4**
SOLIDTHREAD	MTECS	Whitworth								
	MTECSH									
	MTEC	Whitworth BSPT NPT NPTF		NPT	Whitworth BSPT		NPT			
	MTECB	Whitworth NPT			Whitworth					
	MTECZ	Whitworth								
	MTECQ									
MULTI-MASTER	MT-...-MM	Whitworth			Whitworth					
	MM TRD	Partial profile - 55°								
T-SLOT	SD TRD								Partial profile - 55°	
MILLTHREAD	MTE	UN Whitworth NPT NPTF BSPT NPS NPSF	UN ABUT	NPT NPTF NPS NPSF	Whitworth BSPT	UN ABUT	UN Whitworth NPT NPTF NPS NPSF ABUT		UN ABUT	ABUT
	MTF	UN Whitworth NPT NPTF BSPT NPS NPSF	UN ABUT	NPT NPTF NPS NPSF	Whitworth BSPT	UN ABUT	UN Whitworth NPT NPTF NPS NPSF ABUT		UN ABUT	ABUT
	MTFL	UN Whitworth NPT NPTF BSPT NPS NPSF	UN ABUT	NPT NPTF NPS NPSF	Whitworth BSPT	UN ABUT	ABUT			
	MTSRH endmill	UN Whitworth	UN	NPT NPTF	Whitworth BSPT	UN	UN NPT	UN		
	MTSRH shell mill	Whitworth	UN	NPT NPTF	Whitworth BSPT		UN NPT		UN	

Application

Depth of Thread	• What is the depth of thread?

The tables below define the possible maximum thread depth that can be produced with each thread milling family / line, according to thread standard.

Maximum Thread Depth - Full and Partial Profile - ISO Standard - Solution for Internal Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.60**	**0.70**	**0.75**	**0.80**	**1.00**	**1.25**
SOLIDTHREAD	MTECS	3	4	4.8	6	7.5	20	10.5	16.7	25	16	20	24
	MTECSH			4.8	6	7.5	9.5	7.5	12.5		16	20	24
	MTEC						10.3		7.4	10	9.2	16.5	19.4
	MTECB						10.3		7.4	24.4	9.2	24.5	19.4
	MTECZ											16.5	19.4
	MTECQ											21	
	MTECI			5.2			28				12.5	39	
MULTI-MASTER	MT-…-MM						200			200		250	
	MM TRD						200						
T-SLOT	SD TRD												
MILLTHREAD	MTE						182			182		206	182
	MTF											50	
	MTSRH endmill											130	
	MTSRH shell mill											52	

Maximum Thread Depth - Full and Partial Profile - ISO Standard - Solution for Internal Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**1.50**	**1.75**	**2.00**	**2.50**	**3.00**	**3.50**	**4.00**	**4.50**	**5.00**	**5.50**	**6.00**	**8.00**
SOLIDTHREAD	MTECS	31.5	26	50	43								
	MTECSH	23	26	35									
	MTEC	33.8	28.9	41	48.8	58.5							
	MTECB	33.8	28.9	39	48.8	58.5							
	MTECZ	33.8	28.9	27									
	MTECQ	18		34			28						
	MTECI	39		50									
MULTI-MASTER	MT-…-MM	250		250	250	250	250						
	MM TRD	200				250							
T-SLOT	SD TRD							150					
MILLTHREAD	MTE	263	206	263	206	263	263	263	263	263	210	210	
	MTF	65	50	65	50	65	65	65	65	65	65	65	
	MTSRH endmill	130		130		130	130	130	130	130	130	130	
	MTSRH shell mill	60		60		60	60	60	60	60	60	60	

Maximum Thread Depth - Full and Partial Profile - MJ Standard - Solution for Internal Threading

Thread Milling		Pitch (mm)											
Family	**Subfamily**	**0.25**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.60**	**0.70**	**0.75**	**0.80**	**1.00**	**1.25**
SOLIDTHREAD	MTECS								10		12.5	15	20
	MTECI			5.2			28				12.5	39	
MULTI-MASTER	MM TRD						200						
T-SLOT	SD TRD												

Maximum Thread Depth - Full and Partial Profile - MJ Standard - Solution for Internal Threading

Thread Milling		Pitch (mm)											
Family	Subfamily	1.50	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	8.00
SOLIDTHREAD	MTECS		30										
	MTECI	39		50									
MULTI-MASTER	MM TRD					250							
T-SLOT	SD TRD							150					

Maximum Thread Depth - Full and Partial Profile - ISO Standard - Solution for External Threading

Thread Milling		Pitch (mm)											
Family	Subfamily	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.75	0.80	1.00	1.25
SOLIDTHREAD	MTEC											16.5	16.9
	MTECI			5.2			28				12.5	39	
MULTI-MASTER	MT-...-MM						200			200		250	
	MM TRD						200						
T-SLOT	SD TRD												
MILLTHREAD	MTE									182		206	182
	MTF											50	
	MTFL											21	
	MTSRH endmill											110	
	MTSRH shell mill												

Maximum Thread Depth - Full and Partial Profile - ISO Standard - Solution for External Threading

Thread Milling		Pitch (mm)											
Family	Subfamily	1.50	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	8.00
SOLIDTHREAD	MTEC	20.3	20.1	21									
	MTECI	39		50									
MULTI-MASTER	MT-...-MM	250		250	250	250	250						
	MM TRD	200				250							
T-SLOT	SD TRD							150					
MILLTHREAD	MTE	263	182	263	206	263	263	263		210			
	MTF	65		65	50	65	50	65		65			
	MTFL	21		21	21	21							
	MTSRH endmill	130		130		130		130					
	MTSRH shell mill	60		60		52		52					

Maximum Thread Depth - Full and Partial Profile - UN Standard - Solution for Internal Threading

Thread Milling		TPI														
Family	Subfamily	80	72	56	48	40	36	32	28	27	24	20	19	18	16	14
SOLIDTHREAD	MTECS	8	6	6.6	5.2	12	9	15	19		24	25		35	30.2	25
	MTECSH	4		6.6	5.2	9.6		15	14.5		24	25		23	22	25
	MTEC							6.8	14.5		20	27.3		26.1	30	37.2
	MTECB							16	11.3		20.6	22.3		26.1	31	37.2
	MTECZ											22.3		26.1	16.7	
	MTECQ															
MULTI-MASTER	MT-…-MM							150	150		200	200		250	200	250
	MM TRD				200											
T-SLOT	SD TRD															
MILLTHREAD	MTE							182.3	182.3	182.3	206.3	263		263	263	263
	MTF										50	50		50	50	65
	MTFL															
	MTSRH endmill							110			110	130		130	130	110
	MTSRH shell mill											52		52	60	

Maximum Thread Depth - Full and Partial Profile - UN Standard - Solution for Internal Threading

Thread Milling		TPI													
Family	Subfamily	13	12	11.5	11	10	9	8	7	6	5	4.5	4	3.5	3
SOLIDTHREAD	MTECS	27.5			50										
	MTECSH	27.5			34.5										
	MTEC	22.5	41.3		28.9	34.3	38.1	42.9							
	MTECB	22.5			28.9	34.3		42.9							
	MTECZ					34.3									
	MTECQ														
MULTI-MASTER	MT-…-MM		250			250	250	250	250						
	MM TRD	200						250							
T-SLOT	SD TRD									150					
MILLTHREAD	MTE		263		182.3	263		263	206.3	263	263	210	210		
	MTF		65			65		50	50	65	50	65	65		
	MTFL														
	MTSRH endmill		130			110		130	110	130	130	130	130		
	MTSRH shell mill		60					60		60	52	60	60		

Maximum Thread Depth - Full and Partial Profile - UN Standard - Solution for External Threading

Thread Milling		TPI														
Family	Subfamily	80	72	56	48	40	36	32	28	27	24	20	19	18	16	14
SOLIDTHREAD	MTEC										16.4	21				
MULTI-MASTER	MM TRD				200											
T-SLOT	SD TRD															
MILLTHREAD	MTE							182.3	182.3		206.3	263		263	163	263
	MTF										50	50		50	65	65
	MTFLE										21	21		21	21	21
	MTSRH endmill										130	130		130	130	110
	MTSRH shell mill										50	50		50	50	

Maximum Thread Depth - Full and Partial Profile - UN Standard - Solution for External Threading															
Thread Milling		TPI													
Family	Subfamily	13	12	11.5	11	10	9	8	7	6	5	4.5	4	3.5	3
MULTI-MASTER	MM TRD	200						250							
T-SLOT	SD TRD									150					
MILLTHREAD	MTE		263			263		263		263					
	MTF		65			65		65		65					
	MTFLE		21			21									
	MTSRH endmill		130			110		130	110	130					
	MTSRH shell mill		50					50		52					

Maximum Thread Depth - Full and Partial Profile - Whitworth Standard - Solution for Internal and External Threading													
Thread Milling		TPI											
Family	Subfamily	28	24	20	19	16	14	...	11	8	6	...	3
SOLIDTHREAD	MTECS	19.5			30		37						
	MTEC	9.5			14		26.3		38.1				
	MTECB	14.1			16.7		26.3		47.3				
	MTECZ	14.1			16.7		26.3						
MULTI-MASTER	MT-...-MM				150		250		250				
	MM TRD						250						
T-SLOT	SD TRD										150		
MILLTHREAD	MTE		182.3	206.3	206.3	263	263		263	210			
	MTF			50	50	50	50		65	65			
	MTFLE			21	21	21	21		21				
	MTSRH endmill						130		130				
	MTSRH shell mill						52		60				

Maximum Thread Depth - Full and Partial Profile - UNJ Standard - Solution for Internal and External Threading											
Thread Milling		TPI									
Family	Subfamily	48	...	32	28	27	24	20	19	18	16	14
SOLIDTHREAD	MTECS			10.5	16		20	28		20	24	
MULTI-MASTER	MM TRD	200										

Maximum Thread Depth - Full and Partial Profile - UNJ Standard - Solution for Internal and External Threading											
Thread Milling		TPI									
Family	Subfamily	13	12	11	8	...	6	5	4	...	3
SOLIDTHREAD	MTECS	27.5									
MULTI-MASTER	MM TRD	200			250						
T-SLOT	SD TRD						150				

Maximum Thread Depth - Full and Partial Profile - BSPT Standard - Solution for Internal and External Threading

Thread Milling		TPI								
Family	Subfamily	28	19	14	...	11	10	6	...	3
SOLIDTHREAD	MTEC	9.5	14	19.1		28.9				
MULTI-MASTER	MM TRD			250						
T-SLOT	SD TRD							150		
MILLTHREAD	MTE		182.3	206.3		263				
	MTF			50		65				
	MTFLE			21		21				
	MTSRH endmill					130				
	MTSRH shell mill					60				

Maximum Thread Depth - Full and Partial Profile - NPT Standard - Solution for Internal and External Threading

Thread Milling		TPI														
Family	Subfamily	48	...	27	...	18	14	...	12	11.5	8	...	6	5	4	...	3
SOLIDTHREAD	MTEC			9.9		14.8	20.9			27.6	39.7						
	MTECB			10.8		16.2	22.7										
MULTI-MASTER	MM TRD	200									250						
T-SLOT	SD TRD												150				
MILLTHREAD	MTE					182.3	206.3			263	263						
	MTF						50			65	65						
	MTFLE						21			21							
	MTSRH endmill									130	130						
	MTSRH shell mill									60	60						

Maximum Thread Depth - Full and Partial Profile - NPTF Standard - Solution for Internal and External Threading

Thread Milling		TPI														
Family	Subfamily	48	...	27	...	18	14	...	12	11.5	8	...	6	5	4	...	3
SOLIDTHREAD	MTEC			9.9		14.8	20.9										
	MTECZ			10.8		16.2											
MULTI-MASTER	MM TRD	200									250						
T-SLOT	SD TRD												150				
MILLTHREAD	MTE					182.3	206.3			263	263						
	MTF						50			65	65						
	MTFLE						21			21							
	MTSRH endmill									130							
	MTSRH shell mill									52							

Maximum Thread Depth - Full and Partial Profile - NPS / NPSF Standard - Solution for Internal and External Threading

Thread Milling		TPI														
Family	Subfamily	48	...	18	...	14	...	12	11.5	11	8	...	6	5	4	...	3
MULTI-MASTER	MM TRD	200									250						
T-SLOT	SD TRD												150				
MILLTHREAD	MTE			182.3		206.3			263		263						
	MTF					50			65		65						
	MTFLE					21			21								

Maximum Thread Depth - Full and Partial Profile - ABUT Standard - Solution for Internal and External Threading							
Thread Milling		TPI					
Family	Subfamily	16	12	10	8	6	4
MILLTHREAD	MTE	263	263	263	263	263	263
	MTF	50	50	50	50	50	65
	MTFLE	21	21	21	21		

Maximum Thread Depth - Full and Partial Profile - PG Standard - Solution for Internal and External Threading			
Thread Milling		TPI	
Family	Subfamily	18	16
MILLTHREAD	MTE	206.3	263
	MTF	50	50
	MTFLE	21	21

Maximum Thread Depth - Full and Partial Profile - ACME Standard - Solution for Internal Threading									
Thread Milling		TPI							
Family	Subfamily	12	10	8	6	5	4	3.5	3
MILLTHREAD	MTE	263	263	263	263	263	263	210	210
	MTF	50	50	50	50	50	65	65	65

Application

Machining Diameter	• What is the machining diameter?

The tables below define the range of cutter diameters available, according to the requested thread profile / standard and pitch / TPI.

Based on Chapter 3.11, **ISCAR**'s recommendations for cutter diameter selection are as follows:

- For internal thread milling, in most cases the initial endmill diameter is recommended to be up to 70% of the thread major diameter.
- For external thread milling, in most cases the initial endmill diameter can be over 70% of the thread major diameter.

