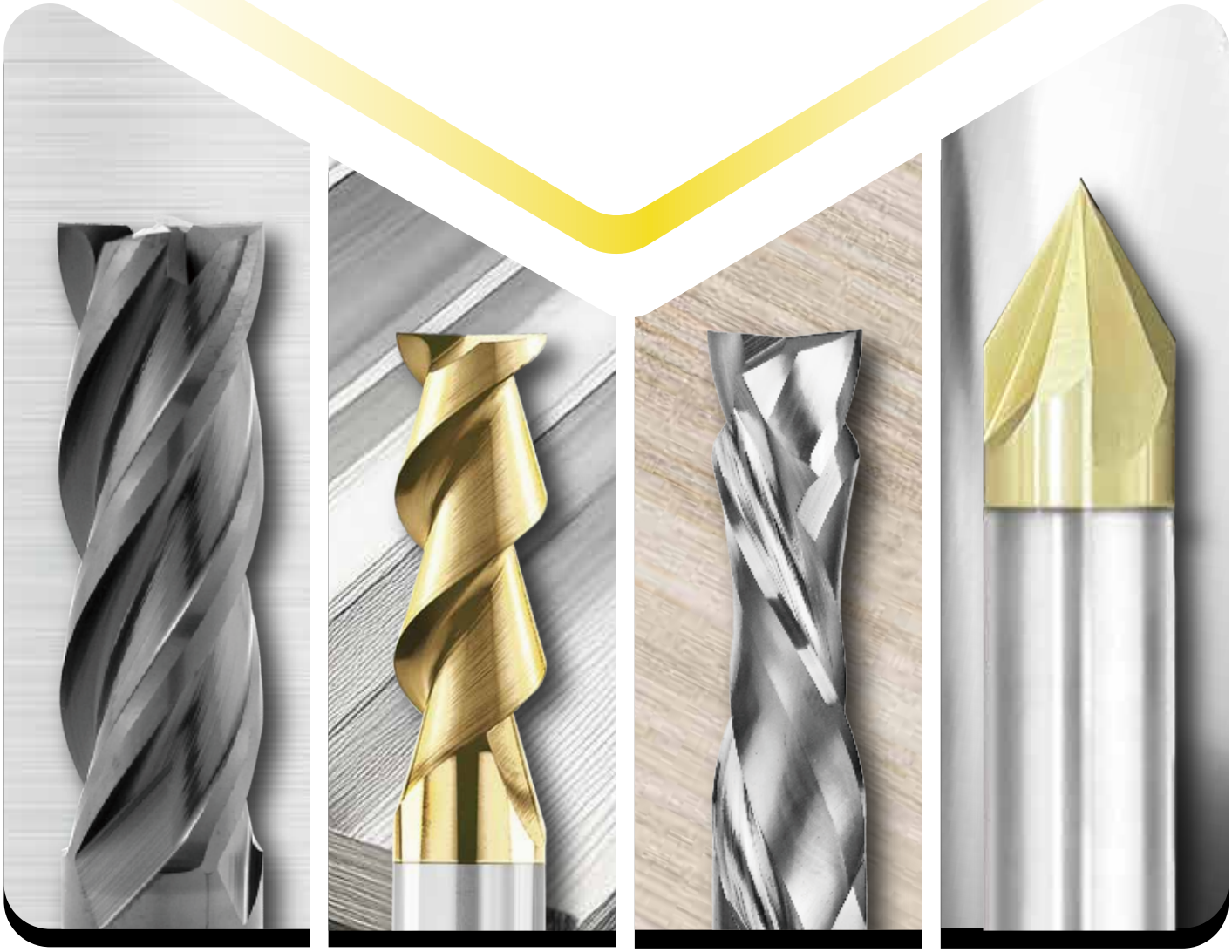
SPEED TIGER



2025-2026

FRATIONAL PRODUCT CATALOG

www.speedtigertools.com

For 20+ years, Speed Tiger has been at the forefront of the cutting tool industry.

Speed Tiger Precision Technology Co., Ltd. was founded in 1998. It is not only the largest cutting tools manufacturer, but also the first one that combined coating technology. We have up to 160 sales locations in 42 major industrial countries from Europe, America, Japan, etc.

Speed Tiger offers not only the high efficient cutting tools, but also advice and guidance about the idea through to implementation of the customized machining process. In collaboration with customers, we work continuously to develop innovative solutions to the most varied of problems in the most varied of processing requests. We are the people to contact if you need special tools for special machining tasks.

VISION

To assist enterprises in using high efficient cutting tools to produce high quality and innovative products; happy work happy life.

VALUES

· Eco Friendly
· Quality Assurance
· Innovation & R&D
· Pursuing Excellence
· Customer Orientation

QUALITY POLICY

· Quality Priority
· Customer Satisfaction
· Continual Improvement

COMPANY'S HISTORY



1998

Founded in Taichung, Taiwan

2000

1st expanding factory
-
Set up international trade Dept.

2002

2nd expanding factory



2004

3rd expanding factory
-
Set up Coating Dept.
-
Changed name to “Speed Tiger Precision Technology Co.,Ltd.”

2006

China Branch: Top Tiger (Shanhai) Percision Tool Co., ltd.

2011

4th expanding factory

2014

Inserts released

2016

New Head Office

2018

Taiwan Excellence Award

2019

Taiwan Excellence Award

2020

Taiwan Excellence Award
-
National Talent Development Awards

2021

Taiwan Excellence Award



Company Profile

Advanced Production Technology

SPEED TIGER introduced the latest technology and facilities, and have more than 100 sets of grinding machine from Germany, Switzerland, Japan and Taiwan. We have been increasing our prductivity to do mass production and produce customized tools in a short time, and match up with the updating requests.



Professional Coating Technology

Speed Tiger introduced coating technology and equipments from Switzerland in 2004, and became the first manufaturer combining cutting tools with coating techniques. We are also good at developing many kinds of coating based on customers' processed requests and eventually become an eco friendly cutting tools company.



Strict Quality Control System

Ahead of others, Speed Tiger developed auto-inspect machines with our collaboration factory. From raw materials to finished products, we insist on high standard of inspection system, to make sure every product share equivalent and stable quality.





Highest Precision Indication ± 2 μm

Speed Tiger cutting Tool's tolerance indication entered the nanometer level precision; the world highest precesion size ±2μm in faith value enables the user to grasp the cutting tool's news throughly, understood how to request the cutting tool quality.

Well-rounded and Rapid Service

Speed Tiger Test Center is dedicated to innovative R&D and cutting test, in order to quickly solve our customers; various processing problems, and help them reduce processing time and costs. That's why we can become the best milling adviser.

Well-rounded and Rapid Service

Speed Tiger offers not only the high efficient cutting tools, but also advice and guidance about the idea through to implementation of the customized machining process. In collaboration with customers, we wordk continuously to develop innovative solutions to the most varied of problems in the most varied of processing requests. We are the people to contact if you need special tools fot special machining tasks.

Taiwan No.1 Identity Number

Speed Tiger built the End Mills Tracebility System in order to ensure the accountability of each process participants, from incominng raw material to finished products, of any production procedure. Once there is any doubt about our cutting tools, will track its "identity number", and then clarify the problem and recall the products promptly to lower the damage and loss caused by the issue.





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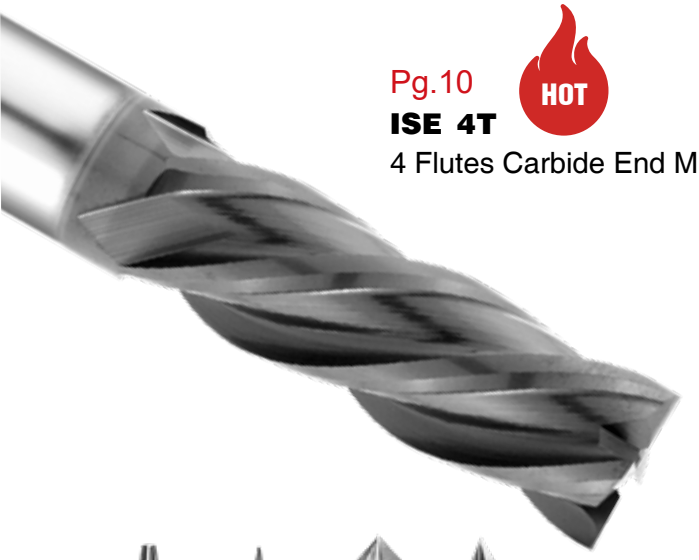
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Pg.10

HOT

ISE 4T

4 Flutes Carbide End Mill



Pg.15

ITBTA

Tapered End Mill



Pg.27

ISEUD

Up-Down Cut

Pg.21

IAP

Long Flute Square Carbide End Mill



4 in 1 ! packaging

Pg.28-29

ICARVE SET

ICL - 15° Detail Carving Liner
ICSMC 60° - 60° V Groove
ICSMC 90° - 90° V Groove
IPB - 20° Flat Tip Profile Bit

Pg.27

ISES 2T

Straight Cut





01 METAL WORKING SERIES

GENERAL | FOR EXOTIC MATERIAL

Index - Metal Working

FRACTIONAL

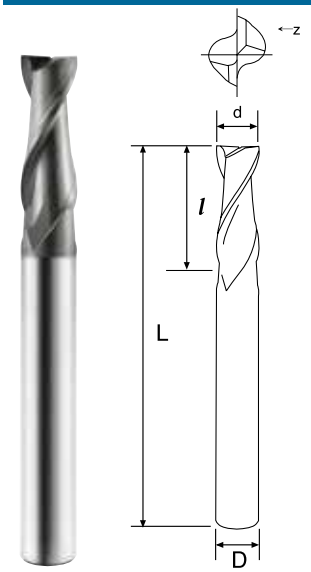
General						
Shape	Flute	Mode	Photo	Coating	Spec.	Cutting Condition
Square Type	2	ISE		ALTiBN	10	34-39
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	2,4	25pcs/set		ALTiBN	12	34-39
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For Exotic Material						
Square	4	IPVE		ALTiBN	16	44-49
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Available at amazon

ISE

Square Type - 2 flutes

Cutting Condition P34-39 | 600 Nano | 35° | ALTiBN



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ISE1/16"2T	1/16	3/16	1-1/2	1/8	2
ISE5/64"2T	5/64	3/16	1-1/2	1/8	2
ISE3/32"2T	3/32	9/32	1-1/2	1/8	2
ISE7/64"2T	7/64	3/8	1-1/2	1/8	2
ISE1/8"2T	1/8	3/8	1-1/2	1/8	2
ISE3/16"2T	3/16	5/8	2	3/16	2
ISE1/4"2T	1/4	3/4	2-1/2	1/4	2
ISE5/16"2T	5/16	13/16	2-1/2	5/16	2
ISE3/8"2T	3/8	1	2-1/2	3/8	2
ISE1/2"2T	1/2	1	3	1/2	2
ISE5/8"2T	5/8	1-1/4	3-1/2	5/8	2

Unit:inch

◎ : Excellent ○ : Good

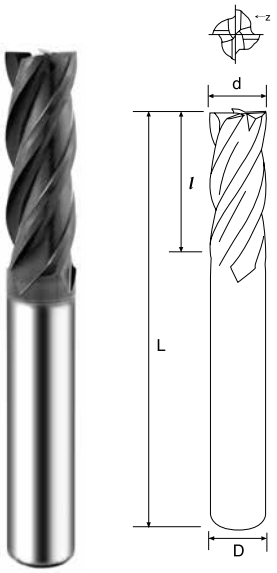
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○				○		

www.speedtigertools.com

ISE

Square Type - 4 flutes

Cutting Condition P34-39 | 600 Nano | 35° | ALTiBN



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ISE1/32"4T	1/32	5/64	1-1/2	1/8	4
ISE3/64"4T	3/64	7/64	1-1/2	1/8	4
ISE1/16"4T	1/16	3/16	1-1/2	1/8	4
ISE5/64"4T	5/64	3/16	1-1/2	1/8	4
ISE3/32"4T	3/32	9/32	1-1/2	1/8	4
ISE7/64"4T	7/64	3/8	1-1/2	1/8	4
ISE1/8"4T	1/8	3/8	1-1/2	1/8	4
ISE3/16"4T	3/16	5/8	2	3/16	4
ISE1/4"4T	1/4	3/4	2-1/2	1/4	4
ISE5/16"4T	5/16	13/16	2-1/2	5/16	4
ISE3/8"4T	3/8	1	2-1/2	3/8	4
ISE7/16"4T	7/16	1	2-3/4	7/16	4
ISE1/2"4T	1/2	1	3	1/2	4
ISE9/16"4T	9/16	1-1/8	3-1/2	9/16	4
ISE5/8"4T	5/8	1-1/4	3-1/2	5/8	4

Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						



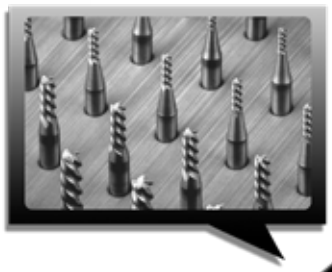




25 PCS / SET

Square Type - 2 flutes or 4 flutes

1/16 inch x 5 pcs
5/64 inch x 5 pcs
3/32 inch x 5 pcs
7/64 inch x 5 pcs
1/8 inch x 5 pcs





50 PCS / SET

Square Type - 2&4 flutes

1/16 inch - 2 flutes x 5 pcs, 4 flutes x 5 pcs
5/64 inch - 2 flutes x 5 pcs, 4 flutes x 5 pcs
3/32 inch - 2 flutes x 5 pcs, 4 flutes x 5 pcs
7/64 inch - 2 flutes x 5 pcs, 4 flutes x 5 pcs
1/8 inch - 2 flutes x 5 pcs, 4 flutes x 5 pcs



Foldable



Recycle



Easy to take

◎ : Excellent ○ : Good

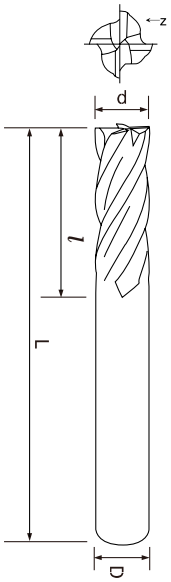
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

IPE

Square Type - Long Flute - 4 flutes

Cutting Condition P34-39 | 600 Nano | 45° | ALTIBN





FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
IPE 1/16"4T	1/16	3/16	1-1/2	1/8	4
IPE 5/64"4T	5/64	3/16	1-1/2	1/8	4
IPE 3/32"4T	3/32	9/32	1-1/2	1/8	4
IPE 7/64"4T	7/64	3/8	1-1/2	1/8	4
IPE 1/8"4T	1/8	3/8	1-1/2	1/8	4
IPE 3/16"4T	3/16	5/8	2	3/16	4
IPE 1/4"4T	1/4	3/4	2-1/2	1/4	4
IPE 5/16"4T	5/16	13/16	2-1/2	5/16	4
IPE 3/8"4T	3/8	1	2-1/2	3/8	4
IPE 1/2"4T	1/2	1	3	1/2	4
IPE 5/8"4T	5/8	1-1/4	3-1/2	5/8	4

Unit:inch

◎ : Excellent ○ : Good

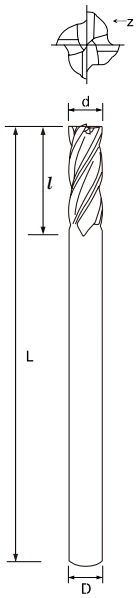
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

ISLE

Extra Long Reach - 4 flutes

Cutting Condition P34-39 | 600 Nano | 35° | ALTIBN





FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ISLE 1/4"4T	1/4	1/2	4	1/4	4
ISLE 5/16"4T	5/16	13/16	4	5/16	4
ISLE 3/8"4T	3/8	7/8	4	3/8	4
ISLE 1/2"4T	1/2	1	4	1/2	4

Unit:inch

◎ : Excellent ○ : Good

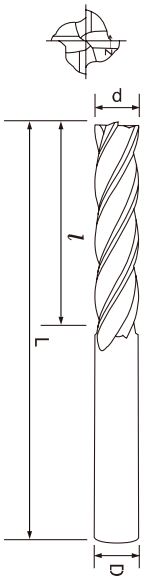
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

ILET

Square Type - Long Flute - 4 flutes

Cutting Condition P34-39 | 600 Nano | 35° | ALTiBN





FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ILET1/4"4T	1/4	1-1/8	3	1/4	4
ILET5/16"4T	5/16	1-1/4	3	5/16	4
ILET3/8"4T	3/8	1-1/2	4	3/8	4
ILET1/2"4T	1/2	1	4	1/2	4

Unit:inch

◎ : Excellent ○ : Good

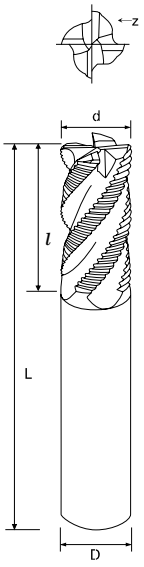
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

INTA

Roughing Type - 4 flutes

Cutting Condition P40-41 | 600 Nano | 35° | ZrN-A





FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
INTA1/4"4 ZrN-A	1/4	3/4	2-1/2	1/4	4
INTA5/16"4 ZrN-A	5/16	13/16	2-1/2	5/16	4
INTA3/8"4 ZrN-A	3/8	7/8	2-1/2	3/8	4
INTA1/2"4 ZrN-A	1/2	1	3	1/2	4
INTA5/8"4 ZrN-A	5/8	1-1/4	3-1/2	5/8	4

Unit:inch

◎ : Excellent ○ : Good

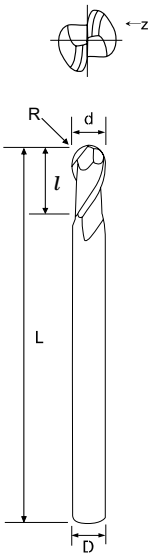
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Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

ISB

Ball Nose Type - 2 flutes

Cutting Condition P34-39 | 600 Nano | 35° | ALTiBN





FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	l	L	D	Z
ISB1/16"2T	1/16	3/16	1-1/2	1/8	2
ISB5/64"2T	5/64	3/16	1-1/2	1/8	2
ISB3/32"2T	3/32	9/32	1-1/2	1/8	2
ISB7/64"2T	7/64	3/8	1-1/2	1/8	2
ISB1/8"2T	1/8	3/8	1-1/2	1/8	2
ISB3/16"2T	3/16	5/8	2	3/16	2
ISB1/4"2T	1/4	3/4	2-1/2	1/4	2
ISB5/16"2T	5/16	13/16	2-1/2	5/16	2
ISB3/8"2T	3/8	1	2-1/2	3/8	2
ISB1/2"2T	1/2	1	3	1/2	2
ISB5/8"2T	5/8	1-1/4	3-1/2	5/8	2

Unit:inch

◎ : Excellent ○ : Good

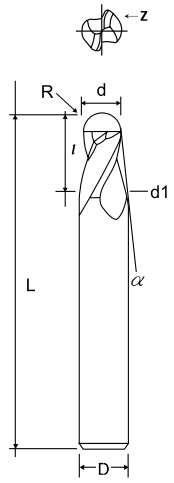
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Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○			○	○	○	

ITBTA

Taper Ball Nose - 2 flutes

Cutting Condition P42-43 | 600 Nano | 35° | nACo





FRACTIONAL

MODE	Diameter	Radius	Flute Length	Full Length	Shank Diameter	α Single Side Angle	Flutes
	d	R	l	L	D		Z
ITBTA0250526 nACo	0.5	0.25	1-1/4	3	1/4	5.26°	2
ITBTA0500482 nACo	1	0.5	1-1/4	3	1/4	4.82°	2
ITBTA0750436 nACo	1.5	0.75	1-1/4	3	1/4	4.36°	2
ITBTA1000392 nACo	2	1	1-1/4	3	1/4	3.92°	2

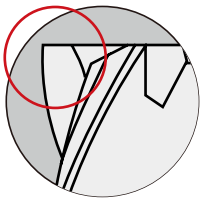
Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎	○		○						

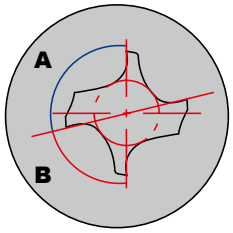
- M e t a l W o r k i n g -

For Exotic Material

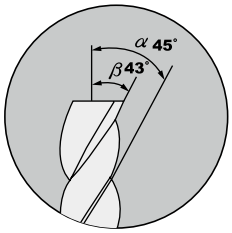


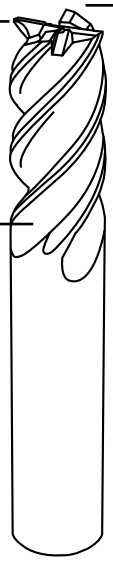
Strong edge

Irregular Helix Flutes



Unequal Flute Spacing





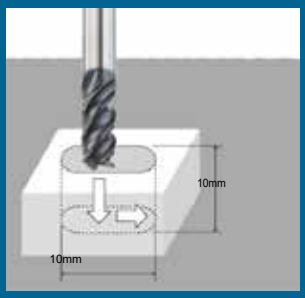
1.Excellent vibration absorption provides stability.

2.Less chatter and high efficiency finishing.

3.Reduce metal burr when machining.

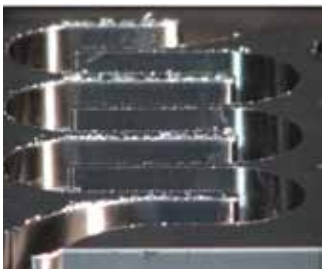
Unequal V.S Unequal - Surface and Tool Life Comparison

End mill	PVE1004 (Ø10mm)
Workpiece Material	SUS316
Milling Type	Slotting
Rotation Speed (S)	2644rpm
Milling Speed (Vc)	83m/min
Feed Rate (min-1) (F)	646 mm/min
Depth of cut	ap=10mm ae=10mm
Feed of teeth (Fz)	0.062
Machine	Vertical Machining Center

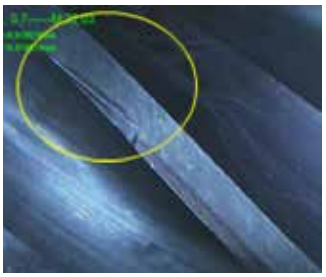


400PLUS video

Competitor A

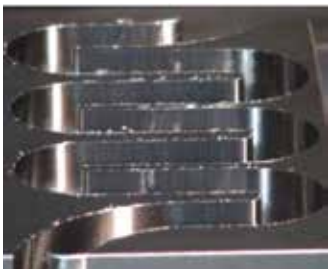


Metal Burr: Heavy
Surface: Fine

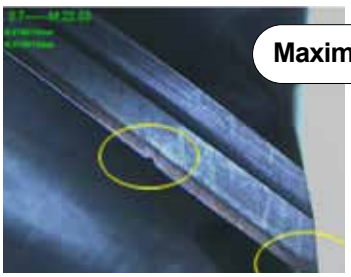


The cutting edge broke.

