



SINCE 1977
YIH TROUN

UFO THREAD MILL





COMPANY INTRODUCTION

公 司 簡 介

Y.T. Profile:

YIH TROUN was established in 1977, which has professional experience in manufacturing of Milling & Turning cutter, Drill, Carbide cutting tools in Taiwan for over 35 years. We started in selling Disposable cutter & cutting tools, then set our own factory to produce & research. Regarding the technical principal “Increasing the producing efficiency” from our president, David Chen, YIH TROUN is always engaged in researching & innovating new product. Our technical achievement is well-known in the relative enterprises and became the leader of the field.

Y.T. Milestone:

- 1990 Started to import and distribute the SECO(Sweden), Fraisa(Switzerland) and some other global well-known brands in Taiwan.
- 1996 Started to export our own products, e.g.: Carbide cutting tools, Endmills, we also represented other domestic outstanding brands products for export.
- 2000 Innovated the “High Feed Cutter”, it obtained the patents of several countries and won excellent reputation in the relative business field in the world.
- 2005 Established the Insert producing department, innovating and producing different kinds of insert The insert specifications grow into more than 1000 items.
- 2006 Exclusively created the “Locking Saw Blade”, and gained the technological cooperation with National Taiwan University of Science and Technology.
- 2007 Won the “top 100 Taiwan enterprise award”.
- 2008 YIH TROUN became the guided Factory of Ministry of Economic Affairs, R.O.C.. Applied the right of priority of world patent from UN.
- 2009 YIH TROUN “Locking Saw Blade”, received the Taiwan R.O.C. patent approval.
- 2010 Established the world's most complete locking type saw blade and T-slot milling cutter. Indexable saw blade gain the Ringier innovation award 2010.
- 2012 Announced the patented “Indexable Countersink”, comprehensive range from ϕ 4.0 ~ ϕ 110mm, It's approved by Taiwan, ching and UN patents.
- 2013 The smallest “indexable thread mill and taps are announced, min ϕ 8.0mm with Z flutes. Patent applications in progress.

公司源起

益壯公司成立於1977年，是一家超過三十五年歷史，專業生產製作銑刀、車刀、鑽頭、鎢鋼刀系列產品的製造商。一開始從捨棄式切削刀具起步，在台灣設立工廠，自己開發製造刀具。在董事長 陳立誠先生專業的技術基礎上，秉持著“提高生產效率”為最高原則下，益壯公司研發部門不斷的投入心血於產品的創新與改造，在專業技術上的成就，是同行業者有目共睹的。

公司世紀

西元1990年 開始從事進口刀具、工具貿易，代理瑞典SECO、瑞士FRAISA的刀具，及代理過其他海外知名廠商。

西元1996年 開始把觸角伸入海外。主要出口項目有益壯公司所生產的刀具，例如鎢鋼刀、銑刀等並代理國內的廠商出口海外市場。

西元2000年 首創“HIGH FEED CUTTER”，引起全世界爭相仿冒，並擁有多項國際專利。在專業技術上的成就，是同行業者有目共睹的。

西元2005年 開始成立刀片生產部門，從事各種刀片開發及生產。刀片種類多達1000多種。

西元2006年 獨立開發“捨棄式圓鋸片”，並於2008年與中華民國國立台灣科技大學取得技術合作。

西元2007年 獲頒“台灣百大企業品牌”獎。

西元2008年 益壯公司成為中華民國經濟部專案輔導工廠。提出聯合國世界優先權專利申請。

西元2009年 益壯公司“捨棄式圓鋸片”，獲得中華民國專利權。

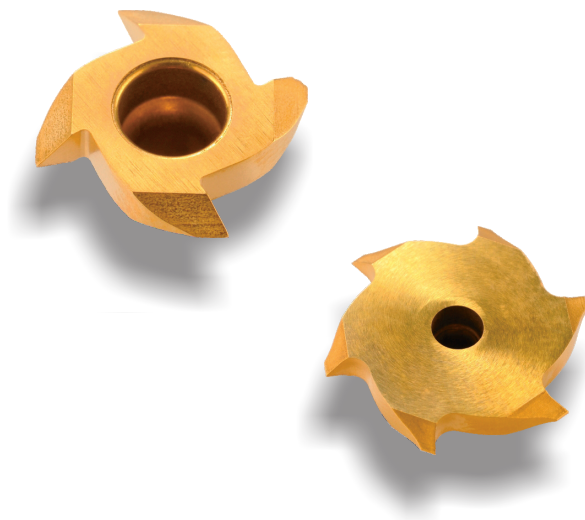
西元2010年 全世界唯一建立規格最齊全 捨棄式圓鋸片，T型刀，榮獲2010年金屬加工業“榮格技術創新獎”。

西元2012年 創新推出 ϕ 4.0 ~ ϕ 110mm “捨棄式倒角刀”，榮獲中華民國、中國專利權，並通過聯合國優先申請權。

西元2013年 首創推出世界上最小的 ϕ 8mm及2刀的“捨棄式牙刀”，並專利申請中。

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TECHNICAL GUIDE

技 術 資 料

Insert grades

Grades

Cemented carbide is an alloy of tungsten carbide (WC) and cobalt (Co). Cubic carbides like tantalum carbide (TaC), titanium carbide (TiC) and niobium carbide (NbC) can also be added. Tungsten carbide is the main component and gives the hardness. Cobalt is the binder phase and gives the toughness.

Cubic carbides are added in order to affect properties like hot hardness, deformation resistance and chemical wear resistance.

Most modern grades are coated with either CVD (Chemical Vapour Deposition) or PVD (physical Vapour Deposition) technique.

The coating improves the wear resistance of the grade.

With CVD-technique layers of titanium carbide (TiC), titanium nitride (TiN), titanium carbonitride (Ti(C,N)) and alumina (Al₂O₃) can be made. CVD-coated grades are suitable for wear resistance in demanding applications with high feed rates and intermediate to high cutting speed.

The common coating materials made by PVD-technique are titanium nitride (TiN), titanium carbonitride (Ti(C,N)) and titanium aluminium nitride ((Ti,Al)N). PVD-coated grades are recommended for applications with low feed rate where high edge toughness is required. PVD-coated grades are suitable for applications with low to intermediate cutting speed.

材質等級

硬質合金是一種碳化鎢 (WC) 與鈷 (Co) 的合金, 還添加了象碳化鉭 (TaC)、碳化鈦 (TiC) 與碳化鈮 (NbC) 等立方碳化物。碳化鎢是主要元素並提供硬度, 鈷是粘結相並提供韌性。添加立方碳化物是為了提高諸如紅硬性、抗塑性變形與抗化學磨損的性能。最新的材質等級使用CVD (化學氣相沉積) 或PVD (物理氣相沉積) 技術進行鍍層, 鍍層提高了材質等級的耐磨性。有了CVD技術, 就能生產碳化鈦 (TiC)、氮化鈦 (TiN)、碳氮化鈦 (Ti(C,N)與氧化鋁 (Al₂O₃) 鍍層。CVD 鍍層材質等級適用於對耐磨性有要求的高進給量與中到高的切削速度應用場合。PVD技術常用的鍍層材料是氮化鈦 (TiN)、碳氮化鈦 (Ti(C,N)與氮化鈦鋁 ((Ti,Al)N)。PVD鍍層材質等級推薦用於要求刃口韌性高的低進給量應用場合。PVD鍍層材質等級適用於低到中等的切削速度。

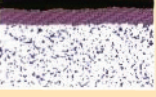
	Grades	P Steel 鋼					M Stainless Steel 不鏽鋼					K Cast iron 鑄鐵					N Non Ferrous Metal 非鐵金屬				S Heat resistant super alloys 抗熱,耐熱材料				H Hardened steel 淬硬材料				
		P01	P10	P20	P30	P40	P50	M01	M10	M20	M30	M40	K01	K10	K20	K30	K40	N01	N10	N20	N30	S01	S10	S20	S30	H01	H10	H20	H30
PVD	C110																												
	C125			○															○			○							
	C130			○					○																				
	C200			○																									
	C250			○					○												○								
	CE60			○					○																				
	F20												○					○								○			
	F30												○																

TECHNICAL GUIDE

技 術 資 料

Insert grades/刀片材質

PVD coated grades/PVD 鍍鈦材質介紹

	C110 C125 C130	Hard and wear resistant grade for milling in aluminium and nonferrous alloys. 較硬及較耐磨的材質,適合用於鋁及其他非金屬材料上. (Ti,Al) N-TiN
	C200	Tough grade for rough milling in tool steels. 韌性較好的材質,適合用於工具鋼粗銑使用.
	F20	This substrate is in accordance to the ISO K classification. For application in Non Ferrous Cast Iron, Aluminum,Copper or Plastic etc.. 適合用於ISO K及N類材料,例如: 鋁、鑄鐵、銅、塑膠等. TiN
	C250 F30	C250 is in the ISO P20-P35 application areas. It has a tough substrate and suitable in hardened and interrupt cutting steels. F30 is suitable in castiron machining. C250為韌性較好的材質,適合用於ISO P20-P35的材料應用,尤其是用於較硬的鋼料及斷續銑削使用.F30則適合用於鑄鐵加工. (Ti,Al) N-TiN
	CE60	Metal cermet grade is oxidation resistant and wear resistant for fine to medium rough milling of steel at high cutting speed and for finishing in austenitic stainless steel.(First choice for high demand on surface finishes). 金屬陶瓷具有極佳的抗氧化及高耐熱特性,適合用於穩定加工下一般鋼料及白鐵使用. α + Tin

Uncoated grades/沒有鍍鈦材質

	CE K10	Hard,wear resistant grade for milling in Aluminum and Non-ferrous metal. 適合用於銑削鋁合金及其他非金屬類材料使用.
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PRODUCT INTRODUCTION

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Thread terminology 名詞說明

External Thread/外螺紋

A thread on the external surface of a cylinder screw or cone.
在圓柱體或圓錐體的外圓上形成的螺紋稱外螺紋。

Depth of Thread/螺紋深度

The distance between crest and root measured normal to the axis.
螺紋從牙底到牙尖的垂直於軸線的距離。

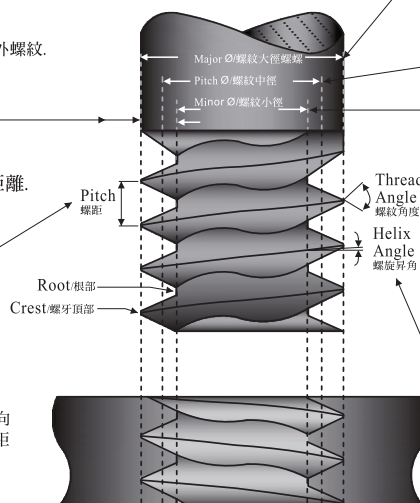
Pitch/螺距

The distance between corresponding points on adjacent thread forms measured parallel to the axis. This distance can be defined in millimeters or by the tpi (threads per inch), which is the reciprocal of the pitch.
相鄰兩牙在螺紋中徑線上對應兩點間的軸向距離。此距離採用公制時，單位為"mm"，而此距離採用英制時，被定義為"tpi"(每英寸牙數)。

Nominal Diameter/公稱直徑

The diameter from which the diameter limits are derived by the application of deviation allowances and tolerances. 依據螺紋的偏差和螺紋的等級，可計算螺紋直徑的極限尺寸。

External Thread/外螺紋



Major Diameter/螺紋大徑

The largest diameter of a screw thread
螺紋輪廓的最大直徑

Pitch Diameter/螺紋中徑

On a straight thread, the diameter of an imaginary cylinder, the surface of which cuts the thread forms where the width of the thread and groove are equal.
母線通過牙型上溝槽和凸起寬度相等的地方的假想圓柱的直徑

Minor Diameter/螺紋小徑

The smallest diameter of a screw thread
螺紋輪廓的最小直徑

Helix Angle/螺旋昇角

For a straight thread, where the lead of the thread and the pitch diameter circle circumference form a right angled triangle, the helix angle is the angle opposite the lead.
中徑螺旋線在一個導程上的展開長與導程及中徑的周長形成的直角三角形，導程所對的角為昇角。

Internal Thread/內螺紋

A thread on the internal surface of a cylinder or cone.
在圓柱體或圓錐體內孔處形成的螺紋稱內螺紋

Straight Thread/直螺紋

A thread formed on a cylinder
在圓柱體上形成的螺紋

Taper Thread/錐螺紋

A thread formed on a cone
在圓錐體上形成的螺紋

PRODUCT INTRODUCTION

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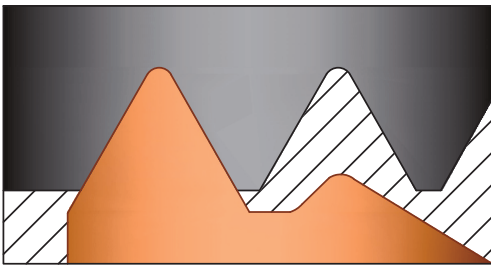
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介

Thread terminology 名詞說明

Insert profile Styles/刀片牙型圖示

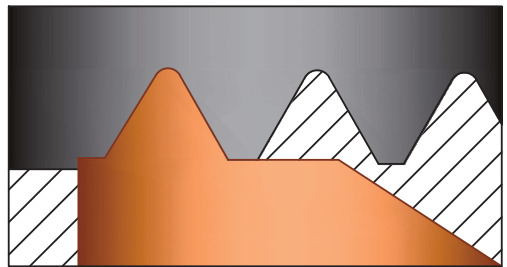
partial profile/通用牙型



The V partial profile insert cuts without topping the outer diameter of the thread. The same insert can be used for a range of different thread pitches which have a common thread angle.

V型通用牙型刀片切削時不會修整到螺紋的外徑。一種通用刀可以加工不同螺距,相同螺旋升角的多種螺紋。

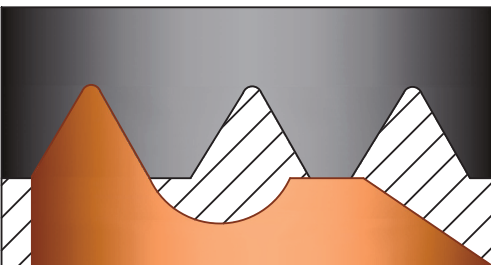
Full profile/標準牙型(全牙型)



The full profile insert will form a complete thread profile including the crest. For every thread pitch and standard, a separate insert is required.

全牙型螺紋刀片可加工出包括螺紋牙頂尺寸完整的螺紋形狀。但不同的螺紋標準,不同螺距的螺紋加工,僅有一種刀片適用。

Full profile for Fine pitches/細牙全牙型

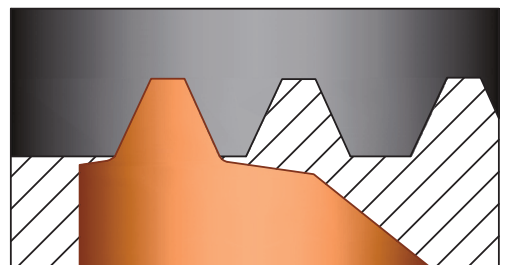


The full profile for Fine pitches will form a complete thread.

The topping of the outer diameter is generated by the second tooth.

全牙型細牙螺紋刀片可加工出完整的螺紋牙形。採用間隔一個齒形進行齒頂加工的方式完成螺紋外徑。

Semi Full/半全牙型



The Semi profile insert will form a complete thread including crest radius but without topping the outer diameter.

Mainly used for trapezoidal profiles. 半全牙型螺紋刀片具完整的牙型,並能加工出牙頂圓弧,但螺紋外徑無法修整。主要用於加工梯形螺紋....



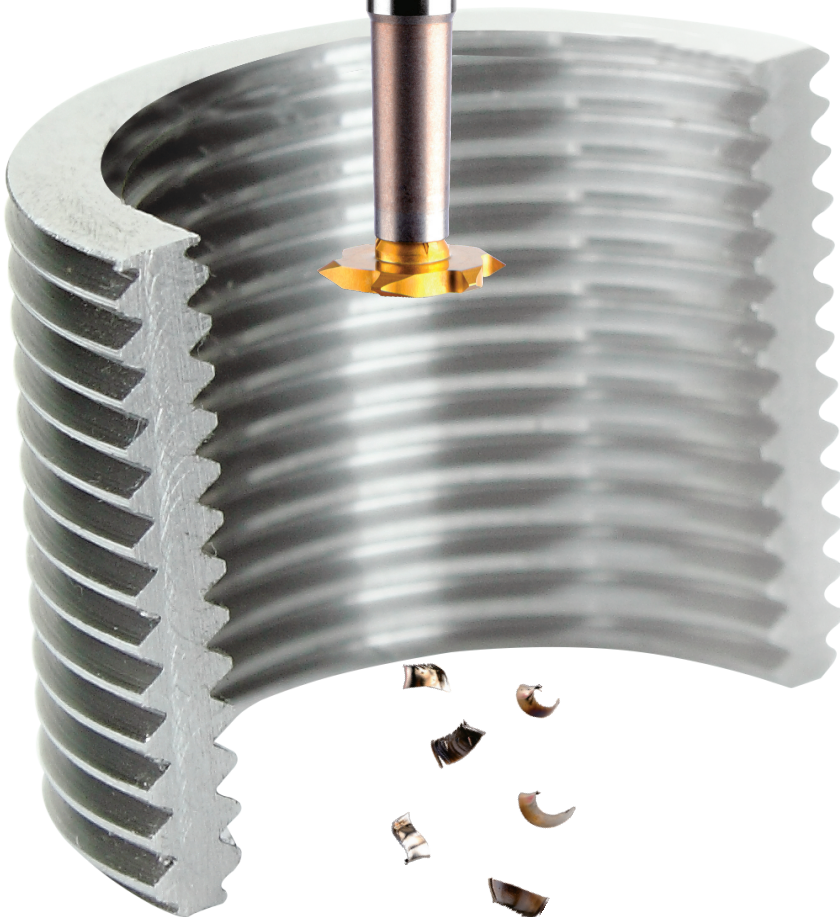
UFO Thread Mill

 UFO thread mill is a single-point cutting design with the circular ramping movement of a rotating tool. Reduced cutting forces also make thread mills an ideal in small CNC M/C. UFO thread mill offers machining advantageous alternative to thread tapping.