Cutter Diameters - Partial Profile - 60° - Solution for Internal and External Threading

Thread Milling		Pitch (mm)											
Family	Subfamily	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.75	0.80	1.00	1.25
SOLIDTHREAD	MTECI			Ø1.9			Ø1.9 - Ø4.0	Ø3.2 - Ø8.0			Ø3.2 - Ø4.0	Ø8.0 - Ø12.0	
MULTI-MASTER	MM TRD						Ø15.7						
T-SLOT	SD TRD												

Cutter Diameters - Partial Profile - 60° - Solution for Internal and External Threading

Thread Milling		Pitch (mm)											
Family	Subfamily	1.50	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	8.00
SOLIDTHREAD	MTECI	Ø8.0 - Ø12.0		Ø12.0 - Ø16.0									
MULTI-MASTER	MM TRD	Ø15.7				Ø21.7							
T-SLOT	SD TRD							Ø32					Ø40

Cutter Diameters - Partial Profile - 55° - Solution for Internal and External Threading

Thread Milling		TPI				
Family	Subfamily	14	11	6	4	3
MULTI-MASTER	MM TRD	Ø21.7				
T-SLOT	SD TRD			Ø32		Ø40

Cutter Diameters - Full Profile - Solution with Indexable Inserts

Thread Milling		Cutter Diameter (mm)	
Family	Subfamily	min.	max.
MILLTHREAD	MTE	Ø9.5	Ø48
	MTF	Ø63	Ø100
	MTFL	Ø20	Ø45
	MTSRH endmill	Ø23	Ø45
	MTSRH shell mill	Ø32	Ø63

Cutter Diameters - Full Profile - ISO Standard - Solution for Internal Threading										
Thread Milling		Pitch (mm)								
Family	Subfamily	0.25	0.30	0.35	0.40	0.45	0.50	0.60	0.70	0.75
SOLIDTHREAD	MTECS	Ø0.72 - Ø0.90	Ø1.05	Ø1.2	Ø1.53	Ø1.65 - Ø1.95	Ø2.37 - Ø5.35	Ø2.75	Ø3.1	Ø8
	MTECSH			Ø1.2	Ø1.55	Ø1.65 - Ø1.95	Ø2.35	Ø2.75	Ø3.1	
	MTEC						Ø2.2 - Ø3.8		Ø3.1	Ø4.5
	MTECB						Ø3.8		Ø3.1	Ø4.5 - Ø10.0
	MTECZ									
	MTECQ									
MULTI-MASTER	MT-…-MM						Ø10.0 - Ø12.0			Ø10.0 - Ø12.0

Cutter Diameters - Full Profile - ISO Standard - Solution for Internal Threading										
Thread Milling		Pitch (mm)								
Family	Subfamily	0.80	1.00	1.25	1.50	1.75	2.00	2.50	3.00	3.50
SOLIDTHREAD	MTECS	Ø3.8	Ø4.65	Ø6	Ø7.8	Ø9	Ø11.8	Ø15		
	MTECSH	Ø3.8	Ø4.65	Ø5.95	Ø7.8	Ø9	Ø11.8			
	MTEC	Ø3.6	Ø4.0 - Ø8.0	Ø5	Ø7.0 - Ø16.0	Ø8	Ø10.0 - Ø20.0	Ø14	Ø16	
	MTECB	Ø3.8	Ø4.6 - Ø10.0	Ø6	Ø7.8 - Ø16.0	Ø9	Ø10.0 - Ø11.8	Ø15	Ø18	
	MTECZ		Ø4.8 - Ø8.0	Ø6	Ø7.8 - Ø16.0	Ø9	Ø10.0 - Ø11.8			
	MTECQ		Ø12		Ø10		Ø20			Ø20
MULTI-MASTER	MT-…-MM		Ø10.0 - Ø16.0	Ø10.0 - Ø12.0	Ø10.0 - Ø16.0	Ø12	Ø12.0 - Ø20.0	Ø15.4	Ø16.0 - Ø20.0	Ø20

Cutter Diameters - Full Profile - ISO Standard - Solution for External Threading						
Thread Milling		Pitch (mm)				
Family	Subfamily	1.00	1.25	1.50	1.75	2.00
SOLIDTHREAD	MTEC	Ø10	Ø10	Ø10.0 - Ø12.0	Ø12	Ø12

Cutter Diameter - Full Profile - UN Standard - Solution for Internal Threading											
Thread Milling		TPI									
Family	Subfamily	80	72	56	48	40	36	32	28	24	20
SOLIDTHREAD	MTECS	Ø1.15	Ø1.45	Ø1.65	Ø1.9	Ø2.1 - Ø2.45	Ø3.3	Ø2.55 - Ø3.7	Ø5	Ø6.6	Ø4.75 - Ø8.0
	MTECSH	Ø1.15		Ø1.65	Ø1.9	Ø2.1 - Ø2.45		Ø2.55 - Ø3.7	Ø4.2 - Ø5.0	Ø3.5 - Ø6.6	Ø4.75 - Ø8.0
	MTEC							Ø3.2	Ø4.0 - Ø6.0	Ø5.0 - Ø7.0	Ø4.5 - Ø12.0
	MTECB							Ø3.2 - Ø6.0	Ø5	Ø6.6 - Ø8.0	Ø8.0 - Ø10.0
	MTECZ										Ø10
MULTI-MASTER	MT-…-MM							10	10	10.0-12.0	10.0-12.0

Cutter Diameter - Full Profile - UN Standard - Solution for Internal Threading											
Thread Milling		TPI									
Family	Subfamily	18	16	14	13	12	11	10	9	8	7
SOLIDTHREAD	MTECS	Ø6.0 - Ø12.0	Ø6.7	Ø7.7	Ø9.2		Ø11.4				
	MTECSH	Ø6.0	Ø6.7	Ø7.7	Ø9.2		Ø11.4				
	MTEC	Ø5.0 - Ø10.0	Ø6.0 - Ø12.0	Ø15.0	Ø8.0	Ø10.0 - Ø16.0	Ø10.0	Ø12.0	Ø15.0	Ø16	
	MTECB	Ø5.6 - Ø11.3	Ø6.7 - Ø12.0	Ø16.0	Ø9.2		Ø11.4	Ø14.4		Ø19.5	
	MTECZ	Ø11.3	Ø6.7	Ø14.4							
MULTI-MASTER	MT-…-MM	Ø10.0-Ø16.0	Ø10.0-Ø12.0	Ø12.0-Ø16.0		Ø16.0-Ø20.0		Ø15.3	Ø16.0	Ø16.0-Ø20.0	Ø20.0

Cutter Diameter - Full Profile - UN Standard - Solution for External Threading			
Thread Milling		TPI	
Family	Subfamily	24	20
SOLIDTHREAD	MTEC	Ø10.0	Ø12.0

Cutter Diameter - Full Profile - Whitworth Standard - Solution for Internal and External Threading					
Thread Milling		TPI			
Family	Subfamily	28	19	14	11
SOLIDTHREAD	MTECS	Ø7.8	Ø10	Ø12	
	MTEC	Ø6	Ø8	Ø12	Ø12.0 - Ø16.0
	MTECB	Ø7.8	Ø10	Ø16	Ø16.0 - Ø20.0
	MTECZ	Ø7.8	Ø10	Ø16	
MULTI-MASTER	MT-…-MM		Ø10	Ø16.0 - Ø20.0	Ø16.0 - Ø20.0

Cutter Diameter - Full Profile - BSPT Standard - Solution for Internal and External Threading					
Thread Milling		TPI			
Family	Subfamily	28	19	14	11
SOLIDTHREAD	MTEC	Ø6	Ø8	Ø12	Ø16

Cutter Diameter - Full Profile - UNJ Standard - Solution for Internal Threading								
Thread Milling		TPI						
Family	Subfamily	32	28	24	20	18	16	13
SOLIDTHREAD	MTECS	Ø3.3	Ø5.1	Ø6.7	Ø4.9 - Ø8.0	Ø6.15	Ø6.9	Ø9.4

Cutter Diameters - Full Profile - MJ Standard - Solution for Internal Threading						
Thread Milling		Pitch (mm)				
Family	Subfamily	0.70	0.80	1.00	1.25	1.75
SOLIDTHREAD	MTECS	Ø3.2	Ø3.9	Ø4.8	Ø6.1	Ø9.2

Cutter Diameter - Full Profile - NPT Standard - Solution for Internal and External Threading						
Thread Milling		TPI				
Family	Subfamily	27	18	14	11.5	8
SOLIDTHREAD	MTEC	Ø6.0	Ø8.0	Ø12	Ø16	Ø20
	MTECB	Ø7.6	Ø10	Ø15.5		

Cutter Diameter - Full Profile - NPTF Standard - Solution for Internal and External Threading				
Thread Milling		TPI		
Family	Subfamily	27	18	14
SOLIDTHREAD	MTEC	Ø6.0	Ø8.0	Ø12.0
	MTECZ	Ø7.6	Ø10.0	

Application	
Coolant	• What type of coolant is available (external / internal coolant)?
↓	
Tool Adaptor	• What tool adaptor is available?

ISCAR recommends always using coolant when threading, but this also depends on the type of machine that's available.

Tool adaptation selection, like coolant selection, depends on the type of machine that's available.

The table below defines the thread milling family / line adaptation and coolant possibility.

Family	Subfamily	Adaptation	Coolant
SOLIDTHREAD	MTECS	Cylindrical	Internal coolant holes directed to the cutting edges along the flutes for MJ and UNJ standards only. For other standards no coolant channels
	MTECSH		
	MTEC		No coolant channels
	MTECB		Central coolant hole
	MTECZ		Internal coolant holes directed to the cutting edges along the flutes
	MTECQ		Central coolant hole
MULTI-MASTER	MT-…-MM	Cylindrical	No coolant channels
	MM TRD		
T-SLOT	SD TRD	Cylindrical	No coolant channels
MILLTHREAD	MTE	Weldon	Internal coolant channels detected to cutting area
	MTF	Shell Mill	
	MTFLE	Shell Mill	
	MTSRH endmill	Weldon	
	MTSRH shell mill	Shell Mill	

Tool Configuration	
Machining Load / Application Stability	• Are there geometrical limitations in the part that requires small cutting forces, such as thin walls, high overhang?

If small cutting edges are required due to geometrical limitations in the part, such as thin walls, high overhang, etc., **ISCAR** recommends using either a single-point cutter or a cutter with helix cutting edges, or to increase radial passes.

The table below defines the thread milling family / line according to the cutter's cutting geometry.

Family	Subfamily	Single-Point Cutter	Multi-Tooth	Helical Cutting Edges
SOLIDTHREAD	MTECS	V		
	MTECSH	V		
	MTEC			V
	MTECB			V
	MTECZ			V
	MTECQ			V
MULTI-MASTER	MT-…-MM			V
	MM TRD	V		
T-SLOT	SD TRD	V		
MILLTHREAD	MTE		V	
	MTF		V	
	MTFLE		V	
	MTSRH endmill			V
	MTSRH shell mill			V

Tool Material

Grade	• Which cutting tool grade is most suitable for threading?

Selecting a grade is strongly connected with the cutting geometry of a tool and other factors. The following table can assist in making the right choice: they visualize a grade position in the field of application in accordance with standard ISO 513 and characterize the grade properties compared with other grades.

The tables provide a summary of data about grade application in coordinates of classification numbers from standard ISO 513 and availability of each grade per thread family.

There are main and complementary grades. The main grades are more popular in machining a considered class of engineering materials but in specific cases the complementary grades can be effective as well. In a situation where a product produced from a main grade is not available, a complementary grade provides an acceptable alternative.

The figures prioritize the main grades by numbers in brackets below the designation of a grade. Prioritizing has general character and is intended for help in selecting the grade when the information about application is not enough. A basic principle for selecting a grade is that if abrasive wear is dominant, a hard grade should be used, while a tough grade is needed for substantial mechanical loading during cutting.

			Material					
			Steel	Stainless Steel	Cast Iron	Non ferrous	High Temp. Allows	Hardened Steel
			Material Field					
Grade	Tough ↑	IC528	P25 - P45[2]	M30 - M40[2]			S15 - S30	
Grade		IC908	P15 - P30[1]	M20 - M30[1]	K20 - K30[1]	N10 - N25[1]	S10 - S25[1]	H20 - H30[2]
Grade		IC903	P05-P15	M10-M20			S10-S20	H01-H10[1]
Grade	Hard ↓	IC902	P05-P15	M10-M15	K05-K15		S05-S10[2]	H05-H15

[1] Recommended; [2] Suitable

Economical Consideration

Economical Efficiency	• Which tool should be used; indexable insert, indexable head or solid cutter? • What are the number of cutting edges?

The parameter for a number of cutting edges is an economic consideration.
The more cutting edges on an insert, the lower the cost per insert cutting edge.

Example for a Quick and Easy way to Select a Correct Solution
Requirements:

- M20x1.75 according to ISO Standard
- Internal threads with depth of 27.5mm
- Full Thread profile
- Through hole
- AISI 316 stainless steel
Available: internal coolant, Weldon and cylindrical adaptations.

Application	
Gender of Thread	• Is external or internal threading required?

Required internal threading in through hole, meaning that the thread families below are suitable.

Thread Milling		Internal Threading
Family	Subfamily	Through Hole
SOLIDTHREAD	MTECS	V
	MTECSH	V
	MTEC	V
	MTECB	•
	MTECZ	V
	MTECQ	•
MULTI-MASTER	MT-…-MM	V
	MM TRD	V
T-SLOT	SD TRD	V
MILLTHREAD	MTE	V
	MTF	V
	MTSRH endmill	V
	MTSRH shell mill	V

Application	
Thread Profile/ Thread Standard / Pitch or TPI	• Is full profile or partial profile required? • What is the threading profile (square, triangular, trapezoidal or other)? • What is the threading standard? • What is the threading pitch / TPI?

Required full profile according to ISO standard M20x1.75, meaning a triangular thread form with an angle of 60°.

Available Standards - Full and Partial Profile - Solution for Internal Threading												
Thread Milling		Pitch (mm)										
Family	Subfamily	1.50	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00
SOLIDTHREAD	MTECS	ISO	ISO MJ	ISO	ISO							
	MTECSH	ISO	ISO	ISO								
	MTEC	ISO	ISO	ISO	ISO	ISO						
	MTECB	ISO	ISO	ISO	ISO	ISO						
	MTECZ	ISO	ISO	ISO								
MULTI-MASTER	MT-...-MM	ISO	ISO	ISO	ISO	ISO	ISO					
MILLTHREAD	MTE	ISO	ISO	ISO	ISO							
	MTF	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO

Application	
Depth of thread	• What is the depth of thread?

The required thread depth is 27.5mm. According to the table below, the selection options are concentrated into the most specific solutions.

Maximum Thread Depth - Full and Partial Profile - ISO Standard - Solution for Internal Threading													
Thread Milling		Pitch (mm)											
Family	Subfamily	1.50	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	8.00
SOLIDTHREAD	MTEC	33.8	28.9	41	48.8	58.5							
	MTECB	33.8	28.9	39	48.8	58.5							
	MTECZ	33.8	28.9	27									
MILLTHREAD	MTE	263	206	263	206	263	263	263	263	263	210	210	
	MTF	65	50	65	50	65	65	65	65	65	65	65	

Application	
Machining Diameter	• What is the machining diameter?

For internal thread milling, in most cases the initial endmill diameter is recommended to be up to 70% of the thread's major diameter.

The requested thread with a major diameter of 20 mm, means that the maximum recommended diameter can be 14 mm (20*0.7=14).

Cutter Diameters - Full Profile - ISO Standard - Solution for Internal Threading

Thread Milling		Pitch (mm)		
Family	Subfamily	1.5	1.75	2
SOLIDTHREAD	MTEC	Ø7.0 - Ø16.0	Ø8	Ø10.0 - Ø20.0
	MTECB	Ø7.8 - Ø16.0	Ø9	Ø10.0 - Ø11.8
	MTECZ	Ø7.8 - Ø16.0	Ø9	Ø10.0 - Ø11.8

Cutter Diameters - Full Profile - Solution with Indexable Inserts

Thread Milling		Cutter Diameter (mm)	
Family	Subfamily	min.	max.
MILLTHREAD	MTE	Ø9.5	Ø48

Application	
Coolant	• What type of coolant is available (external / internal coolant)?
Tool Adaptor	• What tool adaptor is available?

For an internal through hole, it is recommended to use solid cutters with internal coolant holes directed to the cutting edges along the flutes, or tools with internal coolant channels directed to the cutting area for indexable inserts.

Family	Subfamily	Adaptation	Coolant
SOLIDTHREAD	MTECZ	Cylindrical	Internal coolant holes directed to the cutting edges along the flutes
MILLTHREAD	MTE	Weldon	Internal coolant channels detected to cutting area

Tool Configuration

Machining Load / Application Stability	• Are there geometrical limitations in the part that requires small cutting forces, such as thin walls, high overhang?

There are no geometric limitations in the part.

Family	Subfamily	Multi-Tooth	Helical Cutting Edges
SOLIDTHREAD	MTECZ		V
MILLTHREAD	MTE	V	

Tool Material

Grade	• Which cutting tool grade is most suitable for threading?

Cutters with grade IC908 are suitable for thread milling in AISI 316 stainless steel.