Competitor B



Metal Burr: Some
Surface: Chattering



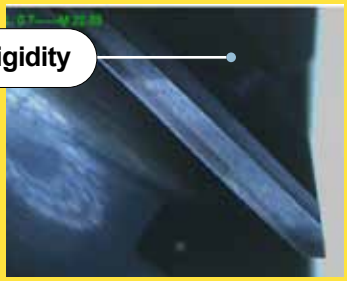
The cutting edge got chipping.

PVE1004 (ø10mm)



Metal Burr: Less
Surface : Excellent

Maximized Rigidity

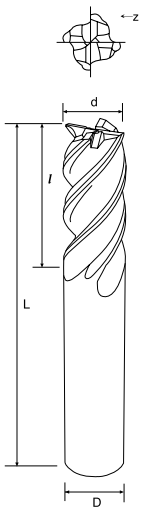


The cutting edge is fine!

IPVE
Square Type

Cutting Condition P44-49 | 400 PLUS | ALTiBN





FRACTIONAL

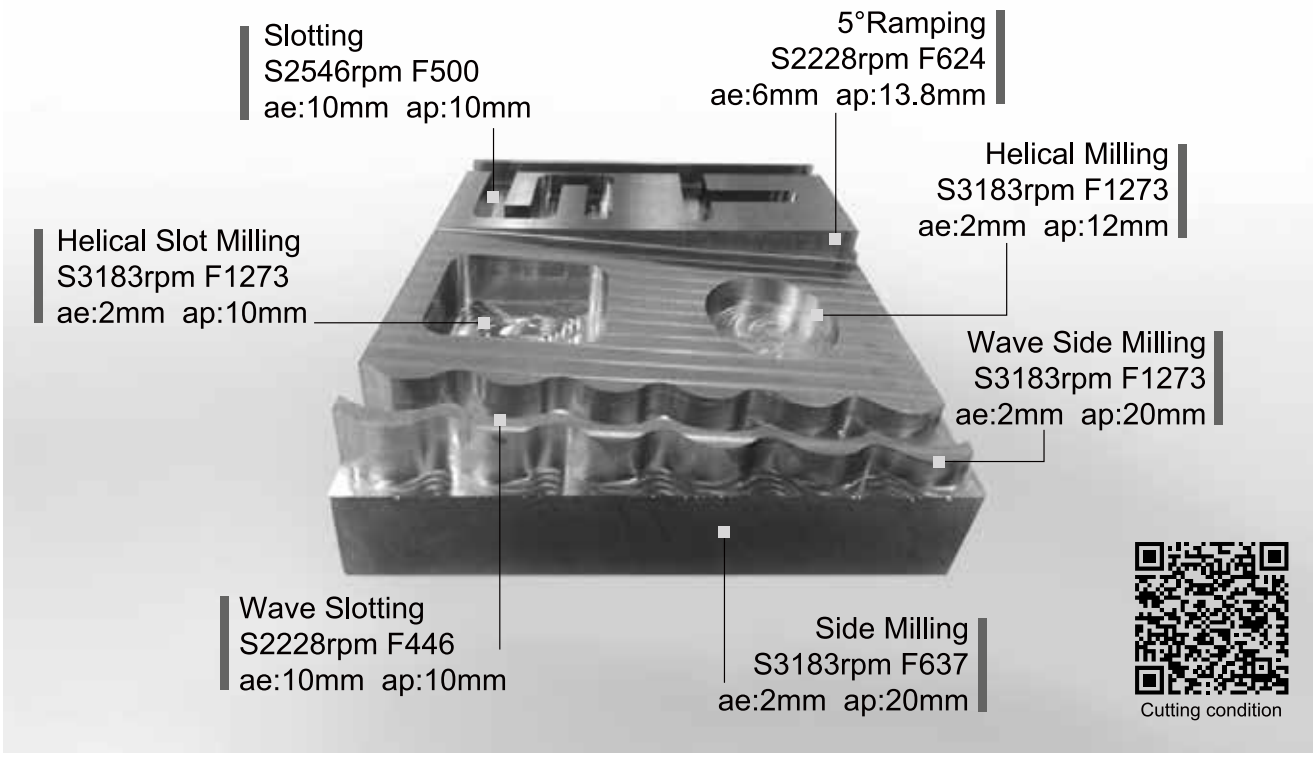
MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	l	L	D	Z
IPVE1/4"4	1/4	1/2	2-1/2	1/4	4
IPVE5/16"4	5/16	13/16	2-1/2	5/16	4
IPVE3/8"4	3/8	7/8	2-1/2	3/8	4
IPVE1/2"4	1/2	1	3	1/2	4
IPVE5/8"4	5/8	1-1/4	3-1/2	5/8	4

Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
◎	◎	◎	◎		◎	○	○	○				

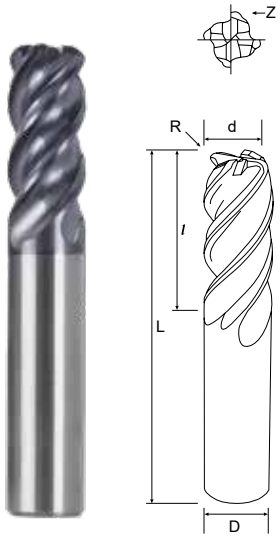
Cutting Case for reference - Carbon Steel (S45C)



IPVR1T

Corner Radius Type





FRACTIONAL

Cutting Condition
P44-50

MODE	Diameter	Corner Radius	Flute Length	Full Length	Shank Diameter	Flutes
	d	R	l	L	D	Z
IPVR1T1/4”0.015”4	1/4	R.015	9/16	2-1/2	1/4	4
IPVR1T1/4”0.03”4	1/4	R.030	9/16	2-1/2	1/4	4
IPVR1T1/4”0.06”4	1/4	R.060	9/16	2-1/2	1/4	4
IPVR1T5/16”0.015”4	5/16	R.015	11/16	2-1/2	5/16	4
IPVR1T5/16”0.03”4	5/16	R.030	11/16	2-1/2	5/16	4
IPVR1T5/16”0.06”4	5/16	R.060	11/16	2-1/2	5/16	4
IPVR1T3/8”0.02”4	3/8	R.020	13/16	2-1/2	3/8	4
IPVR1T3/8”0.03”4	3/8	R.030	13/16	2-1/2	3/8	4
IPVR1T3/8”0.06”4	3/8	R.060	13/16	2-1/2	3/8	4
IPVR1T3/8”0.09”4	3/8	R.090	13/16	2-1/2	3/8	4
IPVR1T1/2”0.02”4	1/2	R.020	1	3	1/2	4
IPVR1T1/2”0.03”4	1/2	R.030	1	3	1/2	4
IPVR1T1/2”0.06”4	1/2	R.060	1	3	1/2	4
IPVR1T1/2”0.09”4	1/2	R.090	1	3	1/2	4
IPVR1T1/2”0.125”4	1/2	R.125	1	3	1/2	4
IPVR1T5/8”0.03”4	5/8	R.030	1-1/4	3-1/2	5/8	4
IPVR1T5/8”0.06”4	5/8	R.060	1-1/4	3-1/2	5/8	4
IPVR1T5/8”0.09”4	5/8	R.090	1-1/4	3-1/2	5/8	4
IPVR1T5/8”0.125”4	5/8	R.125	1-1/4	3-1/2	5/8	4

Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎		○	○	◎	○				

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02 NON - FERROUS SERIES

For Aluminum / Copper

Index - Non-Ferrous Series

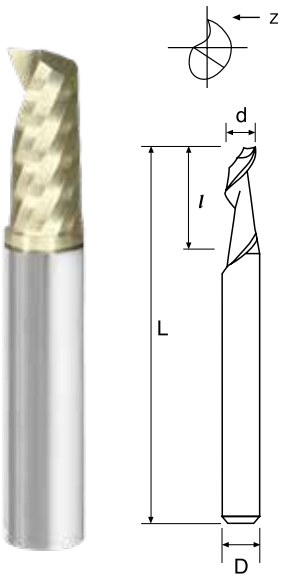
FRACTIONAL

For Aluminum						
Shape	Flute	Mode	Photo	Coating	Spec.	Cutting Condition
Square Type	1	IAP		ZrN	21	51
	2	IAE5		ZrN	21	52
	3	IAUE			22	52

Available at amazon

IAP
Spiral O Single Flute Type

Cutting Condition P51 | 600 Nano | ZrN | 30°



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flute
	d	*l*	L	D	Z
IAP1/8"1	1/8	1/2	2	1/4	1
IAP3/16"1	3/16	5/8	2	1/4	1
IAP5/16"1	5/16	9/16	2-1/2	5/16	1
IAP3/8"1	3/8	1	3	3/8	1
IAP1/2"1	1/2	1-1/8	3	1/2	1

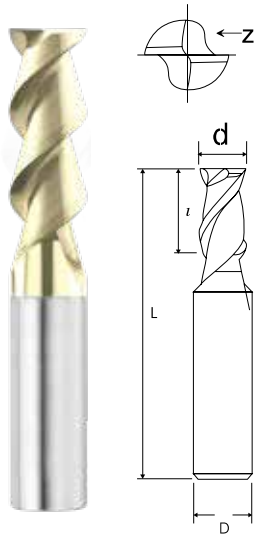
Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									◎	◎	◎	◎

IAE5
Square Type - 2 flutes

Cutting Condition P52 | 600 Nano | ZrN | 55°



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
IAE5 1/4"2 ZrN	1/4	3/4	2	1/4	2
IAE5 5/16"2 ZrN	5/16	5/8	2-1/2	5/16	2
IAE5 3/8"2 ZrN	3/8	1-1/4	2-1/2	3/8	2
IAE5 1/2"2 ZrN	1/2	1-1/4	3	1/2	2
IAE5 5/8"2 ZrN	5/8	1-5/8	3-1/2	5/8	2

Unit:inch

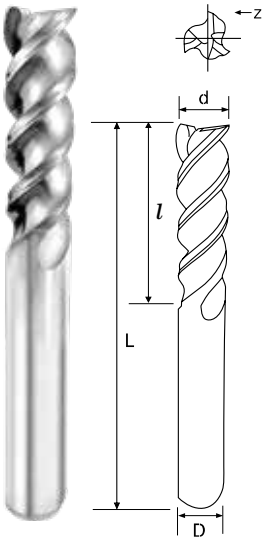
◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	◎		

IAUE

High Feed U-Type For Aluminum Application

Cutting Condition P52 | 600 Nano | 50°



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
IAUE1/8"3	1/8	3/8	1-1/2	1/8	3
IAUE3/16"3	3/16	9/16	2	3/16	3
IAUE1/4"3	1/4	3/4	2	1/4	3
IAUE5/16"3	5/16	5/8	2-1/2	5/16	3
IAUE3/8"3	3/8	1-1/4	2-1/2	3/8	3
IAUE1/2"3	1/2	1-1/4	3	1/2	3
IAUE5/8"3	5/8	1-5/8	3-1/2	5/8	3

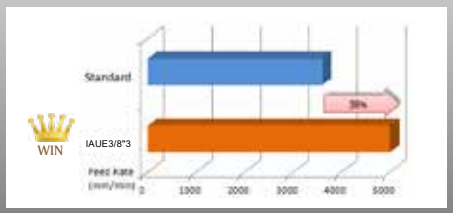
Unit:inch

※Special U-Type design:
Material removal rate (MRR) and surface finishes are greatly improved due to effective chip removal at high rate.

※Strong tooth with double relief angles:
Excellent production rates become 100% possible due to the improvement of tooth hardness.

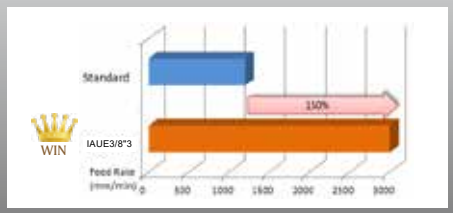
※Sharp aluminum alloy tooth design. Applicable for roughing and finishing.

Feed Rate Comparison (Side Milling)



Work piece material: Aluminum alloy expanding material 6061
Speed: 15000 min-1, Depth of Cut: ap=2.0D, ae=0.5D

Feed Rate Comparison (Slotting)

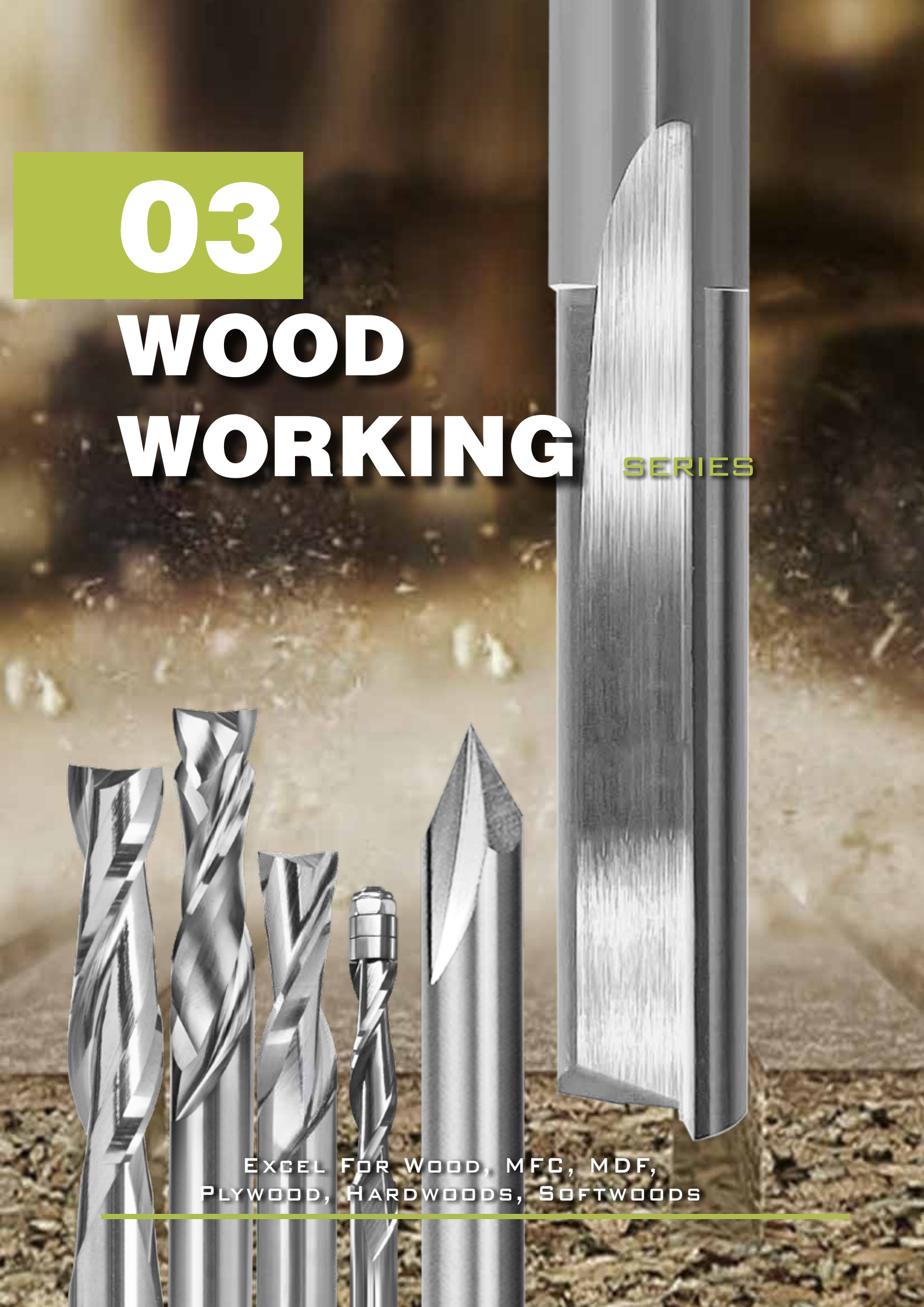


Work piece material: Aluminum alloy expanding material 6061
Speed: 10000 min-1, Depth of Cut: ap=2.0D, ae=1.0D

★: Perfect ◎: Excellent ○: Good

P					H	M	K	N		S	
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels		High Hardened Steels	Stainless Steels	Cast Iron	Copper	Aluminum	Titanium	High Temperature Alloy
~HB225	HB225~325	HRC30~40	HRC40~45	HRC45~55	HRC55~70						
								◎	★		

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03 WOOD WORKING SERIES

EXCEL FOR WOOD, MFC, MDF,
PLYWOOD, HARDWOODS, SOFTWOODS

INDEX - WOOD WORKING

FRACTIONAL

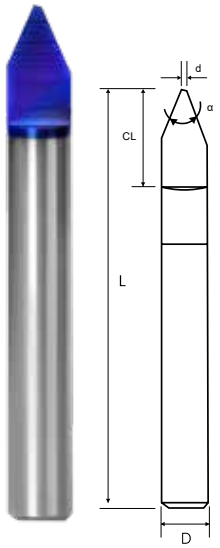
Flute	Mode	Photo	Coating	Spec.	Cutting Condition
1	IEB		nACo	25	53-54
2	ISEU			26	53-54
2	ISED			26	53-54
2	ISES			27	55
2	ISEUD			27	56
3	ICARVE SET			28-29	
3					
2					
1					

Available at amazon

IEB

Engraving Router Bit - 1 Flute

Cutting Condition
P53-54



FRACTIONAL

MODE	Angle Degree	Tip Width	CL	Shank Diameter	Full Length	Flute
	α	d		D	L	Z
IEB0.0050" 1-50°	15°	0.005	0.93	1/4	2	1
IEB0.0050" 1-30°	30°	0.005	0.44	1/4	2	1
IEB0.0100" 1-30°	30°	0.01	0.44	1/4	2	1
IEB0.0200" 1-30°	30°	0.02	0.42	1/4	2	1
IEB0.0300" 1-30°	30°	0.03	0.4	1/4	2	1
IEB0.0250" 1-45°	45°	0.025	0.272	1/4	2	1
IEB0.0420" 1-45°	45°	0.042	0.242	1/4	2	1
IEB0.0050" 1-60°	60°	0.005	0.212	1/4	2	1
IEB0.0100" 1-60°	60°	0.01	0.208	1/4	2	1
IEB0.0200" 1-60°	60°	0.02	0.199	1/4	2	1
IEB0.0300" 1-60°	60°	0.03	0.191	1/4	2	1

Unit:inch

◎ : Excellent ○ : Good

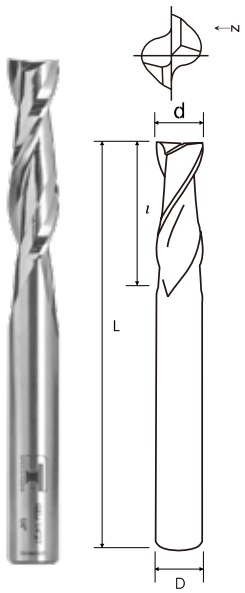
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	○	◎	◎

ISEU

Up Cut - 2 Flutes

Cutting Condition P53-54

30°



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	l	L	D	Z
ISEU1/8"2	1/8	1/2	2	1/8	2
ISEU1/4"2	1/4	1	2-1/2	1/4	2
ISEU3/8"2	3/8	1	2-1/2	3/8	2
ISEU1/2"2	1/2	1-1/4	3	1/2	2

Unit:inch



Up Cut

Sends them up to ward the shank.

◎ : Excellent ○ : Good

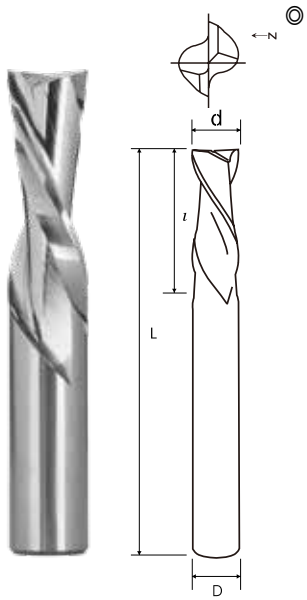
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	○	◎	◎

ISED

Down Cut - 2 Flutes

Cutting Condition P53-54

-35°



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	l	L	D	Z
ISED1/8"2	1/8	1/2	2	1/8	2
ISED1/4"2	1/4	1	2-1/2	1/4	2
ISED3/8"2	3/8	1	2-1/2	3/8	2
ISED1/2"2	1/2	1-1/4	3	1/2	2

Unit:inch



Down Cut

Cause the chip flow to be directed downward.