飛碟銑牙刀為單一切削刃口設計並利用螺旋銑削方式製作螺紋,因此具有良好的斷屑及排屑效果,因較小的加工阻力使銑牙刀也可用在較小的機台上,提供絲攻銑牙之外的另一種選擇。

Patent No. M386953

專利號碼: ZL 2010 2 0112933.7



PRODUCT INTRODUCTION

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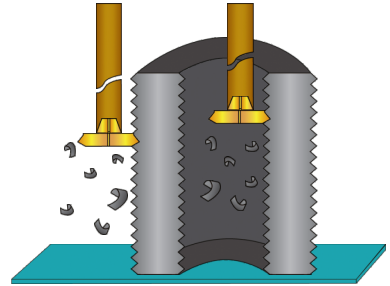
Indexable UFO thread mill - Excellent in chip evacuation and small cutting force
捨棄式飛碟銑牙刀-具有良好的斷屑能力及較小的加工阻力

◎NEW



UFO thread mill is excellent in chip evacuation, minimized the problem of chip twining and tap breakage, reduces machine down time effectively, best choice for expensive components and reduces risk of tap breakage at the last stage of machining.

飛碟銑牙刀具有優良的斷屑效果,減少攻牙時鐵屑纏繞,及絲攻容易斷裂的問題有效降低機台停機時間,非常適合用於昂貴的零件或是最後一道加工程序。



Helicool-R for Improved Chip
Evacuation for Thru-Holes



Low cutting forces make UFO thread mill insert with single-point design the first choice for medium to large threads in CNC M/C BT30, thin-walled components and unstable conditions, such as milling thread with long overhangs.



飛碟銑牙刀,為單一接觸刃設計,減小加工阻力,可用在CNC BT30 以上機台加工大孔徑牙,較小的加工阻力也很適合用在薄板加工,或是穩定度不好的工況上,例如懸伸很長。



BT30

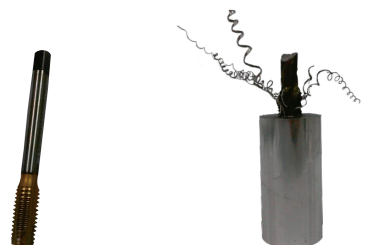
◎OLD



Machining with thread tapping easy to get problems in chip evacuation, tap breakage on the parts and machining stopage. It takes time and cost to remove the breakage tap.

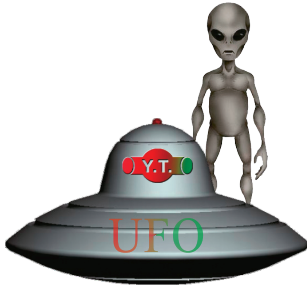


絲攻加工容易有鐵屑不易斷屑及排屑不良的問題,容易導致鐵屑纏繞刀具,使絲攻斷裂,卡在工件裡面,需再多一道工序將絲攻移除。



Advantages of UFO thread mill

飛 碟 銑 牙 刀 優 勢



Patent No. M386953

專利號碼: ZL 2010 2 0112933.7

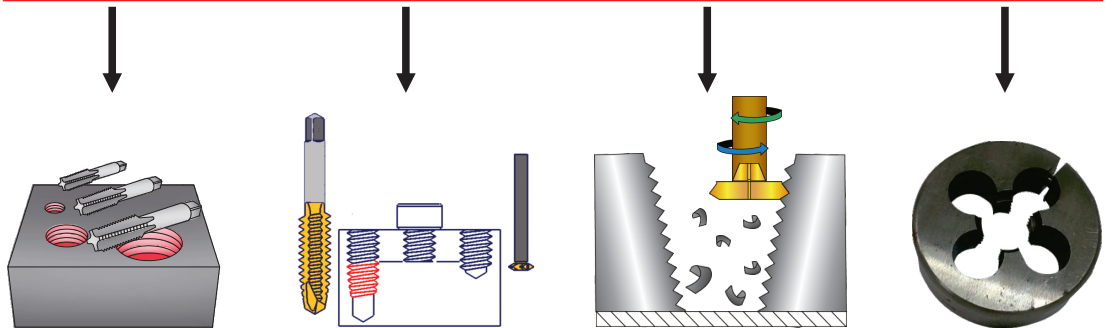
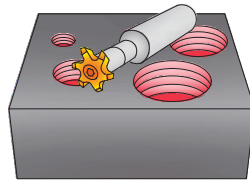


FIG.1

FIG.2

FIG.3

FIG.4

FIG.1 Same UFO thread mill insert for all holes and all pitches(only in V partial-profile insert)). If use tap, it needs different taps for different holes and different pitches.

FIG.2 UFO thread mill can achieve full-bottom threading in a blind hole with out any extra drill depth required.

It's also easy to adjusting the thread tolerance by programme and achieve better tolerance

FIG.3 Same UFO thread milling inserts can be used in PT(NPT) thread without extra tool inventory.

FIG.4 Same UFO thread milling inserts are available for both external and internal threads.

FIG.1 同一飛碟銑牙刀刀片可用於不同大小的螺紋跟牙距(限通用牙刀片),但如果使用的是絲攻,不同的pitch,需再另外選購不同尺寸的絲攻.

FIG.2 飛碟銑牙刀的設計既使用在盲孔加工時,也可以直接攻到底部,此外,也可利用程式隨時修正螺紋的公差,製作高精度的螺紋.

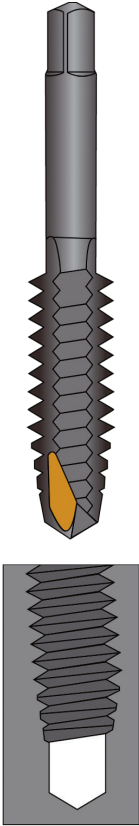
FIG.3 同一支飛碟銑牙刀可用水管牙加工,無需另外選購.

FIG.4 同一飛碟銑牙刀可使用於內牙及外牙加工.

Advantages of UFO thread mill

飛 碟 銑 牙 刀 優 勢

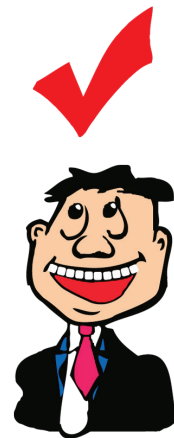
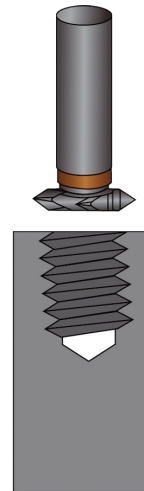
Taps
絲攻



Thread Gauge
牙規



UFO Thread mill
飛碟銑牙刀



PRODUCT INTRODUCTION

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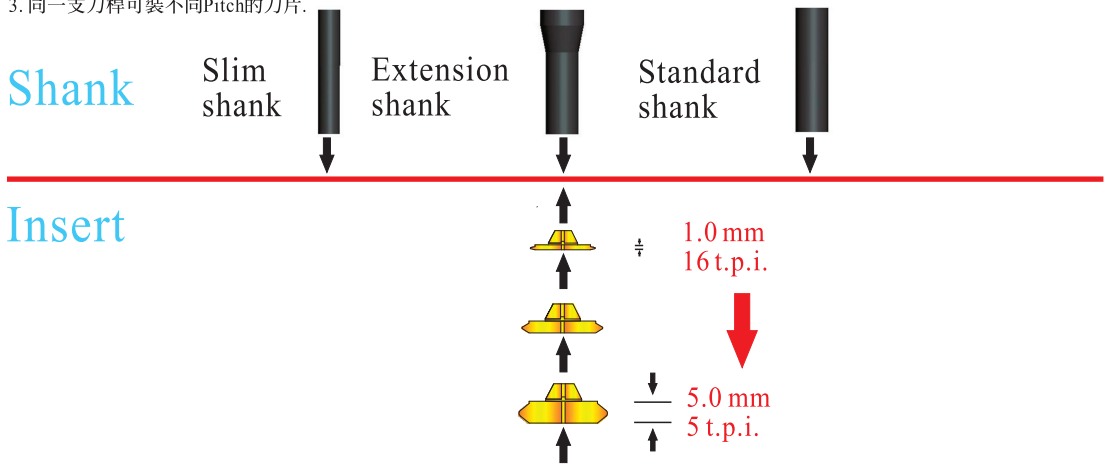
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介

UFO Thread mill 飛碟銑牙刀

1. High precision pre-hardened steel HRC(60) shank with good stability and excellent strength.
 2. Comprehensive toolholder with three different shank types, available in overhangs from 40~150mm.
 3. Same shank can fit different inserts of pitch.
1. 高精度預硬鋼刀桿, 提高強度及精準度。
2. 多種刀桿長度(L:40~150mm)及三種刀桿類型做選擇。
3. 同一支刀桿可裝不同Pitch的刀片。



1. UFO thread mill insert min start from M14 it offers inserts for metric, UN and whitworth.
 2. Unique center tip design to get the excellent stability in high speed machining.
 3. The front-mounted insert are positioned in a taper seat for center-positioning, giving secure and continuous performance.
 4. High productivity with many teeth (4~6 teeth).
1. 飛碟牙刀提供M14以上的孔徑, 以及公制、英制、惠氏的螺紋刀片。
2. 特殊鎢鋼卡桿設計, 於高速加工下也能保持良好的穩定度。
3. 刀片中心錐度設計, 具有良好的中心定位。
4. 多齒數設計(4~6齒)提高生產效率。

Fitting insert on UFO shank with following steps/根據下列步驟固定飛碟銑牙刀刀片:

Step.1



Lubricated

Step.2



Not press

Step.3



Locking the screw



For best performance and to reach the precision, clean and lubricate the insert seat before use. Keep insert naturally on the seat and mount/un-mount the screw several times to get the good tolerance.



為了達到最好的精準度及性能, 建議在裝刀片時先清理刀片座, 再加點油, 安裝時切勿以手壓刀片, 保持刀片自然置於刀片座上, 重覆幾次鎖緊, 放鬆動作以達到最好的公差。

PRODUCT INTRODUCTION

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品

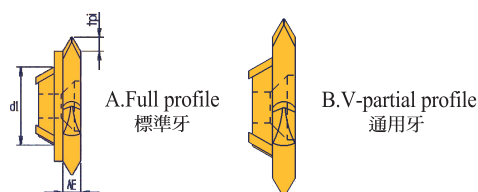
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介

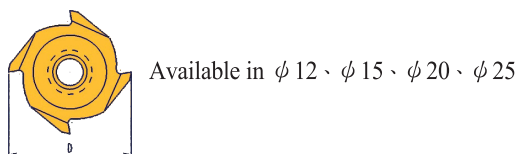
How to choose UFO thread mill insert 如何選擇飛碟銑牙刀片

T1	-	20	-	60	-	1.0	-	ME,	CE60
1		2		3		4		5	6

1.UFO Thread mill insert 飛碟銑牙刀片



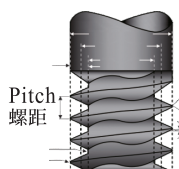
2. Insert dia. 刀片直徑



3.Thread angle 牙的角度



4.Pitch size Pitch大小



5.Insert geometry 刀片槽型



Suitable for Non.Ferrous metal .
such as : Aluminum 、Copper 、Plastic
適合非金屬類材料加工,例如: 鋁、銅、塑膠



Suitable for Steel 、Stainless
Steel 、Cast Iron
適合鋼、不鏽鋼、鑄鐵類材料加工

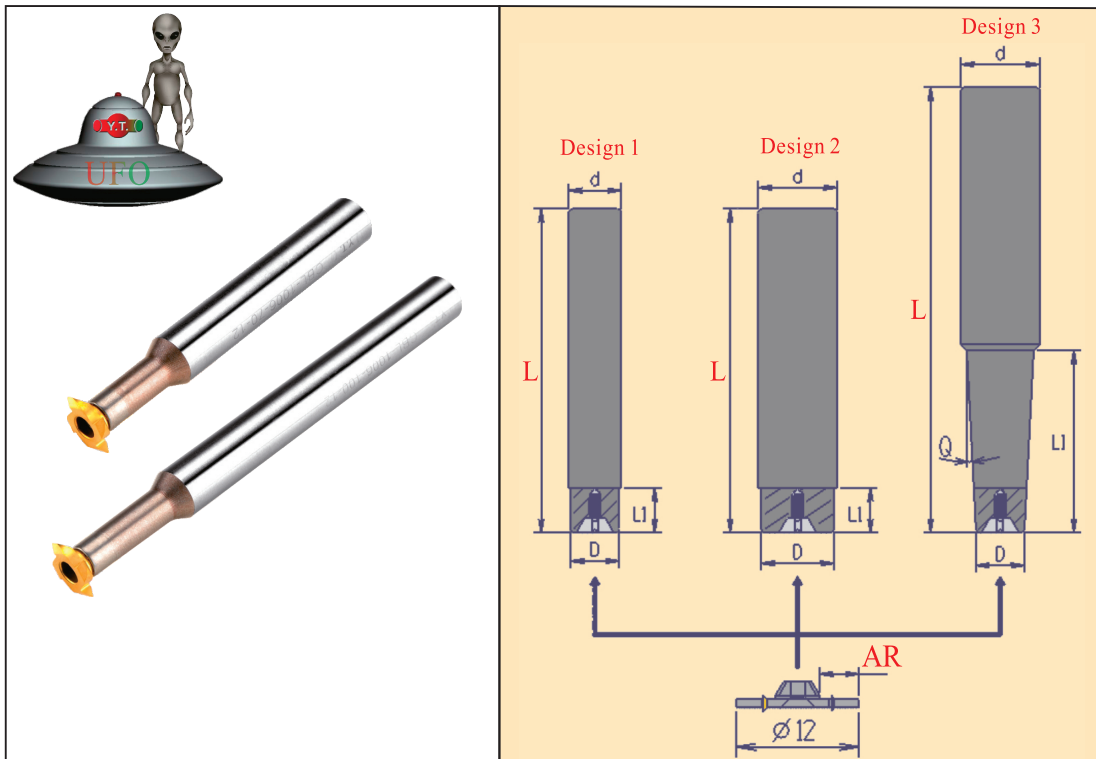
6.Insert grade 刀片材質



See page 2-3 詳見2-3頁

CBL Combimaster toolholders(alternative holders)

可 換 式 接 桿

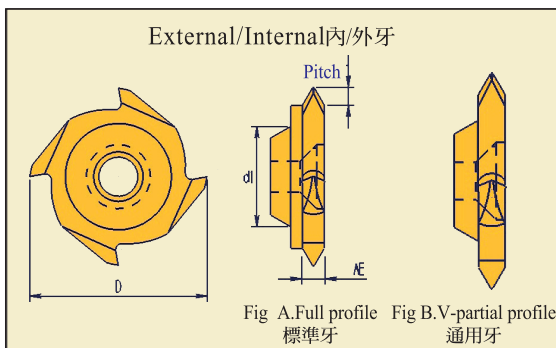


 Combimaster toolholders available for UFO dia.12 mm inserts

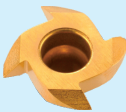
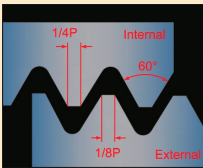
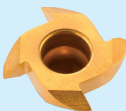
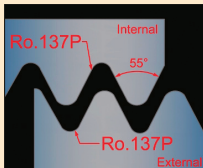
適用於 UFO ϕ 12刀片之可換式接桿

Order code	AR	Dimensions(mm)					Design		Screw	Key
		D	d	L	L1	Q				
CBL-0606-40-12	2.5	5.9	6	40	10		1	0.01	C03010	T09P
CBL-0606-55-12				55				0.01		
CBL-0808-60-12	1.5	7.9	8	60			2	0.03		
CBL-0808-80-12				80				0.04		
CBL-1006-70-12	2.5	5.9	10	70	15	1°	3	0.05		
CBL-1006-100-12				100	20			0.05		
CBL-1008-100-12	1.5	7.9			30			0.05		

T1-12 Inserts



Dimensions in mm						
D	d1	AE	Pitch mm	Pitch t.p.i	angle	Fig
12	6.5	3.2	1.0~2.5		60°	Fig B
		2.0	1.0			Fig A
			1.25			
		2.5	1.5			
			2.0			
		3.2	2.5			
		3.2		6~10	55°	Fig B
				16		Fig A
		2.5		14		
				12		
		3.2		11		
				10		

Inserts	FigA.Full profile 標準牙	FigB.V-partial profile 通用牙	Grade											
			Carbide					Metal cermet		Uncoated				
			C125	C200	C250	F20	F30	CE25	CE60		K10	CE		
60°  ISO Metric (M,MF)		T1-12-60-1.0~2.5-E				■								 Defined by: R262 (DIN 13) Tolerance class:6g/6H
	T1-12-60-1.0-E					■								
	T1-12-60-1.25-E					■								
	T1-12-60-1.5-E					■								
	T1-12-60-2.0-E					■								
	T1-12-60-2.5-E					■								
55°  BSW/BSF		T1-12-55-16~10TPI-E				■								 BSW Defined by: B.S.84:1956, DIN 259, ISO228/1:1982 BSF Defined by: B.S.2779:1956 Tolerance class: BSW-Medium class A, BSF-Medium class
	T1-12-55-16TPI-E					■								
	T1-12-55-14TPI-E					■								
	T1-12-55-12TPI-E					■								
	T1-12-55-11TPI-E					■								
	T1-12-55-10TPI-E					■								