			Material					
			Steel	**Stainless Steel**	**Cast Iron**	**Nonferrous**	**High Temp. Allows**	**Steel**
				Material Field				
Grade	Tough	IC528	P25 - P45[2]	M30 - M40[2]			S15 - S30	
	↑	IC908	P15 - P30[1]	M20 - M30[1]	K20 - K30[1]	N10 N25[1]	S10 - S25[1]	H20 - H30[2]
	↓	IC903	P05-P15	M10-M20			S10-S20	H01-H10[1]
	Hard	IC902	P05-P15	M10-M15	K05-K15		S05-S10[2]	H05-H15

(1) Recommended; (2) Suitable

Economical Consideration

Economical Efficiency	• Which tool should be used; indexable insert, indexable head or solid cutter? • What are the number of cutting edges?

Two cutters are suitable for mill threading;

- MTECZ – a solid carbide endmill with 3 flutes and cutting diameter of 9 mm.
- MTE - a tool carrying a single indexable insert with 2 cutting edges and a cutting diameter of 13.2 mm.

Conclusion: If MTECZ is selected, we can finish the requested thread faster than if MTE is selected, but a solution with interchangeable inserts will be cheaper in terms of longer-term instrument expenditure.

3.14 Cutting Conditions

Recommended initial cutting conditions are shown in the tables below.

Machining Data for Solid Carbide Threading Endmills with Small Diameter, Short Solid Carbide Thread Mills

ISO	Materials	Cutting Speed, m/min	Feed mm/Tooth for Diameter (mm)												
			Ø1.5	Ø2	Ø3	Ø4	Ø5	Ø6	Ø7	Ø8	Ø9	Ø10	Ø12	Ø14	Ø15
P	Low & medium carbon steels	60-120	0.05	0.05	0.07	0.09	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.18
P	High carbon steels	60-90	0.04	0.05	0.06	0.08	0.09	0.1	0.12	0.13	0.14	0.14	0.16	0.17	0.18
P	Alloy steels, treated steels	50-80	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.1	0.12	0.13	0.14
P	Cast steels	70-90	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.1	0.12	0.13	0.14
M	Stainless steels	60-90	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.08	0.09	0.1	0.11	0.12	0.13
S	Nickel alloys, titanium alloys	20-40	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08
K	Cast iron	40-80	0.05	0.05	0.07	0.09	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.18
N	Aluminum	80-150	0.05	0.05	0.07	0.09	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.18
N	Synthetics, duroplastics, thermoplastics	50-200	0.1	0.11	0.12	0.14	0.16	0.18	0.19	0.19	0.19	0.19	0.19	0.2	0.2

ISO	Materials	Cutting Speed, ft/min	Feed (Inch/Tooth) for Diameter (Inch)												
			Ø.06	Ø.08	Ø.12	Ø.16	Ø.20	Ø.24	Ø.28	Ø.31	Ø.35	Ø.39	Ø.47	Ø.55	Ø.59
P	Low & medium carbon steels	200-390	.0018	.0021	.0028	.0035	.0043	.0050	.0057	.0060	.0062	.0064	.0067	.0070	.0071
P	High carbon steels	200-300	.0016	.0019	.0024	.0030	.0035	.0041	.0046	.0050	.0054	.0057	.0062	.0067	.0069
P	Alloy steels, treated steels	160-260	.0015	.0017	.0019	.0021	.0024	.0026	.0028	.0033	.0037	.0041	.0047	.0052	.0055
P	Cast steels	230-300	.0015	.0017	.0019	.0021	.0024	.0026	.0028	.0033	.0037	.0041	.0047	.0052	.0055
M	Stainless steels	200-300	.0011	.0013	.0016	.0019	.0022	.0025	.0026	.0031	.0035	.0038	.0044	.0049	.0051
S	Nickel alloys, titanium alloys	70-130	.0011	.0013	.0015	.0017	.0020	.0022	.0024	.0025	.0026	.0027	.0029	.0031	.0031
K	Cast iron	130-260	.0018	.0021	.0028	.0035	.0043	.0050	.0057	.0060	.0062	.0064	.0067	.0070	.0071
N	Aluminum	260-490	.0018	.0021	.0028	.0035	.0043	.0050	.0057	.0060	.0062	.0064	.0067	.0070	.0071
N	Synthetics, duroplastics, thermoplastics	160-660	.0038	.0042	.0049	.0056	.0063	.0070	.0073	.0074	.0075	.0075	.0077	.0078	.0078

Machining Data for Solid Carbide Thread Mills for Small Internal Threads in Hard Materials

ISO	Material	Hardness HRC	Cutting Speed m/min	Feed mm/Tooth for Cutting Diameter (mm)								
				1.5	2	3	4	5	6	7	8	9
H	Hardened Steels	45-50	60-70	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08
H	Hardened Steels	51-55	50-60	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07
H	Hardened Steels	56-62	40-50	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06

ISO	Material	Hardness HRc	Cutting Speed SFM	Feed (IPT) for Cutting Diameter (D)								
				.06	.08	.12	.16	.2	.24	.28	.31	.35
H	Hardened Steels	45-50	200-230	.0016	.0016	.002	.002	.0024	.0024	.0028	.0028	.0031
H	Hardened Steels	51-55	160-200	.0012	.0012	.0016	.0016	.002	.002	.0024	.0024	.0028
H	Hardened Steels	56-62	130-160	.0008	.0008	.0012	.0012	.0016	.0016	.002	.002	.0024

Machining Data for Solid Carbide Threading Endmills

ISO	Material		Condition	Tensile Strength [N/mm²]	Hardness HB	Material No.
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1
		≥ 0.25 %C	Annealed	650	190	2
		< 0.55 %C	Quenched and tempered	850	250	3
		≥ 0.55 %C	Annealed	750	220	4
			Quenched and tempered	1000	300	5
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	200	6
			Quenched and tempered	930	275	7
				1000	300	8
				1200	350	9
	High alloyed steel, cast steel, and tool steel		Annealed	680	200	10
			Quenched and tempered	1100	325	11
	Stainless steel and cast steel		Ferritic/martensitic	680	200	12
			Martensitic	820	240	13
M	Stainless steel		Austenitic	600	180	14
K	Grey cast iron (GG)		Ferritic		160	17
			Pearlitic		250	18
	Cast iron nodular (GGG)		Ferritic/pearlitic		180	15
			Pearlitic		260	16
	Malleable cast iron		Ferritic		130	19
			Pearlitic		230	20
N	Aluminum- wrought alloy		Not cureable		60	21
			Cured		100	22
	Aluminum-cast, alloyed	=<12% Si	Not cureable		75	23
			Cured		90	24
		>12% Si	High temperature		130	25
	Copper alloys	>1% Pb	Free cutting		110	26
			Brass		90	27
			Electrolitic copper		100	28
	Non-metallic		Duroplastics, fiber plastics			29
			Hard rubber			30
S	High temp. alloys	Fe based	Annealed		200	31
			Cured		280	32
		Ni or Co based	Annealed		250	33
			Cured		350	34
			Cast		320	35
	Titanium Ti alloys			RM 400		36
			Alpha+beta alloys cured	RM 1050		37
H	Hardened steel		Hardened		55 HRC	38
			Hardened		60 HRC	39
	Chilled cast iron		Cast		400	40
	Cast iron		Hardened		55 HRC	41

Material No.	Cutting Speed (m/min)	Cutting Diameter											
		Feed mm/tooth											
	IC908	2	3	4	6	8	10	12	14	16	20	25	30
1	100-250	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
2	80-210	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
3	65-170												
4	110-180	0.02	0.03	0.03	0.05	0.06	0.07	0.08	0.09	0.1	0.12	0.15	0.18
5	95-160	0.02	0.03	0.03	0.05	0.06	0.07	0.08	0.09	0.1	0.12	0.15	0.18
6	90-160	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
7	65-200	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
8	70-210	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
9	95-160	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
10	130-170	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
11	75-100	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
12	110-170	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
13	70-155	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
14	85-100	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.1	0.11
15	120-160	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
16	75-160	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
17	70-150	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
18	110-140	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
19	120-160	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
20	110-140	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.21	0.15	0.18	0.21
21	160-300	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
22													
23	150-350	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.21
24													
25	100-250	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.12
26													
27													
28													
29	100-400	0.05	0.06	0.07	0.09	0.1	0.11	0.12	0.13	0.15	0.18	0.22	0.25
30													
31													
32													
33	20-80	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05
34													
35													
36													
37	20-80	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05
38	55-65												
39	45-55												
40	90-105												
41	55-65												

* For cutters with long cutting flute, reduce feed rate by 40%.

Machining Data for Solid Carbide Threading Endmills

ISO	Material		Condition	Tensile Strength [Kspi]	Hardness HB	Material No.
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	61	125	1
		≥ 0.25 %C	Annealed	94	190	2
		< 0.55 %C	Quenched and tempered	123	250	3
		≥ 0.55 %C	Annealed	109	220	4
			Quenched and tempered	145	300	5
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	87	200	6
			Quenched and tempered	135	275	7
				145	300	8
				174	350	9
	High alloyed steel, cast steel, and tool steel		Annealed	99	200	10
			Quenched and tempered	160	325	11
	Stainless steel and cast steel		Ferritic/martensitic	99	200	12
			Martensitic	119	240	13
M	Stainless steel		Austenitic	87	180	14
K	Grey cast iron (GG)		Ferritic		160	17
			Pearlitic		250	18
	Cast iron nodular (GGG)		Ferritic/pearlitic		180	15
			Pearlitic		260	16
	Malleable cast iron		Ferritic		130	19
			Pearlitic		230	20
N	Aluminum- wrought alloy		Not cureable		60	21
			Cured		100	22
	Aluminum-cast, alloyed	=<12% Si	Not cureable		75	23
			Cured		90	24
		>12% Si	High temperature		130	25
	Copper alloys	>1% Pb	Free cutting		110	26
			Brass		90	27
			Electrolitic copper		100	28
	Non-metallic		Duroplastics, fiber plastics			29
			Hard rubber			30
S	High temp. alloys	Fe based	Annealed		200	31
			Cured		280	32
		Ni or Co based	Annealed		250	33
			Cured		350	34
			Cast		320	35
	Titanium Ti alloys			58		36
			Alpha+beta alloys cured	152		37
H	Hardened steel		Hardened		55 HRC	38
			Hardened		60 HRC	39
	Chilled cast iron		Cast		400	40
	Cast iron		Hardened		55 HRC	41

Material No.	Cutting Speed (SFM)	Cutting Diameter Feed (in/Tooth)										
	IC908	3/32	1/8	5/32	1/4	5/16	3/8	1/2	5/8	3/4	1.0	1.25
1	330-820	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
2	260-690	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
3	210-560											
4	360-590	.0008	.0012	.0012	.0020	.0024	.0028	.0031	.0039	.0047	.0059	.0071
5	310-520	.0008	.0012	.0012	.0020	.0025	.0028	.0031	.0039	.0047	.0059	.0071
6	300-520	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
7	210-660	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
8	230-690	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
9	310-520	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
10	430-560	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
11	250-330	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
12	360-560	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
13	230-510	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
14	280-330	.0008	.0008	.0012	.0012	.0016	.0020	.0020	.0028	.0031	.0039	.0043
15	230-490	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
16	360-460	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
17	390-520	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
18	250-520	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
19	390-520	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
20	360-460	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
21	520-980	.0012	.0016	.0016	.0024	.0028	.0031	.0035	.0047	.0059	.0071	.0083
22												
23												
24												
25												
26												
27												
28												
29	330-460	.0020	.0024	0028	0035	.0039	.0043	.0047	.0059	.0071	.0087	.0110
30												
31												
32												
33	70-260	.0008	.0008	.0008	.0012	.0012	.0012	.0012	.0016	.0016	.0020	.0020
34												
35												
36												
37	70-260	.0008	.0008	.0008	.0012	.0012	.0012	.0012	.0016	.0016	.0020	.0020
38	180-210											
39	150-180											
40	300-340											
41	180-210											

* For cutters with long cutting flute, reduce feed rate by 40%.

Machining Data for Indexable Insert Threading Tools

ISO	Material		Condition	Tensile Strength		Hardness HB	Material No.
				[N/mm^2]	[Ksp]		
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	61	125	1
		≥ 0.25 %C	Annealed	650	94	190	2
		< 0.55 %C	Quenched and tempered	850	123	250	3
		≥ 0.55 %C	Annealed	750	109	220	4
			Quenched and tempered	1000	145	300	5
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	87	200	6
			Quenched and tempered	930	135	275	7
				1000	145	300	8
				1200	174	350	9
	High alloyed steel, cast steel, and tool steel		Annealed	680	99	200	10
			Quenched and tempered	1100	160	325	11
	Stainless steel and cast steel		Ferritic/martensitic	680	99	200	12
			Martensitic	820	119	240	13
M	Stainless steel		Austenitic	600	87	180	14
K	Grey cast iron (GG)		Ferritic			160	17
			Pearlitic			250	18
	Cast iron nodular (GGG)		Ferritic/pearlitic			180	15
			Pearlitic			260	16
	Malleable cast iron		Ferritic			130	19
			Pearlitic			230	20
N	Aluminum- wrought alloy		Not cureable			60	21
			Cured			100	22
	Aluminum-cast, alloyed	=<12% Si	Not cureable			75	23
			Cured			90	24
		>12% Si	High temperature			130	25
	Copper alloys	>1% Pb	Free cutting			110	26
			Brass			90	27
			Electrolitic copper			100	28
	Non-metallic		Duroplastics, fiber plastics				29
			Hard rubber				30
S	High temp. alloys	Fe based	Annealed			200	31
			Cured			280	32
		Ni or Co based	Annealed			250	33
			Cured			350	34
			Cast			320	35
	Titanium Ti alloys			RM 400	58		36
			Alpha+beta alloys cured	RM 1050	152		37
H	Hardened steel		Hardened			55 HRC	38
			Hardened			60 HRC	39
	Chilled cast iron		Cast			400	40
	Cast iron		Hardened			55 HRC	41

No.	Indexable Cutting Speed for IC908 m/min	SFM
1	100-200	330 - 655
2	95-190	310 - 625
3	90-180	295 - 590
4	90-170	295 - 560
5	80-150	260 - 490
6	120-170	395 - 560
7	115-160	375 - 525
8	105-150	345 - 490
9	90-140	295 - 460
10	90-170	295 - 560
11	75-145	245 - 475
12	110-170	360 - 560
13	100-160	330 - 525
14	90-145	295 - 475
15	65-135	215 - 445
16	65-110	215 - 360
17	65-135	215 - 445
18	60-100	195 - 330
19	65-135	215 - 445
20	60-120	195 - 395
21	110-260	360 - 855
22	110-200	360 - 655
23	145-350	475 - 1150
24	145-275	475 - 900
25	95-225	310 - 740
26	145-350	475 - 1150
27	145-350	475 - 1150
28	145-350	475 - 1150
29	90-370	295 - 1215
30	80-330	260 - 1085
31	20-60	65 - 195
32	20-50	65 - 165
33	20-30	65 - 100
34	10-20	35 - 65
35	15-25	50 - 80
36	30-90	100 - 295
37	20-70	65 - 230
38	25-60	80 - 195
39	20-40	65 - 130
40	25-60	80 - 195
41	20-50	65 - 165

Calculating RPM:

Metric Example:

V=120 m/min

D=30 mm

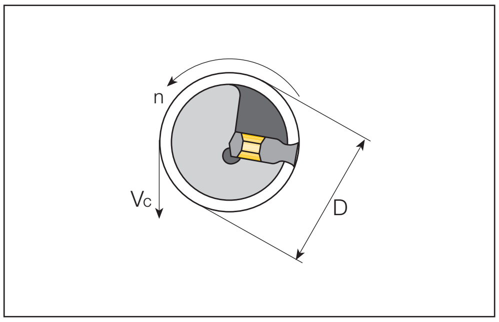
$$n = \frac{Vc \times 1000}{\pi x D} = \frac{120 \times 1000}{3.14x30} = 1274 \text{ RPM}$$