◎ : Excellent ○ : Good

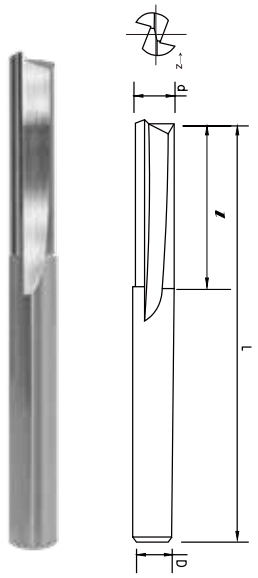
P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	○	◎	◎

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ISES

Straight Flute - 2 flutes

Cutting Condition
P55



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ISES1/4"2	1/4	1	2-1/2	1/4	2

Unit:inch

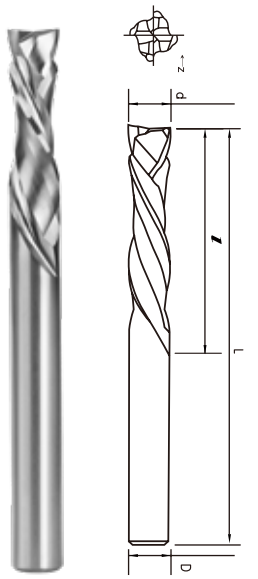
◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	○	◎	◎

ISEUD

Up Down Compression - 2 flutes

Cutting Condition
P56



FRACTIONAL

MODE	Diameter	Flute Length	Full Length	Shank Diameter	Flutes
	d	*l*	L	D	Z
ISEUD1/4“2	1/4	1	2-1/2	1/4	2
ISEUD3/8“2	3/8	1-1/4	4	3/8	2
ISEUD1/2“2	1/2	1-1/2	4	1/2	2

Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
									○	○	◎	◎



ICARVE
Carving Router Bit

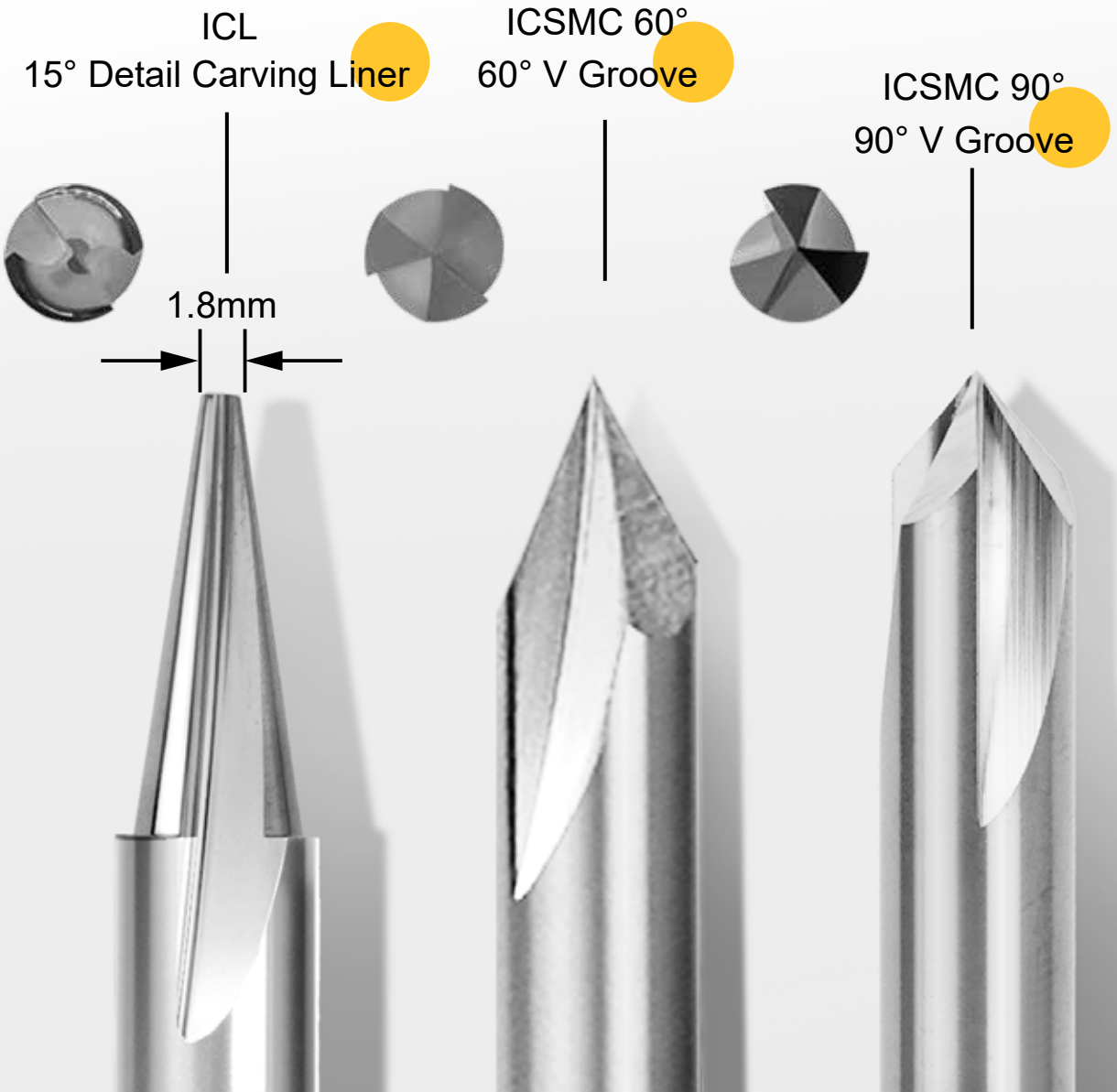
**4-Piece Set - Includes 1 each of below tool

ICSMC: 60 Degree V Groove

ICSMC: 90 Degree V Groove

ICL:15° Detail Carving Liner

IPB: 20° Flat Tip Profile Bit



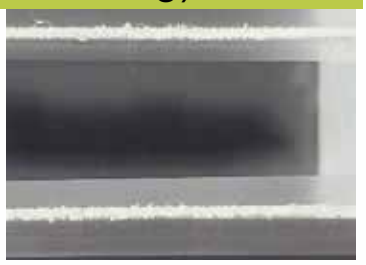
ICSMC
Cutting Comparison

Speed Tiger VS Competitor

Arcylic (Side Milling)

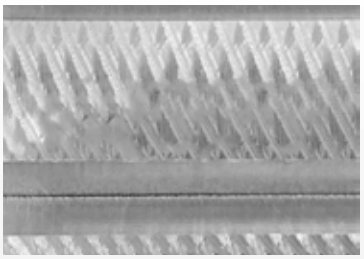


Less Burr

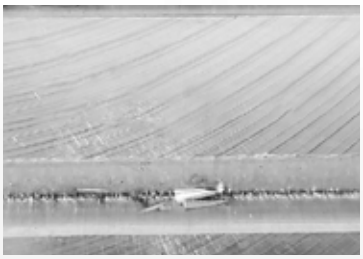


Heavy burr

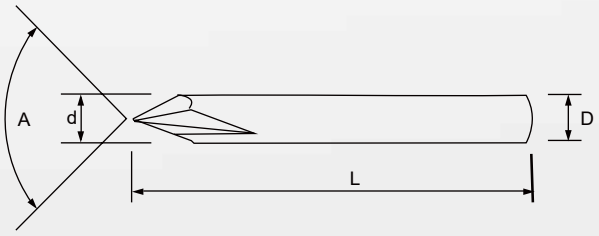
Aluminum (V groove)



Less Burr



Heavy Burr



FRACTIONAL

MODE	Diameter	Angle	Full Length	Shank Diameter	Flutes
	d	A	L	D	Z
ICSMC0601/4"3	1/4	60°	2	1/4	3
ICSMC09014"3	1/4	90°	2	1/4	3
ICL0180151/4"2	1.8mm	15°	2	1/4	2
IPB0020201/4"1	0.2mm	20°	2	1/4	1

Unit:inch

IPB 20° Flat Tip Profile Bit





04

CHAMFER

SERIES



INDEX - CHAMFER

FRACTIONAL

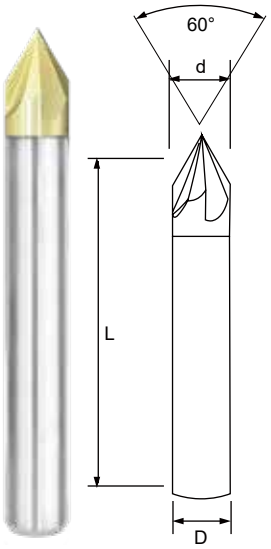
Flute	Mode	Photo	Coating	Spec.	Cutting Condition
4	ICSM60°		ZrN-A	32	57-58
4	ICSM90°		ZrN-A	32	57-58
	HSE30°			33	59
	HSE45°			33	59

Available at amazon

ICSM60°

Straight Flute Chamfer End Mill - 4 flutes

Cutting Condition P57-58 | 600 Nano | ZrN-A



FRACTIONAL

MODE	Diameter	Full Length	Shank Diameter	Flutes
	d	L	D	Z
ICSM0601/4"4 ZrN-A	1/4	2	1/4	4
ICSM0603/8"4 ZrN-A	3/8	3	3/8	4
ICSM0601/2"4 ZrN-A	1/2	3	1/2	4

Unit:inch

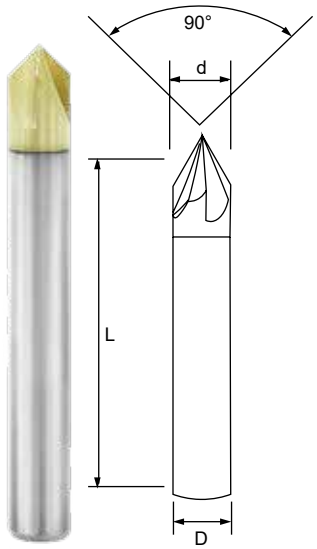
◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎						◎	◎	○	○

ICSM90°

Straight Flute Chamfer End Mill - 4 flutes

Cutting Condition P57-58 | 600 Nano | ZrN-A



FRACTIONAL

MODE	Diameter	Full Length	Shank Diameter	Flutes
	d	L	D	Z
ICSM0901/4"4 ZrN-A	1/4	2	1/4	4
ICSM0903/8"4 ZrN-A	3/8	3	3/8	4
ICSM0901/2"4 ZrN-A	1/2	3	1/2	4

Unit:inch

◎ : Excellent ○ : Good

P				H	M	K	S		N			
Carbon Steels	Alloy Steels	Prehardened Steels	Hardened Steels	High Hard-ened Steels	Stainless Steels	Cast Iron	Titanium	High Temperature Alloy	Copper	Aluminum	Wood	Plastic
~HB225	HB225~325	HRC30~	HRC40~45	HRC55~70								
○	◎	◎	◎						◎	◎	○	○

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S E 1 2

Spot Drill / Chamfer Mill + Inserts SET



Holder*1, Screw*1, Blade*4, Wrench*1

60°



HSE1230-S16-120

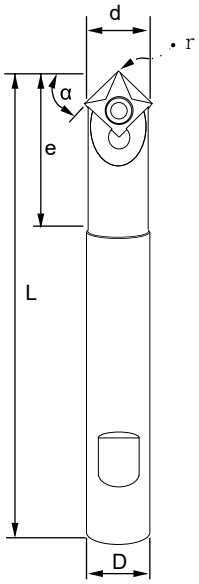
90°



HSE1245-S16-120

● Characteristic :

1. For general chamfering and NC spot drilling.
2. The multi-edge design make it a cost-efficient solution- 4 times use.
3. New spotting way, stable center spotting, improves tool life effectively.
4. New developed SH + ZrN coating increase the lubrication and lower the friction, improves tool performance effectively.
5. Patent of Taiwan No. : M560955



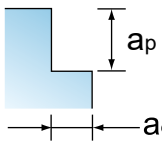
FRACTIONAL

Cutting Condition **P59**

MODE	D	L	α	d	e	r	Insert	Screw	Wrench
HSE1245-S16-120	16	120	45°	16.9	40	0.8	SE12T4 (5pcs)	TS4006	T15
HSE1230-S16-120	16	120	30°	20.8	40	0.8			

Unit:mm

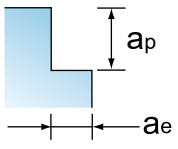
CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Side Milling	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536					ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100					TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2				
Hardness BRINELL	≦ 175					≦ 275					> 375 ≦ 475				
HRC	≦ 6.4					≦ 28					> 39.8 ≦ 49.1				
Vc (SFM)	437 (350-525)					318 (255-382)					166 (133-199)				
ae/ap	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	106,838	0.00003	6.4	9.6	12.8	77,806	0.00002	3.11	4.67	6.22	40598	0.00002	1.6	2.4	3.2
1/32	53,419	0.00006	6.4	9.6	12.8	38,903	0.00005	3.89	5.84	7.78	20299	0.00005	2.0	3.0	4.1
3/64	35,613	0.00010	7.1	10.7	14.2	25,935	0.00007	3.63	5.45	7.26	13533	0.00007	1.9	2.8	3.8
1/16	26,709	0.00013	6.9	10.4	13.9	19,451	0.00009	3.50	5.25	7.00	10150	0.00009	1.8	2.7	3.7
5/64	21,368	0.00018	7.7	11.5	15.4	15,561	0.00012	3.66	5.49	7.31	8120	0.00012	1.9	2.9	3.8
3/32	17,806	0.00023	8.2	12.3	16.4	12,968	0.00015	3.76	5.64	7.52	6766	0.00015	2.0	2.9	3.9
7/64	15,263	0.00027	8.2	12.4	16.5	11,115	0.00017	3.83	5.75	7.67	5800	0.00017	2.0	3.0	4.0
1/8	13,355	0.00030	8.0	12.0	16.0	9,726	0.00020	3.89	5.84	7.78	5075	0.00020	2.0	3.0	4.1
9/64	11,871	0.00036	8.6	12.9	17.2	8,645	0.00025	4.32	6.48	8.65	4511	0.00025	2.3	3.4	4.5
5/32	10,684	0.00043	9.1	13.6	18.2	7,781	0.00030	4.67	7.00	9.34	4060	0.00030	2.4	3.7	4.9
11/64	9,713	0.00049	9.5	14.2	18.9	7,073	0.00035	4.95	7.43	9.90	3691	0.00035	2.6	3.9	5.2
3/16	8,903	0.00055	9.8	14.7	19.6	6,484	0.00040	5.19	7.78	10.37	3383	0.00040	2.7	4.1	5.4
13/64	8,218	0.00061	10.1	15.1	20.1	5,985	0.00045	5.39	8.08	10.77	3123	0.00045	2.8	4.2	5.6
7/32	7,631	0.00068	10.3	15.5	20.6	5,558	0.00050	5.56	8.34	11.12	2900	0.00050	2.9	4.3	5.8
15/64	7,123	0.00074	10.5	15.8	21.0	5,187	0.00055	5.71	8.56	11.41	2707	0.00055	3.0	4.5	6.0
1/4	6,677	0.00080	10.7	16.0	21.4	4,863	0.00060	5.84	8.75	11.67	2537	0.00060	3.0	4.6	6.1
17/64	6,285	0.00089	11.2	16.7	22.3	4,577	0.00066	6.06	9.10	12.13	2388	0.00066	3.2	4.7	6.3
9/32	5,935	0.00098	11.6	17.4	23.1	4,323	0.00073	6.27	9.40	12.54	2255	0.00073	3.3	4.9	6.5
19/64	5,623	0.00106	11.9	17.9	23.9	4,095	0.00079	6.45	9.67	12.90	2137	0.00079	3.4	5.0	6.7
5/16	5,342	0.00115	12.3	18.4	24.6	3,890	0.00085	6.61	9.92	13.23	2030	0.00085	3.5	5.2	6.9
21/64	5,088	0.00124	12.6	18.9	25.2	3,705	0.00091	6.76	10.14	13.52	1933	0.00091	3.5	5.3	7.1
11/32	4,856	0.00133	12.9	19.3	25.7	3,537	0.00098	6.90	10.34	13.79	1845	0.00098	3.6	5.4	7.2
23/64	4,645	0.00141	13.1	19.7	26.2	3,383	0.00104	7.02	10.53	14.04	1765	0.00104	3.7	5.5	7.3
3/8	4,452	0.00150	13.4	20.0	26.7	3,242	0.00110	7.13	10.70	14.26	1692	0.00110	3.7	5.6	7.4
25/64	4,274	0.00156	13.4	20.0	26.7	3,112	0.00115	7.16	10.74	14.32	1624	0.00115	3.7	5.6	7.5
13/32	4,109	0.00163	13.4	20.0	26.7	2,993	0.00120	7.18	10.77	14.36	1561	0.00120	3.7	5.6	7.5
27/64	3,957	0.00169	13.4	20.0	26.7	2,882	0.00125	7.20	10.81	14.41	1504	0.00125	3.8	5.6	7.5
7/16	3,816	0.00175	13.4	20.0	26.7	2,779	0.00130	7.22	10.84	14.45	1450	0.00130	3.8	5.7	7.5
29/64	3,684	0.00181	13.4	20.0	26.7	2,683	0.00135	7.24	10.87	14.49	1400	0.00135	3.8	5.7	7.6
15/32	3,561	0.00188	13.4	20.0	26.7	2,594	0.00140	7.26	10.89	14.52	1353	0.00140	3.8	5.7	7.6
31/64	3,446	0.00194	13.4	20.0	26.7	2,510	0.00145	7.28	10.92	14.56	1310	0.00145	3.8	5.7	7.6
1/2	3,339	0.00200	13.4	20.0	26.7	2,431	0.00150	7.29	10.94	14.59	1269	0.00150	3.8	5.7	7.6
9/16	2,968	0.00210	12.5	18.7	24.9	2,161	0.00158	6.81	10.21	13.62	1128	0.00158	3.6	5.3	7.1
5/8	2,671	0.00220	11.8	17.6	23.5	1,945	0.00165	6.42	9.63	12.84	1015	0.00165	3.3	5.0	6.7
11/16	2,428	0.00230	11.2	16.8	22.3	1,768	0.00173	6.10	9.15	12.20	923	0.00173	3.2	4.8	6.4
3/4	2,226	0.00240	10.7	16.0	21.4	1,621	0.00180	5.84	8.75	11.67	846	0.00180	3.0	4.6	6.1
7/8	1,908	0.00260	9.9	14.9	19.8	1,389	0.00195	5.42	8.13	10.84	725	0.00195	2.8	4.2	5.7
1	1,669	0.00280	9.3	14.0	18.7	1,216	0.00210	5.11	7.66	10.21	634	0.00210	2.7	4.0	5.3
Depth of cut															

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

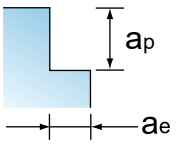
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CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Side Milling 	CAST IRONS Gray, Malleable, Ductile					STAINLESS STEELS (Free MachiNIng) 303, 416, 420F, 430F 440F					STAINLESS STEELS (Difficult) 304, 304L,316, 316L				
Hardness BRINELL	≦ 220					≦ 275					≦ 275				
HRC	≦ 18.8					≦ 28					≦ 28				
Vc (SFM)	335 (255-382)					318 (281-422)					242 (194-290)				
ae/ap	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	77,806	0.00003	4.7	7.0	9.3	85,935	0.00002	3.4	5.2	6.9	59,225	0.00002	2.4	3.6	4.7
1/32	38,903	0.00006	4.7	7.0	9.3	42,967	0.00005	4.3	6.4	8.6	29,613	0.00004	2.4	3.6	4.7
3/64	25,935	0.00010	5.2	7.8	10.4	28,645	0.00007	4.0	6.0	8.0	19,742	0.00006	2.4	3.6	4.7
1/16	19,451	0.00013	5.1	7.6	10.1	21,484	0.00009	3.9	5.8	7.7	14,806	0.00008	2.4	3.6	4.7
5/64	15,561	0.00018	5.6	8.4	11.2	17,187	0.00012	4.0	6.1	8.1	11,845	0.00011	2.6	3.9	5.2
3/32	12,968	0.00023	6.0	8.9	11.9	14,322	0.00015	4.2	6.2	8.3	9,871	0.00014	2.8	4.1	5.5
7/64	11,115	0.00027	6.0	9.0	12.0	12,276	0.00017	4.2	6.4	8.5	8,461	0.00017	2.9	4.3	5.8
1/8	9,726	0.00030	5.8	8.8	11.7	10,742	0.00020	4.3	6.4	8.6	7,403	0.00020	3.0	4.4	5.9
9/64	8,645	0.00036	6.3	9.4	12.5	9,548	0.00025	4.8	7.2	9.5	6,581	0.00024	3.1	4.7	6.3
5/32	7,781	0.00043	6.6	9.9	13.2	8,593	0.00030	5.2	7.7	10.3	5,923	0.00028	3.3	4.9	6.5
11/64	7,073	0.00049	6.9	10.3	13.8	7,812	0.00035	5.5	8.2	10.9	5,384	0.00031	3.4	5.0	6.7
3/16	6,484	0.00055	7.1	10.7	14.3	7,161	0.00040	5.7	8.6	11.5	4,935	0.00035	3.5	5.2	6.9
13/64	5,985	0.00061	7.3	11.0	14.7	6,610	0.00045	5.9	8.9	11.9	4,556	0.00039	3.5	5.3	7.1
7/32	5,558	0.00068	7.5	11.3	15.0	6,138	0.00050	6.1	9.2	12.3	4,230	0.00043	3.6	5.4	7.2
15/64	5,187	0.00074	7.7	11.5	15.3	5,729	0.00055	6.3	9.5	12.6	3,948	0.00046	3.7	5.5	7.3
1/4	4,863	0.00080	7.8	11.7	15.6	5,371	0.00060	6.4	9.7	12.9	3,702	0.00050	3.7	5.6	7.4
17/64	4,577	0.00089	8.1	12.2	16.2	5,055	0.00066	6.7	10.0	13.4	3,484	0.00055	3.8	5.7	7.7
9/32	4,323	0.00098	8.4	12.6	16.9	4,774	0.00073	6.9	10.4	13.8	3,290	0.00060	3.9	5.9	7.9
19/64	4,095	0.00106	8.7	13.1	17.4	4,523	0.00079	7.1	10.7	14.2	3,117	0.00065	4.1	6.1	8.1
5/16	3,890	0.00115	8.9	13.4	17.9	4,297	0.00085	7.3	11.0	14.6	2,961	0.00070	4.1	6.2	8.3
21/64	3,705	0.00124	9.2	13.8	18.3	4,092	0.00091	7.5	11.2	14.9	2,820	0.00075	4.2	6.3	8.5
11/32	3,537	0.00133	9.4	14.1	18.7	3,906	0.00098	7.6	11.4	15.2	2,692	0.00080	4.3	6.5	8.6
23/64	3,383	0.00141	9.6	14.3	19.1	3,736	0.00104	7.8	11.6	15.5	2,575	0.00085	4.4	6.6	8.8
3/8	3,242	0.00150	9.7	14.6	19.5	3,581	0.00110	7.9	11.8	15.8	2,468	0.00090	4.4	6.7	8.9
25/64	3,112	0.00156	9.7	14.6	19.5	3,437	0.00115	7.9	11.9	15.8	2,369	0.00094	4.4	6.7	8.9
13/32	2,993	0.00163	9.7	14.6	19.5	3,305	0.00120	7.9	11.9	15.9	2,278	0.00098	4.4	6.7	8.9
27/64	2,882	0.00169	9.7	14.6	19.5	3,183	0.00125	8.0	11.9	15.9	2,194	0.00101	4.4	6.7	8.9
7/16	2,779	0.00175	9.7	14.6	19.5	3,069	0.00130	8.0	12.0	16.0	2,115	0.00105	4.4	6.7	8.9
29/64	2,683	0.00181	9.7	14.6	19.5	2,963	0.00135	8.0	12.0	16.0	2,042	0.00109	4.4	6.7	8.9
15/32	2,594	0.00188	9.7	14.6	19.5	2,864	0.00140	8.0	12.0	16.0	1,974	0.00125	4.9	7.4	9.9
31/64	2,510	0.00194	9.7	14.6	19.5	2,772	0.00145	8.0	12.1	16.1	1,910	0.00116	4.4	6.7	8.9
1/2	2,431	0.00200	9.7	14.6	19.5	2,685	0.00150	8.1	12.1	16.1	1,851	0.00120	4.4	6.7	8.9
9/16	2,161	0.00210	9.1	13.6	18.2	2,387	0.00158	7.5	11.3	15.0	1,645	0.00125	4.1	6.2	8.2
5/8	1,945	0.00220	8.6	12.8	17.1	2,148	0.00165	7.1	10.6	14.2	1,481	0.00130	3.8	5.8	7.7
11/16	1,768	0.00230	8.1	12.2	16.3	1,953	0.00173	6.7	10.1	13.5	1,346	0.00135	3.6	5.5	7.3
3/4	1,621	0.00240	7.8	11.7	15.6	1,790	0.00180	6.4	9.7	12.9	1,234	0.00140	3.5	5.2	6.9
7/8	1,389	0.00260	7.2	10.8	14.4	1,535	0.00195	6.0	9.0	12.0	1,058	0.00155	3.3	4.9	6.6
1	1,216	0.00280	6.8	10.2	13.6	1,343	0.00210	5.6	8.5	11.3	925	0.00170	3.1	4.7	6.3
Depth of cut															