■ Stock standard/標準庫存

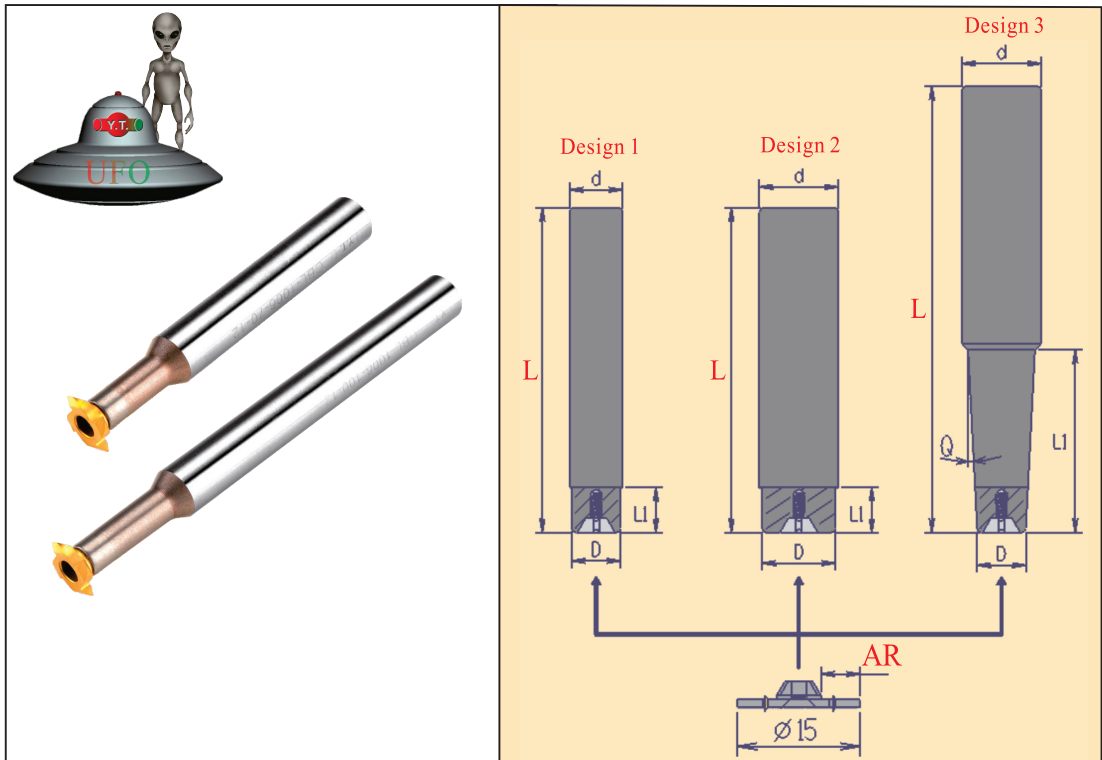
Correct price and stock are based on current situation/正確庫存及價格依實際情況為準

UFO M/MF V-Partial profile insert can also be used in UN thread/公制通用牙刀片也可使用在UN螺紋加工

Only V-Partial profile insert is used for milling external thread/銑外螺紋只能用通用牙刀片

CBL Combimaster toolholders(alternative holders)

可 換 式 接 桿

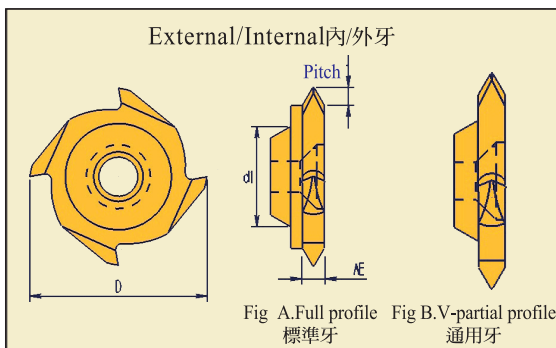


 Combimaster toolholders available for UFO dia.15 mm inserts

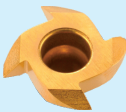
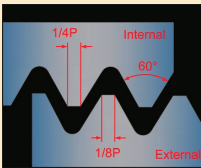
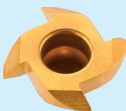
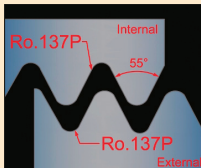
適用於 UFO ϕ 15刀片之可換式接桿

Order code	AR	Dimensions(mm)					Design		Screw	Key
		D	d	L	L1	Q				
CBL-0808-40-15	3	7.9	8	40	10		1	0.02	C03010	T09P
CBL-0808-55-15				55				0.03		
CBL-1010-70-15	2	9.9	10	70			2	0.05		
CBL-1010-90-15				90				0.06		
CBL-1208-90-15	3	7.9	12	90	25	1°	3	0.07		
CBL-1208-110-15				110	30			0.08		
CBL-1210-120-15	2	9.9		120				0.09		

T1-15 Inserts



Dimensions in mm						
D	d1	AE	Pitch mm	Pitch t.p.i	angle	Fig
15	7.9	4.0	1.0~3.0		60°	Fig B
		2.0	1.0			Fig A
			1.25			
		2.5	1.5			
			2.0			
		3.2	2.5		55°	Fig B
			3.0			Fig A
		4.0		11~8		
				11		
		3.5		10		
				9		
		4.0		8		

Inserts	FigA.Full profile 標準牙	FigB.V-partial profile 通用牙	Grade											
			Carbide					Metal cermet		Uncoated				
			C125	C200	C250	F20	F30	CE25	CE60		K10	CE		
60°  ISO Metric (M,MF)		T1-15-60-1.0~3.0-E				■							 Defined by: R262 (DIN 13) Tolerance class:6g/6H	
	T1-15-60-1.0-E					■								
	T1-15-60-1.25-E					■								
	T1-15-60-1.5-E					■								
	T1-15-60-2.0-E					■								
	T1-15-60-2.5-E					■								
	T1-15-60-3.0-E					■								
		T1-15-60-1.0~3.0-ME				■			■					
	T1-15-60-1.0-ME					■			■					
	T1-15-60-1.25-ME					■			■					
	T1-15-60-1.5-ME					■			■					
	T1-15-60-2.0-ME					■			■					
	T1-15-60-2.5-ME					■			■					
	T1-15-60-3.0-ME					■			■					
55°  BSW/BSF		T1-15-55-11~8TPI-E				■							 BSW Defined by: B.S.84:1956, DIN 259, ISO228/1:1982 BSF Defined by: B.S.2779:1956 Tolerance class: BSW-Medium class A, BSF-Medium class	
	T1-15-55-11TPI-E					■								
	T1-15-55-10TPI-E					■								
	T1-15-55-9TPI-E					■								
	T1-15-55-8TPI-E					■								
		T1-15-55-11~8TPI-ME				■			■					
	T1-15-55-11TPI-ME					■			■					
	T1-15-55-10TPI-ME					■			■					
	T1-15-55-9TPI-ME					■			■					
	T1-15-55-8TPI-ME					■			■					

■ Stock standard/標準庫存

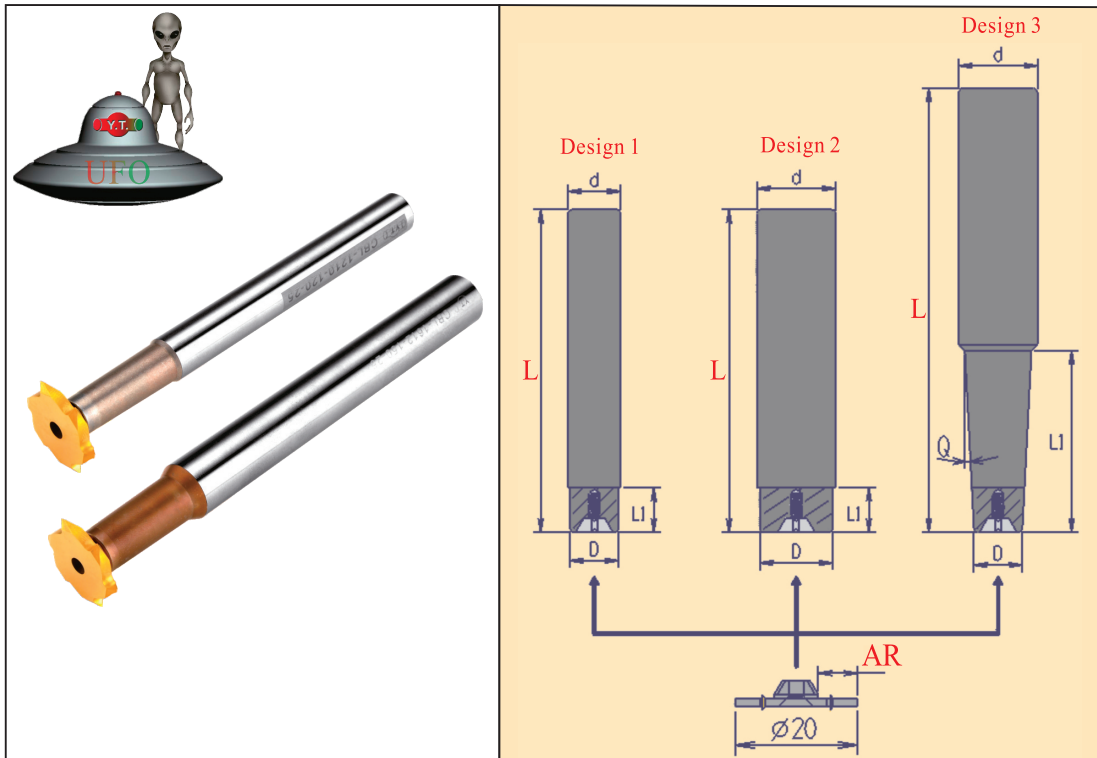
Correct price and stock are based on current situation/正確庫存及價格依實際情況為準

UFO M/MF V-Partial profile insert can also be used in UN thread/公制通用牙刀片也可使用在UN螺紋加工

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CBL Combimaster toolholders(alternative holders)

可 換 式 接 桿

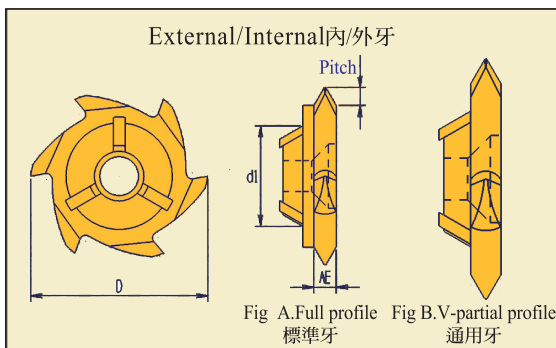


 Combimaster toolholders available for UFO dia.20 mm inserts

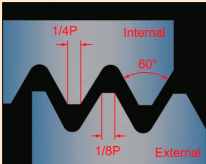
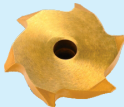
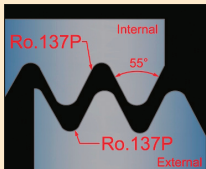
適用於 UFO $\phi 20$ 刀片之可換式接桿

Order code	AR	Dimensions(mm)					Design		Screw	Key
		D	d	L	L1	Q				
CBL-1010-50-20	4.5	9.9	10	50	10		1	0.04	C03010	T09P
CBL-1010-65-20				65				0.05		
CBL-1212-80-20	3.5	11.9	12	80	30		2	0.08		
CBL-1212-100-20				100				0.10		
CBL-1210-120-20	4.5	9.9	16	120	25	1°	3	0.09		
CBL-1610-90-20				90				0.12		
CBL-1612-150-20	3.5	11.9		150	30			0.17		

T1-20 Inserts



Dimensions in mm						
D	d1	AE	Pitch mm	Pitch t.p.i	angle	Fig
20	9.9	4.5	1.0~3.5		60°	Fig B
		2.0	1.0			Fig A
			1.25			
		2.5	1.5			
		3.2	2.0			
			2.5			
		4.5	3.0		55°	Fig B
			3.5			Fig A
		5.5		11~6		
		3.2		11		
		4.5		7		
		5.5		6		

Inserts	FigA.Full profile 標準牙	FigB.V-partial profile 通用牙	Grade													
			Carbide					Metal cermet		Uncoated						
			C125	C200	C250	F20	F30	CE25	CE60		K10	CE				
60°  ISO Metric (M,MF)		T1-20-60-1.0~3.5-E				■								 Defined by: R262 (DIN 13) Tolerance class:6g/6H		
	T1-20-60-1.0-E					■										
	T1-20-60-1.25-E					■										
	T1-20-60-1.5-E					■										
	T1-20-60-2.0-E					■										
	T1-20-60-2.5-E					■										
	T1-20-60-3.0-E					■										
	T1-20-60-3.5-E					■										
		T1-20-60-1.0~3.5-ME				■			■							
	T1-20-60-1.0-ME					■			■							
	T1-20-60-1.25-ME					■			■							
	T1-20-60-1.5-ME					■			■							
	T1-20-60-2.0-ME					■			■							
T1-20-60-2.5-ME					■			■								
T1-20-60-3.0-ME					■			■								
T1-20-60-3.5-ME					■			■								
55°  BSW/BSF		T1-20-55-11~6TPI-E				■								 BSW Defined by: B.S.84:1956, DIN 259, ISO228/1:1982 BSF Defined by: B.S.2779:1956 Tolerance class: BSW-Medium class A, BSF-Medium class		
	T1-20-55-11TPI-E					■										
	T1-20-55-7TPI-E					■										
	T1-20-55-6TPI-E					■										
		T1-20-55-11~6TPI-ME				■			■							
	T1-20-55-11TPI-ME					■			■							
	T1-20-55-7TPI-ME					■			■							
	T1-20-55-6TPI-ME					■			■							

■ Stock standard/標準庫存

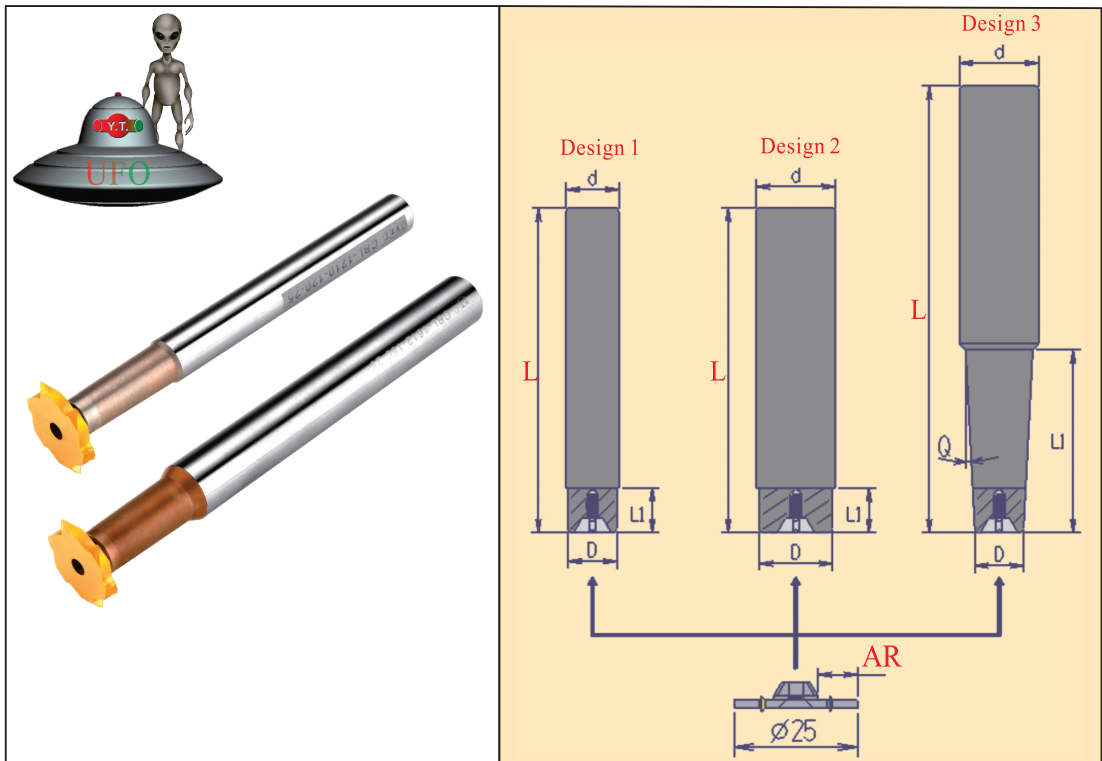
Correct price and stock are based on current situation/正確庫存及價格依實際情況為準

UFO M/MF V-Partial profile insert can also be used in UN thread/公制通用牙刀片也可使用在UN螺紋加工

Only V-Partial profile insert is used for milling external thread/銑外螺紋只能用通用牙刀片

CBL Combimaster toolholders(alternative holders)

可 換 式 接 桿

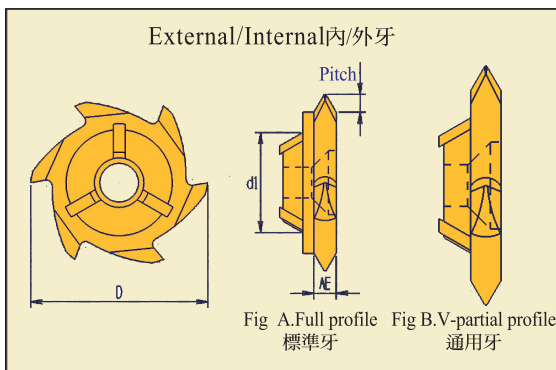


 Combimaster toolholders available for UFO dia.25 mm inserts

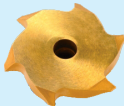
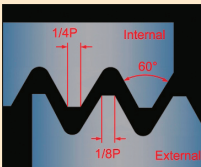
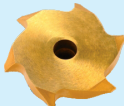
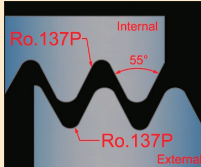
適用於 UFO $\phi 25$ 刀片之可換式接桿

Order code	AR	Dimensions(mm)					Design		Screw	Key
		D	d	L	L1	Q				
CBL-1010-50-25	7	9.9	10	50	10		1	0.04	C03010	T09P
CBL-1010-65-25				65				0.05		
CBL-1212-80-25	6	11.9	12	80	30		2	0.08		
CBL-1212-100-25				100				0.10		
CBL-1210-120-25	7	9.9	16	120	25	1°	3	0.09		
CBL-1610-90-25				90				0.12		
CBL-1612-150-25	6	11.9		150	30			0.17		

T1-25 Inserts



Dimensions in mm						
D	d1	AE	Pitch mm	Pitch t.p.i	angle	Fig
25	9.9	6	1~5		60°	Fig B
		2	1.0			Fig A
		2.5	1.5			
		3	2.0			
		4	3.0			
		4.5	3.5			
		5	4.0			
		5.5	4.5			
		6	5.0		55°	Fig B
		6		11~5		Fig A
		3.2		11		
		5.5		6		
		6		5		