Inch Example:

V= 410 SFM

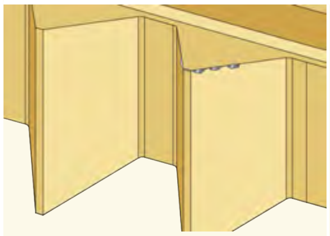
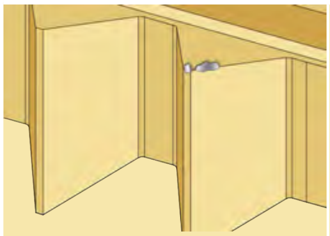
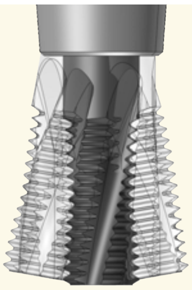
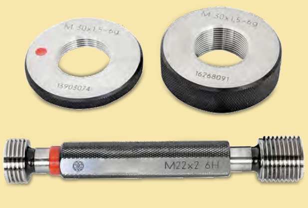
D=1.5 inch

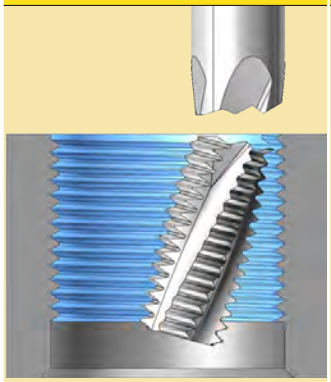
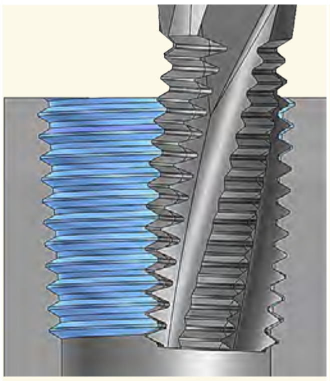
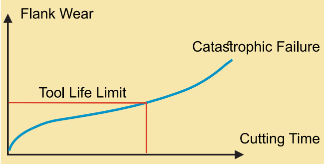
$$n = \frac{Vc \times 12}{\pi x D} = \frac{120 \times 12}{3.14x1.5} = 1045 \text{ RPM}$$



Feed: 0.05-0.15 mm/tooth
0.002-0.006 inch/tooth

3.15 Troubleshooting

Problem	Cause	Solution
 Flank Wear	• High cutting speed • Chip too thin • Insufficient coolant	• Reduce cutting speed • Increase feed rate and reduce radial passes • Check coolant pressure / flow direction
 Fracture/Chipping	• Vibration • High load on cutting edge	• Check stability • Reduce feed rate • Add radial passes
 Build up Edge	• Cutting speed too low • Insufficient coolant	• Increase cutting speed • Check coolant pressure / flow direction
 Thread Surface-Chatter Marks/Vibrations	• Feed rate is too high • Large profile • Thread length too long	• Reduce feed rate • Add passes • Add radial passes • Reduce overhang
 Thread Accuracy (GO/NOGO Gauge)	• Tool deflection • CNC program error	• Reduce feed rate • Add radial passes • Use ZERO compensation • Check CNC program

Problem	Cause	Solution
 Insert/Tool Breakage	• High load on the cutting edge • Unproper cutting conditions • Chip evacuation • CNC program error	• Add radial passes • Adjust cutting conditions • Add sufficient coolant • Check CNC program
 Tapered Thread	• Tool cutting load • Tool overhang	• Add radial passes and/or reduce cutting conditions • Clamp tool to the minimum overhang length
 Short Tool Life	• Unsuitable cutting conditions • Vibrations	• Adjust feed/speed • Reduce overhang as short as possible • Check tool and workpiece clamping

3.16 Special Request Form Thread Milling

Project Information

Customer | Industry | Country

Customer Goal (Productivity, Economy, etc.):

Proposal for: ☐ Insert ☐ Tool ☐ Machining Concept

ISCAR Representative: | Email: | Tel:

Competitors: | Target Price: | Annual Consumption:

Thread

Designation | Pitch | Standard | Tolerance Clas

Major Dia. | Minor Dia. | Pitch Dia. | Number of Starts

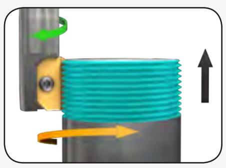
Thread Depth | ☐ Through Hole | ☐ Blind Hole

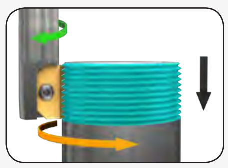
Special Form

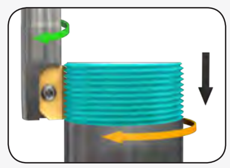
For non-standard profiles, detailed information must be supplied (drawing, dimensions & tolerances)

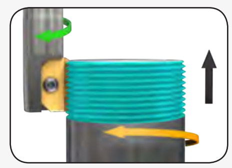
Application

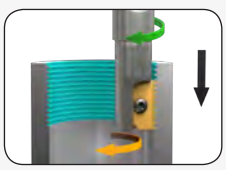
Part | Material | Hardness

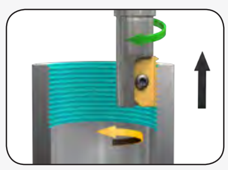

☐ External Right-hand Thread Conventional Milling

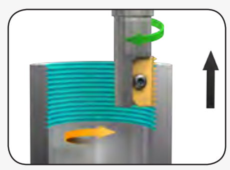

☐ External Left-hand Thread Conventional Milling

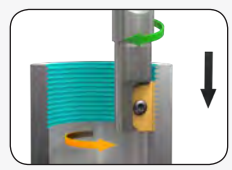

☐ External Right-hand Thread Climb Milling


☐ External Left-hand Thread Climb Milling

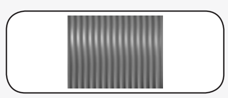

☐ Internal Right-hand Thread Conventional Milling


☐ Internal Left-hand Thread Conventional Milling


☐ Internal Right-hand Thread Climb Milling


☐ Internal Left-hand

Serration:


☐

Solution


☐ Single-Tooth


☐ Multi-Tooth


☐ Indexable


☐ Multi-Master


☐ Solid Carbide


☐ Multi-Master Indexable

Attachments ☐ Drawing ☐ Model ☐ Sketch ☐ Photo

Machine

Model ____________ Shank Type/Size ____________

Coolant: ☐ Internal ☐ External ☐ None Type: ____________

Remarks: ____________

GRADES AND MATERIALS

4 Cutting Material Grades and Engineering Materials

4.1 Tool Material Grades for Indexable Inserts and Solid Tools

The indexable inserts and solid carbide tools for thread production are produced from different tungsten carbide grades. The grade is defined by a combination of substrate type, coating type and post-coating treatment. If the indexable insert or solid carbide tool is not coated, then the grade will be defined by substrate type only.

ISCAR's products for threading are made from cemented carbide. Cemented carbides are very hard materials, and therefore, can cut most engineering materials that are softer.
In most cases, to improve performance of thread cutting products when applied to machining a specific class of materials, the indexable inserts and solid carbide tools are coated. One of the most common methods of coating is by physical vapor deposition (PVD). PVD coatings have a wide distribution in indexable thread turning inserts and thread a solid carbide tools because they leave the cutting edges sharp.

PVD coatings are applied at a relatively low temperature (about 500°C).

Nano layered PVD coating

PVD coatings were introduced during the late 1980's. With the use of advanced nanotechnology, PVD coatings performed a gigantic step in overcoming complex problems that were impeding progress in the field. Developments in science and technology brought a new class of wear-resistant nano layered coatings. These coatings are a combination of layers having a thickness of up to 50 nm (nanometers) and demonstrate significant increases in the strength of the coating compared to conventional methods.

SUMO TEC technology

SUMO TEC is a specific post-coating treatment process developed by **ISCAR**.
The treatment has the effect of making coated surfaces even and uniform, minimizing inner stresses and droplets in coating. In CVD coatings, due to the difference in thermal expansion coefficients between the substrate and the coating layers, internal tensile stresses are produced. Also, PVD coatings feature surface droplets. These factors negatively affect a coating and therefore shorten insert tool life. Applying SUMO TEC post-coating technologies considerably reduces and even removes these unwanted defects and results in increasing tool life and greater productivity.

ISCAR offers a rich variety of carbide grades for indexable threading inserts and threading solid carbide tools.

ISCAR's Most Popular Carbide Grades for Threading

Grade				Application Field According ISO 513 Standard						Used in	
Description	Coating Type	Coating Layers	Post-Coating Treatment	P	M	K	N	S	H	Thread Turning	Thread Milling
IC28	Uncoated	Uncoated								•	
IC928	PVD	TiAlN								•	
IC528	PVD	TiCN + TiN								•	•
IC228	PVD	TiCN + TiN		P30 - P45	M25 - M40					•	
IC50M	Uncoated	Uncoated								•	
IC250	PVD	TiCN + TiN		P15 - P35	M20 - M40					•	
IC08	Uncoated	Uncoated			M15 - M30		N10 - N25	S15 - S30		•	
IC908	PVD	TiAlN		P15 - P30	M20 - M30	K20 - K40		S15 - S30	H20 - H30	•	•
IC808	PVD	TiAlN + TiN	•	P15 - P30	M20 - M30	K20 - K40		S15 - S30	H20 - H30	•	
IC1008	PVD	TiAlN + TiN								•	
IC508	PVD	TiCN + TiN								•	
IC806	PVD	AlTiN + TiAlN	•		M05 - M15			S05 - S15		•	
IC1007	PVD	TiAlN + TiN		P10 - P20	M05 - M15	K15 - K30		S10 - S20	H05 - H15	•	
IC903	PVD	TiAlN									•
IC902	PVD	TiAlN									•

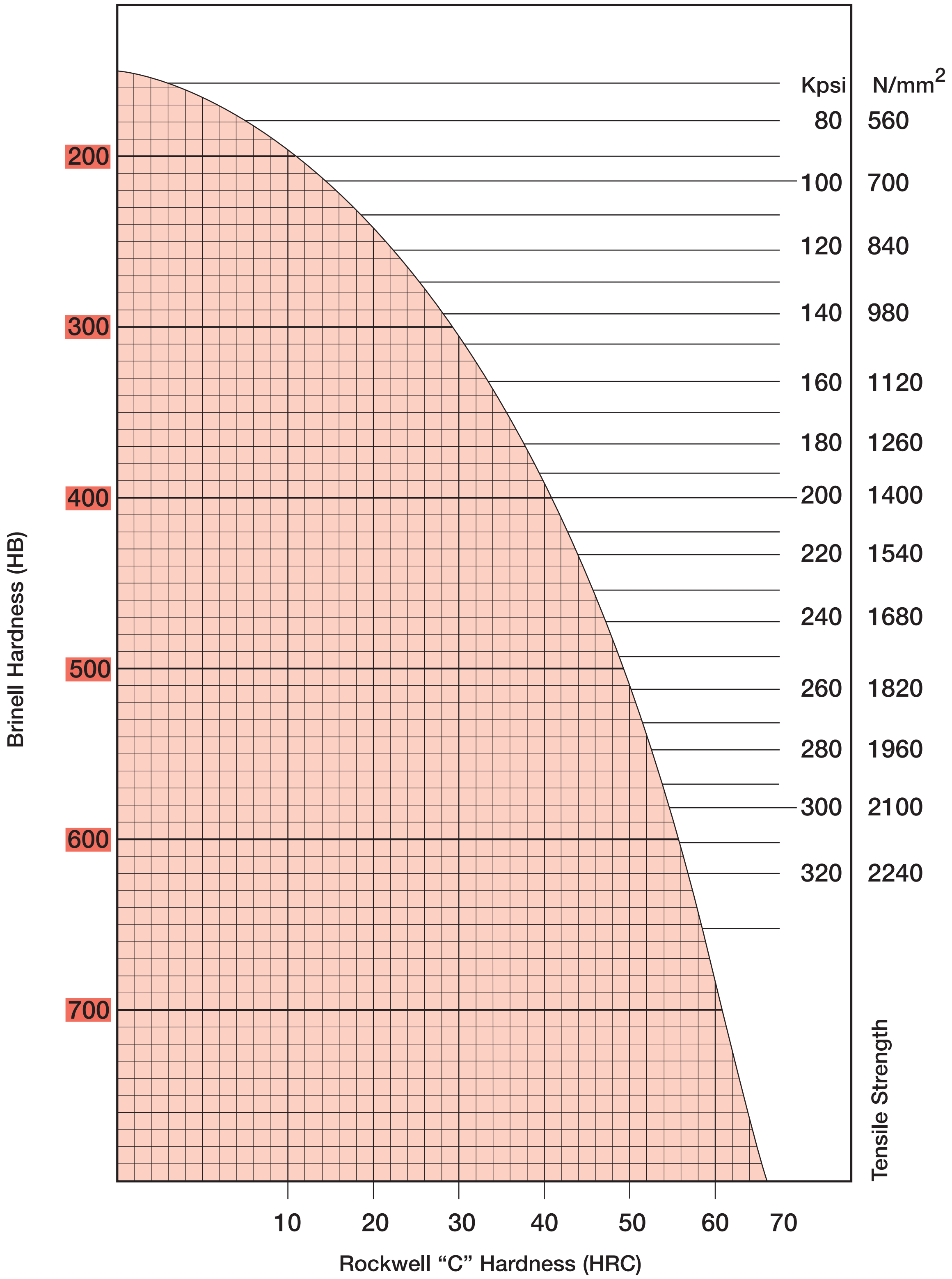
4.2 Material Groups

According to DIN / ISO 513 and VDI 3323

ISO	Material		Condition	Tensile Strength [N/mm²]	K_c1 [N/mm²]	mc	Hardness HB	Material No.
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	1350	0.21	125	1
		>= 0.25 %C	Annealed	650	1500	0.22	190	2
		< 0.55 %C	Quenched and tempered	850	1675	0.24	250	3
		>= 0.55 %C	Annealed	750	1700	0.24	220	4
			Quenched and tempered	1000	1900	0.24	300	5
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	1775	0.24	200	6
			Quenched and tempered	930	1675	0.24	275	7
				1000	1725	0.24	300	8
				1200	1800	0.24	350	9
	High alloyed steel, cast steel, and tool steel		Annealed	680	2450	0.23	200	10
			Quenched and tempered	1100	2500	0.23	325	11
	Stainless steel and cast steel		Ferritic/martensitic	680	1875	0.21	200	12
			Martensitic	820	1875	0.21	240	13
M	Stainless steel		Austenitic, duplex	600	2150	0.20	180	14
K	Grey cast iron (GG)		Ferritic/pearlitic		1150	0.20	180	15
			Pearlitic		1350	0.28	260	16
	Nodular cast iron (GGG)		Ferritic		1225	0.25	160	17
			Pearlitic		1350	0.28	250	18
	Malleable cast iron		Ferritic		1225	0.25	130	19
			Pearlitic		1420	0.3	230	20
N	Aluminum- wrought alloy		Not hardenable		700	0.25	60	21
			Hardenable		800	0.25	100	22
	Aluminum-cast, alloyed	<=12% Si	Not hardenable		700	0.25	75	23
			Hardenable		700	0.25	90	24
		>12% Si	High temperature		750	0.25	130	25
	Copper alloys	>1% Pb	Free cutting		700	0.27	110	26
			Brass		700	0.27	90	27
			Electrolytic copper		700	0.27	100	28
	Non metallic		Duroplastics, fiber plastics					29
			Hard rubber					30
S	High temperature alloys	Fe based	Annealed		2600	0.24	200	31
			Hardened		3100	0.24	280	32
		Ni or Co based	Annealed		3300	0.24	250	33
			Hardened		3300	0.24	350	34
			Cast		3300	0.24	320	35
	Titanium alloys		Pure	RM 400	1700	0.23		36
			Alpha+beta alloys hardened	RM 1050	2110	0.22		37
H	Hardened steel		Hardened		4600		55 HRC	38
			Hardened		4700		60 HRC	39
	Chilled cast iron		Cast		4600		400	40
	Cast iron		Hardened		4500		55 HRC	41