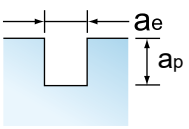
rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Side Milling 	SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 601,617,625,718,Incoly 800,Monel 400,Rene,Waspalloy					TITANIUM ALLOYS Ti6Al4V,Ti6Al2Sn4Zr2Mo,Ti4Al4Mo2Sn0.5Si, Ti10Al2Fe3Al,Ti5Al53Mo3Cr,Ti7Al4Mo,Ti3Al8 V6Cr4Zr4Mo,Ti6Al6V6Sn,Ti52 Cr3Sn3Al					GRAPHITE				
Hardness BRINELL	≦ 300					≦ 350									
HRC	≦ 32					≦ 37.9									
Vc (SFM)	62 (49-74)					170 (137-205)					627 (502-752)				
ae/ap	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D	ae(2)=0.05D ap(2)=1.5D		ae(3)=0.25D ap(3)=1.5D		ae(4)=0.25D ap(4)=1.5D
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	15,097	0.00002	0.6	0.9	1.2	41,806	0.00002	1.7	2.5	3.3	153,289	0.00006	18.4	27.6	36.8
1/32	7,548	0.00003	0.5	0.7	0.9	20,903	0.00004	1.7	2.5	3.3	76,644	0.00012	18.4	27.6	36.8
3/64	5,032	0.00005	0.5	0.7	0.9	13,935	0.00006	1.7	2.5	3.3	51,096	0.00020	20.4	30.7	40.9
1/16	3,774	0.00006	0.5	0.7	0.9	10,452	0.00008	1.7	2.5	3.3	38,322	0.00026	19.9	29.9	39.9
5/64	3,019	0.00010	0.6	0.9	1.1	8,361	0.00011	1.8	2.8	3.7	30,658	0.00036	22.1	33.1	44.1
3/32	2,516	0.00013	0.7	1.0	1.3	6,968	0.00014	2.0	2.9	3.9	25,548	0.00046	23.5	35.3	47.0
7/64	2,157	0.00017	0.7	1.1	1.4	5,972	0.00017	2.0	3.0	4.1	21,898	0.00054	23.7	35.5	47.3
1/8	1,887	0.00020	0.8	1.1	1.5	5,226	0.00020	2.1	3.1	4.2	19,161	0.00060	23.0	34.5	46.0
9/64	1,677	0.00023	0.8	1.1	1.5	4,645	0.00024	2.2	3.3	4.4	17,032	0.00073	24.7	37.0	49.4
5/32	1,510	0.00025	0.8	1.1	1.5	4,181	0.00028	2.3	3.4	4.6	15,329	0.00085	26.1	39.1	52.1
11/64	1,372	0.00028	0.8	1.1	1.5	3,801	0.00031	2.4	3.6	4.8	13,935	0.00098	27.2	40.8	54.3
3/16	1,258	0.00030	0.8	1.1	1.5	3,484	0.00035	2.4	3.7	4.9	12,774	0.00110	28.1	42.2	56.2
13/64	1,161	0.00033	0.8	1.1	1.5	3,216	0.00039	2.5	3.7	5.0	11,791	0.00123	28.9	43.3	57.8
7/32	1,078	0.00035	0.8	1.1	1.5	2,986	0.00043	2.5	3.8	5.1	10,949	0.00135	29.6	44.3	59.1
15/64	1,006	0.00038	0.8	1.1	1.5	2,787	0.00046	2.6	3.9	5.2	10,219	0.00148	30.1	45.2	60.3
1/4	944	0.00040	0.8	1.1	1.5	2,613	0.00050	2.6	3.9	5.2	9,581	0.00160	30.7	46.0	61.3
17/64	888	0.00045	0.8	1.2	1.6	2,459	0.00055	2.7	4.1	5.4	9,017	0.00178	32.0	48.0	64.0
9/32	839	0.00050	0.8	1.3	1.7	2,323	0.00060	2.8	4.2	5.6	8,516	0.00195	33.2	49.8	66.4
19/64	795	0.00055	0.9	1.3	1.7	2,200	0.00065	2.9	4.3	5.7	8,068	0.00213	34.3	51.4	68.6
5/16	755	0.00060	0.9	1.4	1.8	2,090	0.00070	2.9	4.4	5.9	7,664	0.00230	35.3	52.9	70.5
21/64	719	0.00065	0.9	1.4	1.9	1,991	0.00075	3.0	4.5	6.0	7,299	0.00248	36.1	54.2	72.3
11/32	686	0.00070	1.0	1.4	1.9	1,900	0.00080	3.0	4.6	6.1	6,968	0.00265	36.9	55.4	73.9
23/64	656	0.00075	1.0	1.5	2.0	1,818	0.00085	3.1	4.6	6.2	6,665	0.00283	37.7	56.5	75.3
3/8	629	0.00080	1.0	1.5	2.0	1,742	0.00090	3.1	4.7	6.3	6,387	0.00300	38.3	57.5	76.6
25/64	604	0.00083	1.0	1.5	2.0	1,672	0.00094	3.1	4.7	6.3	6,132	0.00313	38.3	57.5	76.6
13/32	581	0.00085	1.0	1.5	2.0	1,608	0.00098	3.1	4.7	6.3	5,896	0.00325	38.3	57.5	76.6
27/64	559	0.00088	1.0	1.5	2.0	1,548	0.00101	3.1	4.7	6.3	5,677	0.00338	38.3	57.5	76.6
7/16	539	0.00090	1.0	1.5	1.9	1,493	0.00105	3.1	4.7	6.3	5,475	0.00350	38.3	57.5	76.6
29/64	521	0.00093	1.0	1.4	1.9	1,442	0.00109	3.1	4.7	6.3	5,286	0.00363	38.3	57.5	76.6
15/32	503	0.00095	1.0	1.4	1.9	1,394	0.00125	3.5	5.2	7.0	5,110	0.00375	38.3	57.5	76.6
31/64	487	0.00098	0.9	1.4	1.9	1,349	0.00116	3.1	4.7	6.3	4,945	0.00388	38.3	57.5	76.6
1/2	472	0.00100	0.9	1.4	1.9	1,306	0.00120	3.1	4.7	6.3	4,790	0.00400	38.3	57.5	76.6
9/16	419	0.00105	0.9	1.3	1.8	1,161	0.00125	2.9	4.4	5.8	4,258	0.00420	35.8	53.7	71.5
5/8	377	0.00110	0.8	1.2	1.7	1,045	0.00130	2.7	4.1	5.4	3,832	0.00440	33.7	50.6	67.4
11/16	343	0.00115	0.8	1.2	1.6	950	0.00135	2.6	3.8	5.1	3,484	0.00460	32.1	48.1	64.1
3/4	315	0.00120	0.8	1.1	1.5	871	0.00140	2.4	3.7	4.9	3,194	0.00480	30.7	46.0	61.3
7/8	270	0.00155	0.8	1.3	1.7	747	0.00155	2.3	3.5	4.6	2,737	0.00520	28.5	42.7	56.9
1	236	0.00140	0.7	1.0	1.3	653	0.00170	2.2	3.3	4.4	2,395	0.00560	26.8	40.2	53.7
Depth of cut															

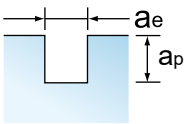
rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Slot Milling 	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536					ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100					TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2				
Hardness BRINELL	≦ 175					≦ 275					> 375 ≦ 475				
HRC	≦ 6.4					≦ 28					> 39.8 ≦ 49.1				
Vc (SFM)	350 (278-418)					255 (203-306)					133 (106-159)				
ae/ap	ae(2)=1D ae(3)=1D ae(4)=1D a p (2) = 1 D a p (3) = 0 . 5 D ap(4)=0.4D					ae(2)=1D ae(3)=1D ae(4)=1D a p (2) = 1 D a p (3) = 0 . 5 D ap(4)=0.4D					ae(2)=1D ae(3)=1D ae(4)=1D a p (2) = 1 D a p (3) = 0 . 5 D ap(4)=0.4D				
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	85,470	0.00003	5.1	7.7	10.3	62,245	0.00002	2.49	3.73	4.98	32479	0.00002	1.3	1.9	2.6
1/32	42,735	0.00006	5.1	7.7	10.3	31,122	0.00005	3.11	4.67	6.22	16239	0.00005	1.6	2.4	3.2
3/64	28,490	0.00010	5.7	8.5	11.4	20,748	0.00007	2.90	4.36	5.81	10826	0.00007	1.5	2.3	3.0
1/16	21,368	0.00013	5.6	8.3	11.1	15,561	0.00009	2.80	4.20	5.60	8120	0.00009	1.5	2.2	2.9
5/64	17,094	0.00018	6.2	9.2	12.3	12,449	0.00012	2.93	4.39	5.85	6496	0.00012	1.5	2.3	3.1
3/32	14,245	0.00023	6.6	9.8	13.1	10,374	0.00015	3.01	4.51	6.02	5413	0.00015	1.6	2.4	3.1
7/64	12,210	0.00027	6.6	9.9	13.2	8,892	0.00017	3.07	4.60	6.14	4640	0.00017	1.6	2.4	3.2
1/8	10,684	0.00030	6.4	9.6	12.8	7,781	0.00020	3.11	4.67	6.22	4060	0.00020	1.6	2.4	3.2
9/64	9,497	0.00036	6.9	10.3	13.8	6,916	0.00025	3.46	5.19	6.92	3609	0.00025	1.8	2.7	3.6
5/32	8,547	0.00043	7.3	10.9	14.5	6,224	0.00030	3.73	5.60	7.47	3248	0.00030	1.9	2.9	3.9
11/64	7,770	0.00049	7.6	11.4	15.2	5,659	0.00035	3.96	5.94	7.92	2953	0.00035	2.1	3.1	4.1
3/16	7,123	0.00055	7.8	11.8	15.7	5,187	0.00040	4.15	6.22	8.30	2707	0.00040	2.2	3.2	4.3
13/64	6,575	0.00061	8.1	12.1	16.1	4,788	0.00045	4.31	6.46	8.62	2498	0.00045	2.2	3.4	4.5
7/32	6,105	0.00068	8.2	12.4	16.5	4,446	0.00050	4.45	6.67	8.89	2320	0.00050	2.3	3.5	4.6
15/64	5,698	0.00074	8.4	12.6	16.8	4,150	0.00055	4.56	6.85	9.13	2165	0.00055	2.4	3.6	4.8
1/4	5,342	0.00080	8.5	12.8	17.1	3,890	0.00060	4.67	7.00	9.34	2030	0.00060	2.4	3.7	4.9
17/64	5,028	0.00089	8.9	13.4	17.8	3,661	0.00066	4.85	7.28	9.70	1911	0.00066	2.5	3.8	5.1
9/32	4,748	0.00098	9.3	13.9	18.5	3,458	0.00073	5.01	7.52	10.03	1804	0.00073	2.6	3.9	5.2
19/64	4,498	0.00106	9.6	14.3	19.1	3,276	0.00079	5.16	7.74	10.32	1709	0.00079	2.7	4.0	5.4
5/16	4,274	0.00115	9.8	14.7	19.7	3,112	0.00085	5.29	7.94	10.58	1624	0.00085	2.8	4.1	5.5
21/64	4,070	0.00124	10.1	15.1	20.1	2,964	0.00091	5.41	8.11	10.82	1547	0.00091	2.8	4.2	5.6
11/32	3,885	0.00133	10.3	15.4	20.6	2,829	0.00098	5.52	8.28	11.03	1476	0.00098	2.9	4.3	5.8
23/64	3,716	0.00141	10.5	15.7	21.0	2,706	0.00104	5.62	8.42	11.23	1412	0.00104	2.9	4.4	5.9
3/8	3,561	0.00150	10.7	16.0	21.4	2,594	0.00110	5.71	8.56	11.41	1353	0.00110	3.0	4.5	6.0
25/64	3,419	0.00156	10.7	16.0	21.4	2,490	0.00115	5.73	8.59	11.45	1299	0.00115	3.0	4.5	6.0
13/32	3,287	0.00163	10.7	16.0	21.4	2,394	0.00120	5.75	8.62	11.49	1249	0.00120	3.0	4.5	6.0
27/64	3,166	0.00169	10.7	16.0	21.4	2,305	0.00125	5.76	8.65	11.53	1203	0.00125	3.0	4.5	6.0
7/16	3,053	0.00175	10.7	16.0	21.4	2,223	0.00130	5.78	8.67	11.56	1160	0.00130	3.0	4.5	6.0
29/64	2,947	0.00181	10.7	16.0	21.4	2,146	0.00135	5.80	8.69	11.59	1120	0.00135	3.0	4.5	6.0
15/32	2,849	0.00188	10.7	16.0	21.4	2,075	0.00140	5.81	8.71	11.62	1083	0.00140	3.0	4.5	6.1
31/64	2,757	0.00194	10.7	16.0	21.4	2,008	0.00145	5.82	8.73	11.65	1048	0.00145	3.0	4.6	6.1
1/2	2,671	0.00200	10.7	16.0	21.4	1,945	0.00150	5.84	8.75	11.67	1015	0.00150	3.0	4.6	6.1
9/16	2,374	0.00210	10.0	15.0	19.9	1,729	0.00158	5.45	8.17	10.89	902	0.00158	2.8	4.3	5.7
5/8	2,137	0.00220	9.4	14.1	18.8	1,556	0.00165	5.14	7.70	10.27	812	0.00165	2.7	4.0	5.4
11/16	1,943	0.00230	8.9	13.4	17.9	1,415	0.00173	4.88	7.32	9.76	738	0.00173	2.5	3.8	5.1
3/4	1,781	0.00240	8.5	12.8	17.1	1,297	0.00180	4.67	7.00	9.34	677	0.00180	2.4	3.7	4.9
7/8	1,526	0.00260	7.9	11.9	15.9	1,112	0.00195	4.33	6.50	8.67	580	0.00195	2.3	3.4	4.5
1	1,335	0.00280	7.5	11.2	15.0	973	0.00210	4.08	6.13	8.17	507	0.00210	2.1	3.2	4.3
Depth of cut															

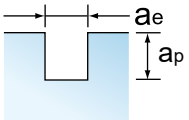
rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Slot Milling 	CAST IRONS Gray, Malleable, Ductile					STAINLESS STEELS (Free MachiNIng) 303, 416, 420F, 430F 440F					STAINLESS STEELS (Difficult) 304, 304L,316, 316L				
Hardness BRINELL	≦ 220					≦ 275					≦ 275				
HRC	≦ 18.8					≦ 28					≦ 28				
Vc (SFM)	255 (204-306)					281 (225-337)					194 (154-231)				
ae/ap	ae(2)=1D ae(4)=1D ap(3)=0.5D				ae(3)=1D ap(2)=1D ap(4)=0.4D					ae(3)=1D ap(2)=1D ap(4)=0.4D					ae(3)=1D ap(2)=1D ap(4)=0.4D
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	62,245	0.00003	3.7	5.6	7.5	68,748	0.00002	2.7	4.1	5.5	47,380	0.00002	1.9	2.8	3.8
1/32	31,122	0.00006	3.7	5.6	7.5	34,374	0.00005	3.4	5.2	6.9	23,690	0.00004	1.9	2.8	3.8
3/64	20,748	0.00010	4.1	6.2	8.3	22,916	0.00007	3.2	4.8	6.4	15,793	0.00006	1.9	2.8	3.8
1/16	15,561	0.00013	4.0	6.1	8.1	17,187	0.00009	3.1	4.6	6.2	11,845	0.00008	1.9	2.8	3.8
5/64	12,449	0.00018	4.5	6.7	9.0	13,750	0.00012	3.2	4.8	6.5	9,476	0.00011	2.1	3.1	4.2
3/32	10,374	0.00023	4.8	7.2	9.5	11,458	0.00015	3.3	5.0	6.6	7,897	0.00014	2.2	3.3	4.4
7/64	8,892	0.00027	4.8	7.2	9.6	9,821	0.00017	3.4	5.1	6.8	6,769	0.00017	2.3	3.5	4.6
1/8	7,781	0.00030	4.7	7.0	9.3	8,593	0.00020	3.4	5.2	6.9	5,923	0.00020	2.4	3.6	4.7
9/64	6,916	0.00036	5.0	7.5	10.0	7,639	0.00025	3.8	5.7	7.6	5,264	0.00024	2.5	3.8	5.0
5/32	6,224	0.00043	5.3	7.9	10.6	6,875	0.00030	4.1	6.2	8.2	4,738	0.00028	2.6	3.9	5.2
11/64	5,659	0.00049	5.5	8.3	11.0	6,250	0.00035	4.4	6.6	8.7	4,307	0.00031	2.7	4.0	5.4
3/16	5,187	0.00055	5.7	8.6	11.4	5,729	0.00040	4.6	6.9	9.2	3,948	0.00035	2.8	4.1	5.5
13/64	4,788	0.00061	5.9	8.8	11.7	5,288	0.00045	4.8	7.1	9.5	3,645	0.00039	2.8	4.2	5.6
7/32	4,446	0.00068	6.0	9.0	12.0	4,911	0.00050	4.9	7.4	9.8	3,384	0.00043	2.9	4.3	5.8
15/64	4,150	0.00074	6.1	9.2	12.2	4,583	0.00055	5.0	7.6	10.1	3,159	0.00046	2.9	4.4	5.8
1/4	3,890	0.00080	6.2	9.3	12.4	4,297	0.00060	5.2	7.7	10.3	2,961	0.00050	3.0	4.4	5.9
17/64	3,661	0.00089	6.5	9.7	13.0	4,044	0.00066	5.4	8.0	10.7	2,787	0.00055	3.1	4.6	6.1
9/32	3,458	0.00098	6.7	10.1	13.5	3,819	0.00073	5.5	8.3	11.1	2,632	0.00060	3.2	4.7	6.3
19/64	3,276	0.00106	7.0	10.4	13.9	3,618	0.00079	5.7	8.5	11.4	2,494	0.00065	3.2	4.9	6.5
5/16	3,112	0.00115	7.2	10.7	14.3	3,437	0.00085	5.8	8.8	11.7	2,369	0.00070	3.3	5.0	6.6
21/64	2,964	0.00124	7.3	11.0	14.7	3,274	0.00091	6.0	9.0	11.9	2,256	0.00075	3.4	5.1	6.8
11/32	2,829	0.00133	7.5	11.2	15.0	3,125	0.00098	6.1	9.1	12.2	2,154	0.00080	3.4	5.2	6.9
23/64	2,706	0.00141	7.6	11.5	15.3	2,989	0.00104	6.2	9.3	12.4	2,060	0.00085	3.5	5.3	7.0
3/8	2,594	0.00150	7.8	11.7	15.6	2,864	0.00110	6.3	9.5	12.6	1,974	0.00090	3.6	5.3	7.1
25/64	2,490	0.00156	7.8	11.7	15.6	2,750	0.00115	6.3	9.5	12.6	1,895	0.00094	3.6	5.3	7.1
13/32	2,394	0.00163	7.8	11.7	15.6	2,644	0.00120	6.3	9.5	12.7	1,822	0.00098	3.6	5.3	7.1
27/64	2,305	0.00169	7.8	11.7	15.6	2,546	0.00125	6.4	9.5	12.7	1,755	0.00101	3.6	5.3	7.1
7/16	2,223	0.00175	7.8	11.7	15.6	2,455	0.00130	6.4	9.6	12.8	1,692	0.00105	3.6	5.3	7.1
29/64	2,146	0.00181	7.8	11.7	15.6	2,371	0.00135	6.4	9.6	12.8	1,634	0.00109	3.6	5.3	7.1
15/32	2,075	0.00188	7.8	11.7	15.6	2,292	0.00140	6.4	9.6	12.8	1,579	0.00125	3.9	5.9	7.9
31/64	2,008	0.00194	7.8	11.7	15.6	2,218	0.00145	6.4	9.6	12.9	1,528	0.00116	3.6	5.3	7.1
1/2	1,945	0.00200	7.8	11.7	15.6	2,148	0.00150	6.4	9.7	12.9	1,481	0.00120	3.6	5.3	7.1
9/16	1,729	0.00210	7.3	10.9	14.5	1,910	0.00158	6.0	9.0	12.0	1,316	0.00125	3.3	4.9	6.6
5/8	1,556	0.00220	6.8	10.3	13.7	1,719	0.00165	5.7	8.5	11.3	1,185	0.00130	3.1	4.6	6.2
11/16	1,415	0.00230	6.5	9.8	13.0	1,562	0.00173	5.4	8.1	10.8	1,077	0.00135	2.9	4.4	5.8
3/4	1,297	0.00240	6.2	9.3	12.4	1,432	0.00180	5.2	7.7	10.3	987	0.00140	2.8	4.1	5.5
7/8	1,112	0.00260	5.8	8.7	11.6	1,228	0.00195	4.8	7.2	9.6	846	0.00155	2.6	3.9	5.2
1	973	0.00280	5.4	8.2	10.9	1,074	0.00210	4.5	6.8	9.0	740	0.00170	2.5	3.8	5.0
Depth of cut															