Inserts	FigA.Full profile 標準牙	FigB.V-partial profile 通用牙	Grade												
			Carbide					Metal cermet		Uncoated					
			C125	C200	C250	F20	F30	CE25	CE60		K10	CE			
60°  ISO Metric (M,MF)	T1-25-60-1.0-E	T1-25-60-1.0~5.0-E				■								 Defined by: R262 (DIN 13) Tolerance class:6g/6H	
	T1-25-60-1.5-E					■									
	T1-25-60-2.0-E					■									
	T1-25-60-3.0-E					■									
	T1-25-60-3.5-E					■									
	T1-25-60-4.0-E					■									
	T1-25-60-4.5-E					■									
	T1-25-60-5.0-E					■									
		T1-25-60-1.0~5.0-ME					■			■					
	T1-25-60-1.0-ME						■			■					
	T1-25-60-1.5-ME						■			■					
	T1-25-60-2.0-ME						■			■					
	T1-25-60-3.0-ME						■			■					
T1-25-60-3.5-ME						■			■						
T1-25-60-4.0-ME						■			■						
T1-25-60-4.5-ME						■			■						
T1-25-60-5.0-ME						■			■						
55°  BSW/BSF		T1-25-55-11~5TPI-E				■								 BSW Defined by: B.S.84:1956, DIN 259, ISO228/1:1982 BSF Defined by: B.S.2779:1956 Tolerance class: BSW-Medium class A, BSF-Medium class	
	T1-25-55-11TPI-E					■									
	T1-25-55-6TPI-E					■									
	T1-25-55-5TPI-E					■									
	T1-25-55-11TPI-ME					■			■						
	T1-25-55-6TPI-ME					■			■						
	T1-25-55-5TPI-ME	T1-25-55-11~5TPI-ME				■			■						

■ Stock standard/標準庫存

Correct price and stock are based on current situation/正確庫存及價格依實際情況為準

UFO M/MF V-Partial profile insert can also be used in UN thread/公制通用牙刀片也可使用在UN螺紋加工

Only V-Partial profile insert is used for milling external thread/銑外螺紋只能用通用牙刀片

Recommended cutting data and insert grade 加工數據建議及刀片材質選擇表

Series UFO Thread mill-Insert Grade selection/飛碟銑牙刀刀片材質選擇表

Material group No.	Recom. feed f_z mm/tooth $a_e/D_c = 10\%$	T...ME	T...E		
1		CE60			
2		CE60			
3		CE60			
4		CE60			
5		CE60			
6		CE60			
7		CE60			
8		CE60			
9		CE60			
10		CE60			
11		CE60			
12		F20			
13		F20			
14		F20			
15		F20			
16			F20		
17			F20		
20		CE60			
21		CE60			
22		CE60			

Recommended Cutting speed, V_c (m/min)/線速度建議表

Data reference/參考數據

Material group No.	Grades						
	C125	C250	F20	CE60	CE	K10	
	Cutting speed, v_c (m/min)						
1	- - -	- - -	- - -	255 230 200	- - -	- - -	
2	- - -	- - -	- - -	200 180 162	- - -	- - -	
3	- - -	- - -	- - -	180 162 145	- - -	- - -	
4	- - -	- - -	- - -	160 145 130	- - -	- - -	
5	- - -	- - -	- - -	144 130 116	- - -	- - -	
6	- - -	- - -	- - -	130 117 105	- - -	- - -	
7	- - -	- - -	- - -	40 - -	- - -	- - -	
8	- - -	- - -	- - -	180 162 145	- - -	- - -	
9	- - -	- - -	- - -	130 118 105	- - -	- - -	
10	- - -	- - -	- - -	95 86 77	- - -	- - -	
11	- - -	- - -	- - -	70 63 56	- - -	- - -	
12	- - -	- - -	160 136 120	- - -	- - -	- - -	
13	- - -	- - -	144 120 112	- - -	- - -	- - -	
14	- - -	- - -	128 112 104	- - -	- - -	- - -	
15	- - -	- - -	100 92 -	- - -	- - -	- - -	
16	- - -	- - -	- - -	- - -	- - -	1150 950 850	
17	- - -	- - -	- - -	- - -	- - -	950 780 700	
20	- - -	- - -	- - -	50 45 -	- - -	- - -	
21	- - -	- - -	- - -	35 40 -	- - -	- - -	
22	- - -	- - -	- - -	50 45 -	- - -	- - -	

Feed, f_z (mm/tooth)/每刃進給

Data reference/參考數據

 pitch mm	Feed fz													
	Material group No.													
	1 2 3 4	5 6	8 9 10 11	12 13 14 15	16 17	20 21 22								
1.0-1.5	0.04-0.06	0.03-0.05	0.04-0.06	0.04-0.07	0.05-0.08	0.03-0.04								
1.75-2.5	0.05-0.07	0.04-0.06	0.05-0.07	0.05-0.08	0.06-0.09	0.04-0.05								
3.0-4.0	0.06-0.08	0.05-0.07	0.06-0.08	0.06-0.09	0.07-0.1	0.05-0.06								
5.0-6.0	0.06-0.08	0.05-0.07	0.06-0.08	0.06-0.09	0.07-0.1	0.05-0.06								

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Thread infeed depth recommendation 螺紋進刀深度建議表

Number of passes and infeed depths/進刀數及進刀深度

External ISO - metric threads/公制外螺紋



The below recommended data is for steel/以下的加工數據是給鋼料使用

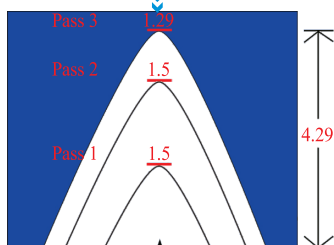
Pitch(mm)	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.75	1.5	1.25	1.0	0.80	0.75	0.50
Tot.inf.depth (mm)	3.82	3.52	3.19	2.87	2.53	2.23	1.92	1.60	1.25	1.13	0.93	0.81	0.65	0.52	0.48	0.48
Pass 1 (mm)	1.50	1.50	1.30	1.60	1.53	1.23	1.0	1.60	1.25	1.13	0.93	0.81	0.65	0.52	0.48	0.48
2	1.30	1.20	1.10	1.37	1.0	1.0	0.92									
3	1.02	0.82	0.79													

Internal ISO - metric threads/公制內螺紋

Pitch(mm)	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.75	1.5	1.25	1.0	0.80	0.75	0.50
Tot.inf.depth (mm)	3.54	3.25	2.96	2.65	2.33	2.05	1.78	1.48	1.17	1.05	0.85	0.75	0.60	0.49	0.46	0.31
Pass 1 (mm)	1.50	1.30	1.60	1.50	1.33	1.10	1.0	1.48	1.17	1.05	0.85	0.75	0.60	0.49	0.46	0.31
2	1.20	1.10	1.39	1.15	1.0	0.95	0.78									
3	0.84	0.85														

Internal - Inch threads/英制內螺紋

Pitch TPI	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10	11	12	14	16	18	19	20	26	28
Tot.inf.depth (mm)	4.29	3.82	3.44	2.96	2.50	2.17	1.93	1.76	1.58	1.45	1.20	1.13	1.01	0.96	0.92	0.72	0.69
Pass 1 (mm)	1.50	1.50	1.50	1.60	1.40	1.20	1.10			1.45	1.20	1.13	1.01	0.96	0.92	0.72	0.69
2	1.50	1.30	1.20	1.36	1.10	0.97	0.83										
3	1.29	1.02	0.74														



On stainless steel, the infeed depth per pass should be decreased.

加工白鐵時,進刀深度需降低。



The threading insert nose radius is relatively small and can be easily damaged if it is overloaded.

銑牙刀的圓弧角相對較小,如果刀片負載太大,刀片容易損壞。

Example of thread infeed method
螺紋加工進刀法範例圖

PRODUCT INTRODUCTION

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About thread milling 關於螺紋銑削

In order to perform a thread milling operation, a milling machine with three-axis control capable of helical interpolation is required. Helical interpolation is a CNC function producing tool movement along a helical path. This helical motion combines circular movement in one plane with a simultaneous linear motion in a plane perpendicular to the first. For example, the path from point A to point B (Fig.A) on the envelope of the cylinder combines a circular movement in the xy plane with a linear displacement in the z direction.

為了實現螺紋的銑削,機床必須具備三軸聯動的功能.而螺旋插補是CNC機床的功能,由機床控制刀具實現螺旋軌跡,螺旋插補由平面圓弧插補和垂直於該平面的線性運動聯動形成.例如:從A點到B點(圖.A)的螺旋軌跡是由X-Y的平面圓弧插補運動和Z軸的線性直線運動聯動而成.

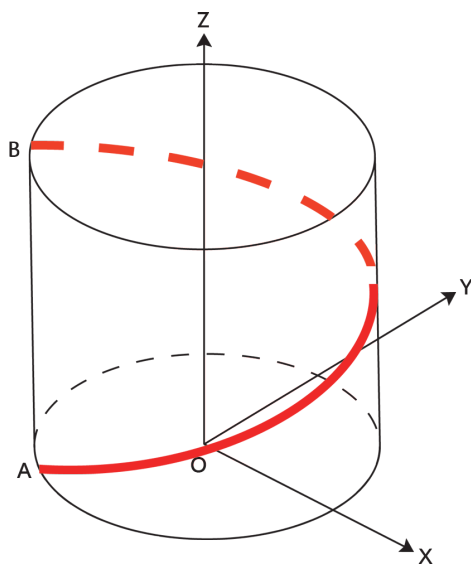


FIG.A

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Internal thread milling example CNC code

內 螺 旋 銑 削 程 式 範 例

Method 1/方式一: Tool offset-cutler compen sation/刀具補正

Insert code/刀片編號: T1-12-60-1.0~2.5

Thread/螺紋規格: M16*2.0P

Milling/銑削方式: Climb milling/Internal thread

CNC programme/控制器: Fanuc/Mitsubishi

FIG.1

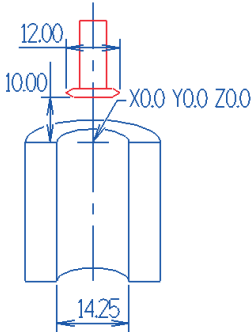
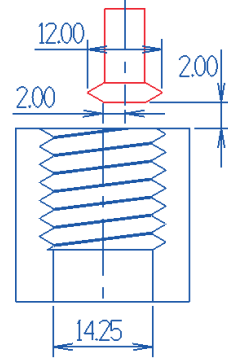


FIG.2



Fanuc

Exact cutting data see page 20/實際加工數據請參考第20頁

G90 G0 G54 X0.0 Y0.0

G43 Z10.0 H1 S3978 M3 (On centerline of workpiece Fig1/工件中心為原點 如圖一)

M8

G0 X2.0 Y0.0 Z2.0 (Move to the contour starting point Fig 2/刀具位移至預備下刀點 如圖二)

G42 D? (Setting Tool offset/補正區域)

G2 I-2.0 Z-0.0 F636 (Thread milling/開始銑削螺牙)

I-2.0 Z-2.0

I-2.0 Z-4.0

I-2.0 Z-6.0

G1 X0.0 Y0.0 (Move dear of the contour/刀具位移偏離工件,預備提刀)

G0 Z50.0 M9 (Retract from thread/提刀)

G40 (Offset finish/補正取消)

M30 (Programme finisch,check the quality of thread change to a control the quality/程式結束,檢查螺牙緊密度,修改G42D(值)

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Internal thread milling example CNC code

內 螺 旋 銑 削 程 式 範 例

Method 2/方式二: Reset the starting point(X)/重設預備下刀點X值,銑削螺牙值

Insert code/刀片編號: T1-12-60-1.0~2.5

Thread/螺紋規格: M16*2.0P

Milling/銑削方式: Climb milling/Internal thread

CNC programme/控制器: Fanuc/Mitsubishi

FIG.1

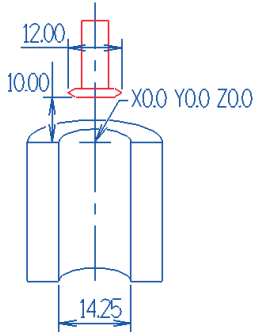
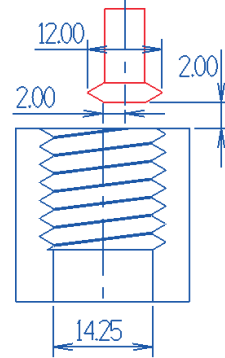


FIG.2



Fanuc

Exact cutting data see page 20/實際加工數據請參考第20頁

G90 G0 G54 X0.0 Y0.0

G43 Z10.0 H1 S3978 M3 (On centerline of workpiece Fig1/工件中心為原點 如圖一)

M8

G0 X2.0 Y0.0 Z2.0 (Move to the contour starting point Fig 2/刀具位移至預備下刀點 如圖二)

G2 I-2.0 Z-0.0 F636 (Thread milling/開始銑削螺牙)

I-2.0 Z-2.0

I-2.0 Z-4.0

I-2.0 Z-6.0

G1 X0.0 Y0.0 (Move dear of the contour/刀具位移偏離工件,預備提刀)

G0 Z50.0 M9 (Retract from thread/提刀)

G40 (Offset finish/補正取消)

M30 (Programme finisch,check the quality of thread change to a control the quality/程式結束,檢查螺牙緊密度,修改 X.I 值)

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External thread milling example CNC code

外 螺 旋 銑 削 程 式 範 例

Method 1/方式一: Tool offset-cutler compen sation/刀具補正

Insert code/刀片編號: T1-12-60-1.0~2.5

Thread/螺紋規格: M16*2.0P

Milling/銑削方式: Climb milling/Internal thread

CNC programme/控制器: Fancu/Mitsubishi

FIG.1

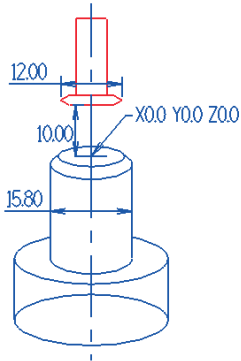
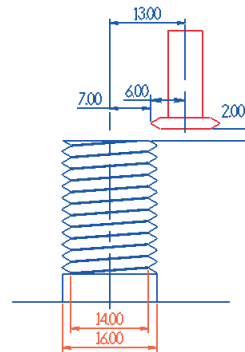


FIG.2



Fanuc

Exact cutting data see page 20/實際加工數據請參考第20頁

G90 G0 G54 X0.0 Y0.0

G43 Z10.0 H1 S3978 M3 (On centerline of workpiece Fig1/工件中心為原點 如圖一)

M8

G0 X13.0 Y0.0 Z2.0 (Move to the contour starting point Fig 2/刀具位移至預備下刀點 如圖二)

G42 D? (Setting Tool offset/補正區域)

G2 I-13.0 Z-0.0 F636 (Thread milling/開始銑削螺牙)

I-13.0 Z-2.0

I-13.0 Z-4.0

I-13.0 Z-6.0

G1 X16.0 (Move dear of the contour/刀具位移偏離工件,預備提刀)

G0 Z50.0 M9 (Retract from thread/提刀)

G40 (Offset finish/補正取消)

M30 (Programme finisch,check the quality of thread change to a control the quality/程式結束,檢查螺牙緊密度,修改G42D(值)

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External thread milling example CNC code

外 螺 旋 銑 削 程 式 範 例

Method 2/方式二: Reset the starting point(X)/重設預備下刀點X值,銑削螺牙值

Insert code/刀片編號: T1-12-60-1.0~2.5

Thread/螺紋規格: M16*2.0P

Milling/銑削方式: Climb milling/Internal thread

CNC programme/控制器: Fanuc/Mitsubishi

FIG.1

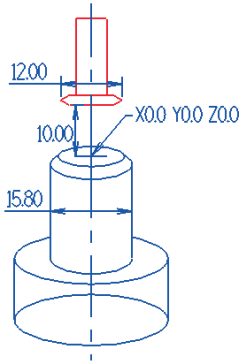
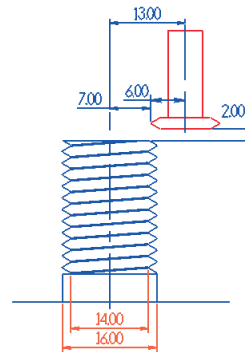


FIG.2



Fanuc

Exact cutting data see page 20/實際加工數據請參考第20頁

G90 G0 G54 X0.0 Y0.0

G43 Z10.0 H1 S3978 M3 (On centerline of workpiece Fig1/工件中心為原點 如圖一)

M8

G0 X13.0 Y0.0 Z2.0 (Move to the contour starting point Fig 2/刀具位移至預備下刀點 如圖二)

G2 I-13.0 Z-0.0 F636 (Thread milling/開始銑削螺牙)

I-13.0 Z-2.0

I-13.0 Z-4.0

I-13.0 Z-6.0

G1 X16.0 (Move clear of the contour/刀具位移偏離工件,預備提刀)

G0 Z50.0 M9 (Retract from thread/提刀)

G40 (Offset finish/補正取消)

M30 (Programme finish, check the quality of thread change to a control the quality/程式結束,檢查螺牙緊密度,修改X.1值)

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Thread Milling Methods 螺 紋 銑 削 方 法

External / 外螺紋



FIG.1

Right Hand
Thread-
Climb
Milling
右旋螺紋-順銑

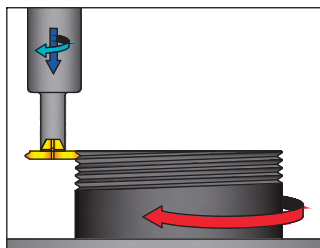


FIG.2



Left Hand
Thread-
Climb
Milling
左旋螺紋-順銑

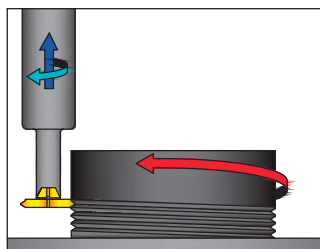


FIG.1

Right Hand
Thread-
Conventional
Milling
右旋螺紋-逆銑

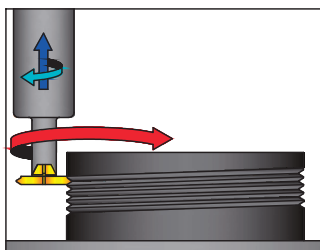
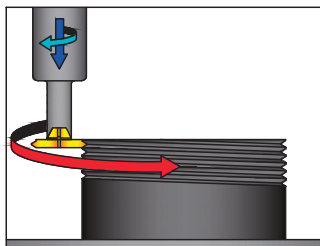