Steel · Stainless Steel · Cast Iron · Nonferrous · High Temp. and Titanium Alloys · Hardened Steel and Cast Iron

Hardness Conversion Table



Material Groups According to VDI 3323 Standard

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
1			1.0028	Ust 34-2 (S250G1T)	
1			1.0034	RSt 34-2 (S250G2T)	1449 34/20HR; 1449 34/20HS; 1449 34/20CR; 1449 34/20CS
1			1.0035	St185 (Fe 310-0); St 33	Fe 310-0; 1449 15HR; 1449 15HS
1	A 570 Gr. 33; A 570 Gr. 36		1.0036	S235JRG1; (Fe 360 B); Ust 37-2	Fe 360 B; 4360-40 B
1			1.0037	S235JR (Fe 360 B); St 37-2	Fe 360 B; 4360-40 B
1	A 570 Gr. 40		1.0044	S275JR (Fe 430 B); St44-2	Fe 430 B FN; 1449 43/25 HR; 1449 43/25HS; 4360-43 B
1			1.0045	S355JR	4360-50 B
1	A 570 Gr.50; A 572 Gr.50		1.0050	E295 (Fe 490-2); St 50-2	Fe 490-2 FN; 4360-50 B
1	A 572 Gr. 65		1.0060	E335 (Fe 590-2); St 60-2	Fe 60-2; 4360-55 E; 4360-55 C
1			1.0112	P235S	1501-164-360B LT20
1			1.0114	S235JU; St 37-3 U	4360-40C
1			1.0130	P265S	1501-164-400B LT 20
1			1.0143	S275J0; St 44-3 U	4360-43C
1	A 573 Gr. 70; A 611 Gr.D		1.0144	S275J2G3 (Fe 430 D 1); St 44-3	Fe 430 D1 FF; 4360-43 C; 4360-43 D
1			1.0149	S275JOH; RoSt 44-2	4360-43C
1			1.0226	DX51D; St 02 Z	Z2
1	M 1010		1.0301	C10	040 A 10; 045 M 10; 1449 10 CS

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
A 34-2		Fe 330; Fe 330 B FU		SS 330	
A 34-2 NE		Fe 330 B FN			St2sp; St2ps
A 33	1300	Fe 320	Fe 310-0		St0
	1311; 1312	FE37BFU	AE 235 B; Fe 360 B		16D; 18kp; St3kp
E 24-2	1311	Fe 360 B; 1449 37/23 HR	AE 235 B; Fe 360 B	STKM 12 A; STKM 12 AC	
E 28-2	1412	Fe 430 B; Fe 430 B FN	AE 275 B; Fe 430 B FN	SM 400 A; SM 400 B; SM 400 C	St4ps; St4sp
E 36-2	2172	Fe 510 B	AE 355 B		
A 50-2	1550; 2172	Fe 490	a 490-2; Fe 490-2 FN	SS 490	ST5ps; ST5sp
A 60-2	1650	Fe 60-2; Fe 590	A 590-2; Fe 590-2 FN	SM 570	St6ps; St6sp
A37AP		Fe 360 C	AE 235 C		
E 24-3		Fe 360 C	AE 235 C		
A 42 AP			SPH 265		
E 28-3	1414-01	Fe 430 D	AE 275 D		
E 28-3; E 28-4	1411; 1412; 1414	Fe 430 B; Fe 430 C (FN); Fe 430 D (FF)	AE 275 D; Fe 430 D1 FF	SM 400 A; SM 400 B; SM 400 C	St4kp; St4ps; St4sp
	1412-04	Fe 430 C	Fe 430 C		
GC	1151 10	FeP 02 G	FeP 02 G		
AF 34 C 10; XC 10		C 10; 1 C 10	F.1511; F.151.A	S 10C	10

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
1	A 621 (1008)		1.0330	DC 01; St 2; St 12	1449 4 CR; 1449 3 CS
1	A 619 (1008)		1.0333	Ust 3 (DC03G1); Ust 13	1449 2 CR;1449 3 CR
1	A 621 (1008)		1.0334	UStW 23 (DD12G1)	
1	A 622 (1008)		1.0335	DD13; StW 24	1449 1 HR
1	A 620 (1008)		1.0338	DC04; St 4; St 14	1449 1 CR; 1449 2 CR
1	A 516 Gr. 65; 55 A 515 Gr. 65; 55 A 414 Gr. C; A 442 Gr.55		1.0345	P235GH/H I	1501 Gr. 141- 360; 1501 Gr. 161- 360; 151-360 1501 Gr. 161-400; 154-360 1501 Gr. 164-360; 161-360
1	(M) 1020; M 1023	2C/2D	1.0402	C22	055 M 15; 070 M 20; 1499 22 HS; 1499 22 CS
1	1020	2C/2D	1.0402	C22	050A20
1	1020; 1023	2C	1.0402	C22	055 M 15; 070 M 20
1			1.0425	P265GH/H II	1501 Gr. 161- 400; 151-400 1501 Gr. 164-360; 161-400 1501 Gr. 164-400; 154-400
1	A27 65-35		1.0443	GS-45	A1
1			1.0539	S355NH;StE 335	
1			1.0545	S355N; StE 355	4360-50E
1			1.0546	S355NL;TStE 355	4360-50EE
1			1.0547	S355JOH	4360-50C
1			1.0549	S355 NLH;TStE 355	
1			1.0553	S355JO;St 52-3U	4360-50C

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
TC	1142	FeP 00; FeP 01	AP 11	SPHD	15 kp
E		FeP 02	AP 02	SPCD	
S C		FeP 12	AP 12	SPHE	10kp
3 C		FeP 13	AP 13	SPHE	08kp
ES	1147	FeP 04	AP 04	SPCE	08Ju; JuA
A 37 CP; A 37 AP	1331; 1330	FeE235; Fe 360 1 KW; Fe 360 1KG; Fe 360 2 KW; Fe 360 2 KG	A 37 RC I; RA II	SGV 410; SGV 450; SGV 480; SPV 450; SPV 480	
AF 42 C 20; XC 25; 1 C 22	1450	C 20; C 21; C 25	1 C 22; F.112	S20C	20
CC20	1450	C20; C21	F.112	S22 C	20
AF 42 C 20; XC 25; 1 C 22	1450	C 20;C 21;C 25	1 C 22F.112	S 20 C; S 22 C	
A 42 CP; A 42 AP	1431; 1430; 1432	Fe 410 1KW; Fe 410 1KG; Fe 410 1KT; Fe 410 2KW; Fe 410 2KG	A 42 RC I; A 42 RC II	SPV 315; SPV 355; SG 295; SGV 410; SGV 450; SGV 480	16K; 20K
E 23-45 M	1305				
TSE 355-4	2134-04	Fe 510 B	Fe 355 KGN		
E 355 R	2334-01	FeE 355 KG	AE 355 KG		
E 355 FP	2135-01	FeE 355 KT	AE 355 KT		
TSE 355-3	2172-04	Fe 510 C	Fe 510 C		
	2135	Fe 510 D	FeE 355 KTM		
E 36-3		Fe 510 C			

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
1	A 633 Gr.C; A 588		1.0562	P355N; StE 355	1501 Gr.225-490A LT 20
1			1.0565	P355NH; WStE 355	1501-225-490B LT 20
1			1.0566	P355NL1; TStE 355	1501-225-490A LT 50
1	1		1.0570	S355J2G3; St 52-3	Fe 510 D1 FF; 1449 50/35 HR›HS; 4360-50 D
1	1213		1.0715	9 SMn 28 (1SMn30)	230 M 07
1	1213		1.0715	9 SMn 28	230 M 07
1	12 L 13		1.0718	9 SMnPb 28 (11SMnPb30)	
1	1108; 1109		1.0721	10 S 20	10S20
1	11 L 08		1.0722	10 SPb 20	
1	11 L 08		1.0722	10 SPb 20	
1	1215		1.0736	9 SMn 36 11SMn37)	
1	12 L 14		1.0737	9 SMnPb 36 (11SMnPb37)	
1			1.0972	S315MC; QStE 300 TM	1501-40F30
1			1.0976	S355MC; QStE 360 TM	1501-43F35
1			1.0982	S460MC; QStE 460 TM	1501-50F45
1			1.0984	S500MC; QStE 500 TM	
1			1.0986	S500MC; QStE 500 TM	1501 - 60F55
1	1010		1.1121	CK 10; (C10E)	040 A 10
1			1.1121	St 37-1	4360 40 A
1	1015	32C	1.1141	CK 15; (C15E)	040 A 15; 080 M 15
1	1020; 1023		1.1151	C22E; CK 22	055 M 15; (070 M 20)

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
FeE 355 KG N; E 355 R/FP; A 510 AP	2106	FeE 355 KG; FeE 355 KW	AEE 355 KG; AEE 355 DD	SM 490 A; SM 490 B; SM 490 C; SM 490 YA; SM 490YB	15GF
A 510 AP	2106	FeE 355-2			
A 510 FP	2107-01	FeE 355-3			
E 36-3; E 36-4	2132; 2133; 2134; 2174	17GS; 17G1S	AE 355 D; Fe 510 D1 FF	SM 490 A; SM 490 B; SM 490 C; SM 490 YA; SM 490YB	17GS; 17G1S
S 250	1912	CF SMn 28	F.2111 - 11 SMn 28	SUM 22	
S 250	1912	CF 9 SMn 28	11 SMn 28	SUM 22	
S 250 Pb	1914	CF 9 SMnPb 28	F.2112-11 SMnPb 28	SUM 22 L; SUM 23 L; SUM 24 L	
10S20; 10 F 2		CF 10 S 20	F. 2121 - 10 S 20		
10PbF 2		CF 10 SPb 20	F.2122-10 SPb 20		
10 PbF 2		CF 10 SPb 20	10 SPb 20		
S 300		CF 9 Mn 36	F.2113 - 12 SMn 35	SUM 25	
S 300 Pb	1926	CF 9 SMnPb 36	F.2114- 12 SMnPb 35		
E 315 D					
E 355 D	2642	FeE 355TM			
E 490 D	2662	FeE 490 TM			
E 560 D		FeE 560 TM			
XC 10	1265	C 10; 2 C 10; 2 C 15	F-1510-C 10 K	S 9 CK; S 10 C	08;10
	1300				
XC 12; XC 15; XC 18	1370	C 15; C 16	F.1110-C 15 K; F.1511-C 16 K	S 15; S 15 CK	15
2 C 22; XC 18; XC 25	1450	C 20; C 25	F.1120-C 25 K	S 20 C; S 20 CK; S 22 C	20

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
1			1.2083		
1	A572-60		1.8900	StE 380	4360 55 E
1	A36			St 44-2	4360 43 A
1				StE 320-3Z	1 501 160
2	(M) 1025		1.0406	C 25	070 M 26
2			1.0416	GS-38	
2	A 537 Cl.1; A 414 Gr. G; A 612		1.0473	P355GH; 19 Mn 6	
2	1035		1.0501	C35	080 A 32; 080 A 35; 080 M 36; 1449 40 CS
2	1045		1.0503	CF 45; (C45G)	060 A 47; 080 M 46
2	1040		1.0511	C40	080 M 40
2			1.0540	C 50	
2	A27 70-36		1.0551	GS-52	A2
2	A148 80-40		1.0553	GS-60	A3
2	A738		1.0577	S355J2G4 (Fe 510 D 2)	Fe 510 D2 FF; 1501 Gr.224-460; 1501 Gr. 224-490
2	1140	8M	1.0726	35 S 20	212 M 36
2	1146		1.0727	45 S 20 (46S20)	
2	1035; 1041	15	1.1157	40Mn4	150 M 36
2	1025		1.1158	C25E; CK 25	(070 M 25)
2	1536		1.1166	34Mn5	
2	1330	14A	1.1170	28Mn6	(150 M 28); (150 M 18)
2			1.1178	C30E; CK 30	080M30
2	1035		1.1180	C35R; Cm 35	080 A 35
2	1035; 1038		1.1181	C35E; CK 35	080 A 35; (080 M 36)
2	1035		1.1181	C35E; CK 35	080 A 35; (080 M 36)
2	1035		1.1183	Cf 35 (C35G)	080 A 35

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
	2314				
	2145	FeE390KG		S25C	
NFA 35-501 E 28	1411				
	1421				
1 C 25		C 25; 1 C 25			
20-400 M	1306				
A 52 CP	2101; 2102	Fe E 355-2	A 52 RC I, RA II	SGV 410; SGV 450; SGV 480	
1 C 35; AF 55 C 35; XC 38	1572; 1550	C 35; 1 C 35	F.113	S 35 C	35
XC 42 H 1 TS	1672	C 43; C 46		S 45 C	45
1 C 40; AF 60 C 40		C40; 1 C 40	F.114.A		
	1674	C 50	1 C 50		
280-480 M	1505				
320-560 M	1606				
A 52 FP	2107		A 52 RB II; AE 355 D		
35MF 6	1957		F.210.G		
45 MF 4	1973				
35 M 5; 40 M 5					40G
2 C 25; XC 25		C25	F.1120 - C 25 K	S 25 C; S 28 C	25
			TO.B	SMn 433 H	
20 M 5; 28 Mn 6		C 28 Mn	28 Mn 6	SCMn 1	30G
XC 32		C 30	2 C 30		
3 C 35; XC 32	1572		F.1135-C 35 K-1		
2 C 35; XC 32; XC 38 H 1	1550; 1572	C 35	F.1130-C 35 K	S 35 C	35
XC 38	1572	C36		S35C	
XC 38 H 1 TS	1572	C 36; C 38		S 35 C	35

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
2	1042		1.1191	GS- Ck 45	080 A 46
2	1049; 1050		1.1206	C50E; CK 50	080 M 50
2	1050; 1055		1.1213	Cf 53; (C53G)	070 M 55
2	4520		1.5423	22Mo4	1503-245-420
3	A 516 Gr.70; A 515 Gr. 70; A 414 Gr.F; A 414 Gr.G		1.0481	P295GH; 17 Mn 4	1501 Gr. 224
3	1043		1.0503	C35	060 A 47; 080 M 46; 1449 50 HS, 1449 50 CS
3	1074		1.0614	C 76 D; D 75-2	
3	1086		1.0616	C 86 D; D 85-2	
3	1095		1.0618	C 92 D; D 95-2	
3	1036; 1330		1.1165	30Mn5	120 M 36; (150 M 28)
3	1335		1.1167	36Mn5	150 M 36
3	1040		1.1186	C40E; CK 40	060 A 40; 080 A 40; 080 M 40
3	1045		1.1191	C45E; CK 45	080 M 46; 060 A 47
3	1049		1.1201	C45R; Cm 45	080 M 46
3			1.7242	18 CrMo 4	
3	A 387 Gr. 12 Cl		1.7337	16 CrMo 4 4	
3			1.7362	12 CrMo 19 5	3606-625
3	A572-60			17 MnV 6	436055 E
4	1055		1.0535	C55	070 M 55