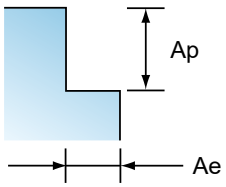
rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

CUTTING CONDITION – ISE/IPE/ISLE/ISB/ILET SERIES

Slot Milling 	SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 601,617,625,718,Incoly 800,Monel 400,Rene,Waspalloy					TITANIUM ALLOYS Ti6Al4V,Ti6Al2Sn4Zr2Mo,Ti4Al4Mo2Sn0.5Si, Ti10Al2Fe3Al,Ti5Al53Mo3Cr,Ti7Al4Mo,Ti3Al8 V6Cr4Zr4Mo,Ti6Al6V6Sn,Ti52 Cr3Sn3Al					GRAPHITE				
Hardness BRINELL	≦ 300					≦ 350								
HRC	≦ 32					≦ 37.9								
Vc (SFM)	50 (37-56)					137 (108-162)					500 (399-599)			
ae/ap	ae(2)=1D ap(2)=1D		ae(3)=1D ap(3)=0.5D		ae(4)=1D ap(4)=0.4D	ae(2)=1D ap(2)=1D		ae(3)=1D ap(3)=0.5D		ae(4)=1D ap(4)=0.4D	ae(2)=1D ap(2)=1D		ae(3)=1D ap(3)=0.5D		ae(4)=1D ap(4)=0.4D
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes	RPM	Fz	Feed (IPM) 2 flutes	3 flutes	4 flutes
1/64	12,077	0.00002	0.5	0.7	1.0	33,445	0.00002	1.3	2.0	2.7	122,631	0.00006	14.7	22.1	29.4
1/32	6,039	0.00003	0.4	0.5	0.7	16,722	0.00004	1.3	2.0	2.7	61,316	0.00012	14.7	22.1	29.4
3/64	4,026	0.00005	0.4	0.5	0.7	11,148	0.00006	1.3	2.0	2.7	40,877	0.00020	16.4	24.5	32.7
1/16	3,019	0.00006	0.4	0.5	0.7	8,361	0.00008	1.3	2.0	2.7	30,658	0.00026	15.9	23.9	31.9
5/64	2,415	0.00010	0.5	0.7	0.9	6,689	0.00011	1.5	2.2	2.9	24,526	0.00036	17.7	26.5	35.3
3/32	2,013	0.00013	0.5	0.8	1.0	5,574	0.00014	1.6	2.3	3.1	20,439	0.00046	18.8	28.2	37.6
7/64	1,725	0.00017	0.6	0.9	1.1	4,778	0.00017	1.6	2.4	3.2	17,519	0.00054	18.9	28.4	37.8
1/8	1,510	0.00020	0.6	0.9	1.2	4,181	0.00020	1.7	2.5	3.3	15,329	0.00060	18.4	27.6	36.8
9/64	1,342	0.00023	0.6	0.9	1.2	3,716	0.00024	1.8	2.6	3.5	13,626	0.00073	19.8	29.6	39.5
5/32	1,208	0.00025	0.6	0.9	1.2	3,344	0.00028	1.8	2.8	3.7	12,263	0.00085	20.8	31.3	41.7
11/64	1,098	0.00028	0.6	0.9	1.2	3,040	0.00031	1.9	2.9	3.8	11,148	0.00098	21.7	32.6	43.5
3/16	1,006	0.00030	0.6	0.9	1.2	2,787	0.00035	2.0	2.9	3.9	10,219	0.00110	22.5	33.7	45.0
13/64	929	0.00033	0.6	0.9	1.2	2,573	0.00039	2.0	3.0	4.0	9,433	0.00123	23.1	34.7	46.2
7/32	863	0.00035	0.6	0.9	1.2	2,389	0.00043	2.0	3.0	4.1	8,759	0.00135	23.7	35.5	47.3
15/64	805	0.00038	0.6	0.9	1.2	2,230	0.00046	2.1	3.1	4.1	8,175	0.00148	24.1	36.2	48.2
1/4	755	0.00040	0.6	0.9	1.2	2,090	0.00050	2.1	3.1	4.2	7,664	0.00160	24.5	36.8	49.1
17/64	710	0.00045	0.6	1.0	1.3	1,967	0.00055	2.2	3.2	4.3	7,214	0.00178	25.6	38.4	51.2
9/32	671	0.00050	0.7	1.0	1.3	1,858	0.00060	2.2	3.3	4.5	6,813	0.00195	26.6	39.9	53.1
19/64	636	0.00055	0.7	1.0	1.4	1,760	0.00065	2.3	3.4	4.6	6,454	0.00213	27.4	41.1	54.9
5/16	604	0.00060	0.7	1.1	1.4	1,672	0.00070	2.3	3.5	4.7	6,132	0.00230	28.2	42.3	56.4
21/64	575	0.00065	0.7	1.1	1.5	1,593	0.00075	2.4	3.6	4.8	5,840	0.00248	28.9	43.4	57.8
11/32	549	0.00070	0.8	1.2	1.5	1,520	0.00080	2.4	3.6	4.9	5,574	0.00265	29.5	44.3	59.1
23/64	525	0.00075	0.8	1.2	1.6	1,454	0.00085	2.5	3.7	4.9	5,332	0.00283	30.1	45.2	60.2
3/8	503	0.00080	0.8	1.2	1.6	1,394	0.00090	2.5	3.8	5.0	5,110	0.00300	30.7	46.0	61.3
25/64	483	0.00083	0.8	1.2	1.6	1,338	0.00094	2.5	3.8	5.0	4,905	0.00313	30.7	46.0	61.3
13/32	465	0.00085	0.8	1.2	1.6	1,286	0.00098	2.5	3.8	5.0	4,717	0.00325	30.7	46.0	61.3
27/64	447	0.00088	0.8	1.2	1.6	1,239	0.00101	2.5	3.8	5.0	4,542	0.00338	30.7	46.0	61.3
7/16	431	0.00090	0.8	1.2	1.6	1,194	0.00105	2.5	3.8	5.0	4,380	0.00350	30.7	46.0	61.3
29/64	416	0.00093	0.8	1.2	1.5	1,153	0.00109	2.5	3.8	5.0	4,229	0.00363	30.7	46.0	61.3
15/32	403	0.00095	0.8	1.1	1.5	1,115	0.00125	2.8	4.2	5.6	4,088	0.00375	30.7	46.0	61.3
31/64	390	0.00098	0.8	1.1	1.5	1,079	0.00116	2.5	3.8	5.0	3,956	0.00388	30.7	46.0	61.3
1/2	377	0.00100	0.8	1.1	1.5	1,045	0.00120	2.5	3.8	5.0	3,832	0.00400	30.7	46.0	61.3
9/16	335	0.00105	0.7	1.1	1.4	929	0.00125	2.3	3.5	4.6	3,406	0.00420	28.6	42.9	57.2
5/8	302	0.00110	0.7	1.0	1.3	836	0.00130	2.2	3.3	4.3	3,066	0.00440	27.0	40.5	54.0
11/16	274	0.00115	0.6	0.9	1.3	760	0.00135	2.1	3.1	4.1	2,787	0.00460	25.6	38.5	51.3
3/4	252	0.00120	0.6	0.9	1.2	697	0.00140	2.0	2.9	3.9	2,555	0.00480	24.5	36.8	49.1
7/8	216	0.00155	0.7	1.0	1.3	597	0.00155	1.9	2.8	3.7	2,190	0.00520	22.8	34.2	45.5
1	189	0.00140	0.5	0.8	1.1	523	0.00170	1.8	2.7	3.6	1,916	0.00560	21.5	32.2	42.9
Depth of cut															

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

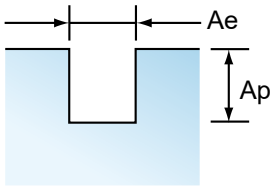
CUTTING CONDITION - INTA SERIES

Side Milling	CARBON STEELS 1018,1040,1080,1090,10L50,1140, 1212,12L15,1525,1536			Side Milling	ALLOY STEELS 4140,4150,4320,5120,5150,8630, 86L20,50100		
Hardness BRINELL	≦175			Hardness BRINELL	≦275		
Vc (SFM)	500 (400-600)			Vc (SFM)	365 (292-438)		
ae/ap	ae≦0.5 ap≦1.5			ae/ap	ae≦0.5 ap≦1.5		
MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes	MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes
1/4	7640	0.0006	13.8	1/4	5577	0.0004	4.5
5/16	6089	0.0008	15.8	5/16	4471	0.0005	5.1
3/8	5093	0.0011	16.8	3/8	3718	0.0008	5.9
1/2	3820	0.0014	21.4	1/2	2789	0.0011	6.1
5/8	3044	0.0015	18.8	5/8	2231	0.0012	5.37
3/4	2547	0.0017	17.3	3/4	1859	0.0013	4.8
1	1910	0.0020	19.1	1	1394	0.0015	4.2
Side Milling	TOOL STEELS A2,D2,H13,L2,M2,P20,S7,T15,W2			Side Milling	CAST IRONS Gray,Mallable,Ductile		
Hardness BRINELL	≦250			Hardness BRINELL	≦220		
Vc (SFM)	345 (276-414)			Vc (SFM)	365 (292-438)		
ae/ap	ae≦0.5 ap≦1.5			ae/ap	ae≦0.5 ap≦1.5		
MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes	MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes
1/4	5272	0.0006	6.3	1/4	5577	0.0008	8.9
5/16	4218	0.001	6.3	5/16	4461	0.0014	10.21
3/8	3514	0.0009	6.3	3/8	3718	0.0015	11.2
1/2	2636	0.0015	7.9	1/2	2789	0.002	11.2
5/8	2042	0.0016	6.96	5/8	2231	0.0022	9.8
3/4	1757	0.0018	6.3	3/4	1859	0.0024	8.9
1	1318	0.0021	5.5	1	1394	0.0028	7.8
Depth of cut							

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

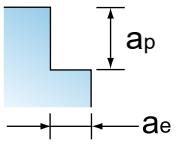
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CUTTING CONDITION - INTA SERIES

Slot Milling	CARBON STEELS 1018,1040,1080,1090,10L50, 1140,1212,12L15,1525,1536			Slot Milling	ALLOY STEELS 4140,4150,4320,5120,5150,8630, 86L20,50100		
Hardness BRINELL	≦175			Hardness BRINELL	≦275		
Vc (SFM)	400 (320-480)			Vc (SFM)	295 (236-354)		
ae/ap	ae=1 ap≦1			ae/ap	ae=1 ap≦1		
MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes	MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes
1/4	6112	0.0006	7.3	1/4	4508	0.0004	3.6
5/16	4890	0.0008	8.4	5/16	3606	0.0005	4.1
3/8	4075	0.0011	9.0	3/8	3005	0.0008	4.8
1/2	3056	0.0014	8.6	1/2	2254	0.0011	5.0
5/8	2445	0.0015	7.6	5/8	1803	0.0012	4.4
3/4	2037	0.0017	6.9	3/4	1503	0.0013	3.9
1	1528	0.0020	6.1	1	1127	0.0015	3.4
Slot Milling	TOOL STEELS A2,D2,H13,L2,M2,P20,S7,T15,W2			Slot Milling	CAST IRONS Gray,Mallable,Ductile		
Hardness BRINELL	≦250			Hardness BRINELL	≦220		
Vc (SFM)	275 (220-330)			Vc (SFM)	295 (236-354)		
ae/ap	ae=1 ap≦1			ae/ap	ae=1 ap≦1		
MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes	MILL DIA. (inch)	RPM	Fz	Feed(IPM) 4 flutes
1/4	4202	0.0006	5.0	1/4	4508	0.0008	7.2
5/16	3361	0.0008	5.0	5/16	3606	0.0012	8.3
3/8	2801	0.0009	5.0	3/8	3005	0.0015	9.0
1/2	2101	0.0015	6.3	1/2	2254	0.0020	9.0
5/8	1680	0.0016	5.5	5/8	1803	0.0022	7.9
3/4	1401	0.0018	5.0	3/4	1503	0.0024	7.2
1	1051	0.0021	4.4	1	1127	0.0028	6.3
Depth of cut							

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

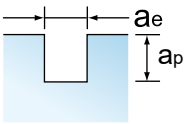
CUTTING CONDITION - ITBTA SERIES

Side Milling	P									K		
	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			CAST IRONS Gray, Malleable, Ductile		
Hardness BRINELL	≦ 175			≦ 275			≦ 250			≦ 220		
Vc (SFM)	460 (368-552)			335 (268-402)			315 (252-378)			335 (268-402)		
ae/ap	ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	7029	0.0008	11.2	5119	0.0006	6.1	4813	0.0006	5.8	5119	0.0008	8.2
Side Milling	M						N					
	STAINLESS STEELS (Free Machining) 303, 416, 420F, 430F 440F			STAINLESS STEELS (Difficult) 304, 304L,316, 316L,17-4PH, 15-5, 13-4			ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze, C110, Muntz Brass		
Hardness BRINELL	≦ 275			≦ 275			≦ 150			≦ 140		
Vc (SFM)	370 (296-444)			255 (204-306)			880 (704-1056)			485(388-582)		
ae/ap	ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	5654	0.0006	6.8	3896	0.0005	3.9	13446	0.0016	43	7411	0.0008	11.9
Depth of cut												

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

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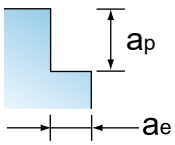
CUTTING CONDITION - ITBTA SERIES

Slot Milling	P									K		
	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			CAST IRONS Gray, Malleable, Ductile		
Hardness BRINELL	≦ 175			≦ 275			≦ 250			≦ 220		
Vc (SFM)	335 (268-402)			245 (196-294)			230 (184-276)			245 (196-294)		
ae/ap	ae=1D ap ≦ 1D			ae=1D ap ≦ 1D			ae=1D ap ≦ 1D			ae=1D ap ≦ 1D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	5119	0.0008	8.2	3744	0.0006	4.5	3514	0.0006	4.2	3744	0.0008	6.0
Slot Milling	M						N					
	STAINLESS STEELS (Free Machining) 303, 416, 420F, 430F 440F			STAINLESS STEELS (Difficult) 304, 304L,316, 316L			ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze, C110, Muntz Brass		
Hardness BRINELL	≦ 275			≦ 275			≦ 150			≦ 140		
Vc (SFM)	270 (216-324)			185 (148-222)			640 (512-768)			350 (280-420)		
ae/ap	ae=1D ap ≦ 1D			ae=1D ap ≦ 1D			ae=1D ap ≦ 1D			ae=1D ap ≦ 1D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	4126	0.0006	5.0	2827	0.0005	2.8	9779	0.0016	31.3	5348	0.0008	8.6
Depth of cut												

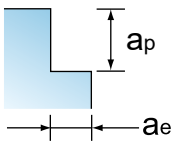
FRACTIONAL

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

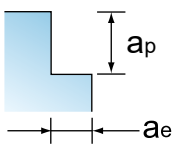
CUTTING CONDITION - IPVE/IPVRIT

Side Milling 	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2		
Hardness BRINELL	≦ 275			≦ 375			≦ 375			> 375 ≦ 475			> 475 ≦ 655		
HRC	≦ 28.5			≦ 39.8			≦ 39.8			> 39.8 ≦ 49.1			> 50 ≦ 65		
Vc (SFM)	555 (442-662)			315 (253-378)			405 (324-486)			210 (168-252)			90 (72-108)		
ae/ap	ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	16,894	0.00040	27.0	9,629	0.00030	11.56	12,332	0.00050	24.7	6,420	0.00040	10.3	2,703	0.00020	2.2
9/64	15,017	0.00048	28.5	8,559	0.00028	9.42	10,962	0.00059	25.8	5,706	0.00048	10.8	2,403	0.00024	2.3
5/32	13,515	0.00055	29.7	7,704	0.00035	10.78	9,866	0.00068	26.6	5,136	0.00055	11.3	2,162	0.00028	2.4
11/64	12,286	0.00063	30.7	7,003	0.00043	11.91	8,969	0.00076	27.4	4,669	0.00063	11.7	1,966	0.00031	2.5
3/16	11,262	0.00070	31.5	6,420	0.00050	12.84	8,222	0.00085	28.0	4,280	0.00070	12.0	1,802	0.00035	2.5
13/64	10,396	0.00078	32.2	5,926	0.00058	13.63	7,589	0.00094	28.5	3,951	0.00078	12.2	1,663	0.00039	2.6
7/32	9,654	0.00085	32.8	5,503	0.00065	14.31	7,047	0.00103	28.9	3,668	0.00085	12.5	1,545	0.00043	2.6
15/64	9,010	0.00093	33.3	5,136	0.00073	14.89	6,577	0.00111	29.3	3,424	0.00093	12.7	1,442	0.00046	2.7
1/4	8,447	0.00100	33.8	4,815	0.00080	15.41	6,166	0.00120	29.6	3,210	0.00010	1.3	1,351	0.00005	0.3
17/64	7,950	0.00113	35.8	4,531	0.00088	15.86	5,803	0.00134	31.0	3,021	0.00113	13.6	1,272	0.00056	2.9
9/32	7,508	0.00123	36.9	4,280	0.00095	16.26	5,481	0.00148	32.3	2,853	0.00123	14.0	1,201	0.00061	2.9
19/64	7,113	0.00134	38.1	4,054	0.00103	16.62	5,193	0.00161	33.5	2,703	0.00134	14.5	1,138	0.00067	3.0
5/16	6,757	0.00145	39.2	3,852	0.00110	16.95	4,933	0.00175	34.5	2,568	0.00145	14.9	1,081	0.00073	3.1
21/64	6,436	0.00156	40.2	3,668	0.00118	17.24	4,698	0.00189	35.5	2,446	0.00156	15.3	1,030	0.00078	3.2
11/32	6,143	0.00168	41.3	3,502	0.00125	17.51	4,485	0.00203	36.3	2,334	0.00168	15.6	983	0.00084	3.3
23/64	5,876	0.00178	41.8	3,349	0.00133	17.75	4,290	0.00216	37.1	2,233	0.00179	16.0	940	0.00089	3.4
3/8	5,631	0.00190	42.8	3,210	0.00140	17.97	4,111	0.00230	37.8	2,140	0.00190	16.3	901	0.00095	3.4
25/64	5,406	0.00198	42.7	3,081	0.00146	18.03	3,946	0.00239	37.7	2,054	0.00198	16.2	865	0.00099	3.4
13/32	5,198	0.00205	42.6	2,963	0.00153	18.07	3,795	0.00248	37.6	1,975	0.00205	16.2	832	0.00103	3.4
27/64	5,006	0.00213	42.5	2,853	0.00159	18.12	3,654	0.00256	37.5	1,902	0.00213	16.2	801	0.00106	3.4
7/16	4,827	0.00220	42.5	2,751	0.00165	18.16	3,524	0.00265	37.3	1,834	0.00220	16.1	772	0.00110	3.4
29/64	4,660	0.00228	42.4	2,656	0.00171	18.20	3,402	0.00274	37.3	1,771	0.00228	16.1	746	0.00114	3.4
15/32	4,505	0.00235	42.3	2,568	0.00178	18.23	3,289	0.00283	37.2	1,712	0.00235	16.1	721	0.00118	3.4
31/64	4,360	0.00243	42.3	2,485	0.00184	18.26	3,183	0.00231	29.4	1,657	0.00243	16.1	698	0.00121	3.4
1/2	4,223	0.00250	42.2	2,407	0.00190	18.30	3,083	0.00300	37.0	1,605	0.00250	16.0	676	0.00125	3.4
9/16	3,754	0.00210	31.5	2,140	0.00215	18.40	2,741	0.00345	37.8	1,427	0.00285	16.3	601	0.00143	3.4
5/8	3,379	0.00310	41.9	1,926	0.00240	18.49	2,466	0.00390	38.5	1,284	0.00320	16.4	541	0.00160	3.5
11/16	3,072	0.00315	38.7	1,751	0.00245	17.16	2,242	0.00405	36.3	1,167	0.00335	15.6	491	0.00168	3.3
3/4	2,816	0.00320	36.0	1,605	0.00250	16.05	2,055	0.00420	34.5	1,070	0.00350	15.0	450	0.00175	3.2
7/8	2,413	0.00335	32.3	1,376	0.00260	14.31	1,762	0.00460	32.4	917	0.00365	13.4	386	0.00183	2.8
1	2,112	0.00350	29.6	1,204	0.00270	13.00	1,542	0.00500	30.8	802	0.00380	12.2	338	0.00190	2.6
Depth of cut															