FIG.2

Left Hand
Thread-
Conventional
Milling
左旋螺紋-逆銑



Internal / 內螺紋



FIG.1

Right Hand
Thread-
Climb
Milling
右旋螺紋-順銑

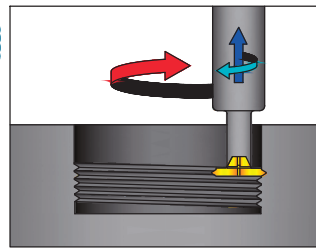


FIG.2



Left Hand
Thread-
Climb
Milling
左旋螺紋-順銑

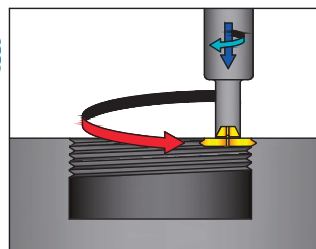


FIG.1

Right Hand
Thread-
Conventional
Milling
右旋螺紋-逆銑

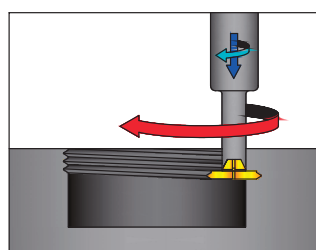
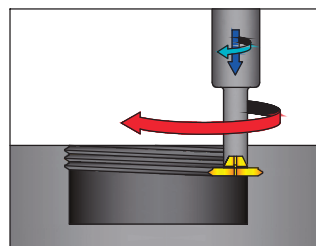


FIG.2

Left Hand
Thread-
Conventional
Milling
左旋螺紋-逆銑



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Recommended inserts for thread/ pitch(mm)/ minium bore dia
螺 紋 直 徑 / 螺 距 (公 制) / 下 孔 徑 建 議 表

Insert dia 刀片直徑	Thread 螺紋直徑	pitch mm 螺距 mm	Minium bore dia. for thread milling 下孔徑			
			Internal 內牙 80%	Internal 內牙 100%	External 外牙 80%	External 外牙 100%
ϕ 12 M/MF	M14	1.0	13.2	13.0	13.88	14
		1.25	13.0	12.7	13.86	14
		1.5	12.7	12.4	13.85	14
		2.0	12.3	11.9	13.82	14
	M15	1.0	14.2	14.0	14.88	15
		1.5	13.7	13.4	14.85	15
	M16	1.0	15.2	15.0	15.88	16
		1.25	15.0	14.7	15.86	16
		1.5	14.7	14.4	15.85	16
		2.0	14.3	13.9	15.82	16
	M18	1.0	17.2	17.0	17.88	18
		1.5	16.7	16.4	17.86	18
		2.0	16.3	15.9	17.82	18
		2.5	15.9	15.3	17.79	18
	M20	1.0	19.2	19.0	19.88	20
		1.5	18.7	18.4	19.85	20
		2.0	18.3	17.9	19.82	20
		2.5	17.9	17.3	19.79	20
ϕ 15 M/MF	M20	1.0	19.2	19.0	19.88	20
		1.5	18.7	18.4	19.85	20
		2.0	18.3	17.9	19.82	20
		2.5	17.9	17.3	19.79	20
	M22	1.0	21.2	21.0	21.88	22
		1.5	20.7	20.4	21.85	22
		2.0	20.3	19.9	21.82	22
		2.5	19.9	19.3	21.79	22
	M24	1.0	23.2	23.0	23.88	24
		1.5	22.7	22.4	23.85	24
		2.0	22.3	21.9	23.82	24
		3.0	21.4	20.8	23.77	24

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Recommended inserts for thread/ pitch(mm)/ minium bore dia
螺 紋 直 徑 / 螺 距 (公 制) / 下 孔 徑 建 議 表

Insert dia 刀片直徑	Thread 螺紋直徑	pitch mm 螺距 mm	Minium bore dia. for thread milling 下孔徑			
			Internal 內牙 80%	Internal 內牙 100%	External 外牙 80%	External 外牙 100%
ϕ 20 M/MF	M24	1.0	23.2	23.0	23.88	24
		1.5	22.7	22.4	23.85	24
		2.0	22.3	21.9	23.82	24
		3.0	21.4	20.8	23.77	24
	M26	1.5	24.7	24.4	25.85	26
	M27	1.5	25.7	25.4	26.85	27
		2.0	25.3	24.9	26.82	27
	M28	1.5	26.7	26.4	27.85	28
	M30	1.5	28.7	28.4	29.85	30
		2.0	28.3	27.9	29.82	30
		3.5	27.0	26.3	29.73	30
	M32	1.5	30.7	30.4	31.85	32
	M33	1.5	31.7	31.4	32.85	33
		2.0	31.3	30.9	32.82	33
		3.5	30.0	29.3	32.73	33

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Recommended inserts for thread/ pitch(mm)/ minium bore dia
螺 紋 直 徑 / 螺 距 (公 制) / 下 孔 徑 建 議 表

Insert dia 刀片直徑	Thread 螺紋直徑	pitch mm 螺距 mm	Minium bore dia. for thread milling 下孔徑			
			Internal 內牙 80%	Internal 內牙 100%	External 外牙 80%	External 外牙 100%
ϕ 25 M/MF	M34	1.5	32.7	32.4	33.85	34
	M35	1.5	33.7	33.4	34.85	35
	M36	1.5	34.7	34.4	35.85	36
		2.0	34.3	33.9	35.82	36
		3.0	33.4	32.8	35.77	36
		4.0	32.6	31.7	35.70	36
	M38	1.5	36.7	36.4	37.85	38
	M39	2.0	37.3	36.9	38.82	39
		4.0	35.6	34.7	38.70	39
	M40	1.5	38.7	38.4	39.85	40
		2.0	38.3	37.9	39.82	40
		3.0	37.4	36.8	39.77	40
	M42	1.5	40.7	40.4	41.85	42
		2.0	40.3	39.9	41.82	42
		3.0	39.4	38.8	41.77	42
		4.5	38.1	37.2	41.69	42
	M45	1.5	43.7	43.4	44.85	45
		2.0	43.3	42.9	44.82	45
		3.0	42.4	41.8	44.77	45
		4.5	41.1	40.2	44.69	45
	M48	1.5	46.7	46.4	47.85	48
		2.0	46.3	45.9	47.82	48
		3.0	45.4	44.8	47.77	48
		5.0	43.7	42.6	47.66	48
	M50	1.5	48.7	48.4	49.85	50
	M52	1.5	50.7	50.4	51.85	52
		5.0	47.7	46.6	51.66	52

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Recommended thread dia/ t.p.i./ minium bore dia
螺紋直徑 / 螺距 (英制) / 下孔徑建議表

Inserts 刀片直徑	Thread 螺紋直徑	pitch mm 牙距 mm	Minium bore dia. for thread milling 下孔徑			
			Internal 內牙 80%	Internal 內牙 100%	External 外牙 80%	External 外牙 100%
φ 12 BSW/BSF	9/16"	16"	12.7	12.3	14.12	
		12"	12.2	11.6	14.14	
	5/8"	14"	14.1	13.6	15.73	
		11"	13.6	13.0	15.72	
	3/4"	12"	16.9	16.4	18.89	
		10"	16.5	15.8	18.89	
φ 15 BSW/BSF	7/8"	11"	19.9	19.3	22.11	
		9"	19.4	18.7	22.10	
	1"	10"	22.8	22.2	25.28	
		8"	22.2	21.4	25.27	
φ 20 BSW/BSF	1 1/8"	11"	26.4	25.7	28.42	
		7"	24.9	24.0	28.44	
	1 1/4"	11"	29.4	28.8	31.59	
		7"	28.1	27.1	31.61	
	1 3/8"	11"	32.6	32.0	34.77	
		6"	30.6	29.5	34.77	
φ 25 BSW/BSF	1 1/2"	11"	35.8	35.3	37.95	
		6"	33.8	32.7	37.95	
	1 5/8"	5"	36.1	34.8	41.11	
	1 3/4"	11"	42.1	41.5	44.29	
		5"	39.3	38.0	44.28	
	1 7/8"	4.5"	41.9	40.4	47.45	
	2"	11"	48.5	47.9	50.64	
		4.5"	45.1	43.6	50.63	

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Troubleshooting 問 題 與 對 策

	Problem 問題	Possible cause 可能原因	Solution 對策
	Flank wear 刀片側刀磨損增加	Cutting speed too high Feed, fz too low, chip is too thin Insufficient coolant 切削速度過快 切屑太薄 冷卻液不充足	Reduce cutting speed/use coated insert Increase feed rate Increase coolant flow rate 降低切削速度/使用塗層刀片 增加進給量 增加冷卻液流量
	Chipping of cutting edge 切削刃破損	Chip is too thick Vibration 切屑速度過快 振動	Reduce feed rate or Increase RPM Use the tangential arc method Check stability, minimize tool overhang Increase number of infeed passes Use a full-profile insert Check toolholder run-out or insert mounting tolerance 降低進給量或增加轉速 採用圓弧切入切出方法 檢查穩定性 縮短刀桿 增加進刀數 使用標準牙加工 檢查刀把偏擺或刀片鎖緊公差
	Material build up on the cutting edge 切削刃上有積 屑瘤	Unsuitable carbide grade Cutting zone temperature is too low Very sticky material, such as low-carbon steel, stain less ste- els, and aluminum 不適合的刀片材質 加工區溫度太低 工件材料易黏, 例如: 低碳鋼、白鐵、鋁	Use a coated carbide grade Use correct cutting data Use oil mist or cutting fluid 用有塗層的刀片 使用正確加工數據 使用油霧或是切削液把鐵屑帶走
Excessive wear causing short tool life 刀片壽命短少	Excessive wear causing short tool life 刀片壽命短少	Vibration Re-cutting of chips Burr formation on component Poor surface finish Heat generation Excessive noise 振動 重複切到鐵屑 切到工件上的毛邊 工件表面粗糙度差 熱能產生 噪音過大	Increase feed, fz Reduce speed Down milling Evacuate chips effectively using compressed air Check recommended cutting data 增加每齒進給轉速 降低轉速 順銑 利用切削液或噴氣有效去除鐵屑 使用正確的加工數據

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Troubleshooting 問題與對策



Problem
問題

Possible cause
可能原因

Solution
對策

Vibration
震動

Vibration
震動

Weak fixturing
Tool overhang too long
Feed rate is too high
夾治具不夠穩
刀具懸伸太長
進給太快

Use correct cutting data
Check clamping of workpiece and tool
Minimize overhang
Check tool holder run out
Choose a tool with fewer teeth
Increase number of infeed passes
Use up-milling in finishing
使用正確的加工數據
檢查工件及刀具的夾持
縮短懸伸
檢查刀把偏擺
使用齒數較少的刀片
增加進刀次數
在精修時使用逆銑



Go or No Go

**Insufficient
thread
accuracy**
螺紋精確度差

Tool deflection
刀具偏差

Reduce feed rate
Execute a “zero” cut, and make sure the
tool in correct center line
降低進給/在空切一次以提高精度,並確保刀具位於正確
的中心線上

Steel

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
1	1.1133	G 28 Mn6	1.1165	20 Mn5	120 M 19	20 M 5	SMnC 420
	1.1165	C10	1.0301	30 Mn5	120 M 36		SMn 1 H; SCMn 2
	1.0301			C 10	045 M 10	AF 34 C 10; XC 10	S 10 C
	1.0401	C22+N	1.0402	C 15	080 M 15	AF3 7 C 12; XC 18	
	1.0402	C25+N	1.0406	C 22	050 A 20	C 20	
	1.0406	C 10E	1.1121	C 25	070 M 26	AF 50 C 30	S 25 C
	1.1121	C 15R	1.1141	Ck 10	040 A 10	XC 10	S 10 C; S 9 CK
	1.1141	C 22E	1.1151	Ck 15	080 M 15	XC 15; XC 18	S 15 C; S 15 CK
	1.1151			Ck 22	040 A 22	XC25; XC 18	S 22 C; S 20 CK
	1.1158	S235JR	1.0037	Ck 25	060 A 25	XC 25	S 25 C
	1.0037	S235JRG2	1.0038	St 37-2		E24-2	STKM 12 C
	1.0116	S275J0H	1.0149	St 37-3	4360-40 C	E 24-3; E 24-4	
	1.0044	S275J2G3	1.0144	St 44-2	4360-43 B	E 28-2	SM 41 B
	1.0144			St 44-3 N	4360-43 C	E 28-3; E 28-4	SM 41 C
2	1.0721	10 S 20	1.0721	10 S 20	210 M 15	10 F 1	
	1.0722			10 SPb 20		10 PbF 2	
	1.0723	15 SMn13	1.0725	15 S 20	210 A 15		SUM 32
	1.0726	35 S20	1.0726	35 S 20	212 M 36	35 MF 4	
	1.0727	46 S20	1.0727	46 S 20	212 M 44	45 MF 4	
	1.0728	60 S20	1.0728	60 S 20		60 MF 4	
	1.0711			9 S 20	220 M 07		SUM 21
	1.0715	11 SMn30	1.0715	9 SMn 28	230 M 07	S 250	SUM 22
	1.0736	11 SMn37	1.0736	9 SMn 36	240 M 07	S 300	
	1.0718	11 SMnPb30	1.0718	9 SMnPb 28		S 250 Pb	SUM 22 L
	1.0737	11 SMnPb37	1.0737	9 SMnPb 36		S 300 Pb	
3	1.5622			14 Ni 6		16 N 6	
	1.5423			16 Mo 5	1503-245-420		SB 450 M
	1.1167	G 28 Mn6+QT	1.1165	36 Mn 5	150 M 36	40 M 5	SMn 438 (H); SCMn 3
	1.1157			40 Mn 4	150 M 36	35 M 5	
	1.0528			C 30	080 A 30	C 30	S 30 C
	1.0501	C35+N		C 35	060 A 35	AF 55 C 35	
	1.0511	C40+N		C 40	080 M 40	AF 60 C 40	S 40 C
	1.0503	E 335	1.0503	C 45	080 M 46	AF 65 C 45	S 45 C
	1.0540	C50+N		C 50	080 M 50	C 50	S 50 C
	1.1178	C 30E	1.1178	Ck 30	060 A 30		S 30 C
	1.1181	C 35E	1.1181	Ck 35	080 M 36	XC 38 H1;XC 32	S 35 C
	1.1186	C 40E	1.1186	Ck 40	080 M 40	XC 42 H1	S 40 C
	1.1206	C 50E	1.1206	Ck 50	080 M 50	XC 48 H1	
	1.1203	C 55E	1.1203	Ck 55	070 M 55	XC 55	S 55 C
	1.0570	S355JR	1.0570	St 52-3	4360-50 C	E 36-3; E 36-4	SM 50 YA
	1.0535	E 360	1.0070	St 70-2		A 70-2	
4	1.5680			12 Ni 19		Z 18 N 5	
	1.7012			13 Cr 2			
	1.7335	13 CrMo 4 5	1.7335	13 CrMo 4 4	1501-620 Gr. 27	15 CD 3.5	
	1.7715			14 MoV 6 3	1503-660-440		
	1.5732			14 NiCr 10		14 NC 11	SNC 415 (H)
	1.5752	14 NiCr 14	1.5752	14 NiCr 14	655 M 13	12 NC 15	SNC 815 (H)
	1.7015			15 Cr 3	523 M 15	12 C 3	SCR 415 (H)
	1.7262			15 CrMo 5		12 CD 4	SCM 415 (H)
	1.8521			15 CrMoV 5 9			
	1.5919			15 CrNi 6	S 107	16 NC 6	
	1.5415	16 Mo 3	1.5415	15 Mo 3	1501-240	15 D 3	
	1.2735			15 NiCr 14		10 NC 12	SNC 22
	1.7337			16 CrMo 44	1501-620 Gr. 27	15 CD 4.5	
	1.7131	16 MnCr 5	1.5715	16 MnCr 5	527 M 17	16 MC 5	SCR 415
	1.7139	16 MnCrS 5	1.7139	16 MnCrS 5			
	1.5920			18 CrNi 8		20 NC 6	
	1.6587	17 CrNiMo 6	1.6587	18 CrNiMo 6	820 A 16	18 NCD 6	
	1.7311			20 CrMo 2			
	1.7264	20 CrMo 5	1.7264	20 CrMo 5		18 CD 4	SCM 421
	1.7147	20 MnCr 5	1.7147	20 MnCr 5		20 MC 5	SMnC 420 (H)
	1.7149	20 MnCrS 5	1.7149	20 MnCrS 5		20 MnCrS 5	SMnC 21H
	1.7321			20 MoCr 4			
	1.7323			20 MoCrS 4			
	1.2162			21 MnCr 5		20 NC 5	SCR 420H

Steel

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
G 22 Mn 3 C 10 C 15; C 16 C 20; C 21 C 25 C 10 15; C 16 C 20 C 25 Fe 360 B Fe 360 D FF Fe 430 B FN Fe 430 D FF	1350 1450 1265 1370 1311 1312; 1313 1412 1412; 1414	1022; 1518 1330 1010 1015 1023 1025 1010 1015 1022 1025 A 573 Gr. 58 A 570 Gr. 40 A 573 Gr. 70	G10220 G13300 G10100 G10170 G10200 G10100 G10170 G10250				
CF 10 S 20 CF 10 SPb 20 CF 9 S 22 CF 9 SMn 28 CF 9 SMn 36 CF 9 SMn Pb 28 CF 9 SMn Pb 36	1922 1957 1973 1912 1914 1926	1108 11 L 08 1140 1146 1212 1213 1215 12 L 13 12 L 14	 G11400 G11460 G12120 G12130 G12150 G12134 G12144				
14 Ni 6 16 Mo 5 C 35 C 40 C 45 C 35 C 40 C 50 Fe 510 B; C; D Fe 690	2120 1550 1650 1572 2172; 2132 1655	A 350-LF 5 4520 1335 1039 1035 1040 1045 1049 1030 1035 1040 1050 1055 1055	G45200 G13350 G10390 G10350 G10430 G10340				
14 CrMo 4 5 16 NiCr 11 12 CrMo 4 16 CrNi 4 16 Mo 3 14 CrMo 4 5 16 MnCr 5 18 NiCrMo 7 20 MnCr 5	2216 2912 2216 2511 5120 5120 H	2515 A 182-F11; F12 3415 3310; 9314 5015 4320 A 204 Gr. A P6 A 387 Gr.12 CL2 5115 5120 5120 H	 G 33106 G 50150 T 51605 G51170 G51200				