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
XC 45	1660	C45	F-1140		
2 C 50; XC 48 H 1; XC 50 H1	1674	C 50			50
XC 48 H TS	1674	C 53		S 50 C	50
		16 Mo 5 KG; 16 Mo 5 KW	F.2602- 16 Mo 5	SB 450 M; SB 480 M	
A 48 CP; A 48 AP		Fe 510 KG; Fe 510 KT; Fe 510 KW; Fe 510-2 KG; Fe 510-2KT; Fe 510-2KW; FeE 295	A 47 RC I; RA II	SG 365; SGV 410; SGV 450; SGV 480	14G2
1 C 45; AF 65 C 45	1672; 1650	C 45; 1 C 45	F.114	S 45 C	45
XC 75					
XC 80		C 85			
XC 90					
35 M 5			F.8211-30 Mn 5; f.8311-AM 30 Mn 5	SMn 433 H; SCMn 2	27ChGSNMDTL 30GSL
40 M 5	2120		F. 1203-36 Mn 6; F. 8212-36 Mn 5	ssmN 438 (H); SCMn 3	35G2; 35GL
2 C 40; XC 42 H 1		C 40		S 40 C	
2 C 45; XC 42 H 1; XC 45; XC 48 H 1	1672	C 45; C 46	F.1140-C 45 K; F.1142-C48 K	S 45 C; S 48 C	45
3 C 45; XC 42 H 1; XC 48 H 1	1660	C 45	F.1145-C 45K-1; F.1147C 48 K-1	S 50 C	
		A 18 CrMo 4 5 KW			15ChM
Z 10 CD 5.05		16 CrMo 20 5			
NFA 35-501 E 36	2142				
1 C 55; AF 70 C 55	1655	C 55; 1 C 55		S 55 C	55

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
4	1060	43D	1.0601	C60	060 A 62; 1449 HS; 1449 CS
4	107		1.0603	C67	080 A 67; 1449 70 HS
4	1074; 1075		1.0605	C75	1449 80 HS
4	1055		1.1203	C55E; CK 55	060 A 57; 070 M 55
4	1055		1.1209	C55R; Cm 55	070 M 55
4	1060; 1064	43D	1.1221	C60E; CK 60	060 A 62
4	1070		1.1231	Ck 67; (C67E)	060 A 67
4	1074; 1075; 1078		1.1248	CK 75; (C75E)	060 A 78
4	1086		1.1269	CK 85 (C85E)	
4	1095		1.1274	Ck 101 (C101E)	
4	W 112		1.1663	C 125 W	
4					
5			1.0070	E360 (Fe 690-2); St 70-2	Fe 690-2 FN
5			1.7238	49 CrMo 4	
5			1.7701	51 CrMoV 4	
6	A 284 Gr.D; A 573 Gr.58; A 570 Gr 36; A 570 Gr C; A 611 Gr. C		1.0116	S235J2G3 (Fe 360 D 1); St 37-3	Fe 360 D1 FF; 1449 37/23 CR; 4360-40 D
6	5120		1.0841	St 52-3	150 M 19
6	9255	45	1.0904	55 Si 7	250A53
6	9254		1.0904	55 Si 7	250 A 53
6	9262		1.0961	60SiCr7	
6	L3		1.2067	100Cr6	BL3
6	L1		1.2108	90 CrSi 5	
6	L2		1.2210	115CrV3	
6			1.2241	51CrV4	

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
1 C 60; AF 70 C 55		C 60; 1 C 60		S 58 C	60(G)
XC 65		C 67			
		C 75			75
2 C 55; XC 55 H 1	1655	C 55	F.1150-C 55 K	S 55 C	55
3 C 55; XC 55 H 1		C 55	F.1155-C 55K-1		
2 C 60; XC 60 H 1	1665; 1678	C 60		S 58 C	60; 60G; 60GA
XC 68	1770	C70			65GA; 68GA; 70
XC 75	1774	C 75			75(A)
XC 90		C 90			85(A)
XC 100	1870	C 100	F-5117	SUP 4	
Y2 120					
	2223				
A 70-2	1655	Fe 70-2; Fe 690	A 690-2; Fe 690-2 FN		
		51 CrMoV 4			
E 24-3; E 24-4	1312; 1313	Fe 360 D1 FF; Fe 360 C FN; Fe 360 D FF; Fe 37-2	AE 235 D; Fe 360 D1 FF		St3kp; St3ps; St3sp; 16D
20 MC 5	2172	Fe 52	F-431		
55S7	2085	55Si8	56Si7		
55 S 7	2090				
60SC6		60SiCr8	60SiCr8		
Y100C6			100Cr6		
	2092	105WCR 5			
100C3		107CrV3KU			

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
6			1.2311	40 CrMnMo 7	
6	4135		1.2330	35 CrMo 4	708 A 37
6			1.2419	105WCr6	105WC 13
6	0 1		1.2510	100 MnCrW 4	BO1
6	S1		1.2542	45 WCrV7	BS1
6	S1		1.2550	60WCrV7	
6	L6		1.2713	55NiCrMoV6	
6	L 6		1.2721	50NiCr13	
6	O2		1.2842	90MnCrV8	BO2
6	E 50100		1.3501	100 Cr 2	
6	52100	31	1.3505	100Cr6	2 S 135; 535 A 99
6			1.5024	46Si7	
6	9255		1.5025	51Si7	
6	9255		1.5026	55Si7	251 a 58
6	9260		1.5027	60Si7	251 A 60; 251 H 60
6	9260 H		1.5028	65Si7	
6			1.5120	38 MnSi 4	
6	A 204 Gr.A; 4017		1.5415	16Mo3; 15 Mo 3	1503-243 B
6	4419		1.5419	20Mo4	1503-243-430
6	A 350-LF 5		1.5622	14Ni6	
6	3415		1.5732	1 NilCr10	
6	3310; 3314	36A	1.5752	14NilCr14	655M13
6			1.6587	17CrNiMo6	820A16
6			1.6657	14NiCrMo134	
6	5015		1.7015	15 Cr 3	523 M 15
6	5132	18B	1.7033	34Cr4	530A32
6	5140	18	1.7035	41C r4	530M40
6	5140		1.7045	42Cr41	530 A 40
6	5115		1.7131	16MnCr5	527 M 17
6			1.7139	16MnCr5	

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
		35 cRmO 8 KU			
34 CD 4	2234	35CrMo4	34CrMo4	SCM435TK	
105WC13	2140	10WCr6	105WCr5		ChWG
8 MO 8	2140	10WCr6	105WCr5	SKS31	
	2710	45 WCrV8 KU	45WCrSi8		5ChW25F
55WC20	2710	58WCr9KU			
55NCDV7			F.520.S	SKT4	5ChNM
55 NCV 6	2550		f-528		
90 MV8					
100 C 6	2258	100Cr6	F.1310 - 100 Cr 6	SUJ2	SchCh15
45 S 7; Y 46 7; 46 SI 7			F. 1451 - 46 SI 7		
51 S 7; 51 Si 7	2090	48 Si 7; 50 Si 7	F.1450-50 Si 7		
55 S 7	2085; 2090	55 Si 7	F.1440 - 56 Si 7		55S2
60 S 7		60 Si 7	F. 1441 - 60 Si 7		60S2
60 S 7				50 P 7; SUP 6	
15 D 3	2912	16Mo3 KG; 16Mo3KW	F. 2601 - 16 Mo 3		
	2512	G 20 Mo 5; G 22 Mo5		SCPH 11	
16N6		14 Ni 6 KG; 14 Ni 6 KT	F.2641 - 15 Ni 6		
14 NC 11		16NiCr11	15NiCr11	SNC415(H)	
12NC15				SNC815(H)	
18NCD6			14NiCrMo13		
			14NiCrMo131		
12 C 3				SCr415(H)	15Ch
32C4		34Cr4(KB)	35Cr4	SCr430(H)	35Ch
42C4		41Cr4	42Cr4	SCr440(H)	
42 C 4 TS	2245	41Cr4	42Cr4	SCr440	
16 MC 5	2511	16MnCr5	16MnCr5		
	2127				

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	 DIN	United Kingdom BS
6	5155	48	1.7176	55Cr3	527 A 60
6	4135; 4137		1.7220	34CrMo4	708 Aa 37
6	4142		1.7223	41CrMo4	
6	4140		1.7225	42CrMo4	708 M 0
6		33	1.7228	55NiCrMoV6G	823M30
6			1.7262	15CrMo5	
6			1.7321	20 mOcR 4	
6	ASTM A182 F12		1.7335	13CrMo4 4	1501-620Gr27
6	A 182-F11; A 182-F12		1.7335	13 CrMo 4 4	1 501 620 Gr. 27
6	ASTM A 182 F22		1.7380	10CrMo9 10	1501-622gR31; 1501-622gR45
6	A182 F22		1.7380	10 CrMo 9 10	1501-622
6			1.7715	14MoV6 3	1503-660-440
6	A355A	41B	1.8509	41CrAlMo 7	905 M 39
7	A570.36		1.0038	S235JRG2 (Fe 360 B); RSt 37-2	Fe 360 B FU; 1449 27/23 CR; 4360-40 B
7	3135	111A	1.5710	36NiCr6	640A35
7			1.5755	31 NiCr 14	653 M 31
7	8620	362	1.6523	2 NiCrMo2	805M20
7	8740		1.6546	40 NiCrMo 22	311-Tyre 7
7	4340	24	1.6565	40NiCrMo6	817 M 40
7	4130		1.7218	25CrMo4	CDS 110
7			1.7733	24 CrMoV 5 5	
7			1.7755	GS-45 CrMOV 10 4	
7			1.8070	21 CrMoV 5 11	
8	C 45 W		1.173	C 45 W3	
8	4142	19A	1.2332	47 CrMo 4	708 M 40
8	A128 (A)		1.3401	G-X120 Mn 12	
8	3435		1.5736	36 NiCr 10	
8	9840	110	1.6511	36CrNiMo4	816M40
8		40B	1.7361	32 CeMo12	722 M 24
8	6150	47	1.8159	50 CrV 4	735 A 50
8			1.8161	58 CrV 4	

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
55 C 3	2253			SUP9(A)	50ChGA
35 CD 4	2234				35ChM
		41CrMo4	42CrMo4	SNB 22-1	40ChFA
42 CD 4	2244				
	2512	653M31			
12 CD 4	2216		12CrMo4		
	2625				
		14CrMo4 5	14CrMo45		
15 CD 4.5	2216		12CrMo4	SCM415(H)	12ChM; 15ChM
12 CD 9.10	2218	12CrMo9, 12CrMo10	TU.H		
			13MoCrV6		
40 CAD 6.12	2940	41CrAlMo7	41CrAlMo7		
E 24-2NE	1312	Fe 360 B FN	AE 235 B FN; AE 235 B FU; Fe 360 B FN; Fe 360 B FU		St3ps; St3sp
35NC6				SNC236	
18 NC 13					
20 NCD 2	2506	20NiCrMo2	20NiCrMo2	SNCM220(H)	20ChGNM
		40NiCrMo2(KB)	40NiCrMo2	SNCM240	38ChGNM
35 NCD 6	2541	35NiCrMo6(KB)		SNCM 447	38Ch2N2MA
25 CD 4	2225	25CrMo4(KB)	55Cr3	SCM420; SCM430	20ChM; 30ChM
20 CDV 6		21 CrMoV 5 11			
		35 NiCr 9			
XC 48					
42 CD 4	2244	42CrMo4	42CrMo4	SCM (440)	
Z 120 M 12	2183	GX120Mn12	F. 8251-AM-X120Mn12	SCMnH 1; SCMn H 11	110G13L
30 NC 11					
40NCD3		36nIcRmO4(KB)	35NiCrMo4	SUP10	40ChN2MA
30 CD 12	2240	30CrMo12	F.124.A		
50CrV4	2230	50CrV4	51CrV4		50ChGFA

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
8		40B	1.8515	32 CrMo 12	722 M 24
8		40C	1.8523	39CrMoV13 9	897M39
9			1.4882	X 50 CrMnNiNbN 21 9	
9			1.5864	35 niCr 18	
9				31 NiCrMo 13 4	830 m 31
10	A 619		1.0347	DCO3; RRSt; RRSt 13	1449 3 CR; 1449 2 CR
10	M 1015; M 1016; M 1017		1.0401	C15	080 M 15; 080 M 15; 1449 17 CS
10			1.0723	15 S22; 15 S 20	210 A 15; 210 M 15
	D 3		1.2080	X 210 Cr 12	BD 3
10	420		1.2083	X 42 Cr 13	
10			1.2085	X 33 CrS 16	
10			1.2162	21 MnCr 5	
10	L2		1.2210	115 Cr V3	
10			1.2311	40 CrMnMo7	
10	P20+S		1.2312	40CrMnMoS 8.6	
10		X38CrMo16	1.2316	X36CrMo17	
10	H 11		1.2343	x 38 CrMoV 5 1	BH 11
10			1.234	X 38 CrMoV 5 1	
10	H 13		1.2344	X 40 CrMoV 5 1	BH 13
10	A 2		1.2363	X100 CrMoV 5 1	BA 2
10			1.236	X 100 CrMo V5-1	
10	D 2		1.2379	X 155 CrVMo 12 1	BD2
10			1.238	X 155 CrVMo 12 1	
10	HNV3		1.2379	X210Cr12G	BD2
10	D 4 (D 6)		1.2436	X 210 CrW 12	BD6
10			1.244	X 210 CrW 12	
10	O1		1.251	100 MnCrW 4	B0 1
10	H 21		1.2581	X 30 WCrV 9 3	BH 21
10			1.2601	X 165 CrMoV 12	
10	H 12		1.2606	X 37 CrMoW 5 1	BH 12

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
30 CD 12	2240	32CrMo12	F.124.A		
		36CrMoV12			
Z 50 CMNNb 21.09					
	2534		f-1270		
E		Fep 02	AP 02		08JU
AF 37 C12; XC 18	1350	C15; C16; 1 C 15	F.111	S 15 C	
Z 200 C 12	1922		F.210.F	SUM 32	
Z40 C14	2314			SUS 420 J 2	
Z35V CD 17.S					
20 MC 5					
100 C3		107 CrV3 KU	F.520 L		
40 CMD 8		35 cRmO 8 KU			
40CMD8S					
Z 38 CDV 5		X 37 CrMoV 5 1 KU			4Ch5MFS
Z 38 CDV 5		X 37 CrMoV 51 KU			
Z 40 CDV 5	2242	X40CrMoV511KU	F-5318	SKD61	4Ch5MF1S
Z 100 CDV 5	2260	X100CrMoV51KU	F-5227	SKD12	
Z 160 CDV 12	2310	X165CrMoW12KU	X160CrMoW12KU	SKD11	
Z 160 CDV 12		X 155 CrVMo 12 1 KU			
Z160CDV12	2736				
Z 200 CD 12	2312	X215CrW 12 1 KU	F-5213		
90 MnWRrV5		95MnWCr 5 KU	95 MnCrW 5		
Z 30 WCV 9		X30WCrV 9 3 KU	F-526	SKD5	3Ch2W8F
	2310				
Z 35 CWDV 5		X 35 CrMoW 05 KU	F.537		5ChNM