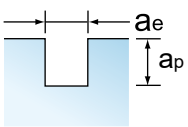
CUTTING CONDITION - IPVE/IPVRIT

SideMilling 	CAST IRONS LOW&MEDIUM ALLOY) Gray, Malleable, Ductile			CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile			STAINLESS STEELS (FREE MACHINING) 304, 416,420F,430F,440F			STAINLESS STEELS (DIFFICULT) 304, 304L,316,316L			STAINLESS STEELS(PH) 13-8 PH,15-5PH,17-4PH, Custom 450		
Hardness BRINELL	≦ 220			> 220 ≦ 260			≦ 275			≦ 275			≦ 325		
HRC	≦ 18.8			> 18.8 ≦ 26.6			≦ 28.5			≦ 28.5			≦ 34.4		
Vc (SFM)	355 (284-426)			340 (272-408)			490 (392-588)			340 (272-408)			310 (248-372)		
ae/ap	ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	10,812	0.00040	17.3	10,305	0.00030	12.40	14,866	0.00030	17.8	10,305	0.00020	8.2	9,460	0.00020	7.6
9/64	9,611	0.00048	18.3	9,160	0.00035	12.80	13,215	0.00035	18.5	9,160	0.00025	9.2	8,409	0.00025	8.4
5/32	8,650	0.00055	19.0	8,244	0.00040	13.20	11,893	0.00040	19.0	8,244	0.00030	9.9	7,568	0.00030	9.1
11/64	7,863	0.00063	19.7	7,495	0.00045	13.50	10,812	0.00045	19.5	7,495	0.00035	10.5	6,880	0.00035	9.6
3/16	7,208	0.00070	20.2	6,870	0.00050	13.70	9,911	0.00050	19.8	6,870	0.00040	11.0	6,307	0.00040	10.1
13/64	6,654	0.00078	20.6	6,342	0.00055	14.00	9,149	0.00055	20.1	6,342	0.00045	11.4	5,822	0.00045	10.5
7/32	6,178	0.00085	21.0	5,889	0.00060	14.10	8,495	0.00060	20.4	5,889	0.00050	11.8	5,406	0.00050	10.8
15/64	5,766	0.00093	21.3	5,496	0.00065	14.30	7,929	0.00065	20.6	5,496	0.00055	12.1	5,046	0.00055	11.1
1/4	5,406	0.00100	21.6	5,153	0.00070	14.40	7,433	0.00070	20.8	5,153	0.00060	12.4	4,730	0.00060	11.4
17/64	5,088	0.00110	22.4	4,849	0.00079	15.30	6,996	0.00079	22.0	4,849	0.00066	12.9	4,452	0.00066	11.8
9/32	4,805	0.00120	23.1	4,580	0.00088	16.00	6,607	0.00088	23.1	4,580	0.00073	13.3	4,205	0.00073	12.2
19/64	4,552	0.00130	23.7	4,339	0.00096	16.70	6,260	0.00096	24.1	4,339	0.00079	13.7	3,983	0.00079	12.5
5/16	4,325	0.00140	24.2	4,122	0.00105	17.30	5,947	0.00105	25.0	4,122	0.00085	14.0	3,784	0.00085	12.9
21/64	4,119	0.00150	24.7	3,926	0.00114	17.90	5,663	0.00114	25.8	3,926	0.00091	14.3	3,604	0.00091	13.2
11/32	3,932	0.00160	25.2	3,747	0.00123	18.40	5,406	0.00123	26.5	3,747	0.00098	14.6	3,440	0.00098	13.4
23/64	3,761	0.00170	25.6	3,584	0.00131	18.80	5,171	0.00131	27.1	3,584	0.00104	14.9	3,291	0.00104	13.7
3/8	3,604	0.00180	25.9	3,435	0.00140	19.20	4,955	0.00140	27.8	3,435	0.00110	15.1	3,153	0.00110	13.9
25/64	3,460	0.00188	25.9	3,298	0.00145	19.10	4,757	0.00145	27.6	3,298	0.00114	15.0	3,027	0.00114	13.8
13/32	3,327	0.00195	25.9	3,171	0.00150	19.00	4,574	0.00150	27.4	3,171	0.00118	14.9	2,911	0.00118	13.7
27/64	3,204	0.00203	25.9	3,053	0.00155	18.90	4,405	0.00155	27.3	3,053	0.00121	14.8	2,803	0.00121	13.6
7/16	3,089	0.00210	25.9	2,944	0.00160	18.80	4,248	0.00160	27.2	2,944	0.00125	14.7	2,703	0.00125	13.5
29/64	2,983	0.00218	25.9	2,843	0.00165	18.80	4,101	0.00165	27.1	2,843	0.00013	1.5	2,610	0.00013	1.3
15/32	2,883	0.00225	25.9	2,748	0.00170	18.70	3,964	0.00170	27.0	2,748	0.00133	14.6	2,523	0.00133	13.4
31/64	2,790	0.00233	25.9	2,659	0.00175	18.60	3,837	0.00175	26.9	2,659	0.00136	14.5	2,441	0.00136	13.3
1/2	2,703	0.00240	25.9	2,576	0.00180	18.50	3,717	0.00180	26.8	2,576	0.00140	14.4	2,365	0.00140	13.2
9/16	2,403	0.00270	25.9	2,290	0.00205	18.80	3,304	0.00205	27.1	2,290	0.00160	14.7	2,102	0.00160	13.5
5/8	2,162	0.00300	25.9	2,061	0.00230	19.00	2,973	0.00230	27.4	2,061	0.00180	14.8	1,892	0.00180	13.6
11/16	1,966	0.00305	24.0	1,874	0.00245	18.40	2,703	0.00245	26.5	1,874	0.00185	13.9	1,720	0.00185	12.7
3/4	1,802	0.00310	22.3	1,718	0.00240	16.50	2,478	0.00240	23.8	1,718	0.00190	13.1	1,577	0.00190	12.0
7/8	1,545	0.00325	20.1	1,472	0.00245	14.40	2,124	0.00245	20.8	1,472	0.00195	11.5	1,351	0.00195	10.5
1	1,351	0.00340	18.4	1,288	0.00250	12.90	1,858	0.00250	18.6	1,288	0.00200	10.3	1,183	0.00200	9.5
Depth of cut															

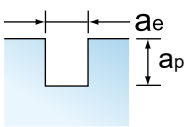
CUTTING CONDITION - IPVE/IPVRIT

SideMilling 	SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 601,617,625,Incoly 800,Monel 400			SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 718,750X,Incoly 925,Waspalloy,Hastelloy,Rene			TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si			TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al		
Hardness BRINELL	≦ 300			> 300			≦ 350			> 350 ≦ 440		
HRC	≦ 32.1			≦ 32.1								
Vc (SFM)	80 (64-96)			62 (50-74)			215 (172-258)			75 (60-90)		
ae/ap	ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D			ae=0.5D ap=1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	2,365	0.00020	1.9	1,858	0.00010	0.70	6,757	0.00020	5.4	2,365	0.00020	1.9
9/64	2,102	0.00023	1.9	1,652	0.00013	0.80	6,007	0.00024	5.7	2,102	0.00024	2.0
5/32	1,892	0.00025	1.9	1,487	0.00015	0.90	5,406	0.00028	5.9	1,892	0.00028	2.1
11/64	1,720	0.00028	1.9	1,351	0.00018	0.90	4,915	0.00031	6.1	1,720	0.00031	2.2
3/16	1,577	0.00030	1.9	1,239	0.00020	1.00	4,505	0.00035	6.3	1,577	0.00035	2.2
13/64	1,455	0.00033	1.9	1,144	0.00023	1.00	4,158	0.00039	6.4	1,455	0.00039	2.3
7/32	1,351	0.00035	1.9	1,062	0.00025	1.10	3,861	0.00043	6.6	1,351	0.00043	2.3
15/64	1,261	0.00038	1.9	991	0.00028	1.10	3,604	0.00046	6.7	1,261	0.00046	2.3
1/4	1,183	0.00040	1.9	929	0.00030	1.10	3,379	0.00050	6.8	1,183	0.00050	2.4
17/64	1,113	0.00045	2.0	874	0.00033	1.10	3,180	0.00057	7.2	1,113	0.00057	2.5
9/32	1,051	0.00050	2.1	826	0.00035	1.20	3,003	0.00063	7.6	1,051	0.00063	2.6
19/64	996	0.00055	2.2	782	0.00038	1.20	2,845	0.00069	7.8	996	0.00069	2.7
5/16	946	0.00060	2.3	743	0.00040	1.20	2,703	0.00075	8.1	946	0.00075	2.8
21/64	901	0.00065	2.3	708	0.00043	1.20	2,574	0.00081	8.4	901	0.00081	2.9
11/32	860	0.00070	2.4	676	0.00045	1.20	2,457	0.00088	8.6	860	0.00088	3.0
23/64	823	0.00075	2.5	646	0.00048	1.20	2,350	0.00094	8.8	823	0.00094	3.1
3/8	788	0.00080	2.5	619	0.00050	1.20	2,252	0.00100	9.0	788	0.00100	3.2
25/64	757	0.00083	2.5	595	0.00053	1.20	2,162	0.00104	9.0	757	0.00104	3.1
13/32	728	0.00085	2.5	572	0.00055	1.30	2,079	0.00108	8.9	728	0.00108	3.1
27/64	701	0.00088	2.5	551	0.00058	1.30	2,002	0.00111	8.9	701	0.00111	3.1
7/16	676	0.00090	2.4	531	0.00060	1.30	1,931	0.00115	8.9	676	0.00115	3.1
29/64	652	0.00093	2.4	513	0.00063	1.30	1,864	0.00119	8.9	652	0.00119	3.1
15/32	631	0.00095	2.4	496	0.00065	1.30	1,802	0.00123	8.8	631	0.00123	3.1
31/64	610	0.00098	2.4	480	0.00068	1.30	1,744	0.00126	8.8	610	0.00126	3.1
1/2	591	0.00100	2.4	465	0.00070	1.30	1,689	0.00130	8.8	591	0.00130	3.1
9/16	526	0.00115	2.4	413	0.00080	1.30	1,502	0.00145	8.7	526	0.00145	3.0
5/8	473	0.00130	2.5	372	0.00090	1.30	1,351	0.00160	8.6	473	0.00160	3.0
11/16	430	0.00135	2.3	338	0.00095	1.30	1,229	0.00165	8.1	430	0.00165	2.8
3/4	394	0.00140	2.2	310	0.00100	1.20	1,126	0.00170	7.7	394	0.00170	2.7
7/8	338	0.00145	2.0	265	0.00011	0.10	965	0.00175	6.8	338	0.00175	2.4
1	296	0.00150	1.8	232	0.00110	1.00	845	0.00180	6.1	296	0.00180	2.1
Depth of cut												

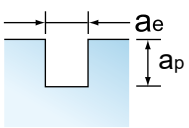
CUTTING CONDITION - IPVE/IPVRIT

Slot Milling 	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2			TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2		
Hardness BRINELL	≦ 275			≦ 375			≦ 375			> 375 ≦ 475			> 475 ≦ 655		
HRC	≦ 28.5			≦ 39.8			≦ 39.8			> 39.8 ≦ 49.1			> 50 ≦ 65		
Vc (SFM)	440 (352-528)			252 (201-303)			320 (256-384)			170 (136-204)			70 (56-84)		
ae/ap	ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	13,515	0.00040	21.6	6,163	0.00030	7.40	9,866	0.00050	19.7	5,136	0.00040	8.2	2,162	0.00020	1.7
9/64	12,013	0.00048	22.8	5,478	0.00028	6.03	8,770	0.00059	20.6	4,565	0.00048	8.7	1,922	0.00024	1.8
5/32	10,812	0.00055	23.8	4,930	0.00035	6.90	7,893	0.00068	21.3	4,109	0.00055	9.0	1,730	0.00028	1.9
11/64	9,829	0.00063	24.6	4,482	0.00043	7.62	7,175	0.00076	21.9	3,735	0.00063	9.3	1,573	0.00031	2.0
3/16	9,010	0.00070	25.2	4,109	0.00050	8.22	6,577	0.00085	22.4	3,424	0.00070	9.6	1,442	0.00035	2.0
13/64	8,317	0.00078	25.8	3,793	0.00058	8.72	6,071	0.00094	22.8	3,160	0.00078	9.8	1,331	0.00039	2.1
7/32	7,723	0.00085	26.3	3,522	0.00065	9.16	5,638	0.00103	23.1	2,935	0.00085	10.0	1,236	0.00043	2.1
15/64	7,208	0.00093	26.7	3,287	0.00073	9.53	5,262	0.00111	23.4	2,739	0.00093	10.1	1,153	0.00046	2.1
1/4	6,757	0.00100	27.0	3,081	0.00080	9.86	4,933	0.00120	23.7	2,568	0.00010	1.0	1,081	0.00005	0.2
17/64	6,360	0.00113	28.6	2,900	0.00088	10.15	4,643	0.00134	24.8	2,417	0.00113	10.9	1,018	0.00056	2.3
9/32	6,007	0.00123	29.6	2,739	0.00095	10.41	4,385	0.00148	25.9	2,283	0.00123	11.2	961	0.00061	2.4
19/64	5,691	0.00134	30.5	2,595	0.00103	10.64	4,154	0.00161	26.8	2,162	0.00134	11.6	910	0.00067	2.4
5/16	5,406	0.00145	31.4	2,465	0.00110	10.85	3,946	0.00175	27.6	2,054	0.00145	11.9	865	0.00073	2.5
21/64	5,149	0.00156	32.1	2,348	0.00118	11.03	3,758	0.00189	28.4	1,956	0.00156	12.2	824	0.00078	2.6
11/32	4,915	0.00168	33.0	2,241	0.00125	11.21	3,588	0.00203	29.1	1,868	0.00168	12.5	786	0.00084	2.6
23/64	4,701	0.00178	33.5	2,144	0.00133	11.36	3,432	0.00216	29.7	1,786	0.00179	12.8	752	0.00089	2.7
3/8	4,505	0.00190	34.2	2,054	0.00140	11.50	3,289	0.00230	30.3	1,712	0.00190	13.0	721	0.00095	2.7
25/64	4,325	0.00198	34.2	1,972	0.00146	11.54	3,157	0.00239	30.2	1,643	0.00198	13.0	692	0.00099	2.7
13/32	4,158	0.00205	34.1	1,896	0.00153	11.57	3,036	0.00248	30.1	1,580	0.00205	13.0	665	0.00103	2.7
27/64	4,004	0.00213	34.0	1,826	0.00159	11.60	2,923	0.00256	30.0	1,522	0.00213	12.9	641	0.00106	2.7
7/16	3,861	0.00220	34.0	1,761	0.00165	11.62	2,819	0.00265	29.9	1,467	0.00220	12.9	618	0.00110	2.7
29/64	3,728	0.00228	33.9	1,700	0.00171	11.65	2,722	0.00274	29.8	1,417	0.00228	12.9	597	0.00114	2.7
15/32	3,604	0.00235	33.9	1,643	0.00178	11.67	2,631	0.00283	29.7	1,370	0.00235	12.9	577	0.00118	2.7
31/64	3,488	0.00243	33.8	1,590	0.00184	11.69	2,546	0.00231	23.6	1,325	0.00243	12.9	558	0.00121	2.7
1/2	3,379	0.00250	33.8	1,541	0.00190	11.71	2,466	0.00300	29.6	1,284	0.00250	12.8	541	0.00125	2.7
9/16	3,003	0.00210	25.2	1,370	0.00215	11.78	2,192	0.00345	30.3	1,141	0.00285	13.0	481	0.00143	2.7
5/8	2,703	0.00310	33.5	1,233	0.00240	11.83	1,973	0.00390	30.8	1,027	0.00320	13.1	432	0.00160	2.8
11/16	2,457	0.00315	31.0	1,121	0.00245	10.98	1,794	0.00405	29.1	934	0.00335	12.5	393	0.00168	2.6
3/4	2,252	0.00320	28.8	1,027	0.00250	10.27	1,644	0.00420	27.6	856	0.00350	12.0	360	0.00175	2.5
7/8	1,931	0.00335	25.9	880	0.00260	9.16	1,409	0.00460	25.9	734	0.00365	10.7	309	0.00183	2.3
1	1,689	0.00350	23.7	770	0.00270	8.32	1,233	0.00500	24.7	642	0.00380	9.8	270	0.00190	2.1
Depth of cut															

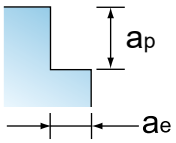
CUTTING CONDITION - IPVE/IPVRIT

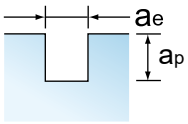
Slot Milling	CAST IRONS (LOW&MEDIUM ALLOY) Gray, Malleable, Ductile			CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile			STAINLESS STEELS (FREE MACHINING) 304, 416,420F,430F,440F			STAINLESS STEELS (DIFFICULT) 304, 304L,316,316L			STAINLESS STEELS(PH) 13-8 PH,15-5PH,17-4PH, Custom 450		
Hardness BRINELL	≦ 220			> 220 ≦ 260			≦ 275			≦ 275			≦ 325		
HRC	≦ 18.8			> 18.8 ≦ 26.6			≦ 28.5			≦ 28.5			≦ 34.4		
Vc (SFM)	284 (356-534)			272 (216-324)			390 (312-468)			270 (216-324)			250 (200-300)		
ae/ap	ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	6,920	0.00040	11.1	6,595	0.00030	7.90	9,515	0.00030	11.4	6,595	0.00020	5.3	6,055	0.00020	4.8
9/64	6,151	0.00048	11.7	5,862	0.00035	8.20	8,457	0.00035	11.8	5,862	0.00025	5.9	5,382	0.00025	5.4
5/32	5,536	0.00055	12.2	5,276	0.00040	8.40	7,612	0.00040	12.2	5,276	0.00030	6.3	4,844	0.00030	5.8
11/64	5,032	0.00063	12.6	4,797	0.00045	8.60	6,920	0.00045	12.5	4,797	0.00035	6.7	4,403	0.00035	6.2
3/16	4,613	0.00070	12.9	4,397	0.00050	8.80	6,343	0.00050	12.7	4,397	0.00040	7.0	4,036	0.00040	6.5
13/64	4,258	0.00078	13.2	4,059	0.00055	8.90	5,855	0.00055	12.9	4,059	0.00045	7.3	3,726	0.00045	6.7
7/32	3,954	0.00085	13.4	3,769	0.00060	9.00	5,437	0.00060	13.0	3,769	0.00050	7.5	3,460	0.00050	6.9
15/64	3,690	0.00093	13.7	3,517	0.00065	9.10	5,074	0.00065	13.2	3,517	0.00055	7.7	3,229	0.00055	7.1
1/4	3,460	0.00100	13.8	3,298	0.00070	9.20	4,757	0.00070	13.3	3,298	0.00060	7.9	3,027	0.00060	7.3
17/64	3,256	0.00110	14.3	3,104	0.00079	9.80	4,477	0.00079	14.1	3,104	0.00066	8.2	2,849	0.00066	7.6
9/32	3,075	0.00120	14.8	2,931	0.00088	10.30	4,229	0.00088	14.8	2,931	0.00073	8.5	2,691	0.00073	7.8
19/64	2,914	0.00130	15.2	2,777	0.00096	10.70	4,006	0.00096	15.4	2,777	0.00079	8.7	2,549	0.00079	8.0
5/16	2,768	0.00140	15.5	2,638	0.00105	11.10	3,806	0.00105	16.0	2,638	0.00085	9.0	2,422	0.00085	8.2
21/64	2,636	0.00150	15.8	2,512	0.00114	11.40	3,625	0.00114	16.5	2,512	0.00091	9.2	2,307	0.00091	8.4
11/32	2,516	0.00160	16.1	2,398	0.00123	11.80	3,460	0.00123	17.0	2,398	0.00098	9.4	2,202	0.00098	8.6
23/64	2,407	0.00170	16.4	2,294	0.00131	12.00	3,309	0.00131	17.4	2,294	0.00104	9.5	2,106	0.00104	8.7
3/8	2,307	0.00180	16.6	2,198	0.00140	12.30	3,172	0.00140	17.8	2,198	0.00110	9.7	2,018	0.00110	8.9
25/64	2,214	0.00188	16.6	2,110	0.00145	12.20	3,045	0.00145	17.7	2,110	0.00114	9.6	1,938	0.00114	8.8
13/32	2,129	0.00195	16.6	2,029	0.00150	12.20	2,928	0.00150	17.6	2,029	0.00118	9.5	1,863	0.00118	8.8
27/64	2,050	0.00203	16.6	1,954	0.00155	12.10	2,819	0.00155	17.5	1,954	0.00121	9.5	1,794	0.00121	8.7
7/16	1,977	0.00210	16.6	1,884	0.00160	12.10	2,718	0.00160	17.4	1,884	0.00125	9.4	1,730	0.00125	8.6
29/64	1,909	0.00218	16.6	1,819	0.00165	12.00	2,625	0.00165	17.3	1,819	0.00013	0.9	1,670	0.00013	0.9
15/32	1,845	0.00225	16.6	1,759	0.00170	12.00	2,537	0.00170	17.3	1,759	0.00133	9.3	1,615	0.00133	8.6
31/64	1,786	0.00233	16.6	1,702	0.00175	11.90	2,455	0.00175	17.2	1,702	0.00136	9.3	1,563	0.00136	8.5
1/2	1,730	0.00240	16.6	1,649	0.00180	11.90	2,379	0.00180	17.1	1,649	0.00140	9.2	1,514	0.00140	8.5
9/16	1,538	0.00270	16.6	1,466	0.00205	12.00	2,114	0.00205	17.3	1,466	0.00160	9.4	1,345	0.00160	8.6
5/8	1,384	0.00300	16.6	1,319	0.00230	12.10	1,903	0.00230	17.5	1,319	0.00180	9.5	1,211	0.00180	8.7
11/16	1,258	0.00305	15.3	1,199	0.00245	11.80	1,730	0.00245	17.0	1,199	0.00185	8.9	1,101	0.00185	8.1
3/4	1,153	0.00310	14.3	1,099	0.00240	10.60	1,586	0.00240	15.2	1,099	0.00190	8.4	1,009	0.00190	7.7
7/8	989	0.00325	12.9	942	0.00245	9.20	1,359	0.00245	13.3	942	0.00195	7.3	865	0.00195	6.7
1	865	0.00340	11.8	824	0.00250	8.20	1,189	0.00250	11.9	824	0.00200	6.6	757	0.00200	6.1
Depth of cut															