Steel

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
4	1.6523	20 NiCrMoS 2 2	1.6526	21 NiCrMo 2	805 M 20	20 NCD 2	SNCM 220 (H)
	1.7271			23 CrMoB 3 3			
	1.7218	25 CrMo 4	1.7218	25 CrMo 4	1717 CDS 110	25 CD 4 S	SCM 420; SCM 430
	1.7325			25 MoCr 4			
	1.7326			25 MoCrS 4			
	1.7030	28 Cr4	1.7030	28 Cr 4	530 A 30		
	1.6513			28 NiCrMo4			
	1.7707			30 CrMoV 9			
	1.6580			30 CrNiMo 8	823 M 30	30 CND 8	SNCM 431
	1.8519	31 CrMoV 9	1.8519	31 CrMov 9		32 CDV 12	
	1.5755			31 NiCr 14	653 M 31	30 NC 11	SNC 836
	1.7020			32 Cr 2			
	1.7361			32 CrMo 12	722 M 24	30 CD 12	
	1.7033	34 Cr 4	1.7033	34 Cr 4	530 A 32	32 C 4	SCr 430 (H)
	1.7220	34 CrMo 4	1.7220	34 CrMo 4	708 A 37	35 CD 4	SCM 432; SCCrM3
	1.2330			35 CrMo 4	708 A 37	34 CD 4	
	1.5864			35 NiCr 18			
	1.6511	36CrNiMo4+TA		36 CrNiMo 4	816 M 40	40 NCD 3	
	1.5736			36 NiCr 10		35 NC 11	
	1.5710			36 NiCr 6	640 A 35	35 NC 6	
	1.7034			37 Cr 4	530 A 36	38 C 4	
	1.5122			37 MnSi 4			
	1.7003	38 Cr2	1.7003	38 Cr 2		38 C 2	
	1.5120			38 MnSi 4			
	1.8523			39 CrMoV 13 9	897 M 39		
	1.2311			40 CrMnMo 7			
	1.2312			40 CrMnMoS 8 6		40 CMD 8S	
	1.2738			40 CrMnNiMo 8		40 CND 8	
	1.7035	41 Cr 4	1.7035	41 Cr4	530 M 40	42 C 4	SCr 440 (H)
	1.7223			41 CrMo 4	708 M 40	42 CD 4 TS	SCM 440
	1.7045			42 Cr 4	530 A 40	42 C 4 TS	SCr 440
	1.7225	42 CrMo 4	1.7225	42 CrMo 4	708 M 40	42 CD 4	SCM 440 (H)
	1.7561			42 CrV 6			
	1.5223			42 MnV 7			
	1.3563			43 CrMo 4			
	1.3561			44 Cr 2			
	1.7006			46 Cr 2		42 C 2	
	1.5121			46 MnSi 4			
	1.3565			48 CrMo 4			
	1.7228			50 CrMo 4	708 A 47		SCM 445 (H)
	1.8159	50 CrV 4	1.8159	50 CrV 4	735 A 50	50 CV 4	SUP 10
	1.5131	50 MnSi4	1.5131	50 MnSi 4			
	1.5141			53 MnSi 4			
	1.7176	55 Cr 3	1.7176	55 Cr3	527 A 60	55 C 3	SUP 9(A)
	1.0904	55 SiCr7	1.7100	55 Si 7	250 A 53	55 S 7	
	1.2103			58 SiCr 8			
	1.0961			60 SiCr 7		60 SC 7	SUP 7
	1.2101			62 SiMnCr4			
	1.1730			C 45W		Y3 42	
	1.1820			C 55W			
	1.0601	C60+N	1.0601	C 60	080 A 62	CC 55	
	1.1740			C 60W		Y3 55	SK7
	1.1744			C 67W			
	1.1520			C 70W1			
	1.1620			C 70W2			
	1.1750	C 75 W	1.1750	C 75W	BW 1A		
	1.1525			C 80W1		Y1 90; Y1 80	
	1.1625			C 80W2	BW 1 B	Y1 80	SKC 3; SK 5; SK 6
	1.1830			C 85W		Y3 90	SK 5
	1.1191	C 45E	1.1191	Ck 45	080 M 46	XC 42	S 45 C
	1.1221	C 60E	1.1221	Ck 60	080 A 62	XC 60	S 58 C
	1.1231	C 67S	1.1231	Ck 67	060 A 67	XC 68	
	1.1248	C 75S	1.1248	Ck 75	060 A 78	XC 75	
	1.8159			GS-50 CrV 4			
	1.0060	E 335	1.0060	St 60-2	4360-SSE; SSC	A 60-2	SM 58

Steel

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
20 NiCrMo 2	2506	8620	G86170				
25 CrMo 4 (KB)	2225	4130	G41300				
		5130					
30 NiCrMo 8							
32 CrMo 12	2240						
34 Cr 4 (KB)		5132	G51320				
35 CrMo 4	2234	4135; 4137	G41350				
35 CrMo 4	2234	4135	T 51620				
38 NiCrMo 4 (KB)		9840	G98400				
35 NiCr 9		3435					
		3135					
38 Cr 4		5135					
38 Cr 2							
36 CrMoV 13 9							
		P 20					
		P 20+S					
		P 20+Ni					
41 Cr 4		5140	G51400				
41 CrMo 4	2244	4142; 4140	G41420				
42 Cr 4	2244 *)	5140					
42 CrMo 4	2244	4142; 4140	G41400				
45 Cr 2		5045					
		5045					
51 CrV 4	2230	4150	G41470				
		6150	H61500				
55 Cr 3	2253	5155	G51550				
55 Si 8	2085; 2090	9255					
60 SiCr 8		9262					
C60		1060	G10600				
C 80 KU		W1	T72301				
C 80 KU		W 108					
C 45	1672		G10420				
C 60	1665; 1678	1064	G10640				
C 70	1770	1070	G10700				
C 75	1774; 1778	1078; 1080	G10780				
		6150H					
Fe 590; Fe 60-2							

Steel

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
4	1.4006	X 12 Cr 13	1.4006	X 10 Cr 13	410 S 21	Z 12 C 13	SUS 410
	1.4724	X 10 CrAl 13	1.4724	X 10 CrAl 13	BH 12	Z 10 C 13	SUS 405
	1.4762	X 10 CrAl 24	1.4762	X 10 CrAl 24		Z 10 CAS 24	SUH 442
	1.4006	X 12 Cr 13	1.4006	X 12 Cr 13	410 S 21		SUS 410
	1.4104	X 14 CrMoS 17	1.4104	X 12 CrMoS 17	411 S 29	Z 10 CF 17	SUS 430 F
	1.4005	X 12 CrS 13	1.4005	X 12 CrS 13	416 S 21	Z 12 CF 13	SUS 416
	1.4024	X 12 Cr 13	1.4024	X 15 Cr 13	420 S 29	Z 12 C 13	SUS 410 J 1
	1.4521	X 2 CrMoTi18 2	1.4521	X 2 CrMoTi18 2			
	1.4521	X 2 CrMoTi18 2	1.4521	X 2 CrMoTi18 2			
	1.4003	X 2 CrNi 13	1.4003	X 2 CrNi 12			
	1.4313	X 3 CrNiMo 13 3	1.4313	X 5 CrNi 13 4	425 C 11	Z 5 CN 13.4	SCS 5
	1.4512	X 5 CrTi 12	1.4512	X 5 CrTi 12	409 S 19	Z 6 CT 12	SUH 409
	1.4000	X 6 Cr 13	1.4000	X 6 Cr 13	403 S 17	Z 6 C 12	SUS 403
	1.4016	X 6 Cr 17	1.4016	X 6 Cr 17	430 S 15	Z 8 C 17	SUS 430
	1.4002	X 6 CrAl 13	1.4002	X 6 CrAl 13	405 S 17	Z 6 CA 13	SUS 405
	1.2341	X 6 CrMo 4	1.2341	X 6 CrMo 4			
	1.4510	X 6 CrTi 17	1.4510	X 6 CrTi 17		Z 8 CT 17	SUS 430 LX
	1.4511	X 3 CrNb 17	1.4511	X 8 CrNb 17		Z 8 CNb 17	SUS 430 LX
5	1.7380	10 CrMo 9 10	1.7380	10 CrMo 9 10	1501-622 Gr. 31; 45	10 CD 9. 10	
	1.3505	100 Cr 6	1.3505	100 Cr 6	534 A 99	100 C 6	SUJ 2
	1.2510			100 MnCrW 4	BO 1	90 MWCV 5	SKS 3
	1.2833			100 V 1	BW 2	Y1 105 V	SKS 43
	1.2419	105 WCr 6	1.2419	105 WCr 6		105 WC 13	SKS 31
	1.2210	107 CrV 3	1.2210	115 CrV 3		100 C 3	
	1.2516			120 WV 4	BF 1	110 WC 20	
	1.7735	14 CrMoV 6 9	1.7735	14 CrMoV 6 9		20 CDV 5.07	
	1.5860			14 NiCr 18			
	1.7709			21 CrMoV 5 7			
	1.6746			32 NiCrMo 14 5	830 M 31	35 NCD 14	
	1.8504	34 CrAl 6	1.8504	34 CrAl 6			
	1.8507			34 CrAlMo 5	905 M 31	30 CAD 6.12	
	1.8550	34 CrAlNi 7	1.8550	34 CrAlNi 7		34 CAND 7	
	1.8506			34 CrAlS 5			
	1.6582	34 CrNiMo 6	1.6582	34 CrNiMo 6	817 M 40	35 NCD 6	SNCM 447
	1.6546			40 NiCrMo 2 2	311-Type 7	40 NCD 2	SNCM 240
	1.6565			40 NiCrMo 6	311-Type 6		SNCM 439
	1.8509	41 CrAlMo 7 10	1.8509	41 CrAlMo 7	905 M 39	40 CAD 6.12	SACM 645
	1.2542			45 WCrV 7	BS 1		
	1.2721			50 NiCr 13			
	1.8161			58 CrV 4			
	1.2826			60 MnSiCr 4			
	1.2550			60 WCrV 7		55 WC 20	
	1.7103			67 SiCr 5			
	1.2108			90 CrSi 5			
	1.1273			90 Mn 4			
	1.2842	90 MnCrV 8	1.2842	90 MnCrV 8	BO 2	90 MV 8	
	1.1545	C 105U	1.1545	C 105 W1		Y1 105	
	1.1645			C 105 W2		Y1 105	SK 3
	1.1654			C 110 W			
	1.1663			C 125 W		Y2 120	SK 2
	1.1673			C 135 W		Y2 140	SK 1
	1.1274	C 100S	1.1274	Ck 101	060 A 96		SUP 4
	1.2887			GS-34 CoCrMoV 19 12			
	1.2392			G-X 28 CrMoV 5 1			
	1.2606			G-X 37 CrMoW 5 1			
	1.4749	X 18 CrN 28	1.4749	X 18 CrN 28		Z 18 C 25	
	1.2764			X 19 NiCrMo 4			
	1.4021	X 20 Cr 13	1.4021	X 20 Cr 13	420 S 37	Z 20 C 13	SUS 420 J1
	1.4935	X 20 CrMoWV 12 1	1.4935	X 20 CrMoWV 12 1			
	1.4057	X 20 CrNi 17 2	1.4057	X 20 CrNi 17 2	431 S 29	Z 15 CN 16.02	SUS 431
	1.4923	X 22 CrMoV 12 1	1.4923	X 22 CrMoV 12 1	762	Z 21 CDV 12	
	1.4028	X 30 Cr 13	1.4028	X 30 Cr 13	420 S 45	Z 30 C 13	SUS 420 J 2
	1.2316	X 38 CrMo 16	1.2316	X 36 CrMo 17		Z 35CD17	
	1.4418	X 4 CrNiMo 16 5	1.4418	X 4 CrNiMo 16 5		Z 6 CND 16.05.01	
	1.4031	X 39 Cr 13	1.4031	X 40 Cr 13	(420 S 45)	Z 40 C 14	SUS 420

Steel

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
X 12 Cr 13 X 10 CrAl 12 X 16 Cr 26	2302	410; CA-15 405 446	S41000 S40500 S44600			Martensite Ferrite Ferrite	
X 10 CrS 17 X 12 CrS 13	2302 2383 2380	410 S 430 F 416	S41000 S43020 S41600			Martensite Ferrite Martensite	
	2326 2326	444 444 309	S40977			Ferrite Ferrite Ferrite	
X 6 CrNi 13 04 X 6 CrTi 12 X 6 Cr 13 X 8 Cr 17 X 6 CrAl 13	2385 2301 2320	409 L 403 430 405	S41500 S40900 S41008 S43000 S40500		F6NM	Martensite Ferrite Ferrite Ferrite Ferrite	
X 6 CrTi 17 X 6 CrNb 17		430 Ti 430 Nb	S43036			Ferrite Ferrite	
12 CrMo 9 10 100 Cr 6 95 MnWCr 5 KU 102 V 2 KU 107 WCr 5 KU 107 CrV 3 KU 110 W 4 KU	2218 2258 2140	A 182-F22 52100 O1 W 210	J 21890 G51986 T31501 T 72302				
34 CrAlMo 7		A 355 Cl. D	K 23545 K 52440 K 23745				
35 NiCrMo 6 (KW) 40 NiCrMo 2 (KB)	2541	4340 8740 4340	G87400				
41 CrAlMo 7 45 WCrV 8 KU	2940 2710	A 355 Cl. A S1	K 24065 T41901				
55 WCrV 8 KU							
90 MnVCr 8 KU C 100 KU C 100 KU	1880	O2 W 110	T31502				
C 120 KU C 140 KU	1870	W 112 1095	G10950				
	2322	446	S44600			Ferrite	
X 20 Cr 13	2303	420	S42000 S42200			Martensite Martensite	
X 16 CrNi 16 X 22 CrMoV 12 1 X 30 Cr 13 X 38 CrMo 16 1 KU	2321-03 2317 2304	431 420	S43100 J91153			Martensite Martensite Martensite	
	2387 2304,2314	422 420	- S40280			Martensite Martensite	

Steel

mat. group No.	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
5	1.4034	X 45 Cr 13	1.4034	X 45 Cr 13	(420 S 45)	Z 40 C 14	
	1.4873	X 45 CrNiW 18 9	1.4873	X 45 CrNiW 18 9	331 S 40	Z 35 CNWS 18.09	SUH 31
	1.2767	X 45 NiCrMo 4	1.2767	X 45 NiCrMo 4	EN 20B	45 NCD 17	
	1.4109	X 70 CrMo 15	1.4109	X 65 CrMo 14		Z 70 D 14	SUS 440A
	1.4747	X 80 CrNiSi 20	1.4747	X 80 CrNiSi 20	443 S 65	Z 80 CSN 20.02	SUH 4
	1.4112	X 90 CrMoV 18	1.4112	X 90 CrMoV 18	409 S 19	Z 2 CND 18 05	SUS 440 B
6	1.2711	54 NiCrMoV 6	1.2711	54 NiCrMoV 6	BH 224	55 NCDV 6	
	1.2713			55 NiCrMoV 6		55 NCDV 7	SKT 4
	1.2744			57 NiCrMoV 7 7			
	1.2762			75 CrMoNiW 6 7			
	1.2369			81 CrMov 42 16			
	1.2880			G-X 165 CrCoMo 12			
	1.2601			G-X 165 CrMoV 12			
	1.2201			G-X 165 CrV 12			
	1.3207	HS 10-4-3-10	1.3207	S 10-4-3-10	BT 42	Z 130 WKCDV 10-4-3-10	SKH 57
	1.3318	HS 12-1-2	1.3318	S 12-1-2			
	1.3302	HS 12-1-4	1.3302	S 12-1-4			
	1.3202	HS 12-1-4-5	1.3202	S 12-1-4-5			
	1.3355	HS 18-0-1	1.3355	S 18-0-1	BT 1	Z 80 WCV 18-04-01	SKH 2
	1.3265	HS 18-1-2-10	1.3265	S 18-1-2-10	BT 5		SKH 4 A
	1.3257	HS 18-1-2-15	1.3257	S 18-1-2-15			
	1.3255	HS 18-1-2-5	1.3255	S 18-1-2-5	BT 4	Z 80 WKCV 18-05-04-0	SKH 3
	1.3247	HS 2-10-1-8	1.3247	S 2-10-1-8	BM 42	Z 110 DKCWV 09-08-04	SKH 51
	1.3346	HS 2-9-1	1.3346	S 2-9-1	BM 1	Z 85 DCWV 08-04-02-0	
	1.3348	HS 2-9-2	1.3348	S 2-9-2		Z 100 DCWV 09-04-02-	
	1.3249			S 2-9-2-8	BM 34		
	1.3333	HS 3-3-2	1.3333	S 3-3-2			
	1.3343	HS 6-5-2	1.3343	S 6-5-2	BM 2	Z 85 WDCV 06-05-04-0	SKH 9; SKH 51
	1.3243	HS 6-5-2-5	1.3243	S 6-5-2-5		Z 85 WDKCV 06-05-05-04-02	SKH 53
	1.3344	HS 6-5-3	1.3344	S 6-5-3	BM 4	Z 120 WDCV 06-05-04-	SKH 52; SKH 53
	1.3345	S 6-5-3C	1.3345	S 6-5-3C			SKH 55
	1.3246	HS 7-4-2-5	1.3246	S 7-4-2-5		Z 110 WKCDV 07-05-04	
	1.2363	X 100 CrMoV 5	1.2363	X 100 CrMoV 5 1	BA 2	Z 100 CDV 5	SKD 12
	1.4125	X 105 CrMo 17	1.4125	X 105 CrMo 17		Z 100 CD 17	SUS 440 C
	1.2379	X 155 CrVMo 12 1		X 155 CrVMo 12 1	BD 2	Z 160 CDV 12	SKD 11
	1.2601			X 165 CrMoV 12			
	1.2709			X 2 NiCoMoTi 18 9 5		Z 2 NKD 19-09	
	1.2080	X 210 Cr 12	1.2080	X 210 Cr 12	BD 3	Z 200 C 12	SKD 1
	1.2436			X 210 CrW 12			SKD 2
	1.2706			X 3 NiCrMo 18 8 5		E-Z 2 NKD 18	
	1.2567			X 30 WCrV 5 3		Z 32 WCV 5	SKD 4
	1.2581			X 30 WCrV 9 3	BH 21	Z 30 WCV 9	SKD 5
	1.2885			X 32 CrMoCoV 3 3 3			
	1.2365			X 32 CrMoV 3 3	BH 10	32 DCV 28	SKD 7
	1.2343			X 38 CrMoV 5 1	BH 11	Z 38 CDV 5	SKD 6
	1.2367			X 38 CrMoV 5 3			
	1.2344	X 40 CrMoV 5 1	1.2344	X 40 CrMoV 5 1	BH 13	Z 40 CDV 5	SKD61
Hardened steel							
7	1.3401	X 120 Mn 12	1.3401	X 120 Mn 12	BW 10	Z 120 M 12	SC MnH 1
Stainless steel							
8	1.4305	X 8 CrNiS 18 9	1.4305	X 10 CrNiS 18 9	303 S 31	Z 10 CNF 18.09	SUS 303
	1.4310	X 9 CrNi 18 8	1.4310	X 12 CrNi 17 7	301 S 21	Z 12 CN 17.07	SUS 301
	1.4300	X 12 CrNi 18 8	1.4300	X 12 CrNi 18 8	302 S 25	Z 12 CN 18	SUS 302
	1.4546	X 5 CrNiNb 18 10	1.4546	X 5 CrNiNb 18 10	347 S 31		
	1.4301	X 5 CrNi 18 9	1.4301	X 6 CrNi 18 10	304 S 31	Z 6 CN 18.09	SUS 304
	1.4948	X 6 CrNi 18 11	1.4948	X 6 CrNi 18 11	304 S 51	Z 6 CN 18.09	SUS 304 H
	1.4303	X 4 CrNi 18 11	1.4303	X 6 CrNi 18 12	305 S 19	Z 8 CN 18.11 FF	SUS 305
	1.4550	X 6 CrNiNb 18 10	1.4550	X 6 CrNiNb 18 10	347 S 31	Z 6 CENNb 18.10	SUS 347
9	1.4583	X 5 CrNiMoNb 19 11 2	1.4583	X 10 CrNiMoNb 18 12	318 C 17	Z 6 CNDNb 17.13	SCS 22
	1.4335	X 12 CrNi 25 21	1.4335	X 12 CrNi 25 21	310 S 24	Z 12 CN 25.20	SUH 310; SUS 310 S
	1.4541	X 6 CrNiTi 18 10	1.4878	X 12 CrNiTi 18 9	321 S 51	Z 6 CNT 18.12	SUS 321
	1.4962	X 12 CrNiWTi 16 3	1.4962	X 12 CrNiWTi 16 3		Z 6 CENNb 18.10	
	1.4828	X 15 CrNiSi 20 12	1.4828	X 15 CrNiSi 20 12	309 S 24	Z 17 CNS 20.12	SUH 309
	1.4306	X 2 CrNi 19 11	1.4306	X 2 CrNi 19 11	304 S 12	Z 2 CN 18.10	SUS 304 L
	1.4404	X 2 CrNiMo 17 12 2	1.4404	X 2 CrNiMo 17 13 2	316 S 11	Z 2 CND 17.12.02	SUS 316 L
	1.4435	X 3 CrNiMo 18 14 3	1.4435	X 2 CrNiMo 18 14 3	316 S 12	Z 2 CND 17.13	SCS 16; SUS 316 L
	1.4438	X 2 CrNiMo 18 15 4	1.4438	X 2 CrNiMo 18 16 4	317 S 12	Z 2 CND 19.15.4	SUS 317L