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
10			1.277	X 45 NiCrMo 4	
10	O2		1.284	90 MnCrV 8	B0 2
10	D3		1.3343	S 6-5-2	BM2
10	ASTM A353		1.5662	X8Ni9	1501-509; 1501-510
10	ASM A353		1.5662	X8Ni9	502-650
10	2517		1.568	12Ni19	12Ni19
10	2515		1.5680	12 Ni 19	
10			1.713	16 MnCr 5	
10			1.276	X 19 NiCrMo 4	
11			1.3202	S 12-1-4-5	BT 15
11			1.3207	S 10-4-3-10	BT42
11	T 15		1.3243	S 6-5-2-5	
11			1.3246	S 7-4-2-5	
11			1.3247	S 2-10-1-8	BM 42
11	M 42		1.3249	S 2-9-2-8	BM 34
11	T 4		1.3255	S 18-1-2-5	BT 4
11	M 2		1.3343	S6-5-2	BM2
11	M 7		1.3348	S2-9-2	
11	T 1		1.3355	S 18-0-1	BT 1
11	HNV 3	52	1.4718	X45CrSi 9 3	401S45
11	422		1.4935	X20 CrMoWV 12 1	
12	403		1.4000	X6Cr13	403 S 17
12			1.4001	X6Cr14	
12	(410S)		1.4001	X7 Cr 13	(403 S 7)
12	405		1.4002	X6CrA12	405S17
12	405		1.4002	X6 CrAl 13	405 S 17
12	416		1.4005	X12CrS 13	416 S 21
12	410; CA-15	56A	1.4006	(G-)X10 Cr 13	410S21
12	430		1.4016	X8Cr17	Z8C17
12	430	60	1.4016	X6 Cr 17	430 S 15
12			1.4027	G-X20Cr14	420C29
12	420		1.4028	X30 Cr 13	420 S 45
12			1.4086	G-X120Cr29	452C11
12	430 F		1.4104	X12CrMoS17	420 S 37

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
45 NCD 16		40 NiCrMoV 8 KU			
90 MV 8		90 MnVCr 8 KU			
Z200C12	2715	X210Cr13KU	X210Cr12	SUH3	R6M5
		14 Ni 6 KG; 14 Ni 6 KT	XBNiO9		
9 Ni		X10Ni9	F-2645	SL9N60(53)	
Z18N5					
Z 18 N 5					
16 MC 5					
		HS 12-1-5-5	12-1-5-5		
Z130WKCDV					
KCV 06-05-05-04-02	2723	HS 6-5-2-5	6-5-2-5	SKH55	R6M5K5
Z110 WKCDV 07-05-04	7-4-2-5	HS 7-4-2-5	M 35		
Z110 DKCWV 09-08-04	2-10-1-8	HS 2-9-1-8	M 41		
			2-9-2-8		R6M5
Z 80 WKCV 18-05-04-0					
Z 85 WDCV	2722	HS 6 5 2	F-5604	SKH 51	
Z 100 DCWV 09-04-02-	2782	HS 2 9 2	F-5607		
Z 80 WCV 18-4-01					R18
Z45CS9		X45CrSi8	F322	SUH1	40Ch9S2
Z 6 C 13	2301	X6Cr13	F.3110	SUS403	08Ch13
			F8401		08Ch13
Z 8 C 13	2301				08Ch13
Z8CA12		X6CrAl13			
Z6CA13	2302	X6CrAl13			
Z11 CF 13	2380	X12 CrSC13	F-3411	SUS 416	
Z10 C 13	2302	X12Cr13	F.3401	SUS410	12Ch13
430S15	2320	X8Cr17	F.3113		12Ch17
Z 8 C 17	2320	X8Cr17	F3113	SUS430	12Ch17
Z20C13M					20Ch13L
Z 30 C 13	2304				20Ch13
Z 10 CF 17	2383	X10CrS17	F.3117	SUS430F	

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
12	440B		1.4112	X90 CrMoV 18	
12	434		1.4113	X6CrMo 17	434 S 17
12			1.4340	G-X40CrNi27 4	
12	S31500		1.4417	X2CrNiM0Si19 5	
12	S31500		1.4417	X2 CrNoMoSi 18 5 3	
12			1.4418	X4 CrNiMo16 5	
12	XM 8; 430 Ti; 439		1.4510		
12	430tI		1.4510	X6 CrTi 17	
12			1.4511	X 6 CrNb 17	
12	409		1.4512	X 6 CrTi 12; (X2CrTi12)	LW 19; 409 S 19
12			1.4720	X20CrMo13	
12	405		1.4724	X10CrA113	403S17
12	430	60	1.4742	X10CrA118	439S15
12	HNV6	59	1.4747	X80CrNiSi20	443S65
12	446		1.4749	x18 cRn 28	
12	446		1.4762	X10CrA124	
12	EV 8		1.4871	X 53 CrMnNiN 21 9	349 S 54
12	302			x12 CrNi 18 9	302 S 31
12	429			X10 CrNi 15	
13	420		1.4021	X20Cr13	420S37
13	420		1.4031	X40 Cr 13	
13			1.4034	X46Cr13	420 S 45
13	431	57	1.4057	X20CrNi172	431 S 29
13	CA6-NM		1.4313	G-X4 CrNi 13 4	425 C 11
13			1.4544		S. 524; S. 526
13	348		1.4546	X5CrNiNb 18-10	347 S 31; 2 S. 130; 2 S. 143; 2 S. 144; 2 S. 145; S.525; S.527
13			1.4922	x20cRmV12-1	
13			1.4923	X22 CrMoV12 1	
14	304		1.4301	X 5 CrNi 18 9	304 S 15

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
Z 8 CD 17.01	2325	X8CrMo17		SUS434	
	2376				
	2376				
Z6CND16-04-01	2387				
Z 4 CT 17		X 6 CrTi 17	F.3115 -X 5 CrTi 17	SUS 430 LX	08 Ch17T
Z 4 CT 17					08Ch17T
Z 4 CNb 17		X 6 CrNb 17	F.3122-X 5 CrNb 17	SUS 430 LK	
Z 3 CT 12		X 6 CrTi 12		SUH 409	
Z10C13		X10CrA112	F.311		10Ch13SJu
Z10CAS18		X8Cr17	F.3113	SUS430	15Ch13SJu
Z80CSN20.02		X80CrSiNi20	F.320B	SUH4	
Z10CAS24	2322	X16Cr26		SUH446	
Z 52 CMN 21.09		X53CrMnNiN21 9		SUH35, SUH36	55Ch20G9AN4
Z 10 CN 18-09	2330				
Z 20 C 13	2303	14210			20Ch13
Z 40 C 14	2304				40Ch13
Z40 C 14		X40Cr14	F.3405	SUS420J2	
Z 15 CN 16.02	2321	X16CrNi16	F.3427	SUS431	20Ch17N2
Z 4 CND 13-04 M	2385	(G)X6CrNi304		SCS5	
		X 6 CrNiTi 18 11			08Ch 18N12T
		X 6 CrNiNb 18 11			
	2317	x20cRmOnl 12 01			
Z 5 CN 18.09	2332; 2333				08Ch18N10

Mtl. No.	USA	European Union	Germany		United Kingdom
	AISI/SAE	EN	Werkstoff	DIN	BS
14	303	58M	1.4305	X10 CrNiS 18 9	303 S 21
14	304L		1.4306	X2CrNi18 9	304S12
14	304L		1.4306	X2 CrNi 18 10	304 S 11
14	CF-8	58E	1.4308	X6 CrNi 18 9	304 C 15
14	301		1.4310	X12CrN i17 7	301 S 21
14	304 LN		1.4311	X2 CrNiN 18 10	304 S 62
14			1.4312	G-X10CrNi18 8	302C25
14	305		1.4312	X8 CrNi 18 12	305 s 19
14	304	58E	1.4350	X5CrNi18 9	304S15
14	S32304		1.4362	X2 CrNiN 23 4	
14	202		1.4371	X3 CrMnNiN 188 8 7	284 S 16
14	316		1.4401	X 5 CrNiMo 17 12 2; (X4 CrNiMo 17 -12-2)	316 S 13; 316 S 17; 316 S 19; 316 S 31; 316 S 33
14	316L		1.4404	X2 CrNiMo 17 13 2; (X2 CrNiMo 17-12-2); GX 2 CrNiMoN 18-10	316 S 11; 316 S 13; 316 S 14; 316 S 31; 316 S 42; S.537; 316 C 12; T.75; S. 161
14	316LN		1.4406	X2 CrNiMoN 17 12 2; (X2CrNiMoN 18-10)	316 S 61; 316 S 63
14	CF-8M		1.4408	GX 5 CrNiMoN 7 12 2; G-X 6 CrNiMo 18 10	316 C 16 (LT 196); ANC 4 B
14			1.4410	G-X10CrNiMo18 9	
14	316 Ln		1.4429	X2 CrNiMo 17 -13-3	316 S 62
14	316L		1.4435	X2 CrNiMo18 14 3	316 S 11; 316 S 13; 316 S 14; 316 S 31; LW 22; LWCF 22

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
Z 8 CNF 18-09	2346	X10CrNiS18.09	F.3508	SUS303	30Ch18N11
Z2CrNi18 10	2352	x2cRnI18 11	F.3503	SCS19	
Z 3 CN 19-11	2352	X2CrNi18 11			
Z 6 CN 18-10 M	2333			SUS304L	
Z 12 CN 17.07	2331	X2CrNi18 07	F.3517		
Z 2 CN18.10	2371	X2CrNiN18 10		SUS304LN	
Z10CN18.9M					10Ch18N9L
					10Ch18N9L
Z6CN18.09	2332	X5CrNi18 10	F.3551	SUS304	
Z 2 CN 23-04 AZ	2327				
Z 8 CMN 18-08-05					
Z 3 CND 17 -11-01; Z 6 CND 17-11; Z 6 CND 17-11-02; Z 7 CND 17-11-02; Z 7 CND 17-12-02	2347	X 5 CrNiMo 17 12	F.3534-X 5 CrNiMo 17 12 2	SUS 316	
Z 2 CND 17-12; Z 2 CND 18-13; Z 3 CND 17-11-02; Z 3 CND 17-12-02 FF; Z 3 CND 18-12-03; Z 3 CND 19.10 M	2348	X 2 CrNiMo 17 12; G-X 2 CrNiMo 19 11	F.3533 - X 2 CrNiMo 17 13 2; F.3537 - X 2 CrNiMo 17 13 3	SUS 316 L	
Z2 CND 17-12 AZ		X 2 CrNiMoN 17 12	F.3542-X 2 CrNiMoN 17 12 2	SUS316LN	07 Ch 18N
	2343		F.8414-AM-X 7 CrNiMo 20 10	SCS 14	10G2S2MSL
Z5CND20.12M	2328				
Z 2 CND 17-13 Az	2375	X 2 CrNiMoN 17 13	F.3543-X 2 CrNiMoN 17 13 3	SUS 316 LN	
Z 3 CND 17-12-03; Z 3 CND 18-14-03	2375	X2CrNiMoN 17 13	F.3533-X 2 CrNiMo 17 13 2	SUS 316 L	O3 Ch 17N14M3

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
14	316		1.4436	X 5 CrNiMo 17 13 3; (X4CRNIMO 17-13-3	316 S 19; 316 S 31; 316 S 33; LW 23; LWCF 23
14	317L		1.4438	X2 CrNiMo 18 16 4; (X2CrNiMo 18-15-4)	317 S 12
14	(s31726)		1.4439	X2 CrNiMoN 17 13 5	
14			1.444	X 2 CrNiMo 18 13	
14	317		1.4449	X5 CrNiMo 17 13 3	317 S 16
14	329		1.4460	X 4 CrNiMo 27 5 2; (X3CrNiMo27-5-2)	
14	329		1.4460	X8CrNiMo27 5	
14			1.4462	X2CrNiMoN22 5 3	318 S 13
14			1.4500	G-X7NiCrMoCuNb25 20	
14	17-7PH		1.4504		316S111
14	443 444		1.4521	X2CrMoTi18-2	
14	UNS N 08904		1.4539	X1NiCrMoCuN25-20-5	
14	CN-7M		1.4539	(G-)X1 NiCrMoCu 25 20 5	
14	321		1.4541	Z 6 CrNiTi 18-10	321 S 31; 321 S 51 (1010; 1105); LW 24; LWCF 24
14	630		1.4542	X5 CrNiCuNb 17 4; (X5 CrNiChNb 16-4)	
14	15-5PH		1.4545	Z7 CNU15.05	
14	S31254		1.4547	X1 CrNiMoN 20 18 7	
14	347	58F	1.4550	X6 CrNiNb 18 10	347 S 17
14			1.4552	G-X7CrNiNb18 9	
14	17-7PH		1.4568		316S111
14	316tTi		1.4571	X6 CrNiMoTi 17 12 2	320 S 31

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
Z 6 CND 18-12-03; Z 7 CND 18-12-03	2343	X 5 CrNiMo 117 13; X 8 cRnImO 17 13	F.3543-X 5 CrNiMo 17 12 2 F.3538-X 5 CrNiMo 17 13 3	SUS 316	
Z 2 CND 19-15-04; Z 3 cnd 19-15-04	2367	X2CrNiMo18 16	f.3539-x 2 cRnImO 18 16 4	SUS317L	
Z 3 CND 18-14-06 AZ					
		X 5 CrNiMo 18 15		SUS 317	
(Z 3 CND 25-07 Az); Z 5 CND 27-05 Az	2324		F.3309-X 8 CrNiMo 17 12 2; F.3552-X 8 CrNiMo 18 16 4	SUS 329 J 1	
	2324				
Z 3 CND 22-05 Az; (Z 2 CND 24 -08 Az); (Z 3 CND 25-06-03 Az)	2377			SUS 329 J3L	
23NCDU25.20M					
		Z8CNA17-07	X2CrNiMo1712		
	2326		F.3123-X 2 CrMoTiNb 18 2	SUS 444	
Z 2 NCDU 25-20	2562				
Z1 NCDU 25-02 M	2564				
Z 6 CNT 18-10	2337	X 6 CrNiTi 18 11	F.3523 - X 6 CrNiTi 18 10	SUS 321	06Ch18N10T; 08Ch18N10T; 09Ch18N10T; 12Ch18N10T
Z 7 CNU 15-05; Z 7 CNU 17-04				SCS 24; SUS 630	
	2378				
Z 6 CNNb 18.10	2338	X6CrNiNb18 11	F.3552	SUS347	08Ch18N12B
Z4CNNb19.10M					
		Z8CNA17-07	X2CrNiMo1712		09Ch17NJu1
Z 6 CNDT 17-12002	2350				10Ch17N13M2T

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
14	316 Ti	58J	1.4571	X 6 CrNiMoTi 17 12 2	320 S 31
14			1.4581	G-X 5 CrNiMoNb	318 C 17
14	318		1.4583	X 10CrNiMoNb 18 12	303 S 21
14			1.4585	G-X7CrNiMoCuNb18 18	
14			1.4821	X20CrNiSi25 4	
14			1.4823	G-X40CrNiSi27 4	
14	309	58C	1.4828	X15CrNiSi20 12	309 S 24
14	309S		1.4833	X6 CrNi 22 13	309 S 13
14	310 S		1.4845	X12 CrNi 25 21	310S24
14	321	58B	1.4878	X6 CrNiTi 18 9	32 1 S 20
14	Ss30415		1.4891	X5 CrNiNb 18 10	
14	S30815		1.4893	X8 CrNiNb 11	
14	304H		1.4948	X6 CrNi 18 11	304 S 51
14	660		1.4980	X5 NiCrTi 25 15	
14				X5 NiCrN 35 25	
14	S31753			X2 CrNiMoN 18 13 4	
14				X2 CrNiMoN 25 22 7	
15	CLASS20		0.6010	GG10	
15	A48-20B		0.6010	GG-10	
15	NO 25 B		0.6015	GG 15	Grade 150
15	CLASS25		0.6015	GG15	GRADE150
15	A48 25 B		0.6015	GG 15	Grade 150
15	A48-30B		0.6020	GG-20	Grade 220
15	NO 30 B		0.6020	GG 20	Grade 220
15	A436 Type 2		0.6660	GGL-NiCr202	L-NiCuCr202
15	60-40-18		0.7040	GGG 40	SNG 420/12
15	No 20 B			GG 10	
16	CLASS30		0.6020	GG20	GRADE220
16	A48-40 B		0.6025	EN- GJL-250 (GG25)	Grade260
16	CLASS45		0.6030	GG30	GRADE300
16	A48-45 B		0.6030		Grade 300
16	A48-50		0.6035	GG-35	GRADE 350
16	A48-60 B		0.6040	GG40	GRADE400