CUTTING CONDITION - IPVE/IPVRIT

Slot Milling 	SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 601,617,625,Incoly 800,Monel 400			SUPER ALLOYS (NICKEL,COBALT,IRON,BASE) Inconel 718,750X,Incoly 925,Waspalloy,Hastelloy,Rene			TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si			TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al		
Hardness BRINELL	≦ 300			> 300			≦ 350			> 350 ≦ 440		
HRC	≦ 32.1			≦ 32.1								
Vc (SFM)	65 (52-78)			50 (40-60)			170 (136-204)			60 (48-72)		
ae/ap	ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D			ae=1D ap=1D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/8	1,514	0.00020	1.2	1,189	0.00010	0.50	4,325	0.00020	3.5	1,514	0.00020	1.2
9/64	1,345	0.00023	1.2	1,057	0.00013	0.50	3,844	0.00024	3.7	1,345	0.00024	1.3
5/32	1,211	0.00025	1.2	951	0.00015	0.60	3,460	0.00028	3.8	1,211	0.00028	1.3
11/64	1,101	0.00028	1.2	865	0.00018	0.60	3,145	0.00031	3.9	1,101	0.00031	1.4
3/16	1,009	0.00030	1.2	793	0.00020	0.60	2,883	0.00035	4.0	1,009	0.00035	1.4
13/64	931	0.00033	1.2	732	0.00023	0.70	2,661	0.00039	4.1	931	0.00039	1.4
7/32	865	0.00035	1.2	680	0.00025	0.70	2,471	0.00043	4.2	865	0.00043	1.5
15/64	807	0.00038	1.2	634	0.00028	0.70	2,307	0.00046	4.3	807	0.00046	1.5
1/4	757	0.00040	1.2	595	0.00030	0.70	2,162	0.00050	4.3	757	0.00050	1.5
17/64	712	0.00045	1.3	560	0.00033	0.70	2,035	0.00057	4.6	712	0.00057	1.6
9/32	673	0.00050	1.3	529	0.00035	0.70	1,922	0.00063	4.8	673	0.00063	1.7
19/64	637	0.00055	1.4	501	0.00038	0.80	1,821	0.00069	5.0	637	0.00069	1.8
5/16	605	0.00060	1.5	476	0.00040	0.80	1,730	0.00075	5.2	605	0.00075	1.8
21/64	577	0.00065	1.5	453	0.00043	0.80	1,648	0.00081	5.4	577	0.00081	1.9
11/32	550	0.00070	1.5	432	0.00045	0.80	1,573	0.00088	5.5	550	0.00088	1.9
23/64	526	0.00075	1.6	414	0.00048	0.80	1,504	0.00094	5.6	526	0.00094	2.0
3/8	505	0.00080	1.6	396	0.00050	0.80	1,442	0.00100	5.8	505	0.00100	2.0
25/64	484	0.00083	1.6	381	0.00053	0.80	1,384	0.00104	5.7	484	0.00104	2.0
13/32	466	0.00085	1.6	366	0.00055	0.80	1,331	0.00108	5.7	466	0.00108	2.0
27/64	448	0.00088	1.6	352	0.00058	0.80	1,281	0.00111	5.7	448	0.00111	2.0
7/16	432	0.00090	1.6	340	0.00060	0.80	1,236	0.00115	5.7	432	0.00115	2.0
29/64	418	0.00093	1.5	328	0.00063	0.80	1,193	0.00119	5.7	418	0.00119	2.0
15/32	404	0.00095	1.5	317	0.00065	0.80	1,153	0.00123	5.7	404	0.00123	2.0
31/64	391	0.00098	1.5	307	0.00068	0.80	1,116	0.00126	5.6	391	0.00126	2.0
1/2	378	0.00100	1.5	297	0.00070	0.80	1,081	0.00130	5.6	378	0.00130	2.0
9/16	336	0.00115	1.5	264	0.00080	0.80	961	0.00145	5.6	336	0.00145	2.0
5/8	303	0.00130	1.6	238	0.00090	0.90	865	0.00160	5.5	303	0.00160	1.9
11/16	275	0.00135	1.5	216	0.00095	0.80	786	0.00165	5.2	275	0.00165	1.8
3/4	252	0.00140	1.4	198	0.00100	0.80	721	0.00170	4.9	252	0.00170	1.7
7/8	216	0.00145	1.3	170	0.00011	0.10	618	0.00175	4.3	216	0.00175	1.5
1	189	0.00150	1.1	149	0.00110	0.70	541	0.00180	3.9	189	0.00180	1.4
Depth of cut												

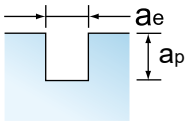
CUTTING CONDITION - IPVR1T

type	IPVR1T		
Side Milling 	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3		
Hardness BRINELL	≦ 300		
HRC	≦ 31		
Vc (SFM)	60		
ae/ap	ae=0.4D ap=1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes
1/8	5,014	0.0005	9.4
3/16	3,345	0.0007	10.0
1/4	2,507	0.0008	8.4
5/16	2,008	0.0010	7.8
3/8	1,671	0.0013	8.8
1/2	1,254	0.0017	8.4
5/8	1,008	0.0019	7.8
3/4	836	0.0023	7.5
Depth of cut			

type	IPVR1T		
Slot Milling 	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3		
Hardness BRINELL	≦ 300		
HRC	≦ 31		
Vc (SFM)	60		
ae/ap	ae=1D ap=1.25D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 4 flutes
1/8	4,013	0.0003	5.0
3/16	2,676	0.0006	6.0
1/4	2,006	0.0008	6.7
5/16	1,607	0.0010	6.3
3/8	1,338	0.0011	6.0
1/2	1,003	0.0017	6.7
5/8	806	0.0017	5.6
3/4	669	0.0021	5.5
Depth of cut			

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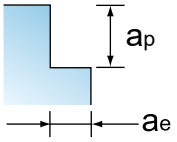
CUTTING CONDITION – IAP SERIES

Side Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze,C110,Muntz Brass			PLASTICS Polycarbonate, PVE, Polypropylene		
Hardness BRINELL	≦ 150			≦ 140					
Vc (sfm)	656	(525-787)		589	(471-707)		880	(704-1056)	
ae/ap	ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D			ae ≦ 0.05D ap ≦ 1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 1 Flute	RPM	Fz	Feed (IPM) 1 Flute	RPM	Fz	Feed (IPM) 1 Flute
1/4	10000	0.0060	60	9000	0.0067	60	13446	0.0045	60
Slot Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze,C110,Muntz Brass			PLASTICS Polycarbonate, PVE, Polypropylene		
Hardness BRINELL	≦ 150			≦ 140					
Vc (sfm)	472	(378-566)		471	(377-565)		640	(512-768)	
ae/ap	ae=1D ap ≦ 1D			ae=1D ap ≦ 1D			ae ≦ 0.05D ap ≦ 1.5D		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 1 Flute	RPM	Fz	Feed (IPM) 1 Flute	RPM	Fz	Feed (IPM) 1 Flute
1/4	7200	0.0063	45	7200	0.0063	45	9779	0.0046	45
Depth of cut	2 x D Reduce chip load by 25% 3 x D Reduce chip load by 50%								

rpm=sfm×3.82/D1
ipm=(inch/flute)×4×rpm

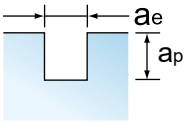
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CUTTING CONDITION – IAUE/IAE5 for Aluminum Application

Side Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075				COPPER ALLOYS Alum Bronze,C110,Muntz Brass			
Hardness BRINELL	≦ 150				≦ 140			
HRC	≦ 80 HRB				≦ 76.4 HRB			
Vc (sfm)	968 (810~1214)				533 (446~669)			
MILL DIA. (inch)	RPM	Fz	Feed (IPM) IAUE-3Flutes	Feed (IPM) IAE5-2Flutes	RPM	Fz	Feed (IPM) IAUE-3Flutes	Feed (IPM) IAE5-2Flutes
1/8	29,380	0.00060	52.9	35.3	16,193	0.00030	14.6	9.7
3/16	19,587	0.00110	64.6	43.1	10,795	0.00055	17.8	11.9
1/4	14,690	0.00160	70.5	47.0	8,096	0.00080	19.4	13.3
5/16	11,752	0.00230	81.1	54.1	6,477	0.00115	22.3	14.9
3/8	9,793	0.00300	88.1	58.8	5,398	0.00150	24.3	16.2
1/2	7,345	0.00400	88.1	58.8	4,048	0.00200	24.3	16.2
5/8	5,876	0.00440	77.6	51.7	3,239	0.00220	21.4	14.3
3/4	4,897	0.00480	70.5	47.0	2,699	0.00240	19.4	13
1	3,673	0.00560	61.7	41.1	2,024	0.00280	17.0	11.3
Depth of cut								

rpm=sfm×3.82/D1
Feed(IPM)=RPM x Fz x T(Flute)

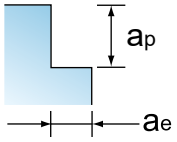
FRACTIONAL

Slot Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075				COPPER ALLOYS Alum Bronze,C110,Muntz Brass			
Hardness BRINELL	≦ 150				≦ 140			
HRC	≦ 80 HRB				≦ 76.4 HRB			
Vc (sfm)	810 (648~972)				446 (357~535)			
MILL DIA. (inch)	RPM	Fz	Feed (IPM) IAUE-3Flutes	Feed (IPM) IAE5-2Flutes	RPM	Fz	Feed (IPM) IAUE-3Flutes	Feed (IPM) IAE5-2Flutes
1/8	23,504	0.00060	42.3	28.2	12,954	0.00030	11.7	7.8
3/16	15,670	0.00110	51.7	34.5	8,636	0.00055	14.2	9.5
1/4	11,752	0.00160	56.4	37.6	6,477	0.00080	15.5	10.4
5/16	9,402	0.00230	64.9	43.2	5,182	0.00115	17.9	11.9
3/8	7,835	0.00300	70.5	47.0	4,318	0.00150	19.4	13.0
1/2	5,876	0.00400	70.5	47.0	3,239	0.00200	19.4	13.0
5/8	4,701	0.00440	62.1	41.4	2,591	0.00220	17.1	11.4
3/4	3,917	0.00480	56.4	37.6	2,159	0.00240	15.5	10.4
1	2,938	0.00560	49.4	32.9	1,619	0.00280	13.6	9.1
Depth of cut								

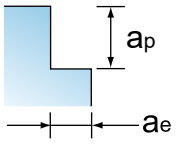
rpm=sfm×3.82/D1
Feed(IPM)=RPM x Fz x T(Flute)

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CUTTING CONDITION - IEB/ISEU/ISED for Wood Working

Side Milling 	Hardwoods			Softwoods			Plywoods			Plastics		
Vc(SFM)	1474 (1178~1767)			1854 (1482~2223)			1854 (1482~2223)			1854 (1482~2223)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/8	45,000	0.0008	75	56,612	0.0010	110	56,612	0.0013	150	56,612	0.0008	90
1/4	22,500	0.0016	70	28,306	0.0019	110	28,306	0.0025	140	28,306	0.0018	100
3/8	15,000	0.0025	75	18,871	0.0029	110	18,871	0.0041	155	18,871	0.0025	95
1/2	11,250	0.0031	70	14,153	0.0035	100	14,153	0.0051	145	14,153	0.0036	102
Depth of cut	 ae ≤ 0.5X D ap ≤ 1.5X D											

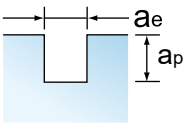
RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

Side Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze,C110,Muntz Brass		
Hardness BRINELL	≦ 150			≦ 140		
HRC	≦ 80 HRB			≦ 76.4 HRB		
Vc (sfm)	968 (810~1214)			533 (446~669)		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2Flutes	RPM	Fz	Feed (IPM) 2Flutes
1/8	29,380	0.00060	35.3	16,193	0.00030	9.7
3/16	19,587	0.00110	43.1	10,795	0.00055	11.9
1/4	14,690	0.00160	47.0	8,096	0.00080	13.3
5/16	11,752	0.00230	54.1	6,477	0.00115	14.9
3/8	9,793	0.00300	58.8	5,398	0.00150	16.2
1/2	7,345	0.00400	58.8	4,048	0.00200	16.2
5/8	5,876	0.00440	51.7	3,239	0.00220	14.3
3/4	4,897	0.00480	47.0	2,699	0.00240	13
1	3,673	0.00560	41.1	2,024	0.00280	11.3
Depth of cut						

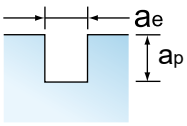
RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

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CUTTING CONDITION - IEB/ISEU/ISED Aluminum Application

Slot Milling 	Hardwoods			Softwoods			Plywoods			Plastics		
Vc(SFM)	1474 (1178~1767)			1854 (1482~2223)			1854 (1482~2223)			1854 (1482~2223)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/8	45,000	0.0008	75	56,612	0.0010	110	56,612	0.0013	150	56,612	0.0008	90
1/4	22,500	0.0016	70	28,306	0.0019	110	28,306	0.0025	140	28,306	0.0018	100
3/8	15,000	0.0025	75	18,871	0.0029	110	18,871	0.0041	155	18,871	0.0025	95
1/2	11,250	0.0031	70	14,153	0.0035	100	14,153	0.0051	145	14,153	0.0036	102
Depth of cut												

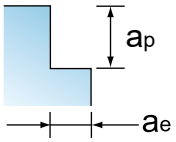
RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

Slot Milling 	ALUMINUM ALLOYS 2017,2024,356,6061,7075			COPPER ALLOYS Alum Bronze,C110,Muntz Brass		
Hardness BRINELL	≦ 150			≦ 140		
HRC	≦ 80 HRB			≦ 76.4 HRB		
Vc (sfm)	810 (648~972)			446 (357~535)		
MILL DIA. (inch)	RPM	Fz	Feed (IPM) 2Flutes	RPM	Fz	Feed (IPM) 2Flutes
1/8	23,504	0.00060	28.2	12,954	0.00030	7.8
3/16	15,670	0.00110	34.5	8,636	0.00055	9.5
1/4	11,752	0.00160	37.6	6,477	0.00080	10.4
5/16	9,402	0.00230	43.2	5,182	0.00115	11.9
3/8	7,835	0.00300	47.0	4,318	0.00150	13.0
1/2	5,876	0.00400	47.0	3,239	0.00200	13.0
5/8	4,701	0.00440	41.4	2,591	0.00220	11.4
3/4	3,917	0.00480	37.6	2,159	0.00240	10.4
1	2,938	0.00560	32.9	1,619	0.00280	9.1
Depth of cut						

rpm=sfm×3.82/D1
Feed(IPM)=RPM x Fz x T(Flute)

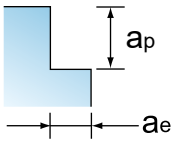
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CUTTING CONDITION - ISES

Side Milling 	Wood, Plywood, Plastic			MDF/Laminate		
Vc (SFM)	950 (800~1100)			950 (800~1100)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 Flutes	RPM	Fz	Feed (IPM) 2 Flutes
1/4	14,516	0.0041	120	14,516	0.0079	230
Depth of cut						

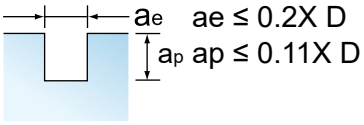
RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

CUTTING CONDITION - ISEUD

Side Milling 	Wood, Plywood, Plastic			MDF/Laminate		
Vc (SFM)	950 (800~1100)			950 (800~1100)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 Flutes	RPM	Fz	Feed (IPM) 2 Flutes
1/4	14,516	0.0041	120	14,516	0.0079	230
3/8	9,678	0.0119	230	9,678	0.0207	400
1/2	7,258	0.0210	305	7,258	0.0289	420
Depth of cut	 ae ≤ 0.5X D ap ≤ 1.5X D					

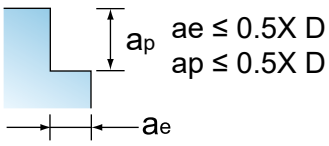
RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

CUTTING CONDITION -ICSM

Slot Milling 	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			STAINLESS STEELS 303, 416, 420F, 430F, 440F			STAINLESS STEELS 304, 304L, 316, 316L			STAINLESS STEELS 13-8 PH, 15-5 PH, 17-4 PH, Custom 450			CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile		
Vc(SFM)	446 (356~535)			253 (203~304)			395 (316-474)			273 (219-328)			253 (203-304)			273 (219-328)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/4	6800	0.0008	22	3865	0.0006	9	6030	0.0007	17	4175	0.0005	9	3865	0.0005	8	4175	0.0005	9
Depth of cut																		

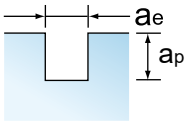
RPM=SFM×3.82/D1
Feed(IPM)=RPM x Fz x T(Flute)

CUTTING CONDITION -ICSM

Side Milling 	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536			ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100			STAINLESS STEELS 303, 416, 420F, 430F, 440F			STAINLESS STEELS 304, 304L, 316, 316L			STAINLESS STEELS 13-8 PH, 15-5 PH, 17-4 PH, Custom 450			CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile		
Vc(SFM)	158 (127~190)			91 (73~110)			141 (112~169)			98 (79~118)			91 (73~110)			98 (79~118)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes	RPM	Fz	Feed (IPM) 4 flutes
1/4	2400	0.0048	46	1395	0.0034	19	2140	0.0035	30	1500	0.0027	16	1395	0.0027	15	1500	0.0042	25
Depth of cut																		

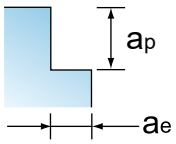
RPM=SFM×3.82/D1
Feed(IPM)=RPM x Fz x T(Flute)

CUTTING CONDITION - ICSM

Slot Milling 	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075			ALUMINUM DIE CAST ALLOYS (HIGH SILICONE) A-390, A-392, B-390			COPPER ALLOYS Alum Bronze, C110, Muntz Brass			PLASTICS Polycarbonate, PVC, Polypropylene		
Vc(SFM)	1716 (1373~2059)			643 (515~772)			370 (403-444)			1716 (1373-2059)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	26190	0.0022	227	9820	0.0022	85	5640	0.0018	40	26190	0.0036	380
Depth of cut	 ae ≤ 0.2X D ap ≤ 0.11X D											

RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

CUTTING CONDITION - ICSM

Side Milling 	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075			ALUMINUM DIE CAST ALLOYS (HIGH SILICONE) A-390, A-392, B-390			COPPER ALLOYS Alum Bronze, C110, Muntz Brass			PLASTICS Polycarbonate, PVC, Polypropylene		
Vc(SFM)	744 (596~893)			279 (223~335)			160 (128-192)			744 (596-893)		
Diameter(D1) inch	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes	RPM	Fz	Feed (IPM) 2 flutes
1/4	11365	0.0046	211	4262	0.0046	79	2440	0.0038	37	11360	0.0078	353
Depth of cut	 ae ≤ 0.5X D ap ≤ 0.5X D											

RPM = SFM × 3.82/D1
Feed(IPM) = RPM x Fz x T(Flute)

HSE

Specification page
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CUTTING CONDITION - Spotting Drill

Work Material	Vc (m/min)	fn	Diameter	Speed	Feed Rate
General steel	100	0.06	4	8000	480
		0.04	6	5300	210
	80	0.03	8	3200	95
		0.03	10	2500	75
		0.02	12	2100	40
Carbon steel	40	0.05	4	3200	160
		0.04	6	2100	85
	35	0.03	8	1400	40
		0.03	10	1100	30
Non-ferrous alloy	150	0.06	4	12000	700
		0.06	6	8000	480
		0.06	8	6000	360
		0.06	10	4800	280
		0.06	12	4000	240

CUTTING CONDITION - Chamfering

Work Material	Vc (m/min)	Ap	Chamfer	Speed	Feed Rate	fn
General steel	120	2 ↓	0.5C	9500	2600	0.25
			1.C		2100	0.22
		2 ~ 4	0.5C	4800	1200	0.25
			1.C		1100	0.22
			2.C		820	0.17
		4 ~ 6	0.5C	3200	800	0.25
			1.C		700	0.22
			2.C		550	0.17
			3.C		385	0.12
Carbon steel	40	2 ↓	0.5C	3200	150	0.05
			1.C		130	0.04
		2 ~ 4	0.5	1600	80	0.05
			1.C		65	0.04
			2.C		50	0.03
		4 ~ 6	0.5C	1100	65	0.06
			1.C		55	0.05
			2.C		45	0.04
			3.C		35	0.03
Non-ferrous alloy	150	2 ↓	0.5C	12000	3000	0.25
			1.C		2750	0.23
		2 ~ 4	0.5C	6000	1500	0.25
			1.C		1400	0.23
			2.C		1250	0.21
		4 ~ 6	0.5C	4000	1000	0.25
			1.C		920	0.23
			2.C		850	0.21
			3.C		600	0.15



What is Coating?

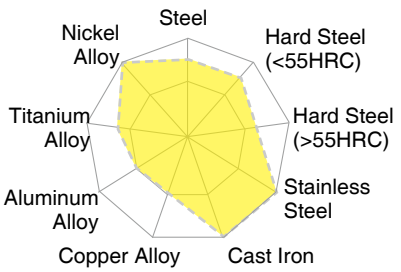
What do End Mills coatings do?

It helps to extend tool life and rear resistance,provide better chip evacuation, etc. It is like the clothes of an end mill. On different occasions, it needs to be worn the right clothes. For example, people need to wear a spacesuit when they are in outer space, and a swimsuit when they swim. Therefore, depending on your processing conditions, it will affect what coating you need to choose.

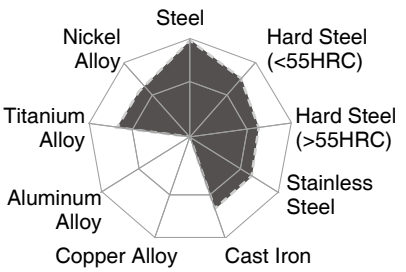
Coating Application

Different coating perform better in different application.The 3 coatings most commonly used with Speed Tiger's End Mills in **FRACTIONAL** :

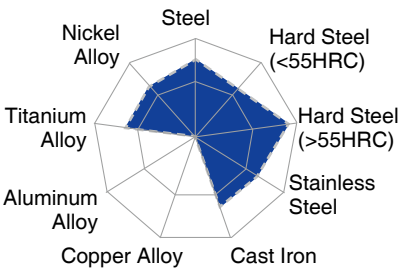
ZrN-A



AlTiBN



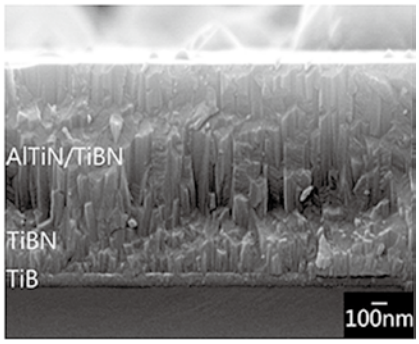
nACo



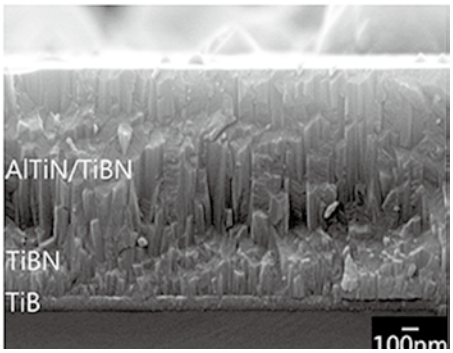
Introduction of AlTiBN Coating

Coating Structural Analysis-SEM

AlTiBN



AlTiN

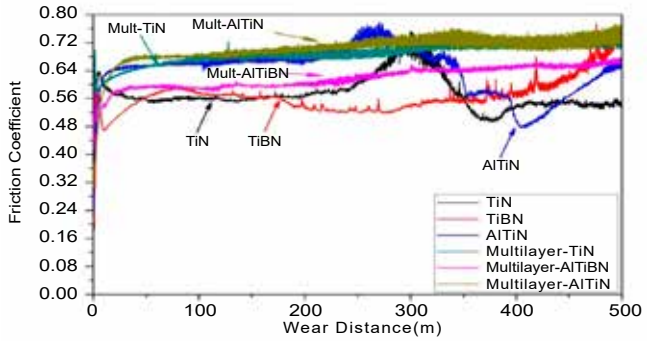


Normal Temperature - Mechanical analysis

	Hardness(Hv)	Impact of Diameter	Lc2-Lc1	Wear Rate	Roughness (μm)
AlTiN	3672	305(um)	8.28N	6.49x10-6	0.233
AlTiBN	4088 ✓	280.9(um)	17.6N	5.11x10-6 ✓	0.166 ✓

In normal temperature mechanical analysis, the performance of AlTiBN is superior to AlTiN in hardness, wear rate and coating roughness.