Steel

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
X 45 CrNiW 18 9 42 NiCrMo 15 7 X 80 CrSiNi 20 X CrTi 12	[2304] 2327	- SAE HNV 3 6F7 440 A SAE HNV 6 440 B	 S44002 S65006 S44003	 sol. treated		Martensite Martensite Martensite PH Martensite	
HS 10-4-3-10		6F2 L6	T61206				
HS 18-0-1 HS 18-1-2-10		T15 T1 T5	T12015 T12001 T12005				
HS 18-1-1-5 HS 2-9-1-8 HS 1-8-1 HS 2-9-2	2782	T4 M42 H41; M1 M7 M33;M34	T12004 T11342 T11301 T11307 T11333				
HS 3-3-2 HS 6-5-2 HS 6-5-2-5 HS 6-5-3	2722 2723	M2 M35 M3 Cl.2 M3 M41	T11302 T11323 T11323 T11341				
HS 7-4-2-5 X 100 CrMoV 5 1 KU X 105 CrMo 17 X 155 CrVMo 12 1 KU X 166 CrMoW 12 KU	2260 2310	A2 440 C D2	T30102 S44004 T30402				
X 210 Cr 13 KU X 215 CrW 12 1 KU	2312	18 MAR 300 D3	T30403 K 93120				
X30 WCrV 5 3 KU X30 WCrV 9 3 KU		H21	T20821				
30 CrMoV 12 12 KU X37 CrMoV 5 1 KU		H10 H11	T20810 T20811				
X 40 CrMo 5 1 1 KU	2242	H13	T20813				
Hardened steel							
	2183	A128 Grade A					
Stainless steel							
X 10 CrNi 18 09 X 12 CrNi 17 07 X 6 CrNiNb 18 11 X 5 CrNi 18 11 X 5 CrNi 18 10 KW X 7 CrNi 18 10 X 6 CrNiNb 18 11	2346 (2331) 2331 2333 2333 2333 2338	303 301 302 348 304; 304 H 304 H 308; 305 347	S30300 S30100 S30200 S34800 S30400 S30480 S30500 S34700			Austenite Austenite Austenite Austenite Austenite Austenite Austenite Austenite	
X 6 CrNiMoNb 17 13 X 6 CrNi 26 20 X 6 CrNiTi 18 11 X 3 Cr Ni 18 11 X 2 CrNiMo 17 12 2 X 2 CrNiMo 17 13 2 X 2 CrNiMo 18 16	2361 2337 2352 2348 2353 2367	318 310 S 321; 321H 347 H 309 304 L 316 L 316 L 317 L	S31008 S32100 S34700 S30900 S30403 S31603 S31603 S31703			Austenite Austenite Austenite Austenite Austenite Austenite Austenite Austenite	

Stainless steel

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
9	1.4311	X 2 CrNiN 18 10	1.4311	X 2 CrNiN 19 11	304 S 62	Z 2 CN 18. 10 Az	SUS 304 LN
	1.4436	X 5 CrNiMo 17 13 3	1.4436	X 5 CrNiMo 17 13 3	316 S 33	Z 6 CND 18.12.03	SUS 316
	1.4308	X 5 CrNi 19 10	1.4308	X 6 CrNi 18 9	304 C 15	Z 6 CN 18.10M	SUS 13
	1.4580	X 6 CrNiMoNb 17 12 2	1.4580	X 6 CrNiMoNb 17 12 2	318 S 17	Z 6 CNDNb 17.12	
	1.4571	X 6 CrNiMoTi 17 12 2	1.4571	X 6 CrNiMoTi 17 12 2	320 S 31	Z 6 CNDT 17.12	SUS 316 Ti
10	1.4841	X 15 CrNiSi 25 20	1.4841	X 15 CrNiSi 25 20	314 S 25	Z 15 CNS 25.20	SUH 310
	1.4401	X 5 CrNiMo 17 12 2	1.4401	X 5 CrNiMo 18 10	316 S 31	Z 3 CND 17.11.1	SUS 316
11	1.4547	X 1 CrNiMoN 20 18 7	1.4547	X 1 CrNiMoN 20 18 7	X 1 CrNiMoN 20 18 7		
	1.4563	X 1 NiCrMoCuN 31 27 4	1.4563	X 1 NiCrMoCuN 31 27 4			
	1.4876	X 10 NiCrAlTi 32 20	1.4876	X 10 NiCrAlTi 32 20	Z 10 NC 32.21	Incoloy 800	NCF 800
	1.4864	X 12 NiCrSi 35 16	1.4864	X 12 NiCrSi 36 16	NA 17	Z 20 NCS 33.16	SUH 330
	1.4410	X 2 CrNiMoN 25 7 4	1.4410	X 2 CrNiMoN 25 7 4		Z 3 CND 25.07 Az	
	1.4507	X 2 CrMoNiCuN 25 6 3	1.4507	X 2 CrMoNiCuN 25 6 3			
	1.4501	X 2 CrNiMoCuWN 25 7 4	1.4501	X 2 CrNiMoCuWN 25 7 4		Z 3 CND 25.06 Az	
	1.4406	X 2 CrNiMoN 17 11 2	1.4406	X 2 CrNiMoN 17 12 2	316 S 61	Z 2 CND 17.12 Az	SUS 316 LN
	1.4429	X 2 CrNiMoN 17 13 3	1.4429	X 2 CrNiMoN 17 13 3	316 S 62	Z 2 CND 17.13 Az	SUS 316 LN
	1.4439	X 2 CrNiMoN 17 13 5	1.4439	X 2 CrNiMoN 17 13 3	(316 S 63)	Z 3 CND 18.14 .05 Az	(SUS 316LN)
	1.4462	X 2 CrNiMoN 22 5 3	1.4462	X 2 CrNiMoN 22 5	332 S 15	Z 2 CND 22.05 Az	
	1.4462	X 2 CrNiMoN 22 5	1.4462	X 2 CrNiMoN 22 5	318 S 13	Z 2 CND 22.05 Az	SUS 329 J 3L
	1.4652	X 1 CrNiMoN 25 22 8	1.4652	X 2 CrNiMoN 25 22 7			
	1.4362	X 2 CrNiN 23 4	1.4362	X 2 CrNiN 23 4			
	1.4539	X 2 NiCrMoCu 25 20 5	1.4539	X 2 NiCrMoCu 25 20 5	904 S 13	Z 2 NCDU 25 20	
	1.4539	X 1 NiCrMoCu 25 20 5	1.4539	X 2 NiCrMoCu 25 20 5			
	1.4540	X 4 CrNiCuNb 16 4	1.4540	X 4 CrNiCuNb 16 4		Z 4 CNUNb 16.4 M	
	1.4460	X 3 CrNiMo 27 5 2	1.4460	X 4 CrNiMo 27 5 2		Z 3 CND 25.7 Az	SUS 329 J 1
	1.4542	X 5 CrNiCuNb 16 4	1.4548	X 5 CrNiCuNb 17 4		Z 6 CNU 17.4	SCS 24; SUS 630

Cast iron

12	0.6100	EN-GJL-100	0.6100	GG-10	Grade 100	Ft 10 D	FC 100
	0.6150	EN-GJL-150	0.6150	GG-15	Grade 150	Ft 15 D	FC 150
	0.7033	EN-GJS-350-22	0.7033	GGG-35.3	Grade 350/22	FGS 370-17	FCD 350-22L
	0.7040	EN-GJS-400-15	0.7040	GGG-40	Grade 420/12	FGS 400-12	FCD 400-18L
	0.7043	EN-GJS-400-18	0.7043	GGG-40.3	Grade 370/17	FGS -370-17	
		EN-GJMB-350-10	0.8135	GTS-35-10	B 340/12	B 340/12	FCMB35-10
13		EN-GJMB-450-6	0.8145	GTS-45-06	P 440/7	P 440/7	PCMP45-06
		EN-GJMB-550-4	0.8155	GTS-55-04	P 540/5	P 540/5	PCMP55-04
	0.6200	EN-GJL-200	0.6200	GG-20	Grade 220	Ft 20 D	FC 200
	0.6250	EN-GJL-250	0.6250	GG-25	Grade 260	Ft 25 D	FC 250
	0.7050	EN-GJS-500-7	0.7050	GGG-50	Grade 500/7	FGS 500-7	FCD 500-7
	0.7060	EN-GJS-600-3	0.7060	GGG-60	Grade 600/3	FGS 600-3	FCD 600-3
	0.7660	EN-GJSA-XNiCr20-2	0.7660	GGG-NiCr 20 2	Grade S2	FGS Ni20 Cr2	
	0.7661	EN-GJSA-XNiCr20-3	0.7661	GGG-NiCr 20 3	Grade S2B	FGS Ni20 Cr3	
	0.7652	EN-GJLA-XNiMn 13-7	0.7652	GGG-NiMn 13 7	Grade S6	FGS Ni13 Mn7	
	0.6660	EN-GJLA-XNiCr 20-2	0.6660	GGL-NiCr 20 2	Grade F2	FGL Ni20 Cr2	
14	0.6661	EN-GJLA-XNiCr 20-3	0.6661	GGL-NiCr 20 3		FGL Ni20 Cr3	
		EN-GJMB-600-3	0.8165	GTS-65-02	P 570/3	P 570/3	PCMP60-03
	0.6300	EN-GJL-300	0.6300	GG-30	Grade 300	Ft 30 D	FC 300
	0.7070	EN-GJS-700-2	0.7070	GGG-70	Grade 700/2	FGS 700-2	FCD 700-2
	0.6655	EN-GJLA-XNiCuCr15-6-2	0.6655	GGL-NiCuCr 15 6 2	Grade F1	FGL Ni15 Cu6 Cr2	
	0.6655	EN-GJLA-XNiCuCr15-6-3	0.6656	GGL-NiCuCr 15 6 3		FGL Ni15 Cu6 Cr3	
15	0.6657	EN-GJMB-700-2	0.8170	GTS-70-02	P 690/2	P 690/2	PCMP70-02
	0.6350	EN-GJL-350	0.6350	GG-35	Grade 350	Ft 35 D	FC 350
	0.6040	-	0.6040	GG-40	Grade 400	Fgl 400	
	0.7080	EN-GJS-800-2	0.7080	GGG-80		FGS 800-2	FCD 800-2
	0.7670	EN-GJSA-XNi22	0.7670	GGG-Ni 22		FGS Ni22	
	0.7683	EN-GJSA-XNi35	0.7683	GGG-Ni 35		FGS Ni35	
	0.7677	-	0.7677	GGG-NiCr 30 1		FGS Ni30 Cr1	
	0.7676	EN-GJSA-XNiCr30-3	0.7676	GGG-NiCr 30 3	Grade S3	FGS Ni30 Cr3	
	0.7683	EN-GJSA-XNiCr35-3	0.7683	GGG-NiCr 35 3		FGS Ni35 Cr3	
	0.7673	EN-GJSA-XNiMn23-4	0.7673	GGG-NiMn 23 4	Grade S2M	FGS Ni23 Mn4	
	0.7665	EN-GJSA-XNiSiCr20-5-2	0.7665	GGG-NiSiCr 20 5 2		FGS Ni20 Si5 Cr2	
	0.7680	EN-GJSA-XNiSiCr30-5-5	0.7680	GGG-NiSiCr 30 5 5		FGS Ni30 Si5 Cr5	
	0.6676	EN-GJSA-XNiCr30-3	0.6676	GGL-NiCr 30 3	Grade F3	FGL Ni30 Cr3	
	0.6667	EN-GJSA-XNiSiCr20-5-3	0.6667	GGL-NiSiCr 20 5 3		FGL Ni20 Si5 Cr3	A1200
	0.6680	-	0.6680	GGL-NiSiCr 30 5 5		FGL Ni30 Si5 Cr5	(A1050)

Stainless steel

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
X 2 CrNiN 18 11 X 5 CrNiMo 17 13 2 X 6 CrNiMoNb 17 12 X 6 CrNiMoTi 17 12	2371 2343 2333 2350	304 LN 316 CF8 316 Cb 316 Ti	S30453 S31600 S31640			Austenite Austenite Austenite Austenite Austenite	
X 16 CrNiSi 25 20 X 5 CrNiMo 17 12	2347	314; 310 316	S31000 S31600	314 S 25 316 S 31		Austenite Austenite	
X 1 CrNiMoN 20 18 7 X 2 CrNiMoN 25 7 4 X 2 CrNiMoN 17 12 X 2 CrNiMoN 17 13 3 X 2 CrNiMoN 22 5 X 2 CrNiMoN 22 5 2327 2562 2564 X 3 CrNiMo 27 5 2	2778 2328 2375 2377 2377 2324	 330 F 53 255 F 55 316 LN 316 LN (316 LN) 329 LN 318 - 904L CN7M XM-12 329 630	S31254 N08028 N08800 N08330 S32750 S32550 S32760 S 31653 S31653 (S31653) S31803 S32205 S32654 S32304 N08904 S15500 S32900 S17400	 Sol. treated Sol. treated Sol. treated	254 SMO Sanicro 28 Alloy 800 Incoloy DS SAF 2507 Ferrallium Zeron 100 SAF 2205 SAF 2205 654 SMO SAF 2304 15-5-PH 17-4-PH	Super austenite Super austenite PH Austenite Super duplex Super duplex Super duplex Austenite Austenite Austenite Duplex Duplex Super austenite Duplex Super austenite Super austenite PH Duplex Super austenite	

Cast iron

G10 G15 GS 400-12 GSO 42/17 B 35-12 P 45-06 P 55-04	01 10-00 01 15-00 07 17-15 07 17-02 07 17-12 08 15-00 08 52-00 08 54-00	A18 20 B A48 25 B 60-40-18 60-40-18 A47 32510 A220 45008 A220 60004	F11401 F11601 F32800 F32800 F22200 F23130 F24130			GCI GCI DCI DCI DCI Martensite Martensite Martensite	
G20 G25 GS 500-7 GS 600-3 P65-02	01 20-00 01 25-00 07 27-02 07 32-03 07 72-00 05 23-00 08 56-00	A48 30 B A48 35 B A536 80-55-6 A476 80-60-03 A436 Type D-2 A436 Type D-2B - A436 Type 2 A436Type 2b A220 70003	F12101 F12401 F33800 F34100 F43000 F43001 - F41002 F41003 F24830			GCI GCI DCI DCI Austenite Austenite Austenite Austenite Austenite Martensite	
G30 GS 700-2 P 70-02	01 30-00 07 37-01 08 62-00	A48 45 B A536 100-70-03 A436 Type 1 A436 Type 1b A220 90001	F13101 F34800 F41000 F41001 F26230			GCI DCI Austenite Austenite Martensite	
G35 GS 800-2	01 35-00 01 40-00	A48 50 B A278 60 B A536 120-90-02 A439 Type D-2B A439 Type D-5 A436 Type D-3A A436 Type D-3 A436 Type D-5B A439 Type D-2M Nicrosilal Spheronic A439 Type D-4 A436 Type 3 Nicrosilal A436 Type D-4	F13502 F14102 F36200 F43006 F43004 F43003 F43007 F43010 - F43005 F41001			GCI GCI Martensite Austenite Austenite Austenite Austenite Austenite Austenite Austenite Austenite Austenite Austenite	