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
Z 6 NDT 17.12	2350	X6CrNiMoTi17 12	F.3535		10Ch17N13M2T
Z 4 CNDNb 18.12 M					
Z15CNS20.12		x15cRnIsl2 12			
		X6CrNiMoTi17 12			
Z20CNS25.04					
Z15CNS20.12			F.8414	SCS17	20Ch20N14S2
Z 15 CN 24-13					
Z 12 CN 25-20	2361	X6CrNi25 20	F.331	SUH310	20Ch23N18
Z 6 CNT 18-12 (B)	2337	X6CrNiTi18 11	F.3553	SUS321	
	2372				
	2368				
Z 5 CN 18-09	2333				
Zz 8 nctv 25-15 b ff	2570				
Ft10D	110	G10			SCh10
FT 10 D	0110-00				SCh10
FT 15 D	0115-00	G 15	FG 15	FC150	SCh15
Ft15D	115	G 15	FG 15		SCh15
Ft 15 D	01 15-00	G14	FG15		SCh15
Ft 20 D	0120-00				SCh20
Ft 20 D	120	G 20		FC200	SCh20
L-NC 202	0523-00				
FCS 400-12	0717-02	GS 370-17	FGE 38-17	FCD400	VCh42-12
Ft 10 D	110			FC100	
Ft20D	120	G 20	FG 20		
Ft 25 D	125	G 25	FG 25	FC250	VCh60-2
Ft30D	130	G 30	FG 30	FC300	SCh20
Ft 30 D	01 30-00				SCh30
Ft35D	135	G 35	FG 35	FC350	SCh30
Ft 40 D	140				SCh40

Mtl. No.	USA	European Union	Germany		United Kingdom
	AISI/SAE	EN	Werkstoff	DIN	BS
16			1.4829	X 12 CrNi 22 12	
16					
16					
17			0.7033	GGG-35.3	350/22 L 40
17	60/40/18		0.7043	GGG-40.3	370/7
17	80-55-06		0.7050	EN- GJS-800-7 (GGG50)	SNG500/7
17	65-45-12		0.7050	GGG-50	SNG 500/7
17			0.7652	GGG-NiMn 13 7	S-NiMn 137
17	A43D2		0.7660	GGG-NiCr 20 2	Grade S6
17				GGG 40.3	SNG 370/17
18			0.7060	GGG60	SNG600/3
18	80/55/06		0.7060	GGG-60	600/3
18	100/70/03		0.7070	GGG-70	SNG700/2
18	A48 40 B				
19			0.8055	GTW55	
19	32510		0.8135	GTS-35-10	B 340/12
19	A47-32510		0.8135	GTS-35-10	B 340/2
19	A220-40010		0.8145	GTS-45-06	P 440/7
19				GTS-35	B 340/12
19					8 290/6
19	32510			GTS-35	B340/12
20			0.8035	GTM-35	W340/3
20			0.8040	GTW-40	W410/4
20			0.8045		
20			0.8065	GTMW-65	
20	A220-50005		0.8155	GTS-55-04	P 510/4
20	50005		0.8155	GTS-55-04	P510/4
20	70003		0.8165	GTS-65-02	P 570/3
20	90001		0.8170	GTS-70-02	P 690/2
20	A220-90001		0.8170	GTS-70-02	
20	1022; 1518		1.1133	20Mn5	120 M 19
20	400 10			GTS-45	P440/7
20	70003			GTS-65	P 570/3
21	Al99		3.0205		

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
					SCh25
FGS 370/17	0717-15				VCh42-12
FGS 370/17	0717-15				VCh50-2
FGS 500/7	0727-02	GGG 50		FCD500	VCh50-2
FGS 500-7	0727-02				
S-Mn 137	0772-00				
S-NC 202	0776-00				
FGS 370-17	0717-12			FC250	
FGS600-3	07 32-03	GGG 60	GGG 60		
FGS 600/3	0727-03			FCD600	
FGS 700-2	07 37-01	GGG 70	GGG 70	FCD700	
			GTW 55		
MN35-10	810		GTS 35		KCh35-10
Mn 35-10	0815-00				KCh35-10
Mn 450-6	0852-00	GMN 45		FCMW370	
	0810-00				
MN 32-8	814			AC4A	
MN 35-10	08 15			FCMW330	
MB35-7	852		GTM 35		
MB40-10		GMB40	GTM 40		
		GMB45	GTM 45		KCh55-4
			GTW 65		KCh55-4
Mn 550-4	0854-00				KCh60-3
MP 50-5	854	GMN 55		FCMP490	KCh70-2
Mn 650-3	0856-00	GMN 65		FCMP590	KCh70-2
Mn 700-2	0862-00	GMN 70		FCMP690	KCh70-2
Mn 700-2	0864-00				20G
20 M 5	2132	G 22 Mn 3; 20 Mn 7	F.1515-20 Mn 6	SMnC 420	
	08 52				
MP 60-3	858			FCMP540	AD0

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
21	1000		3.0255	Al99.5	L31; L34; L36
21			3.3315	AlMg1	
22			3.1325	AlCuMg 1	
22			3.1655	AlCuSiPb	
22			3.2315	AlMgSi1	
22	7050		3.4345	AlZnMgCuO,5	L 86
22			3.437	AlZnMgCu 1,5	
23			3.2381	G-AlSi 10 Mg	
23			3.2382	GD-AlSi10Mg	
23	A360.2		3.2383	G-AlSi0Mg(Cu)	LM9
23			3.2581	G-AlSi12	
23			3.3561	G-AlMg 5	
23	ZE 41		3.5101	G-MgZn4sE1Zr1	MAG 5
23	EZ 33		3.5103	MgSE3Zn27r1	MAG 6
23	AZ 81		3.5812	G-MgAl8Zn1	NMAG 1
23	AZ 91		3.5912	G-MgAl9Zn1	MAG 7
23	A356-72				2789; 1973
23	356,1				LM25
23	A413.2			G-AlSi12	LM 6
23	A413.1			G-AlSi 12 (Cu)	LM 20
23	A413.0			GD-AlSi12	
23	A380.1			GD-AlSi8Cu3	LM24
24			2.1871	G-AlCu 4 TiMg	
24			3.1754	G-AlCu5Ni1,5	
24			3.2163	G-AlSi9Cu3	
24	4218 B		3.2371	G-AlSi 7 Mg	
24	SC64D		3.2373	G-AlSI9MGWA	
24			3.2373	G-AlSi 9 Mg	
24	QE 22		3.5106	G-MgAg3SE2Zr1	mag 12
24	GD-AlSI12			G-ALMG5	LM5
26	C93200		2.1090	G-CuSn 7 5 pb	
26	c 83600		2.1096	G-CuSn5ZnPb	LG 2
26	C 83600		2.1098	G-CuSn 2 Znpb	
26	C23000		2.1182	G-CuPb15Sn	LB1

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
A59050C					D1
					AD35
					AK9
AZ 4 GU/9051		811-04			
					AK12
	4253				
G-TR3Z2					
NF A32-201					
	4244			A5052	AK7
	4261				
	4260			ADC12	AK12
	4247			A6061	
	4250			A7075	
					VAL 8
					AK8
A-S7G	4251			C4BS	AK9
A-SU12	4252				
U-E 7 Z 5 pb 4					
U-pb 15 E 8					

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
26	C 93800		2.1182	G-CuPb15Sn	
27			2.0240	CuZn 15	
27	C27200		2.0321	CuZn 37	cz 108
27	C27700		2.0321	CuZn 37	cz 108
27			2.0590	G-CuZn40Fe	
27	C 86500		2.0592	G-CuZn 35 Al 1	U-Z 36 N 3
27	C 86200		2.0596	G-CuZn 34 Al 2	HTB 1
27	C 18200		2.1293	CuCrZr	CC 102
28			2.0060	E-Cu57	
28			2.0375	CuZn36Pb3	
28	C 63000		2.0966	CuAl 10 Ni 5 Fe 4	Ca 104
28	B-148-52		2.0975	G-CuAl 10 Ni	
28	c 90700		2.1050	G-CuSn 10	CT1
28	C 90800		2.1052	G-CuSn 12	pb 2
28	C 81500		2.1292	G-CuCrF 35	CC1-FF
28			2.4764	CoCr20W15Ni	
31	N 08800		1.4558	X 2 NiCrAlTi 32 20	NA 15
31	N 08031		1.4562	X 1 NiCrMoCu 32 28 7	
31	N 08028		1.4563	X 1 NiCrMoCuN 31 27 4	
31	N 08330		1.4864	X 12 NiCrSi 36 16	NA 17
31	330		1.4864	X12 NiCrSi 36 16	NA 17
31			1.4865	G-X40NiCrSi38 18	330 C 40
31			1.4958	X 5 NiCrAlTi 31 20	
31	AMS 5544		2.4668	NiCr19NbMo	
32			1.4977	X 40 CoCrNi 20 20	
33	Monel 400		2.4360	NiCu30Fe	NA 13
33	5390A		2.4603		
33	Hastelloy C-4		2.4610	NiMo16cR16Ti	
33	Nimonic 75		2.4630	NiCr20Ti	HR 5,203-4
33			2.4630	NiCr20Ti	HR5,203-4
33	Inconel 690		2.4642	NiC29Fe	
33	Inconel 625		2.4856	NiCr22Mo9Nb	NA 21
33	5666		2.4856	NiCr22Mo9Nb	
33	Incoloy 825		2.4858	NiCr21Mo	NA 16
34	Monel k-500		2.4375	NiCu30 Al	NA 18

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
Uu-PB 15e 8					
CuZn 36, CuZn 37		C 2700			L 63
CuZn 36, CuZn 37		C2720			L 63
HTB 1					
U-Z 36 N 3					LTs23AD; ZMts
U-Cr 0.8 Zr					
					LS60-2
U-A 10 N					BrAD; N10-4-4
UE 12 P					
Z1NCDU31-27-03	2584				EK 77
Z 12 NCS 35.16					
Z 12 NCS 37.18				SUH330	
		XG50NiCr39 19		SCH15	
NC20K14					
Z 42 CNKDWNb					
NU 30					
NC22FeD					
NC 20 T					
NC20T					
Nnc 30 Fe					
NC 22 FeDNb					
Inconel 625					
NC 21 Fe DU					KhN38VT
NU 30 AT					

Mtl. No.	USA AISI/SAE	European Union EN	Germany Werkstoff	Germany DIN	United Kingdom BS
34	4676		2.4375	NiCu30Al	3072-76
34			2.4631	NiCr20TiAl	Hr40; 601
34	Inconel 718		2.4668	NiCr19FeNbMo	
34	Inconel 751		2.4694	NiCr16fE7TiAl	
34			2.4955	NiFe25Cr20NbTi	
34	5383		2.4668	NiCr19Fe19NbMo	HR8
34	5391		2 4670	S-NiCr13A16MoNb	3146-3
34	5660		2.4662	NiFe35Cr14MoTi	
34	5537C		2.4964	CoCr20W15Ni	
34	AMS 5772			C0Cr22W14Ni	
35	Inconel X-750		2.4669	NiCr15Fe7TiAl	
35	Hastelloy B		2.4685	G-NiMo28	
35	Hastelloy C		2.4810	G-NiMo30	
35	AMS 5399		2.4973	NiCr19Co11MoTi	
35			3.7115	TiAl5Sn2	
36	R 50250		3.7025	Ti 1	2 TA 1
36	R 52250		3.7225	Ti 1 pd	TP 1
36	AMS 5397		2.4674	NiCo15Cr10MoAlTi	
37			3.7124	TiCu2	2 TA 21-24
37	R 54620		3.7145	TiAl6Sn2Zr4Mo2Si	
37			3.7165	TiAl6V4	TA 10-13; TA 28
37			3.7185	TiAl4Mo4Sn2	TA 45-51; TA 57
37			3.7195	TiAl 3 V 2.5	
37				TiAl4Mo4Sn4Si0.5	
37	AMS R54520			TiAl5Sn2.5	TA14/17
37	AMS R56400			TiAl6V4	TA10-13/TA28
37	AMS R56401			TiAl6V4ELI	TA11
38	W 1		1.1545	C 105 W1	BW 1A
38	W210		1.1545	C105W1	BW2
38			1.2762	75 CrMoNiW 6 7	
38	440C		1.4125	X105 CrMo 17	
38			1.6746	32 nlcRmO 14 5	832 M 31

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
NC20TA					KhN77TYuR
NC 19 Fe Nb					
NC19eNB					
NC12AD					
ZSNCDT42					
KC20WN					
KC22WN					
NC 15 TNb A					
NC19KDT					VT5-1
					VT1-00
T-A 6 V					VT6
T-A5E					
T-A6V					
Y1 105	1880	C 100 KU	F-5118	SK 3	
Y120	2900	C120KU	CF.515	SUP4	U10A
Z 100 CD 17		X 105 CrMo 17			95Ch18
35 NCD 14					

Mtl. No.	USA	European Union	Germany		United Kingdom
	AISI/SAE	EN	Werkstoff	DIN	BS
40	Ni- Hard 2		0.9620	G-X 260 NiCr 4 2	Grade 2 A
40	Ni- Hard 1		0.9625	G-X 330 Ni Cr 4 2	Grade 2 B
40	Ni-Hard 4		0.9630	G-X 300 CrNiSi 9 5 2	
40			0.9640	G-X 300 CrMoNi 15 2 1	
40	A 532 III A 25% Cr		0.9650	G-X 260 Cr 27	Grade 3 D
40	A 532 III A 25% Cr		0.9655	G-X 300 CrNMo 27 1	Grade 3 E
40	310		1.4841	X15 CrNiSi 25 20	314 S31
41			0.9635	G-X 300 CrMo 15 3	
41			0.9645	G-X 260 CrMoNi 20 2 1	

France AFNOR	Sweden SS	Italy UNI	Spain UNE	Japan JIS	Russia GOST
	0512-00				
	0513-00				
	0466-00				ChWG
					20Ch25N20S2
Z 15 CNS 25-20					

Increase Your Productivity Through Knowledge.
Download ISCAR WORLD Now!
All ISCAR's online apps, interfaces, and product catalogs in a single space.
ISCAR World
Member IMC Group
ISCAR WORLD
Robots
Internet of Things
Big Data
Cloud
3D
Simulation
System Integration
ITA
E-CAT
ISCAR
NPA
INDUSTREALIZE
FAQ
ITA
E-Commerce
Media Channel
Matrix
Machining Power
Publications
Productive Geometry
Grade Optimizer
Insert Wear
ISpot
MySales
Chip Thinning
Download ISCAR WORLD App
Play Store
App Store

THREADING HANDBOOK

ISCAR's Reference Guide for Threading Applications

Member IMC Group

www.iscar.com