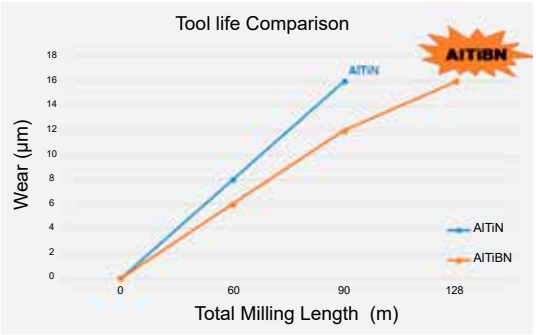
The Oxidation Wear of 700℃



	Friction Coefficient	Wear Distance	Wear Rate
TiN	0.5662	316.3	6.4x10-6
TiBN	0.5664	281.2	5.69x10-6
AlTiN	0.6402	281.4	4.97x10-6
Mult-TiN	0.686	277.4	4.82x10-6
AlTiBN	0.618	281.8	4.66x10-6 ✓
Mult-AlTiN	0.7014	290.1	5.5x10-6

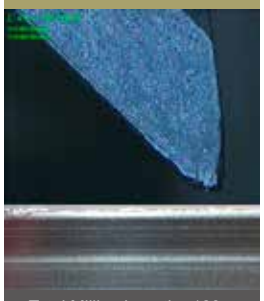
The wear rate of AlTiBN at high temperatures is also superior to the above coatings.

Test Report



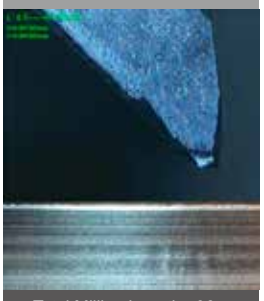
Cutting Edges

AlTiBN



Total Milling Length : 128m

AlTiN



Total Milling Length : 96m

Cutting Conditions

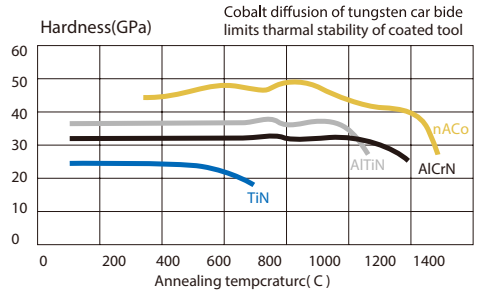
Milling Type	Side Milling	Feed Rate	1082mm/min
Work Piece	S45C	Depth of Cut	ap=20 ae=1.2
Tool Size	10mm x 30 x 75L	Coolant Way	Air
Rotation Speed	3183	CNC Machine CNC	FV102A

Introduction of nACo Coating

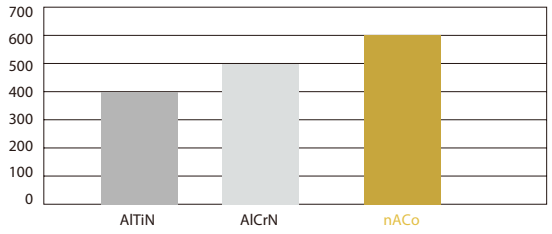
nACo Nanocomposite coating process.

1. Perfect coating structure.
2. High hardness.
3. High adhesion.
4. Adding Si into nACo structure makes atom structuremore completed with high hard-wearing and tools with more longer life.

Heat Resistance Comparison



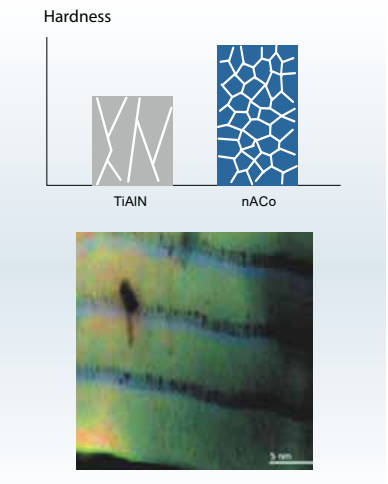
Tool Life Comparison



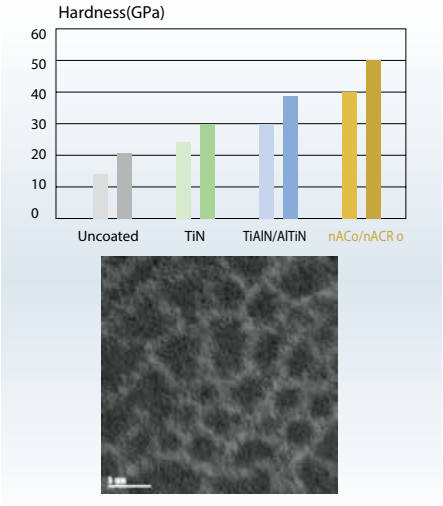
Comparision of AlTiN v.s nACo

S.T Coating	Typical Thickness(£g)	Nanohardness up to (GPa)	Max Service Temp(¢J)	Friction coefficient
AlTiN	2~4	35	800	0.6
nACo	2~4	45	1200	0.35

Hardness Increase through Nanocomposites



Conbentional Nanolayer-Structure : (TiAlN)(TiN)



Nanocomposite structure: (nc- TiAlN)/(a-Si3N4)

Introduction of ZrN-A Coating

Details

Block resistance

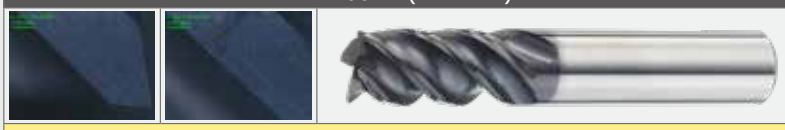
- Suitable for High Speed machining with both dry and wet cutting way.



Good for Stainless steel cutting

- Hardness 2800~3000 HV
- Coefficient of friction: 0.3
- Oxidation Temp: 800~900°C
- High performance coating(Light golden)

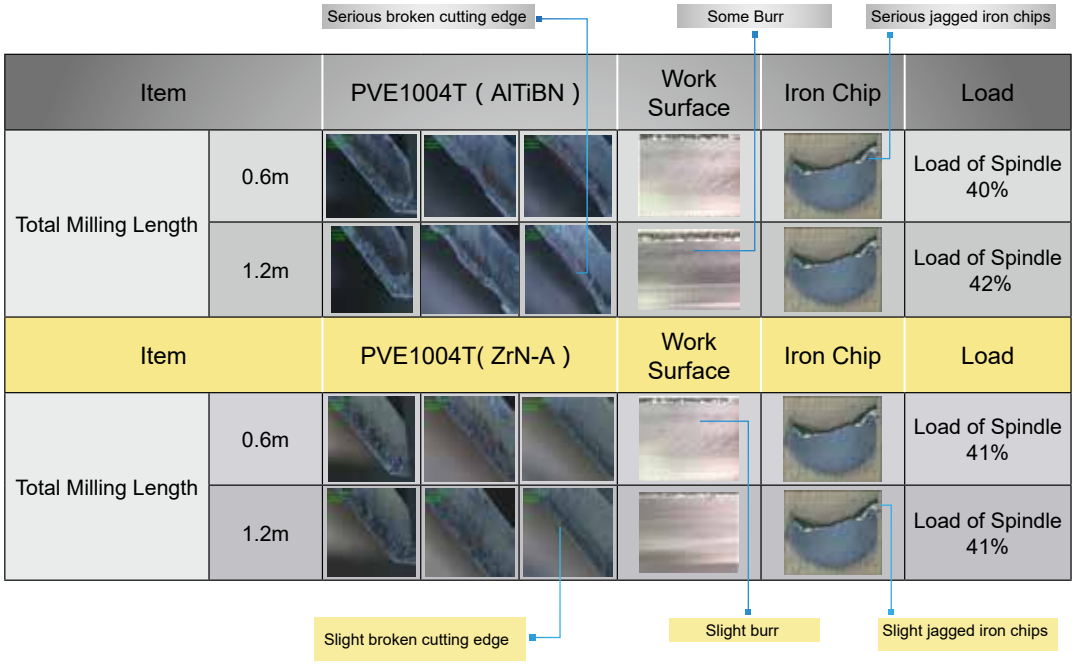
Measurement Comparison - SUS316 Slotting

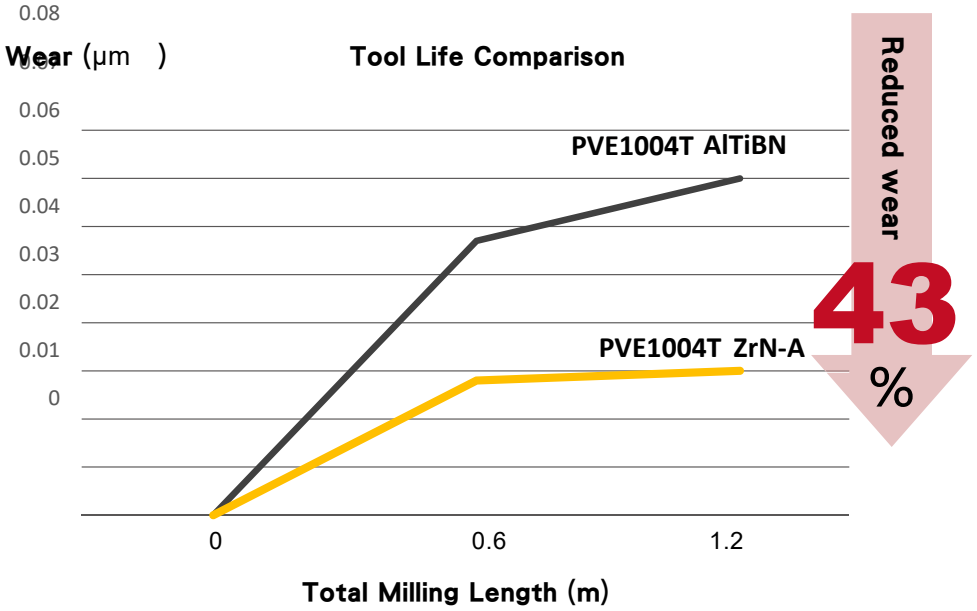
PVE1004(AlTiBN)Coating optimization & ZrN test comparison		
Before Use	PVE1004T (AlTiBN)	
	PVE1004T (ZrN-A)	

Parameter	
Tool (Coating)	PVE1004 ZrN-A
Cutting Material	SUS316
Rotation Speed (S)	2644 rpm
Milling Speed (Vc)	100 m/min
Feed Rate (F)	646 mm/min
Depth of cut	ap=10mm / ae=10mm
(Fz) Feed of teeth	0.062
Machine	YCM FV102A
Holder	BT40 Shrink fit holder
The length of Tool Extend	37mm
Cooling Way	Water

Introduction of ZrN-A Coating

Cutting Performance – SUS316 Slotting





Parameter	
Tool (Coating)	PVE1004 ZrN-A
Cutting Material	SUS316
Rotation Speed (S)	2644 rpm
Milling Speed (Vc)	100 m/min
Feed Rate (F)	646 mm/min
Depth of cut	ap=10mm / ae=10mm
(Fz) Feed of teeth	0.062
Machine	YCM FV102A
Holder	BT40 Shrink fit holder
The length of Tool Extend	37mm
Cooling Way	Water

Coating \ Total milling Length (m)	0.6m	1.2m
ALTIBN	0.057 μ m	0.07 μ m
ZrN-A	0.028 μ m	0.03 μ m

Coating Thickness wear:μm

Icon Guide

Tool Materials

Tungsten Carbide 600 Nano

Tungsten Carbide 400 PLUS

Coating

ALTIBN Coating

ZrN-A Coating

ZrN Coating

nACo Coating

Helix Angle

Helix Angle 35°

Helix Angle 45°

Helix Angle 50°

Irregular Helix Angle

ADDITIONAL GEOMETRY

Unequal Flute Spacing

Corner Radius

Protective Chamfer

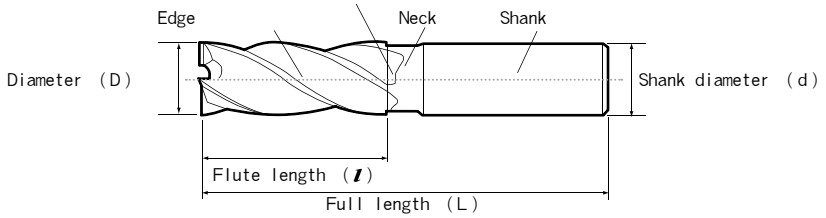
Partially Polished Edge

Special Chip Breaker

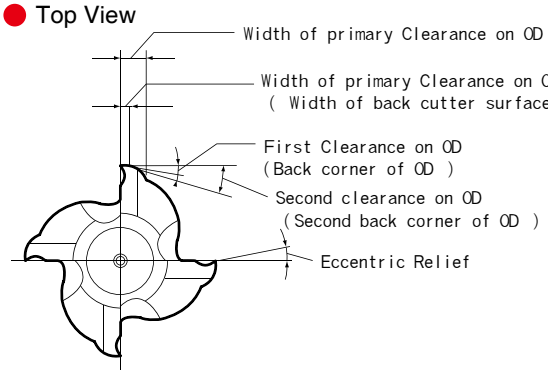
Technical Information

■ Detail of the end mill

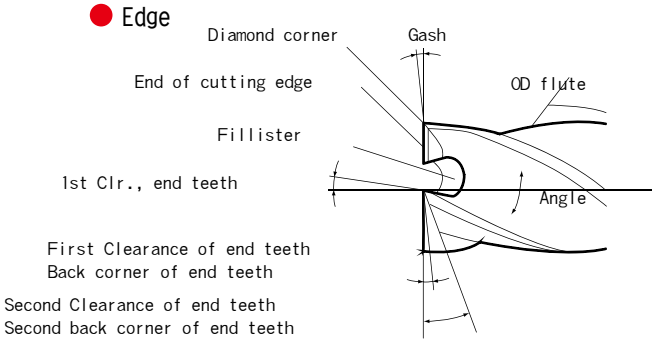
● Side View



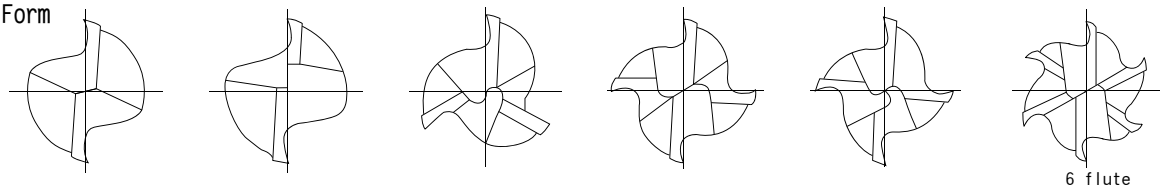
● Top View



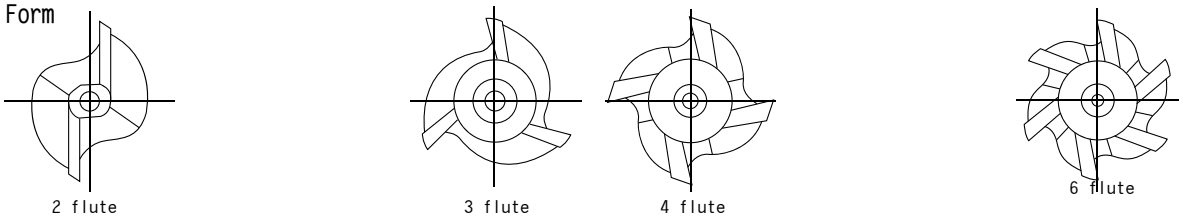
● Edge



● Flute Form



● Flute Form

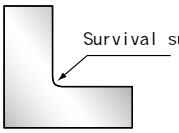


Shape in end teeth of the end mill

● Tip Protection



During the tip protection

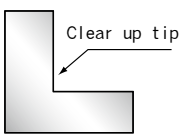


- Batter rigidity of the tip, protecting the edge.
- Tip sharp drop.

● Tip



During the tip



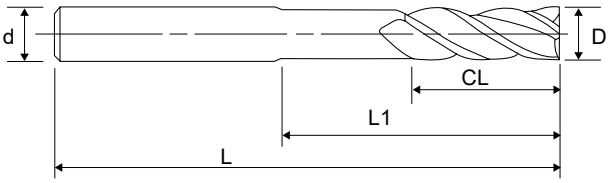
- Use for clear up tip.
- Sharp tip, easy to break.
- Can be use in carbon steel and steel, specially using in Aluminum and non-ferrous material.

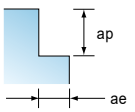
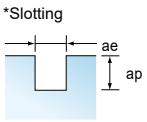
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Failure analysis and solution

Item	Fault	Reason	Solution
● Precision of cutting surface	● Rough surface	● Vibration	▶ Fix the working material as well as posible ▶ Adjust the failed part of machine ▶ Reduce rotating speed ▶ Downcut ▶ Tools minimum lenght out of fixture
		● The heterogeneity in hardness of working material	▶ measuring the hardness of working material
		● The tip was unsuitable	▶ Tool rake angle and clearance angle ▶ Improve cutting roughness
		● Chip lump and fuse attach material	▶ Remove chip lump and fuse attach material ▶ Check on the degenerative condition of cutting fluids
		● Passivation of cutting edge	▶ Determine the adequate time to regrinding
		● Cutting rate (speed) too fast	▶ Reduce the cutting rate (speed)
		● Misfit cutting fluids or deficient of cutting fluids	▶ Change cutting fluids
	● Buckling cracking of the of machined surface	● Unbalance friction of cutting edge	▶ Regrinding to reduce friction
		● Fuse attach material on the cutting edge	▶ Remove fuse attach material ▶ Change cutting fluids
		● Cutting edge deformation	▶ To pay attention to use and safekeeping
	● The corrugation of machined surface	● lesser cutting flute	▶ Increase the number of flutes from 2 flutes to 4 flutes and then 6 flutes
		● Bigger cutting depth and feed rate	▶ To Reduce the Feed Rate of Machine
		● A larger Helix Angle	▶ Decrease the Helix Angle
● Shape precision	● Perpendicularity	● Cutting depth and feed rate is too large	▶ Reduce the depth of cutting and feed rate
		● Tool stretches out over longer	▶ Use the end mill stretches out shortest from chuck
		● Perpendicularity of holder not reach	▶ Improve the perpendicularity of holder
● End mill life	● Shorter life for regrinding end mill	● Work material hardness too high	▶ Improve to suitable hardness by heat treatment process ▶ Reduce the feed rate for high hardness work material or change more hardness tool
		● Unsuitable feed rate	▶ Adjust to suitable feed rate
		● Chip lump and fuse attach material	▶ Remove chip lump and fuse attach material ▶ Use suitable cutting liquid
		● Unsuitable cutting liquid	▶ Use suitable cutting liquid ▶ Use enough cutting liquid
	● Huge friction of cutting edge	● The fault of work material	▶ Achieve the average of inside form of work material ▶ clear up unbalance hardness
		● Unsuitable edge angle	▶ Regrind to suitable angle
		● End mill cutting function go down	▶ Surface treatment
		● Unsuitable cutting liquid	▶ Adjust to suitable cutting liquid ▶ Adjust offer method of liquid
		● Unsuitable regrind schedule	▶ Manage the regrind schedule
	● Flute damage	● Vibration	▶ Strengthen the install tool of work material
		● The fault of work material	▶ Achieve the average of working material structure ▶ Use suitable hardness , clear up unbalance hardness ▶ Check the material may mix other hardness substance or gravel
		● Unsuitable feed rate	▶ Reduce the feed rate
		● Cutter become dull	▶ Regrind the tools
		● Cutting liquid go off	▶ Change the cutting liquid
	● Break	● Work material unsuitable fixed	▶ Indeed fix the work material ▶ Improve install tool
		● Cutter become dull	▶ Regrind process
		● End mill with incorrect operation	▶ Be careful of keep and operate
		● Chip jam	▶ Use cutting liquid in large, during dry milling use air blow to remove chips

Custom Tool Design Inquiry Form

<table>
<tr><td>Work piece Material</td><td colspan="5"></td></tr>
<tr><td>Hardness</td><td colspan="5">☐HRC_____ ☐HB_____ ☐Other_____</td></tr>
<tr><td>Type of Coating</td><td colspan="5">☐ST standard(refer to our catalogue) ☐Uncoated
☐Customers Requirement _____</td></tr>
<tr><td>Type of Flute Spiral</td><td colspan="5">☐Right ☐Left</td></tr>
<tr><td>No of Flutes</td><td colspan="5">☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐Other_____</td></tr>
<tr><td>Type of End Cut</td><td colspan="5"> ☐Square  ☐Corner Radius r=_____  ☐ Ball R=_____</td></tr>
<tr><td>Type of Shank</td><td colspan="5">☐No Side Lock ☐Side Lock</td></tr>
<tr><td>Specification</td><td colspan="5">

D_____ CL_____ L1_____ L_____ d_____</td></tr>
<tr><td rowspan="7">Application</td><td rowspan="2">☐Side Milling</td><td>Common side milling</td><td rowspan="2">
</td><td colspan="2">ap:_____</td></tr>
<tr><td>Cavity</td><td colspan="2">ae:_____</td></tr>
<tr><td colspan="2">☐Slotting</td><td rowspan="2">
</td><td colspan="2">ap:_____</td></tr>
<tr><td colspan="2">☐Drilling & Milling</td><td colspan="2">ae:_____</td></tr>
<tr><td>Machine Processing</td><td colspan="3">☐Finishing ☐Roughing ☐General Purpose
☐Other_____</td></tr>
<tr><td>Coolant Type</td><td colspan="3">☐Soluble ☐Oil Coolant ☐Oil Mist
☐Dry Cutting ☐Air Cooling ☐Other_____</td></tr>
<tr><td>Tool Life Standard</td><td colspan="3">☐Cutting Time ☐Load of Machine ☐Finish
☐Tool Wear ☐Vibration and Sound ☐Other_____</td></tr>
<tr><td>Desired Life</td><td colspan="3"></td></tr>
<tr><td>Finish Requirement</td><td colspan="3">☐Required Roughness_____ ☐Not Required</td></tr>
<tr><td>Other</td><td>Special Requirement</td><td colspan="3"></td></tr>
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