Non-Ferrous metal

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
16	3.0205	AW-1200	Al99	Al99	1C/1200	A-4/1200	A1200
	3.0255	AW-1050A	Al99.5	Al99.5	1B/1050A	A-5/1050A	(A1050)
	3.0275	AW-1070	Al99.7	Al99.7		A-7/1070	
	3.0285	AW-1080	Al99.8	Al99.8	1A	A-8/1080	
	3.1305			AlCu2.5Mg0.5	2L69	A-U2G	
	3.1655	AW-2011	AlCuBiPb	AlCuBiPb	FC1/2011	A-U5PbBi/2011	A2011
	3.1325	AW-2024	AlCuMg1	AlCuMg1	H14	A-U4G/2024	A2017
	3.1355			AlCuMg2	2L97/98	A-U4G1	
	3.1255	AW-2014	AlCuSiMn	AlCuSiMn	H15/2014	A-U4SG/2014	
	3.3315	AW-5005A	AlMg1	AlMg1	N41/5005	A-G0.6	
	3.3316			AlMg1.5		A-G1.5	
	3.3211	AW-6061	AlMg1SiCu	AlMg1SiCu	H20	(6061)	A6061
	3.3523	AW-5052	AlMg2.5	AlMg2.5	(N4)	A-G2.5C/5052	A5052
	3.3537	AW-5454	AlMg2.7Mn	AlMg2.7Mn	N51/5454	A-G2.5MC/5454	A5454
	3.3525	AW-5251	AlMg2Mn0.3	AlMg2Mn0.3	N4 /5251	A-G2M	
	3.3527	AW-5049	AlMg2Mn0.8	AlMg2Mn0.8		A-G2Mn0.8	
	3.3535	AW-5754	AlMg3	AlMg3		A-G3M	
	3.3345			AlMg4.5			A5082
	3.3547	AW-5083	AlMg4.5Mn	AlMg4.5Mn	N8/5083	A-G4.5MC	
	3.3545	AW-5086	AlMg4Mn	AlMg4Mn	(N5/6)	A-G4MC-5086	
	3.3206	AW-6060	AlMgSi0.5	AlMgSi0.5	(H9)/(6060)	A-GS/6060	
	3.3210	AW-6063	AlMgSi0.7	AlMgSi0.7	(H10)	A-GSUC/6061	(A6063)
	3.2315	AW-6082	AlMgSi1	AlMgSi1	H30/6082	A-SGM0.7/6082	
	3.0615			AlMgSiPb		A-SGPb	
	3.0505	AW-3105	AlMn0.5Mg0.5	AlMn0.5Mg0.5	N31		
	3.0525	AW-3005	AlMn0.5Mg0.5	AlMn0.5Mg0.5		A-MG0.5/3005	-
	3.0515	AW-3103	AlMn1	AlMn1	N3/3103		
	3.0517	AW-3003	AlMn1Cu	AlMn1Cu		A-M1/3003	A3003
	3.0526	AW-3004	AlMn1Mg1	AlMn1Mg1		A-M1G/3004	-
	3.4335	AW-7020	AlZn4.5Mg1	AlZn4.5Mg1	H17/7020	A-Z5G/7020	
	3.4345			AlZnMgCu0.5		A-Z4GU	
	3.4365	AW-7075		AlZnMgCu1.5	2L95/96	A-Z5GU/7075	A7075
	3.1841	AC-21100	AlCu4Ti	G-AlCu4Ti			
	3.1371	AC-21000	AlCu4TiMg	G-AlCu4TiMg	2L91/92	A-U5GT	
	3.3541	AC-51100	AlMg3	G-AlMg3		A-G3T	
	3.3241			G-AlMg3Si			
	3.3261	AC-51400	AlMg5(Si)	G-AlMg5			
	3.3555	AC-51400	AlMg5	G-AlMg5	LM5		
	3.3292	AC-51200	AlMg9	G-AlMg9			
	3.2381	AC-43400	AlSi10Mg(Fe)	G-AlSi10Mg	LM9	A-S10G	
	3.2341	AC-42000		G-AlSi5Mg	LM25	A-S7G	
	3.2151	AC-45000	AlSi6Cu4	G-AlSi6Cu4			
	3.2371	AC-42100	AlSi7Mg	G-AlSi7Mg	2L99	A-S7GO3	
	3.2161	AC-46200	AlSi8Cu3(Si)	G-AlSi8Cu3			
	3.2373	AC-43200	AlSi9Mg	G-AlSi9Mg		A-S10G	
	3.5106			G-MgAg3Se2Zr1			
	3.5314	MG-P-62	MgAl3Zn	G-MgAl3Zn	MAG-E-111	G-A3-Z1	
	3.5662	MC 21230	MgAl6Mn	G-MgAl6Mn			
	3.5612	MG-P-63	MgAl6Zn	G-MgAl6Zn	MAG-E-121	G-A6-Z1	
	3.5812	MG-P-61	MgAl8Zn	G-MgAl8Zn	MAG1-M	G-A9	
	3.5812	MC 21110	MgAl8Zn1	G-MgAl8Zn1	A82	G-A92	
	3.5912	MC 21120	MgAl9Zn	G-MgAl9Zn1	MAG3	G-A92	
	3.5200			G-MgMn2	MAG-E-101	G-M2	
	3.5103	MB 65110	MgSe3Zn2Zr1	G-MgSe3Zn2Zr1	MAG6-TE	ZRE1	
	3.5105			G-MgTh3Zn2Zr1			
17	3.2383	AC-43200	AlSi10Mg(Cu)	G-AlSi10Mg(Cu)			
	3.2382	AC-44200	AlSi12	GD-AlSi12			
		AC-46100	AlSi11Cu2(Fe)		LM9		ADC12
		AC-47100	AlSi12Cu1(Fe)				ADC14
18							
	2.1203	CW004A		Cu			
	2.0940.01	CW013A	CuAg0.1	CuAg0.1	Cu-Ag-4		
		CC331G		CuAl10Fe	AB1	CuAl10Fe	
		CC333G-GZ		CuAl10Fe5Ni5			
	2.0975.01	CC333G		CuAl10Ni	AB2	CuAl10Ni5Fe5	

Non-Ferrous metal

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
	4010 4007 4005 4004 4355 4338 4106 4120 4115 4125 4140 4103 4104,4107 4212 4054 4425 4337 4163 4253 4244 4245 4251 4633 4637 4635		AA1200 AA1050A AA1070A AA1080A AA2117 AA2011 AA2017A AA2024 AA2014 AA5005A AA5050B AA6061 AA5052 AA5454 AA5251 AA5049 AA5754 AA5082 AA5083 AA5086 AA6060 AA6005 AA6082 AA6012 AA3105 AA3005 AA3103 AA3003 AA3004 AA7020 AA7022 AA7075 A02040 A05140 A13600 A13560 AZ31B AM60A AZ61A AZ80A AZ81A AZ91A/B M1A B80 B80				
		204 5140 5056A B85 B26 A380 359,2 4418 4437 4442	AA384				
	5015 5030 5710 5716	CA952 CA955	C11600 C95200 C95500				

Non-Ferrous metal

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
18	2.0966	CW307G	CuAl10Ni5Fe4	CuAl10Ni5Fe4	Ca104	CuAl10Ni	C6301
	2.0978	CW308G	CuAl11Ni6Fe6	CuAl11Ni6Fe5			
	2.0916			CuAl5			
	2.0918	CW300G	CuAl5As	CuAl5As			
	2.0932			CuAl8 Fe3			C6140
	2.1291			CuCr			
	2.1310	CW107C	CuFe2P	CuFe2P			
	2.0853	CW109C	CuNi1Si	CuNi1.5Si			
	2.0872		CuNi10Fe1Mn	CuNi10Fe1Mn	CZ102	CuNi10Fe1Mn	
				CuNi10Zn45			
	2.0780	CW406J	CuNi12Zn30Pb1	CuNi12Zn30Pb1			
	2.0790		CW408J	CuNi18Zn19Pb		CuNi18Zn19Pb1	
	2.0790	CW408J	CuNi18Zn19Pb1	CuNi18Zn19Pb1		CuNi18Zn19Pb1	
	2.0740	CW409J	CuNi18Zn20	CuNi18Zn20	Ns106	CuNi18Zn20	C7451
	2.0742	CW410J	CuNi18Zn27	CuNi18Zn27	NS107		
	2.0822			CuNi20			
	2.0830			CuNi25	CN105	CuNi25	
	2.0835			CuNi30			
	2.0883			CuNi30Fe2Mn2			
				CuNi30FeMn			
	2.0882	CW354H	CuNi30Mn1Fe	CuNi30Mn1Fe	CN107	CuNi30Mn1Fe	
	2.0857	CW112C	CuNi3Si	CuNi3Si			
	2.0842			CuNi44Mn1		CuNi44Mn	
				CuNi5Fe1Mn		CuNi5Fe1Mn	
	2.0875	CW351H	CuNi9Sn2	CuNi9Sn2			
	2.1176	CW352H		CuPb10Sn	LB2	CuSn10Pb10	
	2.1183	CC496K-GZ		CuPb15Sn			
	2.1160	CW113C	Cupb1p	CuPb1P			
	2.1189			CuPb20Sn			
	2.1050.01	CC480K		CuSn10	CT1	CuSn10	
	2.1087			CuSn10Zn			
	2.1051.01	CC483K		CuSn12	PB2	CuSn12	
				CuSn14		CuSn14	
	2.1016	CW450K	CuSn4	CuSn4	PB101	CuSn4p	C5111
			CW451K	CuSn5			
	2.1020	CW452K	CuSn6	CuSn6	PB103	CuSn6	C5191
	2.1080			CuSn6Zn6			
				CuSn7			
	2.1090.03	CC493K-GZ		CuSn7Zn Pb			
	2.1030	CW453K	CuSn8	CuSn8	PB104	CuSn8P	C5210
	2.0230	CW501L	CuZn10	CuZn10	CZ101	CuZn10	C2200
	2.0240	CW502L	CuZn15	CuZn15	CZ102	CuZn15	C2300
	2.0250	CW503L	CuZn20	CuZn20	CZ103		C2400
	2.0460	CW702R	CuZn20Al2	CuZn20Al2	CZ110	CuZn22Al2	
				CuZn25Al15			
	2.0261	CW504L	CuZn28	CuZn28	CZ105		C4430
	2.0470	CW706R	CuZn28Sn1	CuZn28Sn1		CuZn29Sn1	
	2.0265	CW505L	CuZn30	CuZn30	CZ106	CuZn30	C2600
				CuZn30AlFeMn		CuZn30AlFeMn	
	2.0490	CW708R	CuZn31Si1	CuZn31Si1			
	2.0280	CW506L	CuZn33	CuZn33	CZ107		C2680
	2.0592.01	CC765S		CuZn35Al1	HTB1	CuZn30AlFeMn	
	2.0540	CW710R	CuZn35Ni2	CuZn35Ni2			
	2.0335	CW507L	CuZn36	CuZn36	CZ108	CuZn36	C2720
	2.0331	CW601N	CuZn35Pb2	CuZn36Pb1.5	CZ131	CuZn35Pb2	
	2.0375	CW602N	CuZn36Pb3	CuZn36Pb3	CZ124	CuZn36Pb3	
	2.0321	CW508L	CuZn37	CuZn37	CZ108	CuZn37	
	2.0332	CW604N	CuZn37Pb0.5	CuZn37Pb0.5	CZ118		
	2.0371	CW607N	CuZn38Pb1.5	CuZn38Pb1.5	CZ119	(CuZn38Pb2)	
	2.0530	CW717R	CuZn38Sn1	CuZn38Sn1			
	2.0525	CW715R	CuZn38SnAl	CuZn38SnAl			
				CuZn39AlFeMn			
	2.0372	CW610N	CuZn39Pb0.5	CuZn39Pb0.5	CZ123	CuZn39Pb0.8	
	2.0380	CW612N	CuZn39Pb2	CuZn39Pb2	CZ128		
	2.0401	CW614N	CuZn39Pb3	CuZn39Pb3	CZ121	CuZn39Pb3	
	2.0360	CW509	CuZn40	CuZn40	CZ109	CuZn40	C2800
	2.0550	CW713R		CuZn40Al2			

Non-Ferrous metal

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
CuNi30	5667		C62730				
			C60800				
			C18400				
			C19400				
			C70600				
			C79300				
			C76300				
			C76300				
			C75200				
			C77000				
			C71300				
			C71580				
	5682		C70600				
			C70250				
			C72150				
CuSn7	5640	CA937	C72500				
			C93700				
			C93800				
			C19000				
			C94100				
	5443 5458 5465 5475	CA907	C90700				
			C90500				
			C91000				
			C51100				
	5428		C51000				
			C51900				
			C93200				
			C83600				
	5112		C52100				
			C22000				
			C23000				
			C24000				
	5217		C68700				
			C86300				
			C25600				
			C44300				
	5220 5122		C26000				
	5256	CA865	C26800				
			C96500				
	5150		C27200				
			C34200				
			C36000				
			C27200				
	5165		C33500				
			C35300				
			C46400				
			C47000				
	5170		C36500				
			C37700				
			C38500				
			C28000				
			C67410				

Non-Ferrous metal

Workpiece materials into material groups							
mat. group No .	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
18	2.0572	CW723R	CuZn40Mn1	CuZn40Mn1	CZ136 CZ120 CZ104 CZ125	CuZn39Pb2	C2100
	2.0580	CW720R	CuZn40Mn1 Pb	CuZn40Mn1 Pb			
	2.0402	CW612N	CuZn40Pb2	CuZn40Pb2			
	2.0410	CW622N	CuZn44Pb2	CuZn44Pb2			
	2.0220	CW500L	CuZn5	CuZn5			
Heat resistant super alloys / Titanium alloys							
19	X2NiCrAlTi3220		1.4876				
20							
21	NiMo30 NiMo30 NiMo16Cr15W NiMo16Cr16Ti 						

Non-Ferrous metal

Workpiece materials into material groups							
UNI	SS	AISI/ASTM	UNS	Condition	Misc.Brands	Structure	Form
	5168 5272		C37800 C68700 C21000		AMPCO 15 AMPCO 18 AMPCO 18.136 AMPCO 18.22 AMPCO 18.23 AMPCO 21 AMPCO 22 AMPCO 25 AMPCO 26 AMPCO 45 AMPCO 483 AMPCO 642 AMPCO 673 AMPCO 674 AMPCO 8 AMPCO 863 AMPCO M4		
Heat resistant super alloys / Titanium alloys							
			S66286 S35000 S35000 S35500 S45500 N08800 N19909 R30155 R30155	Precip.hardened heat treated	A286 AM350 AM350 AM355 Custom 455 Discalloy Incoloy 800 Incoloy 801 Incoloy 909 Lapelloy M-308 N-155 N-155		cast bar,forge,ring
			R30195		Air Resist 13 FSX-414 H531 Haynes 188 Haynes 188 Haynes 25 Mar-M-302 Mar-M-509 MP159 MP35N Stellite 21 Stellite 30 Stellite 31 W152 W162		bar,forge,ring tube
			N10665 N10002 N10002 N10276 N06455 N06007 N06985 N10003 N10003 N06635 N10004 N06002		Astroloy GTD222 Hastelloy B-2 Hastelloy C Hastelloy C Hastelloy C-22 Hastelloy C-276 Hastelloy C-4 Hastelloy G Hastelloy G-3 Hastelloy N Hastelloy N Hastelloy S Hastelloy W Hastelloy X		all forms plate cast bar,forge, ring cast all forms all forms

Heat resistant super alloys / Titanium alloys

mat. group No .	Workpiece materials into material groups						
	W.- Nr	EN	EN-Nr	DIN	BS	AFNOR	JIS
21	2.4816	NiCr15Fe					
	2.4851						
	2.4856	NiCr22Mo9Nb					
	2.4856	NiCr22Mo9Nb					
	2.4856	NiCr22Mo9Nb					
		NiFe38Cr16Nb					
	2.4668	NiCr19Fe19Nb5Mo3					
	2.4668	NiCr19Fe19Nb5Mo3					
	2.4668	NiCr19Fe19Nb5Mo3					
	2.4669						
	2.4669						
	2.4061	Ni99.6					
	2.4634						
	2.4636						
	2.4650						
	2.4631	NiCr20TiAl					
	2.4632						
	2.4662						
	ppm						
		NiCr19Co18Mo4Ti3Al3					
	2.4654	NiCr20Co13Mo4Ti3Al					
	2.4654	NiCr20Co13Mo4Ti3Al					
22	3.7024						
	3.7024			TiV10Fe2Al3			
	3.7124	TiCu2					
		TiAl5Sn2.5					
		TiAl5Sn2.5					
		TiAl5Sn2.5					
	3.7164	TiAl6V4					
	3.7164	TiAl6V4					
	3.7164	TiAl6V4					
	3.7164	TiAl6V4					

Heat resistant super alloys / Titanium alloys

[illegible]

TECHNICAL GUIDE

Cutting data calculation

Nomenclature and formulae

RPM	$n = \frac{v_c \cdot 1000}{\pi \cdot D}$	(rev/min)
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Cutting speed	$v_c = \frac{n \cdot \pi \cdot D}{1000}$	(m/min)
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Feed speed	$v_f = n \cdot z \cdot f_z$	(mm/min)
	$v_f = n \cdot k \cdot f_z$	(mm/min)

Feed per revolution	$f = z \cdot f_z$	(mm/rev)
	$f = k \cdot f_z$	(mm/rev)

Metal removal rate	$Q = \frac{a_e \cdot a_p \cdot v_f}{1000}$	(cm ³ /min)
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Cutting speed and RPM for copying	$v_c = \frac{n \cdot \pi \cdot D_w}{1000}$	(m/min)
	$n = \frac{v_c \cdot 1000}{\pi \cdot D_w}$	(RPM)
	$D_w = 2 \cdot \sqrt{a_p (D - a_p)}$	(mm)

a_e	= Width of cut mm/radial depth of cut	(mm)
a_p	= Depth of cut mm/axial depth of cut	(mm)
D	= Cutter diameter	(mm)
f	= Feed per revolution	(mm/rev)
f_z	= Feed per tooth	(mm/tooth)
K	= Effective No. of teeth for calculation of feed speed or feed per rev (see below)	
n	= RPM	(rev/min)
Q	= Material removal rate	(cm ³ /min)
v_c	= Cutting speed	(m/min)
v_f	= Feed speed	(mm/min)
z	= No of teeth	

Effective No. of teeth (K)

The effective No. of teeth (K) is used to calculate the feed speed (v_f) and the feed per revolution (f). For most of the cutters the effective No. of teeth (K) is equal to the No. of teeth in the cutter (z), but for some of the cutters K is less than z .

CATALOGUE IN INFORMATION

目 錄 資 訊

Our following catalogue upon request

歡 迎 索 取 我 們 下 列 目 錄



Catalogue 2013.10
益壯2013.10 Saw blade.T-slot目錄



Catalogue 2013.10
益壯2013.10 milling cutter目錄